

December 21, 2020

PERMIT SET

SPECIFICATIONS

HILLSBOROUGH COUNTY NORTHWEST AREA HEAD START

HILLSBOROUGH COUNTY BOARD OF COUNTY COMMISSIONERS

Commissioners

Sandra L. Murman

Ken Hagan

Lesley "Les" Miller Jr.

Stacy White

Meriella Smith

Pat Kemp

Kimberly Overman

District 1

District 2

District 3, Chairman

District 4, Board Chaplain

District 5, Countywide

District 6, Countywide

District 7, Countywide, Vice-Chair

DESIGN TEAM

Architect

WILDERARCHITECTURE, INC.

Structural Engineer

Master Consulting Engineers, Inc.

Mechanical Engineering Consultant

Anston-Greenlees, Inc

Electrical Engineering Consultant

Anston-Greenlees, Inc

Civil Engineering Consultant

Campo Engineering, Inc.

Landscape Architect

Anderson Lesniak Limited, In.

SPECIFICATIONS

TABLE OF CONTENTS

DIVISION 1 GENERAL REQUIREMENTS - BY HILLSBOROUGH COUNTY

DIVISION 2 EXISTING CONDITIONS

- 02 4870 Sodding
- 02 8100 Underground Irrigation System
- 02 9000 Landscape Work

DIVISION 3 CONCRETE

- 03 3000 Cast-In-Place Concrete

DIVISION 4 MASONRY

- 04 2000 Unit Masonry
- 04 2030 Reinforced Unit Masonry
- 04 7200 Cast Stone Masonry

DIVISION 5 MISCELLANEOUS METALS AND FABRICATION

- 05 5000 Metal Fabrications
- 05 5213 Pipe and Tube Railings

DIVISION 6 WOOD, PLASTICS, AND COMPOSITES

- 06 1000 Rough Carpentry
- 06 1100 Wood Framing
- 06 1753 Pre-Fabricated Wood Trusses
- 06 4100 Plastic Laminate Casework

DIVISION 7 THERMAL AND MOISTURE PROTECTION

- 07 1600 Underslab Vapor Retarder
- 07 1800 Polyurethane Deck Coating
- 07 1815 Clear Water Repellent Sealer
- 07 2100 Building Insulation
- 07 4110 Metal Roof Panels
- 07 6200 Sheet Metal Flashing and Trim
- 07 8410 Fire Stop Systems
- 07 9200 Joint Sealants

DIVISION 8 OPENINGS

- 08 1110 Standard Steel Doors and Frames
- 08 2110 Flush Wood Doors
- 08 3313 Coiling Counter Doors
- 08 4100 Aluminum Entrances and Storefronts
- 08 5200 Aluminum Windows
- 08 7110 Door Hardware and Schedule
- 08 8000 Glazing
- 08 9119 Fixed Louvers

DIVISION 9 FINISHES

09 2116 Gypsum Board Assemblies
09 2200 Portland Cement Plaster
09 2236 Metal Lath
09 3100 Ceramic Tile
09 5110 Acoustical Panel Ceilings
09 6500 Resilient Flooring
09 6530 Resilient Wall Base and Accessories
09 9120 Painting

DIVISION 10 SPECIALTIES

10 4310 Signs
10 5220 Fire Extinguisher, Cabinets, and Accessories
10 7300 Aluminum Walkway Covers
10 8000 Toilet and Bath Accessories

DIVISION 11 EQUIPMENT – NOT USED

DIVISION 12 FURNISHINGS

12 4910 Horizontal Louver Blinds

DIVISION 13 SPECIAL CONSTRUCTION – NOT USED

DIVISION 14 CONVEYING SYSTEMS – NOT USED

DIVISION 21 FIRE SUPPRESSION – NOT USED

DIVISION 22 PLUMBING

22 0000	Plumbing Requirements
22 0553	Plumbing Identification
22 0719	Plumbing Insulation
22 1010	Plumbing Valves
22 1060	Plumbing Piping and Pipe Fittings
22 1117	Plumbing Supports and Anchors
22 1119	Plumbing Piping Specialties
22 3330	Plumbing Equipment
22 4300	Plumbing Fixtures

DIVISION 23 HVAC

23 0000	HVAC Mechanical Requirements
23 0548	Vibration Isolation
23 0593	Testing, Balancing and Commissioning of HVAC Systems
23 0719	HVAC Mechanical Insulation
23 1060	HVAC Pipes and Pipe Fittings
23 1117	HVAC Supports and Anchors
23 1119	HVAC Piping Specialties
23 2300	Refrigerant Piping
23 3113	Low and Medium Pressure Ductwork
23 3300	Ductwork Accessories
23 3416	Centrifugal Fans
23 3423	Power and Gravity Ventilators
23 3600	Terminal Units
23 3713	Air Outlets and Inlets
23 8126	Split-System Heating and Cooling Units

DIVISION 26

26 0500	Basic Methods and Requirements Electrical
26 0519	Wires and Cables
26 0526	Grounding
26 0529	Supporting Devices
26 0530	Electrical Connections for Equipment
26 0533	Raceways
26 0535	Electrical Boxes and Fittings
26 0553	Electrical Identification
26 0923	Lighting Control Devices
26 2426	Panelboards
26 2616	Circuit and Motor Disconnects
26 2726	Wiring Devices
26 2813	Overcurrent Protective Devices
26 2913	Motor Controllers and Contactors
26 3100	Photovoltaic Power System
26 4313	Surge Protection Devices
26 5100	Interior Building Luminaires
26 5600	Exterior Building Luminaires

DIVISION 28

28 3111	Fire Alarm and Smoke Detection Systems
---------	--

DIVISION 31 EARTHWORK

31 1000	Demolition
31 1100	Clearing and Grubbing
31 2000	General Earthwork
31 2200	Site Grading
31 2216	Earthwork for Paving
31 2300	Structure Excavation and Backfill
31 2319	Dewatering
31 2333	Trenching Backfilling and Compacting
31 2500	Erosion Control
31 3116	Termite Control

DIVISION 32 EXTERIOR IMPROVEMENTS

32 1100	Base Courses
32 1113	Bituminous Paving
32 1133	Portland Cement Concrete Paving
32 1313	Concrete Sidewalks and Slabs
32 1613	Concrete Curb
32 1723	Pavement Markings
32 3019	Traffic Signs
32 3119	Chain Link Fences and Gates

DIVISION 33 UTILITIES

33 1000	Watermain
33 3000	Sanitary Sewers
33 4000	Stormwater System

APPENDICIES

APPENDIX ONE

Geotechnical Engineering Services Report

END OF TABLE OF CONTENTS

SECTION 024870 - SODDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections apply to work of this section.
- B. Related Work:
 - 1. Section 023000: Earthwork
 - 2. Section 029000: Landscape Work
 - 3. All other site work related provisions, Sections, and specifications.

1.2 SUMMARY

- A. The Scope of Work includes all sod, material, equipment and labor necessary for installation of sod indicated on the drawings and/or in the Specifications herein.
- B. Grades: It shall be the responsibility of the Contractor to finish, (fine) grade the top 4" of all sod areas, eliminating all bumps, depressions, sticks, stones and other debris to the satisfaction of the Architect, prior to the application of sod. Any sod installed in areas not approved prior by the Architect may be removed, re-graded and re-installed at the Contractor's expense.

1.3 GENERAL

- A. Description: Provide sodded lawn areas as shown and specified. Work under this Section shall comply with all Division 1 Requirements and Special Provisions. Furnish all labor, materials, and equipment to conduct the following:
 - 1. Soil Preparation
 - 2. Fine Grading
 - 3. Sodding
 - 4. Maintenance

1.4 QUALITY ASSURANCE

- A. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.
- B. Contractor shall certify sod is free of exotic species "soda apple". Contractor shall eradicate at no cost to Owner should species be found on site through guarantee period.
- C. Submittals:

1. Submit sod growers certification of grass species. Identify source location.
 - D. Submit the following materials certification:
 1. Fertilizer(s) Analysis
 - E. Submit Materials Maintenance Instructions
 1. Upon sodded lawn acceptance, submit written maintenance instructions recommending procedures for maintenance of sodded lawns.
 - F. Delivery, Storage, and Handling
 1. Cut, deliver, and install sod within a 24 - hour period.
 2. Do not harvest or transport sod when moisture content may adversely affect sod survival.
 3. Protect sod from sun, wind, and dehydration prior to installation.
 4. Do not tear, stretch, shake, or drop sod during handling and installation.
 - G. Project Conditions:
 1. Work Notification: Notify Architect at least seven (7) days prior to start of sodding operations.
 2. Protect existing utilities, irrigation, paving, and other facilities from damage that may be caused by sodding operations.
 3. Perform sodding work only after planting and other work affecting ground surface has been completed.
 4. Restrict traffic from lawn areas until grass is established. Erect signs and barricades as necessary.
 5. Provide hose and lawn watering equipment as necessary to maintain sod survival. No exceptions will be made for sod survival due to irrigation failure or lack of watering during the warranty period or until final acceptance.
 6. The irrigation system (where applicable) will be installed prior to sodding. Locate, protect, and maintain the irrigation system during sodding operations. Repairs to irrigation system components damaged by sodding operations will be at the Contractor's expense.
 - H. Warranty:
 1. Provide a uniform stand of grass by watering, mowing, and maintaining lawn areas until final acceptance. Re-sod areas, with specified materials, which fail to provide a uniform stand of grass until all affected areas are accepted by the Architect. Provide a one-year warranty from date of Substantial Completion.
- 1.5 INSPECTION:
- A. The Architect will examine finished surfaces, grades, topsoil quality and depth. Do not start sodding work until satisfactory conditions have been approved by the Architect or until unsatisfactory conditions are corrected.

1.6 PREPARATION

- A. Limit preparation to areas which will be immediately sodded.
- B. Loosen topsoil of lawn areas to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish, and extraneous matter.
- C. Grade lawn areas to smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake; remove ridges and fill depressions as required to drain.
- D. Dampen dry soil prior to sodding.
- E. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

PART 2 - PRODUCTS

- A. The sod shall be as specified and indicated on the drawings. Sod shall be nursery grown pasture grass of firm tough texture, having a compact growth with good root development, and shall contain no weeds or any other objectionable vegetation. Sod shall be a minimum of 3" thick at time of installation. The soil embedded in the sod shall be good earth, free of stones and debris and all sod shall be free from fungus, vermin and other diseases.
 - 1. Provide well-rooted, healthy sod free of diseases, nematodes, chinch bugs and other soil borne insects. Provide sod uniform in color, leaf texture and density, capable of vigorous growth and development when planted.
- B. Before being cut and lifted, the sod shall have been mowed at least three times with a lawn mower, with the final mowing not more than five (5) days before the sod is cut. The sod shall be carefully cut into uniform dimensions, not more than two (2) days prior to final installation on site.
- C. Solid sod shall be laid with closely abutting joints with a tamped or rolled, even surface. It shall be the responsibility of the Contractor to bring the sod edge in a neat, clean manner to the edge of all paving and shrub areas, keeping a minimum of 24" back from shrub foliage area and flush with all paving surfaces. If, in the opinion of the Architect, top-dressing is necessary after rolling, clean sand will be evenly applied over the entire surface and thoroughly washed in at the Contractor's expense.
- D. All sod shall be healthy, green and exhibit a habit of growth that is normal for the species and shall be free of insects. All sod shall meet satisfactory approval at the time of final acceptance. Sod that is not accepted shall be replaced at the Contractor's expense.

PART 3 - EXECUTION:

- A. Layout: Area inside the "Limits of Construction" are to be sodded and shall be smooth and uniform. Contractor shall also re-sod all existing areas disturbed by construction activities, including within lay-down and staging areas. If changes have been made in the construction, necessary adjustments will be approved by the Architect.

- B. Peg sod on slopes greater than 4:1 to prevent slippage at a rate of two stakes per square yard (staggered). Pegs are to be removed when sod is established.
- C. Contractor will repair all washouts that occur during construction and within the warranty period at no additional cost to the Owner.
- D. Sod shall be fertilized using approved fertilizer at the manufacturer's recommended rate. Fertilizer will only be applied after the irrigation system is installed, and properly working and approved by the Architect or thoroughly watered in at the time of installation by the Contractor.
- E. Lay sod to form a solid mass with tightly-fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, drains, and seeded areas.
- F. Do not lay dormant sod or install sod on saturated soil.
- G. Install initial row of sod in a straight line, beginning at bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and lightly against previously installed row.
- H. Water sod thoroughly with a fine spray immediately after laying.
- I. Roll with light lawn roller to ensure contact with sub-grade.
- J. Sod areas adjoining contract limits disturbed as a result of construction operations.

3.2 MAINTENANCE:

- A. Maintain sodded lawns until completion and final acceptance of the entire project as issued by the Architect.
- B. Maintain sodded lawn areas, including watering, spot weeding, mowing, application of herbicides, fungicides, insecticides and re-sodding until a full, uniform stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Architect.
- C. Repair, rework, and re-sod all areas that have washed out or are eroded. Replace undesirable or dead areas with new sod.
- D. Apply 16-4-8 formulation fertilizer to lawns approximately 30 days after Sodding and seeding at a rate equal to 1.0 lb. of actual nitrogen per 1,000 sq. ft. Apply with a mechanical rotary or drop type distributor. Thoroughly water fertilizer into sod.
- E. Apply herbicides as required to control weed growth or undesirable grass species.
- F. Apply fungicides and insecticides as required to control diseases and insects.
- G. All replanting or repair required due to the Subcontractor's negligence, carelessness, or failure to provide routine maintenance shall be performed at the Subcontractor's expense.

3.3 ACCEPTANCE

- A. Inspection to determine acceptance of sodded lawns will be made by the Architect prior to Final Acceptance. Provide notification at least 7 days before requested inspection date.
- B. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, even colored viable lawn is established, free of weeds, undesirable grass species, disease, and insects.
- C. Upon final acceptance, the Owner will assume lawn maintenance notwithstanding those Tasks herein imposed upon the Contractor.

3.4 CLEANING:

- D. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from sodding operations.

3.5 GUARANTEE AND REPLACEMENT

- E. Guarantee: The Contractor, as part of his Contract, shall furnish a written guarantee warranting all materials, workmanship and sod, for a period of one year from the date of Substantial Completion. All sod shall be alive and in satisfactory condition at the end of the guarantee period. There shall be an additional 60 day warranty on all replaced areas of sod.

END OF SECTION 024870

SECTION 028100 - UNDERGROUND IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 CONTRACT PROVISIONS

- A. The Subcontractor shall furnish all materials, supplies, tools, labor, transportation, and equipment required to complete the work of installing the irrigation system, including the warranty, in accordance with the Contract Documents.
- B. All materials, installation methods, and design criteria provided by the Subcontractor shall be in strict accordance with the current "Uniform Plumbing Code", "Uniform Mechanical code", state statutes and prevailing county and/ or municipal ordinances.
- C. The Subcontractor shall not willfully install the irrigation system as specified in the Contract documents when it is obvious in the field that there are obstructions, grade differences and/ or discrepancies in area dimensions or specifications that are not accounted for on the Plans. The Subcontractor shall not proceed until such conditions are brought to the attention of the Landscape Architect and Contractor.
- D. Any and all substitutions, changes, additions or deletions to the Contract Documents shall be expressly approved by the Owner through written addendum and copies created by the Contractor and / or Landscape Architect.
- E. Overhead, underground and surface utilities, structures and vegetation are in the area of the work and must be protected against damage during the progress of the work. The Subcontractor shall be held responsible and liable for any damages incurred resulting from his negligence.
- F. The Subcontractor shall visit the project site to examine such conditions as soils, vegetation, utilities, structures, water supply, etc., as they will influence the work pursuant to bid submission and/ or contract execution.
- G. It shall be the responsibility of the Subcontractor to determine and acquire any and all permits and licenses required relevant to the irrigation contract and to assume the cost for such. Inspections required by local ordinances during the course of construction shall be arranged by the contractor as required. On completion of the work, satisfactory evidence shall be furnished to the Landscape Architect to show that all work has been installed in accordance with the ordinances and code requirements.
- H. The Subcontractor shall include in his bid all costs (excluding deposits) for utility connections, unless otherwise specifically stated in the bid proposal and Contract Documents.

1.2 RELATED DOCUMENTS

- A. All provisions of Contract, including General and Special Provisions and Irrigation Drawings, apply to work specified in this Section.

1.3 SUBMITTALS

- A. Submit to the Landscape Architect samples, manufacturers' technical data, and installation instructions for all components of the underground sprinkler system if different from the materials specified on the Drawings.
- B. Prior to Final Acceptance, the Subcontractor shall furnish the Contractor with a record drawings of "as-built" conditions to be submitted in a digital format (PDF) at the same scale as the original irrigation plan document. All change orders and field changes shall be shown. All remote control and isolation valves shall be dimensioned from two permanent points of reference. Record drawings shall include:
 - 1. Location of water supply (water meter or effluent).
 - 2. Tie-in and General Contractor furnished electrical service and disconnects.
 - 3. Location of gate and zone valve controller and other control equipment.
 - 4. Routing and sizing of all sprinkler pipe.
 - 5. Location and type of all sprinkler heads.
 - 6. Routing of zone control valve electrical wiring.
- C. The Subcontractor shall provide as part of this contract the following tools:
 - 1. Two (2) sets of special tools required for adjusting, cleaning or disassembling each type of sprinkler and valve supplied on this project.
 - 2. Two (2) sets of keys for each controller.
- D. Two operation/service manuals covering all major equipment used on this project shall be furnished to the Landscape Architect for approval. Manuals will be hard cover, three ring binders and include the following information:
 - 1. Catalog sheets and exploded views of equipment, including part numbers.
 - 2. Operation and maintenance instructions for all equipment.
 - 3. Listing of major equipment with names, addresses, and phone numbers of local manufacturer's representatives.
 - 4. Warranty information on all major equipment.

1.4 DEFINITIONS AND ABBREVIATIONS

- A. The definitions and abbreviations given here below shall be considered a part of these specifications and shall apply to the interpretation and execution thereof.

1. Contractor: shall refer to the General Contractor providing construction of this proposed facility.
2. Subcontractor: shall refer to the Landscape / Irrigation contractor who has a direct contract with the General Contractor to perform a portion of the Work at the site.
3. Project: The project as referenced herein shall be that tract of real property where the irrigation system is to be installed.
4. P.S.I.: Static water pressure shall be given as pounds per square inch, abbreviated P.S.I., and where one (1) P.S.I. shall equal 2.31 feet of head.
5. G.P.M.: Volume of water shall be given as gallons per minute abbreviated G.P.M.
6. Zone: A zone shall be defined as a group of heads operating at the same time downstream under a common control valve. A zone shall be derived as further described hereinafter on the basis of available water pressure and volume and physical location/ orientation.
7. P.V.C.: P.V.C. shall denote the abbreviation for polyvinyl chloride material used in the manufacture of pipe and fittings as further specified hereinafter.
8. Contract Documents: For the purposes of bid submission, contract agreement, and execution of the work, the contract documents shall be binding upon all parties and shall include but not be limited to applicable plans, details, schedules, specifications and bidder instructions.
9. Equivalency: Relevant to manufacturer product lines specified herein, equivalents shall be of like type, manufacture, design, materials, operation and performance. They shall be approved by the Landscape Architect.
10. The Plans: Irrigation Design and/ or specifications provided by the Owner of Landscape Architect. In the event of conflict between the plans and the written specifications, the plans shall prevail.
11. P.O.C.: Water source(s) for this irrigation system shall be referred to as the point of connection abbreviated P.O.C.
12. A.S.T.M.: Abbreviation for the American Society for Testing Materials.
13. A.W.W.A.: Abbreviation for the American Water Works Association.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All major equipment has been specified and listed on the drawings. Materials not named shall be subject to approval or rejection by the Landscape Architect. All material shall be of new stock and best grade of its kind. It shall be as specified unless otherwise specifically approved by the Landscape Architect. In all cases, workmanship and material shall conform to or exceed the requirements and codes of the municipalities having jurisdiction on the project.

2.2 PVC PIPE

- A. General: Plastic pipe shall be rigid, high impact, Type I, unplasticized polyvinyl chloride extruded from virgin parent material, mainline piping shall be SCH 40 PVC and lateral line piping shall be class 160 PVC unless otherwise required by local governing code. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles or dents. All plastic pipe shall be continuously and permanently marked with:
1. Manufacturer's name
 2. Nominal pipe size
 3. Pressure rating
 4. NSF approval
 5. Schedule or class
 6. Date of extrusion

2.3 PIPE FITTINGS AND CONNECTORS

- A. Main Line Fittings: Plastic pipe fittings to be installed shall be Schedule 40 injection molded from virgin Type I high impact unplasticized rigid Polyvinyl chloride (P.V.C.) molding compound, unless otherwise specified on the plans.
- B. Lateral Line Fittings: Plastic pipe fittings to be installed shall be Schedule 40 injection molded from virgin Type I high impact unplasticized rigid Polyvinyl Chloride (P.V.C.) molding compound, unless otherwise specified on the plans.
- C. Threaded PVC Nipples: Shall be Schedule 80 PVC.
- D. Shrub Head Risers: Risers for shrub spray heads are to be Schedule 40 PVC pipe, unless otherwise specified on the plans.
- E. 1/2" Sprinkler Head Connectors: Shall be an 18 inch long flexible connection, Rain Bird SP-100 Flex Pipe or equal. Unless otherwise specified on the plans.
- F. 3/4" Sprinkler Head Connectors: Shall be an 18 inch long flexible connection, Rain Bird SP-100 Flex Pipe or equal. Unless otherwise specified on the plans.
- G. 1" Sprinkler Head Connectors: Shall be a three elbow swing joint made from PVC SCH 40 Marlex elbows and PVC SCH 80 Nipples, unless otherwise specified on the plans.

2.4 SOLVENT CEMENT

- A. Provide solvent cement and primer for PVC solvent weld pipe and fittings as recommended by the pipe and fitting manufacturer.

2.5 VALVES

- A. Electric Control Valves: Globe configuration valves operated by low-power (24 volt) solenoid, normally closed, manual flow adjustment and 200 PSI working controller with respect to the type of control, voltage, amperage and "normal" sequence positioning. Control valves shall be Rainbird PGA Series.
- B. Isolation Gate Valves: Gate Valves shall be iron body with resilient wedge, equipped with a square operating nut, Matco 10RT or approved equal.

2.6 VALVE BOXES

- A. General: Tapered rib reinforced enclosures manufactured from structural foam, chemically inert and resistant to moisture, ultraviolet light, corrosion and temperature changes. Lids shall be of same material and green in color.
- B. Control Valves: Carson 1419B-12.
- C. Gate Valves: Carson 910-12.
- D. Wire Splices: Carson 910-12.
- E. Drip Valve Assemblies: Carson 1324B-12L.

2.7 SPRINKLER HEADS

- A. General: Manufacturer's standard unit designed to provide uniform coverage over entire area of spray shown on drawings at available water pressure.
- B. 1/2" Inlet Pop-up Spray Head: Removable nozzle with fixed or adjustable spray pattern, with screw-type flow adjustment and stainless steel retraction spring. Rain Bird 1806 / Rain Bird 1812.
- C. 3/4" Inlet Pop-up Rotor Head: Gear driven, full circle and adjustable part circle. Hunter PGP / Hunter PGJ.

2.8 DRIP TUBING

- A. Heavy wall flexible tube with one (1) GPH pressure compensating emitters factor installed at 12 inch spacing. Netafim TLDL9-12.

2.9 AUTOMATIC CONTROLLER

- A. Automatic controller shall be of the size and type as shown on the drawing. Controller shall be capable of "water budgeting each program and shall be compatible with a "rain shut off" device. Install a Rain Bird ESP-4M (exterior model) or approved equivalent.

2.10 AUTOMATIC RAIN SHUT OFF DEVICE

- A. Hunter "Wireless" Rain-Click.

2.11 VOLT SURGE PROTECTION

- A. Advanced Protection #TE-110-JR.

2.12 SLEEVES AND CONDUIT

- A. Sleeves shall be PVC SCH 40 or cast iron pipe of adequate diameter to accommodate the pipe(s) or wire(s) with sufficient free play to allow removal and reinstallation without binding. Minimum sleeve size shall be 2".

2.13 CONTROL WIRING

- A. Shall be direct burial, single strand, size AWG 12/ 14 as specified, UL Listed, type U.F., 600 volt wire. Use red for pilot (hot) wire and white for common wire. Use blue for spare wires.

PART 3 - EXECUTION

3.1 SYSTEM DESIGN

- A. The drawings are generally diagrammatic. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings and sleeves which may be required. The Subcontractor shall carefully investigate the structural and finished conditions affecting all of the work and plan his work accordingly.
- B. The location of heads are approximate. Make minor adjustments as necessary to avoid plantings and other obstructions and to obtain covers. In no case shall head spacing exceed a distance equal to 60% of the manufacturer's effective diameter rating if the sprinklers are placed in a square or rectangular pattern nor 70% if in an equilateral triangular pattern. Irrigation shall provide 100% coverage with "head-to-head" spacing.

- C. The Subcontractor shall comply with pipe sizes indicated on the drawings. No substitutions of smaller pipes will be permitted. Maximum water velocity shall not exceed 5.0 feet per second in the main line and 6.0 feet per second in the lateral lines.

3.2 PIPE INSTALLATION

- A. Trenching: Trenches shall be dug straight. Trench bottoms shall be at true gradient providing support to pipe through its entire length. Trench bottoms shall be free from rocks, clods, debris, and sharp-edged objects. The minimum depth of lines measured to top of pipe, unless otherwise indicated on plans, shall be as stated herein.
 - 1. Main lines and quick coupler lines shall be 24 inches.
 - 2. Lateral sprinkler lines shall be 12 inches.
 - 3. Provide minimum cover of 18 inches for all control wiring.
 - 4. Drip tubing shall be installed at grade and covered with mulch.
- B. All trenching or other work under the limb spread of any and all plants shall be done by the Subcontractor by hand or by other methods so that no limbs or branches are damaged in any way.
- C. Sleeves and Conduit: All pipe and wiring routed under areas to be paved shall be placed in separate sleeves extending twelve (12) inches beyond the edges of the pavement. Sleeves have been provided by the General Contractor. Refer to the plans for sleeve locations.

3.3 PIPING

- A. Storage and Transportation: Pipe shall be handled and stored in a manner to prevent damage. The plastic pipe and fittings shall be stored under cover, and shall transported in a vehicle with a bed long enough to allow the length of pipe to lie flat so as not to be subject to undue bending or concentrated external load at any point. Any plastic pipe that has been dented or damaged shall not be used.
- B. Cleaning Requirement: Clean interior of pipe thoroughly and remove all dirt or foreign matter before lowering pipe into trench. Keep pipe clean during operations by plugs or other approved methods. All offsets shall be made with fittings. All water lines shall be thoroughly flushed out before valves or sprinkler heads are installed.
- C. Install P.V.C. pipe in dry weather when temperature is above 40°F in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperature above 40°F before testing, unless otherwise recommended by manufacturer.
- D. All P.V.C. pipe and fittings shall be installed by the Subcontractor as recommended by the pipe manufacturer. The Subcontractor shall assume full responsibility for the correct installation.

- E. Pipe Joints, in general, shall be formed by competent tradesmen specifically trained in the type of work required and using tools and equipment recommended by the manufacturers of the pipe, fittings and equipment.

3.4 THRUST BLOCKING

- A. All main line shall have thrust blocks at all tees, bends, changes in size or at the end of pipe lines, as specified in the plans. All wires shall be kept free from concrete by the Subcontractor and placed outside of the thrust block. Thrust blocks shall be poured against undisturbed ground. No precast thrust blocks will be allowed.

3.5 FITTINGS

- A. Solvent Welded P.V.C. Fittings: Install as per manufacturer's recommendations.
- B. Ductile Iron Gasket Joint Fittings: Install as per manufacturer's recommendations.
- C. Galvanized Steel Pipe and Fittings: Threads shall be sound, clean cut, and well fitting. threaded joints shall be made up with the best quality pure joint compound or lead paste, carefully and smoothly placed on the male threads only, throughout the system. Any leaky joints shall be remade with new material. Use of thread cement or caulking to make joints tight will not be permitted. All cut ends shall be remade to full bore before assembly.
- D. Plastic to Steel Connections: Male thread plastic to female thread steel shall be used. The same shall apply to plastic and brass or other metal. In no case shall metal be screwed into a plastic fitting. A non-hardening pipe dope such as "Permatex No. 2" or equal, shall be used on threaded plastic to metal joints, and only light wrench pressure should be used.

3.6 WIRING

- A. Wiring shall occupy pipe trenches whenever possible. Lay the wire(s) along the bottom of the pipe. Where more than one (1) wire is placed in a trench, all wires shall be taped together at intervals of twenty (20) feet.
- B. An expansion curl shall be provided within three (3) feet of each wire connection and at least every two hundred (200) feet in length. Expansion curls shall be formed by wrapping at least twelve (12) turns of wire around a pipe 1" (or more) in diameter, then withdrawing pipe.
- C. All splices shall be made with King Technology (King 6) silicone-filled safety connectors. All wire splices must be enclosed in a valve box for easy inspection and servicing.
- D. All control wiring routed beneath or through pavement, walks, curbs and/ or other structural elements shall be run through P.V.C. SCH 40 conduit of sufficient diameter for wire pulling.

- E. Install two (2) spare wires from each controller to the furthest valve in each direction from that controller. A pair of spare wires should pass every valve box on the system. Leave a "pig-tail" loop with thirty-six (36) inches of excess spare wire in every valve box.
- F. Where multiple valves are to be connected to a single controller station, a separate hot wire should be installed from the controller to each valve. Multiple valves tied to a single hot wire will be accepted.

3.7 BACKFILLING

- A. Backfill material shall be approved soil, free from large rocks (over 1 inch in size), debris or sharp objects. In general, the material removed from excavation may be used. All excavated rocky material shall be removed from the site and suitable fill material, approved by the Landscape Architect, obtained for backfill.
- B. Backfilling shall be done when pipe is not in an expanded or contracted condition due to temperature extremes. Cooling of the pipe can be accomplished by operation of the system for a short time before backfill, or by backfilling in the early part of the morning before the heat of the day.
- C. Long runs of P.V.C. pipe shall be snaked in the trench to allow for contraction.
- D. Backfill shall follow excavation with the least possible delay. Open trenches shall be adequately protected to cause the least possible hazard to an interference with people and animals.
- E. The Subcontractor shall hand place the first six (6) inches of backfill (or to the top of pipe) and have it compacted so as to secure the position of the pipe and wire. Backfill shall be compacted by tamping while soil is moist (not wet). The operation shall be repeated until finished grade of back filled trenches matches that of adjacent soil.

3.8 ELECTRIC CONTROL VALVES

- A. Adjust the flow control on all electric control valves to limit the down stream pressure to the recommended operating pressure for the sprinkler/ nozzle combination used on each zone.
- B. Whenever possible, locate valves in plant bed areas for best concealment and accessibility.
- C. Valves are to be large enough to accommodate maintenance and operations of valves. Provide a three (3) inch deep sump of one-half (1/2) inch diameter gravel at bottom of valve pit.

3.9 SPRINKLER HEADS

- A. Sprinkler heads shall be installed in a plumb position at intervals not to exceed the maximum spacings specified by the manufacturer for project conditions, or as indicated on the drawings.

- B. Heads in turf areas shall be installed six (6) inch maximum away from the edge of the curb or walk. All heads shall be installed on flexible connectors or swing joints and shall allow for vertical adjustment of heads. Four (4) inch pop-up spray heads or pop-up rotors (where appropriate) shall be used in turf areas.

3.10 AUTOMATIC CONTROLLER

- A. Unless otherwise noted on the plan, the 120 volt electrical power to the automatic controller location to be furnished by others. The irrigation contractor shall make all connections in the low-voltage system between the automatic controller and the valves.
- B. Each controller shall be properly grounded with the use of one or more 5/8" x 8" copper clad ground rods and AWG #6 bare copper wire. The resistance from the ground rod to earth shall be ten (10) ohms or less. Install a 110 volt, TE-110-JR surge protector per manufacturer's recommendations.
- C. Install a Hunter Wireless Rain Clk rain shut device per manufacturer's recommendations. Provide adequate clearance from overhangs, trees, etc. to allow for proper operation.

3.11 GENERAL

- A. In no event shall the Subcontractor cover up or otherwise remove from view any work under the contract without prior approval of the Contractor, Landscape Architect, and / or Owner. Any work covered prior to inspection shall be opened to view by the Subcontractor at his expense. Notify the Landscape Architect and Contractor in writing when testing will be conducted, and conduct tests in presence of the Landscape Architect and Contractor.
- B. The entire sprinkler system shall be guaranteed for reasons other than neglect, abuse, accidental damage, undue weather conditions and/ or any other Acts of God, by the contractor to give complete and satisfactory service as to materials and workmanship for a period of one (1) year from the date of final acceptance of the work by the Owner.
- C. Should any trouble develop within the specified guarantee period which in the opinion of the Owner is due to inferior or faulty materials and/ or workmanship, the trouble shall be corrected without delay by the Subcontractor, to the satisfaction of any at no expense to the Owner.
- D. Any and all damage to rain water drains, water supply lines, gas lines and/ or other service lines, shall be repaired and made good by the Subcontractor at no extra cost to the Owner. It is the responsibility of the Subcontractor to be aware of the location of all utilities of other permanent or non-permanent installations and to protect these installations from any damage whatsoever.

3.12 LEAKAGE TESTING

- A. All Main Lines shall be tested prior to backfill of joints. Slowly fill the main line piping with water, taking care to purge the air from it by operating all of the control valves one or more times and/or such other means as may be necessary. Allow the pipe to sit full of water for twenty-four (24) hours to dissolve remaining trapped air. Use a metering pump to elevate the water pressure to 100 PSI and hold water for a period of two (2) hours. PVC solvent-weld pipe connections should have no leakage. If the test indicates leaks in the system, locate and repair the leak, then retest the pipeline until it passes the test. Any covered pipe found to leak, shall be excavated and repaired at the Subcontractor's expense.
- B. Operational Testing: The entire installation shall be placed in operation by the Subcontractor and tested in the presence of the Owner or the Contractor for proper functioning as a whole. Location and arc of heads shall be adjusted if required to eliminate any dry spots, over-water or spillage on adjacent areas and to prevent over spray onto walks, roadways and buildings as much as possible.

END OF SECTION 028100

SECTION 029000 - LANDSCAPE WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes provisions for the following items: Trees, Shrubs, Ground Cover, Finish Grading, Pruning Existing Trees, Lawns, Soil Amendments, and Initial Maintenance of landscape materials.

1.3 QUALITY ASSURANCE

- A. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to the Contracting Officer, together with proposal for use of equivalent material.
- B. Analysis and Standards: Package products with manufacturers certified analysis. For other materials provide analysis by recognized laboratory made with methods established by the Association of Official Agriculture Chemists, wherever applicable.
- C. Trees, Shrubs and Ground Cover: Provide trees, shrubs, and ground cover of quantity, size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of Florida #1 standards as given in, Grades and Standards for Nursery Plants, latest edition, published by the Florida Department of Agriculture and Consumer Services. Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.
- D. The Landscape Architect may inspect plant materials either at place of growth or at site before planting, for compliance with requirements of specifications. Landscape Architect retains right to further inspect plant materials for size and condition of root systems, insects, and injuries, and to reject unsatisfactory material at any time during progress of work. Remove rejected materials immediately from project site.
- E. Pre-Installation Conference: Contractor shall attend conference at Project site with Landscape Architect to discuss planting procedures, scheduling, and requirements for approval.
- F. All existing trees within the limits of work shall be pruned by qualified personnel in a manner that minimizes disturbance of areas not under construction. Wood and debris shall become the property of the contractor and shall be removed from the site. Contractor shall protect root areas and crowns of trees not designated for work under this contract from damage from operations and equipment. Provide tree barricades as per the details on the plan.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Contractual Conditions and Division one Specification Sections. Manufacturer's certified analysis for fertilizer materials and mulch type.
- B. Maintenance Instructions: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration while stored at site.
- B. Trees, Shrubs and Ground Cover: Provide Container Grown trees, shrubs and ground cover. Do not prune prior to delivery. Do not bend or bind trees or shrubs in such manner as to damage bark, break branches, or destroy natural shape. Provide protective covering during delivery.
- C. Deliver plant materials after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set plant stock in shade, protect from weather and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.
- D. Do not remove container grown stock from containers until planting time.

1.6 JOB CONDITIONS

- A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- B. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.
- C. Installer must examine Sub grade, verify elevations, and observe conditions under which work is to be performed, and notify Landscape Architect of unsatisfactory conditions. The installer shall not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable.

1.7 SEQUENCING AND SCHEDULING

- A. Planting Time: Proceed with, and complete landscape work as rapidly as portions of site become available. Plant shrubs, ground cover and sod after installation of underground irrigation.

1.8 SPECIAL PROJECT WARRANTY

- A. Warranty trees, shrubs and ground cover, for a period of one year after date of substantial completion, against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Installer's control.
- B. Remove and replace trees, shrubs, or ground cover found to be dead or in unhealthy condition during warranty period. Make replacements during growth season following end of warranty period. Replace trees and shrubs, which are in doubtful condition at end of warranty period.
- C. Another warranty inspection will be conducted at end of extended warranty period, to determine acceptance or rejection. Only one replacement (per plant) will be required at end of warranty period, except for losses or replacements due to failure to comply with specified requirements.

PART 2 - PRODUCTS

2.1 SOIL AMENDMENTS

- A. Mulch: Organic mulch free from deleterious materials and consisting of the following: Pine Bark Nuggets, sized from 2" to 4", Grade "A" or approved equal.
- B. For all ground cover, shrubs, trees, and palms provide Osmocote Plus 15-9-12 slow release formulation to the soil surface of each plant pit at the manufacturer's recommended rate.

2.2 PLANT MATERIALS

- A. Quality: Provide trees, shrubs, and other plants of size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of Florida #1 Standards for type and species required.
- B. Trees: Provide trees of height and caliper scheduled or shown and with branching configuration recommended by Florida #1 Standards for type and species required. Provide single stem trees except where special forms are listed.
- C. Shrubs and Ground Cover: Provide shrubs and ground cover of the height listed and with not less than minimum number of runners required by Florida #1 for type and height of plant material required.
- D. Container Grown Plants: All container grown plants shall be well rooted and established in the container in which they are delivered to the site, and shall have been in that container long enough for the fibrous roots to hold the soil together when the plant is removed from the container. Plant shall not be root-bound in the container. Container grown plants shall not be removed from the container until immediately before planting and with care to prevent damage to the root system.

2.3 MISCELLANEOUS LANDSCAPE MATERIALS

- A. Stakes and Guys: Provide stakes or lodge poles, three per tree. Provide Arbor Tie connections. Any wire ties will be rejected.
- B. Pre-emergent Herbicide: "RONSTAR" pre-emergent herbicide or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION GENERAL

- A. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure Landscape Architect's acceptance before start of planting work. Make minor adjustments as may be required.

3.2 TREE PRUNING

- A. Before construction starts, all existing trees within the limits of grading shall be pruned as follows: Prune tree canopies to minimum 12' height or as required to clear buildings etc., remove any diseased trunks or branches, and remove weak or crossed branches. All roots to be removed during the site-clearing phase shall be severed clean at the perimeter of the designated protected radius.
- B. Cutting back or drop crotch pruning shall consist of the reduction of tops, sides, under branches or individual limbs. All cuts shall be made sufficiently close to the trunk or parent limb, without cutting into the branch collar or leaving a protruding stub, so that closure can readily start under normal conditions. It is necessary to pre-cut branches too heavy to handle to prevent splitting or peeling the bark. Attention shall be taken to the symmetrical appearance of the canopy.
- C. Use clean, sharp tools, disinfect where necessary to prevent the spread of disease. Limbs and debris from this work shall be transported and not dragged over the site.

3.3 PREPARATION OF PLANTING SOIL

- A. Before mixing, clean existing soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth. Aerate existing soil before backfilling.

3.4 EXCAVATION FOR TREES, SHRUBS AND GROUND COVER

- A. Excavate pits and beds with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. For all landscape materials (trees, shrubs and ground cover), make excavations at least twice as wide as the ball diameter and equal to the ball depth. Fill excavations for trees, shrubs, and ground cover with water and allow water to percolate out prior to planting.

3.5 PLANTING TREES, SHRUBS AND GROUND COVER

- A. Set stock on bottom of plant pit, plumb and in center of pit with top of ball 1" above the adjacent finished grade. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. Place "OSMOCOTE" fertilizer on top of plant pit backfill, at the rate indicated by the manufacturer. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.
- B. Mulch pits, trenches, and planted areas. Provide not less than three-inch thickness of mulch, finish level with adjacent finish grades. Keep mulch minimum 4" from tree trunks and shrub stems.
- C. Prune new trees and shrubs in accordance with standard horticultural practice, only if needed. Retain required height and spread. Do not cut tree leaders, and remove only injured or dead branches from trees.

3.6 MISCELLANEOUS LANDSCAPE WORK

- A. Stake and guy trees and palms immediately after planting, as indicated in the details.
- B. Apply "Ronstar" Pre-emergent Herbicide to all areas to be mulched according to the manufacturer's recommended rate. Contractor is responsible for re-applying appropriate herbicide to eradicate all remaining weeds and maintain a weed-free condition in all areas throughout all landscape operations.

PART 4 - MAINTENANCE, CLEANUP AND PROTECTION

4.1 GENERAL MAINTENANCE

- A. Begin maintenance immediately after planting.
- B. Maintain trees, shrubs, and ground cover for one year after date of Substantial Completion for entire project.
- C. Maintain trees, shrubs, and ground cover by pruning, cultivating, adjusting irrigation, fertilizing, and weeding as required for healthy growth. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required. Spray as needed to keep trees, shrubs, and ground cover free of insects and disease.

4.2 CLEANUP AND PROTECTION

- A. During landscape work, keep pavements clean and work area in an orderly condition. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

PART 5 - INSPECTION AND ACCEPTANCE

5.1 SITE INSPECTION

- A. When landscape work is completed, including maintenance, Landscape Architect will make an inspection to determine acceptability.
- B. Landscape work may be inspected for acceptance in portions as agreeable to Landscape Architect, provided each portion of work offered for inspection is complete, including maintenance.
- C. When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Landscape Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.

END OF SECTION 029000

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

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. Specification 03 29 00 – Under Slab Vapor Barrier / Retarder.

1.02 DESCRIPTION OF WORK

- A. Provide cast-in-place concrete work as shown on the drawings and specified herein.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified;
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings."
 - 2. ACI 304 "Recommend Practice for Measuring, Mixing, Transporting, and Placing Concrete."
 - 3. ACI 311 "Recommend Practice for Concrete Inspection."
 - 4. ACI 315 "Manual of Standard Practice for Detailing Concrete Structures."
 - 5. ACI 318 "Building Code Requirements for Reinforced Concrete."
 - 6. ACI 347 "Recommend Practice for Concrete Formwork."
 - 7. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
- B. Full Cooperation shall be given to mechanical, electrical, and plumbing installers to allow them time to coordinate and install all items of their work which are to be encased or built into concrete. Contractor to assure that other work such as sleeves, electrical conduits, pipes, anchors, etc., are properly placed and secured in position before concrete is placed. Items that require inspection shall have been inspected and tested for both material and mechanical operation and shall have been completed before concrete is placed.

1.04 SUBMITTAL

- A. Shop Drawings: Submit for review shop drawings for all concrete work showing reinforcement, bending details, bar schedules, stirrup spacing, and placing details for all reinforcement.
- B. Shop drawings shall bear the initials of both the detailer and checker to indicate that said shop drawings have been checked by the shop prior to submission.
- C. Any error, including omissions, coordination, and errors in dimensions shown on shop drawings shall be the responsibility of the Contractor. Prepare shop drawings in sufficient time to allow the Architect 14 calendar days from his receipt of the full set in which to review and check same.

- D. Mix Designs: Submit for review lab test reports for concrete materials and mix designs as specified.
- E. Mill Reports: Submit for information purposes only mill reports covering the chemical and physical properties of reinforcing as specified.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Store materials to permit easy access for inspection and identification. Keep reinforcing steel under cover and off the ground using supports. Protect reinforcing steel from rusting, oil, grease, or distortion.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with smooth faced plywood to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without objectionable bow or deflection.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Ties: Provide factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent deflection, and to prevent spalling concrete surfaces upon removal.
- D. Unless otherwise shown, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1-1/2" from the outer concrete surface.
- E. Unless otherwise indicated, provide form ties which will leave a hole not larger than 1" diameter in the concrete surface.

2.02 CONCRETE MATERIALS

- A. Portland Cement: Portland cement shall conform to ASTM C150, Type 1.
- B. All cement shall be from the same mill and manufacturer to insure cement of uniform color and shade for all exposed concrete
- C. High early strength Portland cement or other special cement shall be used only when authorized by the Architect.
- D. Fly Ash: ASTM C618, Type F., 20% max.
- E. Fine Aggregate: Fine aggregate shall be clean, natural siliceous sand consisting of hard, strong, durable, uncoated particles, and shall conform to the requirements of ASTM C33.
- F. Coarse Aggregate for Stone Concrete: Coarse aggregate for stone concrete shall consist of clean, hard, uncoated, strong, durable gravel or crushed stone and shall conform to the requirements of ASTM C33.

- G. Water: Water for mixing and curing concrete shall be potable and shall not contain amounts of impurities injurious to the concrete. Drinkable.

2.03 REINFORCING MATERIALS

- A. Reinforcing Steel: Reinforcing steel must be correctly rolled to section and free from all surface defects and shall be in accordance with ASTM A615 Grade 60 as evidenced by manufacturer's certificates. The grade of steel shall be intermediate, new billet stock. All bars shall be deformed and rolled with raised symbols to identify the manufacturer and the size of the bar.
- B. Welded Wire Mesh shall conform to ASTM A185 and ASTM A82 (FY = 65 ksi). Flat sheets only.
- C. Steel Wire: The Wire shall be No. 18 U.S. Steel wire gauge black annealed wire.
- D. Supports for Reinforcement: Spacer bars, slab bolsters, chairs, wiring, nails, and other accessories shall be standard commercial metal supports, and plastic where exposed to weather, or where rust could impair architectural finishes. Use chairs with plastic tips on all framed slabs.

2.04 ADMIXTURES

- A. General: No admixtures other than those listed below shall be used in concrete mixes after design mix approval. Admixtures shall contain no more chloride ions than are present in municipal drinking water. Certification of conformance to requirements and the chloride ion content will be required from the admixture manufacturer prior to mix design review to the Architect. Upon request only, provide a qualified, full-time representative to assure proper use of admixtures.
- B. Water Reducing Admixture: The water-reducing admixture "Eucon WR-75" manufactured by the Euclid Chemical Company, "Plastocrete 161" manufactured by the Sika Chemical Corporation, or "Pozzolith 322N" manufactured by Master Builders Company or equal shall be used in all concrete. The admixture shall conform to ASTM C494, Type A, and shall not contain more chloride ions than are present in municipal drinking water.
- C. High Range Water Reducing Admixture (Superplasticizer): "Eucon 37" by The Euclid Chemical Company or "Sikament" by Sika Chemical Corporation, may be used in all pumped concrete and concrete with a water-cement ratio below 0.50. The admixture shall conform to ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
- D. Non-Corrosive, Non-Chloride Accelerator: Accelguard 80" by the Euclid Chemical Company or "Pozzolith LL880" by Master Builders. The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. It shall be used in all concrete placed at temperatures below 50 degrees F.
- E. The admixture manufacturer must have long-term, non-corrosive test data from an independent testing laboratory (of a least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.
- F. Water Reducing Retarder Admixture: The water reducing retarder admixture "Eucon Retarder-75" manufactured by the Euclid Chemical Company, "Plastocrete 161R" manufactured by Sika Chemical Corporation or "Pozzolith 100-XR" manufactured by Master Builders or approved equal, shall not contain more chloride ions than are present in municipal drinking water.
- G. Air Entraining Admixture: The air-entraining admixture shall conform to ASTM C260 and shall be used where necessary to achieve the specified air content.

- H. Calcium Chloride: Calcium chloride, thiocyanate, or admixture containing more than 0.05% chloride ions are not permitted.
- I. Air Content: Air content of concrete shall be as follows:
1. For concrete exposed to soil and/or weather, $5\% \pm 1.5\%$.
 2. 3% for all other concrete.
- J. Joint Filler: Expansion joint fillers shall be asphalt impregnated fiber board conforming to ASTM D-1751. Joint fillers shall extend full depth of slab or joint and be thickness and lengths indicated on drawings.
- K. Anchor Slots: Hot-Dipped galvanized, #22 ga. metal, felt filled, equal to No. 305 made by Hohman & Bernard or approved equal.
- L. Inserts: Inserts shall be either adjustable, threaded or wedge types depending on use as manufactured by Hohman & Bernard or approved equal.
- M. Non-Shrink Grout: Pre-mixed non-shrink grout as called for on drawings shall be manufactured by:
1. The Euclid Chemical Company - "Euco N-S Group" (All exposed grout).
 2. The Euclid Chemical Company - "Firmix".
 3. Master Builders - "Embeco 885".
 4. Anto-Hydro Company - "Axpandcrete Metalics."
 5. Sonneborn - "Ferrolith G".
 6. Lambert Corporation - "Vibropruf #11".
- Curing Compounds:
- N. Manufacturer: Subject to compliance with requirements, products incorporated in the work shall be one of the following:
1. "Clear Bond"; Guardian Chemical.
 2. "Master Seal"; Master Builders.
 3. "Abco Cure N Seal 830"; Nox-Crete.
 4. "Crystal Gard - 0800"; Lambert Corporation.
- O. Absorptive Cover: Burlap cloth made from Jute or Kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- P. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C171.
1. Waterproof paper.
 2. Polyethylene film.

3. Polyethylene coated burlap.
- Q. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicate per gal.
- R. Plastic Reglets: Provide "Type A" prefilled P.V.C. reglets where indicated, made by the Superior Concrete Accessories, Inc. Install in strict accordance with manufacturers details and directions.
- S. Bonding Compound: The Compound shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces, "Euco Epoxy #463 or #615" by the Euclid Chemical Company or "Sikadur Hi-Mod" by Sika Chemical Corporation.

PART 3 - EXECUTION

3.01 FORMS

- A. Forms shall be so constructed that the finished concrete will conform to the shapes, lines, and dimensions shown on the Contract drawings. They shall be substantially built and sufficiently tight to prevent leakage of water or paste and securely braced in order to maintain their true position and shape. If any form loses its proper shape or position, it shall immediately be repaired to the satisfaction of the Architect or removed and replaced with a new form.
- B. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor.
- C. Wetting and Oiling Forms: The inside surface of woodboard forms shall be soaked with clean water prior to placing concrete. Unfinished plywood or presswood forms (except as otherwise specified herein) shall be treated with an approved form oil or lacquer. If oil is used, all excess oil shall be wiped off with rags to leave the surface of the forms just oily to the touch. Oil is not to be applied after reinforcing is in place.

3.02 VAPOR RETARDER/BARRIER INSTALLATION

- A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour. Follow Specification section 03 29 00.
- B. Lap joints 6 inches minimum and seal as per manufacturer's recommendations.

3.03 CONCRETE PROPORTIONS

- A. All mix designs shall be proportioned in accordance with Section 4.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318-83 and as noted below. Preparation of mix designs are the responsibility of the Contractor. If trial batches are selected as the method of proportioning, the mix design shall be proportioned to achieve an average 28-day compressive strength of 1200 psi in excess of the design strength indicated on the Contract drawings. All proposed mixes shall be submitted with complete standard deviation analysis or trial batch data for the Architect's review a minimum of 14 days prior to the use of the mix.
- B. Water-Cement Ratio: Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:
 1. 5000-psi, 28-day compressive strength; W/C ratio, 0.42 maximum (non-air-entrained), 0.32 maximum (air-entrained).

2. 4000-psi, 28-day compressive strength; W/C ratio, 0.45 maximum (non-air-entrained), 0.35 maximum (air-entrained).
 3. 3500-psi, 28-day compressive strength; W/C ratio, 0.48 maximum (non-air-entrained), 0.40 maximum (air-entrained).
 4. 3000-psi, 28-day compressive strength; W/C ratio, 0.52 maximum (non-air-entrained), 0.46 maximum (air-entrained).
 5. 2500-psi, 28-day compressive strength; W/C ratio, 0.54 maximum (non-air-entrained), 0.50 maximum (air-entrained).
- C. All concrete subjected to freezing and thawing shall have a minimum water-cement ratio of 0.45. All concrete subjected to de-icers and/or required to be watertight shall have a maximum water-cement ratio of 0.40. All reinforced concrete subjected to brackish water, salt spray or de-icers shall have a maximum water-cement ratio of 0.40.
- D. Cement, aggregate, cylinder molds, and other materials required for design or verification mixes by the laboratory shall be supplied by the Contractor. The test lab cost shall be at the expenses of the Contractor.
- E. Measurements of fine and coarse aggregate shall be made separately by weight. The proportioning of aggregate for fractional sacks of cement will not be permitted unless the cement is weighed for each batch. Weighing equipment shall be arranged to permit making compensation for changes in the weight of moisture contained in the aggregate.
- F. Lightweight Concrete - Proportion mix as specified. Design mix to produce strength and modulus of elasticity as noted on drawings, with a splitting tensile strength factor (F_{ct}) of not less than 5.5 for 3000-psi concrete and a dry weight of not less than 95 lbs. or more than 110 lbs. after 28 days. Limit shrinkage to 0.03 percent at 28 days.

3.04 MIXING

- A. General: The mixing shall be done by the use of modern, efficient, mechanical equipment and devices satisfactory to the Architect for accurately controlling and easily checking the weight of each of the ingredients. The Architect shall have free access to the plant at all time for sampling the materials, or inspection of the work.
- B. Concrete mixers shall be of the revolving drum type. Each batch shall be mixed for not less than 2 minutes after the water has been added at the rate of rotation specified by the manufacturer. The concrete shall be discharged completely before the mixer is recharged.
- C. Ready-mixed concrete shall be mixed and delivered as specified for central-mixed or truck-mixed concrete in ASTM C94. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

3.05 PLACING REINFORCEMENT

- A. Fabrication: Reinforcement fabricated to the shapes and dimensions shown or required shall be in place where indicated on the drawings, or as required to comply with the Contract Documents.
- B. Tags: Reinforcing bars shall be furnished with identification tags.

- C. Cleaning: Before any reinforcement is placed, any loose rust or mill scale, or coatings, including ice or oil, which would reduce or destroy the bond shall be removed. Reinforcement material reduced in section shall not be used.
- D. Concrete cover over steel reinforcement shall not be less than that permitted by "Building Code Requirements for Reinforced Concrete, ACI 318" or as shown on the drawings.
- E. Positioning: Bar reinforcement shall be carefully formed to the shapes shown and required to resist most effectively the stresses involved. Bars with kinks or bends not required shall not be used. The reinforcement shall not be bent or straightened in a manner which would injure the material. The heating of reinforcement for bending or straightening will not be permitted.
- F. Bends or hooks, unless otherwise shown or required, shall be cold formed around pins. Hooks shall be ACI Standard.
- G. Securing Reinforcement: Reinforcement shall be wired securely at intersections and shall be held in place with approved bars, spacers, chairs, high chairs, bolsters, or other supports so that it will not be dislocated or otherwise disturbed during the depositing of concrete.
- H. Splices: Steel reinforcement shall not be spliced at points of maximum stress. Laps shall be tied and seized tight at both ends. See drawings for lap lengths and details.
- I. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.06 CONVEYING AND PLACING

- A. General: Concrete shall be conveyed from the mixer to the forms as quickly as possible by method which will prevent segregation and loss of materials. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling. Special care shall be exercised to prevent splashing of forms or reinforcement with concrete in advance of pouring. Concrete shall be deposited in a continuous manner until a given unit of construction, as approved by the Architect, has been completed.
- B. Temporary Runways: Delivery carts and/or buggies where used shall be kept on temporary runways built over the construction, and runway supports shall not bear upon reinforcing steel or fresh concrete.
- C. Maximum Time: Concrete shall not be incorporated in the work after it has attained its initial set nor in any event more than 1-1/2 hours after water has been added to the dry materials, or more than 1-1/2 hours after cement has been added to aggregate. This period may be reduced at the option of the Architect if it develops that presetting is taking place, particularly in hot weather.
- D. Redosage with the specified high range water-reducing admixture (superplasticizer) may be permitted with the approval of the Architect as to methods and procedure.
- E. Vertical Drop: Concrete containing the specified high range water-reducing admixture (superplasticizer) shall not be allowed to drop freely more than 10 feet. Maximum drop for other concrete shall be 6 feet. Provide placement holes in formwork, chutes, or elephant trunks for placement of concrete where the drop exceeds these limits.
- F. Patching: After form approval, repairable defective areas shall be immediately patched.

- G. Repair of Defective Areas: With prior approval of the Architect, as to method and procedure, all repairs of defective areas shall conform to ACI 301, Chapter 9, except that the specified bonding compound must be used.
- H. All structural repairs shall be made with prior approval of the Architect as to method and procedure, using the specified epoxy adhesive and/or epoxy mortar. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used.

3.07 COMPACTION AND VIBRATION

- A. General: Concrete shall be consolidated with the aid of mechanical internal vibrating equipment supplemented by hand spading, rodding, and tamping to force out air pockets, to work the materials into corners and around reinforcement and embedded items, and to eliminate honeycomb. Concrete shall not be moved horizontally over long distances with the use of mechanical vibrator. Use and type of vibrators shall be in strict conformance with ACI 309, "Recommended Practice for Consolidation of Concrete".

3.08 COLD WEATHER PLACEMENT

- A. In temperatures of 40 deg. F and above, when it is not anticipated that temperatures will drop below 40 deg. F., no special protection is required for placing concrete other than providing heated concrete and the means of maintaining concrete temperatures of at least 50 deg. F. for a period of seven (7) days after placing. If high early strength concrete is used, this time period may be reduced to three (3) days.
- B. For temperatures below 40 deg. F., concrete must be delivered to the project site at between 55 deg. F. and 70 deg. F. Water shall not be heated over 180 deg. F. Concrete work shall be protected by wind breaks, curing compounds, and blanket covers if necessary in order to maintain the concrete in-place temperatures of at least 50 deg. F. for five (5) days.
- C. Non-Corrosive, Non-Chloride Accelerating Admixture shall be used as previously specified. In no case shall calcium chloride, thiocyanate, or admixtures containing more than 0.05% chloride ions be used.
- D. Heating Methods: All methods proposed for heating materials, and protecting the concrete shall be subject to approval by the Architect. Concrete shall never be heated over 90 deg. F. nor will any other overheating which would produce a flash set be permitted.

3.09 WARM AND INCLEMENT WEATHER PLACEMENT

- A. During very warm weather, the concrete shall be delivered to the forms at the coolest practicable temperature. In no case shall concrete above 90 deg. F. be placed.
- B. When high temperatures and/or placing conditions dictate, the Contractor shall use the water-reducing, retarding formulation (Type D) in lieu of the specified water-reducing admixture (Type A) as specified. Concrete shall not be placed when the sun, heat, wind, rain, sleet, or humidity would prevent proper placement.

3.10 CONSTRUCTION JOINTS

- A. Where indicated, construction joints shall be of the types and at the locations specified on the drawings or as requested by the Architect on the shop drawings. All other construction joints shall be resubmitted for the Architect's approval.

- B. Shear Keys: Construction joints shall be provided with adequate shear keys for succeeding placements and reinforcement shall be continuous through such joints, unless otherwise noted on the drawings.
- C. Joint Spacing: Unless otherwise noted, the maximum spacing of construction joints shall be as follows:
 - 1. Foundation walls: forty-five (45) feet.
 - 2. Slabs: Fifteen (15) feet.

3.11 BONDING

- A. General: Before any new concrete is deposited on or against concrete that has hardened, the form shall be retightened, the surfaces of the hardened concrete shall be roughened as required, thoroughly cleansed of foreign matter, dampened and the specified bonding compound applied. The forms shall then be retightened. New concrete shall be placed after the bonding compound has dried.

3.12 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 3 days.
- C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- D. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified.
- E. Provide moisture curing by following methods:
 - 1. Keep concrete surface continuously wet by covering with water.
 - 2. Continuous water-fog spray.
 - 3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
- F. Provide moisture-cover curing as follows:
 - 1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with side and ends lapped at least 3" and sealed by waterproof tape or adhesive.
 - 2. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- G. Provide curing compound to slabs as follows:

1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Maintain continuity of coating and repair damage during curing period.
 2. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.
- H. Chemical Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water, and apply in 3 coats; first coat, 1/3 strength, second coat, 1/2 strength; third coat, 2/3 strength. Evenly apply each coat, and allow 24 hours for drying between coats.

3.13 CONCRETE FINISHES

- A. Troweled Finish: All concrete slabs, except as noted below but including those that shall receive resilient flooring, tile with a thin set application, or carpet shall be screeded level to the established elevations, thoroughly consolidated and bullfloated. When slabs have set sufficiently, machine float and then trowel with a steel trowel.
- B. Concrete shall be in condition acceptable to trades that will furnish and install the finish materials.
- C. During the floating and troweling operations, care shall be taken that no holes or depressions are left from the removal of coarse aggregate and that no excess moisture or bleed water is present on the surface. The trowel finished surface shall be level so that the surface conforms to an F25 number as measured by the "Dipstick" or an optical device approved by the Architect.
- D. Exposed Surfaces: Provide smooth rubbed finish to exposed surfaces (except floor slabs), which have received smooth form finish treatment, not later than one day after form removal. Moisten concrete surfaces, and rub with abrasive until a uniform texture is produced. Do not apply cement grout other than that created by rubbing. Immediately repair defective surfaces and remove excess paste from adjacent surfaces.
- E. Scratched Finish: For slab surfaces intended to receive bonded applied "mud set" cementitious applications, ceramic tile or quarry tile, etc., after the concrete has been placed, struck-off consolidated and leveled, the surface shall be roughened with stiff brushes or rakes before final set.
- F. Rough Finish: Rough concrete finish shall be used for all other concrete for which no other finish is indicated or specified. Obtain by using clean, straight lumber, plywood, or metal forms. Concrete having a rough finish shall have honeycombing and minor defects patched.
- H. Sidewalk Finishes: Unless noted otherwise, sidewalk shall have broom finish.
- I. Rock Salt Finish: Where noted on architectural Plan A-2, sidewalks shall receive rock salt treatment by hand sprinkling onto wet concrete surface and tamping. Provide a 4 s.f. sample for Architect approval.

3.14 BUILT IN ITEMS

- A. Mechanical, Electrical and Plumbing installers shall be given time to coordinate and install all items of their work which are to be encased in concrete.

3.15 TESTING AND INSPECTION

- A. General: The Contractor shall pay for the services of a test laboratory for concrete inspection. Retesting of any material that fails to meet the specified standards and testing of any material that has replaced rejected material shall be paid by the Contractor. Contractor shall coordinate his work with testing laboratory and shall cooperate in the testing procedure.
- B. Certified copies of mill reports covering the chemical and physical properties of the steel used in the work shall be furnished at the Contractor's expense.
- C. Codes: The Testing Laboratory will test the concrete for compliance with contract documents and all applicable ACI and ASTM codes and standards.
- D. Understrength Concrete: If, in the opinion of the Contractor, test cylinders that fail to meet the strength requirements are not truly representative, he may have the right to cut cores from the work affected.
- E. Such cores shall be not less than 3 in number and shall comply as to size and shape and shall be secured and tested in conformance with the requirements of ASTM C42. The cores shall be taken at points mutually agreeable to the Contractor and the Architect, and shall be tested at points mutually agreeable to the Contractor and the Architect, and shall be tested in the presence of the Architect by a laboratory approved by the Architect. All costs incurred shall be borne by the Contractor. If test results are not satisfactory to the Architect, the Contractor shall remove from the work all affected concrete and replace such defective work in a satisfactory manner, all without further compensation.
- F. Contractor's Responsibility: The sole responsibility for producing concrete in the field having the strength required without causing excessive shrinkage cracks shall rest on the Contractor, regardless of the laboratory determination. If, in his opinion, the field conditions are such that a lower water-cement ratio is necessary to produce the required strength, he shall submit the mix he proposes to use to the Architect in writing. In no case will the Contractor be permitted to use a higher water-cement or lower cement factor than those used in the approved mix.
- G. Maximum Slump: Concrete containing the specified high range water reducing admixture (superplasticizer) shall have a maximum slump of 8 inches, unless otherwise approved by the Architect. The concrete shall arrive at the jobsite at a slump of 2 to 3 inches, be verified, then the high range water reduction admixture added to increase the slump to the approved level. All other concrete shall have a maximum slump of 4 inches.

3.16 TESTING DURING PROGRESS OF WORK

- A. Batch Plant Inspection by the Testing Laboratory, if authorized, will include:
 - 1. Attendance at the batching plant during all batching.
 - 2. Determination that all weighing and measuring equipment is in proper working order and that calibration certificates of scales are current.
 - 3. Determination that the truck mixers are regularly cleaned and maintained and that the drums revolve at the proper speeds.
 - 4. Ascertain that only correct weights of cement and aggregate are used.

5. Ascertain that only those admixtures as specified and in proper qualities are used in the mix.
 6. Insure that only the correct amount of mixing water is loaded into the tank of the truck.
 7. Insure that only approved materials are used.
 8. Ascertain that aggregated and water are of the proper temperature.
 9. Make necessary tests of the aggregates to determine the moisture content so that the total water in the batch may be properly adjusted.
 10. Test of aggregates received at the batching plant for gradation and cleanliness.
 11. Check and sign delivery tickets issued by supplier that will identify each load of concrete dispatched to the project as having been inspected when directed by the Architect.
- B. Field Inspection by the Testing Laboratory, if authorized, will include:
1. Attendance at the project site during all concrete placing operations.
 2. Ascertain that concrete delivered to the site has been inspected by the batch plant inspector, if so directed by Architect.
 3. Control the addition of mixing water in order to maintain the required water/cement ratio.
 4. Ascertain that the concrete is conveyed from the mixer to the point of pour in accordance with specifications and good practice.
 5. Ascertain that the concrete is of the proper temperature when placed.
- C. Air Contents Tests: At least two tests shall be made for each day's placing or from each batch of concrete from which cylinders are cast. Tests shall be representative of each type of concrete.
- D. Slump Tests: At frequent intervals to properly control the consistency and at least one at time of casting each group of cylinders and at least one test for every 25 cubic yards.
- E. Concrete Compression Cylinders: Unless otherwise specified, there shall be taken from the concrete of each strength placed on any one day at least one set of five representative 6"x12" test cylinders. For large placements on any one day there shall be taken not less than one set of five representative type cylinders for each 50 cubic yard more than the first 25 cubic yards of each type of concrete strength placed. Two cylinders to be tested at 7 days, two at the age of 28 days and the fifth cylinder to be reserve for further testing. Ascertain that the test specimens are properly protected until shipped to the testing laboratory. Record and identify each cylinder with the location of the concrete from which the specimen was taken. Keep marking in sequence.
- F. Additional Test Lab Responsibilities: Report any material or work performed that fails to meet the job specifications immediately with the Contractor, and then to the Architect. Work will be checked as it progresses. Failure to detect any defective work or materials shall not in any way prevent later rejections or obligate the Architect for final acceptance.
- G. Reports on Inspection: Submit reports on testing and inspection. Reports shall include detailed data with respect to all requirements of the specifications referenced. Materials or workmanship not meeting the requirements of the Contract Documents, either at the plant or project site, will be rejected by the Testing Laboratory and Immediately reported to the Contractor and then to the Architect. In no case shall the laboratory recommend any method of adjustment or correction

without obtaining prior approval of the Architect. Include in all reports and project title and number, location, Contractor's name, and date work was performed.

- H. Report Copies and Timing: Immediately after tests or inspections have been made and in no case late than seven (7) days after tests of inspection have been made, the laboratory shall furnish copies of all test and inspection reports.
- I. Batch Plant Inspection Daily Report: The batch plant inspectors shall submit a daily report which shall contain the following data:
1. Concrete supplier.
 2. Weather conditions and air temperature (ranges).
 3. Type of concrete.
 4. Required strength of concrete.
 5. Total number of batches, batch weight, and identifying number of each batch and truck load.
 6. Basic control data concrete mix, indicating mix number source, and type of cement, source of aggregates, type of admixtures, basic quantities of cement, aggregates (dry), water and admixtures of concrete per cubic yard, required slump, required air entrainment and water/cement ratio.
 7. Actual data and quantities of concrete batch, indicating time of batching, actual quantities of cement, aggregates (moist) and admixtures, gallons of water added to plant; percent of total moisture in aggregates; temperature of aggregates and water, gallons of water to be added in transit or at site; time truck dispatched from plant.
 8. Name of inspector, with time of arrival and departure from batch plant and total hours for day.
- J. Site Inspection Daily Report: The site inspectors shall submit a daily report which shall contain the following data:
1. Concrete supplier.
 2. Weather conditions and air temperature (ranges).
 3. Type of concrete placed.
 4. Location of placed concrete and time of starting and stopping of placement.
 5. Identification of truck loads.
 6. Amount of water added in transit or at site.
 7. Time of discharging concrete from truck.
 8. Temperature of concrete during discharging from truck and during placing.
 9. Slump test results, identifying truck load and cylinders made.
 10. Air entrainment test results, identifying truck load.

11. Test cylinders cast, identifying cylinder number, design strength, time taken, slump, truck numbers from which taken and location of pours with yardage of concrete placed at each location.
12. Name of inspector, with time of arrival and departure from site and total hours for day.
13. Cylinder Test Reports: Reports on test cylinders for 7 and 28 day tests (also show 7-day data on 28 day report).
14. Location of pour and specific location represented by cylinders.
15. Date cast.
16. Date tested.
17. Age of test.
18. Number of days cured in laboratory.
19. Required strength.
20. Actual strength.
21. Type of fracture.
22. Consistency as measured by slump.
23. Air content (if air entrained concrete).
24. Weight of cylinders as received.
25. Temperature of concrete when placed.

END OF SECTION 03 30 00

**SECTION 04 20 00
UNIT MASONRY**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with governing codes and applicable provisions of the following:
1. National Concrete Masonry Association (NCMA), including "TEK Bulletins".
 2. American Concrete Institute (ACI), including ACI 531, ACI 531R and ACI 531.1.
 3. Portland Cement Association (PCA), "Concrete Masonry Handbook".
- B. Fire Performance Characteristics: Where fire-resistance ratings are indicated for unit masonry work, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.
- C. Field Construction Mock-Ups: Prior to installation of masonry work, erect sample wall representative of completed masonry work required for project with respect to qualities of appearance, materials and construction. Locate mock-ups during construction as standard for judging completed masonry work. Build mock-ups which are approximately 6' long by 4' high by full thickness. When directed, demolish mock-ups and remove from site.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory and other manufactured products, including certifications that each type complies with specified requirements.

1.04 JOB CONDITIONS

- A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.
- B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.
- D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.
- E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over all surface.
- F. Protect sills, ledges and projections from droppings of mortar.

G. Cold Weather Protection

1. Do not lay masonry units which are wet or frozen.
2. Remove all masonry determined to be damaged by freezing conditions.
3. No masonry work shall be performed when the air temperature is 38 deg. F. and falling.

PART 2 - PRODUCTS

2.01 MASONRY UNITS - GENERAL

- A. Manufacturer: Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related areas.
- B. Masonry Unit Characteristics: Provide units complying with standards referenced and requirements indicated.

2.02 CONCRETE MASONRY UNITS (CMU)

- A. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" (15-5/8" x 7-5/8" actual), unless otherwise indicated.
- B. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
- C. Hollow Load Bearing (HL) CMU: ASTM C 90 and as follows:
1. Grade N.
- D. Weight Classification: Normal weight units unless otherwise indicated. (125 lbs. per cu. ft. or more, oven dry weight of concrete.)
- E. Cure units by atmospheric drying for not less than 30 days before installation, to comply with ASTM C 90, Type II.
- F. Exposed Faces: Provide manufacturer's standard color and texture, unless otherwise indicated.
1. Where special finishes are indicated, provide units with exposed faces of the following general description matching color and texture as selected by Architect from manufacturers standard color and texture.
 - a. Standard aggregate, ground finish.
 - b. Standard aggregate, split face finish.
- G. Prefaced Concrete Block: Provide lightweight concrete units indicated below with manufacturer's standard smooth resinous tile facing complying with ASTM C744:
1. For units on which prefaced surfaces are molded, comply with the following requirements:
 - a. Hollow Loadbearing Block: ASTM C90, Grade N, Type I.

2. Size: Manufacturer's standard with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thickness indicated for units on which prefaced surfaces are molded; with 1/16" thick returns of facing to create 1/4" wide mortar joints with modular coursing.
- I. Color and Pattern: Match Architect's sample.
 - J. Products: Subject to compliance with requirements, provide one of the following:
 1. "Astra-Glaze"; Nabco Glazed Products.
 2. "Spectra-Glaze II"; manufacturer approved by the Burns & Russell Co.

2.03 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color.
- B. Masonry Cement: ASTM C 91.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.
- E. Aggregate for Grout: ASTM C 404.
- F. Water: Clean and potable.

2.04 MASONRY ACCESSORIES

- A. Horizontal Joint Reinforcing and Ties for Masonry: Provide welded wire units prefabricated in straight lengths of not less than 10', with matching corner ("L") and intersecting ("T") units. Fabricate from cold-drawn steel wire complying with ASTM A 82, with deformed continuous side rods and plain cross rods, into units with widths of approximately 2" less than nominal width of walls and partitions as required to position side rods for full embedment in mortar with mortar coverage of not less than 5/8" on joint faces exposed to exterior and not less than 1/2" elsewhere. Provide the following type of joint reinforcing unless otherwise indicated.
 1. Truss type with diagonal cross rods spaced not more than 16" o.c.
- B. Number of Side Rods: Single pair for single wythe masonry.
- C. Wire Sizes: Fabricate with 9-gage side and cross rods, unless otherwise indicated.
- D. Wire Finish: Provide manufacturer's standard mill galvanized finish except as otherwise indicated.
- E. For exterior walls hot-dip galvanized joint reinforcing after fabrication to comply with ASTM A 153, Class B-2 coating (1.5 oz. per sq. ft.).
- F. Steel Strap Anchors: Provide straps, bars, bolts and rods fabricated from not less than 16 ga. sheet metal or 3/8" diameter rod stock, unless otherwise indicated.
- G. Miscellaneous Masonry Accessories
 1. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18.

2.05 MORTAR AND GROUT MIXES

- A. Do not lower the freezing point of mortar by use of admixtures or anti-freeze agents.
- B. Do not use calcium chloride in mortar or grout.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated.
- D. Limit cementitious materials in mortar to portland cement - lime.
- E. Use Type N mortar for all interior masonry work.
- F. Use Type S mortar for all exterior masonry work.
- G. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

- A. Thickness: Build masonry construction to the full thickness shown, except, build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
- B. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses unless otherwise noted.
- C. Cut masonry units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible. Use dry cutting saws to cut concrete masonry units.
- D. Do not wet concrete masonry units.
- E. Pattern Bond: Lay exposed masonry in running bond vertical joint in each course centered on units in courses above and below except as otherwise noted.
- F. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half size units at corners, jambs and wherever possible at other locations.
- G. Lay-up walls plumb and with courses level, accurately spaced and coordinated with other work.
- H. Stopping and Resuming Work: Rack back 1/2-masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.
- I. Built-In Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.
- J. Fill space between hollow metal frames and masonry solidly with mortar.

- K. Where built-in items are to be embedded in cores of hollow masonry units, place a layer metal lath in the joint below and rod mortar or grout into core.
- L. Fill CMU cores with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar conditions unless otherwise indicated.
- M. Non-Loadbearing Interior Partition Walls: Build full height of story to underside of solid structure above, unless otherwise indicated.

3.02 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout. For starting courses on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- B. Joints: Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not otherwise indicated, lay walls with 3/8" joints. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials. Tool all exposed joints in masonry walls slightly concave using a jointer larger than joint thickness. Rake out mortar in preparation for application of caulking or sealants where shown.
- C. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.03 HORIZONTAL JOINT REINFORCING

- A. Provide continuous horizontal joint reinforcing as shown and specified. Full embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls and 1/2" at other locations. Lap reinforcement a minimum of 6". Do not bridge control and expansion joints with reinforcing, unless otherwise indicated. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, pipe enclosures and other special conditions.
- B. Space conditions horizontal reinforcing as follows:
 - 1. For single wythe walls, space reinforcing at 16" o.c. vertically, unless otherwise indicated.
 - 2. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcing placed in 2 horizontal joints approximately 8" apart, both immediately above lintels and below sills.
 - 3. Extend reinforcing a minimum of 2'-0" beyond jambs of the opening, bridging control joints where provided.

3.04 ANCHORING MASONRY WORK

- A. See Drawings.

3.05 LINTELS

- A. Provide masonry lintels where shown and wherever openings of more than 1'-0" are shown without structural steel or other supporting lintels. Provide precast or formed in place lintels. Cure precast masonry before handling or installing. Temporarily support formed-in-place lintels.

- B. Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

3.06 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.
- C. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Comply with recommendations in NCMA TEK Bulletin No. 28.

END OF SECTION 04 20 00

**SECTION 04 20 30
REINFORCED UNIT MASONRY**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

- A. Provide each type of reinforced unit masonry work as indicated on drawings and in schedules and specified herein.
- B. Requirements of Section 04 20 00, "Unit Masonry" apply to work of this section.

1.03 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Refer to Section 04 20 00 for masonry materials and accessories not included in this section.
- B. Reinforcement Bars: Provide deformed bars of Grade 60 complying with ASTM A 615.
- C. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

PART 3 - EXECUTION

3.01 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1" (whichever is greater).
- C. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Architect. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

- D. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8" on exterior face of walls and 1/2" at other locations. Lap units not less than 6" at ends. Use prefabricated "L" and "T" units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

3.02 INSTALLATION - GENERAL

- A. Refer to Section 04 20 00 for general installation requirements of unit masonry.

3.03 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. General

1. Do not wet concrete masonry units (CMU).
2. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.

B. Walls

1. Pattern Bond: Lay CMU wall units in 1/2 running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimensions indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells on non-reinforced vertical cells, or provide units with solid bottoms.

C. Grouting

1. Use "Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or both horizontal directions.
2. Use "Course Grout" per ASTM C476 for filling 4" spaces or larger in both horizontal directions.

D. Low-Lift Grouting

1. Provide minimum clear dimension of 2" and clear area of 8 sq. in. in vertical cores to be grouted.

2. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 ft.
3. Lay CMU to maximum pour height. Do not exceed 5' height, or if bond beam occurs below 5' height stop pour at course below bond beam.
4. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2" below top course of pour.
5. Bond Beams - Stop grout in vertical cells 1-1/2" below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

END OF SECTION 04 20 30

SECTION 04 7200 - CAST STONE MASONRY

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Units required are:
 - 1. Exterior wall units, including wall caps.
 - 2. Other items indicated on drawings.
- 1.2 RELATED REQUIREMENTS
 - A. Section 04 2000 - Unit Masonry: Installation of cast stone in conjunction with masonry.
 - B. Section 07 9005 - JOINT SEALERS: Materials and execution methods for sealing soft joints in cast stone work.
- 1.3 REFERENCE STANDARDS
 - A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - B. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
 - D. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - E. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
 - F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - G. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
 - H. ASTM C150/C150M - Standard Specification for Portland Cement.
 - I. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
 - J. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
 - K. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
 - L. ASTM C1364 - Standard Specification for Architectural Cast Stone.
- 1.4 SUBMITTALS
 - A. See Section 01330 - Submittal Procedures.
 - B. Product Data: Test results of cast stone components made previously by the manufacturer.
 - 1. Include one copy of ASTM C1364 for Wilder Architecture, Inc.'s use.
 - C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
 - D. Mortar Color Selection Samples.
- 1.5 QUALITY ASSURANCE
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
 - B. Number each piece individually to match shop drawings and schedule.
 - C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
 - D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
 - E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
 - F. Store mortar materials where contamination can be avoided.
 - G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

- 2.1 MATERIALS
 - A. Portland Cement: ASTM C150/C150M.
 - 1. For Mortar: Type I or II, except Type III may be used in cold weather.
 - B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
 - C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
 - D. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.
 - E. Admixtures: ASTM C494/C494M.

- F. Water: Potable.
- G. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.
 - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- H. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- I. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- J. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.
- K. Mortar: Portland cement-lime, ASTM C270, Type N; do not use masonry cement.
- L. Sealant: As specified in Section 07920 - Joint Sealants.
- M. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine construction to receive cast stone components. Notify Wilder Architecture, Inc. if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

- A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.
- B. Mechanically anchor cast stone units indicated; set remainder in mortar.
 - 1. Anchorage indicated in the drawings.
- C. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.3 CLEANING

- A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
 - 1. Wet surfaces with water before applying cleaner.
 - 2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
 - 3. Remove cleaner promptly by rinsing thoroughly with clear water.
 - 4. Do not use acidic cleaners.

3.4 PROTECTION

- A. Protect completed work from damage.
- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
 - A. Shop fabricated steel and aluminum items.
- 1.2 SUMMARY
 - A. This Section includes the following:
 - 1. Steel framing and supports for mechanical and electrical equipment.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Aluminum sun shades.
 - 4. Slotted Channel Framing and Accessories.
 - 5. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint finish.
 - 6. Lintels: As detailed; prime paint finish.
 - 7. Toilet Partitions Suspension Members: Steel angle sections; prime paint finish.
- 1.3 SUBMITTALS
 - A. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
 - 2. Provide layouts of slotted channel framing, indicating threaded rod locations and accessories used to achieve design intent. Indicate the connections required but not identified in the documents such as splices.
- 1.4 QUALITY ASSURANCE
 - A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
 - B. Basic Metal Requirements
 - 1. Galvanic Action: Adhere to the requirements of ASTM G82 - 98
- 1.5 PROJECT CONDITIONS
 - A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.
- 1.6 COORDINATION
 - A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

- 2.1 METALS, GENERAL
 - A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- 2.2 FERROUS METALS
 - A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
 - C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

- D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- E. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.
- E. Aluminum-Alloy Sand Castings: ASTM B26.
- F. Aluminum-Alloy Die Castings: ASTM B85.
- G. Bolts, Nuts, and Washers: Stainless steel.
- H. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.4 PAINT

- A. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.
- B. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

2.6 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 CONCRETE FILL

- A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.8 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
 - 1. Fully seal all welded joints to prevent avenues for moisture migration.
 - 2. Seal-weld joints exposed to the exterior.
- H. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- I. Remove sharp or rough areas on exposed traffic surfaces.

- J. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
- B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
 - 2. Furnish inserts if units must be installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

2.10 FINISHES, GENERAL

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

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

2.12 FINISHES - ALUMINUM

- A. Exterior Aluminum Surfaces: Anodized Aluminum
- B. Interior Aluminum Surfaces

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

3.3 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 5210 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe and tube handrails and railing systems.
- B. Related Sections: Requirements relating to this Section are contained in the following Sections:
 - 1. Division 5 Section "Metal Stairs" for steel pipe handrails and railing systems included with metal stairs.

1.3 DEFINITIONS

- A. Definitions in ASTM E 985 for railing-related terms apply to this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:
 - 1. Cold-Formed Structural Steel: AISI "Specification for the Design of Cold-Formed Steel Structural Members."
- B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on the following:
 - 1. Structural computations.
- C. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
 - 1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot applied horizontally and concurrently with uniform load of 100 lbf per linear foot applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 - d. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
 - 1) Concentrated load of 200 lbf applied at any point and in any direction.
 - 2) Uniform load of 50 lbf per linear foot applied in any direction.
 - 3) Concentrated and uniform loads above need not be assumed to act concurrently.
 - e. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area.
 - 1) Above load need not be assumed to act concurrently with loads on top rails of railing systems in determining stress on guard.
- D. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing handrails and railing systems to prevent buckling, opening of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Change (Range): 120 deg F ambient 180 deg F material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for mechanically connected handrails and railing systems, each kind of fitting, grout, anchoring cement, and paint products.
- C. Shop drawings showing fabrication and installation of handrails and railing systems including plans, elevations, sections, details of components, and attachments to other units of Work.

1. For installed handrails and railing systems indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.
- 1.6 QUALITY ASSURANCE
 - A. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.
 - B. Engineer Qualifications: Professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated for handrails and railing systems similar to this Project in material, design, and extent, and that have a record of successful in-service performance.
- 1.7 STORAGE
 - A. Store handrails and railing systems inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- 1.8 PROJECT CONDITIONS
 - A. Field Measurements: Where handrails and railing systems are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating handrails and railing systems without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

- 2.1 METALS
 - A. General: Provide metals free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
 - B. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:
 1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:
 - a. Black finish, unless otherwise indicated.
 - b. Galvanized finish for exterior installations and where indicated.
 - c. Type F, or Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.
 - d. Steel Tubing: Product type (manufacturing method) and other requirements as follows:
 - 1) Cold-Formed Steel Tubing: ASTM A 500, grade as indicated below:
 - (a) Grade A, unless otherwise indicated or required by structural loads.
 - (b) Hot-Formed Steel Tubing: ASTM A 501.
 - (c) For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.
 - e. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - f. Gray Iron Castings: ASTM A 48, Class 30.
 - g. Malleable Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).
 - C. Brackets, Flanges, and Anchors: Cast or formed metal of the same material and finish as supported rails, unless otherwise indicated.
- 2.2 WELDING MATERIALS, FASTENERS, AND ANCHORS
 - A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
 - B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railings to other types of construction indicated and capable of withstanding design loadings.
 1. For steel railings and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - C. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
 1. Provide concealed fasteners for interconnecting railing components and their attachment to other work, except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated.

2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Cast-in-Place and Postinstalled Anchors: Fabricated from corrosion-resistant materials, capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified, independent testing agency.

2.3 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure, complying with performance requirements of FS TT-P-664.
- B. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and compatibility with finish paint systems indicated, complying with SSPC-Paint 5.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.4 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION

- A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than those required to support structural loads.
- B. Assemble handrails and railing systems in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- C. Form changes in direction of members as follows:
 1. By radius bends of radius indicated.
 2. By flush radius bends.
 3. By bending.
 4. By insertion of prefabricated flush elbow fittings.
 5. By any method indicated above, applicable to change of direction involved.
- D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- E. Welded Connections: Fabricate handrails and railing systems for connection of members by welding. For connections made during fabrication, weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe or tube to which end is joined, and weld all around.
 5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- F. Nonwelded Connections: Fabricate handrails and railing systems by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 1. Fabricate splice joints for field connection using epoxy structural adhesive where this represents manufacturer's standard splicing method.
- G. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing system members to other construction.
- H. Provide inserts and other anchorage devices to connect handrails and railing systems to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.
- I. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

- J. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.
- K. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- L. Provide weepholes, or another means to evacuate entrapped water, in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.
- M. Fabricate joints that will be exposed to weather in a manner to exclude water.
- N. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- O. Fillers: Provide steel sheet or plate fillers, of thickness and size indicated or required to support structural loads of handrails, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses to produce adequate bearing to prevent bracket rotation and overstressing substrate.
- P. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) metal channel frames. Make wire mesh and frames from same metal as railings in which they are installed.
 - 1. Orient wire mesh with wires horizontal and vertical.
 - 2. Woven-Wire Mesh: 2" square opening, intercrimp weave, 10 gauge (0.135 inches).

2.6 FINISHES, GENERAL

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

2.7 STEEL FINISHES

- A. Galvanized Finish: Hot-dip galvanize items indicated to be galvanized to comply with applicable standard listed below:
 - 1. ASTM A 153 for galvanizing iron and steel hardware.
 - 2. ASTM A 123 for galvanizing iron and steel products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips.
 - 3. Galvanize all exposed steel.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized handrails and railing systems, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For nongalvanized steel handrails and railing systems, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except provide galvanized anchors where embedded in exterior masonry and concrete construction.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections accurately together to form tight, hairline joints.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railing systems. Set handrails and railing systems accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
 - 1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/4 inch in 12 feet.
 - 3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.
- D. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.
- E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing handrails and railing systems and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Locate exposed fasteners in least conspicuous locations. Seal recessed holes of exposed locking screws with plastic filler, cement colored to match finish of handrails and railing systems.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact, or use fittings designed for this purpose.
- C. Expansion Joints: Install expansion joints at locations indicated but not further apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Anchor posts in concrete by forming or core-drilling holes not less than 5 inches deep and 3/4 inch greater than outside diameter of post. Clean holes of all loose material, insert posts, and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.
 1. Nonshrink, nonmetallic grout.
- B. Anchor posts to metal surfaces as follows:
 1. For steel member railings, weld plates and stiffeners to metal channel or steel tube stringer.

3.5 ANCHORING RAIL ENDS

- A. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with postinstalled anchors and bolts.

3.6 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets and end fittings. Provide bracket with 1-1/2-inch clearance from inside face of handrail to finished wall surface.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and wall return fittings to building construction as follows:
 1. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
 2. For hollow masonry anchorage, use toggle bolts with square heads.
 3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

3.7 ADJUSTING AND CLEANING

- A. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

3.8 PROTECTION

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

END OF SECTION

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Roofing nailers.
 - B. Roofing curbs.
 - C. Preservative treated wood materials.
 - D. Data and electrical room mounting boards.
 - E. Concealed wood blocking, nailers, and supports.
- 1.2 RELATED REQUIREMENTS
 - A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
 - B. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.
- 1.3 REFERENCE STANDARDS
 - A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - C. AWPA U1 - Use Category System: User Specification for Treated Wood.
 - D. PS 1 - Structural Plywood.
 - E. PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
 - F. PS 20 - American Softwood Lumber Standard.
 - G. SPIB (GR) - Grading Rules.
- 1.4 SUBMITTALS
 - A. See Section 01 3300 - Submittal Procedures.
 - B. Product Data: Provide technical data on application instructions and lumber provided.
 - C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
 - D. Certification: Form for each different product made of sustainably harvested wood (FSC certification).
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS
 - A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
 - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - B. Provide wood harvested in the state of Florida.
 - C. Provide sustainably harvested wood.
- 2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS
 - A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
 - B. Sizes: Nominal sizes as indicated on drawings, S4S.
 - C. Moisture Content: S-dry or MC19.
 - D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.
- 2.3 CONSTRUCTION PANELS
 - A. Roof Sheathing, For top of masonry wall: Any PS 2 type, rated Structural I Sheathing.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 60.
 - 3. Performance Category: 3/4 PERF CAT.
 - B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.4 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
 - 3. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Self-Adhering Membrane Separator: where treated wood may induce galvanic corrosion with adjacent metals (aluminum, carbon steel, and coated carbon steel) provide separator membrane.

2.5 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWA standards.
 - 2. The chemical treatment used shall not promote corrosion when in contact with aluminum, carbon steel, steel roof decking, and cold-formed metal framing including when the galvanized coating is nicked and/or penetrated by fasteners.
- B. Preservative Pressure Treatment of Lumber Above Grade: AWWA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - 1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - a. Treat lumber exposed to weather.
 - 2. Treat lumber in contact with roofing, flashing, or waterproofing.
 - 3. Treat lumber in contact with masonry or concrete.
 - 4. Treat lumber less than 18 inches above grade.

PART 3 EXECUTION

3.1 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following specific nonstructural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.

3.4 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.5 INSTALLATION OF CONSTRUCTION PANELS

- A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 - 1. Nail panels to framing; staples are not permitted.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.6 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.7 CLEANING

- A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 11 00 – WOOD FRAMING

PART 1 - GENERAL

- A. The Conditions of the Contract apply to this Section.

1.01 DESCRIPTION

- A. Work Included:

- 1. Provide all wood nails, bolts, screws, framing anchors, and other rough hardware, and all other items needed for rough and finished carpentry in this work but not specifically described in other sections of these specifications.

1.02 QUALITY ASSURANCE

- A. Standards: Comply with all pertinent codes and regulations, and with the standards listed in the section as described in Conditions of the Contract.
- B. Conflicting requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards of these specifications, the provisions of the more stringent shall govern.

1.03 SUBMITTALS

- A. Provide all manufacturers information regarding lumber hardware indicating allowable loads and other pertinent data.

1.04 PRODUCT HANDLING

- A. Protection

- 1. Use all means necessary to protect lumber materials before, during, and after delivery to the job site, and to protect the installed work and materials of all other trades.
 - 2. Deliver the materials to the job site and store, all in a safe area, out of the way of traffic, and shored up off the ground surface.
 - 3. Identify all framing lumber as to grades, and store all grades separately from other grades.
 - 4. Protect all metal products with adequate waterproof outer wrappings.
 - 5. Use extreme care in the off-loading of lumber to prevent damage, splitting, and breaking of materials.

- B. Replacements

- 1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

2.01 PRODUCTS

- A. Grade Stamps

1. Framing Lumber: Identify all framing lumber by the grade stamp of the Southern Forest Products Association. Under 2.01A paragraph 1 (framing lumber) add the following (Western Cedar shall have a grade stamp from the West Coast Lumber Inspection Bureau and/or National Lumber Grading Authority.).
2. Plywood: Identify all plywood as to species, grade and glue type by the stamp of the American Plywood Association.
3. Other: Identify all materials of this section by the appropriate stamp of the agency listed in the reference standards, or by such other means as are approved by the Architect.

B. Materials

1. General - All concealed structural members will be Southern Yellow Pine No. 1 or better, unless otherwise noted. All materials, unless other wise specifically approved in advance by the Architect, shall meet or exceed the following:
 - a. Item Description - Heavy girders, 4x member, beams, Western Cedar No. #1 hand rail cap, 2x exterior painted wood trim (trim at wind, wall corners; etc.)
 - b. 2" floor and stair decking, floor joists, Southern Yellow Pine #1, square column posts, newal posts CCA Pressure treated
 - c. Sole plate, base plate, lavatory Southern Yellow Pine #1 lavatory framing and all CCA pressure treated Exposed P.T. trim
 - d. Studs, all vertical framing Southern Yellow Pine #1, members at exterior walls (concealed) CCA pressure treated
 - e. Studs, all vertical interior framing Southern Yellow Pine or Spruce members (concealed) or Douglas Fir, all Structural #1
 - f. 2" inch roof decking Western Red Cedar commercial tongue and groove.
 - g. 2" wood trim (exposed-includes Western Red Cedar No. 1 rough sawn handrail pickets), stair stringers, splice boards, fascias
 - h. Bevel siding (kiln dried) Western Red Cedar, rough sawn (B and better)
 - i. 2x member trusses, blocking Southern Yellow Pine, Structural No. 1 minimum plywood CDX, exterior glue or as shown vertical-horizontal roof (concealed) on drawing.
 - j. Plywood - where underside is exposed CC-EXT
 - k. Plywood flooring STURD-I-FLOOR, tongue and groove
 - l. Steel hardware ASTM A36 galvanized after fabrication
 - m. Machine bolts ASTM A307 hot-dipped galvanized
 - n. Lag Bolts Federal Specification FF-B-561

- o. Nails hot dipped galvanized, Federal Specification FF-N-1-1 maze storm guard zinc coated anchor shank nails (grey) to be used for bevel siding and texture 1-11 plywood
 - p. Texture 1-11plywood/4" o.c. Western Red Cedar, rough sawn 303SR
 - q. All wood framing in contact w/concrete Southern Yellow Pine #1 CCA pressure treated
- C. Other Materials
 - 1. All other materials not specifically described but required for a complete and proper installation as indicated on the drawings, shall be new, suitable for intended use, and subject to the approval of the Architect. All glue to be approved exterior type.
- D. Execution
- E. Deliveries
 - 1. Stockpiling: Stockpile all materials sufficiently in advance of need to ensure their availability in a timely manner for this work.
- F. Lumber Seasoning
 - 1. Moisture content of all lumber shall not exceed 19%. Pressure treaded lumber shall be kiln dried after being treated to meet this requirement.
 - 2. Plywood shall be dry.
- G. Certification
 - 1. Contractor shall submit written certification from supplier indicating compliance with Specifications.

END OF SECTION 06 11 00

SECTION 06 17 53 - PREFABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

- A. Definition - Prefabricated wood trusses included planar structural units consisting of metal plate connected members which are fabricated from dimension lumber and which have been cut and assembled prior to delivery to the job site.
- B. Types of fabricated wood trusses include:
 - 1. Triangular-pitched roof trusses.
 - 2. Scissor roof trusses.
 - 3. Parallel-chord roof trusses, top-chord bearing.
 - 4. Parallel-chord roof trusses, bottom-chord bearing.
 - 5. Girder trusses.
 - 6. Parallel-chord floor trusses, top-chord bearing.
 - 7. Parallel-chord floor trusses, bottom-chord bearing.
 - 8. Truss accessories.
- C. Roof sheathing is specified with rough carpentry in another Division 6 section.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance - Engineer, fabricate, and erect metal-plate-connected wood trusses to withstand design loads with limits and under conditions required.
- B. Design loads - As indicated in the plans
- C. Design Trusses to withstand design loads without deflections greater than the following:
 - 1. Roof Trusses - Vertical deflection of $l/360$ of span due to total load
 - 2. Roof Trusses - Horizontal deflection at reactions of 1 1/4 inches due to total load, and 3/4 inch due to live load.
 - 3. Floor Trusses - Vertical deflection of $l/480$ of span due to live load.
- D. Engineering Responsibility - Provide sign and sealed engineering calculations and drawings.

1.04 QUALITY ASSURANCE

- A. TPI Standards - Comply with applicable requirements and recommendations of the following Truss Plate Institute (TPI) publications:
 - 1. "Design Specification for Metal Plate Connected Wood Trusses".
 - 2. "Design Specification for Metal Plate Connected Parallel Chord Wood Trusses".
 - 3. "Commentary and Recommendations for Handling and Erecting Wood Trusses".
 - 4. "Commentary and Recommendations for Bracing Wood Trusses".
 - 5. "Quality Control Manual".
- B. Wood Structural Design Standard - Comply with applicable requirements of "National Design Specification for Wood Construction" published by N.F.P.A.
- C. Lumber Standard - Comply with PS 20 and with applicable rules of the respective grading inspecting agencies for species and grade of lumber indicated.
- D. Connector Plate Manufacturer's Qualifications - Provide truss connector plates manufactured by a firm which is a member of TPI and which complies with TPI quality control procedures for manufacture of connector plates published in TPI "Quality Control Manual".
- E. Fabricator's Qualifications - Provide trusses by a firm which has a record of successfully fabricating trusses similar to type indicated and which complies with the following requirements for quality control:
 - 1. Fabricator participates in TPI "Quality Control Inspection Program" as a licensee authorized to apply TPI marks to trusses.
- F. Uniformity of Manufacture for Connector Plates - Provide metal connector plates from a single manufacturer.

1.05 SUBMITTALS

- A. Product Data - Submit fabricator's technical data covering lumber, metal plates, hardware, fabrication process, handling and erection.
 - 1. Submit certificate, signed by an officer of fabricating firm, indicating that trusses to be supplied for project comply with indicated requirements.
- B. Shop Drawings - Submit shop drawings showing species, sizes and stress grades of lumber to be used; pitch, span, camber, configuration and spacing for each type of truss required; type, size, material, finish, design value, and location of metal connector plates; and bearing and anchorage details.
 - 1. To the extent engineering design considerations are indicated as fabricator's responsibility, submit design analysis and test reports indicating loading, section modulus, assumed allowable stress, stress diagrams and calculations, and similar information needed for analysis and to ensure that trusses comply with requirements.
 - 2. Provide shop drawings which have signed and stamped by a Structural Engineer licensed to practice in the state of Florida.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses with care, and in accordance with manufacturer's instructions and TPI recommendations to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure.
- B. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer - Subject to compliance with requirements, provide metal connector plates of one of the following:
 - 1. Alpine Engineered Products, Inc.
 - 2. Link-Wood Construction Systems
 - 3. Robbins Manufacturing Co.
 - 4. The Panel-Clip Company
 - 5. Structormatic, Inc.
 - 6. Tee-Lok Corp.
 - 7. Truss Connectors of America
 - 8. Truswall Systems Corp.
 - 9. Woodco Ltd.

2.02 MATERIALS

- A. Lumber
 - 1. Factory mark each piece of lumber with type, grade, mill and grading agency.
 - 2. Nominal sizes are indicated except as shown by detail dimensions. Provide actual sizes as required by PS 20, for dressed lumber, S4S, unless otherwise indicated.
 - a) Provide seasoned lumber with a maximum moisture content at time of dressing indicated below:
 - 1. 19%
 - 3. Species - Southern Pine, graded by SPIB.
 - 4. Lumber Grade - For species indicated, provide the following stress-rated grade:
 - a) Grade - No. 2

5. Stress Rating - Provide lumber which has been graded or tested and certified, at indicated moisture content, to be in compliance with stress ratings shown on drawings.

B. Metal Connector Plates, Fasteners and Anchorages

1. Connector Plate Material - Metal complying with following requirements, unless otherwise indicated; not less than 0.036" thick, coated thickness.
 - a. Galvanized Sheet Steel - ASTM A 446, Grade A, Coating G60.
2. Fasteners and Anchorages - Provide size, type, material and finish indicated, complying applicable Federal Specifications for nails, screws, bolts, nuts and washers and anchoring devices.

2.03 FABRICATION

- A. Cut truss members to accurate lengths, angles and sizes to produce close fitting joints with wood-to-wood bearing in assembled units.
- B. Fabricate metal connector plates to size, configuration, thickness and anchorage details required for types of joint design indicated.
- C. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with close fitting joints. Position members to produce design camber indicated.
- D. Connect truss members by means of metal connector plates accurately located and securely fastened to wood members by means indicated or approved.

PART 3 - EXECUTION

3.01 General - Erect and brace trusses to comply with recommendations of manufacturer and the Truss Plate Institute.

- A. Erect trusses with plane of truss webs vertical (plumb) and parallel to each other, located accurately at design spacings indicated.
- B. Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift pints as recommended by fabricator, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- C. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.
- D. Anchor trusses securely at all bearing points to comply with methods and details indicated.
- E. Install permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.
- F. Do not cut or remove truss members.

END OF SECTION 06 17 53

SECTION 06 4100 - PLASTIC LAMINATE CASEWORK

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Extent of plastic laminate casework is indicated on Drawings. Work includes:
 - 1. Plastic laminate finished casework.
 - 2. Plastic laminate countertops.
 - 3. Solid-surfacing material countertops.
 - 4. Cabinet hardware.

1.3 QUALITY ASSURANCE

- A. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards, Illustrated, 8th Edition, Version 1.0, 2003", Section 400, published by the Architectural Woodwork Institute (AWI), except as otherwise indicated.

1.4 SUBMITTALS

- A. Quality Certification: Submit manufacturer's (Fabricator's) certification, stating that the fabricated work complies with quality grades and other requirements indicated.
- B. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale casework sections and details, attachment devices, and other components.
- C. Cabinet hardware: one unit of each type and finish.
- D. Plastic laminate: manufacturer's sample chain.
- E. Solid-surfacing materials, 2 inches square.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect casework during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver casework until painting, wetwork, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, casework must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.6 PROJECT CONDITIONS

- A. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for casework installation areas. Do not install casework until required temperature and relative humidity have been stabilized and will be maintained in installation areas.
- B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed casework within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of casework shall determine optimum moisture content and required temperature and humidity conditions.
- C. Field measurements: Where casework is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing casework; show recorded measurements on approved shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of work.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS AND FABRICATION METHODS

- A. Plastic Laminate: Comply with NEMA LD-3 for type, thickness, color, pattern, and finish indicated for each application. Provide plastic laminate by one of the following; color selection by Architect.
 - 1. Formica.
 - 2. Nevamar.
 - 3. Wilsonart.
- B. Acrylic Latex Sealant with Silicone: Colored acrylic latex caulk with silicone for sealing joints between casework and building and between countertops and backsplashes. Color shall be selected by Architect to match color of laminated plastic surfaces. All products used in this section shall comply with the limits for void content as described in Section 01352 paragraph 2.5. Verify the void content of the following products:
 - 1. "Form Fill Adhesive Caulk".
 - 2. "ColorRITE Caulking Spectrum".
 - 3. "Color Flex"; Kämpel.

- C. Lumber and Panel Materials: Comply with AWi Section 400-G-8 requirements for lumber and panel product requirements, unless specific core material is identified herein.
1. Panel materials for cabinet bodies, doors, drawer fronts, and countertops shall be softwood veneer core plywood as follows. No particleboard or fiberboard shall be used as a substrate for laminated plastic.
 - a. Plywood shall be made:
 - 1) 95% void-free.
 - 2) 3/4" thick / Seven (7) Ply.
 - 3) 3/8" thick / Three (3) Ply.
 - 4) Exposure I: Exterior waterproof glue.
 - 5) Classification: APA Group I, (Fir, Odorless Virola)
 - 6) Appearance Grades: (Installation Applications)
 - (a) A-A Exposed & Semi-Exposed Surface Laminate Base: Two (2) Sides
 - (b) A-C Exposed & Semi-Exposed Surface Laminate Base / Concealed Surface Laminate Base
 - b. Plywood to be used for Casework Sub-Base Platform:
 - 1) 95% void-free.
 - 2) 3/4" thick / Seven (7) Ply.
 - 3) Exposure I: Exterior waterproof glue.
 - 4) Classification: APA Group I, (Southern Pine)
 - 5) Pressure Treated to 0.25-retention.
 - 6) Appearance Grade: (Installation Application).
 - (a) B-C Exposed Surface for Vinyl Base I Concealed Surface
 - D. Solid-Surfacing Material: Homogenous solid sheets of quartz-based fabricated stone.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Caesarstone USA, Inc.: "Caesarstone."
 - b. Cambria: "Cambria"
 - c. Cosentino: "Silestone."
 - d. E.I. du Pont de Nemours and Company: "Zodiaq."
 2. Type: Standard type.
 3. Colors and Patterns: As selected by Architect from manufacturer's full range.
 4. Finish: Polished.
 5. Edges: Beveled.
 6. Corners: Rounded.
 7. Location(s): Bathrooms, Captain's Office, and Kitchen.
 - E. Design and Construction Features: Comply with details shown for profile and construction of casework; and, where not otherwise shown, comply with applicable quality standards.
 - F. Shop-Cut Openings: Fabricate casework with shop-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar item openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

2.2 PLASTIC LAMINATE FINISHED CASEWORK

- A. Grade: AWi Custom Grade.
- B. Cabinet Construction: Flush overlay, conforming to AWi Section 400-G-7. Conform to the following requirements:
 1. Cabinet Body Sides, Dividers, Tops, Bottoms, Fixed Shelves and Stretchers: Not less than 3/4" thick. Provide stretchers at top of base cabinet.
 2. All adjustable shelves shall be constructed using minimum 3/4" thick 9-ply Luan veneer plywood. Shelves shall have GP-50 type laminated plastic on both faces, and it shall be applied in the same machine direction on both faces. Shelves shall be edge banded with GP-50 type laminated plastic on all 4 sides.
 3. Backs: Not less than 1/4" thick.
 4. Drawer Fronts: Not less than 3/4" thick.
 5. Drawers: Sides, subfronts and backs: Not less than W' thick; bottoms: not less than 1/4" thick. Provide box type construction with front, bottom and back lock shouldered in sides and secured with glue and mechanical fasteners.
 6. Doors: Not less than 3/4" thick.
 7. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect wall cabinet tops and bottoms and base cabinet bottoms and stretchers to ends and dividers by means of mechanical fasteners. Rabbet tops, bottoms and backs into end panels.
 8. Subbase: Not less than 1-1/2" thick, 4-1/2" high, recessed 2-1/2" from cabinet fronts and exposed ends. Cover with base as scheduled on drawings.
 9. All base and wall cabinets wider than 36 inches shall have a full height center divider. Omit divider in base cabinets containing sinks.

- C. Exposed Surfaces: Provide high pressure laminate in grades indicated for the following types of surfaces:
 - 1. Horizontal surfaces: GP-50 (0.050" nominal thickness).
 - 2. Vertical Surfaces: GP-28 (0.028" nominal thickness). Doors must have same laminate on both faces.
- D. Semi-Exposed Surfaces: Finish semi-exposed surfaces as follows, unless otherwise indicated.
 - 1. Plastic laminate, CL-20; white in color.
- E. Concealed Surfaces: Finish concealed surfaces without plastic laminate with two coats of shellac or clear sanding sealer.
- F. Fabricate all exposed edges of casework, including edges of doors and drawers when open, with matching plastic laminate.

2.3 PLASTIC LAMINATE COUNTERTOPS

- A. General: Except as otherwise indicated, provide separate plastic laminate countertops (installed on other casework or other support system as indicated) to comply with requirements for casework for plastic laminate finish.
- B. Grade: AWI custom grade.
- C. All countertops containing plumbing fixtures shall be constructed with shop sanded exterior grade plywood, minimum 3/4" thick. Edge details shall conform to AWJ Section 400C, with 1-1/2" wide face.
- D. Standard .02" phenolic back-up sheet required wherever unsupported area exceeds 6 sq. ft. and core is 3/4" thick; 8 sq. ft. and core is 1" thick; 10 sq. ft. and core is 1-1/8" or thicker.
- E. There shall be no seams in laminate within 24" of sink cutouts.
- F. Wire Management Grommets: Provide where indicated on drawings.
 - 1. Grommet sets shall include a plastic grommet to fit a 2" diameter hole, with a retractable, self-storing slot cover. Color: black.
 - 2. Manufacturer: Outwater Plastics Industries, Inc., part #31 BK, or Doug Mockett & Company, Inc., part no. TG.

2.4 SOLID SURFACING - MATERIAL COUNTERTOPS

- A. Grade: Custom
- B. Solid Surfacing - Material Thickness: 3/4 inch.
- C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing- material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate tops with shop-applied edges of materials and configuration indicated.
 - 2. Fabricate tops with loose backsplashes for field application where indicated on drawings.
- D. Drill holes in countertops for plumbing fittings in shop.
- E. Provide adequate support in the cabinet base for the additional weight of solid surfacing.
 - 1. Where seams exist supports shall not allow the the surfacing to move out of a flush, finished plane.

2.5 CABINET HARDWARE

- A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for units which are specified as "door hardware" in other sections of these specifications.
- B. Hardware Standards: Except as otherwise indicated, comply with ANSI A156.9 "American National Standard for Cabinet Hardware".
 - 1. Quality Level: Type 2 (institutional), unless otherwise indicated.
 - 2. Quality Certification: Where available, provide cabinet hardware bearing the BHMA certification label, affixed either to hardware or its packaging, showing compliance with BHMA Cabinet Hardware Standard 201.
- C. Cabinet Hardware Schedule: Refer to schedule included as last pages of this section for specific hardware and accessory items required for casework.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition casework to average prevailing humidity conditions in installation areas prior to installing.
- B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.
- C. Prior to installation of casework, examine shop fabricated work for completion, and complete work as required, including removal of packing.

3.2 INSTALLATION

- A. Installer: The installation of all work of this section shall be by the fabricator of the plastic laminate casework.
- B. Install the work plumb, level, true and straight with no distortions. Shims required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops).
- C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

- D. Anchor casework to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
- E. Install without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
- F. Countertops: Anchor securely to base units and other support systems as indicated.
 - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
- G. Sealant: Caulk exposed joints between casework and building and between laminated plastic countertops and backsplashes with colored acrylic latex caulk with silicone. Color shall be selected by Architect to match color of laminated plastic surfaces.

3.3 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

- A. Repair damaged and defective casework wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace casework. Adjust joinery for uniform appearance.
- B. Clean hardware, lubricate and make final adjustments for proper operation.
- C. Clean casework on exposed and semi-exposed surfaces.
- D. Protection: Installer of casework shall advise Contractor of procedures required to protect casework during remainder of construction period to ensure that work will be without damage or deterioration at time of acceptance.

3.4 CABINET HARDWARE SCHEDULE

- A. Finish: Of all hardware shall be US26 polished chrome unless noted otherwise.
- B. Manufacturers: Provide products by the following manufacturers or approved equal.
 - 1. Adjustable shelving supports - K & V (Knappe & Vogt), #345, for 5 mm hole; nickel-plated steel.
 - 2. Hinges - 5 knuckle, 2-3/4" reveal overlay type with hospital tips and adjustable screw holes; or Weber Knapp #M25R4-0-9-091. Provide US26 dull chrome finish.
 - a. Rockford #375 or .
 - b.
 - c. Provide exposed hinges for millwork.
 - 3. Catches - Stanley #SP41, magnetic type (US28).
 - 4. Pulls - Sugatsune America #EC-100/M EC Series Handle, 303 stainless steel, mirror finish.
 - 5. Box and File Drawer Slides - Knappe & Vogt No. 8400 (100-pound class) telescoping, full extension, ball bearing slide; anochrome finish.
 - 6. File Drawer File Brackets - Kinetron Corporation Kine Flex file bracket system #KHFB with top mount movable brackets that slide over edge of drawer frame, and 5/8" file bars. Provide 1 set per drawer.
 - 7. Locks - Key operated, pintumbler, dead bolt type. Provide National Locks or Corbin Cabinet Lock, US 26 finish.
 - 8. Drawers:
 - a. 1 set.....Slides.....8400
 - b. 1.....Pull.....EC-100/M
 - c. 1.....Lock..... (where indicated on drawings: National CB179)
 - 9. Cabinet Doors (single):
 - a. (Doors 48" high and over shall carry 3 or more hinges per door)
 - b. 1 pair.....Hinge 375
 - c. 1.....Catch 41
 - d. 1.....Pull.....EC-100/M
 - e. 1.....Lock.....(where indicated on drawings: National C8173 x strike)
 - 10. Cabinet Doors (pairs):
 - a. (Doors 48" high and over shall carry 3 or more hinges per door.)
 - b. 2 pair.....Hinges 375
 - c. 2.....Catch 41
 - d. 2.....Pulls.....EC-100/M
 - e. 1.....Lock.....(where indicated on drawings: National C8173 x strike)
 - 11. Door Locks
 - a. Key all personnel lockers individually. Provide 2 keys per lock; provide master key system.
 - 12. Coat Hooks for Personnel Lockers: Sugatsune America, Inc. polished stainless steel hook No. EL-25. Provide one hook on inside of every personnel locker door; mount at same height as clothes rod and center hook on door. Secure with stainless steel screws.

13. Clothes Rods for Personnel Lockers: Knape and Vogt No. 750-1 chrome-look round steel tubing, 1-1/16" O.D.; wall thickness .075". Mounting Flanges: Knape and Vogt No. 734 CHR - chrome-look finish.

END OF SECTION

SECTION 07 1600 - UNDERSLAB VAPOR RETARDER

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Surface preparation.
 - B. Application of underslab vaporproofing membrane.
- 1.2 RELATED SECTIONS
 - A. Section 03 3000 - Cast-in-Place Concrete.
- 1.3 REFERENCES
 - A. American Society for Testing and Materials (ASTM)
 - 1. ASTM E 1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil Or Granular Fill Under Concrete Slabs.
 - 2. ASTM E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
 - 3. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.
 - 4. ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - B. Florida Building Code
 - 1. Comply with Appendix E, Chapter 9 B-67 Florida Standard for Radon Resistant New Commercial Construction, Chapter E301 Construction Requirements for Passive Controls.
 - C. American Concrete Institute (ACI)
 - 1. ACI 302.1R-96 Vapor Barrier Component (plastic membrane) is not less than 15 mils thick.
- 1.4 SUBMITTALS
 - A. Comply with Section 01330 - Submittal Procedures.
 - B. Submit manufacturer's product data and application instructions.
 - C. Shop Drawings: indicate job-specific termination details, penetration details, and other applicable conditions.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
 - B. Store materials in a clean dry area in accordance with manufacturer's instructions.
 - C. Stack membrane on smooth ground or wood platform to eliminate warping.
 - D. Protect materials during handling and application to prevent damage or contamination.
- 1.6 ENVIRONMENTAL REQUIREMENTS
 - A. Product not intended for uses subject to abuse or permanent exposure to the elements.
 - B. Do not apply on frozen ground.

PART 2 PRODUCTS

- 2.1 MANUFACTURER
 - A. Manufacturer must have a minimum of 20 years experience manufacturing vapor barrier/retarder materials and show independent test results for minimum standards listed below.
- B. MATERIALS
 - 1. Plastic Vapor Retarder
 - a. Performance Based Specification: Vapor Retarder membrane must meet or exceed all requirements of ASTM E 1745 Classes A, B, & C.
 - 1) Minimum Permeance ASTM E 96: 0.3 perms or better
 - 2) Resistance to Organisms and Substrates in Contact with Soil ASTM E 154, Section 13: 0.051 Perms
 - 3) Tensile Strength: ASTM E 154, Section 9: 45.6 LBS. Force/Inch or better
 - 4) Puncture Resistance: ASTM D 1709, Method B: 2,200 Grams or better
 - 5) Water Vapor Retarder: ASTM E 1745: Meets or exceeds Class A, B & C
 - 6) Thickness of Retarder (plastic) ACI 302.1R-96: Not less than 15 mils.
 - b. Product: Basis of Design - Stego Industries, LLC Stego Wrap 15 mil or equal .
- C. ACCESSORIES
 - 1. Seam Tape
 - a. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4 inches.
 - 2. Pipe Boots

- a. Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.
- B. Examine all slab-on-grade vapor retarder installation.
 1. Examine after steel reinforcement installation, prior to concrete placement.
 2. Manufacturer's technical representative should examine in addition to Owner's Inspector.
 3. Provide examination report prior to concrete placement shall be provided to the Installer, General Contractor, Owner and Architect within 5 days of each inspection..

3.2 SURFACE PREPARATION

- A. Prepare surfaces in accordance with manufacturers instructions.

3.3 APPLICATION

- A. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.
- B. Unroll vapor barrier with the longest dimension parallel with the direction of the pour.
- C. Lap vapor barrier over footings and seal to foundation walls.
- D. Overlap joints 12 inches and seal with manufacturer's tape.
- E. Seal all penetrations (including pipes) with manufacturer's pipe boot.
- F. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
- G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 12 inches and taping all four sides with tape.

END OF SECTION

SECTION 07 1800 - POLYURETHANE DECK COATING

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes polyurethane waterproofing coating system where indicated on the Drawings.

1.3 SUBMITTALS

- A. Product data:
 - 1. Manufacturer's specifications and other data needed to prove compliance with the specified data.
 - 2. Manufacturer's current recommended installation procedures which, when reviewed by Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 - 3. Written documentation of applicator's qualifications, including reference projects of similar scope and complexity, with current phone contacts of architects and owners for verification.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
- B. Applicator Qualifications:
 - 1. Applicator shall have at least three years experience in installing materials of types specified and shall have successfully completed at least three projects of similar scope and complexity.
 - 2. Applicator shall designate a single individual as project foreman who shall be on site at all times during installation.
- C. Convene a pre-installation job-site conference four weeks prior to commencing work of this Section:
 - 1. Secure attendance by Architect, contractor, applicator, and authorized representatives of the coating system manufacturer and interfacing trades.
 - 2. Examine Drawings and Specifications affecting work of this Section, verify all conditions, review installation procedures, and coordinate scheduling with interfacing portions of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in manufacturer's unopened containers with all labels intact and legible at time of use.
- B. Maintain the products in accordance with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.

1.6 SUBSTRATE CONDITIONS

- A. General:
 - 1. Provide applicator with surfaces that are broom clean, dry, sound and free of voids, bugholes, rockpockets, honeycombs, protrusions, excessive roughness, foreign matter, and other contaminants which may inhibit application or performance of the waterproofing coating system.
 - 2. Using suitable abrasive methods, remove residue of curing compound, chemical retarders and other surface treatments, laitance, mortar smear, sawcutting residue, loose material and other contaminants from concrete surfaces to receive the work of this Section.
- B. Concrete: Provide surfaces that are smooth with finish equal to one that is light steel troweled followed by a fine hair broom.

1.7 WARRANTY

- A. Deliver to the Architect signed copies of the following written warranties against defective materials and workmanship for a period of two years following date of Substantial Completion. Warrant that installed coating system shall be free of defects including adhesive failure, cohesive failure, weathering deficiencies and waterproofing failure resulting from substrate cracking up to 1/16 inch.
- B. Manufacturer's standard warranty covering materials.
 - 1. Applicator's standard warranty covering workmanship.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide a complete liquid applied polyurethane waterproofing coating system having the following minimum attributes:
 - 1. System designed for waterproofing decks subject to pedestrian traffic.

2. Comply with ASTM C957-91 and provide a Class A fire rating on concrete substrates.
3. Color to be selected by Architect from manufacturer's standard color range.
 - a. Acceptable products:
 - b. Vulkem 350/351 (No Substitutions)

2.2 ACCESSORIES

- A. Primer: As recommended by coating system manufacturer.
- B. Aggregate: 40-50 mesh silica sand; local aggregate approved by coating manufacturer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Applicator shall examine the areas and conditions under which work of the Section will be performed.
 1. Verify conformance with manufacturer's requirements.
 2. Report unsatisfactory conditions in writing to the Architect.
 3. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Surface preparation and detailing procedures to be in accord with waterproof coating system manufacturer's instructions and recommendations except where more stringent requirements are indicated.
 1. Clean all deck surfaces to receive coating system in accord with manufacturer's instructions; vacuum clean or blow clean with oil-free compressed air all surfaces to receive sealants, detailing materials or coatings immediately prior to installation.
 2. Rout, clean, prepare and detail surface cracks in accord with manufacturer's instructions; install backer rod where required.
 3. Install 1/2" diameter backer rod into corner of all horizontal-to-vertical junctures and cover with one inch detailant of "Vulkem 921" polyurethane sealant.
 4. Prime surfaces in accord with manufacturer's instructions.

3.3 APPLICATION

- A. Install waterproof coating system in accordance with manufacturer's recommendations and instructions as applies to the Work except where more stringent requirements are indicated.
 1. Grid deck surfaces to assure proper coverage rates and verify coating wet-film mil thickness with gauges as work progresses.
 2. Retain empty product containers during course of work to aid in determining whether completed coating system complies with manufacturers average thickness requirements.
- B. Verify proper dry condition of substrate using method recommended by coating system manufacturer; perform adhesion checks prior to general application of coating system using field adhesion test method recommended by manufacturer.
- C. Mask off adjoining surfaces not to receive coating system, including all surrounding walls above 4 inch wall base.
- D. Wipe clean all detail coats with white rags wetted with Xylene solvent; do not saturate detail coat.
- E. Apply coating base coat uniformly and allow to cure in accord with manufacturer's instructions.
- F. Feather edge when entire area cannot be completed in one day; clean area 6" wide along edge of coating with Xylene solvent on clean white rags prior to startup on next working day; use interlaminary primer per manufacturer's instructions as needed; overlap existing work by 6" with new work.
- G. Apply coating system finish coat in accordance with manufacturer's instructions.
 1. Immediately broadcast aggregate into wet material at rate recommended by manufacturer and backroll to evenly distribute and totally encapsulate.
 2. Allow to cure per manufacturer's instructions.
- H. Extend deck coating system 4" above slab to create an integral wall base.

3.4 PROTECTION AND CLEAN-UP

- A. Promptly remove primer or coating material from adjacent surfaces with MEK, Toluene or Xylene; leave work area in broom clean condition.
- B. Allow completed Work to cure 24 hours before opening to pedestrian traffic.

END OF SECTION

SECTION 07 1815 - CLEAR WATER REPELLENT SEALER

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and applying clear water repellent coating to all exterior masonry walls/surfaces.
- B. Work of this Section includes all labor, materials, equipment and services necessary to complete the installation of the water repellent inclusive but not limited to:
 - 1. Cast Stone - wainscot caps, window sills, and other cap locations.

1.2 REFERENCED STANDARDS

- A. The referenced standards listed below are considered part of the requirements listed in this section. If specific aspects of the standards do not apply, the Contractor shall identify the specific references in writing prior to beginning work. All requests for omission must be approved by the Architect.
 - 1. ASTM E 514 - Water Permeance of Masonry, Concrete Masonry Units
 - 2. ASTM C 67 - Sampling and Testing Brick and Structural Clay Tile, Part F "Absorption"
 - 3. ASTM D 4261 Surface Cleaning Concrete Unit Masonry for Coating;

1.3 DEFINITIONS

- A. Terminology as defined in the following standards apply to this section:
 - 1. ASTM D 16 Paint, Related Coatings, Materials, and Applications;
 - 2. ASTM E 284 Appearance;
 - 3. National Paint & Coatings Association (NPCA) Glossary of Terms as listed at the following URL:
www.paint.org/ind_info/terms.cfm;
- B. Design Standard: The paint/coating material specifically referenced by manufacturer's name/number, which determines the performance and quality requirements for materials referred in this Section.

1.4 SUBMITTALS

- A. Complete and submit the Label Analysis Form for water repellent material(s) submitted (excluding the Design Standard);
- B. Manufacturer's Information: Manufacturer's technical information including instructions for handling, storing, surface preparation application etc.
 - 1. Provide manufacturer's recommendation for protecting adjacent finishes during application.
- C. Pre-Job RILEM Water Uptake Testing - Prior to performing the work, submit a written report of testing (performed by the water repellent supplier or 3rd party) indicating results for each masonry substrate to be sealed. A minimum of one test per elevation and/or individual surface (brick, split-faced block, stone etc.). See Section 3.3 for testing procedures.
- D. Submit a letter from the water repellent manufacturer/supplier that confirms the applicator has been properly trained on the application requirements for the specific materials to be used.
- E. Post-Job Rilem Water Uptake Testing - After the work is complete, submit a written report of testing (performed by the water repellent supplier or 3rd party) indicating results for each sealed masonry substrate. A corresponding test shall be performed in each of the Pre-Job test locations.
- F. Errors, Omissions, and Other Discrepancies
 - 1. Submit all errors, omissions, and other discrepancies in contract documents to the Architect within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies shall be addressed and resolved, and the work plan modified, prior to beginning the initial and follow-up phases of work. Discrepancies that become apparent only after work is uncovered shall be identified at the earliest discoverable time and submitted for resolution.

1.5 QUALITY CONTROL

- A. Applicator Qualifications: A firm or individual must be approved by the water repellent manufacturer/supplier as outlined in Section 1.4, D.
- B. The contractor or applicator's designated Quality Control Person (QCP) shall maintain a daily log of work performed including materials used and square footage completed. In addition, project conditions should be logged for every day water repellent is applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.

4. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 WARRANTY

- A. The water repellent manufacturer shall furnish the School District of Hillsborough County a written labor and materials warranty. The warranty shall cover all walls/surfaces where the water repellent was applied. Warranty performance shall be verified based on the Post-Job testing (as tested using the RILEM Uptake Test outlined in Section 3.2). The warranty period is for five years from the Post-Job testing.
- B. The water-repellent manufacturer shall be responsible for providing labor and material to seal walls/surfaces where the water repellent effectiveness does not meet the Post-Job testing results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The Design Standard water repellent materials for this Section are manufactured by Degusa Corporation, specifically Chem-Trete.
- B. Subject to compliance with product submittal/approval requirements, provide the product listed in this Section or an equivalent product, as determined by the Architect. Other manufacturers will be considered contingent upon their responsiveness to the requirements set forth in this Section (e.g. performance and warranty).

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain all water repellent materials from the same manufacturer.

2.3 WATER REPELLENT MATERIALS

- A. Semi-Porous Substrates (Cast Stone, etc.)
 1. CHEM-TRETE® BSM 40 VOC - Clear, colorless liquid containing isobutyltrialkoxo silane in alcohol.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for water repellent application.
 1. Proceed with water repellent application only after unsatisfactory conditions have been corrected and surfaces receiving water repellent are thoroughly dry.
 2. Start of application will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
 3. Verify that surfaces are dry, free of visible efflorescence, loose particles, laitance, curing compounds, and other foreign matter that would block absorption of the water repellent.
 4. Verify masonry is compatible with coating. If not, notify Architect before proceeding.
 5. Verify that the curing of caulking and/or sealing materials is complete.
 6. Verify that the curing of tuck pointing mortar is complete.

3.2 MOCK-UP APPLICATION

- A. At least two weeks prior to the beginning of work, prepare at least a 3-ft. by 3-ft. area to be sprayed with the water repellent. The Architect will determine the location of the test area. Apply the water repellent in accordance with the manufacturer's recommendations for coverage rates.
 1. Manufacturer's technical representative shall approve the mock-up, including surface preparation, coverage rates, and testing.
- B. After allowing five days for the sample to cure, perform testing as described in Section 3.3 on the treated area.
- C. The Architect or designated representative shall be present for the application of the water repellent and the testing.

3.3 TESTING

- A. To determine if the water repellent is performing a "RILEM Water Uptake Test" procedure will be used. The treated area shall not allow the absorption of more than 1.0 milliliter (ml) of water for a period of 20 minutes. If an area absorbs more than 1.0 ml it will be considered deficient.
 1. All deficient areas shall have additional sealer applied and retested.
 2. Test results shall be documented in a written report that shall include the following (minimum):
 - a. Date;
 - b. Name of individual performing the test;
 - c. Brief description of test procedure; and,

- d. Location of each area and substrate tested with corresponding results
- B. Coordination of Work: Review other Sections in which paint and exterior finishes are provided to ensure compatibility of the total system for various substrates. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.4 PREPARATION

- A. Cleaning: Before applying water repellent, clean substrates to remove substances that could prevent proper penetration of the material. Special cleaning solutions or methods shall be approved in writing by the water repellent manufacturer/supplier. Typical cleaning methods involve pressure cleaning. The pressure shall be suitable to remove the deleterious substances, while not damaging or marring the substrate.
- B. Material Preparation: Prepare water repellent materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

3.5 APPLICATION

- A. Provide adequate protection of glass, metal, and other non-porous substrates. The Contractor will be responsible to clean all surfaces, which are contaminated by the water repellent.
- B. Provide adequate protection of plants, grass, and other vegetation. The Contractor shall be responsible for replacing all plants, grass, or vegetation damaged by the water repellent.
- C. Apply water repellent according to manufacturer's written instructions and applied as supplied by the manufacturer without dilution or alternation.
- D. Apply using low-pressure, airless spray equipment with a fan spray nozzle, flooding the surface to obtain uniform coverage unless otherwise recommended by the manufacturer.
 - 1. Follow manufacturer's recommendations for appropriate coverage rates unless the field tests determine that a heavier rate of application is necessary to meet the performance requirements.
- E. In addition to the manufacturer's requirements for project conditions (ambient weather conditions, substrate dryness etc.), do not proceed with application if ambient temperature of surface exceeds 100°F during application. In addition, do not proceed with the application if precipitation has occurred within 48 hours prior to application or if rain is anticipated within 4 hours after application.

3.6 HOUSEKEEPING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

END OF SECTION

SECTION 07 2100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Concealed thermal building insulation.
 - 2. Concealed acoustical building insulation.
- B. Related Sections include the following:
 - 1. Division 4 Section "Unit Masonry Assemblies" for foamed-in-place masonry wall insulation.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of insulation product specified.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire- test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:
 - 1. Glass-Fiber Blanket Insulation
 - a. CertainTeed Corporation
 - b. Johns Manville Corporation
 - c. Knauf Fiber Glass
 - d. Owens Corning
 - 2. Polyisocyanurate Board Insulation:
 - a. Atlas Roofing Corporation
 - b. Dow Chemical Company
 - c. Rmax, Inc.
 - 3. Slag-Wool / Rock-Wool Fiber Sound Attenuation Insulation:
 - a. Fibrex, Inc.
 - b. Partek Insulations, Inc.
 - c. USG Interiors, Inc.

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.

- B. Faced, Glass-Fiber Blanket (Batt) Insulation: ASTM C 665, Type II (Blankets with kraft paper vapor retarder membrane facing on one face), Class C. Provide blankets with R-19 rating, approximately 6.25" thick.
- C. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core faced on both sides with aluminum foil to comply with referenced standard and with other requirements indicated below:
 - 1. ASTM Standard: ASTM C 1289, Type 1, Class 1 or 2.
 - 2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 75 and 450, respectively, based on tests performed on unfaced core on thicknesses up to 4 inches.
 - 3. Conditioned R-value: 5.0 minimum, per ASTM C 1289 and ASTM C 518.
 - 4. Thickness: 3/4 - inch unless otherwise indicated on drawings.
- D. Unfaced Mineral-Fiber Blanket Insulation: Sound attenuation insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type I (blankets without membrane facing).
 - 1. Mineral-Fiber Type: Fibers manufactured from slag wool or rock wool.
 - 2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively.
 - 3. Thickness: 3", unless otherwise indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled.
- C. Extend insulation in thickness indicated 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. Apply insulation to produce thickness indicated.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- 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. Glass - Fiber Blanket Insulation: Install as follows:
 - 1. Set kraft facing toward plywood roof sheathing.
 - 2. Place blankets in cavities formed by framing members to produce a friction fit between edge of insulation and framing members.
 - a. Provide galvanized chicken wire as required to hold insulation in place between roof trusses.
- C. Polyisocyanurate Board Insulation: Install as follows:
 - 1. Attach boards to masonry and concrete wall substrates by adhesive attachment. Seal joints between boards with aluminum foil tape.
- D. Slag-Wool / Rock-Wool Fiber Sound Attenuation Insulation
 - 1. Install in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3.5 PROTECTION

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

END OF SECTION

SECTION 07 4110 - METAL ROOF PANELS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Standing-seam metal roof panels installed on plywood decks.
 - 2. Metal roofing installed on cupola roofs.
 - 3. Installer-fabricated fascia trim.
 - 4. Preformed soffit panels with "v-groove" profile and concealed fasteners.
 - 5. Installer-fabricated gutters and downspouts
 - 6. Concealed fastenings, flashings, edge metal, trim, cleats, sealants, filler, etc. required for a complete, weathertight installation.
- B. Reglet and counterflashing at roof-wall intersection is specified in Section 07620 - Sheet Metal Flashing and Trim.

1.3 DEFINITIONS

- A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight roofing system.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at the following test-pressure difference:
 - 1. Test-Pressure Difference: Positive and negative 1.57 lbf/sq. ft.
 - 2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 - 3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift pressure difference.
- D. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: No water penetration at 20 lbf/sq.ft.
 - 2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 - 3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift- pressure difference.
- E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- F. Provide panels that comply with the requirements of the Florida Building Code and which carry Florida Product Approval numbers.
- G. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
- H. Wind Loads: Provide roof panel systems including anchorage capable of withstanding wind load design pressures calculated according to the requirements of ASCE 7-98.
 - 1. Design wind velocity = 130 MPH
 - 2. Importance factor = 1.15.
 - 3. Maximum allowable panel deflection = 1/180.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- J. Energy Performance: Provide roof panels with solar reflectance index not less than 29 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated, include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.

- B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and end lap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
 - 1. Accessories: 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 each type of metal roof panel indicated with factory- applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.
 - 2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
 - 3. Accessories: 12-inch- long Samples for each type of accessory.
- E. Delegated-Design Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data with exact clip spacing and anchorage signed and sealed by the qualified Florida professional engineer responsible for their preparation.
- F. Qualification Data: For qualified Installer.
- G. State of Florida Product Approval number.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- I. Field quality-control reports.
- J. Maintenance Data: For metal roof panels to include in maintenance manuals.
- K. Warranties: Samples of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Panel installer shall have a minimum of three (3) years experience in the installation of concealed clip architectural standing seam metal roofing and show evidence of successful completion of at least three (3) projects of similar size, scope, and complexity.
 - 2. Must be State of Florida certified roofing/sheet metal contractor.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.
- D. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, metal roof panel installer, metal roof panel manufacturer's representative, lightning protection system installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal roof panel and soffit panel installation, including manufacturer's written instructions.
 - 4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 5. Review structural loading limitations of deck during and after roofing.
 - 6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - 7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
 - 8. Review temporary protection requirements for metal roof panel assembly during and after installation.
 - 9. Confirm schedule for roof inspections (minimum of three) to be made by roof panel manufacturer.
 - 10. Review roof observation and repair procedures after metal roof panel installation.
 - 11.

1.7 DELIVERY, STORAGE, AND HANDLING

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

- D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.9 COORDINATION

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

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Twenty years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof 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 D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: Twenty years from date of Substantial Completion.
- C. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: Twenty years from date of Substantial Completion.
 - 2. Warranted Wind Velocity: 130mph (3 second peak gust per Florida Building Code) with no exemptions or exclusions. Wind velocity, or loads noted in 1.4 - Performance Requirements, shall be noted in writing on the warranty document.

PART 2 - PRODUCTS

2.1 ROOF PANEL MATERIALS

- A. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - 1. Surface: Smooth, flat finish.
- B. Panel Sealants:
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 ROOF UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: 30 to 40 mils thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 - 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
 - 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
 - b. Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.

4. Metal-Fab Manufacturing, LLC; MetShield.
 - a. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.3 MISCELLANEOUS MATERIALS

- A. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15- mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 1. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 330 and E 331.
- B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.
 1. Subject to compliance with requirements, provide one of the following:
 - a. "Stand 'N Seam Metal Roofing", Fabral.
 - b. "Zip-Rib Standing Seam Panel", Merchant & Evans, Inc.
 - c. "Tite-Loc Plus", Petersen Aluminum Corporation.
 2. Material: Aluminum sheet, 0.040-inch thick.
 - a. Exterior Finish: Metallic fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
 3. Joint Type: As standard with manufacturer.
 4. Panel Coverage: 12 inches.
 5. Panel Height: 2 - 2.5 inches.

2.5 ACCESSORIES

- A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, 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 metal as metal roof panels.
 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin- foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible.
 - a. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum .040 inch thick. 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. Finish flashing and trim with same finish system as adjacent metal roof panels.

2.6 SOFFIT PANELS

- A. Manufacturer: Subject to compliance with requirements, provide soffit panels as follows:
 1. Aluminum V-Groove Soffit Panels: Double 6", solid, v-groove soffit, nominal 3/8" deep, prefinished, 0.019". Provide "Envoy Aluminum Soffit by Alcoa Home Exteriors in any standard color as selected by Architect.
 - a. Provide 0.019" J-channel in matching color.

2.7 FABRICATION, GENERAL

- A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal roof panel side laps with a bead of elastomeric sealant that provides a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.8 GUTTER, FASCIA, AND DOWNSPOUT FABRICATION

- A. General: Fabricate fascia, gutters and downspouts to profiles indicated on drawings. Shop-fabricate work to greatest extent possible. Comply with details shown and with requirements of SMACNA "Architectural Sheet Metal Manual".
- B. Material: Aluminum sheet with "Kynar 500" fluoropolymer coating in thicknesses as follows:
 1. Fascia: .040 Inch.
 2. Gutters: .050 inch, with .063 inch uncoated hangers.
 3. Downspouts: .040 Inch.
- C. Hanging Gutter: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant.
 1. Fabricate gutters for watertight performance.
 2. Fasten gutter hangers to front and back of gutter.
 3. Loosely lock straps to front gutter bead and anchor to roof deck.
 4. Install gutter with expansion joints not exceeding 50 feet apart. Install expansion- joint caps.
- D. Downspouts: Downspouts shall be continuous without joints.
 1. Provide hangers of same material as downspouts with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at maximum of 48 inches o.c. in between.

2.9 METAL FINISHES

- A. Fluoropolymer Coating: Manufacturer's standard two-coat; thermo-cured, full-strength 70 percent "Kynar 500" coating with suspended mica flakes consisting of a primer and a minimum 0.75-mil dry film thickness top coat with a total minimum dry film thickness of 0.9-mil and minimum 30 percent reflective gloss when tested in accordance with ASTM 0523.
 1. Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of a chalk rating of 8 in accordance with ASTM 04214; and without fading in excess of 5 Hunter units.
 2. Color: As selected by the architect from the manufacturer's full range of colors.
 3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5-mil.
- B. High Performance Organic Coating (Soffits Only).
 1. For aluminum v-groove soffit panels, provide manufacturer's standard finish, Alumalure 2000 by Alcoa, or equal.

2.10 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end- welded studs and other suitable fasteners designed to withstand design loads.
- B. Accessories: Provide components required for a complete fascia and soffit panel system, including trim, copings, sills, corner units, flashings, sealants, gaskets, fillers, and similar items. Match materials and finishes of panels.
 1. Sealing Tape: Pressure sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
 2. Join Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as recommended by the panel manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.
- B. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

- C. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Entirety of roof area.

3.3 METAL ROOF PANEL INSTALLATION, GENERAL

- A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
- B. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.
 - 1. Point of Fixity: Fasten each panel along a single line of fixing located at ridge.
 - 2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.
- C. Install metal roof panels as follows:
 - 1. Commence panel installation and complete at least 10% but no more than 20% of the installation for initial inspection by a facility-authorized representative of the panel manufacturer.
 - 2. Field cutting of metal panels by torch is not permitted.
 - 3. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 4. Provide metal closures at rake edges rake walls and each side of ridge and hip caps.
 - 5. Flash and seal metal roof panels with weather closures at eaves, rakes, and
 - 6. perimeter of all openings.
 - 7. Install ridge and hip caps as metal roof panel work proceeds.
 - 8. End Splices: Not allowed.
 - 9. Install metal flashing to allow moisture to run over and off metal roof panels.
- D. Fasteners:
 - 1. Aluminum Roof Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- E. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
 - 1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.
- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
 - 1. Prepare joints and apply sealants to comply with panel manufacturer's requirements.

3.4 METAL ROOF PANEL INSTALLATION

- A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
 - 1. Install clips to roof sheathing with wood screws.
 - 2. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

3.5 FASCIA AND SOFFIT PANEL INSTALLATION

- A. Comply with manufacturer's instructions for assembly and installation. Install in accordance with approved shop drawings.
 - 1. Install v-groove aluminum soffit panels as indicated on drawings and in accordance with manufacturer's requirements for State of Florida product approval.
- B. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.
- C. Limit exposed fasteners to extent indicated on shop drawings.

- D. Anchorage shall allow for temperature expansion/contraction movement without stress or elongation of panels or anchors.
- E. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in accordance with SMACNA standards, using continuous cleats where indicated on drawings.
- F. Installed fascia and soffit system shall be true to line and plane and free of dents and physical defects with a minimum of oil canning.
- G. Form joints in linear metal to allow for $\frac{1}{8}$ inch minimum expansion at 20'-0" o.c. maximum and 8'-0" from corners. Provide 6 inch wide back-up plate at intersections. Form plates to profile of sheet metal item.

3.6 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.
- 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 as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without 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 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 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 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. Connect downspouts to underground drainage system indicated.
- E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of $\frac{1}{4}$ inch in 20 feet on slope and location lines as indicated and within $\frac{1}{8}$ -inch offset of adjoining faces and of alignment of matching profiles.

3.8 FIELD QUALITY CONTROL

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

3.9 CLEANING

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

END OF SECTION

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Extent of flashings is indicated on the drawings.
- B. Type of work specified in this Section includes the following:
 - 1. Metal flashing for metal roof panel installation:
 - a. Reglet and counterflashings at intersections of roof and masonry walls.
- C. Metal roof panels, edge metal, fascia, soffits, gutters, and downspouts are specified in Section 07411 "Metal Roof Panels",

1.3 JOB CONDITIONS

- A. Do not proceed with the installation of flashing and sheet metal work until curb and substrate construction, cant strips, blocking and other construction to receive work is completed.
- B. The Installer must examine the substrate and the conditions under which flashing and sheet metal work is to be performed, and notify the Contractor, in writing, of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Fasteners: Aluminum or Series 300 stainless steel.
- C. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

2.2 REGLET AND COUNTERFLASHING SYSTEM

- A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated. Provide manufacturer's standard accessories including prefabricated corners, wind clips, and foam end pieces.
- B. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
 - 1. Provide wind-restraint clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following in minimum .025" aluminum:
 - 1. Fry Reglet Corporation; "STX Reglet."
 - 2. Hickman: W.P. Hickman Co.
 - 3. Keystone Flashing Company.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with manufacturer's instructions and recommendations for handling and installation of flashing.
- B. Performance: Coordinate the work with other work for the correct sequencing of items which make up the entire system of weatherproofing or waterproofing and rain drainage. It is required that the flashing be permanently watertight, and not deteriorate in excess of manufacturer's published limitations.

3.2 INSTALLATION OF METAL WORK

- A. Provide for thermal expansion of all exposed flashings as follows:
 - 1. 10'-0" maximum spacing and located 2'-0" from corners and intersections.
- B. Isolate dissimilar metals such as galvanized steel and aluminum by application of bituminous coating to prevent metal to metal contact.

3.3 FLASHINGS AT ROOF-TO-WALL INTERSECTIONS

- A. A Install manufactured reglets to receive counterflashing according to manufacturer's instructions, parallel to roof slope and true to line.

- B. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 6 inches and bed with sealant.

END OF SECTION

SECTION 07 8410 - FIRESTOP SYSTEMS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes fire stopping and smoke sealing for the following:
 - 1. At the head of fire-resistance-rated and smoke-resistant walls abutting the underside of structural floor and roof decks, and the perimeter of such walls at abutting construction.
 - 2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 - 3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
 - 4. Sealant joints in fire-resistance-rated construction.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 15 Sections "Mechanical."
 - 2. Division 16 Sections "Electrical."

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.
 - 1. Firestopping and smoke sealing shall comply with the requirements of the Florida Building Code, 2004 edition, and NFPA 101, latest edition.
- B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
- C. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.
- D. For firestopping exposed to moisture and physical damage, provide products that do not deteriorate when exposed to these conditions.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For penetrations involving insulated piping, provide through penetration firestop systems not requiring removal of insulation.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
 - 1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
- C. Shop drawings detailing condition-specific materials, installation methods, and relationships to adjoining construction for each through-penetration firestop and smoke seal system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop and smoke seal configuration for construction and penetrating items.
 - 2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration approved by firestopping manufacturer's fire protection engineer with modifications marked.
- D. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.
- E. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.
- F. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.
 - 3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:
 - a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
 - b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.
- B. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- C. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
- D. Provide firestopping products: shall not contain asbestos. Products shall be certified by manufacturer as "asbestos free."

1.6 COORDINATION

- A. Coordinate with plumbing, mechanical, electrical, and other trades to ensure that pipe, conduit, cable, and other items which penetrate fire-rated or smoke barrier construction have been permanently installed, and sleeved when necessary, prior to installation of firestops and smoke seals.
- B. Schedule and sequence the work to assure that partitions and other construction which would conceal or enclose penetrations are not erected prior to the installation of firestops and smoke seals.

1.7 WARRANTY AND CERTIFICATION

- A. Contractor shall provide the following notarized affidavit jointly signed by corporate officers, with titles noted, of both the Contractor and material applicator:
 - 1. "We the undersigned certify that firestops and smoke seals have been installed in accordance with Contract Document requirements and manufacturer's instructions, and that materials used meet firestopping and smoke sealing requirements of the Contract Documents".
- B. Manufacturer shall provide the following certification, executed by the appropriate person, with title and department noted:
 - 1. "Products provided by (manufacturer) for the (name of project) are composed of the same ingredients and formulation or are of the same components and identical construction as products that have been tested by (the testing agency) for various fire resistive and other performance ratings, and when properly applied or installed in accordance with (manufacturer) instructions will perform in a manner consistent with results obtained in the tests conducted by (the testing agency)".

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials including the following:
 - a. Semirefractory fiber (mineral wool) insulation.
 - b. Ceramic fiber.
 - c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - d. Fire-rated formboard.
 - e. Joint fillers for joint sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.
- C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.2 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

- A. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.
- B. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.
- C. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
- D. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.
- E. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.
- F. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.
- G. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
- H. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
- I. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:
 - 1. Grade: Nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/gunnable sealant.
- J. Acoustical Sealant (for use only in assemblies indicated to be smoke resistant; not for firesafing of assemblies with fire resistance ratings): ASTM C919 and ASTM C834, water-based, highly elastic caulking; non-bleeding and staining, permanently flexible. Flame spread 0, smoke developed 0.
- K. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Endothermic, Latex Sealant:
 - a. Fyre-Shield, Tremco Inc.
 - 2. Endothermic, Latex Compounds:
 - a. Flame-Safe FS500/600 Series, W.R. Grace.
 - b. Flame-Safe FS900/FST900 Series, W.R. Grace.
 - 3. Intumescent Latex Sealant:
 - a. Metacaulk 1000, The RectorSeal Corporation.
 - b. Fire Barrier CP 25WB Caulk, 3M Fire Protection Products.
 - c. Bio Fireshield 500+, The RectorSeal Corporation.
 - d. Bio Fireshield Bio-BF150, The RectorSeal Corporation.
 - 4. Intumescent Putty:
 - a. Pensil 500 Intumescent Putty, General Electric Co.
 - b. SpecSeal Series SSP, Specified Technologies, Inc.
 - c. Fire Barrier Moldable Putty, 3M Fire Protection Products.
 - d. Bio Fireshield Fire Rated Putty, The RectorSeal Corporation.

5. Intumescent Wrap Strips:
 - a. Fire Barrier FS-195 Wrap/Strip, 3M Fire Protection Products.
 - b. Bio Fireshield Wrap Strip, The RectorSeal Corporation.
6. Job-Mixed Vinyl Compound:
 - a. USG Firecode Compound, United States Gypsum Co.
7. Mortar:
 - a. Bio Fireshield K-2 Firestop Mortar, The RectorSeal Corporation
 - b. Bio Fireshield K-10 Firestop Mortar, The RectorSeal Corporation
 - c. KBS-Mortar Seal, International Protective Coatings Corp.
8. Pillows/Bags:
 - a. Bio Fireshield Firestop Pillows, The RectorSeal Corporation
 - b. KBS Sealbags, International Protective Coatings Corp.
9. Silicone Foams:
 - a. Pensil200 Foam, General Electric Co.
10. Silicone Sealants:
 - a. Pensil 100 Firestop Sealant, General Electric Co.
 - b. Metacaulk 835+, The RectorSeal Corporation.
 - c. Fyre-Sil, Tremco Inc.
 - d. Fyre-Sil S/L, Tremco Inc.
 - e. Bio Fireshield Biotherm 100 & 200, The RectorSeal Corporation
11. Acoustical Sealant
 - a. Sheetrock Acoustical Sealant, U.S. Gypsum Company.
 - b. PL Acoustical Sealant; ChemRex, Inc.; Contech Brands.
 - c. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
 1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLING FIRESTOPS AND SMOKESEALS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration and head-of-wall firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
 1. In non-fire-rated, smoke-resistant assemblies, install resilient sealant, either acoustical or fire-resistant type, to completely fill all voids at through-penetrations and head-of-wall intersections to block the passage of smoke. In no event shall drywall compound be used for this purpose.
- C. Install fill materials for through-penetration and head-of-wall firestop systems by proven techniques to produce the following results:
 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- 3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS
- A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.
 - B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
 - C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.
 1. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces
 2. adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- 3.5 CLEANING
- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
 - B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes joint sealants for the following locations:
 - 1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:
 - a. Control and expansion joints in unit masonry.
 - b. Control and expansion joints in Portland cement plaster.
 - c. Perimeter joints between materials listed above and frames of doors and windows.
 - d. Control and expansion joints in ceiling and overhead surfaces.
 - e. Other joints as indicated.
 - f. Exterior joints in horizontal traffic surfaces as indicated below:
 - g. Control, expansion, and isolation joints in cast-in-place concrete slabs.
 - h. Other joints as indicated.
 - 2. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - 3. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - a. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - b. Other joints as indicated.
 - 4. Interior joints in horizontal traffic surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Flashing and Sheetmetal" for sealants used in sheetmetal work.
 - 2. Division 8 Section "Glass and Glazing" for sealants used in glazing.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

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

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data from manufacturers for each joint sealant product required.
- C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- D. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
- E. Provide and maintain a file of manufacturer's instructions for each of the products used.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet.

- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealants in existing interior concrete pavement to occur prior to application of clear concrete sealing compound where indicated or scheduled on drawings.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.2 ELASTOMERIC JOINT SEALANTS

- A. A Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920; including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.
- B. Products: Subject to compliance with requirements, provide one of the products specified.
- C. Single Part Pourable Urethane Sealant for use in horizontal joints in floor slabs, sidewalks, and concrete pavement. Provide one of the following:
 - 1. "Vulkem 45"; Mameco International, Inc.
 - 2. "NR-201 Urexpam"; Pecora Corp.
 - 3. "Sonolastic SL1"; Sonneborn brand by BASF Building Systems.
- D. Single Part Nonsag Urethane Sealant for use in sealing hollow metal door frames to adjoining wall surfaces, roof flashing and edge metal installations, and general purpose exterior sealing except where silicone is specified:
 - 1. "Vulkem 921n"; Tremco.
 - 2. "Dynatrol 1"; Pecora Corp.
 - 3. "Sika Flex-1a"; Sika Corp.
 - 4. "Sonolastic NP 1"; Sonneborn brand by BASF Building Systems.
- E. Medium-Modulus Neutral-Curing Silicone Sealant for use in all exterior masonry control and expansion joints, and for perimeter sealing of aluminum windows and storefronts.
 - 1. 791; Dow Corning (accommodates joint movement of ± 50 percent).
 - a. Apply to masonry and concrete with Dow Corning 1200 Primer.
 - 2. "Sonolastic 150; Sonneborn brand by BASF Building Systems.

2.3 LATEX JOINT SEALANTS

- A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent. Provide at intersections of interior door and window frames and adjoining wall surfaces.
 - 1. "AC-20"; Pecora Corp.
 - 2. "Sonolac"; Sonneborn Building Products.

2.4 ACOUSTICAL JOINT SEALANT

- A. Acoustical sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
 - 1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 2. Install at perimeter joints around all electrical boxes in acoustically-rated walls and all drywall ceilings throughout Music Building 1 and Building 1 Addition, and elsewhere as indicated on drawings.
- B. Manufacturer - Provide one of the following:
 - 1. AC-20FTR Acoustical and Insulation Sealant; Pecora Corporation
 - 2. Sheetrock Acoustical Sealant; USG Corp.

2.5 MILDEW - RESISTANT SILICONE SEALANT

- A. One-part mildew-resistant interior sealant designed to seal nonporous interior building surfaces including tubs, sinks, lavatories, and urinals at perimeter intersection with finished walls.
- B. Manufacturer - Provide one of the following:

1. Dow Corning 786 Mildew-Resistant Silicone Sealant.
2. Sanitary SCS1700 Sealant; G.E. Silicones

2.6 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of either material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, non-outgassing in unruptured state.
 2. Proprietary, reticulated, closed-cell polymeric foam, non-outgassing, with a density of
 3. pcf (40 kg/cu. m) and tensile strength of 35 psi(240 kPa) per ASTM D 1623, and with water absorption less than 0.02 g/ft² per ASTM C 1083.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form release agents from concrete.
 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
 - C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
 - 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
 - D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
 - E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- 3.4 CLEANING
- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
- 3.5 PROTECTION
- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 08 1110 - STANDARD STEEL DOOR AND FRAMES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Standard hollow-metal steel doors.
 - 2. Standard hollow-metal steel frames.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 4 Section "Unit Masonry" for building anchors into and grouting frames in masonry construction.
 - 2. Division 8 Section "Flush Wood Doors" for solid-core wood doors installed in steel frames.
 - 3. Division 8 Section "Door Hardware" for door hardware and weatherstripping.
 - 4. Division 8 Section "Glazing" for glass in steel doors and sidelights.
 - 5. Division 9 Section "Painting" for field painting primed doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

- A. Approval Numbers: Provide State of Florida Product Approval Numbers.
- B. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel door and frame specified.
- C. Shop Drawings:
 - 1. In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:
 - a. Elevations of each door design
 - b. Details of doors, including vertical and horizontal edge details.
 - c. Frame details for each frame type, including dimensioned profiles.
 - d. Details and locations of reinforcement and preparations for hardware.
 - e. Details of each different wall opening condition.
 - f. Details of anchorages, accessories, joints, and connections.
 - 2. State of Florida Product Approval must be applicable to actual door and frame sizes indicated on drawings.
 - 3. Shop drawings shall indicate hardware locations for doors and frames based upon Steelcraft standards. No other locations are acceptable.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
 - 1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 108.
- D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
 - 1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. A Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door Products.
 2. CURRIES Company; an ASSA ABLOY Group Company.
 3. Republic Builders Products Company.
 4. Steelcraft; an Ingersoll-Rand Company.
 5. Hollow Metal, Inc.
 6. Amweld International, LLC

2.2 MATERIALS

- A. A Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
- D. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

2.3 STANDARD STEEL DOORS

- A. A General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
1. Design: As indicated on Drawings.
 2. Core Construction: Manufacturers standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
 - a. Fire Door Core: As required to provide fire-protection ratings indicated.
 3. Vertical Edges for Single-Acting Doors: Beveled edge
 - a. Beveled Edge: 1/8 inch in 2 inches.
 4. Top and Bottom Edges: Closed with flush (at top), inverted (at bottom), 0.042- inch- thick end closures or channels of same material as face sheets.
 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior and Interior Doors: Face sheets fabricated from A-60 galvannealed steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for lever and model and ANSI A250.4 for physical-endurance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), 16 gage (.053 inch).
- C. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick.
 4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.
- D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot- rolled steel sheet.

2.4 STANDARD STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior and Interior Frames: Fabricated from A-60 galvannealed steel sheet.
1. Fabricate frames with mitered or coped and continuously welded face corners.
 2. Frames for Level 3 Steel Doors: 16 gage (.053 inch) thick steel sheet.

- C. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
 - 1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 - 2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 - 3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick.
 - 4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.
- D. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.
- E. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long.
 - 2. Post installed Expansion Type for In-Place Concrete Masonry: minimum 3/8- inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- F. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot- rolled steel sheet.
- G. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick.

2.5 FABRICATION

- A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Standard Steel Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
 - 3. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
 - 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. Provide three anchors per jamb.
 - b. Post installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 - 5. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
 - 1. All locations shall be based upon Steelcraft standards.
 - 2. Reinforce doors and frames to receive nontemplated mortised and surface- mounted door hardware.
 - 3. Comply with applicable requirements in ANSI A250.6 and ANSI/OHi A115 Series specifications for door and frame preparation for hardware. Locate hardware according to ANSI A250.8.

2.6 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish standard steel door and frames after assembly.
- B. Galvannealed Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint for reglvanizing welds in steel, complying with SSPC-Paint 20.
- C. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250. 10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.
 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines. and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware,

3.3 INSTALLATION

- A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Standard Steel Frames: Install standard steel frames for doors of size and profile indicated. Comply with SDI 105.
 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - c. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 2. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 3. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors according to NFPA 105.

3.4 ADJUSTING AND CLEANING

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

- B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

4.1 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.
 - 1. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
 - a.
 - 2.
 - 3. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

SECTION 08 2110 - FLUSH WOOD DOORS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Solid core doors with wood veneer faces.
 - 2. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections:
 - 1. Division 9 Section "Painting" for field painting of metal louvers and metal frames for light openings.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract.
- B. Product data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
- C. Shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, and other pertinent data.
 - 1. For factory-machined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings.
- D. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
 - 1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.
- E. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.4 QUALITY ASSURANCE

- A. Quality Standard: Comply with the following standard:
 - 1. AWI Quality Standard: Architectural Woodwork Quality Standards® of the Architectural Woodwork Institute for grade of door, core, construction, finish, and other requirements.
- B. Fire-Rated Wood Doors: Provide wood doors that comply with NFPA 80; are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152; and are labeled and listed by UL, Warnock Hersey, or another testing and inspection agency acceptable to authorities having jurisdiction.
- C. Single-Source Responsibility: Obtain doors from one source and by a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's instructions.
- B. Identify each door with individual opening numbers as designated on shop drawings, using temporary, removable, or concealed markings.

1.6 PROJECT CONDITIONS

- A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with the following requirements applicable to Project's geographical location:
 - 1. AWI quality standard Section 100-S-11 "Relative Humidity and Moisture Content."

1.7 WARRANTY

- A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span, or do not conform to tolerance limitations of referenced quality standards.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
 - 2. Warranty shall be in effect during the following period of time after date of Substantial Completion.
 - a. Solid Core Interior Doors: Ten years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Solid Core Doors:
 - a. Algoma Hardwoods, Inc.
 - b. Eggers Industries
 - c. Graham Wood Doors
 - d. Marshfield Door Systems
 - e. Mohawk Flush Doors, Inc.
 - f. VT Industries, Inc.

2.2 INTERIOR FLUSH WOOD DOORS

A. Solid Core Doors for Transparent Finish: Comply with the following requirements:

1. Faces: Running, book-matched, rotary-cut, white birch.
2. AW.I. Grade: Premium.
3. Construction: PC 5 (Particleboard core, 5 ply, with core bonded to faces).
4. Core: Particleboard core, ANSI A208. 1, Grade LD-2.
5. Bonding: stiles and rails bonded to core, then entire unit abrasive planed before veneering.

B. Fire-Rated Solid Core Doors: Comply with the following requirements:

1. Faces and Grade: Provide faces and grade to match non-fire-rated doors in same area of building, unless otherwise indicated.
2. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.
3. Blocking: Provide composite blocking designed to maintain fire resistance of door but with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:
 - a. 5-inch top rail blocking.
 - b. 5-inch bottom rail blocking.
 - c. 5-by-18-inch lock blocks.
 - d. 5-inch midrail blocking.

2.3 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

B. Blade Type: Vision-proof, inverted V.

C. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.

D. Fire Door Louvers: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire rating of one and one-half hours and less.

E. Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.0478- inch thick, cold-rolled steel sheet; factory primed and approved for use in doors including fire rated doors where indicated.

2.4 FABRICATION

A. Fabricate flush wood doors to comply with following requirements:

1. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels:
 - a. Comply with clearance requirements of referenced quality standard for fitting.
 - b. Comply with requirements of NFPA 80 for fire-resistance-rated doors.
2. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, DHI A 115-W series standards, and hardware templates.
 - a. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.

B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

2.5 FACTORY FINISHING

A. General: Comply with AWI's Architectural Woodwork Quality Standards Illustrated" for factory finishing.

B. Finish doors at factory.

C. Transparent Finish:

1. Grade: Premium
2. Finish: AWI System TR-6 catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Sheen: Satin

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine installed door frames prior to hanging door:
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors with defects.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation see Division 8 Section "Door Hardware."
- B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and referenced quality standard and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to requirements of NFPA 80.
 - 2. Fitting Clearances for Non-Fire-Rated Doors: Provide 1/8 inch at jambs and heads, 1/16 inch per leaf at meeting stiles for pairs of doors, and 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4-inch clearance from bottom of door to top of threshold.
 - 3. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING AND PROTECTION

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Refinish or replace doors damaged during installation.
- C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08 3313 - COILING COUNTER DOORS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Fire-rated coiling counter doors and operating hardware.
- 1.2 REFERENCE STANDARDS
 - A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Coiling Counter Fire Doors:
 - 1. Alpine Overhead Doors, Inc; _____: www.alpinedoors.com/#sle.
 - 2. C.H.I. Overhead Doors; Model 7522 (steel): www.chiohd.com/#sle.
 - 3. Raynor Garage Doors; FireCurtain, Model _____: www.raynor.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- 2.2 COILING COUNTER DOORS
 - A. Coiling Counter Doors, Fire-Rated: Galvanized steel slat curtain.
 - 1. Mounting: Between jambs, within prepared opening.
 - 2. Provide integral frame and sill of same material and finish.
 - 3. Fire Rating: 3/4 hour; comply with NFPA 80.
 - 4. Nominal Slat Size: 1-1/4 inches wide.
 - 5. Slat Profile: Flat.
 - 6. Finish, Galvanized Steel: Factory baked enamel.
 - 7. Guides: Formed track; same material and finish unless otherwise indicated.
 - 8. Hood Enclosure: Manufacturer's standard; primed steel.
 - 9. Coiling Door Release Mechanism: Fusible link activated with automatically governed closing speed.
 - 10. Manual hand chain lift operation.
- 2.3 MATERIALS
 - A. Curtain Construction: Interlocking, single thickness slats.
 - 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 - 2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
 - 3. Steel Slats: ASTM A653/A653M galvanized steel sheet, with minimum G90/Z275 coating; minimum thickness 16 gauge, 0.06 inch.
 - B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
 - C. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
 - D. Lock Hardware:
 - E. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that opening sizes, tolerances and conditions are acceptable.
- 3.2 INSTALLATION
 - A. Install units in accordance with manufacturer's instructions.
 - B. Install fire-rated doors in accordance with NFPA 80.
 - C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
 - D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
 - E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
 - F. Complete wiring from fire alarm system .
- 3.3 TOLERANCES
 - A. Maintain dimensional tolerances and alignment with adjacent work.

- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.4 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION

SECTION 08 4100 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior entrance systems (hurricane-resistant).
 - a. Exterior storefront systems.
- B. Related sections include the following:
 - 1. Division 7 Section "Joint Sealants" for sealing between framing and masonry.
 - 2. Division 8 Section "Door Hardware" for lock cylinders.

1.3 SYSTEM DESCRIPTION

- A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:
 - 1. Air infiltration and water penetration exceeding specified limits.
 - 2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.
- B. Glazing: Physically and thermally isolate glazing from framing members.
- C. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to the requirements of the Florida Building Code and ASCE 7-98.
 - 1. Refer to structural drawings for table of positive and negative design wind pressures.
 - 2. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller, unless otherwise indicated.
 - 3. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.
 - a. Test Pressure: 150 percent of inward and outward wind-load design pressures.
 - b. Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.
- D. Hurricane-Resistance Test Performance: Provide entrance and storefront systems that pass large and small missile-impact tests, as required by systems' location above grade, and cyclic-pressure tests according to The Florida Building Code, Sections 1606 and 1626.
- E. Dead Loads: Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
 - 1. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.
 - 2. Provide a minimum 1/16-inch clearance between members and operable windows and doors.
- F. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.
- G. Engineering Responsibility: Storefront subcontractor shall engage a Florida registered structural engineer to design connections, member reinforcements, and fastening to building structure, and prepare design calculations and engineering data.
- H. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft.
- I. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. Water leakage is defined as follows:
 - 1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
- J. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint

sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 100 deg F ambient; 150 deg F material surfaces.
- K. Structural-Support Movement: Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.
- L. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.4 SUBMITTALS

- A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work. Show elevations at 2 A scale and details at 3" scale.
 1. Shop drawings shall include large-scale anchorage details indicating attachment to slabs, walls, and overhead structure.
 2. Submit calculations, structural properties, connection information and product information to verify that the system performance and anchorage can successfully resist wind loads. All calculations shall be signed and sealed by a Florida registered professional structural engineer.
 3. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.
 4. Shop drawings shall include State of Florida Product Approval applicable to actual sizes of doors indicated.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.
 1. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project
- B. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated.
 1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Kawneer Company, Inc.
 2. Vistawall Architectural Products.
 3. YKK AP America

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
 1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Bars, Rods, and Wire; ASTM B 211.
- B. Steel Reinforcement: Complying with ASTM A 36 for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 for hot-rolled sheet and strip.
- C. Glazing shall be provided by aluminum entrance manufacturer as follows:
 1. Glass must be laminated glass product of the type included in the entrance assembly that was tested for hurricane resistance.

2. Glass shall be 9/16" thick consisting of a 1/4" thick, fully tempered outer lite of Pilkington LOF "Evergreen" glass, a .090" thick PVB plastic interlayer, and a 1/4" thick, fully tempered inner lite of clear glass.
- D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
 1. Provide silicone sealant in lieu of glazing gasket if required by entrance manufacturer for hurricane-resistant construction.
- E. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

2.3 COMPONENTS

- A. Doors: Provide manufacturer's standard 1-3/4-inch- thick glazed doors with minimum 0.125-inch- thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
 1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded- aluminum glazing stops and preformed gaskets.
 2. Stile Design: Medium stile; 3-1/2-inch nominal width.
- B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 1. Reinforce members as required to retain fastener threads.
 2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
- D. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:
 1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.
 2. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon- fabric or aluminum-strip backing complying with AAMA 701 requirements.

2.4 HARDWARE

- A. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated.
- B. Ball-Bearing Butts: ANSI/BHMA A156.1, Grade 1, 5 knuckle, 4 1/2-by 4-inch ball-bearing butts. Provide nonremovable pins at hinges exposed to door outside and provide nonferrous hinges for applications exposed to weather. Provide 3 hinges at each leaf for doors up to 36 inches wide and 80 inches tall; provide 4 hinges at each leaf for taller doors.
- C. Closers, General: Comply with manufacturer's recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.
 1. Closing Cycle: Comply with Florida Accessibility code for Building construction or the Americans with Disabilities Act (ADA), whichever is more stringent.
 2. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:
 - a. Exterior Doors: 8.5 lbf.
 3. Hold Open: Adjustable.
- D. Surface-Mounted Overhead Closers: ANSI/BHMA A 156.4, Grade 1.
- E. Door Stops: ANSI/BHMA A 156.16, Grade 1, floor- or wall-mounted door stop, as appropriate for door location indicated with integral rubber bumper.
- F. Mortise Cylinders: Cylinders are specified in Section 08710 - Door Hardware.
- G. Deadlatch Locks: Manufacturer's standard mortise deadlatch with minimum 2 inch long latch bolt and auxiliary bolt located below latch bolt and complying with ANSI/BHMA A156.5, Grade 1 requirements.
- H. Radius Face Strikes: Manufacturer's standard stainless-steel, radiused face strike with steel mounting plate and black-plastic dustbox.
- I. Vertical-Rod Exit Devices: At all doors, provide concealed, vertical-rod exit device complying with UL 305 requirements, with 2-point top and bottom latching that is released by a full-width crash bar or when locked down (dogged) by lock cylinder or retracting screws beneath housing.
 1. Device shall comply with hurricane-resistant entrance system requirements.
- J. Pull Handles: As selected by Architect from manufacturer's full range of pull handles and plates.
- K. Thresholds: At exterior doors, provide manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 2- inch- high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in the following material:
 1. Material: Aluminum, mill finish.

- L. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips.

2.5 FABRICATION

- A. A General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
 - 1. Fabricate components for screw-spline frame construction.
- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Prepare components to receive concealed fasteners and anchor and connection devices.
- D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- E. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."
- F. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- G. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete, hurricane-resistant system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
 - 1. Frame dimensions to be 2-1/2" x 5" maximum.
- H. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
 - 1. Provide compression weatherstripping at fixed stops.

2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.7 STEEL PRIMING FOR STEEL REINFORCEMENT

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.
- B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.
- C. J. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 STOREFRONT INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
 - D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated.
 - E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
 - F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
 - 1. Install surface-mounted hardware according to manufacturer=s written instructions using concealed fasteners to greatest extent possible.
 - G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.
 - H. Install perimeter sealant, using compatible backer rod where indicated on drawings.
 - I. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.
 - 2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
 - 3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.
- 3.3 ADJUSTING AND CLEANING
- A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
 - B. Remove excess sealant and glazing compounds, and dirt from surfaces.
- 3.4 PROTECTION
- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08 5200 - ALUMINUM WINDOWS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes Heavy-Commercial Grade aluminum windows of the performance class indicated. Window types required include the following:
 - 1. Horizontal sliding windows.
 - a. Impact-Resistant.
- B. Related Sections include the following: Division 8 Section "Glazing" for glazing requirements for aluminum windows, including those specified to be factory glazed.

1.3 DEFINITIONS

- A. Performance class number, included as part of the window designation system, is the actual design pressure in pounds force per square foot (pascals) used to determine structural test pressure and water test pressure.
 - 1. Structural test pressure, wind load test, is equivalent to 150 percent of the design pressure.
 - 2. Water-leakage-resistance test pressure is equivalent to 15 percent of the design pressure with 2.86 lbf/sq. ft. (137 Pa) as a minimum for Residential, Commercial, and Heavy-Commercial Grade windows.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window assemblies representing types, grades, classes, and sizes required for Project according to test methods indicated.
- B. Test Criteria: Testing shall be performed by a qualified independent testing agency based on the following criteria:
 - 1. Refer to structural drawings for table of positive and negative design wind pressures for doors and windows.
 - 2. Test Procedures: Test window units according to ASTM E 283 for air infiltration, both ASTM E 331 and ASTM E 547 for water penetration, and ASTM E 330 for structural performance.
- C. Performance Requirements: Testing shall demonstrate compliance with requirements indicated in AAMA 101 for air infiltration, water penetration, and structural performance for type, grade, and performance class of window units required. Where required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA 101, Section 3, "Optional Performance Classes," for higher than minimum performance class.
 - 1. Air-Infiltration Rate for Operating Units: Not more than 0.19 cfm/ft. of operable sash joint for an inward test pressure of 1.57 lbf/sq. ft.
 - 2. Water Penetration: No water penetration as defined in the test method at an inward test pressure of 15 percent of the design pressure.
 - 3. Structural Performance: No failure or permanent deflection in excess of 0.4 percent of any member's span after removing the imposed load, for positive (inward) and negative (outward) test pressures indicated on drawings.
 - 4. Thermal Movements: Provide window units that allow thermal movement resulting from the following maximum change (range) in ambient temperature when engineering, fabricating, and installing aluminum windows to prevent buckling, opening of joints, and overstressing of components, connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime sky heat loss.
 - a. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- D. Wind Loads: Provide aluminum window system including anchorage to building capable of withstanding minimum allowable wind load design pressures as indicated. Note that these pressures have been calculated by multiplying the ultimate wind pressures by a factor of 0.6.
 - 1. Refer to drawings for required pressures (positive and negative).
- E. Thermal Performance: provide documentation demonstrating the window units and glazing acting as an assembly provide the following:
 - 1. U-value (overall): 1.1.
 - 2. SHGC: 0.52.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of window required, including the following:
 - 1. Construction details and fabrication methods.
 - 2. Profiles and dimensions of individual components.
 - 3. Data on hardware, accessories, and finishes.
 - 4. Recommendations for maintaining and cleaning exterior surfaces.
- C. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:
 - 1. Layout and installation details, including anchors.
 - 2. Elevations at 1/4 inch= 1foot scale and typical window unit elevations at 3/4 inch = 1 foot scale.
 - 3. Full-size section details of typical composite members, including reinforcement and stiffeners.
 - 4. Location of weep holes.
 - 5. Panning details.
 - 6. Hardware, including operators.
 - 7. Glazing details.
 - 8. Accessories.
 - 9. Anchorage details at head, jamb, and sill.
- D. Samples for initial color selection on 12-inch- long sections of window members. Where finishes involve normal color variations, include Sample sets showing the full range of variations expected.
- E. Test reports from a qualified independent testing agency indicating that each type, grade, and size of window unit complies with performance requirements indicated based on comprehensive testing of current window units within the last 5 years. Test results based on use of down-sized test units will not be accepted.
- F. Submit calculations, structural properties, connection information and product information to verify that system performance and anchorage complies with the loading criteria specified herein. All calculations shall be signed and sealed by a professional engineer registered in the State of Florida, whose discipline is structural engineering.
- G. State of Florida Product Approval Number documentation.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed installation of aluminum windows similar in material design, and extent to those required for this Project and with a record of successful in-service performance.
- B. Single-Source Responsibility: Obtain aluminum windows from one source and by a single manufacturer.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Check window openings by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure -that actual opening dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Horizontal Sliding Windows:
 - a. EFCO Corporation, "Series 6500".
 - b. Graham Architectural Products Corp., "Series 0600.
 - c. Winco Window Company, "Series 3410 HS Series".

2.2 MATERIALS

- A. Aluminum Extrusions: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000- psi ultimate tensile strength and not less than 0.062 inch thick at any location for main frame and sash members.
- B. Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.
 - 1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.

2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
- C. Anchors, Clips, and Window Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with requirements of ASTM B 633; provide sufficient strength to withstand design pressure indicated.
- D. Sliding-Type Weatherstripping: Provide woven-pile weatherstripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.2.
- E. Sealant: For sealants required within fabricated window units, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating. Comply with Division 7 Section "Joint Sealants" of these Specifications for selection and installation of sealants.
- F. Glass-Fiber-Mesh Insect Screen: 18-by-16 or 18-by-14 mesh of plastic-coated glass-fiber threads, woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with requirements of ASTM D 3656

2.3 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended.
- B. Counterbalancing Mechanism: Comply with AAMA 902.2.
 1. Sash-Balance Type: Concealed spiral type of size and capacity to hold sash stationary at any open position.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessories that comply with indicated standards.
- B. Insect Screens: Provide insect screens for each operable exterior sash or ventilator. Locate screens on inside or outside of window sash or ventilator, depending on window type. Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches.
 1. Screen Frames: Fabricate frames of tubular-shaped, extruded- or formed-aluminum members of 0.040-inch minimum wall thickness, with mitered or coped joints and concealed mechanical fasteners. Finish frames to match window units.
 - a. Provide removable PVC spline-anchor concealing edge of screen frame.
- C. Head and Jamb Closures: Provide manufacturer's standard extruded aluminum head and jamb closures compatible with frame profiles provided.

2.5 HORIZONTAL SLIDING WINDOWS

- A. Minimum Window Class and Grade: Comply with requirements of AAMA Performance Class HG-Heavy Commercial. Provide AAMA Performance Grade as required by wind pressures indicated on drawings. Window units shall successfully pass operating force test performance requirements specified in AAMA 101. Thermally broken construction is not required.
- B. Hardware: Provide the following equipment and operating hardware:
 1. Sash Rollers: Steel, lubricated ball-bearing rollers with nylon tires.
 2. Sash Lock: Cam-action sweep sash lock and keeper at meeting rails.

2.6 FABRICATION

- A. General: Fabricate aluminum window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.
 1. Provide units that are reglazable without dismantling sash or ventilator framing.
 2. Prepare window sash or ventilators for glazing, except where preglazing at the factory is indicated.
- B. Frames: Provide 3-5/8" minimum frame depth, with frame and sash extrusions of .062" minimum thickness, and with sill members of .094" minimum thickness. All horizontal rails shall be tubular.
- C. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated.
- D. Glazing Stops: Provide screw-applied or snap-on glazing stops, coordinated with glass selection and glazing system indicated. Finish to match window units.
- E. Preglazed Fabrication: Preglazed window units at the factory where possible and practical for applications indicated. Comply with glass and glazing requirements of Division 8 Section "Glazing" of these Specifications and AAMA 101.

2.7 FINISHES

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect openings before installation. Verify that rough or masonry opening is correct and sill plate is level.
- B. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.

3.2 INSTALLATION

- A. Comply with manufacturer's specifications and recommendations for installing window units, hardware, operators, and other components of the Work.
- B. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.
 - 1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified under "Dissimilar Materials" Paragraph in appendix to AAMA 101.
 - 2. Set windows on .062" thick formed aluminum sill flashing provided by manufacturer, in finish to match windows.
- C. Set sill members and other members in a bed of sealant or with joint fillers or gaskets, as shown on Shop Drawings, to provide weathertight construction. Refer to Division 7 Section "Joint Sealants" for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the Work.

3.3 ADJUSTING

- A. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and a weathertight closure.

3.4 CLEANING

- A. Clean aluminum surfaces promptly after installing windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.
- B. Clean glass of preglazed units promptly after installing windows. Comply with requirements of Division 8 Section "Glazing" for cleaning and maintenance.

3.5 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to aluminum window manufacturer, that ensure window units are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08 7110 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Work Specified Elsewhere:
 - 1. Section 08 1100 - Hollow Metal Doors and Frames
 - 2. Section 08 2110 - Flush Wood Doors

1.2 SUMMARY

- A. The work in this section shall include furnishing of all items of finish hardware as hereinafter specified or obviously necessary to complete the building, except those items that are specifically excluded from this section of the specification.
 - 1. Provide labor, materials, and equipment necessary for furnishing the door hardware materials.
- B. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality; however, it shall be the door hardware supplier's responsibility for thoroughly reviewing existing and new conditions, schedules, Specifications, Drawings, and other Contract Documents to verify the suitability of the hardware specified.
 - 1. Door hardware supplier shall be responsible for furnishing proper hardware for every door opening indicated or scheduled, regardless of whether a hardware set is listed or not.
 - 2. Items listed with "no substitution permitted" or similar.
- C. At least 10 days before bid due date, door hardware supplier shall notify Architect of omissions, discrepancies, and items he believes to be contrary to applicable codes, laws, statutes, and regulations.
- D. No additional monies will be allowed for omissions, changes, or corrections necessary to facilitate proper function and installation of door hardware.

1.3 DESCRIPTION OF WORK

- A. Furnish labor and material to complete hardware work indicated, as specified herein, or as may be required by actual conditions at building.
- B. Include all necessary screws, bolts, expansion shields, other devices, if necessary, as required for proper hardware application. The hardware supplier shall assume all responsibility for correct quantities.
- C. Provide a bitting list at Project Close-out.
- D. All hardware shall meet the requirements of Federal, State and Local codes having jurisdiction over this project, notwithstanding any real or apparent conflict therewith in these specifications.
- E. The Owner hereby names the Construction Manager as the authorized party to order keys and bitting lists and to take receipt of these items from the hardware supplier upon completion of the project.
- F. Fire-Rated Openings:
 - 1. Provide hardware for fire-rated openings in compliance with A.I.A. (NBFU) Pamphlet No. 80 and NFPA Standards No. 101, UBC 702 (1997), and UL101. This requirement takes precedence over other requirements for such hardware. Provide only hardware that has been tested and listed by UL for the types and sizes of doors required, and complies with the requirements of the door and door frame labels.
 - 2. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label indicating Fire Door to be equipped with fire exit hardware and provide UL label on exit device indicating "Fire Exit Hardware".
- G. Fasteners:
 - 1. Hardware as furnished shall conform to published templates generally prepared for machine screw installation.
 - 2. Furnish each item complete with all screws required for installation. Typically, all exposed screws installation.
 - 3. Insofar as practical, furnished concealed type fasteners for hardware units which have exposed screws shall be furnished with Phillips flat heads screws, finished to match adjacent hardware.
 - 4. Door closers and exit devices to be installed with closed head through bolts (sex bolts).
- H. Exterior openings:
 - 1. Provide hardware for hurricane openings in compliance with local jurisdiction.
 - a. This requirement takes precedence over other requirements for such hardware. Provide only hardware that has been tested and listed by local authority for the types and sizes of doors required, and complies with the requirements of the door and door frame. Coordinate Section (08710) Finish Hardware with the Hollow Metal Doors and Frames (08110).
 - 2. Provide Engineering Reports that openings meet the requirement for wind load, water infiltration, and impact as required in FBC.

1.4 SUBMITTALS

- A. Submit in accordance with Division 01 requirements.
- B. Manufacturer's Data, Door Hardware: Submit manufacturer's data for each item of door hardware. Include whatever information may be necessary to show compliance with requirements. Include instructions for installation and for maintenance of operating parts and exposed finishes. Wherever needed, furnish templates to fabricators of other work which is to receive door hardware. Indicated by transmittal that copy of applicable data has been distributed to the Installer.
- C. Hardware Schedule: Submit copies of the Hardware Schedule based on door hardware requirements as indicated (including Drawings, schedules, and specifications). Schedule may be organized in a horizontal or vertical schedule indicating complete designation of every item required for each door or opening. Furnish schedule at the earliest possible date, in order to facilitate the fabrication of other Work (such as steel doors and frames) which may be critical in the Project Construction Schedule.
 - 1. Approval of the schedule will not relieve the Contractor of the responsibility for furnishing all necessary hardware and components.
- D. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled. The keying schedule is to include the opening number, lockset number, and room name.

1.5 QUALITY ASSURANCE

- A. The finish hardware supplier shall prepare and submit to the architect a complete schedule identifying each door and each set number, following the numbering system and not creating any separate system himself. He shall submit the schedule for review, make corrections as directed and resubmit the corrected schedule for final approval. Approval of schedule will not relieve Contractor of the responsibility for furnishing all necessary hardware, including the responsibility for furnishing correct quantities. This submittal shall include project cut sheets for each product.
- B. No manufacturing orders shall be placed until detailed schedule has been submitted to the architect and written approval received.
- C. After hardware schedule has been approved, furnish templates required by manufacturing contractors for making proper provisions in their work for accurate fitting, finishing hardware setting. Furnish templates in ample time to facilitate progress of work.
- D. Furnish four (4) sets of operating and maintenance manuals for all hardware.
- E. Hardware supplier shall have an office and warehouse facilities to accommodate the materials used on this project. The supplier must be an authorized distributor of the products specified.
- F. Before hardware installation, Contractor shall schedule a hardware installation seminar, specifically for locksets, closers, exit devices and overhead stops. Manufacturer's representative of the above products shall present the seminar. Manufacturer's representative of the above products shall present the seminar. Seminar is to be conducted at the job site and attended by installers of hardware (including low voltage hardware) hollow metal and wood doors. Training will include use of installation manuals, hardware schedule, templates and physical products samples. . No Finish Hardware Items shall be installed on the Project until this pre-installation class has been held. The lock, exit device and door closer manufacturer's representative shall complete a post installation review for proper adjustment and installment of locks, exit devices and closers prior to building turnover to occupancy. Any deficiencies shall be reported to the Design Professional within 7 days.
- G. The hardware manufacturer's representative shall ensure that the Owner's keying system is maintained, and shall ensure that the hardware is properly installed and adjusted. The representative shall conduct a post-installation inspection. Any deficiencies shall be reported to the Design Professional within 7 days.
- H. The finish hardware supplier shall submit instructions and templates for installation to the Installer. Whenever needed, furnish templates to fabricators of other work which is to receive door hardware (ie gates). Indicate by transmittal that applicable data has been distributed to the Installer's and fabricators as needed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Wrap, protect finishing hardware items for shipment. Deliver to manufacturing contractors hardware items required by them for their application; deliver balance of hardware to job; store in designated location. Each item shall be clearly marked with its intended location.

1.7 WARRANTY

- A. The material furnished shall be warranted for one year after installation or longer as the individual manufacturer's warranty permits.
- B. Extended Warranties:
 - 1. Door Closers: Thirty (30) years
 - 2. Exit Devices: Three (3) years
 - 3. Mortise Locks: Three (3) years

- C. Overhead door closers shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a period of ten (10) years commencing on the Date of Final Completion and Acceptance, and in the event of failure, the manufacture is to promptly repair or replace the defective with no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. To the greatest extent possible, obtain each kind of hardware from one manufacturer only.
- B. All numbers and symbols used herein have been taken from the current catalogues of the following manufacturers:
1. PRODUCT: ACCEPTABLE MANUFACTURER, (ACCEPTABLE SUBSTITUTE)
 - a. Hinges, Interior: Stanley (Ives, McKinney)
 - b. Hinges, Interior with Closer: Stanley (Ives, McKinney)
 - c. Hinges, Exterior: Stanley (Ives, McKinney)
 - d. Pivots: Ives (Rixon, As approved)
 - e. Locksets - Mortise: Schlage series L9000 03A (Corbin Russwin)
 - f. Cylinders - Conventional 6-pin: Schlage, (Corbin Russwin)
 - g. Exit Devices: Von Duprin, (No Substitution Allowed)
 - h. Door Closers: LCN, (No Substitution Allowed)
 - i. OH Stops/Holders: Rockwood (Glynn Johnson, Rixson)
 - j. Wall Stops: Rockwood (Ives, Quality)
 - k. Flush Bolts: Rockwood (Glynn Johnson, Ives)
 - l. Kick Plates: Rockwood (Ives, Quality)
 - m. Threshold/ Weatherstrip: Pemko, (National Guard, Zero International)
 - n. Silencers: Glynn Johnson (Rockwood, Ives)
- C. If material manufactured by other than specified or listed herewith as an equal, is to bid upon, permission must be requested from the architect seven (7) days prior to bidding. If substitution is allowed, it will be noted by addendum.

2.2 FINISH OF HARDWARE:

- A. Exterior Hinges: Stainless Steel (630 - US32D).
- B. Interior Hinges: Satin Chrome (652 - US26D).
- C. Door Closers: Aluminum (689 - AL).
- D. Locks: Satin Chrome (626 - US26D).
- E. Exit Devices: Satin Chrome (626 - US26D).
- F. Overhead Holders: Stainless Steel (630 - US32D).
- G. Flat Goods: Stainless Steel (630 - US32D).
- H. Thresholds: Mill Finish Aluminum (AL).

2.3 HINGES AND PIVOTS:

- A. Exterior butts shall be Stainless Steel. Butts on all out swinging doors shall be furnished with non-removable pins (NRP). Supply standard weight 4.5 x 4.5 hinges for doors up to 40", supply heavy weight 4.5 x 4.5 hinges for doors 42" or wider, or as specified in Hardware Sets.
- B. Interior butts shall be steel. Supply standard weight 4.5 x 4.5 hinges for door up to and including 40", supply heavy weight 4.5 x 4.5 hinges for doors over 42" and wider.
- C. Doors 5' or less in height shall have two (2) butts. Furnish one (1) additional butt for each 2'-6" in height or fraction thereof. Dutch doors shall have two (2) butts per leaf.

2.4 FASTENERS:

- A. Attach all items of finish hardware to the doors, frames, walls, etc. with fasteners furnished and required by the manufacturer of the item.
- B. Provide concealed fasteners where practical. For butts (hinges) or other hardware requiring exposed screws, provide flat-head Phillips screws, countersunk and finished to match the hardware.
- C. At all doors, closers and exit devices shall be installed with closed-head through bolts (sex bolts). Fastening methods that rely on internal reinforcing are not acceptable.

2.5 KEYING:

- A. New locksets are to be Schlage "E" keyway.
- B. Key new locks to the keyed to the existing AB master key system.
- C. Keying shall be by lock manufacturer and permanent records shall be kept.
- D. Locks at exterior gates shall be keyed alike.
- E. The permanent cylinders and keys are to be shipped directly to the Architectural Hardware Supplier/Distributor and not directly to the Hillsborough County School Board facility.

- F. Provide Five (5) each change keys per lock and master keys and Four (4) control keys. All cut keys and key blanks shall be Primus.
- G. Hardware supplier to provide construction cylinders or cores during the construction phase. At substantial completion, the AHC shall adjust and install the pre-keyed Schlage Primus cylinders and turn over all permanent keys to the Construction Manager.
- H. All locks and cylinders shall be master keyed into a new system. All cylinders shall be construction keyed.
- I. This supplier to meet with Owner to determine final keying requirements.
- J. Provide keys as follows.
 - 1. Ten (10) copies of each master key.
 - 2. Final Key Schedule shall be submitted to the Architect for review prior to ordering hardware.

2.6 LOCKSETS:

- A. Locksets shall be Mortise type, unless specified otherwise, in "L" series, 03A design as manufactured by Schlage.
 - 1. Acceptable substitutions for L series 03A: Corbin/Russwin, ML2200 - LSA.
 - 2. Locksets used for student occupied instructional space are to be Classroom Security Lock L9071 as manufactured by Schlage or equal by Corbin/Russwin (CR ML2072). This lockset has the ability to be locked from either side.
 - 3. Provide Schlage - L9070 at Toilet Rooms.
 - 4. Provide Schlage - L9080 (Store Room function) at Mechanical rooms, Electrical Rooms, and individual Custodial Closets.
- B. Locksets shall be certified BHMA Grade One cylindrical type
- C. Provide locks in function as listed in hardware sets.
- D. Provide all locks with 2 3/4" backset and minimum 1/2" throw.
- E. Deadlocks shall be BHMA Grade One with 2 3/4" backset and minimum 1" throw.
 - 1. Corbin Russwin CL3800 Series

2.7 EXIT DEVICES:

- A. Devices shall be Von Duprin 99 Series in types and functions specified. All devices must be listed under "Panic Hardware" in accident equipment list of Underwriters Laboratories. All labeled doors with "Fire Exit Hardware" must have labels attached and be in strict accordance with Underwriters Laboratories.
- B. All exit devices shall be tested to ANSI/BHMA A156.3 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 1,000,000 cycles must be available for submittal upon request.
- C. All surface strikes shall be roller type and come complete with a plate underneath to prevent movement. And shall be provided with a dead-latching feature to ensure security.
- D. Exit devices shall be stainless steel. Aluminum or powder coated exit devices will not be accepted.

2.8 DOOR CLOSERS:

- A. Doors: LCN 4000 series (No substitutions).
- B. Gates: Corbin Russwin DC6210 (Substitutions as approved by Owner).
- C. Where closers are indicated to be closer/stop, provide units with a rigid arm assembly and a heavy duty bracket with built-in lug to provide means of positive stop.
- D. Door closers shall incorporate tamper resistant non-critical screw valves of V-slot design to reduce possible clogging from particles within the closer. Closers shall have separate and independent screw valve adjustments for latch speed, general speed, and hydraulic backcheck. To protect the door, frame and hardware from damage, backcheck shall be properly set so as to effectively slow the swing of the door at a minimum of 10 degrees in advance of the dead stop location. Pressure relief valves (PRV) are not acceptable.
- E. Door closers shall utilize temperature stable fluid capable of withstanding temperature ranges of 120 degrees Fahrenheit to -30 degrees Fahrenheit, without requiring seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with the standards UBC 7-2 (1997) and UL 10C.
- F. Door closer cylinders shall be of high strength cast iron construction to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
- G. Closers are to be through-bolted at all doors, both steel and wood.
- H. Closers shall be furnished with parallel arm mounted on all doors opening into corridors or other public spaces and shall be mounted to permit 180 degrees door swing where shown on plans. Furnish with non-hold open arms unless specifically approved.

2.9 TRIM AND PLATES:

- A. Kick plates, mop plates, and armor plates, shall be .050 gauge with 32D finish. Kick plates to be 8" high, mop plates to be 4" high, armor plates to be 36" high. All plates shall be two (2) inches less full width of door and bevel all four (4) edges.

2.10 DOOR STOPS:

- A. Door stops shall be furnished for all doors to prevent damage to doors or hardware from striking adjacent walls or fixtures. Wall bumpers equal to Rockwood 400 Series are preferred, but where not practical furnish floor stops. Where conditions prohibit the use of either wall or floor type stops, furnish surface mounted overhead stops equal to Glynn Johnson, 450 Series on interior doors and 800 Series on exterior doors.

2.11 THRESHOLDS AND WEATHERSTRIP:

- A. Thresholds and weather-strip shall be as listed in the hardware schedule.

2.12 DOOR SILENCERS:

- A. Furnish rubber door silencers equal to Glynn Johnson GJ64 for all new interior hollow metal frames, (2) per pair and (3) per single door frame.

2.13 SECURITY GUARD PLATES

- A. Install at all exterior doors where single exterior doors are specified. Guard plates to be compatible with door and frame.

2.14 RAPID ENTRY SYSTEM

- A. Provide rapid entry system at front door. See Architectural elevations for location.
- B. Basis of Design: Knox-Box; 3200 Series.
 - 1. Hinged Door model.
 - 2. Provide UL listed tamper switch tie-in to alarm system.
 - 3. Recessed mounting kit for flush installation in masonry wall.
 - 4. Color: Black.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. All hardware shall be applied and installed in accordance with the Finish Hardware schedule. Care shall be exercised not to mar or damage adjacent work.
- B. Contractor to provide a secure lock-up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items that are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses both before and after installation.
- C. Mount hardware units at the following heights and locations, unless otherwise indicated. Heights are shown from finish floor to center line of item:
 - 1. HingesStandard Placement
 - a. Lockset: 40 inches
 - b. Deadlock: 48 inches
 - c. Push Plate: 45 inches
 - d. Pull Plate: 42 inches
 - e. Panic Bar: 38 inches
 - f. Closer: per manufacturer's template to give maximum degrees of opening
 - g. Kickplate and armor plates: Bottom of kickplate 1/8 inch above door bottom
 - h. Wall stops: on wall in alignment with lever or pull.
 - i. Stops and Holders
 - 1) Wall Bumper - on wall where lever, knob, or pull hits
 - 2) Wall Stop - on wall at top of door
 - 3) Floor Stop - on floor as far from hinge as conditions permit
 - 4) O.H. Door Stops & Holders - per manufacturer's template
- D. Clean adjacent surfaces soiled by hardware installation.
- E. Install each hardware item in compliance with the manufacturer's instructions and recommendations.
- F. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation. Where closers are specified, they shall be the last hardware item to be installed.
- G. Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- H. Cut and fit threshold and floor covers to profile of door frames with mitered corners and hairline joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts, and similar items.

- I. Anchor thresholds to substrate with cadmium plated machine screws.
 - J. At exterior doors and elsewhere as indicated, set thresholds in a bed of either butyl rubber sealant or polyisobutylene mastic sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealants.
 - K. Coordinate installation of hardware for wood doors with Section 09912 - Painting.
 - 1. Do not install surface mounted items until the final coat of clear finish has been applied and dried.
 - 2. Wherever field cutting and fitting of wood doors is required for hardware installation, remove hardware after final fitting, allow painter to seal and finish "raw" surfaces, then reinstall hardware.
- 3.2 ADJUSTING AND CLEANING:
- A. Contractor shall adjust all hardware in strict compliance with manufacturer's instructions. Prior to turning project to owner, contractor shall clean and make any final adjustments to the finish hardware.
- 3.3 PROTECTION:
- A. Contractor shall protect all hardware as it is stored on construction site in a covered and dry place.
 - B. Contractor shall protect exposed hardware installed on doors during the construction phase.
- 3.4 HARDWARE SCHEDULE:
- A. The following schedule is furnished for whatever assistance it may afford the Contractor; do not consider it as entirely inclusive. Should any particular door or item be omitted in any scheduled hardware group, provide door or item with hardware same as required for similar purposes. Quantities listed are for each pair of doors, or for each single door.
 - B. Refer to door schedule for hardware set numbers. Check quantities and advise the architect if omissions or discrepancies occur.
 - C. All lock functions; applications and keying shall be reviewed with the Architect and Owner at a meeting before finish hardware schedules are submitted for final approval. Supplier to confirm that cylinder type specified is appropriate to function properly in the lock, deadbolt, exit devices and mullions supplied for this project.

Hardware Group No. 01

For use on Door #(s): 101

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	ITEMID	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	✓	689	VON
1	EA	FIRE EXIT HARDWARE	HH-9847-EO-F-SNB		626	VON
1	EA	ELEC FIRE EXIT HARDWARE	QEL-HH-9847-NL-OP-F-110MD- CON-SNB 24 VDC	✓	626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	PRIMUS CORE	20-740		626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH TBWMS		689	LCN
1	EA	THRESHOLD	65A-223		A	ZER
1	EA	WIRE HARNESS	CON-12			SCH
1	EA	POWER SUPPLY	PS902 900-2RS	✓	LGR	SCE

BALANCE OF HARDWARE BY ALUM SUPPLIER

CARD READER AND BUZZER BY SECURITY SUB TO RELEASE DEVICE FOR ACCESS

Hardware Group No. 02

For use on Door #(s): 117

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	ITEMID	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	✓	689	VON
1	EA	PANIC HARDWARE	9827-EO		626	VON
1	EA	ELEC PANIC HARDWARE	QEL-9827-L-06-CON 24 VDC	✓	626	VON
1	EA	RIM CYLINDER	20-057		626	SCH
1	EA	PRIMUS CORE	20-740		626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS		689	LCN
2	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	WIRE HARNESS	CON-12			SCH
1	EA	POWER SUPPLY	PS902 900-2RS	✓	LGR	SCE

CARD READER BY SECURITY SUB TO RELEASE DEVICE FOR ACCESS

Hardware Group No. 03

For use on Door #(s): 116

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	ITEMID	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
2	EA	SURFACE BOLT	SB360 12" T		604	IVE
1	EA	STOREROOM LOCK	L9080L 03A		626	SCH
1	EA	PRIMUS MORT. CYL.	20-706 X L583-446 118 EV C 36- 079-037		626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	THRESHOLD	65A-223		A	ZER

Hardware Group No. 04

For use on Door #(s): 103

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		ITEMID	FINISH	MFR
3	EA	HINGE	3CB1 4.5 X 4.5 NRP			630	IVE
1	EA	POWER TRANSFER	EPT10 CON	⚡		689	VON
1	EA	ELEC PANIC HARDWARE	QEL-HH-99-NL-299F-CON 24 VDC	⚡		626	VON
1	EA	RIM CYLINDER	20-057			626	SCH
1	EA	PRIMUS CORE	20-740			626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CCV			630	IVE
1	EA	GASKETING	188SBK PSA			BK	ZER
1	EA	THRESHOLD	65A-223			A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS	⚡		LGR	SCE

CARD READER BY SECURITY SUB TO RELEASE DEVICE FOR ACCESS

Hardware Group No. 05

For use on Door #(s): 113A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		ITEMID	FINISH	MFR
3	EA	HINGE	3CB1 4.5 X 4.5 NRP			630	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8	⚡		652	IVE
1	EA	EU MORTISE LOCK	L9092LEU 03A CON 12/24 VDC	⚡		626	SCH
1	EA	PRIMUS MORT. CYL.	20-706 X L583-446 118 EV C 36-079-037			626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH TBWMS			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	GASKETING	188SBK PSA			BK	ZER
1	EA	THRESHOLD	65A-223			A	ZER

Hardware Group No. 06

For use on Door #(s): 109B, 110B, 112B, 113B

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		ITEMID	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
2	EA	MANUAL FLUSH BOLT	FB458			626	IVE
1	EA	CLASSROOM LOCK	L9070P 03A			626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS			689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
2	EA	WALL STOP	WS406/407CCV			630	IVE
2	EA	SILENCER	SR64			GRY	IVE

Hardware Group No. 07

For use on Door #(s):109, 109A, 110, 110A, 112, 112A,113

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		ITEMID	FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8	↗		652	IVE
1	EA	EU MORTISE LOCK	L9092LEU 03A CON 12/24 VDC	↗		626	SCH
1	EA	PRIMUS MORT. CYL.	20-706 X L583-446 118 EV C 36-079-037			626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CCV			630	IVE
1	EA	GASKETING	188SBK PSA			BK	ZER
1	EA	WIRE HARNESS	CON-32				SCH

CARD READER AND POWER SUPPLY BY SECURITY SUB TO RELEASE LOCK FOR ACCESS

Hardware Group No. 08

For use on Door #(s): 108, 111,

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		ITEMID	FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8	↗		652	IVE
1	EA	EU MORTISE LOCK	L9092LEU 03A CON 12/24 VDC	↗		626	SCH
1	EA	PRIMUS MORT. CYL.	20-706 X L583-446 118 EV C 36-079-037			626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CCV			630	IVE
1	EA	GASKETING	188SBK PSA			BK	ZER

CARD READER AND POWER SUPPLY BY SECURITY SUB TO RELEASE LOCK FOR ACCESS

Hardware Group No. 09

For use on Door #(s):115

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		ITEMID	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	STOREROOM LOCK	L9080L 03A			626	SCH
1	EA	PRIMUS MORT. CYL.	20-706 X L583-446 118 EV C 36-079-037			626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CCV			630	IVE
3	EA	SILENCER	SR64			GRY	IVE

Hardware Group No. 10

For use on Door #(s): 104, 105, 106,

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	ITEMID	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050L 06A 09-544		626	SCH
1	EA	PRIMUS MORT. CYL.	20-706 X L583-446 118 EV C 36-079-037		626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

Hardware Group No. 11

For use on Door #(s): 108A, 108B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	ITEMID	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	L9070P 03A		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

Hardware Group No. 12

For use on Door #(s): 107

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	ITEMID	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK	L9040 03A L583-363 L283-722		626	SCH
1	EA	SURFACE CLOSER	4011 TBWMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

Hardware Group No. 13

For use on Door #(s): 110C

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	ITEMID	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK	L9040 03A L583-363 L283-722		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER

SECTION 08 8000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Window units.
 - a. Vision lites.
 - b. Entrances and other doors.
 - c. Fixed glass, fire rated interior windows.
- B. Related Sections: The following sections contain requirements that relate to this Section.
 - 1. Glass for storefront entrances is specified in Division 8 Section "Aluminum Entrances and Storefronts".

1.3 DEFINITIONS

- A. Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each glass product and glazing material indicated.
- C. Samples for verification purposes of 12-inch square samples of each type of glass indicated except for clear monolithic glass products, and 12-inch long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system..
- D. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.
 - 1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. FGMA Publications: "FGMA Glazing Manual."
- B. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.
 - 1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
- C. Fire-Resistive Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 152, labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Fire-Resistive Glazing Products for Window Assemblies: Products identical to those tested per ASTM E 163, labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- E. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.
- F. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:
 - 1. Primary glass of each (ASTM C 1036) type and class indicated.
 - 2. Heat-treated glass of each (ASTM C 1048) condition indicated.
- G. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

PART 2 - PRODUCTS

2.1 PRIMARY FLOAT GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), and Quality q3 (glazing select).

2.2 HEAT-TREATED FLOAT GLASS

- A. Uncoated, Clear, Heat-Treated Float Glass [G01]: ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below, 1/4" thick:

1. Kind FT (fully tempered) in the following locations:
 - a. Interior door vision panels in doors in non fire-rated openings.
 - b. Interior windows in non fire-rated openings.
2. Manufacturers: Subject to compliance with requirements, provide heat-treated glass by one of the following companies.
 - a. AFG Industries, Inc.
 - b. Ford Glass Division
 - c. Guardian Industries Corp.
 - d. HGP & Affiliates, Inc.
 - e. Pilkington LOF
 - f. PPG Industries, Inc.
 - g. Saint-Gobain
 - h. Viracon, Inc.

2.3 LAMINATED GLASS

- A. Laminated Lite [G02]: 19/32" Thick Lite. ASTM C1172, one laminated lite-two tempered panes laminated with 0.090" Clear PVB Interlayer and complying with other requirements specified and with the following:

1. Must meet impact requirements.
2. Coordinate thickness with manufacturer's standard stop sizes.
3. Highly reflective (mirrored) tints are not allowed.
4. Bronze glass is not allowed.

- B. Minimum assembly U-Value:

1. Aluminum window assemblies: 1.1 (or better).

- C. Minimum assembly SHGC-Value:

1. Aluminum window assemblies: 0.52 (or better).

2.4 FIRE-PROTECTION-RATED CERAMIC GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies.

1. Install at all interior fire rated doors and windows.

- B. Laminated Ceramic glazing [G03]: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch (8-mm) total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials, and certified as approved safety glazing.

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

- a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.
- b. Schott North America, Inc.; Laminated Pyran Crystal.

2. Vetrotech Saint-Gobain; SGG Keralite FR-L.

2.5 ELASTOMERIC GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
2. Suitability: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.
3. Colors: Provide color of exposed joint sealants to comply with the following:
4. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

- B. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants that comply with ASTM C 920 requirements.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, nonstaining and nonmigrating in contact with nonporous surfaces, with or without spacer rod as recommended by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with AAMA 800.
- B. Expanded Cellular Glazing Tape: Closed-cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces, packaged on rolls with release liner protecting adhesive, and complying with AAMA 800 for product 810.5.

2.7 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.
- B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
 - 1. Neoprene, ASTM C 864.
 - 2. EPDM, ASTM C 864.
 - 3. Silicone, ASTM C 1115.
 - 4. Thermoplastic polyolefin rubber, ASTM C 1115.
 - 5. Any material indicated above.
- C. Soft Compression Gaskets: Extruded or molded closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C 509, Type 11, black, and of profile and hardness required to maintain watertight seal:
 - 1. Neoprene.
 - 2. EPDM.
 - 3. Silicone.
 - 4. Thermoplastic polyolefin rubber.
 - 5. Any material indicated above.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

2.9 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Presence and functioning of weep system where required.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass from edge damage during handling and installation as follows:
 - 1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
 - 2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
 - 1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously but not in one continuous length. Do not stretch tapes to make them fit opening.
- C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each lite is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
- B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- C. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.7 PROTECTION AND CLEANING

- A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.
- E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

SECTION 08 9119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fixed, extruded-aluminum intake and exhaust louvers at Apparatus Area.
 - 2. Louvers in exterior hollow metal doors.
- B. Related Sections include the following:
 - 1. Division 8 Section "Steel Doors and Frames" for louvers in hollow-metal doors and frames.
 - 2. Division 8 Section "Flush Wood Doors" for louvers in wood doors.
 - 3. Division 15 Sections for louvers that are a part of mechanical equipment.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.
 - 1. As indicated in the Contract Documents.
 - 2. Missile Impact Loads: Provide large and small hurricane missile protection in accordance with the Florida Building Code, Section 1626 - Impact Tests for Windborne Debris.
 - a. Impact-resistant louvers are indicated on drawings.
 - 3. Structural Design Criteria: Louvers shall pass Miami-Dade Protocols TAS-201 (Large Missile Impact), TAS-202 (Uniform Pressure), and TAS-203 (Cyclic Wind Pressure).
 - 4. Wind Driven Rain Criteria: Louvers shall be AMCA 540 and AMCA 550 listed without the need for a damper or sloped duct.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.
 - 1. For installed louvers and vents indicated to comply with design loads, include structural analysis data including anchorage to structure (fastener size, type, and spacing) signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Verification: For each type of metal finish required.
- D. Qualification Data: For professional engineer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.
 - 1. Provide State of Florida Product Approval number.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements including masonry opening details indicated on drawings, provide products by one of the following:
 - 1. Louvers:
 - a. Aiolite Company, LLC.
 - b. Industrial Louvers, Inc.
 - c. Ruskin Company.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-TS or T-52.
- B. Aluminum Sheet: ASTM 8 209 (ASTM 8209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/8 26M, alloy 319.
- D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use Phillips pan-head screws for exposed fasteners, unless otherwise indicated.
- E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in. openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Universal flange frame, unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Where indicated, provide subsills made of same material as louvers or extended sills for recessed louvers.
- F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Wind-Driven Rain-Resistant, Missile-Resistant Louver [L02 and L03]:
 - 1. Products:
 - a. Ruskin - Model EME6325D.
 - 2. Louver Depth: 5" to 12" overall assembly including missile protection system.
 - 3. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch for blades and 0.080 inch for frames.
 - 4. Performance Requirements:
 - a. Percent Free Area: Not less than 38%, based upon actual louver size indicated on drawings.
 - b. Air Performance: Not more than 0.15 inch wg static pressure drop at 850 fpm free-area velocity.
 - c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph at a core-area intake velocity of 500 fpm.
 - d. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 - 5. Finish system: 70% PVDF color anodize.
 - 6. Screening Type: Bird Screen.
- B. Horizontal Louver [L01]:
 - 1. Product: Ruskin ELF637X.
 - 2. Frame depth: 6".
 - 3. Screening Type: Bird screen.
 - 4. Finish system: Kynar.
 - 5. Free Area: 55% Minimum.

2.5 ACOUSTIC LOUVERS

- A. Horizontal, Acoustic Louver [L04]:
 - 1. Profile: Blade.

2. Manufacturer: Price - Model QA845.
3. Material: aluminum.
4. Depth: 8".

2.6 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Bird screening.
- B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
 3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.
- D. Louver Screening for Aluminum Louvers:
 1. Bird Screening: Fiberglass, 16x18 mesh (51% free area), 0.0048-inch wire.

2.7 DOOR LOUVER

- A. Hurricane Rated Door Louver: PLSL - Anemostat (Basis of Design).
 1. Material: 12 GA Cold Rolled Steel Security Grille Frame. 20 GA cold Rolled Louver Blades.
 2. Finish: Grey Primer. Paint to match door color.
 3. Free Area: 50% free area.
 4. Impact Resistant.

2.8 FINISHES, GENERAL

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

2.9 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. High'. "Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION

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

- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Resilient sound isolation clips.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07841 - Through-Penetration Fire Stop Systems.
- D. Section 07 9005 - Joint Sealers: Acoustic sealant.
- E. Section 09912 - Painting.

1.3 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2019b.
- I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2018.
- J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2018.
- K. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.
- L. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- M. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- N. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.
- O. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2019.
- P. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- Q. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019.
- R. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- S. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
- T. ASTM E413 - Classification for Rating Sound Insulation; 2016.
- U. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.
- V. UL (FRD) - Fire Resistance Directory; Current Edition.
- W. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 SUBMITTALS

- A. See Section 01330 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing.

- C. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, joint finishing system, and manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.5 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
- B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum ____ years of experience.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. Fire-Resistance-Rated Partitions: UL listed assembly No. ____; ____ hour rating.
 - 2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.2 METAL FRAMING MATERIALS

- A. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
 - 1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi (275 MPa) minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
 - 2. Studs: C-shaped with knurled or embossed faces.
 - 3. Runners: U shaped, sized to match studs.
 - 4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 - 5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (12 mm) channel depth.
 - a. Products:
 - 1) Substitutions: See Section 01 6000 - Product Requirements.
 - 6. Resilient Sound Isolation Clips: Steel resilient clips with molded rubber isolators, attaches to framing; improves noise isolation performance of wall and floor-ceiling assemblies.
- B. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
 - a. Provide G60/Z180 coating at: all wet walls and all exterior walls.
 - b. G40/Z120 hot dipped galvanized coating is allowed at interior dry areas.

2.3 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company; ____: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation; ____: www.certainteed.com/#sle.
 - 3. Georgia-Pacific Gypsum; ____: www.gpgypsum.com/#sle.
 - 4. National Gypsum Company; ____: www.nationalgypsum.com/#sle.
 - 5. USG Corporation; ____: www.usg.com/#sle.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces, unless otherwise indicated.
 - 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.

3. Thickness:
 - a. Vertical Surfaces: 1/2 inch (13 mm).
 - b. Ceilings: 1/2 inch (13 mm).
4. Edges: Tapered.
5. Mold Resistant Paper Faced Products:
 - a. National Gypsum Company; Gold Bond Brand XP Gypsum Board or equal.
- C. Abuse Resistant Wallboard:
 1. Application: where scheduled.
 2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 6. Glass Mat-Faced Type: Gypsum wallboard, as defined in ASTM C1658/C1658M.
 7. Type: Fire-resistance-rated Type X, UL or WH listed.
 8. Thickness: 5/8 inch (16 mm).
 9. Edges: Tapered.
 10. Glass Mat Faced Products:
 - a. Georgia-Pacific Gypsum; DensArmor Plus Abuse-Resistant: www.gpgypsum.com/#sle.
 - b. National Gypsum Company; Gold Bond eXP Interior Extreme AR Gypsum Panel: www.nationalgypsum.com/#sle.
- D. Backing Board For Wet Areas: with Tile.
 1. Application: Surfaces behind tile in wet areas.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Products:
 - 1) Custom Building Products; _____: www.custombuildingproducts.com/#sle.
 - 2) National Gypsum Company; PermaBase Brand Cement Board.
 - 3) National Gypsum Company; PermaBase Flex Brand Cement Board.
 - 4) USG Corporation; _____: www.usg.com/#sle.
 4. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Regular Type: Thickness 1/2 inch (12.7 mm).
 - b. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch (16 mm).
 - c. Products:
 - 1) Georgia-Pacific Gypsum; DensShield Tile Backer: www.gpgypsum.com/#sle.
- E. Backing Board For Wet Areas: without Tile.
 1. Application: Surfaces in wet areas with epoxy paint (without tile).
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Type: Regular, and Type X, in locations indicated.
 4. Regular Board Thickness: 5/8 inch.
 5. Edges: Tapered.
 6. Products:
 - a. National Gypsum Company; Gold Bond Brand XP Gypsum Board.
- F. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Type: Regular and Type X, in locations indicated.
 4. Type X Thickness: 5/8 inch (16 mm).
 5. Regular Board Thickness: 1/2 inch (13 mm).
 6. Edges: Tapered.
 7. Products:
 - a. Georgia-Pacific Gypsum; DensShield Tile Backer.
 - b. National Gypsum Company; Gold Bond Brand XP Gypsum Board.
 - c. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.
- G. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: 1/2 inch (13 mm).
 3. Edges: Tapered.
 4. Products:

- a. American Gypsum; Interior Ceiling Board.
- b. CertainTeed Corporation; ProRoc Interior Ceiling.
- H. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
 - 1. Application: Exterior sheathing, unless otherwise indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
 - 4. Core Type: Regular.
 - 5. Regular Board Thickness: 1/2 inch (13 mm).
 - 6. Edges: Square.
 - 7. Glass Mat Faced Products:
 - a. CertainTeed Corporation; GlasRoc Brand.
 - b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.
 - c. National Gypsum Company; Gold Bond eXP Sheathing: www.nationalgypsum.com/#sle.

2.4 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced.
 - 1. At Sound Rated Walls:
 - a. Product: Sound Attenuation Batts Fiber Glass manufactured by Owens Corning (or equal).
 - b. Thickness: As indicated on drawings or full thickness of stud cavity.
 - 2. At Ceilings:
 - a. Product: Sonobatts manufactured by Owens Corning (or equal).
 - b. Thickness: 3-1/2".
 - c. Facing: unfaced.
- B. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
- C. Acoustic Isolation Clip: Resilient Sound Isolation Clip.
 - 1. Product: RISC-1 manufactured by PAC International.
- D. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - 1. Types: As detailed or required for finished appearance.
 - 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
 - a. At soffit interface with wall use 'T' molding.
 - 1) Fry-Reglet: TDM-625-75. (Coordinate ceiling/soffit board thickness where required.)
 - 3. Products:
 - a. Fry-Reglet.
- E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
- F. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- I. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.
- J. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.2 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
 - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches on center (at 406 mm on center).
 - 1. Extend partition framing to structure in all locations.
 - 2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with

manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jamps.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.
 - 1. Install with Isolation Clips as indicated on drawings.
- G. Resilient Sound Isolation Clips: Install resilient sound isolation clips, and where applicable, associated furring sections and channels, in accordance with clip manufacturer's written instructions.
- H. Blocking: Install wood blocking for support of:
 - 1. Wall-mounted cabinets.
 - 2. Plumbing fixtures.
 - 3. Toilet partitions.
 - 4. Toilet accessories.
 - 5. Wall-mounted door hardware.
- I. Blocking: Install blocking for support of hardware. Bolt or screw steel channels to studs.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place two beads continuously on substrate before installation of perimeter framing members.
 - 2. Place continuous bead at perimeter of each layer of gypsum board.
 - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.
- C. Acoustic Isolation Clips: Install in accordance with manufacturer's instructions.

3.4 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
- E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.
- G. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.6 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 3: Walls to receive textured wall finish.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
 2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 3. Taping, filling, and sanding are not required at base layer of double-layer applications.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.
- 3.7 TOLERANCES
- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.
- 3.8 FINISH LEVEL SCHEDULE
- A. Level 1: Above finished ceilings concealed from view.
- B. Level 2: Utility areas and areas behind cabinetry.
- C. Level 2: Backing board to receive tile finish.
- D. Level 4: Walls and ceilings to receive paint finish.
- E. Level 5: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

END OF SECTION

SECTION 09 2200 - PORTLAND CEMENT PLASTER

PART 1- GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. This Section includes the following:
 - 1. Portland cement plaster.
 - 2. Stucco finishes.
 - 3. Plastic accessories.
- 1.3 SUBMITTALS
 - A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
 - B. Product Data for each product specified.
- 1.4 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver cementitious materials to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name and lot number.
 - B. Store materials inside, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.
- 1.5 PROJECT CONDITIONS
 - A. Environmental Requirements, General: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.
 - B. Warm-Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.
 - C. Exterior Plaster Work: Do not apply plaster when ambient temperatures is below 40 deg F.
 - D. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Plastic Accessories:
 - a. Alabama Metal Industries Corp. (AMICO).
 - b. Plastic Components, Inc.
 - c. Vinyl Corp.
 - 2. Stucco:
 - a. California Stucco Products Corp.
 - b. Florida Stucco Corp.
 - c. Highland Stucco.
 - d. IPA Systems, Inc.
 - e. United States Gypsum Co.
- 2.2 ACCESSORIES
 - A. General: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thickness and number of plaster coats required.
 - 1. Plastic Components: ASTM D 4216, high-impact polyvinyl chloride (PVC) for building products.
 - B. Cornerbeads: Small nose cornerbeads fabricated from the following metal with expanded flanges of large-mesh diamond-metal lath allowing full plaster encasement.
 - 1. PVC Plastic: Minimum 0.035 inch thick.
 - C. Casing Beads: Square-edged style, with expanded flanges of the following material:
 - 1. PVC Plastic: Minimum 0.035 inch thick.
 - D. Control Joints: Prefabricated, of material and type indicated below:
 - 1. PVC Plastic: Minimum 0.035 inch thick.
 - 2. One-Piece Type: Folded pair of nonperforated screeds in M-shaped configuration, with expanded or perforated flanges.

- E. Reveals, Drip Screeds, Control Screeds, and Channel Screeds: Shapes as indicated on drawings, of material indicated below.
 - 1. PVC Plastic: Minimum 0.035 inch thick.

2.3 PLASTER MATERIALS

- A. Base-Coat Cements: Type as indicated below:
 - 1. Portland cement, ASTM C 150, Type I.
- B. Stucco Finish Coat: Manufacturer's standard factory-packaged stucco, including portland cement, aggregate, and other proprietary ingredients.
- C. Sand Aggregate for Base Coats: ASTM C 897.

2.4 MISCELLANEOUS MATERIALS

- A. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, $\frac{1}{8}$ inch long, free of contaminants, manufactured for use in portland cement plaster.
- B. Water for Mixing and Finishing Plaster: Potable.
- C. Bonding Agent: ASTM C 932.
- D. Acid-Etching Solution: Muriatic acid (10 percent solution of commercial hydrochloric acid) mixed 1 part to not less than 6 nor more than 10 parts water.

2.5 PLASTER MIXES AND COMPOSITIONS

- A. General: Comply with ASTM C 926 for base- and finish-coat mixes as applicable to plaster bases, materials, and other requirements indicated.
- B. Base-Coat Mixes and Compositions: Proportion materials for respective base coats in parts by volume per sum of cementitious materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.
- C. Fiber Content: Add fiber to following mixes after ingredients have mixed at least 2 minutes. Comply with fiber manufacturer's written instructions but do not exceed 1 lb/cu.ft of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.
- D. Two-Coat Work Over concrete unit masonry: $\frac{1}{2}$ " total thickness; base-coat proportions as indicated below:
 - 1. Base Coat: 1 part Portland cement, $\frac{3}{4}$ to 1- $\frac{1}{2}$ parts lime, 3 to 4 parts aggregate; $\frac{3}{8}$ " thickness.
- E. Job-Mixed Finish Coats: Proportion materials for finish coats in parts by volume for cementitious materials and parts by volume per sum of cementitious materials to comply with the following requirements:
 - 1. Proportions using sand aggregates as indicated below:
 - a. 1 part Portland cement, $\frac{3}{4}$ to 1- $\frac{1}{2}$ parts lime, 3 parts sand; $\frac{1}{8}$ " thickness.
- F. Stucco Finish Coat: (May be used in lieu of above described job mixed finish coat). Add water only; comply with stucco manufacturer's written instructions; $\frac{1}{8}$ " thickness.

2.6 MIXING

- A. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 PREPARATIONS FOR PLASTERING

- A. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair the Work.
- B. Etch concrete surfaces indicated for direct plaster application. Scrub with acid-etching solution on previously wetted surface and rinse thoroughly with clean water. Repeat application, if necessary, to obtain adequate suction and mechanical bond of plaster.
- C. Apply bonding agent on concrete and concrete unit masonry surfaces indicated for direct plaster application; comply with manufacturer's written instructions for application.
- D. Install temporary grounds and screeds to ensure accurate rodding of plaster to true surfaces; coordinate with scratch-coat work.

3.2 INSTALLATION OF PLASTERING ACCESSORIES

- A. General: Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and in alignment during plastering. Install accessories of type indicated at following locations:
 - 1. External Corners: Install corner reinforcement at external corners.
 - 2. Terminations of Plaster: Install casing beads, unless otherwise indicated.
 - 3. Control Joints: Install at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Architect:

- a. Where an expansion or contraction joint occurs in surface of construction directly behind plaster membrane.
- b. Distance between Control Joints: Not to exceed 18 feet in either direction or a length-to-width ratio of 2-1/2 to 1.
- c. Wall Areas: Not more than 144 sq. ft.
- d. Horizontal Surfaces: Not more than 100 sq. ft. in area.
- e. Where plaster panel sizes or dimensions change, extend joints full width or height of plaster membrane.

3.3 PLASTER APPLICATION

- A. Plaster Application Standard: Apply plaster materials, composition, and mixes to comply with ASTM C 926.
- B. Do not use materials that are caked, lumpy, dirty, or contaminated by foreign materials.
- C. Do not use excessive water in mixing and applying plaster materials.
- D. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed at any location on surface.
- E. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.
- F. Plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where interior plaster is not terminated at metal frame by casing beads, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
- G. Corners: Make internal corners and angles square; finish external corners flush with cornerbeads on interior work, square and true with plaster faces on exterior work.
- H. Finish Coats: Apply finish coats to comply with the following requirements:
 - I. Float Finish: Apply finish coat to a minimum thickness of 1/8 inch to completely cover base coat, uniformly floated to a true even plane with "sand float" finish.
 - J. Prepared Finish: Apply factory-prepared finish coats according to manufacturer's written instructions.
- K. Moist-cure plaster base and finish coats to comply with ASTM C 926, including written instructions for time between coats and curing in "Annex A2 Design Considerations."

3.4 CUTTING AND PATCHING

- A. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.5 CLEANING AND PROTECTING

- A. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure plaster work is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 09 2236 - METAL LATH

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Metal lath for portland cement plaster.
 - B. Access panels.
 - C. Cement Plaster Accessories.
- 1.2 RELATED REQUIREMENTS
 - A. Section 05 4000 - Cold-Formed Metal Framing: Sheathing on exterior walls.
 - B. Section 07 2500 - Weather Barriers: Weather barrier under exterior plaster and stucco.
 - C. Section 08 3100 - Access Doors and Panels: Product requirements for metal access panels integral with metal lath.
 - D. Section 09 2116 - Gypsum Board Assemblies: Sheathing on exterior soffits.
- 1.3 REFERENCE STANDARDS
 - A. ASTM C847 - Standard Specification for Metal Lath.
 - B. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - C. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - D. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
 - E. Portland Cement Association (PCA) - Stucco Installation Manual Portland Cement Plaster/Stucco Manual
- 1.4 PERFORMANCE REQUIREMENTS
 - A. Design and install framing and lath to limit deflection to the following:
 - 1. Maximum Deflection of Horizontal Assemblies: 1:240 deflection under dead loads and wind uplift.
- 1.5 SUBMITTALS
 - A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
 - B. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.
 - C. Submit details of all anticipated accessories to be installed.
- 1.6 QUALITY CONTROL
 - A. Maintain one copy of each installation standard referenced on site throughout the duration of lathing and plastering work.
 - B. Installer Qualifications: Company specializing in performing the work of this section a minimum five years documented experience.
 - C. A preinstallation conference is to be conducted on site to include the Constuction Manager, architect, subcontractor installing lath, accessories, portland cement plaster systems and masonry.
 - D. Contractor to contact representative of accessory manufacturer to visit site during installation and verify installation complies with manufacturer's requirements.
 - E. As part of the closeout documents the contractor is to submit a letter stating work is in accordance with manufacturer's product data and referenced standards.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Metal Lath and Accessories:
 - 1. Alabama Metal Industries Corporation: www.amico-lath.com.
 - 2. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
- 2.2 FRAMING AND LATH ASSEMBLIES
 - A. Provide completed assemblies with the following characteristics:
 - 1. Maximum Deflection of Vertical Assemblies: 1:360 under lateral point load of 100 lbs.
 - 2. Maximum Deflection of Horizontal Assemblies: 1:240 deflection under dead loads and wind uplift.
- 2.3 LATH
 - A. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
 - 1. Weight: To suit application, comply with deflection criteria, and as specified in ASTM C841 or ASTM C1063 for framing spacing.
 - 2. Weight: 3.4 lb/sq yd.
 - 3. Backed with treated paper.

- B. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, and maximum possible lengths.
 - 1. Material: PVC, open grid flanges or perforated.
 - 2. Casing Beads with Weep Holes: Square edges.
 - a. Thickness to accommodate plaster installation thickness.
 - 3. Corner Beads: Right angle corners.
 - 4. Base Screeds: Bevelled edges.
 - 5. Control Joints: Accordion profile with factory-installed protective tape, 2 inch flanges.
 - 6. Channel Screed: Use PVC with the same profile dimensions as DCS-626-75 manufactured by Fry Reglet.
 - 7. Reveal Molding: Use PVC with the same profile dimensions as PRM-75-75 manufactured by Fry Reglet.

2.4 BONDING AGENTS

- A. Surface-applied bonding agents should conform to the requirements of ASTM C 932. Integral bonding agents should be used only after review of the manufacturer's documentation of testing and past performance

2.5 ACCESSORIES

- A. Access Panels: As specified in Section 08 3100.
- B. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.
- C. Fasteners: Self-piercing tapping screws; ASTM C1002 or ASTM C954.
- D. Tie Wire: Annealed galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that substrates are ready to receive work and conditions are suitable for application.
- C. For exterior plaster and stucco on stud framed soffits, verify that weather barrier has been installed over sheathing substrate completely and correctly.
- D. Do not begin until unacceptable conditions have been corrected.
- E. If substrate preparation is the responsibility of another installer, notify Wilder Architecture, Inc. of unsatisfactory preparation before proceeding.

3.2 INSTALLATION - GENERAL

- A. Install interior lath and furring for gypsum plaster in accordance with ASTM C841.
- B. Install metal lath and furring for Portland cement plaster in accordance with ASTM C1063.

3.3 CONTROL JOINTS

- A. Control Joint Spacing: 15 feet on center and as indicated on drawings.
 - 1. Install control joints per ASTM C1063.
 - a. Maintain a length to width ratio of 2.5 to 1.
 - b. Provide control joints to meet the ASTM standard. Coordinate additional control joints with Architect prior to installation.
- B. Construct control joints of back-to-back casing beads set 1/4 inch apart. Set both beads over 6 inch wide strip of polyethylene sheet.
 - 1. Provide the polyethylene sheet where cement plaster is installed with metal plaster bases.

3.4 ACCESS PANELS INSTALLATION

- A. Install access panels and rigidly secure in place.
- B. Install frames plumb and level in opening. Secure rigidly in place.
- C. Position to provide convenient access to concealed work requiring access.

3.5 LATH INSTALLATION

- A. Apply lath taut, with long dimension perpendicular to supports.
- B. Attach metal lath to metal supports using tie wire at maximum 6 inches on center.
- C. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
- D. Place corner bead at external wall corners; fasten at outer edges of lath only.
- E. Place base screeds at termination of plaster areas; secure rigidly in place.
- F. Place 4 inch wide strips of lath centered over junctions of dissimilar backing materials, and secure rigidly in place.
- G. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.

- H. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
- I. Install all accessories in accordance with manufacturer's product data and referenced standards.
- J. Provide elastomeric sealant at all joints, transitions, and terminations within plastering accessories to eliminate air and water migration within cement plaster applications.

3.6 TOLERANCES

- A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet.
- B. Maximum Variation from True Position: 1/8 inch.

END OF SECTION

SECTION 09 3100 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Porcelain paver tile.
 - 2. Unglazed ceramic mosaic tile.
 - 3. Glazed wall tile.
 - 4. Marble thresholds and window sills.
 - 5. Crack suppression membrane.
 - 6. Grout sealer.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
- C. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures, and patterns available for each type and composition of tile indicated. Include samples of grout and accessories involving color selection.
- D. Samples for verification purposes of each item listed below, prepared on samples of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.
 - 1. Each type and composition of tile and for each color and texture required, at least 12 inches square, mounted on plywood or hardboard backing and grouted.
 - 2. Full-size units of each type of trim and accessory for each color required.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
- C. Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.6 PROJECT CONDITIONS

- A. A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

1.7 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Porcelain Paver Tile:
 - a. Daltile "Alta Vista Color Body Porcelain". No substitutions.
 - 2. Unglazed Ceramic Mosaic Tile:
 - a. American Olean Tile Co., Inc.
 - b. Dal-Tile Corp.

- c. United States Ceramic Tile Co.
- 3. Glazed Wall Tile:
 - a. American Olean Tile Co., Inc.
 - b. Dal-Tile Corp.
 - c. United States Ceramic Tile Co.
- 4. Latex-Emulsion-Based Latex-Portland Cement Mortars:
 - a. American Olean Tile Co., Inc.
 - b. Bonsal
 - c. Bostik Construction Products Div.
 - d. Custom Building Products
 - e. Laticrete International Inc.
 - f. Mapei Corp.
- 5. Commercial Portland Cement Grouts:
 - a. American Olean Tile Co., Inc.
 - b. Bonsal
 - c. Bostik Construction Products Div.
 - d. Custom Building Products
- 6. Acrylic Emulsions for Latex-Portland Cement Grouts:
 - a. American Olean Tile Co., Inc.
 - b. Bonsal
 - c. Bostik Construction Products Div.
 - d. Custom Building Products
 - e. Laticrete International Inc.
 - f. Mapei Corp.
- 7. Crack Suppression Membranes:
 - a. Schluter Systems L.P.
 - b. National Applied Construction Products, Inc.
 - c. Mapei
- 8. Grout Sealer:
 - a. Stone Tech Professional, Inc.
 - b. Aquamix
 - c. CeramaSeal
 - d. Mapei

2.2 PRODUCTS, GENERAL

- A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.
 - 1. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.
- B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 - 1. Provide selections made by Architect from Manufacturer's standard color ranges as follows:
 - a. Porcelain Paver Tile: Any color in price groups 1 or 2.
 - b. Glazed Wall Tile: Any color in price groups 1 or 2 (no "accent" colors), similar to American Olean "Bright and Matte," and Dal-Tile "Semi-Gloss" and "Matte."
 - c. Unglazed Ceramic Mosaic Tile: Any color in price groups 1 or 2.
 - 2. Provide tile trim and accessories that match color and finish of adjoining flat tile.
- D. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
- E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.

2.3 TILE PRODUCTS

- A. Porcelain Paver Tile: Provide flat tile complying with the following requirements:
 - 1. Composition: Porcelain.
 - 2. Nominal Facial Dimensions:
 - a. 18 inches by 18 inches - Dayroom Floors.
 - b. 8 inches by 8 inches - Restroom Floors.
 - c. 4 inches by 12 inches
 - 3. Nominal Thickness: 1/4 inch.

4. Face: Plain with square edges
 5. Finish: Unpolished.
 6. Pattern: Provide at Dayroom (refer to drawings).
 - B. Unglazed Ceramic Mosaic Tile: Provide factory-mounted flat tile complying with the following requirements:
 1. Composition: Natural clay.
 2. Nominal Facial Dimensions: 2 inches by 2 inches.
 3. Nominal Thickness: 1/4 inch.
 4. Face: Plain with cushion edges.
 - C. Glazed Wall Tile: Provide flat tile complying with the following requirements:
 1. Nominal Facial Dimensions: 4-1/4 inches by 4-1/4 inches.
 2. Nominal Facial Dimensions: 6 inches by 6 inches - Restroom Wall.
 3. Nominal Thickness: 5/16 inch.
 4. Face: Plain with modified square edge or cushion edge.
 5. Mounting: Factory back-mounted.
 - D. Trim Units: Provide glazed wall tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:
 1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
 2. Glazed Wall Tile: Base to be 4-1/4" high by 6" long with 7/16" radius sanitary cove profile; surface bullnose cap; surface bullnose external corners; internal corners field butted square corners.
 3. Porcelain Paver Tile: Base to be 4" high by 12" long surface bul/nose base.
- 2.4 STONE THRESHOLDS
- A. General: Provide stone that is uniform in color and finish, fabricated to sizes and profiles indicated or required to provide transition between tile surfaces and adjoining finished floor surfaces.
 - B. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and for abrasion resistance where exposed to foot traffic, a minimum hardness of 10 per ASTM C 241.
 1. Provide white, honed marble complying with MIA Group "A" requirements for soundness.
 - C. Window Sills: White marble, minimum 1/2" thick.
- 2.5 SETTING MATERIALS
- A. Thin Set Latex Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A118.4 and as specified below.
 1. Mixture of Dry-Mortar Mix and Latex Additive: Factory-mixed formulation of mix and additive.
 - a. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1A.
 - 1) Wall Base Adhesive: Construction adhesive for securing tile base to gypsum board (except at showers). Do not use thin set mortar for securing porcelain paver tile base to walls.
 - 2) Product Liquid Nails Ceramic Wall and Floor Tile Adhesive.
- 2.6 GROUTING MATERIALS
- A. Dry-Set Sanded Grout: ANSI A118.6, color as indicated, for floor tile installation.
 1. Latex additive (water emulsion) serving as replacement for part or all of gauging water, added at job site with dry grout mixture, with type of latex and dry grout mix as follows:
 - a. Latex Type: Manufacturer's standard.
 - b. Dry Grout Mixture: Dry-set sanded grout specified or supplied by latex additive manufacturer. Use latex additive without retarder with dry-set grout.
 2. Dry Set Non-Sanded Cementitious Grout, for Wall Tile Installation: ANSI A 118.6, color as selected by Architect, with latex additive.
- 2.7 CRACK SUPPRESSION MEMBRANE
- A. Flexible "Peel-and-Stick Sheet: Provide a highly flexible elastomeric, self-bonding, pressure- sensitive sheet membrane system for crack isolation that is compatible with latex-modified thin set mortars. Provide one of the following:
 1. Mapelastic SM, Mapei
 2. ECB Membrane, National Applied Construction Products, Inc.
 3. Schluter - KERD1, Schluter Systems
- 2.8 GROUT SEALER
- A. Grout Sealer: Water-based liquid sealer that resists water, oil, and acid-based contaminants. Provide one of the following:
 1. All Purpose Grout Sealer, StoneTech Professional, Inc.
 2. Grout & Tile Sealer, CeramaSeal
 3. Keraseal Tile and Grout Sealer, Mapei
 4. Grout Sealer, Aqua Mix

2.9 GROUT RELEASE

- A. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - 1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile. Provide one of the following:
 - a. "Grout Release," Aqua Mix.
 - b. "SL-90 Summit Shield Grout Release," Summitville.
 - c. "Grout Easy," Aldon.
 - d. "Super Grout Release," Klein and Company, Inc.

2.10 WATERPROOFING FOR TILE SHOWER RECEPTORS

- A. Polyethylene Sheet Waterproofing: Manufacturer's standard proprietary product consisting of composite sheets, 60 inches wide by a nominal thickness of 0.040 inches, composed of an inner layer of chlorinated polyethylene sheet faced on both sides with laminated high-strength nonwoven polyester material designed for embedding in latex-Portland cement mortar, and as the substrate for latex-Portland cement mortar setting bed.
- B. PVC-Sheet Waterproofing: Manufacturer's standard proprietary product consisting of composite sheets, 60 inches of PVC sheet heat-fused together and to facings of bendable nonwoven polyester, designed for embedding in latex-Portland cement mortar and as the substrate for latex-Portland cement mortar setting bed.
- C. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Polyethylene Sheet Waterproofing:
 - a. "Chloraloy"; Noble Co.
 - 2. PVC Sheet Waterproofing:
 - a. "Composeal Blue"; Compotite Corp.

2.11 MISCELLANEOUS MATERIALS

- A. Temporary Protective Coating for Porcelain Paver Tile: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.
 - 1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.

2.12 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.
- B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated.

- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 - D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.
 - 1. Porcelain paver wall base shall be mitered at inside and outside corners. Ease cut edges at miters.
 - E. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.
 - F. Expansion Joints: Locate expansion joints as noted on architectural and/or structural drawings and field verify.
 - 1. Provide sealant-filled joints in tile directly above expansion joints in slabs. Use 1 or 2 part pourable polyurethane sealant for Use T in color selected by architect. Follow Tile Council of America Handbook for Ceramic Tile Installation details.
 - 2. Tile expansion joints are not required at concrete slab control joints which are to receive crack suppression membrane.
 - G. Grout tile to comply with the requirements of the following installation standards:
 - 1. For ceramic tile grouts (sand-Portland cement, dry-set, commercial Portland cement, and latex-Portland cement grouts), comply with ANSI A108.10.
 - 2. Apply grout release when installing porcelain paver tile.
 - 3. Seal all grout joints with grout sealer applied in accordance with manufacturer's directions.
- 3.4 FLOOR INSTALLATION METHODS
- A. Ceramic Mosaic Tile at Shower Receptors: Install tile to comply with requirements indicated below for setting bed methods, TCA installation methods related to types of subfloor construction, and grout types:
 - 1. Bond Coat: Portland cement paste or dust coat on plastic bed or the following thin-set mortar on cured bed, ANSI A108.5 at Contractor's option:
 - a. Latex - Portland Cement Mortar.
 - 2. Grout: Dry-set sanded grout with latex additive: Installation Specification - ANSI A108.10.
 - 3. TCA Installation Method 8420 for glass mat tile backer board.
 - B. Porcelain Paver Tile for Thin Set Installation Over Concrete Slabs: Install tile to comply with requirements indicated below for setting bed methods, TCA installation method and grout types:
 - 1. Latex - Portland Cement Mortar: Installation Specification - ANSI A108.5.
 - 2. Grout: Dry-set sanded grout with latex additive: Installation specification - ANSI A108.10.
 - 3. TCA Installation Method f 113.
- 3.5 WALL TILE INSTALLATION METHODS
- A. Install types of tile designated for wall application to comply with requirements indicated below for setting-bed methods, TCA installation methods related to subsurface wall conditions, and grout types:
 - 1. Thin-set latex-Portland Cement Mortar: Installation Specification-ANSI A108.5.
 - 2. Grout: Dry-set, non-sanded with latex additive: Installation Specification-ANSI A108.10.
 - 3. TCA Installation Method 8420 for glass mat tile backer board. Install sanitary cove base flush with floor tile - do not set base on top of floor tile.
 - 4. Secure porcelain paver tile base to drywall partitions using construction adhesive applied in accordance with manufacturer's instructions using V-type trowel with notches 3/16" deep.
- 3.6 CLEANING AND PROTECTION
- A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-Portland cement grout residue from tile as soon as possible.
 - 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer.
 - B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
 - C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensure that tile is without damage or deterioration at time of Substantial Completion.

1. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
 2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 09 5110 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. This Section includes ceilings composed of acoustical panels and exposed suspension systems.
- 1.3 SUBMITTALS
 - A. General: Submit each item in this Article according to the Conditions of the Contract.
 - B. Product data for each type of product specified.
 - C. Samples for initial selection in the form of manufacturer's color charts consisting of actual acoustical panels or sections of panels and sections of suspension system members showing the full range of colors, textures, and patterns available for each ceiling assembly indicated.
 - D. Samples for verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
 - 1. 6-inch square samples of each acoustical panel type, pattern, and color.
 - 2. Set of 12-inch long samples of exposed suspension system members, including moldings, for each color and system type required.
 - E. Product test reports from a qualified independent testing agency that are based on its testing of current products for compliance of acoustical panel ceilings and components with requirements.
- 1.4 QUALITY ASSURANCE
 - A. Installer Qualifications: Engage an experienced Installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
 - B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
 - C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.
- 1.6 PROJECT CONDITIONS
 - A. Space Enclosure and Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete, and ambient temperature and humidity conditions are being maintained at the levels required by manufacturer(s) to eliminate sagging or curling of ceiling panels.
- 1.7 COORDINATION
 - A. Coordinate layout and installation of acoustical panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition assemblies (if any).
- 1.8 EXTRA MATERIALS
 - A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
 - 1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

- 2.1 ACOUSTICAL CEILING UNITS, GENERAL:
 - A. Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated that comply with ASTM E 1264 classifications as designated by reference to types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - 1. Mounting Method for Measuring NCR: Type E-400 (plenum mounting in which face of test specimen is 15-3/4 inches away from the test surface) per ASTM RE 795.
 - B. Colors and Patterns: Provide products to match appearance characteristics indicated under each product type.

2.2 HIGH HUMIDITY RESISTANT ACOUSTICAL PANELS

- A. Description: Provide Type III, Form 2, Pattern CD units per ASTM E 1264 with painted finish; and as follows:
 - 1. Performance Criteria: LR 0.82; NRC 0.55-.65; CAC 35-39.
 - 2. Edge Detail: Square. Install in wide-face suspension system.
 - 3. Size: 24 inches by 24 inches by 5/8 inch, typical.
 - 4. Color: White.
 - 5. Panels are scheduled as "APC-1" on drawings.
- B. Product: Subject to compliance with requirements, provide one of the following:
 - 1. "Fine Fissured Humiguard, Lay-In No. 1728"; Armstrong World Industries.
 - 2. "Celotex Fine Fissured"; BPB Celotex.
 - 3. "Radar ClimaPlus, No. 2210"; USG Interiors.

2.3 CERAMIC AND MINERAL FIBER COMPOSITE PANELS

- A. Description: Provide high density, ceramic-base panels classified as noncombustible by the NFPA, flame spread- 0; smoke developed- 0.
 - 1. Performance Criteria: LR 0.80; NRC 0.45-0.55; CAC 40-44.
 - 2. Edge Detail: Square. Install in wide-face suspension system.
 - 3. Size: 24 inches by 24 inches by 5/8 inch.
 - 4. Color: White.
 - 5. Panels are scheduled as "APC-2" on drawings.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. "Fine Fissured Ceramaguard - Perforated, No. 607"; Armstrong World Industries, or approved equal.
 - 2. "Radar Ceramic ClimaPlus, No. 56644"; USG Interiors.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated Carbon Steel Wire: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so that its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than the yield stress of wire, but provide not less than 0.106-inch diameter (12 gage) wire.
- E. Sheet-Metal Edge Moldings and Trim: Type and profile indicated, or if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
 - 1. Provide stepped, reveal edge molding ("Shadowline"), typical.
 - a. Product: Armstrong "Shadow Molding No. 7820" or equal by Chicago Metallic or Donn.

2.5 NON-FIRE-RESISTANCE-RATED, DIRECT-HUNG SUSPENSION SYSTEMS

- A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from hot dipped galvanized, cold-rolled steel sheet, with prefinished 15/16-inch wide metal caps on flanges; other characteristics as follows:
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) type.
 - 3. Cap Material and Finish: Hot dipped galvanized steel sheet painted white.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Standard Grid (for APC-1 and APC-2).
 - 2. Prelude 15/16" Exposed Tee System"; Armstrong World Industries.
 - 3. Series 200 - "H" Hot Dipped; Chicago Metallic.
 - 4. "Donn DX"; Donn/USG Interiors, Inc., flat white #050.
- C. Warranty; Manufacturer's standard limited 10-year warranty against rusting of grid.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
 - 1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.
- B. Measure each ceiling area and establish the layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and C/SCA "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of the supporting structure or of the ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of 3 tight turns. Connect hangers either directly to structures or to inserts, eye screws, or other devices that are secure, that are appropriate for substrate, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise shown; and provide hangers not more than 8 inches from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Screw attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - 2. Install panels with pattern running in one direction parallel to long axis of space.
- F. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6500 - RESILIENT FLOORING

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Rubber athletic flooring.
- B. Related Sections include the following:
 - 1. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors and patterns available for each type of product indicated.
- C. Samples for Verification: Full-size tiles of each different color and pattern of resilient floor tile specified, showing the full range of variations expected in these characteristics.
- D. Maintenance Data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Fire-Test-Response Characteristics: Provide products with the following fire-test- response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 W/sq.cm or greater when tested per ASTM E 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.
- C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Do not install products until they are at the same temperature as the space where they are to be installed.
- B. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.
- C. Install flooring and accessories after other finishing operations, including painting, have been completed.
- D. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test.

1.7 EXTRA MATERIALS

- A. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 RUBBER ATHLETIC FLOORING

- A. Resilient rubber flooring made from recycled rubber and specifically designed for use as an athletic activity surfacing material.
 - 1. Manufacturer: "Everlast Surfacing", Dodge-Regupol.
 - 2. Color and Pattern: "High Intensity", Standard 20% Color, as selected by Architect.
 - 3. Form: Roll goods; 48" wide.
 - 4. Thickness: 3/8".
 - 5. Impact Insulation Class (ASTM E492): 45 minimum.
 - 6. Recycled Content:
 - a. Flooring to be comprised of shredded and cleaned SBR tire rubber (100% post-consumer waste) and colored EPDM flecks (30% pre-consumer waste).
 - 7. Product to be odorless.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, port/and-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Low VOC, Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
 - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 RUBBER ATHLETIC FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor coverings.
- B. Unroll floor coverings and allow them to stabilize before cutting and fitting.
- C. Lay out floor coverings as follows:
 - 1. Maintain uniformity of floor covering direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
 - 3. Match edges of floor coverings for color shading at seams.
 - 4. Avoid cross seams.
- D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
- F. Maintain references markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing resilient products:
 - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 - 2. Sweep or vacuum floor thoroughly.
 - 3. Do not wash floor until after time period recommended by flooring manufacturer.
 - 4. Damp-mop floor to remove marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.
- C. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

- D. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

END OF SECTION

SECTION 09 6530 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. This Section includes the following:
 - 1. Resilient wall base.
 - 2. Related Sections include the following:
 - a. Division 9 Section "Resilient Flooring."
- 1.3 SUBMITTALS
 - A. Product Data: For each type of product specified.
 - B. Samples for Initial Selection: Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.
- 1.4 QUALITY ASSURANCE
 - A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
 - B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
 - B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.
 - C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.
- 1.6 PROJECT CONDITIONS
 - A. Do not install products until they are at the same temperature as the space where they are to be installed.
 - B. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.
- 1.7 EXTRA MATERIALS
 - A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for each 500 linear feet for fraction thereof, of each different type, color, pattern, and size of resilient product installed.
 - 2. Deliver extra materials to Owner.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation.
- 2.2 RESILIENT WALL BASE
 - A. Rubber Wall Base: Products complying with FS SS-W-40, Type IJ and with requirements specified:
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
 - 2. Style: Cove with top-set toe.
 - 3. Minimum thickness: 1/8 inch.
 - 4. Height: 4 inches.
 - 5. Lengths: Coils in lengths standard with manufacturer.
 - 6. Outside Corners: Formed on job.
 - 7. Surface: Smooth.
 - 8. Manufacturer: One of the following:
 - a. Afco Rubber Corp.
 - b. Armstrong World Industries
 - c. Azrock Industries, Inc.

- d. Johnsonite
- e. Mercer Products Co., Inc.
- f. Flexco
- g. Roppe Corporation
- h. Tarkett, Inc.
- i. VPI Floor Products Division

2.3 INSTALLATION ACCESSORIES

- A. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

3.3 INSTALLATION

- A. General: Install resilient products according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 3. Do not stretch base during installation.
 - 4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 5. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
- C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
 - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 - 2. Do not wash resilient products until after time period recommended by resilient product manufacturer.
- B. Protect resilient products against marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.
- C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

END OF SECTION

SECTION 09 9120 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color or finish is not indicated, Architect will select from standard colors and finishes available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork.
 - b. Acoustical Wall Panels.
 - c. Metal lockers.
 - d. Elevator entrance doors and frames.
 - e. Elevator equipment.
 - f. Finished mechanical and electrical equipment.
 - g. Light fixtures.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas.
 - b. Ceiling plenums.
 - c. Pipe spaces.
 - d. Duct shafts.
 - e. Elevator shafts.
 - f. Attic spaces.
 - 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - 4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
 - 5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.2 REFERENCED STANDARDS

- A. The referenced standards listed below are considered part of the requirements listed in this section. If specific aspects of the standards do not apply, the Contractor shall identify the specific references in writing prior to beginning work. All requests for omission must be approved by the Architect.
 - 1. ASTM International (ASTM)
 - a. ASTM A 123 Hot-Dip Galvanized Coatings on Iron and Steel Products;
 - b. ASTM A 780 - Repair of Hot Dip Galvanized Coatings;
 - c. ASTM D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications;
 - d. ASTM D 653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process;
 - e. ASTM D 6386 - Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting;
 - f. ASTM D 2092 Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting;
 - g. ASTM D 4258 Surface Cleaning Concrete for Coating;
 - h. ASTM D 4261 Surface Cleaning Concrete Unit Masonry for Coating;
 - i. ASTM D 4259 Abrading Concrete;
 - j. ASTM F 1869 Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride;
 - k. ASTM D 4414 Standard Practice for Measurement of Wet Film Thickness (WFT) by Notch Gages;
 - l. ASTM D 5064 Practice for Conducting a Patch Test to Assess Coating Compatibility;
 - m. ASTM D 3276 Standard Guide for Painting Inspectors (Metal Substrates);
 - n. ASTM D 3359 Adhesion by Tape Test

- o. ASTM D 4261 Surface Cleaning Concrete Unit Masonry for Coating;
- p. ASTM D 4414 Standard Practice for Measurement of Wet Film Thickness (WFT) by Notch Gages;
- 2. Society for Protective Coatings (SSPC)
 - a. SSPC-PA 1 Shop, Field, and Maintenance Painting of Steel;
 - b. SSPC-PA 2 Measurement of Dry Coating Thickness with Magnetic Gauges;
 - c. SSPC-SP 2 Hand Tool Cleaning;
 - d. SSPC-SP 3 Power Tool Cleaning;
 - e. SSPC Guide 6 Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations;
- 3. High Performance Building Reference Standards:
 - a. CAL (VOC) - Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers (including Addendum 2004-01); State of California Department of Health Services.
 - b. Refer to Specification Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 DEFINITIONS

- A. Terminology as defined in the following standards apply to this section:
 - 1. ASTM D 16 Paint, Related Coatings, Materials, and Applications;
 - 2. ASTM E 284 Appearance;
 - 3. ASTM C 11 Standard Terminology Relating to Gypsum and Related Building Materials and Systems;
 - 4. National Paint & Coatings Association (NPCA) Glossary of Terms as listed at the following URL:
www.paint.org/ind_info/terms.cfm;
 - 5. Paint/Coatings Dictionary, © 1978 by Federation of Societies for Coatings Technology.
- B. Design Standard: The paint/coating material specifically referenced by manufacturer's name/number, which determines the performance and quality requirements for materials referred in this Section.
- C. Low VOC Alternative: Where a primer or paint is scheduled for use on the interior of the building a product that meets (does not exceed) the VOC content limits established in the Project Manual shall be used. The supplier shall review all primers and paints submitted and provide appropriate alternative, comparable submittal to ensure that all primers (anti-corrosive, anti-rust, and otherwise), paints, varnishes, stains, shellacs, and coatings meet the criteria established in the Project Manual for Volatile Organic Compounds (VOCs), see Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.
 - 1. Interior of the building is inside the weatherproofing system(s).

1.4 SUBMITTALS

- A. Complete and submit the Paint Material Cross Reference List for all paint/coating materials submitted (excluding the Design Standard).
- B. Complete and submit the Label Analysis Form for all paint/coating materials submitted (excluding the Design Standard).
- C. Environmental Health and Safety Plan (relating to disturbance of paint with hazardous constituents);
- D. Containment System Plan.
- E. Waste Collection, Handling, Disposal Plan.
- F. Manufacturer's Information: Manufacturer's technical information including instructions for handling, storing, surface preparation application, warranty etc.
- G. Samples for Initial Selection: For each type of finish-coat material indicated provide a full color palette. After color selection, Architect will furnish a schedule indicating surfaces for each color selected.
- H. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
 - 1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall Surfaces: Provide samples on at least one wall.
 - b. Small Areas and Items: Architect will designate items or areas required.
 - 2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
 - a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
 - b. Final approval of colors will be from benchmark samples.
- I. Errors, Omissions, and Other Discrepancies
 - 1. Submit all errors, omissions, and other discrepancies in contract documents to the Architect within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies shall be addressed and resolved, and the work plan modified, prior to beginning the initial and follow-up phases of work. Discrepancies that become

apparent only after work is uncovered shall be identified at the earliest discoverable time and submitted for resolution.

1.5 QUALITY CONTROL

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. The Contractor should provide evidence to the Owner, with the bid submittal, that the Contractor, performing these coating operations is currently certified SSPC QP-1 by SSPC, The Society for Protective Coatings. Such certification is to remain in effect through the life of the contract.
- C. The Contractor shall designate a specific individual as the Paint/Coating Quality Control Supervisor (QCS). The QCS shall perform testing to ensure conformance to all requirements outlined in this section.
 - 1. QCS or designated personnel performing Quality Control (QC) testing during steel surface preparation and painting shall be NACE Level 1 Certified.
- D. During steel surface preparation and painting, Daily Inspection Reports shall be prepared in accordance with ASTM D 3276.

1.6 WARRANTY

- A. Manufacturer shall provide a minimum 5 year material and labor warranty covering defective materials for all finish systems. If a specific finish system has a standard warranty greater than the 5 year warranty indicated the greater warranty shall apply.
- B. Installer Warranty: two years from date of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.8 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
- C. Do not apply paint in rain, fog, or to damp or wet surfaces.
- D. Do not apply when the air or surface is excessively hot resulting in "mud cracking." If mud cracking occurs an additional coat will be required. Mud cracking is not considered an acceptable condition.
- E. Do not apply paint when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The Design Standard paint/coating materials for this Section is The Sherwin Williams Company (SW). Subject to compliance with product submittal/approval requirements, provide one of the products listed in this Section or an equivalent product, as determined by the Architect. Other manufacturers will be considered contingent upon their responsiveness to the requirements set forth in Section

2.2 MATERIALS (GENERAL)

- A. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- B. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- C. Colors: As selected by Architect from manufacturer's full range.

1. Approval of the in-place color against approved color chips shall be solely the right and judgment of the Architect.
2. Each underlying coat shall be tinted lighter than next coat or finish coat. The contrast shall be visible at a distance not less than 10 feet. The degree of contrast can be modified at the discretion of the Architect or appointed designee.

2.3 PRIMERS

- A. Exterior Painted Portland-Cement Plaster, Finished and/or Painted Concrete:
 1. SW Loxon Conditioner A24W100 (Guide Coat White).
- B. Exterior Traffic Coating:
 1. SW Tread-Plex Primer.
- C. Ferrous-Metal Door and Frame Primer:
 1. SW Kem Kromik Universal Metal Primer B50NZ6/B50WZ1.
- D. Hot-dip Galvanized Metal:
 1. SW Pro-Cryl Universal Primer B66-310
- E. Interior Gypsum Wall Board (GWB) with textured and smooth finish (water-based finishes):
 1. SW PrepRite 200 Latex Wall Primer B28W200 Series

2.4 FINISH COATS

- A. Exterior, High-build Acrylic Paint (Flat finish):
 1. SW Loxon Acrylic Coating A24W300
- B. Exterior Alkyd Gloss Enamel :
 1. SW Industrial Enamel HS B54Z-400.
- C. Interior Alkyd Semi-gloss Enamel:
 1. SW ProMar 200 Interior Alkyd Semi-Gloss B34W200.
- D. Interior Semi-Gloss Water-Based Epoxy:
 1. SW Water-based Catalyzed Epoxy B70 (with Semi-Gloss Hardener B60V25)
- E. Interior Semi-Gloss
 1. SW ProMar 200 Interior Latex Semi-Gloss B31W2200.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 TECHNICAL REPRESENTATION BY PAINT MANUFACTURER

- A. A qualified technical representative of the paint manufacturers shall periodically visit the site to verify that the quality of surface preparation and painting conform to their requirements. Visits are required at the start of the project and a minimum of two visits during each of the following phases:
 1. Mockup review;
 2. Surface preparation;
 3. Primer application; and,
 4. Finish coat application.
- B. The manufacturer's representative shall summarize the results of the inspections in writing and provide recommendations if necessary. The Contractor shall provide copies of the manufacturer's reports to the Owner within seven days after each site visits.
- C. The Contractor shall comply with all manufacturers recommendations presented within the report at no additional cost to the Owner.

3.3 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning:
 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
 2. Solvent Cleaning: Solvent Cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Allow adequate ventilation. Refer to Steel Structures Paint Council Surface Preparation Specification No.1 (SSPC-SP1).
 3. Water Blasting NACE Standard RP-01-72: Removal of oil, grease, dirt, loose rust, loose mill scale, and loose paint by water pressures of 2,000 to 2,5000 psi at a flow of 4 to 14 gallons per minute.
 4. Hand Tool Cleaning: Hand tool cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they can not be removed by lifting with a dull putty knife. Before hand tool cleaning, remove visible oil, grease, soluble residues, and salts by the methods outlined in SSPC-SP1. For complete instructions refer to Steel Structures Paint Council Surface Preparation Specification No.2.
- C. Surface Preparation:
 1. Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings in accordance with manufacturer's written instructions for each particular substrate condition and as specified.
 2. Provide barrier coats over incompatible primers or remove and reprime. Typical incompatibility involves epoxy primers that have cured beyond their maximum recoat time.
 3. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents from concrete and/or cementitious materials. If chemical compounds have been used to expedite curing, use mechanical methods of surface preparation to enable water to penetrate. Perform water mist testing of new concrete to determine the presence of curing compounds.
 4. Previously Painted Stucco: The amount of time between pressure cleaning and primer application shall not exceed four (4) days or re-cleaning will be required.
 5. If dirt splash along base of a cleaned surface occurs, removal shall be performed via pressure cleaning or scrub brush and water. Dry broom removal is not an acceptable method of cleaning.
 6. Determine alkalinity and moisture content of concrete surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 7. Previously Coated Surfaces: Maintenance painting will frequently not permit or require the removal of all old coatings prior to repainting. However, all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers must be removed to assure sound bonding to the tightly adhering old paint. Glossy surfaces of old paint films must be clean and dull before repainting. Thorough washing with an abrasive cleanser will clean and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer. Check for compatibility by applying a test patch of the recommended coating system, covering at least 2 to 3 square feet. Allow to dry one week before testing adhesion per ASTM D3359. If the coating system is incompatible, complete removal is required.
 8. Ferrous metal that has not been hot-dip galvanized or shop-primed shall be cleaned as follows:
 - a. Clean in accordance with SSPC SP 1 Solvent Cleaning
 - b. Blast steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
 - c. Primer shall be applied within four hours of abrasive blasting or as soon as practicable after structural engineer's inspection.
 - 1) Coordinate abrasive blasting with structural engineer. Engineer shall inspect raw metal prior to application of primer to determine if additional steel replacements are needed.
 9. Shop-primed ferrous metal (hollow metal doorframes and metal doors) shall be inspected for damage to the shop-applied primer and cleaned/touched-up as follows:
 - a. Clean in accordance with SSPC SP 1 Solvent Cleaning;
 - b. Sand damaged areas to smooth the edges of the damaged surface;
 - c. Touch-up with field primer immediately after cleaning and sanding.
 - d. Existing metal to remain shall be prepared to create a 'like new' finished appearance.
 10. Existing ferrous metal (hollow metal door frames and metal doors) shall be inspected for adhesion integrity prior to application of the new paint system. The following testing shall be performed on each existing doorframe and door prior to painting:

- a. Measure existing dry film thickness (DFT) testing. If existing thickness exceeds 20 mils the coating system shall be chemically removed (to bare steel or galvanized layer).
 - b. Perform two adhesion tests (ASTM D 3359) per side of door; rating shall be a minimum of 3A. If rating of 2A or less is found, the poorly adhered paint shall be removed and the exposed paint edges feather sanded prior to primer application;
 - c. Perform three adhesion tests (ASTM D 3359) per door frame; rating shall be a minimum of 3A. If rating of 2A or less is found, the poorly adhered paint shall be removed and the exposed paint edges feather sanded prior to primer application;
 - d. Existing metal to remain shall be prepared to create a 'like new' finished appearance.
- 11. Hot-dip Galvanized (HDG) Steel:
 - a. Clean galvanized surfaces using a degreasing solution (e.g. Simple Green).
 - b. If chromate pretreatment is present, remove by mechanical methods.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.4 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 3. Provide finish coats that are compatible with primers used.
 - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convactor covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
 - 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 - 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 - 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 - 9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
 - 10. Sand lightly between each succeeding enamel coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 - 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 - 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 - 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
 - 1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 - 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 - 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
 - 1. Uninsulated metal piping.
 - 2. Pipe hangers and supports.
 - 3. Tanks that do not have factory-applied final finishes.
 - 4. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - 5. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
 - 6. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- G. Electrical items to be painted include, but are not limited to, the following:
 - 1. Switchgear.
 - 2. Panelboards.
 - 3. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.5 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
 - 1. Construction Manager will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Subcontractor.
 - 2. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.6 EXTERIOR PAINT SCHEDULE

- A. Exterior Concrete Masonry Units (smooth), Vertical Stucco Surfaces at conditioned spaces:
 - 1. Primer: SW Loxon Block Surfacers A24W200; apply at WFT range of 16.0 mils to achieve a minimum of 8.0 mils.
 - 2. Patching: Voids in mortar joints and/or CMU shall be filled with a lightweight spackle compound and tooled to match the surrounding texture.
 - 3. Intermediate Coat: SW Acrylic Coating A24W300; apply at WFT range of 8.0 - 10.0 mils to achieve DFT range of 3.6 - 4.5 mils. Tint 50-percent of finish coat to create definable contrast.
 - 4. Finish Coat: SW Acrylic Coating A24W300; apply at WFT range of 8.0 - 10.0 mils to achieve DFT range of 3.6 - 4.5 mils per coat.
- B. Exterior Stucco Soffits:
 - 1. Primer: SW Loxon Exterior Masonry Acrylic Primer A24W300; apply at WFT range of Coverage rate shall not exceed 300 square feet per gallon.
 - 2. Finish Coat: SW Loxon Acrylic Coating A24W300; apply at WFT range of 8.0 - 10.0 mils to achieve DFT range of 3.6 - 4.5 mils per coat.
- C. Ferrous Metal Doors and Frames:
 - 1. Primer: SW Kem Kromik Universal Metal Primer B50NZ6/B50WZ1; apply at a dry film thickness of not less than 3.0 mils.
 - 2. Finish Coat: SW Industrial Enamel HS B54Z-400; apply at WFT range of 3.5 - 7.0 mils to achieve DFT range of 2.0 - 4.0 mils. If one coat does not completely cover the primer, apply additional coat.
 - a. Note: Primer and Finish Coat shall have a definable contrast between the two colors.
- D. HDG Steel:
 - 1. Primer: SW Pro-Cryl Universal Primer B66-310; apply at WFT range of 5.0 - 10.0 mils to achieve DFT range of 2.0 - 4.0 mils.

2. Finish Coat: SW Industrial Enamel HS B54Z-400; apply at WFT range of 3.5 - 7.0 mils to achieve DFT range of 2.0 - 4.0 mils. If one coat does not completely cover the primer, apply additional coat.
 - a. Note: Primer and Finish Coat shall have a definable contrast between the two colors.

3.7 INTERIOR PAINT SCHEDULE

- A. Concrete Masonry Units (smooth-faced) and brick masonry substrates at conditioned and unconditioned spaces:
 1. Primer: SW Loxon Block Surfacers A24W200; apply at WFT range of 16.0 mils to achieve a minimum of 8.0 mils.
 2. Patching: Voids in mortar joints and/or CMU shall be filled with a lightweight spackle compound and tooled to match the surrounding texture.
 3. Intermediate Coat: SW ProMar 200 Interior Latex Semi-Gloss B31W2200; apply at WFT range of 4.0 - 5.0 mils to achieve DFT range of 1.5 - 2.0 mils. Tint 50-percent of finish coat to create definable contrast.
 4. Finish Coat: SW ProMar 200 Interior Latex Semi-Gloss B31W2200; apply at WFT range of 4.0 - 5.0 mils to achieve DFT range of 1.5 - 2.0 mils.
- B. Sealed Concrete Floor:
 1. Primer: ArmorSeal Water Based Epoxy Primer Clear; one coat, apply at DFT of 2.0 - 3.0 mils.
 2. Finish Coat: ArmorSeal 700 HS Water Based Epoxy Floor Coating; one coat, apply at DFT of 6.5 - 7.5 mils.
- C. Gypsum Wallboard:
 1. Primer: SW PrepRite 200 Interior Latex Primer B28W200; apply at WFT range of 4.0 - 5.0 mils to achieve DFT range of 1.5 - 2.0 mils.
 2. Intermediate Coat: SW ProMar 200 Interior Latex Semi-Gloss B31W2200; apply at WFT range of 4.0 - 5.0 mils to achieve DFT range of 1.5 - 2.0 mils. Tint 50-percent of finish coat to create definable contrast.
 3. Finish Coat: SW ProMar 200 Interior Latex Semi-Gloss B31W2200; apply at WFT range of 4.0 - 5.0 mils to achieve DFT range of 1.5 - 2.0 mils.
- D. Gypsum Wallboard (Epoxy Coating):
 1. Primer: SW PrepRite 200 Interior Latex Primer B28W200; apply at WFT range of 4.0 - 5.0 mils to achieve DFT range of 1.5 - 2.0 mils.
 2. Intermediate Coat: SW Water Based Catalyzed Epoxy (semi-gloss); apply at WFT range of 6.0 - 8.0 mils to achieve DFT range of 2.5 - 3.0 mils. Tint 50-percent of finish coat to create definable contrast.
 3. Finish Coat: SW Water Based Catalyzed Epoxy (semi-gloss); apply at WFT range of 6.0 - 8.0 mils to achieve DFT range of 2.5 - 3.0 mils.
 4. Provide at all gypsum wallboard surfaces in Toilet Rooms.
- E. Ferrous Metal Doors and Frames:
 1. Primer: SW Kem Kromik Universal Metal Primer B50NZ6/B50WZ1; apply at a dry film thickness of not less than 3.0 mils.
 2. Finish Coat: SW Industrial Enamel HS B54Z-400; apply at WFT range of 3.5 - 7.0 mils to achieve DFT range of 2.0 - 4.0 mils. If one coat does not completely cover the primer, apply additional coat.
 - a. Note: Primer and Finish Coat shall have a definable contrast between the two colors.
- F. HDG Steel: Provide the following finish systems over exterior zinc-coated metal surfaces:
 1. Primer: SW Pro-Cryl Universal Primer B66-310; apply at WFT range of 5.0 - 10.0 mils to achieve DFT range of 2.0 - 4.0 mils.
 2. Finish Coat: SW Industrial Enamel HS B54Z-400; apply at WFT range of 3.5 - 7.0 mils to achieve DFT range of 2.0 - 4.0 mils. If one coat does not completely cover the primer, apply additional coat.
 - a. Note: Primer and Finish Coat shall have a definable contrast between the two colors.
- G. Exterior Aluminum:
 1. Preparation: Acid Etch with Porter - 33 Aluma Prep.
 2. Prime Coat: Porter - 215 Rust Screen Acrylic Metal Primer.
 3. Finish Coat: Porter -739 Acrylic Shield Exterior Acrylic Paint.

3.8 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.9 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.
Comply with procedures specified in PDCA P1.

PAINT MATERIAL CROSS REFERENCE LIST

PROVIDE A LABEL ANALYSIS AS SHOWN IN THE EXAMPLE BELOW. THIS LIST IS REQUIRED AS PART OF THE SUBMITTALS.

SPEC SECTION	GENERIC DESCRIPTION	PRODUCT NAME	PRODUCT NO.	SUBSTRATE(S)	LOCATION(S)
2.4,H, 1 (E.G.)	WATER BASED EPOXY (E.G.)	HI-BILD WATER-BAS ED CATALYZED EPOXY (E.G)	B71-V10 0 (E.G.)	DRYWALL (FINISH), CMU, CAST-IN-PLACE (C.I.P) CONCRETE (E.G.)	BATHROOM INTERIOR WALLS (E.G.)

CONTINUE ROWS AS REQUIRED BY THE SUBMITTAL.

LABEL ANALYSIS FORM

PROVIDE A LABEL ANALYSIS AS SHOWN IN THE EXAMPLE BELOW. THIS LIST IS REQUIRED AS PART OF THE SUBMITTALS WHEN THE DESIGN STANDARD IS NOT PROVIDED. PROVIDE THE FOLLOWING DATA:

PRODUCT NAME:	PRODUCT NUMBER:	MANUFACTURER:

COMPOSITION BY WEIGHT:

WEIGHT PER GALLON:	LBS.	P.V.C.	%
SOLIDS BY WEIGHT:	%	SOLIDS BY VOLUME:	%
TOTAL PIGMENT:	%	TOTAL VEHICLE:	%

LIST COMPONENTS COMPRISING PIGMENT. QUANTIFY COMPONENTS NOT PROVIDED (I.E. EXTENDER PIGMENTS, ANTI-CORROSIVES, ETC.).	LIST COMPONENTS COMPRISING VEHICLE. QUANTIFY COMPONENTS NOT PROVIDED (I.E. ADDITIVES, FUNGICIDE, BIOCIDES, ETC.).
--	--

TITANIUM OXIDE (TiO₂)	%	ACRYLIC RESIN (SOLIDS)	%
ZINC OXIDE	%	ALKYD RESINS (SOLIDS)	%
CALCIUM CARBONATE	%	VINYL/ACRYLIC CO-POLYMER	%
SILICATES	%	POLYVINYL ACETATE (P.V.A.)	%
MISCELLANEOUS FELDSPARS	%	ETHYLENE GLYCOL	%
	%	VOLATILE (WATER)	%
	%	VOLATILE (SOLVENT)	%
	%		%
	%		%
	%		%
TOTAL	100 %	TOTAL	100 %

VOLATILE ORGANIC COMPOUND (V.O.C.) AS SUPPLIED ?	LBS/GAL	G/L
---	----------------	------------

FINISH OR TOP COAT PRODUCTS

WHAT IS THE 60 DEGREE ANGULAR SHEEN (SATIN OR HIGHER)	UNITS
WHAT IS THE 85 DEGREE ANGULAR SHEEN (FLAT OR MATTE FINISHES)	UNITS
IS THE PRODUCT OFF-CASTED (PIGMENTS ADDED TO INCREASE HIDING POWER)?	
IF COLORS ARE FACTORY ADDED, WHAT PIGMENT IS USED?	

END OF SECTION

SECTION 10 4310 - SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following types of signs:
 - 1. Panel signs.
 - a. Dimensional letters and numbers.
 - 1) Fabricated numbers.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract.
- B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- C. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
 - 1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
 - 2. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
- D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
 - 1. Samples for initial selection of color, pattern, and texture:
 - a. Cast Acrylic Sheet and Melamine Sheet: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.
 - b. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.
 - 2. Samples for verification of color, patterns, and texture selected and compliance with requirements indicated:
 - a. Cast Acrylic Sheet and Melamine Sheet: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material, color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.
 - b. Dimensional Letters: Provide full-size representative samples of each dimensional letter type required, showing letter style, color, and material finish and method of attachment.

1.4 QUALITY ASSURANCE

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.
- C. All signs shall conform to all requirements of the Americans with Disabilities Act 2010, ADA Standards for Accessible Design, Section 216 - Signs.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Manufacturers of Panel Signs:
 - a. APCO Graphics, Inc.
 - b. ASi Sign Systems
 - c. Clarke Systems
 - d. Best Sign Systems
 - e. Mohawk Sign Systems
 - 2. Manufacturers of Dimensional Letters:

- a. Allen Industries, Inc.
- b. APCO Graphics, Inc.
- c. A.R.K. Ramos Manufacturing Company, Inc.
- d. ASI Sign Systems, Inc.
- e. Gemini Incorporated
- f. Metal Arts
- g. The Southwell Company

2.2 PANEL SIGNS FOR ROOM IDENTIFICATION

- A. Panel signs shall be minimum 1/8" thick (excluding thickness of raised sign letters) melamine or acrylic plastic with 1/32" thick raised characters with Grade 2 Braille.
 1. At sign manufacturer's option, the minimum 1/8" thickness of the panel can be achieved by laminating a base layer of melamine or acrylic to the top layer containing the integral raised characters. Edges shall be ground smooth.
 2. The characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with the background -either light characters on a dark background or dark characters on a light background. Submit manufacturer's standard palette of colors meeting these requirements to Architect for selection.
 3. Graphics and text are to be etched to achieve correctly spaced and accurately reproduced sharp, true characters and Braille. The text shall be an integral part of the sign and not applied to the plate with adhesive or chemicals. Text height is to be determined within the range of 5/8" up to 2". Graphics are etched into the face prior to the application of the background color.
- B. Room identification and number signs are to be provided at each interior door opening and at certain exterior door openings where indicated on drawings.
 1. Provide an identification number sign at swinging doors or pairs of doors leading to a room as indicated on drawings. Room numbers to be as indicated on drawings.
 2. Provide an identification name sign at swinging doors or pairs of doors leading to a room as indicated on drawings.
 - a. In addition to room number and name signs, include a pictogram of the international symbol of accessibility at each toilet room.
 - b. Example:
 - 1) Room Number Sign: 120
 - 2) Room Name Sign: Men's Toilet
 - 3) Pictogram: Accessibility Symbol
 3. General Description of Signs.
 - a. Room number signs shall be combined with room identification signs.
 - 1) Room numbers shall be 3/4" Helvetica Medium Letters centered on sign (capital letter for suffix).
 - 2) Grade 2 Braille centered below number on all signs.
 - 3) Number shall be combined with Identification Sign on a single panel.
 - b. Room Identification Signs.
 - 1) Room identification letters shall be 5/8" upper and lower case Helvetica Medium letters centered on sign.
 - 2) Grade 2 Braille centered on sign.
 4. Fabrication: Provide 9 inch by 9 inch overall size. Sign edges are to be straight and free from saw marks or any other imperfections. Corners shall be rounded, with 1/4" to 3/8" radius.

2.3 CAST DIMENSIONAL LETTERS AND NUMBERS

- A. Cast Letters and Numbers: Form individual letters and numbers by casting aluminum. Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects. Cast lugs into the back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.
- B. Finish: High gloss polyurethane enamel in custom matched colors (two, maximum) to be selected by Architect.
- C. Typeface: Helvetica Medium.
- D. Sizes: 5" high and 6" high x 3/4" thick; in locations indicated on drawings.

2.4 FABRICATED, LARGE SIZE NUMBERS

- A. Fabricated Numbers: Form individual numbers for large number "25" from .250 inch aluminum plate.
 1. Aluminum Grade AA3003H22.
 2. Weld threaded mounting studs to back of numbers. Sand as required to remove distortion due to welding. Sand edges of fabricated numbers smooth.
- B. Finish.
 1. Apply high gloss acrylic polyurethane finish coat over single component epoxy primer after fabrication.
- C. Typeface: Helvetica Neue 85 Heavy.

- D. Sizes: As indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Room Identification Signs: Mount on adjoining walls and locate signs adjacent to the latch side of the door. In case of conflicts with closely spaced doors, with vision panels or where there is no wall space to the latch side of the door, notify Architect. Verify all sign locations with Architect prior to installation.
- C. Wall Mounted Signs: Attach signs to wall surfaces using a minimum of two stainless steel screws. For exterior signs, use four stainless steel screws. Use expansion shields for screws set in masonry; use "Molly" type hollow wall fasteners for screws set in gypsum board or plaster.
 - 1. Mounting shall be at a height of 60" to the centerline of the sign (to centerline of top sign when two signs are mounted one above the other).
- D. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
 - 1. Projected Mounting: Mount cast letters at a 1" projection distance from the wall surface indicated using projecting studs and spacers.

3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instruction.
- B. Protect units from damage until acceptance by the Owner.

END OF SECTION

SECTION 10 5220 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1- GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. This Section includes the following:
 - 1. Fire extinguishers.
 - 2. Fire extinguisher cabinets.
- 1.3 SUBMITTALS
 - A. General: Submit the following according to the Conditions of the Contract.
 - B. Product data for cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.
 - C. samples for initial selection purposes in the form of manufacturer's color charts consisting of sections of units showing full range of colors, textures, and patterns available for each type of cabinet finish indicated or exposed to view.
- 1.4 QUALITY ASSURANCE
 - A. Single-Source Responsibility: Obtain extinguishers and cabinets from one source from a single manufacturer.
 - B. UL-Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. J.L Industries.
 - 2. Larsen's Manufacturing Co.
 - 3. Modern Metal Products by Muckle
 - 4. Potter-Roemer, Inc.
 - 5. Samson Metal Products, Inc.
 - 6. Strike First
- 2.2 FIRE EXTINGUISHERS
 - A. General: Provide fire extinguishers for each cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard, that comply with authorities having jurisdiction.
 - B. Multipurpose Dry Chemical Type: UL-rated 2A-10B:C, 5-lb nominal capacity, in enameled steel container.
 - 1. Provide at all locations except Dining/Day Room.
 - C. Wet Chemical "K Class" Type: UL-rated 2A:1B:K, 6 liter nominal capacity, in enameled steel container.
 - 1. Provide at Dining/Day Room.
 - D. Multipurpose Dry Chemical Type: UL-rated 4A-80B:C, 10 lb. nominal capacity, in enameled steel container.
 - 1. Provide at Fueling Station.
- 2.3 CABINETS
 - A. Construction: Manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
 - B. Fire-Rated Cabinets: UL listed with UL listing mark with fire-resistance rating of wall where it is installed. Provide wherever cabinet is to be installed in a fire-rated wall or partition.
 - C. Cabinet Type: Suitable for containing the following:
 - 1. Fire extinguisher.
 - D. Cabinet Mounting: Suitable for the following mounting conditions:
 - 1. Semi-recessed: Cabinet box (tub) partially recessed in walls of shallow depth.
 - E. Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.
 - 1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - a. Provide 2-1/2 inch rolled edge.
 - F. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

1. Enameled Steel: Manufacturer's standard finish, hollow steel door construction with tubular stiles and rails.
 - G. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
 1. Application Process: Silk screen.
 2. Lettering Style: Horizontal
 3. Lettering Color: White.
 - H. Door Style: Manufacturer's standard design.
 1. Full-Glass Panel: Tempered glass, 1/8 inch thick.
 - I. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.
 - J. Exterior Cabinet: Heavy duty outdoor cabinet constructed of 16 gauge galvanized steel with red acrylic enamel finish. Provide weather-resistant gasketing, safety break cylinder lock, and sloped roof. Door to be solid metal, no glass.
 1. Provide at Fueling Station.
- 2.4 FINISHES FOR CABINETS, GENERAL
- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
 - B. Protect mechanical finishes on exposed surfaces from damage by applying temporary strippable protective covering prior to shipping.
- 2.5 STEEL CABINET FINISHES
- A. Surface Preparation: Solvent-clean surfaces complying with SSPS-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5 (white metal blast cleaning) or SSPC-SP 8 (pickling).
 - B. Factory-Priming for Field-Painted Finish: Apply shop primer specified below immediately following surface preparation and pretreatment.
 1. Shop Primer: Manufacturer's or fabricator's standard fast-curing, lead-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
 - C. Baked-Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard two-coat baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 2.0 mils.
 1. Color: White. Paint the following:
 - a. Exterior of cabinet.
 - b. Interior of cabinet.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- A. Examine walls and partitions for thickness and framing for cabinets to verify cabinet depth and mounting prior to cabinet installation.
 - B. Do not proceed until unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION
- A. Follow manufacturer's printed instructions for installation.
 - B. Install in locations indicated. Each extinguisher requires a cabinet. Mount cabinet with bottom edge of trim located 32" above finished floor.
 1. Prepare recesses in walls for cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions. Recesses in masonry walls shall be neatly sawcut.
 2. Fasten mounting brackets and cabinets to structure, square and plumb.

END OF SECTION

SECTION 10 7300 - ALUMINUM WALKWAY COVERS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. The bidding requirements, general conditions, supplementary conditions, drawings and requirements of division one specification shall apply to work specified in this section.

1.2 SUMMARY

- A. The work in this section includes furnishing of all items necessary to provide for a complete aluminum walkway system.

1.3 DESCRIPTION OF WORK:

- A. The extent of aluminum walkway cover is shown on the drawings and as specified herein.
- B. Extruded Aluminum Walkway Cover shall consist entirely of extruded aluminum sections (roll-formed not acceptable). System shall consist of heli-arc welded, one-piece rigid structural bents (column and beam assemblies), decking, fascia, accessory items and hardware to provide a complete system.
- C. Water shall sheet drain from deck as indicated in drawings.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following except as other-wise indicated:
- B. Standard Building Code, latest addition with amendments, if any.
- C. AWS (American Welding Society) standards for structural aluminum welding.
- D. Manufacturer: Obtain aluminum covered walkway system from only one (1) manufacturer.
- E. Installer Qualification: Firm with not less than three (3) years experience in installation of aluminum walkway covers of type, quantity and installation methods similar to work of this section.
- F. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to insure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay work.
- G. Shop Assembly: Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- H. Coordination: Coordinate work of this section with work of other sections which interface with covered walkway system.

1.5 SUBMITTALS

- A. Shop Drawings: Submit detailed drawings, layout of walkway cover system, bent locations (identify drain columns and wet bents), all mechanical joint locations with complete details, connections, jointing and accessories. Include sizing, engineered (signed and sealed) design, and details of concrete footings and bent anchorage.
- B. Product Data: Submit manufacturer's product data, specifications, component performance data and installation instructions.
- C. Calculations: Provide signed and sealed structural calculations for the proposed walkway cover and foundation systems, by a professional engineer registered in the state of Florida, who professes his discipline to be structural engineering.

1.6 PERFORMANCE REQUIREMENTS:

- A. System Performance: Provide aluminum covered walkway system that has been designed, produced, fabricated and installed to withstand normal temperature changes as well as live loading, dead loading and wind loading in compliance with Standard Building Code requirements for geographic area in which work is located and as follows:
 - 1. Live Load: 20 psf min.
 - 2. Structural design for wind forces: Comply with Florida Building Code - 2014, Fifth Edition
 - 3. Design Wind Velocity: 150 mph (ultimate).
 - 4. Risk Category: III.
 - 5. Exposure: C.
- B. The design intent is to meet the component sizes shown on the drawings.
- C. Structure shall be capable of sustaining hail, hurricane force winds and supporting a concentrated load such as being walked upon.

PART 2 - PRODUCT

2.1 ALUMINUM WALKWAY COVERS

- A. Basis of Design: DITT DECK Extruded Aluminum Walkway Cover System by Dittmer or equal.
- B. All aluminum extrusions shall be alloy 6063 heat treated to a T-6 temper.
- C. Standard finish for all components shall be Class I Anodized.

- D. Fasteners:
 - 1. Deck Screws (rivets not permitted): Per manufacturer's requirements to meet design intent and performance requirements.
 - 2. Fascia Rivets: Size 3/16" by 1/2" grip range aluminum rivets with aluminum mandrel.
 - 3. Bolts: All bolts, nuts and washers to be Per manufacturer's requirements to meet design intent and performance requirements.
 - 4. Tek Screws: not permitted.
- E. Warranty:
 - 1. Manufacturer shall warrant the entire system against defects in labor and materials for a period of five (5) years commencing on the date of substantial completion.
 - 2. Intention of this warranty is the manufacturer will come onto the jobsite and do all necessary to effect corrections of any deficiencies.
 - 3. Prima Facie Evidence of defects in labor and material may include but is not limited to, one or more of the following:
 - a. Moisture leaks.
 - b. Metal failure including excessive deflection.
 - c. Fastener failure.
 - d. Finish failure.

2.2 FABRICATION

- A. Comply with indicated profiles, dimensioned requirements and structural requirements.
- B. Use sections true to details with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, free from defects impairing strength and durability.
- C. All welding do be done by heli-arc process.
- D. Bents shall consist of shop welded one piece units. When size of bents do not permit shipment as a welded unit, concealed mechanical joints may be used.
- E. Mechanical joints shall consist of stainless steel bolts with a minimum of two (2) bolts per fastening. Bolts and nuts shall be installed in a concealed manner utilizing 1/2" thick by 1 1/2" aluminum bolt bars welded to structural members. All such mechanical joints must be detailed on shop drawings showing all locations.
- F. Roof Deck: Extruded Aluminum shapes, interlocking self-flashing sections. Shop fabricate to lengths and panels widths required for field assembly. Depth of sections to comply with structural requirements. Provide shop induced camber in deck units with spans greater than 16'- 0" to offset dead load deflections. Welded dams are to be used at non-draining ends of deck.
- G. Expansion joints, design structure for thermal expansion and contraction. Provide expansion joints per manufacturer's recommendation.
- H. Exposed rivets used to fasten bottom of fascia to deck to have finish to match fascia.
- I. Apply a shop applied dip-coat of clear acrylic enamel to each column end terminating in concrete to isolate from electrolytic reaction. Column ends shall be pierced to "key" grout to bent for maximum uplift protection.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING:

- A. Deliver, store and handle covered walkway system components as recommended by manufacturer. Handle and store in a manner to avoid deforming members and to avoid excessive stresses.

3.2 EXAMINATION

- A. Examine adjacent work for conditions that would prevent quality installation of system.
- B. Do not proceed until defects are corrected.

3.3 CONCRETE FOOTINGS

- A. Concrete footings are not work of this section. Refer to "concrete work", Section 03 3000.
- B. Sleeves (styrofoam blockouts) shall be furnished by walkway cover manufacturer and placed by general contractor.

3.4 FIELD DIMENSIONS

- A. General contractor shall field confirm bent locations, dimensions and elevations shown on shop drawings prior to fabrication.

3.5 INSTALLATION

- A. Erection: Set roof support frames (bents) into pockets provided in top of footings; set to required elevations, align, plumb and level; and grout in place with 2,000 p.s.i. portland cement grout. Assure that grout fills all voids and "keys" to columns. Fill downspout units with grout to bottom of discharge level. Install aluminum deflectors after grouting. Follow manufacturer's instructions. Match to finish and elevation of adjacent sidewalks.

- B. Install roof deck sections, accessories and related flashing in accordance with manufacturer's instructions. Provide roof slope for rain drainage without ponding water. Align and anchor roof deck units to structural support frames.
- C. Assemble all components in a neat, workmanlike manner.

3.6 FLASHING

- A. Flashings: Flashings required between covered walkway system and adjoining structures are not work of this section. Refer to "Sheet Metal Flashing and Trim", Section 07 6200.

3.7 CLEANING AND PROTECTION

- A. Damaged Units: Replace roof deck panels and other components of the work which have been damaged or have deteriorated beyond successful minor repair.
- B. Cleaning: Remove protective coverings at time in project construction sequence which will afford greatest protection of work. Clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.
- C. Protection: Advise subcontractor of protection and surveillance procedures to ensure that work of this section will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 10 8000 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes toilet and bath accessory items as scheduled, including privacy curtains and curtain rods for bunk rooms.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specifications Sections.
- B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.
- C. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.
- D. Maintenance instructions including replaceable parts and service recommendations.

1.4 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.

1.5 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Specifications are based upon products by Bobrick Washroom Equipment, Inc. unless noted otherwise. Subject to compliance with requirements, equivalent toilet accessories by one of the following manufacturers are also acceptable:
 - 1. A & J Washroom Accessories.
 - 2. American Specialties, Inc.
 - 3. Bradley Corporation.
 - 4. McKinney/Parker.

2.2 MATERIALS, GENERAL

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034 inch minimum thickness.
- B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16 (ASTM B 16M); Castings, ASTM B 30.
- C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366 (ASTM A 366M), 0.04 inch minimum. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 527 G60 (ASTM A 527M Z180).
- E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B456, Type SC 2.
- F. Mirror Glass: Nominal 6.0 mm thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.
- G. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.3 PAPER TOWEL DISPENSERS (PTO)

- A. Surface-Mounted Towel Dispensers: Fabricate of stainless steel with hinged front equipped with tumbler lockset. Provide pierced slots at sides as refill indicator.
 - 1. Capacity: Not less than 400 C-fold or 525 multi-fold paper towels without need for special adapters.
 - 2. Product: Bobrick "Model B-262."

2.4 TOILET PAPER DISPENSERS (TPD)

- A. Double-Roll Dispenser and utility shelf: Size to accommodate two separate rolls of core type tissue up to 5-1/2-inch diameter roll.
 - 1. Fabrication: Chrome-plated plastic spindles with heavy duty internal springs, with type-304 satin-finished, stainless steel brackets designed for surface mounting. Unit includes 16D wide by 5" deep stainless steel shelf with %n return edges, satin finish.

2. Product: Bobrick "B-2840:
- 2.5 GRAB BARS (GB)
- A. Stainless Steel Type: Provide grab bars with wall thickness not less than 18 gage (.050 inch) and as follows:
1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
 2. Clearance: 1-1/2 inches clearance between wall surface and inside face of bar.
 3. Gripping Surfaces: Smooth satin finish.
 4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.
 5. Product: Bobrick's "Series B-6806", for 36 inch (GB-36) and 42 inch (GB-42) lengths at toilet stall/room locations as shown. Bobrick's series B-6806," for 24 " and 48" units at shower stall locations as shown.
- 2.6 MIRROR UNITS (MIR)
- A. Stainless Steel Framed Mirror Units: Fabricate frame with angle shapes of not less than 18 gage (.050 inch), with square comers mitered, welded, and ground smooth. Provide in No. 4 satin polished finish. Mirror to be 1/4" tempered glass guaranteed against silver spoilage for 15 years.
1. Product: Bobrick "Model B-2908-1836" (for toilet rooms).
- 2.7 STAINLESS STEEL SHELF (SSS)
- A. Stainless Steel Shelf: 6" wide by 16" long, 18-gauge, type 304 stainless steel, satin finish, 3/4" return edge; front edge hemmed. Two 16-gauge brackets.
1. Product: Bobrick "Model B-296".
- 2.8 SHOWER CURTAIN RODS (SCR) AND BUNK CURTAIN RODS (BCR)
- A. Stainless Steel, heavy duty type: 1" outside diameter; 18-8, type 304, 20 gage tubing with satin finish. Flanges shall be 20 gage stainless steel with satin finish.
1. Product; Bobrick "Model B-6107"
- 2.9 ANTIBACTERIAL SHOWER CURTAIN (SC)
- A. Antibacterial Shower Curtain: 72-inch wide by 72-inch-high, 10-ounce, nylon-reinforced, antibacterial vinyl fabric with hemmed edges. Fabric to be flame proof, stain-resistant and self-deodorizing, with stainless steel grommets at minimum 6 inches o.c. through top hem. Furnish in color as selected by Architect. Provide one per shower stall.
1. Product: A & J "Model 250A".
 2. Shower Hooks: Provide stainless steel hooks in quantity required by number of eyelets in curtains; A & J "Model UX169 Curtain Ring."
- 2.10 BUNK CURTAIN AND HOOKS (BC)
- A. A. Curtain fabric shall be Trevira or Avera polyester, flame-retardant, machine-washable curtain, 54" wide by 76" high, as manufactured by Knoll Textiles-Healthcare Cubicle Fabric. Pattern shall be "Water's Edge," or "Orchard," in color to be selected by Architect. Hiles Curtain Specialties is an acceptable fabricator (813) 886-5464.
- B. Curtain Hooks: Provide stainless steel hooks in quantity required; A&J "Model UX169 Curtain Ring."
- 2.11 SOAP DISH (SOSH)
- A. Soap dish is furnished as an accessory with the hand-held shower. Refer to Plumbing Fixture Schedule on drawings.
- 2.12 ROBE HOOK (RH)
- A. Surface-Mounted Hat and Coat Hook: Heavy-duty satin-finished stainless steel hook welded to rectangular flange and support arm with backplate for concealed mounting.
1. Product: Bobrick "Model B-6727".
- 2.13 STAINLESS STEEL HOOK STRIP (HS)
- A. Wall mounted, three-hook unit with hooks secured to 18 gauge, 4 inch high by 24 inch long satin-finished stainless steel mounting strip.
1. Product: Bobrick "Model B-232 x 24" with three hooks at all bunk rooms and toilet rooms.
 2. Product: Bobrick "Model 8-232 x 36" with four hooks at Corridor XXX where indicated on drawings.
- 2.14 STAINLESS STEEL TOWEL BAR (TB)
- A. A Stainless steel, surface-mounted towel bar with 18 inch long, 1/2" square tubing bar attached to rectangular flanges and support arms with concealed wall plates; satin-finish.
1. Product: Bobrick "Model B-6737 x 18".

2.15 MOP AND BROOM HOLDER/UTILITY SHELF (MBH)

- A. Combination unit with 0.05-inch (18 gage), Type 304, stainless steel shelf with 1/4-inch returns, 0.062-inch (16 gage) support brackets for wall mounting. Provide 0.062-inch (16 gage) stainless steel hooks for wiping rags on front of shelf, together with spring-loaded, rubber hat, cam-type mop/broom holders; 1/4 inch diameter stainless steel drying rod suspended beneath shelf. Provide unit 36 inches long and complete with three mop/broom holders and two hooks.
 - 1. Product: Bobrick "Model 8-224 x 36".

2.16 FABRICATION

- A. General: Only a maximum 1-1/2 inch diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.
- C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when units closed.
- D. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:
 - 1. Provide galvanized-steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- E. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theft proof installation, as follows:
 - 1. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
- F. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 466.

3.2 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION

SECTION 12 4910 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. This Section includes aluminum mini blinds for installation at all exterior windows.
- 1.3 SUBMITTALS
 - A. General: Submit each item in this Article according to the Conditions of the Contract.
 - B. Product Data: Include printed data on physical characteristics, including slat metal thickness.
 - C. Shop drawings showing location and extent of blinds. Show installation details at and relationship to adjoining work. Include elevations indicating blind units. Indicate location of blind controls.
 - D. Samples for initial selection in the form of manufacturer's color deck of actual slats showing the full range of colors available.
 - E. Maintenance data for horizontal louver blinds to include the following:
 - 1. Methods for maintaining horizontal louver blinds and finishes.
 - 2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance.
- 1.4 QUALITY ASSURANCE
 - A. Fire-Test-Response Characteristics: Provide horizontal louver blinds identical to those tested for the following fire-test-response characteristics as determined by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Test Methods: NFPA 701.
 - 2. Rating: Pass.
- 1.5 PROJECT CONDITIONS
 - A. Field Measurements: Check actual horizontal louver blind dimensions by accurate field measurements before fabrication, and show recorded measurements on final shop
 - B. drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
 - C. Space Enclosure and Environmental Limitations: Do not install horizontal louver blinds until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Springs Window Fashions Division, Inc., "Bali S 3000"
 - 2. Hunter Douglas, Inc., "Lightlines" Blinds.
 - 3. Levolor Corp., "Mark i 1" with Lightmaster feature.
- 2.2 HORIZONTAL LOUVER BLINDS
 - A. Louvers: Manufacturer's 1" wide aluminum slats, unperforated:
 - 1. Privacy slat design for enhanced light control with hidden cord holes.
 - 2. Minimum Thickness: .008 inches
 - 3. Profile: crowned.
 - 4. Braided ladder spacing: 18.0mm
 - B. Tilt Operation: Manual with wand.
 - 1. Length of Tilt Control: 3/4 length of blind.
 - 2. Position of Tilt Control: Left side, unless otherwise indicated.
 - 3. Tilt: Full.
 - C. Cord-Lock Operation: Cord Jock; locks pull cord to stop blind at any position in ascending or descending travel.
 - 1. Position of Cord Lock: Right side, unless otherwise indicated.
 - D. Cord Equalizers: Self-aligning to maintain horizontal louver blind position.
 - E. Valance: Match color of louvers.
 - F. Headrail: 1" high x minimum 1-1/2" wide.
 - G. Provide light-blocking lip at lower rear of headrail.
 - H. Mounting: End at each single window. At windows 6 feet wide and larger, mounting shall be at ends and window opening head as required for installation of a pair of blinds at each window.

- I. Colors and Patterns: Where manufacturer's standard products are indicated, provide horizontal louvers complying with the following requirements.
 1. Provide Architect's selections from manufacturer's full range of colors.

2.3 FABRICATION

- A. Product Standard and Description: Comply with AWCMA Document 1029 for each horizontal louver blind unit consisting of louvers, rails, cord locks, tilting mechanisms, tapes, and installation hardware.
- B. Lifting and Tilting mechanism: Noncorrosive, self-lubricating materials.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 degrees F.
 1. Blind Units Installed Between (Inside) Jambs: Width equal to 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch, less than jamb to jamb dimension of opening in which each blind is installed. Provide 1/2 inch clearance between each pair of blinds. Length equal to 1/4 inch, plus or minus 1/8 inch, less than head to sill dimension of opening in which each blind is installed.
- D. Installation Fasteners: Not less than 2 fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; support blind units under conditions of normal use.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of horizontal louver blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install blinds level, plumb, and located so exterior louver edges in any position are not closer than 1 inch to interior face of glass lites.
- B. Jamb Mounted: Install headrail flush with face of opening jamb and head.

3.3 ADJUSTING

- A. Adjust components and accessories for proper operation.

3.4 CLEANING

- A. Clean blind surfaces, according to manufacturer's instructions, after installation.
- B. Remove surplus materials, packaging, rubbish and debris resulting from installation. Leave installation areas neat, clean, and ready for use.

3.5 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensure that horizontal louver blinds are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 22 0000 - PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Work herein shall conform to all applicable laws, ordinances, and to regulations of the local utility companies. The general conditions and all requirements of the contract documents shall apply to all work of this section. Work shall be in accordance with the requirements of:
 - 1. Florida Building Code (FBC) 6th Edition (2017): This code includes the 2017 FBC Building, Mechanical, Plumbing, Energy Conservation, Fuel Gas, Accessibility, and Test Protocols volumes. Further, see "Referenced Standards" in the FBC Building Chapter 35; FBC Mechanical Chapter 15; FBC Plumbing Chapter 14; FBC Energy Conservation Chapter 6; and FBC Fuel Gas Chapter 8) (Effective December 31, 2017).
 - 2. 6th Edition of the Florida Fire Prevention Code (FFPC): This code also includes the Florida versions of NFPA 1 and NFPA 101. (Effective December 31, 2017).
 - 3. 2014 National Electric Code.
 - 4. State of Florida, Department of Environmental Regulation Rules
 - 5. Florida Accessibility Code for Building Construction
 - 6. Florida Energy Efficiency Code for Building Construction
 - 7. Local Utility Codes
- B. Cooperate with all other trades and install work as fast as the progress of the job will permit.
- C. Use only mechanics skilled in the work they are to perform and have a competent representative on the job when any work is being done.
- D. No work shall be done unless the Superintendent of the Contractor is on the job site. Work shall be properly protected, all rubbish removed promptly, and exposed work shall be carefully cleaned prior to final acceptance.
- E. The term "provide" shall include labor, materials, and equipment necessary to furnish and install, complete and operable, the item or system indicated.
- F. In decisions arising from discrepancies, interpretation of Drawings and Specifications, substitutes, and other pertinent matters, the decision of the Owner's representative's approval shall be final.

1.2 SPECIFICATIONS AND DRAWINGS

- A. Plans show location of fixtures and equipment and are intended to depict the general intent of the work in scope, layout and quality of workmanship. They are not intended to show in minute detail every or all accessories intended for the purpose of executing the work, but it is understood that such details are a part of this work.
- B. Where Drawings and Specifications conflict, it shall be the responsibility of this Contractor to bring such conflict to the attention of the Architect/Engineer for clarification. Refer to Supplementary Conditions, Paragraph 1.2. In general, the Architectural Drawings shall take precedence over the Plumbing Drawings with reference to building construction. All changes from the Drawings necessary to make the work conform with the building as constructed and to fit the work of other trades or to conform to the rules of authorities having jurisdiction, shall be made by the Contractor at his own expense.
- C. Keep a record of the locations of concealed work and of any field changes in Contract Drawings and Specifications for each trade and, upon completion of the job. Refer to Specification Section - Contract Closeout for requirements.

1.3 PERMITS, FEES AND INSPECTIONS:

- A. The Contractor shall give all necessary notices, obtain all permits and pay all government fees in accordance with the Supplementary Conditions, sales taxes and other costs, including utility connections or extensions, in connection with this work; file all permit applications required by all governmental departments having jurisdiction.
- B. Obtain all required certificates of inspection for work and deliver them to the Owner before requesting acceptance and final payment for the work.
- C. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations.
- D. The Contractor shall inform the Owner of any work or materials which conflict with any of the applicable codes, standards, laws and regulations before submitting his bid.

1.4 GENERAL

- A. Materials or products specified herein and/or indicated on drawings by trade name, manufacturer's name and/or catalog number shall be provided as specified. Substitutions will not be permitted except as described herein and in the Supplementary and General Conditions.

- B. Since manufacturers reserve the right to change their products at any time, contractors shall verify all dimensions, performance data, etc. for each piece of equipment submitted to assure compliance with the intent of the drawings and specifications.
- C. All materials shall be new and of quality as specified, and when required, be clearly labeled and/or stamped as manufactured in the United States.
- D. Where an accepted substitution or deviation requires different quantity or arrangement of foundations, supports, ductwork, piping, wiring, conduit, and any other equipment or accessories normal to this equipment, contractor shall furnish said changes and additions and pay all costs for all changes and additions to his work and the work of others affected by this substitution or deviation.
- E. Deviations mean the use of any listed approved manufacturer other than those on which the drawings are based.

1.5 SHOP AND ERECTION DRAWINGS AND SAMPLES

- A. The Architect/Engineer's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site. Submittals shall be made for all equipment and systems as indicated in the respective specification section.
- B. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Architect/Engineer to ascertain that the proposed equipment and materials comply with specification and drawing requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- C. Shop and erection drawing submittals shall conform to the requirements of the General Conditions and Division 00 specifications except as modified herein.
- D. Submit required and/or requested shop and erection drawings, for review by Architect/Engineer before ordering or installing any equipment or material. Equipment or material ordered or installed before Architect/Engineer review may not be accepted and may have to be removed from the project if deemed unacceptable.
- E. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs, including descriptive literature which shall clearly indicate the construction, material, physical dimensions, wiring diagrams and complete operating data clearly marked for each item. Data of general nature will not be accepted.
- F. Shop drawings on paper larger than 11"x17" shall be submitted in the form of one set of reproducible (vellum) and one set of blueprints. The blueprints will be retained by the engineer and the reproducible will be returned to the contractor. All drawings are to be submitted no later than 60 days after the contract has been awarded.
 - 1. Coordination drawings shall show major elements, components, and systems of mechanical equipment and materials in relationship with other building components. Prepare drawings to an accurate scale of 1/4"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.
- G. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval. Submittals shall be submitted for all applicable products and materials specified in each individual section of these specifications.
- H. Make submittals for the equipment and materials in accordance with the following:
 - 1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
 - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 - 3. The submittals shall include the following:
 - a. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required. Provide any additional information specifically requested in the individual specification section or on the drawings.
 - b. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
 - 4. Electronic PDF submittal files shall be named utilizing the specification number followed by a sequential number for the submittal made under the given specification number followed by "r#" if it is a resubmittal, and then followed by a brief description of the submitted item.
 - a. The description shall indicate the actual item submitted, shall not be general in nature, and does not have to be that of the specification section heading.
 - b. Using the example, "220519-4r2 Differential Pressure Gauge"; 220519 – Meters and Gauges is the relevant specification, the "4" shows it was the fourth submittal for specification section 220519 02, "r2" shows it was the second resubmittal, and the description indicates what item is submitted.

- c. Each specification item shall be submitted in a separate PDF file. PDF files with multiple specification items will be returned without review.
 - d. Each file shall have sufficient space allowance for the Architects and Engineer's review stamp(s).
 - e. Each file shall have the Constructors Managers review stamp(s) and indicate information required by specification 220000.1.5.K.
 - I. Shop drawings on paper 11"X17" or smaller in size shall be submitted in a tabbed and indexed three ring binder. The binder shall not exceed 11-5/8" height. Partial submittals are unacceptable. The index shall indicate the related specification section number.
 - J. A Fee will be charged for Engineering review of drawings received after the time allotted as described in "F" above or for plans that have been rejected two or more times due to non-compliance or incompleteness. The fee will be determined by the Architect/Engineer and will accompany the re-submittal in the form of a cashiers check or money order made payable to the Engineer.
 - K. The Construction Manager will certify that all Division 22 shop drawings are in conformance with the plans and specifications. Deviations from the plans and specifications shall be noted, and the specific area of the deviation clouded and in contrasting color (green) with a complete explanation for the reasons for the deviation. Any redesign of the system shall be Certified by a Professional Engineer currently registered in the State of Florida, and will be accompanied by the fees as described in "J" above.
 - L. Carefully examine all shop drawings and mark-up as necessary before submitting to the Architect/Engineer for review. The consultant will only consider shop drawings bearing the contractor's stamp of approval.
 - M. The engineer's review shall not relieve the contractor from the responsibility for deviations from drawings and specifications. The engineer's review shall be construed to apply only to general arrangement and shall not relieve the contractor from the responsibility for the correctness of details and dimensions and provision of the correct equipment.
 - N. The contractor shall retain copies of all reviewed shop drawings on the job site for reference.
 - O. In addition to the requirement of SUBMITTALS, the Owner reserves the right to request the manufacturer to arrange for the Owner's representative(s) to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.
 - P. Operation and Maintenance Manuals:
 - 1. Maintenance manuals shall be complete and shall be furnished in a loose leaf binder or in the manufacturer's standard binder. Information shall be sufficient to enable a qualified technician to perform normal first line maintenance and repair. A parts list shall be included which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
 - 2. Operation manuals shall be clear and concise and shall describe, in detail, the information required to properly operate the equipment specified. The manuals shall include complete catalog cuts and as-built wiring diagrams.
 - 3. Operation and maintenance manuals shall be submitted for approval prior to final close-out.
- 1.6 EXPERIENCE
- A. The Contractor performing this work shall be a licensed, reputable firm, regularly performing the type of work incorporated in this project and who also maintains, as part of the firm, a service department with qualified personnel who regularly perform this type of work. The Contractor shall, upon request, show evidence of at least two jobs of similar character and size installed within the preceding two years.
- 1.7 COORDINATION WITH OTHER TRADES
- A. Contractor shall coordinate his work with other trades to avoid interferences and delays. He shall assist in working out space requirements to make a satisfactory installation.
 - B. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with the work of other trades, he shall make the necessary changes in his work to correct the condition without extra charge.
 - C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.
- 1.8 STORAGE OF MATERIALS
- A. All materials stored on site shall be properly protected from injury or deterioration. Materials shall not be stored in contact with ground or floor.
 - B. Do not remove manufacturer's packing materials until ready to install. Materials showing signs of corrosion, improper handling or storage shall be replaced at no cost to the Owner.
 - C. Provide continuous protection for all equipment already installed.
- 1.9 CUTTING, PATCHING, EXCAVATION, BACKFILL, AND LAYOUT
- A. Provide openings and excavation required for the installation of the work. Patch work and backfill as required. Finished work shall match the existing adjoining work.

- B. Verify all conditions affecting the work to be performed under this contract.
- C. Carefully verify measurements at the site, determine the exact location of chases and openings required. Provide sleeves, inserts, and hangers as required. No columns, beams, joists, building foundations or any other structural building component shall be cut, drilled or disturbed in any way. Conflicts shall immediately be brought to the attention of the Architect/Engineer.
- D. All excavation on sites containing existing buildings and existing services shall be done with hand shovel to avoid damage to existing services. Any damage incurred by the Contractor shall be repaired by the Contractor in a manner approved by the Architect/Engineer at no cost to the Owner and with no extension of time limitation.

1.10 REMOVAL OF RUBBISH

- A. Contractor shall keep premises free from accumulations of waste material or rubbish caused by his employees or work in accordance with Specifications Section - Construction Procedures. At completion of work, the Contractor shall remove all his tools, scaffolding, surplus materials, and rubbish from building and site. He shall leave premises and his work in a clean orderly condition acceptable to the General Contractor.

1.11 ELECTRICAL WORK FOR PLUMBING SYSTEMS

- A. Factory installed starters, controllers, and control equipment mounted in manufactured Plumbing equipment necessary for Plumbing equipment operation shall be furnished under Division 22 Plumbing.
- B. Power wiring for motors and installation of starters shall be under Division 26 Electrical.
- C. Motors shall be furnished under Division 22 Plumbing of capacity required to operate equipment specified, but shall not be less than that specified.
- D. Furnish and install all low voltage (120V and under) wiring for equipment provided under this division.
- E. Provide conduit when required for control wiring.

1.12 MOTORS

- A. All motors shall be furnished and installed under Division 22 Plumbing and shall be wired under Division 26 Electrical.
- B. All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards. All general purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. Motors shall be rated explosion proof when located in hazardous atmospheres. Type II weather protected motors may be used in lieu of TEFC motors on roof mounted fan units and similar equipment.
- C. Unless indicated otherwise, motors shall be NEMA Design B with a service factor of 1.15 with total temperature rise of 90 degrees C. (resistance measured) in 40 degrees C. ambient when powered from the system voltage feeding the motor. TEFC motors shall have a service factor of 1.00 with total temperature rise of 80 degrees C. in the above conditions. Motors located in areas exceeding 40 degrees C. ambient shall be factory rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Design N split phase induction motors with built-in thermal protectors. Single phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors. Single phase motors of 1/10 HP or less may be shaded pole induction motors.
- D. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, he shall first inform the Architect/Engineer of the change and shall then coordinate the change and shall pay all additional charges in connection with the change.
- E. All motors supplied on this project three (3) HP and larger shall have a power factor not less than 85 percent under rated load conditions. Power factor of less than 85 percent shall be corrected to at least 90 percent under rated load conditions. Power factor corrective devices, installed to comply with this Code, shall be switched with the utilization equipment.
- F. All motors supplied on this project shall be energy efficient. All efficiency testing and labeling shall be performed in accordance with the NEMA Standard MG 1-12.54 and IEEE 112 Test Standard, Method B. Minimum efficiencies shall conform to the following listing:

Motor HP	Efficiency (%)
3/4	80.0
1	84.0
1-1/2	85.5
2	86.5
3	88.5
5	88.5

7-1/2	90.2
10	90.2
15	91.7
20	92.4

1.13 QUIET OPERATION AND VIBRATION

- A. All equipment provided under this section shall operate under all conditions of load free of objectionable sound and vibration. Sound and vibration conditions considered objectionable shall be corrected in an approved manner.
- B. Vibration and sound control shall be by means of approved vibration eliminators or sound attenuators in a manner as specified and as recommended by the manufacturer.

1.14 EQUIPMENT IDENTIFICATION

- A. Each unit shall be identified by its system number and other appropriate designation by labels in letters of approved size and wording. Equipment requiring identification shall include: pumps, piping, control cabinets, and other equipment units as may be directed by the Architect/Engineer.

1.15 CLEANING AND ADJUSTMENTS

- A. Upon completion of the work, Contractor shall clean and lubricate fans, motors, and other running equipment and apparatus which he has installed and make certain such apparatus and mechanisms are in proper working order and ready to test.
- B. Scratched or damaged painting shall be touched up as necessary to return the painting to "new" condition and appearance.
- C. All piping and equipment shall be thoroughly blown out under pressure and cleared of all foreign matter, wasting air, gas or water through temporary connections as long as necessary to thoroughly clean system before system is placed in operation. Use every precaution to prevent pipe compound, scale, dirt, welding and other objectionable matter from getting into the piping system and equipment.
- D. During blow out period, baskets from strainers shall be removed, traps and control valves, etc., shall be by-passed.
- E. All cleaning shall be done prior to any sterilization, pressure testing, flow balancing or equipment adjustment procedures.
- F. During construction protect all piping and equipment from damage and dirt. Cap the open ends of all piping and equipment.

1.16 WATERPROOFING

- A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Owner before the work is done.
- B. Provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight. Waterproof flashing materials shall be compatible with base materials.

1.17 TESTS

- A. Contractor shall make all tests required to establish the adequacy, quality, safety, completed status and satisfactory operation of all systems to the satisfaction of the Architect/Engineer. Provide all instruments, labor and services necessary to conduct tests.

1.18 INSTRUCTIONS

- A. Fully instruct Owner's personnel in the care and operation of Plumbing systems and furnish a letter to the Architect/Engineer advising the particular person who has received such instruction.

1.19 GUARANTEE

- A. Equipment shall be started, tested, adjusted, and placed in satisfactory operating condition. Furnish a letter addressed to the Architect/Engineer advising that the completed systems have been installed in accordance with the Plans and Specifications and that they are in proper operating condition. The Owner shall receive a written guarantee covering all defects in workmanship and material for a period of one year from date of final acceptance. Any defects appearing within this year period shall be repaired without additional cost to the Owner.

1.20 FACILITY STARTUP BROCHURE

- A. At the completion of work, Contractor shall provide startup instruction in accordance with the General Specifications sections and shall submit a bound brochure containing the following:
 - 1. Shop Drawings
 - 2. Maintenance Manuals
 - 3. Control Wiring and Piping Diagrams
 - 4. Operating Instructions

5. Copy of Guarantee
 6. Certificate of Instruction of Owner's Representative
 7. Certificate of Job Completion
 8. Record Documents
- B. Where projects are of sufficient size to make a single brochure impractical, several brochures shall be prepared by trade and As-Built Drawings may be submitted as a separate item.
- C. Brochure shall be indexed and divided for reasonable clarity.
- D. Brochure shall be turned over to the Architect/Engineer for review and approval. The contractor shall make modifications to the brochure as deemed necessary for compliance and clarity, by the Architect/Engineer, and resubmit the final brochure to the Architect/Engineer to be forwarded to the Owner.

END OF SECTION

SECTION 22 0553 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
 - B. This section is a Division-22 Basic Plumbing Materials and Methods section, and is part of each Division-22 section making reference to identification devices specified herein.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of plumbing identification work required by this section is indicated on drawings and/or specified in other Division-22 sections.
 - B. Types of identification devices specified in this section include the following:
 - 1. Painted Identification Materials.
 - 2. Plastic Pipe Markers.
 - 3. Plastic Tape.
 - 4. Valve Tags.
 - 5. Engraved Plastic-Laminate Signs.
 - 6. Plastic Equipment Markers.
 - 7. Plasticized Tags.
 - C. Plumbing identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division-22 sections.
 - D. Refer to Division- 23 section for identification requirements of HVAC work; not work of this section.
 - E. Refer to Division-26, 27 and 28 sections for identification requirements of electrical work; not work of this section.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - B. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

PART 2 - PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS:
 - A. Manufacturer: Subject to compliance with requirements, provide plumbing identification materials of one of the following, or approved equal:
 - 1. Allen Systems, Inc.
 - 2. Brady (W.H.) Co.; Signmark Div.
 - 3. Industrial Safety Supply Co., Inc.
 - 4. Seton Name Plate Corp.
- 2.2 PLUMBING IDENTIFICATION MATERIALS:
 - A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than a single type is specified for application, the selections are the Installer's option, but provide single selection for each product category.
- 2.3 PLASTIC PIPE MARKERS:
 - A. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1.
 - B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125oF (52oC) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
 - C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - 1. Adhesive lap joint in pipe marker overlap.
 - 2. Laminated or bonded application of pipe marker to pipe (or insulation).

3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".
 - D. Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.
 - E. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.
- 2.4 PLASTIC TAPE:
- A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
 - B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.
 - C. Color: Comply with ANSI A13.1, except where another color selection is indicated.
- 2.5 VALVE TAGS:
- A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
 1. Provide 1-1/2" diameter tags.
 2. Fill tag engraving with black enamel.
 - B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
 - C. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.
- 2.6 ENGRAVED PLASTIC-LAMINATE SIGNS:
- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 - B. Thickness: 1/8".
 - C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- 2.7 PLASTIC EQUIPMENT MARKERS:
- A. General: All plumbing equipment, starters, etc. shall be identified with Bakelite laminate labels with 1" high minimum letters. Conform to the following color code:
 1. Green: Cooling equipment and components.
 2. Yellow/Green: Combination cooling and heating equipment and components.
 3. Blue: Equipment and components that do not meet any of the above criteria.
 - B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 1. Name and plan number.
 2. Equipment service.
 3. Design capacity.
 4. Other design parameters such as pressure drop, entering and leaving conditions, rpm, etc.
 - C. Size: Provide approximate 2-1/2" x 4" markers for control devices, dampers, and valves; and 4-1/2" x 6" for equipment.
- 2.8 PLASTICIZED TAGS:
- A. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matte finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).
- 2.9 LETTERING AND GRAPHICS:
- A. General: Coordinate names, abbreviations and other designations used in plumbing identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of plumbing systems and equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS:

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting, or other coverings or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPING SYSTEM IDENTIFICATION:

- A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
 - 1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.
- B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - 1. Near each valve and control device.
 - 2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - 3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 - 4. At access doors, manholes, and similar access points which permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
 - 7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.3 VALVE IDENTIFICATION:

- A. General: Provide valve tag on every valve, cock, and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibbs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
- B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.
 - 1. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

3.4 PLUMBING EQUIPMENT IDENTIFICATION:

- A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 - 1. Main control and operating valves.
 - 2. Meters, gages, thermometers, and similar units.
 - 3. Pumps and similar motor-driven units.
 - 4. Fans, blowers, primary balancing dampers and mixing boxes.
- B. Lettering Size: Provide a minimum of 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
- C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- D. Optional Use of Plasticized Tags: Where equipment to be identified is concealed above acoustical ceiling or similar concealment, plasticized tags may be installed within concealed space to reduce amount of text in exposed sign (outside concealment). For equipment located above the ceiling, in addition to a label on the device, labels are to be permanently affixed to the ceiling grid as near to the item as possible using epoxy glue. Where hard ceilings are used, the label is to be affixed to the frame of the access panel for the unit. Labels are to be black core white or beige Bakelite. The lettering is to be 3/8" inches high. The minimum label size is 3/4" wide by 2" long. Variable air volume boxes and powered induction units shall be identified as follows (VAV Unit #- Floor # - Unit #), (example VAV-3-5- 7). The thermostat that controls each variable air volume box, powered induction unit or fan coil unit shall be identified with an identical but appropriately sized label. Labels for other typed of equipment are to identify the item and designation.

3.5 ADJUSTING AND CLEANING:

- A. Adjusting: Relocate any plumbing identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION

SECTION 22 0719 - PLUMBING INSULATION

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
 - B. Division 22 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of plumbing insulation required by this section is indicated on drawings and schedules, and by requirements of this section.
 - B. Types of plumbing insulation specified in this section include the following:
 - 1. Piping System Insulation:
 - a. Fiberglass
 - b. Flexible Unicellular.
 - C. Refer to Division-22 section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.
 - D. Refer to Division-22 section "Plumbing Identification" for installation of identification devices for piping, ductwork, and equipment; not work of this section.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
 - B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with plumbing insulations similar to that required for this project.
 - C. Flame/Smoke Ratings: Provide composite plumbing insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
 - D. Exception: Outdoor plumbing insulation may have flame spread index of 75 and smoke developed index of 150.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of plumbing insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each plumbing system requiring insulation.
 - B. Maintenance Data: Submit maintenance data and replacement material lists for each type of plumbing insulation. Include this data and product data in maintenance manual.
- 1.5 DELIVERY, STORAGE, AND HANDLING:
 - A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
 - B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS:
 - A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corp.
 - 3. Knauf Fiber Glass GmbH.
 - 4. Manville Products Corp.
 - 5. Owens-Corning Fiberglas Corp.
 - 6. Pittsburgh Corning Corp.
 - 7. Rubatex Corp.
- 2.2 PIPING INSULATION MATERIALS:
 - A. Fiberglass Piping Insulation: ASTM C 547, Class 1.
 - B. Flexible Unicellular Piping Insulation: ASTM C 534, Type I.
 - C. Jackets for Piping Insulation: ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.

- D. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
- E. Encase exterior piping insulation and piping insulation in mechanical rooms up to 6 feet above the floor with aluminum jacket. Aluminum jackets shall cover all fittings and valves for 100% coverage. PVC fitting covers are not permissible in these locations.
- F. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- G. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which plumbing insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PLUMBING PIPING SYSTEM INSULATION:

- A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, and pre-insulated equipment.
- B. Hot Piping:
 - 1. Application Requirements: Insulate the following hot plumbing piping systems:
 - a. Potable hot water piping.
 - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 1" thick for pipe sizes up to and including 6".
- C. Cold Equipment (Below Ambient Temperature):
 - 1. Application Requirements: Insulate the following cold equipment:
 - a. Cold equipment, including chillers, tanks, valve bodies, strainers and pumps.
 - b. Drip pans under chilled equipment.
 - c. Cold and chilled water pumps.
 - d. Roof drain bodies.
 - 2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
 - a. Cellular Glass: 3" thick for surfaces above 35°F (2°C) and 4- 1/2" thick for surfaces 35°F (2°C) and lower (cold and chilled water pumps, expansion tanks, and air and solids separators).
 - b. Flexible Unicellular: 1" thick (roof drain bodies and drip pans).

3.3 INSTALLATION OF PIPING INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
- F. Cover valves, fittings, and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise indicated.
- H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.4 INSTALLATION OF DUCTWORK INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.

- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.
- F. Corner Angles: Install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.5 INSTALLATION OF EQUIPMENT INSULATION:

- A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- D. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.
- E. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
- F. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.
- G. Do not insulate hand holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- H. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames, and accessories.
- I. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by manufacturer.

3.6 PROTECTION AND REPLACEMENT:

- A. Replace damaged insulation which cannot be satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 22 1010 - PLUMBING VALVES

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
 - B. This section is a Division 22 Basic Plumbing Materials and Methods section, and is part of each Division 22 section making reference to valves specified herein.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of valves required by this section is indicated on drawings and/or specified in other Division 22 sections.
 - B. Types of valves specified in this section include the following:
 - 1. Drain Valves.
 - 2. Ball Valves.
 - 3. Swing Check Valves.
 - C. Valves furnished as part of factory-fabricated equipment, are specified as part of equipment in other Division 22 sections.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - B. Valve Types: Provide valves of same type by same manufacturer.
 - C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
 - D. Codes and Standards:
 - E. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
 - F. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing manufacturer's figure number, size, location, and valve features for each required valve.
 - B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

PART 2 - PRODUCTS

- 2.1 VALVES:
 - A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.
 - B. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
 - C. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves, 6" and smaller.
- 2.2 DRAIN VALVES:
 - A. Comply with the following standards:
 - 1. Water Heater Drain Valves: ASSE 1005.
 - B. Manufacturer: Subject to compliance with requirements, provide globe valves of one of the following:
 - 1. Crane
 - 2. Hammond Valve Corp.
 - 3. Milwaukee
 - 4. Nibco
 - 5. Stockham
- 2.3 BALL VALVES:
 - A. Comply with the following standards:
 - 1. Cast-Iron Valves: MSS SP-72.

- 2. Steel Valves: ANSI B16.34
- B. Manufacturer: Subject to compliance with requirements, provide ball valves of one of the following:
 - 1. Crane
 - 2. Hammond Valve Corp.
 - 3. Milwaukee
 - 4. Nibco
 - 5. Stockham
- 2.4 SWING CHECK VALVES:
 - A. Comply with the following standards:
 - 1. Cast-Iron Valves: MSS SP-71.
 - 2. Bronze Valves: MSS SP-80
 - 3. Steel Valves: ANSI B16.34.
 - B. Manufacturer: Subject to compliance with requirements, provide swing check valves of one of the following:
 - 1. Crane
 - 2. Hammond Valve Corp.
 - 3. Milwaukee
 - 4. Nibco
 - 5. Stockham
- 2.5 VALVE FEATURES:
 - A. General: Provide valves with features indicated and, where not indicated otherwise, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.
 - B. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5, (steel), or ANSI B16.24 (bronze).
 - C. Threaded: Valve ends complying with ANSI B2.1.
 - D. Socket-Welding: Valve ends complying with ANSI B16.11.
 - E. Solder-Joint: Valve ends comply with ANSI B16.18.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Except as otherwise indicated, comply with the following requirements:
 - 1. Install valve where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
 - 2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.
- B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.
- C. Mechanical Actuators: Install mechanical actuators with chain operators where indicated. Extend chains to about 5' above floor and hook to clips to clear aisle passage.
- D. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:
 - 1. Tube Size 2" and Smaller: Soldered-joint valves.
 - 2. Pipe Size 2" and Smaller: One of the following, at Installer's option:
 - a. Threaded valves.
 - b. Butt-welding valves
 - c. Socket-welding valves.
 - d. Flanged valves.
 - 3. Pipe Size 2 1/2" and Larger: One of the following, at Installer's option.
 - a. Grooved-end valves.
 - b. Butt-welding valves.
 - c. Socket-welding valves.
 - d. Flanged valves.
- E. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.
- F. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.
- G. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

H. Fluid Control: Except as otherwise indicated, install ball, and butterfly valves to comply with ANSI B31.9. Where throttling is indicated or recognized as principal reason for valve, install butterfly valves, unless indicated otherwise on the plans.

3.2 INSTALLATION OF CHECK VALVES:

A. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

3.3 ADJUSTING AND CLEANING:

A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

B. Valve Identification: Tag each valve in accordance with Division 21 section "Plumbing Identification".

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.4 VALVE SCHEDULE:

A. General: Provide the following valves for various valve types listed in Division 21, 22, and 23 piping sections.

3.5 DRAIN VALVES:

A. Class 125: Bronze body, screw-in bonnet, rising stem, composition disc, 3/4" hose outlet.

	Threaded Ends	Solder Ends
Hammond:	712	711
Lee:	717-20	717-12
Mansfield:	526.40	526.41
Prier:	C-73ST	C-71ST
Tanner:	806	851

3.6 BALL VALVES:

A. 1" and Smaller: 150 psi, bronze body, standard port, bronze trim, 2-piece construction, TFE seats and seals.

	Threaded Ends	Solder Ends
Conbraco:	70	70
Crane:	2182	2182
Grinnell:	3700	3700-SJ
Jamesbury:	21-1100	-
Jenkins:	900T	902T
Metraflex:	IT	IS
Powell:	4520R20	421OR
Stockham:	S-216BRRT	S-216BRRS
Watts:	B-6000	B-6001

B. 1 1/4" to 2": 150 psi, bronze body, standard port, 3-piece body, TFE seats with bronze trim.

	Threaded Ends	Solder Ends
Conbraco:	82	82
Fairbanks:	0851	-
Nibco:	T-595-Y	S-959-Y
Powell:	4201-R	4201-R
Watts:	B-6800	B-6801

3.7 SWING CHECK VALVES:

A. 2" and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc.

	Threaded Ends	Solder Ends
Crane:	37	1342
Fairbanks:	0640	0680
Grinnell:	3300	3300-SJ
Jenkins:	92-A	1222
Lunkenheimer:	2144	2145
Milwaukee:	509	1509
Nibco:	T-413	S-413

- | | | |
|-----------|--------|---------|
| Powell: | 578 | 1825 |
| Stockham: | B-319 | B-309 |
| Walworth: | 340600 | 3406-SJ |
- B. 2 1/2" and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends.
- | | |
|---------------|---------|
| Crane: | 373. |
| Fairbanks: | 0702. |
| Grinnell: | 6300. |
| Hammond: | IE1124. |
| Jenkins: | 624. |
| Lunkenheimer: | 1790. |
| Milwaukee: | F2971. |
| Powell: | 559. |
| Stockham: | G-931. |
| Walworth: | 8928-F. |
- C. 2 1/2" and Larger; FM: 175 psi, iron body bronze mounted, renewable composition disc and bronze seat ring, bolted cover, flanged ends.
- | | |
|------------|----------|
| Fairbanks: | 0711. |
| Jenkins: | 729. |
| Stockham: | G-940. |
| Walworth: | 8883-LT. |

END OF SECTION

SECTION 22 1060 - PLUMBING PIPES AND PIPE FITTINGS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
 - B. This section is a Division 22 Basic Plumbing Materials and Methods section, and is part of each Division 22 section making reference to pipes and pipe fittings specified herein.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division 22 sections.
 - B. Type of pipes and pipe fittings specified in this section include the following:
 - 1. Steel Pipes.
 - 2. Copper Tube.
 - 3. Cast-Iron Soil Pipes.
 - 4. Plastic Pipes.
 - 5. Miscellaneous Piping Materials/Products.
 - C. Pipes and pipe fittings furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- 1.4 CODES AND STANDARDS:
 - A. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.
 - 1. Certify welding of piping work using Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).
 - B. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.
 - C. NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).
- 1.5 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.
 - B. Welding Certifications: Submit reports as required for piping work.
 - C. Brazing Certifications: Submit reports as required for piping work.
 - D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of the specifications.
- 1.6 DELIVERY, STORAGE, AND HANDLING:
 - A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
 - B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
 - C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

- 2.1 GENERAL:
 - A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.
- 2.2 STEEL PIPES AND PIPE FITTINGS:
- A. Black Steel Pipe: ASTM A53, A106 or A120; except comply with ASTM A53 or A106 where close coiling or bending is required.
 - B. Malleable-Iron Threaded Fittings: ANSI B16.3.
 - C. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass).
 - D. Threaded Pipe Plugs: ANSI B16.14.
 - E. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
 - 1. Material Group: Group 1.1.
 - 2. End Connections: Buttwelding.
 - 3. Facings: Raised-face.
 - F. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.
 - G. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).
- 2.3 COPPER TUBE AND FITTINGS:
- A. Copper Tube: ASTM B88; type (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated.
 - B. Cast-Copper Solder-Joint Fittings: ANSI B16.18.
 - C. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
 - D. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.
- 2.4 PLASTIC PIPES AND PIPE FITTINGS:
- A. Polyvinyl Chloride Pipe (PVC): ASTM D1785.
 - B. Polyvinyl Chloride Drain, Waste, and Vent Pipe (PVC): ASTM D2665.
 - C. Chlorinated Polyvinyl Chloride Pipe (CPVC): ASTM F441.
 - D. PVC Fittings:
 - 1. Schedule 40 Socket: ASTM D2466.
 - 2. Schedule 80 Socket: ASTM D2467.
 - 3. Schedule 80 Threaded: ASTM D2464.
 - 4. DWV Socket: ASTM D2665.
 - 5. Sewer Socket: ASTM D2729.
 - 6. Solvent Cement: ASTM D2564.
 - 7. Solvent Cement (To Join PVC to ABS): ASTM D3138.
- 2.5 GROOVED PIPING PRODUCTS:
- A. General: As Installer's option, mechanical grooved pipe couplings and fittings may be used for piping systems in mechanical equipment rooms having operating conditions not exceeding 230°F (110°C), excluding steam piping and any other service not recommended by manufacturer, in lieu of welded, flanged, or threaded methods, and may also be used as unions, seismic joints, flexible connections, expansion joints, expansion compensators, or vibration reducers.
 - B. Coupling Housings: Malleable iron conforming to ASTM A47 or ductile iron conforming to ASTM A536.
 - C. Coupling Housings Description: Grooved mechanical type, which engages grooved or shouldered pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secure together during assembly with nuts and bolts. Permit degree of contraction and expansion as specified in manufacturer's latest published literature.
 - D. Gaskets: Mechanical grooved coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D2000.
 - E. Bolts and Nuts: Heat-treated carbon steel, ASTM A183, minimum tensile 110,000 psi.
 - F. Branch Stub-Ins: Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts.
 - G. Fittings: Grooved or shouldered end design to accept grooved mechanical couplings.
 - H. Malleable Iron: ASTM A47.

- I. Ductile Iron: ASTM A536.
 - J. Fabricated Steel: ASTM A53, Type F for 3/4" to 1-1/2"; Type E or S, Grade B for 2" to 20".
 - K. Steel: ASTM A234.
 - L. Flanges: Conform to Class 125 cast iron and Class 150 steel bolt hole alignment.
 - M. Malleable Iron: ASTM A47.
 - N. Ductile Iron: ASTM A536.
 - O. Grooves: Conform to the following:
 - 1. Standard Steel: Square cut.
 - P. Manufacturer: Subject to compliance with requirements, provide grooved piping products of one of the following:
 - 1. ITT Grinnell Corp.
 - 2. Stockham Valves & Fittings, Inc.
 - 3. Victaulic Co. of America.
- 2.6 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:
- A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.
 - B. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
 - C. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.
 - D. Tin-Antimony Solder: ASTM B32, Grade 95TA.
 - E. Gaskets for Flanged Joints: ANSI B16.21; full-faces for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.
 - F. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.
 - G. Manufacturer: Subject to compliance with requirements, provide piping connectors of the following:
 - 1. Fernco, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leak proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance.
- B. Comply with ANSI B31 Code for Pressure Piping.
- C. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
- D. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures.

3.2 PIPING SYSTEM JOINTS:

- A. General: Provide joints of type indicated in each piping system.
- B. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- C. Solder copper tube-and fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- D. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.
- E. Weld pipe joints only when ambient temperature is above 0oF (-18oC) where possible.

- F. Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
- G. Use pipe clamps or tack-welded joints with 1" long welds. Use 4 welds for pipe sizes to 10" and 8 welds for pipe sizes 12 "to 20".
- H. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
- I. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
- J. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
- K. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards.
- L. Making Solvent-Cemented Joints: ASTM D2235, and ASTM F402.
- M. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.3 CLEANING, FLUSHING, INSPECTING:

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings. Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
- B. Inspect pressure piping in accordance with procedures of ASME B31.
- C. Disinfect water service piping in accordance with AWWA C601.

3.4 PIPING TESTS:

- A. Test pressure piping in accordance with ASME B31.
- B. General: Provide temporary equipment for testing, including pump and gages. Test piping systems before insulation is installed, wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
- C. Required test period is 24 hours.
- D. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
- E. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- F. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- G. Drain test water from piping systems after testing and repair work has been completed.

END OF SECTION

SECTION 22 1117 - PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
 - B. This section is a Division 22 Basic Plumbing Materials and Methods section, and is part of each Division 22 section making reference to supports and anchors specified herein.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division 22 sections.
 - B. Types of supports and anchors specified in this section include the following:
 - 1. Horizontal-Piping Hangers and Supports.
 - 2. Hanger-Rod Attachments.
 - 3. Building Attachments.
 - 4. Saddles and Shields.
 - 5. Miscellaneous Materials.
 - 6. Anchors.
 - 7. Equipment Supports.
 - C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - B. Codes and Standards:
 - 1. Code Compliance: Comply with Florida Building Code pertaining to product materials and installation of supports and anchors.
 - 2. UL and FM Compliance: Provide products which are UL-listed and FM approved.
 - 3. MSS Standard Compliance:
 - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
 - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - d. Terminology used in this section is defined in MSS SP-90.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.
 - B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

PART 2 - PRODUCTS

- 2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:
 - A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. All steel hangers and supports shall be galvanized steel. Provide copper-plated hangers and supports for copper-piping systems.
 - B. Adjustable Steel Clevis Hangers: MSS Type 1.
 - C. Steel Double Bolt Pipe Clamps: MSS Type 3.
 - D. Steel Pipe Clamps: MSS Type 4.
 - E. Pipe Hangers: MSS Type 5.
 - F. Split Pipe Rings: MSS Type 11.
 - G. Clips: MSS Type 26.
 - H. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast-iron floor flange.
 - I. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base-support and cast-iron floor flange.

2.2 HANGER-ROD ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. Steel Turnbuckles: MSS Type 13.

2.3 BUILDING ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
- B. Concrete Inserts: MSS Type 18.
- C. Top Beam C-Clamps: MSS Type 19.
- D. Side Beam or Channel Clamps: MSS Type 20.
- E. Center Beam Clamps: MSS Type 21.
- F. Steel Brackets: One of the following for indicated loading:
 - 1. Light Duty: MSS Type 31.
 - 2. Medium Duty: MSS Type 32.
 - 3. Heavy Duty: MSS Type 33.

2.4 SADDLES AND SHIELDS:

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
- C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- D. Thermal Hanger Shields: Constructed of 360° insert of high density, 100 psi, water-proofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.
- E. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
 - 1. Elcen Metal Products Co.
 - 2. Pipe Shields, Inc.

2.5 MANUFACTURERS OF HANGERS AND SUPPORTS:

- A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - 1. B-Line Systems, Inc.
 - 2. Carpenter and Patterson, Inc.
 - 3. Corner & Lada Co., Inc.
 - 4. Elcen Metal Products Co.
 - 5. Fee & Mason Mfg. Co.; Div. Figgie International.
 - 6. ITT Grinnel Corp.

2.6 MISCELLANEOUS MATERIALS:

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION:

- A. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies, including (but not limited to) proper placement of inserts, anchors, and other building structural attachments.

- B. Prior to installation of hangers, supports, anchors, and associated work, Installer shall meet at project site with Contractor, installers of other work requiring coordination with work of this section for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.3 INSTALLATION OF BUILDING ATTACHMENTS:

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional anchors for concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.4 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Install hangers, supports, clamps, and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. For exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping, except where otherwise indicated.
- C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- D. Provisions for movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Do not use pipe stands in mechanical equipment rooms.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- H. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - 2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields.
 - 3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.5 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required accommodating both expansion and contraction of piping.

3.6 EQUIPMENT SUPPORTS:

- A. Provide concrete housekeeping bases for all floor-mounted equipment furnished as part of the work of Divisions 22. Size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Provide 6" bases for air handling units. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate stainless steel anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.
- B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.7 ADJUSTING AND CLEANING:

- A. Hanger Adjustments: Adjust hangers so as to distribute loads equally on attachments.
- B. Supports Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 22 1119 - PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
- B. This section is a Division 22 Basic Plumbing Materials and Methods section, and is part of each Division 22 section making reference to piping specialties specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.
- B. Types of piping specialties specified in this section include the following:
 - 1. Pipe Escutcheons
 - 2. Pipeline Strainers
 - 3. Vandal-Proof Vent Caps
 - 4. Dielectric Unions
 - 5. Mechanical Sleeve Seals
 - 6. Fire Barrier Penetration Seals
 - 7. Water Hammer Arresters
 - 8. Drip Pans
 - 9. Pipe Sleeves
 - 10. Sleeve Seals
- C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.

1.3 QUALITY ASSURANCE

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

1.4 CODES AND STANDARDS:

- A. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.
- B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.
- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of the specifications.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

- A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 PIPE ESCUTCHEONS

- A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside the pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
- B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

- C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.
- D. Manufacturer: Subject to compliance with requirements, provide pipe escutcheons of one of the following:
 - 1. Chicago Specialty Mfg. Co.
 - 2. Producers Specialty & Mfg. Corp.
 - 3. Sanitary-Dash Mfg. Co.

2.3 LOW PRESSURE Y-TYPE PIPELINE STRAINERS:

- A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure, with Type 304 stainless steel screens with 3/64" perforations @ 233 per sq.in.
 - 1. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
 - 2. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 - 3. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 - 4. Butt Welded Ends, 2-1/2" and Larger: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 - 5. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.
- B. Manufacturer: Subject to compliance with requirements, provide low pressure Y-type strainers of one of the following:
 - 1. Armstrong Machine Works.
 - 2. Hoffman Specialty ITT; Fluid Handling Div.
 - 3. Metraflex Co.
 - 4. R-P&C Valve; Div. White Consolidated Industries, Inc.
 - 5. Spirax Sarco.
 - 6. Trane Co.
 - 7. Victaulic Co. of America.
 - 8. Watts Regulator Co.

2.4 VANDAL-PROOF VENT CAPS:

- A. General: Provide cast-iron vandal-proof vent caps, full size of base for steel pipes.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering vandal-proof vent caps which may be incorporated in the work include; but are not limited to, the following:
- C. Manufacturer: Subject to compliance with requirements, provide vandal-proof vent caps of one of the following:
 - 1. Josam Mfg. Co.
 - 2. Smith (Jay R.) Mfg. Co.
 - 3. Tyler Pipe; Sub. of Tyler Corp.
 - 4. Zurn Industries, Inc.; Hydromechanics Div.

2.5 DIELECTRIC UNIONS

- A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.
- B. Manufacturer: Subject to compliance with requirements, provide dielectric unions of one of the following:
 - 1. B & K Industries, Inc.
 - 2. Capital Mfg. Co.; Div. of Harsco Corp.
 - 3. Eclipse, Inc.
 - 4. Epco Sales, Inc.
 - 5. Perfection Corp.
 - 6. Rockford-Eclipse Div.

2.6 MECHANICAL SLEEVE SEALS

- A. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
- B. Manufacturer: Subject to compliance with requirements, provide mechanical sleeve seals of one of the following:
 - 1. Thunderline Corp.

2.7 FIRE BARRIER PENETRATION SEALS

- A. Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for Plumbing components such as piping or duct work.
- B. Cracks, Voids, or Holes Up to 4" Diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.
- C. Openings 4" or Greater: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350°F (121 to 177°C), UL-listed.
- D. Manufacturer: Subject to compliance with requirements, provide fire barrier penetration seals of one of the following:
 - 1. Electro Products Div./3M.
 - 2. Nelson; Unit of General Signal.

2.8 WATER HAMMER ARRESTERS:

- A. General: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.
- B. Manufacturer: Subject to compliance with requirements, provide water hammer arresters of one of the following:
 - 1. Amtrol, Inc.
 - 2. Smith (Jay R.) Mfg. Co.
 - 3. Tyler Pipe; Sub. of Tyler Corp.
 - 4. Watts
 - 5. Zurn Industries, Inc.; Hydromechanics Div.

2.9 FABRICATED PIPING SPECIALTIES:

- A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.
- B. Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricated from the following gages: 3" and smaller, 20 gage; 4" to 6" 16 gage; over 6", 14 gage.
 - 2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
 - 3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.
 - 4. Plastic-Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
- C. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:
 - 1. Mechanical Sleeve Seals: Installed between sleeve and pipe.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.
- B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.
 - 1. Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:
 - a. Pumps
 - b. Temperature control valves
 - c. Pressure reducing valves
 - d. Temperature or pressure regulating valves
- C. Vandal-Proof Vent Caps: Install vandal-proof vent caps on each vent pipe passing through roof, and elsewhere as indicated. Locate base of vent cap 6" above roof surface, or higher where required by Code.
- D. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.
- E. Mechanical Sleeve Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

- F. Fire Barrier Penetration Seals: Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions.
- G. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES:

- A. Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.
- B. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish, and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.
 - 1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.
 - 2. Install iron-pipe sleeves at exterior penetrations; both above and below grade.
 - 3. Install steel-pipe or plastic-pipe sleeves except as otherwise indicated.
- C. Sleeve Seals: Install in accordance with the following:
 - 1. Link-Seal or equivalent: Fill and pack annular space between sleeve and pipe with Link-Seal Modular Seals, Model "C" or equivalent.

END OF SECTION

SECTION 22 3330 - PLUMBING EQUIPMENT

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions and Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of plumbing equipment work is indicated on drawings and provisions of this section, including schedules and equipment lists associated with either drawings or this section
 - B. Types of plumbing equipment required for project include the following:
 - 1. Domestic water heaters.
 - a. Electric water heaters.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturers: Firms regularly engaged in manufacturer of plumbing equipment of type and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - B. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.
 - C. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.
 - D. NSF Labels: Provide water heaters which have been listed and labeled by National Sanitation Foundation.
 - E. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.
 - F. Mineral Standards: Provide mineral products for water softeners, acceptable under state and local public health control regulations.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's plumbing equipment specifications, installation and start-up instructions, and capacity and ratings, with selection points clearly indicated.
 - B. Wiring Diagrams: Submit ladder-type wiring diagrams for all components, clearly indicating all required field electrical connections.
 - C. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.
 - D. LEED Submittals:
 - 1. Product Data for Prerequisite EA 2: Provide documentation indicating compliance with ASHRAE/IESNA 90.1, Section 7, "Service Water Heating".

PART 2 - PRODUCTS

- 2.1 RESIDENTIAL ELECTRIC WATER HEATERS:
 - A. General: Provide residential electric water heaters of size, capacity, and electrical characteristics as indicated on schedule. Comply with ANSI/ASHRAE/IES 90A for energy efficiency. Provide UL listing.
 - B. Heater: Working pressure of 150 psi; magnesium anode rod; glass lining on internal surfaces exposed to water.
 - C. Heating Elements: Low watt density with zinc plated copper sheath; double element, non-simultaneous operation.
 - D. Safety Controls: Equip with high temperature cutoff for each element, factory wired.
 - E. Jacket: Equip with full size control compartments with front panel opening. Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with baked enamel finish.
 - F. Warranty: Furnish 5 year limited warranty for tank leakage.
 - G. Accessories: Provide brass drain valve; 3/4" relief valve; cold water dip tube.
 - H. Controls: Provide thermostat for each element, factory wired.
 - I. Manufacturer: Subject to compliance with requirements, provide residential electric water heaters of one of the following:
 - 1. A.O. Smith, Consumer Products Div.
 - 2. Rheem Water Heater Div., City Investing Co.
 - 3. Ruud Water Heater Div., City Investing Co.
 - 4. State Industries.
 - 5. Viking Superior Corp.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRIC WATER HEATERS:

- A. General: Install electric water heaters as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.
- B. Support: Set units on concrete pads, orient so controls and devices needing service and maintenance have adequate access. Level and plumb unit.
- C. Electrical Supply: Furnish wiring diagram to Electrical Installer. Refer to Division 26 for wiring of units; not work of this section.
- D. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union.
- E. Start-up: Start-up, test, and adjust electric water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

END OF SECTION

SECTION 22 4300 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
- B. Division- 22, and 23 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of plumbing fixtures work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of plumbing fixtures specified in this section include the following:
 - 1. Water closets.
 - 2. Urinals.
 - 3. Lavatories.
 - 4. Water coolers.
 - 5. Service sinks.
 - 6. Kitchen Sinks
- C. Refer to Division- 22, and 23 sections for potable water systems used in conjunction with plumbing fixtures; not work of this section.
- D. Refer to Division- 22, and 23 sections for soil and waste systems used in conjunction with plumbing fixtures; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Codes and Standards:
 - 1. Plumbing Fixture Standards: Comply with applicable portions of Florida Building Code – Plumbing, pertaining to materials and installation of plumbing fixtures.
 - 2. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
 - 3. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
 - 4. Federal Standards: Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.
 - 5. ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with code.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, furnished specialties and accessories; and installation instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, roughing-in requirements, required clearances, and methods of assembly of components and anchorages.
- C. Maintenance Data: Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, and shop drawings in maintenance manual.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.
- B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES:

- A. General: Provide factory-fabricated fixtures of type, style, and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, and as required for complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

2.2 MATERIALS:

- A. General: Unless otherwise specified, comply with applicable Federal Specification WW-P-541/-Series sections pertaining to plumbing fixtures, fittings, trim, metals, and finishes. Comply with requirements of WW-P-541/-specification relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps, and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541/-specification.
- B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.
- C. Where fittings, trim and accessories are exposed or semi-exposed provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
- D. Stainless Steel Sheets: ASTM A 167, Type 302/304, hardest workable temper.
- E. Finish: No. 4, bright, directional polish on exposed surfaces.
- F. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.
- G. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

2.3 PLUMBING FITTINGS, TRIM, AND ACCESSORIES:

- A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.
- B. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.
- C. P-Traps: Include removable P-traps where drains are indicated for direct connection to drainage system.
- D. Carriers: Provide cast-iron supports for fixtures of either graphitic gray iron, ductile iron, or malleable iron as indicated.
- E. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- F. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated cast-brass escutcheons with set screw.
- G. Aerators: Provide aerators of types approved by Health Departments having jurisdiction.
- H. Comply with additional fixture requirements contained in fixture schedule attached to this section.
- I. Manufacturer: Subject to compliance with requirements, provide plumbing fixtures of one of the following:
 - 1. Plumbing Fixtures:
 - a. American Standard; U.S. Plumbing Products
 - b. Zurn
 - c. Briggs
 - d. Kohler
 - 2. Plumbing Trim:
 - a. American Standard; U.S. Plumbing Products.
 - b. Chicago Faucet Co.
 - c. Delta Faucet Co.; Div. of Masco Corp.
 - d. Eljer Plumbingware Div.; Household International Co.
 - e. Kohler Co.
 - f. Speakman Co.
 - g. T & S Brass and Bronze Works, Inc.
 - h. Sloan
 - i. McGuire
 - j. Water-Tite
 - 3. Fixture Seats:
 - a. Bemis Mfg. Co.
 - b. Beneke Corp.
 - c. Church
 - d. Olsonite Corp.; Olsonite Seats.
 - 4. Water Fountains:
 - a. Halsey Taylor Div.; Household International Co.
 - b. Oasis
 - c. Elkay
 - 5. Service Sinks:
 - a. American Standard; U.S. Plumbing Products.
 - b. Eljer Plumbingware Div.; Household International Co.
 - c. Fiat Products.

- d. Kohler Co.
- 6. Stainless Steel Sinks:
 - a. American Standard; U.S. Plumbing Products
 - b. Elkay Mfg. Co.
 - c. Just Mfg. Co.
- 7. Fixture Carriers:
 - a. Josam Mfg. Co.
 - b. Kohler Co.
 - c. Smith (Jay R.)
 - d. Tyler Pipe.
 - e. Zurn Industries, Inc.; Hydromechanics Div.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PLUMBING FIXTURES:

- A. General: Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of Florida Building Code -Plumbing pertaining to installation of plumbing fixtures.
- B. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.
- C. Protect installed fixtures from damage during remainder of construction period.

3.3 FIELD QUALITY CONTROL:

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

3.4 ADJUSTING AND CLEANING:

- A. Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation.
- B. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.
- C. Adjust or replace washers to prevent leaks at faucets and stops.

3.5 EXTRA STOCK:

- A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim. Furnish one device for every 10 units.

END OF SECTION

SECTION 23 0000 - HVAC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Work herein shall conform to all applicable laws, ordinances, and to regulations of the local utility companies. The general conditions and all requirements of the contract documents shall apply to all work of this section. Work shall be in accordance with the requirements of:
 - 1. Florida Building Code (FBC) 6th Edition (2017): This code includes the 2017 FBC Building, Mechanical, Plumbing, Energy Conservation, Fuel Gas, Accessibility, and Test Protocols volumes. Further, see "Referenced Standards" in the FBC Building Chapter 35; FBC Mechanical Chapter 15; FBC Plumbing Chapter 14; FBC Energy Conservation Chapter 6; and FBC Fuel Gas Chapter 8) (Effective December 31, 2017).
 - 2. 6th Edition of the Florida Fire Prevention Code (FFPC): This code also includes the Florida versions of NFPA 1 and NFPA 101. (Effective December 31, 2017).
 - 3. 2014 National Electric Code.
 - 4. State of Florida, Department of Environmental Regulation Rules
 - 5. Florida Accessibility Code for Building Construction
 - 6. Florida Energy Efficiency Code for Building Construction
 - 7. Local Utility Codes
- B. Cooperate with all other trades and install work as fast as the progress of the job will permit.
- C. Use only mechanics skilled in the work they are to perform and have a competent representative on the job when any work is being done.
- D. No work shall be done unless the Superintendent of the Contractor is on the job site. Work shall be properly protected, all rubbish removed promptly, and exposed work shall be carefully cleaned prior to final acceptance.
- E. The term "provide" shall include labor, materials, and equipment necessary to furnish and install, complete and operable, the item or system indicated.
- F. In decisions arising from discrepancies, interpretation of Drawings and Specifications, substitutes, and other pertinent matters, the decision of the Owner's representative's approval shall be final.

1.2 SPECIFICATIONS AND DRAWINGS

- A. Plans show location of fixtures and equipment and are intended to depict the general intent of the work in scope, layout and quality of workmanship. They are not intended to show in minute detail every or all accessories intended for the purpose of executing the work, but it is understood that such details are a part of this work.
- B. Where Drawings and Specifications conflict, it shall be the responsibility of this Contractor to bring such conflict to the attention of the Architect/Engineer for clarification. Refer to Supplementary Conditions, Paragraph 1.2. In general, the Architectural Drawings shall take precedence over the Mechanical Drawings with reference to building construction. All changes from the Drawings necessary to make the work conform with the building as constructed and to fit the work of other trades or to conform to the rules of authorities having jurisdiction, shall be made by the Contractor at his own expense.
- C. Keep a record of the locations of concealed work and of any field changes in Contract Drawings and Specifications for each trade and, upon completion of the job. Refer to Specification Section - Contract Closeout for requirements.

1.3 PERMITS, FEES AND INSPECTIONS:

- A. The Contractor shall give all necessary notices, obtain all permits and pay all government fees in accordance with the Supplementary Conditions, sales taxes and other costs, including utility connections or extensions, in connection with this work; file all permit applications required by all governmental departments having jurisdiction.
- B. Obtain all required certificates of inspection for work and deliver them to the Owner before requesting acceptance and final payment for the work.
- C. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations.
- D. The Contractor shall inform the Owner of any work or materials which conflict with any of the applicable codes, standards, laws and regulations before submitting his bid.

1.4 GENERAL

- A. Materials or products specified herein and/or indicated on drawings by trade name, manufacturer's name and/or catalog number shall be provided as specified. Substitutions will not be permitted except as described herein and in the Supplementary and General Conditions.

- B. Since manufacturers reserve the right to change their products at any time, contractors shall verify all dimensions, performance data, etc. for each piece of equipment submitted to assure compliance with the intent of the drawings and specifications.
- C. All materials shall be new and of quality as specified, and when required, be clearly labeled and/or stamped as manufactured in the United States.
- D. Where an accepted substitution or deviation requires different quantity or arrangement of foundations, supports, ductwork, piping, wiring, conduit, and any other equipment or accessories normal to this equipment, contractor shall furnish said changes and additions and pay all costs for all changes and additions to his work and the work of others affected by this substitution or deviation.
- E. Deviations mean the use of any listed approved manufacturer other than those on which the drawings are based.

1.5 SHOP AND ERECTION DRAWINGS AND SAMPLES

- A. The Architect/Engineer's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site. Submittals shall be made for all equipment and systems as indicated in the respective specification section.
- B. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Architect/Engineer to ascertain that the proposed equipment and materials comply with specification and drawing requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- C. Shop and erection drawing submittals shall conform to the requirements of the General Conditions and Division 00 specifications except as modified herein.
- D. Submit required and/or requested shop and erection drawings, for review by Architect/Engineer before ordering or installing any equipment or material. Equipment or material ordered or installed before Architect/Engineer review may not be accepted and may have to be removed from the project if deemed unacceptable.
- E. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs, including descriptive literature which shall clearly indicate the construction, material, physical dimensions, wiring diagrams and complete operating data clearly marked for each item. Data of general nature will not be accepted.
- F. Shop drawings on paper larger than 11"x17" shall be submitted in the form of one set of reproducible (vellum) and one set of blueprints. The blueprints will be retained by the engineer and the reproducible will be returned to the contractor. All drawings are to be submitted no later than 60 days after the contract has been awarded.
 - 1. Coordination drawings shall show major elements, components, and systems of mechanical equipment and materials in relationship with other building components. Prepare drawings to an accurate scale of 1/4"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.
- G. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval. Submittals shall be submitted for all applicable products and materials specified in each individual section of these specifications.
- H. Make submittals for the equipment and materials in accordance with the following:
 - 1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
 - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 - 3. The submittals shall include the following:
 - a. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required. Provide any additional information specifically requested in the individual specification section or on the drawings.
 - b. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
 - 4. Electronic PDF submittal files shall be named utilizing the specification number followed by a sequential number for the submittal made under the given specification number followed by "r#" if it is a resubmittal, and then followed by a brief description of the submitted item.
 - a. The description shall indicate the actual item submitted, shall not be general in nature, and does not have to be that of the specification section heading.
 - b. Using the example, "230519-4r2 Differential Pressure Gauge"; 230519 – Meters and Gauges is the relevant specification, the "4" shows it was the fourth submittal for specification section 230519 02, "r2" shows it was the second resubmittal, and the description indicates what item is submitted.

- c. Each specification item shall be submitted in a separate PDF file. PDF files with multiple specification items will be returned without review.
 - d. Each file shall have sufficient space allowance for the Architects and Engineer's review stamp(s).
 - e. Each file shall have the Constructors Managers review stamp(s) and indicate information required by specification 230000.1.5.K.
 - I. Shop drawings on paper 11"X17" or smaller in size shall be submitted in a tabbed and indexed three ring binder. The binder shall not exceed 11-5/8" height. Partial submittals are unacceptable. The index shall indicate the related specification section number.
 - J. A Fee will be charged for Engineering review of drawings received after the time allotted as described in "F" above or for plans that have been rejected two or more times due to non-compliance or incompleteness. The fee will be determined by the Architect/Engineer and will accompany the re-submittal in the form of a cashiers check or money order made payable to the Engineer.
 - K. The Construction manager will certify that all Division 23 shop drawings are in conformance with the plans and specifications. Deviations from the plans and specifications shall be noted, and the specific area of the deviation clouded and in contrasting color (green) with a complete explanation for the reasons for the deviation. Any redesign of the system shall be Certified by a Professional Engineer currently registered in the State of Florida, and will be accompanied by the fees as described in "J" above.
 - L. Carefully examine all shop drawings and mark-up as necessary before submitting to the Architect/Engineer for review. The consultant will only consider shop drawings bearing the contractor's stamp of approval.
 - M. The engineer's review shall not relieve the contractor from the responsibility for deviations from drawings and specifications. The engineer's review shall be construed to apply only to general arrangement and shall not relieve the contractor from the responsibility for the correctness of details and dimensions and provision of the correct equipment.
 - N. The contractor shall retain copies of all reviewed shop drawings on the job site for reference.
 - O. In addition to the requirement of SUBMITTALS, the Owner reserves the right to request the manufacturer to arrange for the Owner's representative(s) to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.
 - P. Operation and Maintenance Manuals:
 - 1. Maintenance manuals shall be complete and shall be furnished in a loose leaf binder or in the manufacturer's standard binder. Information shall be sufficient to enable a qualified technician to perform normal first line maintenance and repair. A parts list shall be included which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
 - 2. Operation manuals shall be clear and concise and shall describe, in detail, the information required to properly operate the equipment specified. The manuals shall include complete catalog cuts and as-built wiring diagrams.
 - 3. Operation and maintenance manuals shall be submitted for approval prior to final close-out.
- 1.6 EXPERIENCE
- A. The Contractor performing this work shall be a licensed, reputable firm, regularly performing the type of work incorporated in this project and who also maintains, as part of the firm, a service department with qualified personnel who regularly perform this type of work. The Contractor shall, upon request, show evidence of at least two jobs of similar character and size installed within the preceding two years.
- 1.7 COORDINATION WITH OTHER TRADES
- A. Contractor shall coordinate his work with other trades to avoid interferences and delays. He shall assist in working out space requirements to make a satisfactory installation.
 - B. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with the work of other trades, he shall make the necessary changes in his work to correct the condition without extra charge.
 - C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.
- 1.8 STORAGE OF MATERIALS
- A. All materials stored on site shall be properly protected from injury or deterioration. Materials shall not be stored in contact with ground or floor.
 - B. Do not remove manufacturer's packing materials until ready to install. Materials showing signs of corrosion, improper handling or storage shall be replaced at no cost to the Owner.
 - C. Provide continuous protection for all equipment already installed.
- 1.9 CUTTING, PATCHING, EXCAVATION, BACKFILL, AND LAYOUT
- A. Provide openings and excavation required for the installation of the work. Patch work and backfill as required. Finished work shall match the existing adjoining work.

- B. Verify all conditions affecting the work to be performed under this contract.
- C. Carefully verify measurements at the site, determine the exact location of chases and openings required. Provide sleeves, inserts, and hangers as required. No columns, beams, joists, building foundations or any other structural building component shall be cut, drilled or disturbed in any way. Conflicts shall immediately be brought to the attention of the Architect/Engineer.
- D. All excavation on sites containing existing buildings and existing services shall be done with hand shovel to avoid damage to existing services. Any damage incurred by the Contractor shall be repaired by the Contractor in a manner approved by the Architect/Engineer at no cost to the Owner and with no extension of time limitation.

1.10 REMOVAL OF RUBBISH

- A. Contractor shall keep premises free from accumulations of waste material or rubbish caused by his employees or work in accordance with Specifications Section - Construction Procedures. At completion of work, the Contractor shall remove all his tools, scaffolding, surplus materials, and rubbish from building and site. He shall leave premises and his work in a clean orderly condition acceptable to the General Contractor.

1.11 ELECTRICAL WORK FOR MECHANICAL SYSTEMS

- A. Factory installed starters, controllers, and control equipment mounted in manufactured mechanical equipment necessary for mechanical equipment operation shall be furnished under Division 23 Mechanical.
- B. Power wiring for motors and installation of starters shall be under Division 26 Electrical.
- C. Motors shall be furnished under Division 23 Mechanical of capacity required to operate equipment specified, but shall not be less than that specified.
- D. Furnish and install all low voltage (120V and under) wiring for equipment provided under this division.
- E. Provide conduit when required for control wiring.

1.12 MOTORS

- A. All motors shall be furnished and installed under Division 23 Mechanical and shall be wired under Division 26 Electrical.
- B. All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards. All general purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. Motors shall be rated explosion proof when located in hazardous atmospheres. Type II weather protected motors may be used in lieu of TEFC motors on roof mounted fan units and similar equipment.
- C. Unless indicated otherwise, motors shall be NEMA Design B with a service factor of 1.15 with total temperature rise of 90 degrees C. (resistance measured) in 40 degrees C. ambient when powered from the system voltage feeding the motor. TEFC motors shall have a service factor of 1.00 with total temperature rise of 80 degrees C. in the above conditions. Motors located in areas exceeding 40 degrees C. ambient shall be factory rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Design N split phase induction motors with built-in thermal protectors. Single phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors. Single phase motors of 1/10 HP or less may be shaded pole induction motors.
- D. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, he shall first inform the Architect/Engineer of the change and shall then coordinate the change and shall pay all additional charges in connection with the change.
- E. All motors supplied on this project three (3) HP and larger shall have a power factor not less than 85 percent under rated load conditions. Power factor of less than 85 percent shall be corrected to at least 90 percent under rated load conditions. Power factor corrective devices, installed to comply with this Code, shall be switched with the utilization equipment.
- F. All motors supplied on this project shall be energy efficient. All efficiency testing and labeling shall be performed in accordance with the NEMA Standard MG 1-12.54 and IEEE 112 Test Standard, Method B. Minimum efficiencies shall conform to the following listing:

Motor HP	Efficiency (%)
3/4	80.0
1	84.0
1-1/2	85.5
2	86.5
3	88.5
5	88.5
7-1/2	90.2

10	90.2
15	91.7
20	92.4

1.13 QUIET OPERATION AND VIBRATION

- A. All equipment provided under this section shall operate under all conditions of load free of objectionable sound and vibration. Sound and vibration conditions considered objectionable shall be corrected in an approved manner.
- B. Vibration and sound control shall be by means of approved vibration eliminators or sound attenuators in a manner as specified and as recommended by the manufacturer.

1.14 EQUIPMENT IDENTIFICATION

- A. Each unit shall be identified by its system number and other appropriate designation by labels in letters of approved size and wording. Equipment requiring identification shall include: supply and exhaust fans, air conditioning and heating machinery and apparatus, pumps, piping, control cabinets, and other equipment units as may be directed by the Architect/Engineer.

1.15 CLEANING AND ADJUSTMENTS

- A. Upon completion of the work, Contractor shall clean and lubricate fans, motors, and other running equipment and apparatus which he has installed and make certain such apparatus and mechanisms are in proper working order and ready to test.
- B. Scratched or damaged painting shall be touched up as necessary to return the painting to "new" condition and appearance.
- C. All piping and equipment shall be thoroughly blown out under pressure and cleared of all foreign matter, wasting air, gas or water through temporary connections as long as necessary to thoroughly clean system before system is placed in operation. Use every precaution to prevent pipe compound, scale, dirt, welding and other objectionable matter from getting into the piping system and equipment.
- D. During blow out period, baskets from strainers shall be removed, traps and control valves, etc., shall be bypassed.
- E. All cleaning shall be done prior to any sterilization, pressure testing, flow balancing or equipment adjustment procedures.
- F. During construction protect all piping and equipment from damage and dirt. Cap the open ends of all piping and equipment.

1.16 WATERPROOFING

- A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Owner before the work is done.
- B. Provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight. Waterproof flashing materials shall be compatible with base materials.

1.17 TESTS

- A. Contractor shall make all tests required to establish the adequacy, quality, safety, completed status and satisfactory operation of all systems to the satisfaction of the Architect/Engineer. Provide all instruments, labor and services necessary to conduct tests.

1.18 INSTRUCTIONS

- A. Fully instruct Owner's personnel in the care and operation of mechanical systems and furnish a letter to the Architect/Engineer advising the particular person who has received such instruction.

1.19 GUARANTEE

- A. Equipment shall be started, tested, adjusted, and placed in satisfactory operating condition. Furnish a letter addressed to the Architect/Engineer advising that the completed systems have been installed in accordance with the Plans and Specifications and that they are in proper operating condition. The Owner shall receive a written guarantee covering all defects in workmanship and material for a period of one year from date of final acceptance. Any defects appearing within this year period shall be repaired without additional cost to the Owner.

1.20 FACILITY STARTUP BROCHURE

- A. At the completion of work, Contractor shall provide startup instruction in accordance with the General Specifications sections and shall submit a bound brochure containing the following:
 - 1. Shop Drawings
 - 2. Maintenance Manuals
 - 3. Control Wiring and Piping Diagrams

4. Operating Instructions
 5. Copy of Guarantee
 6. Certificate of Instruction of Owner's Representative
 7. Certificate of Job Completion
 8. Record Documents
- B. Where projects are of sufficient size to make a single brochure impractical, several brochures shall be prepared by trade and As-Built Drawings may be submitted as a separate item.
- C. Brochure shall be indexed and divided for reasonable clarity.
- D. Brochure shall be turned over to the Architect/Engineer for review and approval. The contractor shall make modifications to the brochure as deemed necessary for compliance and clarity, by the Architect/Engineer, and re-submit the final brochure to the Architect/Engineer to be forwarded to the Owner.

END OF SECTION

SECTION 23 0548 - VIBRATION ISOLATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
- B. This section is Division 23 Basic Mechanical Materials and Methods section, and is part of each Division 23 section making reference to vibration isolation work specified herein.

1.2 DESCRIPTION OF WORK:

- A. Noise criteria, vibration tolerance, and vibration isolation for HVAC and plumbing work.

1.3 RELATED WORK

- A. Concrete for Inertia Bases: Refer to other divisions of these specifications for concrete for inertia bases.
- B. Air Handling Unit Internal Vibration Isolation: Section 23 81 26, Split System Heating and Cooling Units.
- C. Flexible Duct Connectors, Sound Attenuators and Sound Absorbing Duct Lining: Section 23 3300 DUCTWORK ACCESSORIES.
- D. Sound Tests and Vibration Tests: Section 23 05 93, TESTING, ADJUSTING, AND commissioning.

1.4 QUALITY ASSURANCE

- A. Refer to article, QUALITY ASSURANCE in Section 23 00 00, MECHANICAL REQUIREMENTS.
- B. Noise Criteria:
 - 1. Noise levels in all 8 octave bands due to equipment and duct systems shall not exceed the following values. The stated NC levels are "raw" NC levels and do not include room effect. Manufacturer's product data which includes a room attenuation or room effect are not acceptable and must be increased by the room effect.
 - 2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the foregoing noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE 2015 Applications Handbook, , SOUND AND VIBRATION CONTROL. An average value of 10 dB shall be used as the room attenuating effect, i.e., the difference between sound power level emitted to room and sound pressure level in room.
 - 3. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.
- C. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 0.20-inch per second RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

1.5 SUBMITTALS

- A. Submit in accordance with the specifications regarding samples and shop drawings.
- B. Manufacturer's Literature and Data:
 - 1. Vibration isolators:
 - a. Floor mountings.
 - b. Hangers.
 - c. Snubbers.
 - d. Thrust restraints.
 - 2. Bases.
 - 3. Acoustical enclosures.
 - 4. Sound attenuators.
- C. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.
- D. Sound attenuator manufacturer shall furnish with submittal sound attenuating capability of each sound attenuator provided.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
 - 1. HVAC Applications Handbook 2007, Chapter 47, Sound and Vibration Control.
- C. American Society for Testing and Materials (ASTM):

1. A123-89 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2. A307-90 Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
3. D2240-86 Rubber Property - Durometer Hardness
- D. Manufacturers Standardization (MSS):
 1. SP-58-88 Pipe Hangers and supports-Materials, Design and Manufacture
- E. Occupational Safety and Health Administration (OSHA):
 1. Occupational Noise Exposure

PART 2 - PRODUCTS

2.1 GENERAL

- A. Type of sound attenuator, isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer but subject to minimum requirements indicated in the schedule on the drawings.
- B. Group 1: NC 35
 1. Classrooms

2.2 VIBRATION ISOLATORS

- A. Floor Mountings:
 1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.
 2. Spring Isolators (Type S): Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.
 3. Spring Isolators with Vertical Limit Stops (Type SP): Similar to spring isolators preceding, except include a vertical limit stop to limit upward travel if weight is removed and also to reduce movement due to wind loads. Provide clearance around restraining bolts to prevent mechanical short circuiting.
 4. Pads (Type D), Washers (Type W), and Bushings (Type L): Pads shall be felt, cork, neoprene waffle, neoprene and cork sandwich, neoprene and fiberglass, neoprene and steel waffle, or reinforced duck and neoprene. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 50 pounds per square inch.
- B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe. Hanger supports for piping 2-inches and larger shall have a pointer and scale deflection indicator.
 1. Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
 2. Spring Position Hanger (Type HP): Similar to combination neoprene and spring hanger except hanger shall hold piping at a fixed elevation during installation and include a secondary adjustment feature to transfer load to spring while maintaining same position.
 3. Neoprene (Type HN): Vibration hanger shall contain a double deflection type neoprene isolation element. Hanger rod shall be separated from contact with hanger bracket by a neoprene grommet.
 4. Spring (Type HS): Vibration hanger shall contain a coiled steel spring in series with a neoprene grommet. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
- C. Manufacturer: Subject to compliance with requirements, provide vibration isolators of one of the following:
 1. Vibration Eliminator Co., Inc.
 2. Mason Industries

2.3 BASES

- A. Rails (Type R): Design rails with isolator brackets to reduce mounting height of equipment and cradle machines having legs or bases that do not require a complete supplementary base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension but not less than four-inches. Where rails are used with neoprene mounts for small fans or close coupled pumps, extend rails to compensate overhang of housing.
- B. Integral Structural Steel Base (Type B): Design base with isolator brackets to reduce mounting height of equipment which require a complete supplementary rigid base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension, but not less than four-inches.
- C. Inertia Base (Type I): Base shall be a reinforced concrete inertia base. Pour concrete into a welded steel channel frame, incorporating pre-located equipment anchor bolts and pipe sleeves. Level concrete to provide a smooth uniform bearing surface for equipment mounting. Provide grout under uneven supports.

Channel depth shall be a minimum of 1/12 of longest dimension of base but not less than six inches. Form shall include 1/2-inch reinforcing bars welded in place on minimum of eight inch centers running both ways in a layer 1-1/2 inches above bottom. Use height saving brackets in all mounting locations. Weight of inertia base shall be equal to or greater than weight of equipment supported to provide a maximum peak-to-peak displacement of 1/16-inch.

- D. Curb Mounted Isolation Base (Type CB): Fabricate from aluminum to fit on top of standard curb with overlap to allow water run-off and have wind and water seals which shall not interfere with spring action. Provide resilient snubbers with 1/4-inch clearance for wind resistance. Top and bottom bearing surfaces shall have sponge type weather seals. Integral spring isolators shall comply with Spring Isolator (Type S) requirements.

2.4 GENERAL ISOLATOR REQUIREMENTS:

- A. Elastomeric isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.
- B. Exposure to Weather: Isolators, including springs, exposed to weather shall be hot-dip galvanized after fabrication. Hot-dip zinc coating shall be not less than two ounces per square foot by weight complying with ASTM A123. In addition, provide limit stops to resist wind velocity.
- C. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.
- D. Color code isolator by type and size for easy identification of capacity.

2.5 DUCT SOUND ATTENUATORS

- A. General: Contractor shall furnish and install prefabricated silencers in the air handling system of the sizes and performance shown on schedule and/or on drawings. They shall be the product of a nationally known manufacturer who has engaged in the manufacture and distribution of this type of equipment for at least 5 years. Manufacturer shall, upon request, provide certified test reports from a nationally known qualified independent laboratory corroborating his cataloged performance. Test reports shall be based on a 24" x 24" cross sectional rectangular and/or 24" diameter tubular silencers of each type and model required for this project. Manufacturer shall obtain prior product approval from the architect and/or consulting engineer not less than 10 days before bid date.
- B. Outer casings shall be of not less than 22 gauge galvanized steel construction. All external seams shall be lockformed and filled with mastic, or continuously welded, and shall be airtight up to 10" water gauge pressure differential. Casings should be suitably stiffened to prevent permanent deformation when tested at 10" pressure differential. They shall not vibrate audibly during normal operation of air handling system.
- C. Interior partitions shall be of not less than 24 gauge galvanized steel perforated to remove not more than 18% of the area. Acoustically absorptive filler material made from an inorganic fiber-glass-like material (mineral wool or spun felt) shall be compressed not less than 5% to eliminate voids and prevent settling. Material shall be vermin and moisture proof and impart no odor to the air. Incombustible filler material shall exhibit not more than the following fire hazard classification values when tested in accordance with standard ASTM E84, NFPA 255 or UL-723 test methods:
- | | |
|---------------------|----|
| 1. Flamespread | 15 |
| 2. Fuel Contributed | 15 |
| 3. Smoke Developed | 0 |
- D. Provide polyethylene bagging for fill. Bagging shall be continuous and air tight and shall isolate the fill from the air stream.
- E. Acoustical ratings shall be determined by the "duct-to-reverberation room" method as recommended in 1960 by the S1W42 Subcommittee of the American Standards Association. Tests shall be run both with and without air flowing through silencer at not less than three different flow rates. All ratings shall be based on test data from a nationally known qualified independent laboratory. Test method shall eliminate effects due to end reflection, vibration, flanking transmission and standing waves in the reverberant room. Airflow and pressure loss data taken in accordance with AMCA procedures shall be obtained from the same silencer used for acoustic performance tests. Upon request, evidence will be shown of an airflow pressure drop calibration check with an independent laboratory certified by AMCA.
- F. Silencer shall provide the minimum attenuation values indicated on the drawings in terms of dB insertion Loss for models shown on drawings at design air velocities.
- G. The sound power level generated by airflow through silencer in dB re: 10-12 watts (PWL12) shall not exceed the values indicated on the drawings at design flow rates.
- H. Airflow pressure drop performance of silencer shall not exceed values indicated on schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Vibration Isolation:
1. No metal-to-metal contact will be permitted between fixed and floating parts.

2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, (etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports.
 3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
 4. Provide heat shields where elastomers are subject to temperatures over 100 degrees F.
 5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
 6. Non-rotating equipment such as heat exchangers and converters shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.
- B. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.
- C. Duct Sound Attenuators: Install duct sound attenuators in strict conformance with manufacturer's written instructions. Maintain required lengths of straight duct upstream and downstream of the attenuator.

END OF SECTION

SECTION 23 0593 - TESTING, BALANCING AND COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 TESTING, BALANCING, AND COMMISSIONING OF HVAC SYSTEMS:

- A. Selection: The Contractor will procure the services of, and have a contract with, an independent Test, Balance, and Commissioning Agency (Agency), which specializes in the balancing, testing, and commissioning of heating, ventilating, and air conditioning systems. The General Contractor shall enter into an agreement with Agency so the Agency is responsible to the General Contractor for all work. The Agency shall balance, adjust, and test all air moving equipment, air distribution, and exhaust systems, and temperature control equipment as herein specified and shown on the drawings.
- B. The Contractor shall prepare a critical schedule, coordinated with all subcontractors, so as to accomplish all tasks required of the Agency as scheduled herein.
- C. Refer to related sections listed on page 23 0000-1.
- D. Work performed under those sections in Division 23 is herein referred to as the Installer. Refer to specific items of work provided by each installer, and outlined in this section, "MECHANICAL CONTRACTORS RESPONSIBILITIES". Installers shall cooperate with the Agency as required during execution of the work under this section.
- E. The Agency shall inspect all work under the above sections as it relates to work under this section and report in writing to the Contractor and Architect any deviations from plans and specifications that will affect the performance of the systems. All correspondence (written, fax, electronic mail, and the like) is to be copied to the Agency.

1.3 AGENCY QUALIFICATIONS:

- A. The Agency shall be a member in good standing with The Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) and shall provide AABC National Project Certification Performance Guaranty or equivalent to the Owner. The Agency must be totally independent, having no affiliation with any contractor, design engineer, or equipment manufacturer/supplier of HVAC related equipment.
- B. The Agency shall provide proof that personnel performing work has successfully completed at least five (5) projects of similar size and scope, with at least three (3) projects with the Owner. A complete list of reference projects, including name and phone number of contacts, shall be submitted with the bid.
- C. The Agency shall have a Florida Registered Professional Engineer on its staff.
- D. All instruments used shall be accurately calibrated within six months of balancing and maintained in good working order. If requested, the test shall be conducted in the presence of the Architect/Engineer and/or his representative.

1.4 AGENCY SUBMITTALS:

- A. Provide a plan review within thirty days upon receipt of contract. The plan review should include comments and recommendations on any discrepancies that may hinder balancing. This plan review shall be transmitted directly to the Contractor.
- B. Submit to Contractor, equipment start-up forms. After receipt from the contractor of the submittal data, forms will be transmitted by the Agency to the Mechanical Contractor for use in equipment start-up. The completed forms will be turned over to the Agency prior to the beginning of the test and balance phase.
- C. Submit agenda of test procedures for each system, describing balancing standards for the testing, balancing, and commissioning of the air conditioning, heating, and ventilating systems for the approval of the Architect/Engineer. This agenda shall include all forms for each system and component, with specified data from the project plans and specifications included on the forms.
- D. The Final Testing, Balancing and Commissioning Report, with the Engineer's letter of acceptance, must be received by the Owner at least one week prior to the proposed date of the substantial completion inspection.

1.5 AGENCY INSPECTIONS AND TESTS:

- A. Make inspections of the systems during construction for proper installation of balancing devices and general construction as related to the test and balance work... The number of inspections will vary with size and complexity of the project, but a minimum of two inspections are required: one at 50% completion of ductwork installation; and the second at 80% completion of ductwork installation. A written report of each job visit shall be sent to the Construction Manager for transmittal to the Architect / Engineer.
- B. Perform Final Test & Balance work associated with the HVAC system as described herein.

- C. A minimum of one after-occupancy inspection shall be made within 90 days of the final test and balance. At this time, any minor adjustments shall be made for occupant comfort. Major problems, which will require major readjustments, shall be addressed to the Architect / Engineer prior to any readjustments. Any alterations to the final test and balance report shall be transmitted as a revised report to the Construction Manager for transmittal to the Architect / Engineer.
- D. Provide for checking balance during opposite season (if tested in winter, recheck and update data during summer and vice versa). Send Opposite Season Report containing new and revised data to the Construction Manager for transmittal to the Architect / Engineer.

1.6 AGENCY GUARANTEE AND REPORTS:

- A. Provide AABC National Project Certification Performance Guarantee or equivalent.
- B. Provide a one year warranty commencing on the substantial completion date of the entire project, or on the date of the accepted Final Testing, Balancing and Commissioning Report, whichever is later. During the warranty period the Owner may request, a recheck or resetting of any equipment or device listed in the report.
- C. Provide five copies of tabulated report in neatly organized typed form with AABC approved minimum data, within fifteen working days after completion of test. Report will include start-up reports and drawings to coincide with the test report. All commissioning tests will be included in a separate report format. In addition, all reports shall incorporate a summary page(s) which shall include:
 - 1. General description of project (building type, system type, equipment description, etc.)
 - 2. A descriptive list of all equipment and test results (sorted building by building) which do NOT meet plans and specifications. All equipment and test data NOT listed on the above mentioned summary page(s) will be considered to perform within 10% of design requirements.
 - 3. Copies of reduced plan drawings that uniquely identify and cross reference air devices, dampers, equipment, etc.
 - 4. HVAC equipment approved submittals.
 - 5. Duct pressure test/leakage reports.
 - 6. Copies of the equipment manufacturer's computer generated INPUT and OUTPUT data sheets. Refer to paragraph 3.2/A/17.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITIES:

- A. Final testing, balancing and commissioning of the HVAC systems shall be performed as specified above. It is the responsibility of the Mechanical Contractor to be completely familiar with all the provisions and responsibilities of the Agency, and to provide such certification, cooperation, and support required.
- B. The Contractor shall repair all deficiencies noted by the Agency in a timely manner. The Agency will notify the contractor the Agency immediately, in writing, upon completion of the repairs. The cost for extra re-testing by the Agency due to failure to repair items that were certified as repaired will be the responsibility of the Contractor.
- C. The Contractor shall:
 - 1. Allow adequate time in the construction schedule to perform the Testing, Balancing and Commissioning work.
 - 2. Notify the Construction Manager and the Agency upon commencement of work related to the HVAC system.
 - 3. Provide required shop drawings and equipment data.
 - 4. Provide test openings as required for testing and balancing HVAC systems.
 - 5. Provide updated job schedule and timely notice prior to scheduled events.
 - 6. Provide test openings and temporary end caps or otherwise seal off ends of ductwork to permit leakage testing prior to installation of diffusers, grilles, and similar devices.
 - 7. Make preliminary tests to establish adequacy, quality, safety, completed status, and satisfactory operation of HVAC systems and components. The systems shall be free of electrical grounds and short circuits.
 - 8. Perform duct leakage tests, in the presence of the agency, on all supply, return, outside air make-up, and exhaust air systems.
 - 9. Within the intent of the contract documents, provide, at the request of the Agency, all equipment, material, supplies, workmen, and supervisions necessary to provide a satisfactory, operating system.
 - 10. During the test and balance period, operate all HVAC equipment as necessary to permit systems to be tested and balanced as fully operating, functional systems.

11. Work harmoniously with the Agency, providing all courtesies normally extended to professional consultants.
12. Perform all work necessary to make ceiling plenums air-tight and functional.
13. Remove and replace ceilings as necessary to permit test and balance operations.
14. Remove and replace equipment, lights, or other items which obstruct testing and balancing operations. Where equipment, lights, or other items will interfere with future adjustments of the HVAC system, such as equipment, lights, or other items shall be relocated as directed by the Architect / Engineer.
15. Provide completed start-up forms on each piece of equipment.
16. Replace belts and drives as required for proper balancing. Drives shall be adjusted and aligned to prevent abnormal belt wear and vibration.
17. Adjust fan speed to full load motor amperage, but, not over full load.
18. Open all manually adjustable dampers and test dampers for smooth, vibration-free operation.
19. Verify that all controls are installed and operating in accordance with the control sequence of operation.
20. Before requesting final testing and balancing, submit signed statement that HVAC systems are installed, adjusted, fully lubricated, operating satisfactorily, and are ready for use.

3.2 AGENCY'S RESPONSIBILITIES:

- A. Air Balance: Construction Manager for transmittal to the Architect / Engineer The Agency shall perform the following tests, and balance system in accordance with the following requirements:
 1. Record minimum data required by AABC forms.
 2. Test and adjust fan rpm to design requirements.
 3. Test and record motor full load amperage/voltage and operating amperage/voltage.
 4. Make pitot tube traverse of main supply, return, OA and exhaust ducts and obtain design CFM at fans. The airflow in rectangular duct shall be traversed and measured using the Log-Tchebycheff method and round duct shall be measured with the Log-Linear method (a.k.a. log-Tchebycheff) no exceptions. Refer to the AABC's 1989 National Standards, Section 10 and ASHRAE's 1997 Fundamentals Handbook, Chapter 14.
 5. Test and adjust system for design CFM recirculated air.
 6. Test and adjust system for design CFM outside air.
 7. Test and record system static pressure profile.
 8. Adjust all main supply and return air ducts to proper design CFM.
 9. Adjust all zones to proper design CFM, supply, return, and exhaust.
 10. Provide suggestion/corrective measures pertaining to performance related issues.
 11. Test and adjust each diffuser, grille, and register to within 10% of design requirements.
 12. Each grille, diffuser, and register shall be identified as to the location, area, and system.
 13. Test and adjust fan to within 100%-110% of design.
 14. Provide a table in the report that itemizes all the Outside Air Make-up CFM compared to all the Exhaust Air CFM (specified and actual) that is to demonstrate that the building is experiencing a continual positive pressure. There is to be one table per building.
 15. Transmit the measured/actual data at the time of the equipment tests and the design data based on design conditions listed on the drawings to the equipment manufacturer. The equipment manufacturer is to use this input data to produce the output data on their equipment selection computer program. The input and output data sheets are to be transmitted back to the Agency to be included in the report. The equipment to be computer analyzed are all cooling coils, Energy Recovery Units, and the like.
- B. Size, AK catalog factors of diffusers, grilles, registers, and all tested equipment shall be identified and listed.
- C. Readings and test of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM, and test resultant CFM after adjustments. When direct CFM measuring instruments are used, velocities are not required.
- D. In cooperation with the controls contractor, set adjustments of automatically operated dampers to operate as specified, indicated, and / or noted.
- E. Check all controls for proper calibrations, and list all controls requiring adjustment by control installers. A software point by point check-out and test, along with verification forms, will be required.
- F. All diffusers, grilles, and registers shall be adjusted to minimize drafts in all areas.
- G. Advise Mechanical Contractor in writing of all ductwork that shall be repaired to reduce air leakage. Retest to confirm minimum allowable leakage. The cost of retest of failed systems will be the responsibility of the Mechanical Contractor.
- H. Controls Testing: Test and record control temperature or pressure readout of each device and compare to actual measured condition. Include in report.
 1. Test Each Sequence Of Operation for all systems to verify proper operation. Include description of operation in report.
 2. Record The Dry Bulb Temperature in each space and in addition, record a wet bulb temperature at each thermostat or sensor.

- I. Deficiencies: All deficiencies shall be noted by the Agency in a field report and submitted to Contractor and the Architect on a daily basis.
- J. Controls Testing: Test and record control temperature or pressure readout of each device and compare to actual measured condition. Include in report.
- K. Test each Sequence of Operation for all systems to verify proper operation. Include description of operation in report.
- L. Record the dry bulb temperature in each space and in addition, record a wet bulb temperature at each thermostat or sensor.
- M. Deficiencies: All deficiencies shall be noted by the Agency in a field report and submitted to the Contractor and the Architect on a daily basis.
- N. Upon Correction Of The Deficiency, the Contractor shall notify the Agency in writing that the problem is resolved. If the deficiency is not corrected, the Contractor will be responsible for the cost of additional re-testing.
- O. Equipment: All information required as shown, but not limited to, shall be compiled in a neat, orderly, itemized format on 8½" x 11" test forms. The following data shall be submitted to the Construction Manager for distribution to the Architect / Engineer and the Owner. This data is the minimum required data except where specified standard (i.e. AABC) requires additional data. In addition, any HVAC equipment specified for the project, but not indicated below, is required per AABC form.
- P. Air Handlers, Fan Coils, and Duct-mounted Coils:
 - 1. Mark number
 - 2. Unit manufacturers and model number
 - 3. Total supply air CFM and rpm - specified and actual
 - 4. Return air CFM - specified and actual
 - 5. Outside air CFM - specified and actual
 - 6. Unit static pressure profile, including total fan static
 - 7. Specified total and external static pressure
 - 8. Coil - entering and leaving air DB/°F and WB/°F - specified and actual
 - 9. Outside air DBF and WB/°F at time of test
 - 10. Voltage, phase, and cycle specified load conditions
 - 11. Hand calculations of the BTUH at test conditions of total cooling, latent cooling and Sensible cooling.
 - 12. Btu per hour when converted to specified load conditions
- Q. Condensing Units:
 - 1. Mark number
 - 2. Unit manufacturers and model number
 - 3. Voltage, phase, and cycle specified load conditions
 - 4. Head pressures.
- R. Fans:
 - 1. Mark number
 - 2. Manufacturer and model number
 - 3. Total CFM supply and rpm - specified and actual
 - 4. Static pressure (discharge static - suction static)
 - 5. Full load amperage - specified and actual
 - 6. Voltage, phase, and cycles - specified and actual
- S. Air Devices (grilles, Registers, Diffusers, and Louvers):
 - 1. Mark number
 - 2. Room number
 - 3. CFM - specified and actual
 - 4. Size
 - 5. Effective area
 - 6. Velocity FPM - specified and actual

END OF SECTION

SECTION 23 0719 - HVAC MECHANICAL INSULATION

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
 - B. Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section.
 - B. Types of mechanical insulation specified in this section include the following:
 - 1. Piping System Insulation:
 - a. Fiberglass.
 - b. Flexible Unicellular.
 - 2. Duct Work System Insulation:
 - a. Fiberglass.
 - C. Refer to Division-23 section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.
 - D. Refer to Division-23 section "Low Pressure Ductwork" for duct linings; not work of this section.
 - E. Refer to Division-23 section "Mechanical Identification" for installation of identification devices for piping, ductwork, and equipment; not work of this section.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
 - B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
 - C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
 - D. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.
 - E. Exception: Industrial mechanical insulation that will not affect life safety egress of building may have flame spread index of 75 and smoke developed index of 150.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
 - B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.
 - C. Samples: Submit manufacturer's sample of each piping insulation type required, and of each duct and equipment insulation type required. Affix label to sample completely describing product.
- 1.5 DELIVERY, STORAGE, AND HANDLING:
 - A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
 - B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS:
 - A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Babcock & Wilcox; Insulating Products Div.
 - 3. CertainTeed Corp.
 - 4. Knauf Fiber Glass GmbH.
 - 5. Manville Products Corp.
 - 6. Owens-Corning Fiberglas Corp.

- 7. Pittsburg Corning Corp.
- 8. Rubatex Corp.
- 9. Imcoa

2.2 PIPING INSULATION MATERIALS:

- A. Flexible Unicellular Piping Insulation: ASTM C 534, Type I.
- B. Jackets for Piping Insulation: ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.
- C. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
- D. Encase insulation on exterior piping and interior piping in mechanical rooms with aluminum jacket with weatherproof construction for 100% coverage.
- E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.3 DUCTWORK INSULATION MATERIALS:

- A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class 1.
- B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, Class B-4.
- C. Jackets for Ductwork Insulation: ASTM C 921, Type I for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient.
- D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 HVAC PIPING SYSTEM INSULATION:

- A. Insulation Omitted: Omit insulation on cold piping within unit cabinets provided piping is located over drain pan; and on unions, flanges, strainers, flexible connections, and expansion joints.
- B. Cold Piping (40oF (4.4oC) to ambient).
 - 1. Application Requirements: Insulate the following cold HVAC piping systems:
 - a. Refrigerant suction piping.
 - b. Air conditioning condensate drain piping.
 - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Flexible Unicellular: 1" thick for pipe sizes up to 1-1/2" (largest size permitted).

3.3 DUCTWORK SYSTEM INSULATION:

- A. Insulation Omitted: Do not insulate fibrous glass ductwork, or lined ductwork.
- B. Cold Ductwork (Below Ambient Temperature):
 - 1. Application Requirements: Insulate the following cold ductwork.
 - a. Outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet.
 - b. HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet.
 - c. Insulate neck and bells of supply diffusers.
 - d. HVAC return ductwork between room terminal inlet and return fan inlet, or HVAC unit inlet; except omit insulation on return ductwork located in return air ceiling plenums.
 - e. HVAC plenums and unit housings not pre-insulated at factory or lined.
 - 2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
 - a. Flexible Unicellular: 1" thick.

3.4 INSTALLATION OF PIPING INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
- F. Cover valves, fittings, and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise indicated.
- H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.5 INSTALLATION OF DUCTWORK INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.
- F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.
- G. Ductwork Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.
- H. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.6 PROTECTION AND REPLACEMENT:

- A. Replace damaged insulation which cannot be satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 23 1060 - HVAC PIPES AND PIPE FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
- B. This section is a Division 23 Basic Mechanical Materials and Methods section, and is part of each Division 23 section making reference to pipes and pipe fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division 23 sections.
- B. Type of pipes and pipe fittings specified in this section include the following:
 - 1. Copper Tube.
 - 2. Plastic Pipes.
 - 3. Miscellaneous Piping Materials/Products.
- C. Pipes and pipe fittings furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 23 sections.
- D. Refer to Specification Section 23 23 00 - Refrigerant Piping for refrigerant piping requirements.

1.3 QUALITY ASSURANCE:

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

1.4 CODES AND STANDARDS:

- A. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.
 - 1. Certify welding of piping work using Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).
- B. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.
- C. NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).

1.5 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.
- B. Welding Certifications: Submit reports as required for piping work.
- C. Brazing Certifications: Submit reports as required for piping work.
- D. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of the specifications.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.
- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment

connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 COPPER TUBE AND FITTINGS:

- A. Copper Tube: ASTM B88; type (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated.
- B. Cast-Copper Solder-Joint Fittings: ANSI B16.18.
- C. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
- D. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.3 PLASTIC PIPES AND PIPE FITTINGS:

- A. Polyvinyl Chloride Pipe (PVC): ASTM D1785.
- B. PVC Fittings:
 - 1. Schedule 40 Socket: ASTM D2466.
 - 2. Schedule 80 Socket: ASTM D2467.
 - 3. Schedule 80 Threaded: ASTM D2464.
 - 4. DWV Socket: ASTM D2665.
 - 5. Sewer Socket: ASTM D2729.
 - 6. Solvent Cement: ASTM D2564.
 - 7. Solvent Cement (To Join PVC to ABS): ASTM D3138.

2.4 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

- A. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.
- B. Tin-Antimony Solder: ASTM B32, Grade 95TA.
- C. Gaskets for Flanged Joints: ANSI B16.21; full-faces for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.
- D. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.
- E. Manufacturer: Subject to compliance with requirements, provide piping connectors of the following:
 - 1. Fernco, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leak proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance.
- B. Comply with ANSI B31 Code for Pressure Piping.
- C. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
- D. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures.

3.2 PIPING SYSTEM JOINTS:

- A. General: Provide joints of type indicated in each piping system.
- B. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- C. Solder copper tube-and fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply

- solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- D. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.
 - E. Weld pipe joints only when ambient temperature is above 0oF (-18oC) where possible.
 - F. Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
 - G. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
 - H. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
 - I. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
 - J. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
 - K. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards.
 - L. Making Solvent-Cemented Joints: ASTM D2235, and ASTM F402.
 - M. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.
- 3.3 CLEANING, FLUSHING, INSPECTING:
- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings. Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
 - B. Inspect pressure piping in accordance with procedures of ASME B31.
 - C. Disinfect water service piping in accordance with AWWA C601.
- 3.4 PIPING TESTS:
- A. Test pressure piping in accordance with ASME B31.
 - B. General: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
 - C. Required test period is 24 hours.
 - D. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
 - E. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
 - F. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
 - G. Drain test water from piping systems after testing and repair work has been completed.

END OF SECTION

SECTION 23 1117 - HVAC SUPPORTS AND ANCHORS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
 - B. This section is a Division 23 Basic Mechanical Materials and Methods section, and is part of each Division 23 section making reference to supports and anchors specified herein.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division 23 sections.
 - B. Types of supports and anchors specified in this section include the following:
 - 1. Horizontal-Piping Hangers and Supports.
 - 2. Hanger-Rod Attachments.
 - 3. Building Attachments.
 - 4. Saddles and Shields.
 - 5. Miscellaneous Materials.
 - 6. Anchors.
 - 7. Equipment Supports.
 - C. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other 23 sections.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - B. Codes and Standards:
 - 1. Code Compliance: Comply with Florida Building Code pertaining to product materials and installation of supports and anchors.
 - 2. UL and FM Compliance: Provide products which are UL-listed and FM approved.
 - 3. MSS Standard Compliance:
 - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
 - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - d. Terminology used in this section is defined in MSS SP-90.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.
 - B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

PART 2 - PRODUCTS

- 2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:
 - A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. All steel hangers and supports shall be galvanized steel. Provide copper-plated hangers and supports for copper-piping systems.
 - B. Adjustable Steel Clevis Hangers: MSS Type 1.
 - C. Steel Double Bolt Pipe Clamps: MSS Type 3.
 - D. Steel Pipe Clamps: MSS Type 4.
 - E. Pipe Hangers: MSS Type 5.
 - F. Split Pipe Rings: MSS Type 11.
 - G. Clips: MSS Type 26.
 - H. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast-iron floor flange.
 - I. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base-support and cast-iron floor flange.

2.2 HANGER-ROD ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. Steel Turnbuckles: MSS Type 13.

2.3 BUILDING ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
- B. Concrete Inserts: MSS Type 18.
- C. Top Beam C-Clamps: MSS Type 19.
- D. Side Beam or Channel Clamps: MSS Type 20.
- E. Center Beam Clamps: MSS Type 21.
- F. Steel Brackets: One of the following for indicated loading:
 - 1. Light Duty: MSS Type 31.
 - 2. Medium Duty: MSS Type 32.
 - 3. Heavy Duty: MSS Type 33.

2.4 SADDLES AND SHIELDS:

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
- C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- D. Thermal Hanger Shields: Constructed of 360° insert of high density, 100 psi, water-proofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.
- E. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
 - 1. Elcen Metal Products Co.
 - 2. Pipe Shields, Inc.

2.5 MANUFACTURERS OF HANGERS AND SUPPORTS:

- A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - 1. B-Line Systems, Inc.
 - 2. Carpenter and Patterson, Inc.
 - 3. Corner & Lada Co., Inc.
 - 4. Elcen Metal Products Co.
 - 5. Fee & Mason Mfg. Co.; Div. Figgie International.
 - 6. ITT Grinnel Corp.

2.6 MISCELLANEOUS MATERIALS:

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION:

- A. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachments.

- B. Prior to installation of hangers, supports, anchors, and associated work, Installer shall meet at project site with Contractor, installers of other work requiring coordination with work of this section for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.3 INSTALLATION OF BUILDING ATTACHMENTS:

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.4 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Install hangers, supports, clamps, and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- D. Provisions for movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Do not use pipe stands in mechanical equipment rooms.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- H. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - 2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields.
 - 3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.5 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.6 EQUIPMENT SUPPORTS:

- A. Provide concrete housekeeping bases for all floor-mounted equipment furnished as part of the work of Divisions 21, 22, and 23. Size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Provide 6" bases for air handling units. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate stainless steel anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.
- B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.7 ADJUSTING AND CLEANING:

- A. Hanger Adjustments: Adjust hangers so as to distribute loads equally on attachments.
- B. Supports Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 23 1119 - HVAC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
- B. This section is a Division 23 Basic Mechanical Materials and Methods section, and is part of each Division 23 section making reference to piping specialties specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.
- B. Types of piping specialties specified in this section include the following:
 - 1. Pipe Escutcheons
 - 2. Pipeline Strainers
 - 3. Dielectric Unions
 - 4. Mechanical Sleeve Seals
 - 5. Fire Barrier Penetration Seals
 - 6. Drip Pans
 - 7. Pipe Sleeves
 - 8. Sleeve Seals
- C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 23 sections.

1.3 QUALITY ASSURANCE

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

1.4 CODES AND STANDARDS:

- A. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.
- B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.
- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of the specifications.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

- A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 PIPE ESCUTCHEONS

- A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside the pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
- B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
- C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.
- D. Manufacturer: Subject to compliance with requirements, provide pipe escutcheons of one of the following:

1. Chicago Specialty Mfg. Co.
2. Producers Specialty & Mfg. Corp.
3. Sanitary-Dash Mfg. Co.

2.3 LOW PRESSURE Y-TYPE PIPELINE STRAINERS:

- A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure, with Type 304 stainless steel screens with 3/64" perforations @ 233 per sq.in.
 1. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
 2. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 3. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 4. Butt Welded Ends, 2-1/2" and Larger: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 5. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.
- B. Manufacturer: Subject to compliance with requirements, provide low pressure Y-type strainers of one of the following:
 1. Armstrong Machine Works.
 2. Hoffman Specialty ITT; Fluid Handling Div.
 3. Metraflex Co.
 4. R-P&C Valve; Div. White Consolidated Industries, Inc.
 5. Spirax Sarco.
 6. Trane Co.
 7. Victaulic Co. of America.
 8. Watts Regulator Co.

2.4 DIELECTRIC UNIONS

- A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.
- B. Manufacturer: Subject to compliance with requirements, provide dielectric unions of one of the following:
 1. B & K Industries, Inc.
 2. Capital Mfg. Co.; Div. of Harsco Corp.
 3. Eclipse, Inc.
 4. Epco Sales, Inc.
 5. Perfection Corp.
 6. Rockford-Eclipse Div.

2.5 MECHANICAL SLEEVE SEALS

- A. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
- B. Manufacturer: Subject to compliance with requirements, provide mechanical sleeve seals of one of the following:
 1. Thunderline Corp.

2.6 FIRE BARRIER PENETRATION SEALS

- A. Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for mechanical components such as piping or duct work.
- B. Cracks, Voids, or Holes Up to 4" Diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.
- C. Openings 4" or Greater: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350oF (121 to 177oC), UL-listed.
- D. Manufacturer: Subject to compliance with requirements, provide fire barrier penetration seals of one of the following:
 1. Electro Products Div./3M.
 2. Nelson; Unit of General Signal.

2.7 WATER HAMMER ARRESTERS:

- A. General: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.
- B. Manufacturer: Subject to compliance with requirements, provide water hammer arresters of one of the following:
 - 1. Amtrol, Inc.
 - 2. Smith (Jay R.) Mfg. Co.
 - 3. Tyler Pipe; Sub. of Tyler Corp.
 - 4. Watts
 - 5. Zurn Industries, Inc.; Hydromechanics Div.

2.8 FABRICATED PIPING SPECIALTIES:

- A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.
- B. Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricated from the following gages: 3" and smaller, 20 gage; 4" to 6" 16 gage; over 6", 14 gage.
 - 2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
 - 3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.
 - 4. Plastic-Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
- C. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:
 - 1. Lead and Oakum: Caulked between sleeve and pipe.
 - 2. Mechanical Sleeve Seals: Installed between sleeve and pipe.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.
- B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.
 - 1. Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:
 - a. Pumps
 - b. Temperature control valves
 - c. Pressure reducing valves
 - d. Temperature or pressure regulating valves
- C. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.
- D. Mechanical Sleeve Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.
- E. Fire Barrier Penetration Seals: Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions.
- F. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES:

- A. Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.
- B. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide

sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish, and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.
 2. Install iron-pipe sleeves at exterior penetrations; both above and below grade.
 3. Install steel-pipe or plastic-pipe sleeves except as otherwise indicated.
- C. Sleeve Seals: Install in accordance with the following:
1. Lead and Oakum: Fill and pack annular space between sleeve and pipe with oakum, caulk with lead, on both sides.

END OF SECTION

SECTION 23 2300 - REFRIGERANT PIPING

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Conform to Drawings and other sections of this division.
- 1.2 DESCRIPTION OF WORK
 - A. Extent of refrigerant piping work is indicated on drawings and schedules, and by requirements of this Section.
- 1.3 QUALITY ASSURANCE
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of refrigerant piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
 - B. Installer's Qualifications: Firm with at least three years of successful installation experience on projects with refrigerant piping work similar to that required for project.
 - C. ANSI Compliance: Fabricate and install refrigerant piping in accordance with ANSI B31.5 "Refrigeration Piping" and extend applicable lower pressure limits to pressures below 15 psi.
 - D. ASHRAE Compliance: Fabricate and install refrigerant piping in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
 - E. Comply with the latest approved edition of the "Florida Energy Code for Building Construction".
- 1.4 SUBMITTALS
 - A. Submit in accordance with General, Supplementary and Special Conditions.
 - B. Product Data: Submit manufacturer's technical product data and installation instructions for refrigerant piping materials and products.
 - C. Record Drawings: At project closeout, submit record drawings of installed refrigerant piping and piping products.
 - D. Maintenance Data: Submit maintenance data and parts lists for refrigerant piping materials and products.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe end damage and eliminating dirt and moisture from inside of pipe and tube.

PART 2 - PRODUCTS

- 2.1 MATERIALS AND PRODUCTS, GENERAL
 - A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for Refrigeration Piping. Base pressure rating on refrigerant piping system maximum design pressures.
- 2.2 PIPES AND PIPE FITTINGS
 - A. Copper Tube:
 - 1. All copper tube in compliance with ASTM B-88.
 - 2. Liquid Lines One and Three-Eighths Inch (1-3/8") and Smaller: Copper tube, ACR Type L, soft annealed, temper fittings, wrought copper-ally fittings for flared copper tubes; flared joints.
 - 3. Liquid Lines One and Five-Eighths Inch (1-5/8") and Larger: Copper tube, ACR Type K, hard drawn temper; wrought-copper, colder-joint fittings; brazed joints.
 - 4. Suction Lines, All Sizes: Copper tube, ACR Type L, soft annealed temper fittings; wrought copper-alloy fittings for flared copper tubes; flared fittings.
 - 5. Hot gas bypass lines: Copper tube type "L" copper.
 - B. Soldering Materials: Silver-lead solder, ASTM B32, Grade 96TS.
- 2.3 SUPPORTS AND ANCHORS
 - A. Except as otherwise indicated, provide factory fabricated supports and anchors complying with MSS SP-58, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit around insulation with saddle or shield for insulated piping. Provide copper-plated hangers, supports, and attachments for copper-piping systems.
 - 1. Adjustable steel clevises, for horizontal piping hangers and supports, equal to Grinnell Fig. 260.

2. Two-bolt riser clamps for vertical piping supports, equal to Grinnell Fig. 261.
3. Concrete inserts equal to Grinnell Fig. 285, C-clamps equal to Grinnell Fig. 86, and steel brackets equal to Grinnell Fig. 194 or 195 for building attachments.
4. Protection shields equal to Grinnell Fig. 167 for insulated piping support in hangers.

2.4 REFRIGERANT VALVES

- A. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300°F temperature rating, 500 psi working pressure. Acceptable manufacturers include Henry Valve Co., Parker Hannifin Corp. (Refrigeration & Air-Cond. Div.), Sporlan Valve Co.
- B. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250°F temperature rating, 500 psi working pressure. Acceptable manufacturers include Henry Valve Co., Parker Hannifin Corp. (Refrigeration & Air-Cond. Div.), Sporlan Valve Co.
- C. Two-Way Solenoid Valves: forged brass, designed to conform to ARI 760, normally closed, Teflon valve seat, NEMA 1 solenoid enclosure, UL-listed, 1/2" conduit adapter, 250°F temperature rating, 400 psi working pressure. Provide manual operator to open valve. Alco Controls Div. (Emerson Electric Co.), Automatic Switch Co., and Sporlan Valve Co.

2.5 REFRIGERANT SPECIALTIES

- A. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL-listed, 350 psi working pressure.
- B. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL-listed, 200°F temperature rating, 500 psi working pressure.
- C. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.
- D. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL-listed.
- E. Acceptable manufacturers of refrigerant specialties are Alco Controls Div.; Emerson Electric Co., Henry Valve Co., Parker-Hannifin Corp. (Refrigeration & Air-Conditioning Div.), and Sporlan Valve Co.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which refrigerant piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF REFRIGERANT PIPING

- A. Equipment manufacturer to size refrigerant lines and provide necessary specialties as required. Install pipes and pipe fittings in accordance with recognized industry practices. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes by use of reducing fittings. Comply with ANSI B31 Code for Pressure Piping.
- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building. Where possible, locate piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Run piping mains 6" or more from fire rated walls to facilitate inspection.
- C. Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces. Do not run piping above electrical panels per NEC.
- D. Install refrigerant piping with 1/4" per foot 1% downward slope in direction of oil return to compressor. Provide oil traps and double risers where indicated, and where required to provide oil return.
- E. Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.
- F. Connect refrigerant piping to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated.
- G. Where refrigerant piping is indicated to run below grade, sleeve piping with 6" PVC piping with 3/16" minimum wall thickness. Fill voids in sleeve with expandable urethane foam and seal end watertight with roofing tar.

- H. Where refrigerant piping is indicated to run above grade and exposed outdoor conditions, sleeve piping with minimum 20 gage aluminum cladding. Fill voids in sleeve with expandable urethane foam and seal ends watertight with roofing tar.

3.3 INSTALLATION OF SUPPORTS AND ANCHORS

- A. Install supports and anchors in accordance with manufacturer's recommendations. Maximum spacing between pipe supports shall be as follows:

Nominal Pipe Size (Inches)	Maximum Span (Ft.)	Rod Size (Inches)
1/2	5	1/4
3/4	5	1/4
1	6	1/4
1-1/2	8	3/8
2	8	3/8
2-1/2	9	3/8
3	10	3/8
4	12	1/2

- B. Additional hangers and/or bracket support shall be provided at each valve, fitting, change of direction and dead ends of pipe longer than 2'-0".

3.4 INSTALLATION OF REFRIGERANT VALVES

- A. Install refrigerant valves in accordance with manufacturer's instructions. Remove accessible internal parts before soldering or brazing; replace after joints are completed.
- B. Install solenoid valves in refrigerant piping as indicated with stem pointing upwards. Wiring of solenoid valves is specified in applicable Division 16 sections, and is included as work of this Section.

3.5 INSTALLATION OF REFRIGERANT SPECIALTIES

- A. Install refrigerant specialties in accessible locations for service. Install refrigerant discharge line mufflers in horizontal or downflow portions of hot gas lines, immediately after compressor; not in riser.

3.6 FIELD QUALITY CONTROL

- A. Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum, and then 200 psi using halide torch. System must be entirely leak-free.
- B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

3.7 DEHYDRATION AND CHARGING OF SYSTEM

- A. Install core in filter dryer after leak test but before evacuation.
- B. Evacuate refrigerant system with vacuum pump; until temperature of 35°F is indicated on vacuum dehydration indicator. During evacuation, apply heat to pockets, elbows, and low spots in piping. Maintain vacuum on system for minimum of five hours after closing valve between vacuum pump and system. At completion of dehydration procedure, break vacuum with refrigerant gas and allow pressure to build up to 2 psi.
- C. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

3.8 CLEANING AND INSPECTING

- A. Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings. Inspect each run of each system for completion of joints, supports and accessory items. Inspect pressure piping in accordance with procedures of ASME B31.

END OF SECTION

SECTION 23 3113 - LOW AND MEDIUM PRESSURE DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

- A. Extent of low pressure ductwork is indicated on drawings and in schedules, and by requirements of this section. Low pressure ductwork is hereby defined as ductwork subjected to velocities of 2,500 fpm or less, and operating pressure of 2" w.g. or less, positive or negative.
- B. Types of low pressure ductwork required for project include the following:
 - 1. Heating supply and return air systems.
 - 2. Air-conditioning supply from outlet of VAV box to ceiling devices and return air systems.
 - 3. Fresh air supply systems.
 - 4. Mechanical exhaust systems.
 - 5. Air relief systems.
- C. Extent of medium pressure ductwork is indicated on drawings and in schedules, and by requirements of this section. Medium pressure ductwork is hereby defined as ductwork subjected to velocities of 2,000 fpm to 4,000 fpm, and operating pressure of 2.0" w.g. to 6" w.g., positive or negative.
- D. Types of medium pressure ductwork required for project include the following:
 - 1. Air-conditioning supply from air handler discharge to intake of VAV boxes.
- E. Refer to Division-15 insulation sections for external insulation required in conjunction with low pressure ductwork; not work of this section.

1.3 QUALITY ASSURANCE:

- A. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards – Metal and Flexible, 1995" for fabrication and installation of low pressure ductwork.
- B. NFPA Compliance: Comply with ANSI/NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems".

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications on manufactured products and factory-fabricated ductwork, used for work of this section.
- B. Shop Drawings: Submit dimensioned layouts of ductwork, showing both the accurately scaled ductwork and its relation to space enclosure. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.
- C. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets; in accordance with requirements of Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS:

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.
- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating; mill phosphatized for exposed locations.
- C. Stainless Steel Sheet: Fume hood exhaust ductwork and as otherwise indicated, fabricate ductwork from stainless steel complying with ANSI/ASTM A 167; AISI type 304 with No. 4 directional polish where exposed to view in occupied spaces. Provide welded seams. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

2.2 MISCELLANEOUS DUCTWORK MATERIALS:

- A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
- C. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
- E. Except where space is indicated as "High Humidity" area, interior support materials of not less than 1/4" diameter or 3/16" thickness may be plain (not galvanized).

2.3 FABRICATION:

- A. Shop fabricate ductwork in 4, 8, 10 or 12-foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for re-assembly and coordinated installation.
- B. Shop fabricate ductwork of gages and reinforcement complying with SMACNA "Low Pressure Duct Standards - 5th Edition".
- C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.
- D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-15 section "Duct Accessories" for accessory requirements.
- E. Fabricate ductwork with perforated steel duct liner in each section of duct where indicated. Provide a continuous polyethylene liner on the acoustical liner to isolate the liner material from the airstream. Provide a perforated steel inner liner for strength and sound absorption.

2.4 FACTORY-FABRICATED DUCTWORK:

- A. General: At installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.
- B. Material: Galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating, mill phosphatized.
- C. Gage: 28 ga. minimum for round and oval ducts and fittings, 4" through 24" diameter.
- D. Elbows: One piece construction for 90° and 45° elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.
- E. Divided Flow Fittings: 90° tees, constructed with saddle tap spot welded and bonded to duct fitting body.
- F. Manufacturer: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:
 - 1. Lindab
 - 2. United Sheet Metal Div., United McGill Corp.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK:

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.
- B. Seal ductwork, after installation, to seal class recommended, and method prescribed in SMACNA "HVAC Duct Construction Standards - 1995 - 2nd Edition".
- C. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- D. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural

and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

- E. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.
- F. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2".
- G. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- H. Support ductwork in manner complying with SMACNA "Low Pressure Duct Standards - 5th Edition" hangers and supports section.

3.2 CLEANING AND PROTECTION:

- A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.
- C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

3.3 BALANCING:

- A. Refer to Division-15 section "Testing, Adjusting, and Balancing" for air distribution balancing of low pressure ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION

SECTION 23 3300 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
 - B. Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.
 - B. Types of ductwork accessories required for project include the following:
 - 1. Dampers.
 - 2. Low pressure manual dampers.
 - 3. Control dampers.
 - 4. Counterbalanced relief dampers.
 - 5. Fire dampers.
 - 6. Turning vanes.
 - 7. Duct hardware.
 - 8. Duct access doors.
 - 9. Flexible connections.
 - C. Refer to other Division-23 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
 - B. Codes and Standards:
 - 1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
 - 2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
 - 3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".
 - 4. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.
 - B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.
 - C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

- 2.1 DAMPERS:
 - A. Low Pressure Manual Dampers: Provide dampers of single blade type or multiblade type, constructed in accordance with SMACNA "HVAC Duct Construction Standards".
 - B. Control Dampers: Provide dampers with parallel blades for 2-position control, or opposed blades for modulating control. Construct blades of 16-ga. steel, provide heavy-duty molded self-lubricating nylon bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/4" x 16-ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish with aluminum touch-up. Provide locking quadrant damper operators.
 - C. Counterbalanced Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 16-ga. aluminum, provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" x 1/2" x 1/8" steel channel

for face areas 25 sq. ft. and under; 4" x 1-1/4" x 16-ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.

- D. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
1. Air Balance, Inc.
 2. Airguide Corp.
 3. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.
 4. Louvers & Dampers, Inc.
 5. Penn Ventilator Co.
 6. Ruskin Mfg. Co.

2.2 FIRE DAMPERS:

- A. Fire Dampers: Provide fire dampers, of types and sizes indicated. Construct casings of 11-ga. galvanized steel with bonded red acrylic enamel finish. Provide fusible link rated at 160 to 165°F (71 to 74°C) unless otherwise indicated. Dampers shall be installed out of the air stream so that there is no restriction imposed upon the flow of air. Provide damper with positive lock in closed position, and with the following additional features:
1. Damper Blade Assembly: Curtain type.
 2. Blade Material: Steel, match casing.
- B. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:
1. Air Balance, Inc.
 2. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.
 3. Louvers and Dampers, Inc.
 4. Penn Ventilator Co.
 5. Phillips-Aire.
 6. Ruskin Mfg. Co.

2.3 TURNING VANES:

- A. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" wide curved blades set at 3/4" o.c., supported with bars perpendicular to blades set at 2" o.c., and set into side strips suitable for mounting in ductwork.
- B. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.
- C. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
1. Aero Dyne Co.
 2. Airsan Corp.
 3. Anemostat Products Div.; Dynamics Corp. of America.
 4. Barber-Colman Co.
 5. Duro Dyne Corp.
 6. Environmental Elements Corp.; Subs. Koppers Co., Inc.
 7. Hart & Cooley Mfg. Co.
 8. Register & Grille Mfg. Co., Inc.
 9. Souther, Inc.

2.4 DUCT HARDWARE:

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
 2. Quadrant Locks: Provide for each damper (including dampers at spin-in duct take-offs), quadrant lock device on one end of shaft; and end bearing plate on other end. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork. Provide extensions for all damper operators for volume control dampers located above hard ceilings with no access.
- B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
1. Ventfabrics, Inc.
 2. Young Regulator Co.

2.5 DUCT ACCESS DOORS:

- A. General: Provide where indicated, duct access doors of size indicated.
- B. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct.

Provide one size hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors.

- C. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
1. Air Balance Inc.
 2. Duro Dyne Corp.
 3. Register & Grille Mfg. Co., Inc.
 4. Ruskin Mfg. Co.
 5. Ventfabrics, Inc.
 6. Zurn Industries, Inc.; Air Systems Div.

2.6 FLEXIBLE CONNECTIONS:

- A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.
- B. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
1. American/Elgen Co.; Energy Div.
 2. Duro Dyne Corp.
 3. Flexaust (The) Co.
 4. Ventfabrics, Inc.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES:

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90° elbows in supply and exhaust air systems, and elsewhere as indicated.
- C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Install access doors adjacent to all fire dampers to allow maintenance and inspection of each fire damper. Minimum size of access doors shall be 12 inches square.
- D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 ADJUSTING AND CLEANING:

- A. Adjusting: Adjust ductwork accessories for proper settings.
- B. Label access doors in accordance with Division-15 section "Mechanical Identification".
- C. Final positioning of manual dampers is specified in Division-15 section "Testing, Adjusting, and Balancing".
- D. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 23 3416 - CENTRIFUGAL FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
- B. Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of centrifugal fans work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of centrifugal fans required for project include the following:
 - 1. Inline Centrifugal Fans.
- C. Refer to other Division-23 sections for vibration control used in conjunction with centrifugal fans; not work of this section.
- D. Refer to Division-23 sections for testing, adjusting, and balancing work required in conjunction with centrifugal fans; not work of this section.
- E. Refer to other Division-23 control systems sections for control work required in conjunction with centrifugal fans; not work of this section.
- F. Refer to Division-26 sections for the following work; not work of this section.
 - 1. Power supply wiring from power source to power connection on fan motor. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
 - 2. Interlock wiring between fan units; and between fans and field-installed control devices.
 - 3. Interlock wiring specified as factory-installed work this section.
- G. Provide the following electrical work as work of this section, complying with requirements of Division-26 sections:
 - 1. Control wiring between field-installed controls, indicating devices, and fan starters.
 - 2. Control wiring specified as work of Division-23 for HVAC Control Systems is work of that section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of centrifugal fans, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Codes and Standards:
 - 1. AMCA Compliance: Provide centrifugal fans bearing the AMCA Certified Ratings Seal. Sound rate centrifugal fans in accordance with AMCA 300 "Test Code for Sound Rating Air Moving Devices".
 - 2. ASHRAE Compliance: Test and rate centrifugal fans in accordance with ASHRAE 51 (AMCA 210) "Laboratory Methods of Testing Fans for Rating".
 - 3. UL Compliance: Provide centrifugal fan electrical components which have been listed and labeled by UL.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for centrifugal fans, including specifications, capacity ratings, fan performance curves with operating point clearly indicated, gages and finishes of materials, dimensions, weights, accessories furnished, and installation instructions.
- B. Shop Drawings: Submit assembly-type shop drawings showing fan dimensions, required clearances, construction details, and field connection details.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to fan units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. Maintenance Data: Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals; in accordance with requirements of the specifications.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver centrifugal fans with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.
- B. Handle centrifugal fans carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to centrifugal fan manufacturer.
- C. Store centrifugal fans in clean dry place and protect from weather and construction traffic.

- D. Comply with manufacturer's rigging and installation instructions for unloading centrifugal fans, and moving them to final location.

PART 2 - PRODUCTS

2.1 INLINE CENTRIFUGAL FANS:

- A. General: Provide inline centrifugal fans of sizes and arrangement as indicated, and of capacities and having accessories as scheduled.
- B. Housing: Aluminum split housing, constructed of spun aluminum, with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Belt-Drive Units: Provide ball bearing motor mounted on adjustable base, with adjustable sheaves. Provide enclosure around belts. Provide lubricating tubes from fan bearings to outside of fan housing.
- D. Wheel: Provide aluminum air foil blades on aluminum hub.
- E. Accessories: Provide the following accessories as indicated and/or scheduled:
 - 1. Volume Control Damper: Provide manual controlled volume damper in fan outlet with quadrant and lock.
 - 2. Companion Flanges: Provide matching flanges on inlet and outlet to connect ductwork to fan.
 - 3. Fan Guards: Provide guards on inlets and outlets not connected to ductwork, constructed of expanded metal in removable frame.
- F. Manufacturer: Subject to compliance with requirements, provide inline centrifugal fans of one of the following:
 - 1. Cook (Loren) Co.
 - 2. Greenheck
 - 3. Penn Ventilator Co.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which centrifugal fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF CENTRIFUGAL FANS:

- A. General: Install centrifugal fans where indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices, to ensure that centrifugal fans comply with requirements and serve intended purposes.
- B. Access: Provide access and service space around and over centrifugal fans as indicated, but in no case less than that recommended by manufacturer.
- C. Isolation: Set centrifugal fans on vibration isolators; fasten in accordance with manufacturer's installation instructions.
- D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
- E. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Ensure that rotation is in direction indicated and intended for proper performance. Do not proceed with centrifugal fan start-up until wiring installation is acceptable to centrifugal fan Installer.
- F. Ductwork Connections: Refer to Division 23 "Ductwork" sections. Provide flexible connections on inlet and outlet duct connections.

3.3 FIELD QUALITY CONTROL:

- A. Upon completion of installation of centrifugal fans, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

3.4 ADJUSTING AND CLEANING:

- A. Start-up, test, and adjust centrifugal fans in presence of manufacturer's authorized representative.

3.5 SPARE PARTS:

- A. General: Furnish one spare set of belts for each belt driven centrifugal fan.

END OF SECTION

SECTION 23 3423 - POWER AND GRAVITY VENTILATORS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other related Specification sections, apply to work of this section.
 - B. Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of power and gravity ventilator work required by this section is indicated on drawings and schedules, and by requirements of this section.
 - B. Types of power and gravity ventilators specified in this section include the following:
 - 1. Ceiling ventilators.
 - a. Bathroom exhausters.
 - C. Refer to appropriate sections for installation of prefabricated roof curbs; not work of this section.
 - D. Refer to Division-23 section "Testing, Adjusting, and Balancing" for balancing of power and gravity ventilators; not work of this section.
 - E. Refer to Division-23 temperature control systems sections for control work required in conjunction with power and gravity ventilators; not work of this section.
 - F. Refer to Division-26 sections for the following work; not work of this section.
 - 1. Power supply wiring from power source to power connection on ventilators. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
 - 2. Interlock wiring between ventilators; and between ventilators and field-installed control devices.
 - 3. Interlock wiring specified as factory-installed is work of this section.
 - G. Provide the following electrical work as work of this section, complying with requirements of Division-26 sections:
 - 1. Control wiring between field-installed controls, indicating devices, and ventilators.
 - 2. Control wiring specified as work of Division-23 for Automatic Temperature Controls is work of that section.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of power and gravity ventilators, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
 - B. Codes and Standards:
 - 1. AMCA Compliance: Provide power ventilators which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Ratings Seal.
 - 2. UL Compliance: Provide power ventilators which are listed by UL and have UL label affixed.
 - 3. NEMA Compliance: Provide motors and electrical accessories complying with NEMA standards.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical data for power and gravity ventilators, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.
 - B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.
 - C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to power ventilators. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
 - D. Maintenance Data: Submit maintenance data and parts list for each type of power and gravity ventilator, accessory, and control. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of the specifications.

PART 2 - PRODUCTS

- 2.1 CEILING VENTILATORS:
 - A. Centrifugal Ceiling Exhausters: Provide centrifugal ceiling exhausters, designed for ceiling or wall mounting, of type, size and capacity as scheduled.
 - B. Provide AMCA Certified Ratings Seal.

- C. Type: Provide galvanized steel housing lined with acoustical insulation, adaptable for ceiling or wall installation. Provide centrifugal fan wheels mounted on motor shaft with fan shrouds, all removable for service. Provide integral backdraft damper fan discharge.
- D. Grille: Provide stainless steel louvered grille with flange on intake with thumbscrew attachment to fan housing.
- E. Motor: Provide permanent split-capacitor motor, permanently lubricated, with grounded cord and plug.
- F. Electrical: Provide junction box for electrical connection on housing, and receptacle for motor plug-in.
- G. Accessories: Provide manufacturer's standard roof jack, wall cap, and transition fittings as indicated on drawings or schedules.
- H. Manufacturer: Subject to compliance with requirements, provide centrifugal ceiling exhausters of one of the following:
 - 1. Cook Co., Loren.
 - 2. Greenheck Fan Corp.
 - 3. Penn Ventilator Co., Inc.

PART 3 - EXECUTION

- 3.1 INSPECTION:
 - A. General: Examine areas and conditions under which power and gravity ventilators are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION OF CEILING VENTILATORS:
 - A. General: Except as otherwise indicated or specified, install ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that ventilators serve their intended function.
 - B. Coordinate ventilator work with work of roofing, walls, and ceilings, as necessary for proper interfacing.
 - C. Ductwork: Refer to Division-23 section "Ductwork". Connect ducts to ventilators in accordance with manufacturer's installation instructions.
 - D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - E. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
 - F. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.
- 3.3 FIELD QUALITY CONTROL:
 - A. Testing: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.
- 3.4 ADJUSTING AND CLEANING:
 - A. Cleaning: Clean factory-finished surfaces: Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- 3.5 SPARE PARTS:
 - A. General: Furnish to one spare set of belts for each belt drive power ventilator.

END OF SECTION

SECTION 23 3600 - TERMINAL UNITS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 specification sections, apply to work of this section.
 - B. Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.2 DESCRIPTION OF WORK:
 - A. Extent of terminal unit work is indicated by drawings and schedules, and by requirements of this section.
 - B. Types of terminal units required for project include the following:
 1. Electric duct heaters
 2. Variable Air Volume units
 - C. Refer to other Division-23 sections for piping; ductwork; and testing, adjusting and balancing of terminal units; not work of this section.
- 1.3 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of terminal units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's specifications for terminal units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.
 1. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.
 2. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.
- 1.5 DELIVERY, STORAGE AND HANDLING:
 - A. Handle terminal units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.
 - B. Store terminal units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
 - C. Comply with manufacturer's rigging and installation instructions for unloading terminal units, and moving them to final location.

PART 2 - PRODUCT

- 2.1 ELECTRIC DUCT HEATERS:
 - A. Electric duct heaters and air handling coils shall be as manufactured by Brasch Manufacturing Company, Inc. Voltage, size, KW, steps and control voltage shall be as scheduled. Three phase heaters shall have balanced phases.
 1. Heaters shall be UL Listed for zero clearance and shall meet all NEC requirements.
 2. Type: Heaters shall be of the following configuration:
 - a. For Duct MountingAll Slip-in or Flanged
 - b. For Air Handling Unit CoilsAll Slip-in or Flanged
 3. Open coil heating elements shall be 80% nickel and 20% chromium; steps shall be arranged to prevent stratification when operating at less than full capacity. Elements for draw-through air handling units shall be derated to 35 watts per square inch; blow-through air handling coils and variable volume reheat coils shall be derated to 25 watts per square inch.
 4. Element terminals shall be stainless steel; insulators and bracket bushings shall be nonporous ceramic and securely positioned. Terminals shall be machine crimped to elements.
 5. Elements for Finned Tubular heaters shall have steel fins brazed to copper plated sheath. Element wire shall be 80/20 Nichrome. Elements shall be protected against corrosion by a high-temperature aluminum coating.
 6. Terminals shall be sealed with silicone rubber to protect against moisture.
 7. Frame shall be constructed of heavy gauge galvanized steel with galvanized steel brackets, stiffening ribs and gussets spot-welded to the frame.
 8. Terminal box shall be spot welded construction with solid, hinged cover, totally enclosed, without louvers or grilles per the UL Standard.

9. Recessed terminal box to be provided when coils are installed in ducts with internal insulation or obstruction greater than 1".
 10. Direction of airflow: heaters shall be interchangeable for horizontal left or right or vertical up airflow except when position sensitive mercury contactors or SCRs are built-in. In these cases, airflow direction shall be as scheduled.
 11. Safety devices: a disc-type automatic reset thermal cutout shall be furnished for primary overtemperature protection. For secondary protection, a sufficient number of replaceable thermal cutouts in the power lines shall de-energize elements if the primary cutout fails. All safety devices shall be serviceable through the terminal box without removing the heater from the duct.
 12. Wiring diagrams: a unique wiring diagram shall be furnished for each heater. Diagram shall include recommended supply wire gauges per NEC and fuse sizes. Typical wiring diagrams are not acceptable.
 13. Built-in components shall include safety interlocking disconnect switch, disconnecting break magnetic contactors, transformer with primary fusing per UL, pressure-type airflow switch set at .05" WC, supplementary circuit fuses per NEC (one set of fuses per 48 amp circuit), and separate load and control terminal blocks to accept conductors as shown on the electrical plan.
 14. Manufacturer to provide two-year limited warranty for heating elements; other components and accessories to be warranted for one year.
- B. Manufacturer: Subject to compliance with requirements, provide electric duct heaters of one the following:
1. Brasch
 2. Indeeco
 3. Qmark
 4. Dell-Heatrix

PART 3 - EXECUTION

- 3.1 INSPECTION:
- A. Examine areas and conditions under which terminal units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- 3.2 INSTALLATION OF VARIABLE AIR VOLUME TERMINALS:
- A. General: Install variable air volume terminals as indicated, and in accordance with manufacturer's installation instructions.
 - B. Locate variable air volume terminals as indicated. Coordinate the location of the terminal unit with the building structure, ductwork, lighting fixtures, and other obstructions to ensure that conflicts are avoided.
 - C. Install ductwork as indicated.
- 3.3 ELECTRICAL WIRING:
- A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - B. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- 3.4 ADJUSTING AND CLEANING:
- A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

END OF SECTION

SECTION 23 3713 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of air outlets and inlets required for project include the following:
 - 1. Ceiling air diffusers and grilles.
- C. Refer to other Division 23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- D. Refer to other Division 23 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
 - 3. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
 - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS AND GRILLES:

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers and grilles where shown; of size, shape, capacity, and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers and grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air device.
- D. Diffuser Dampers with Fire Damper: Combination adjustable opposed blade damper and fusible link fire damper with UL approved link and assembly designed to meet requirements of NFPA 90A.

- E. Types: Provide ceiling diffusers and grilles of type, capacity, and with accessories and finishes as listed on diffuser schedule.
- F. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
 - 1. Anemostat Products Div.; Dynamics Corp. of America.
 - 2. Carnes Co.; Div. of Wehr Corp.
 - 3. Krueger Mfg. Co.
 - 4. Metalaire
 - 5. Titus Products Div.; Philips Industries, Inc.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

3.3 SPARE PARTS:

- A. Furnish three (3) operating keys for each type of air outlet and inlet that require them.

END OF SECTION

SECTION 23 8126 - SPLIT SYSTEM HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of split system cooling units work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of split system cooling units specified in this section include the following:
 - 1. Split system air conditioners.
- C. Electrical Work: Provide the following wiring as work of this section, in accordance with requirements of Division 26:
 - 1. Provide control wiring between unit-mounted control panel and thermostats, remote control panels, and any other control device furnished as work of this section.
 - 2. Provide factory-mounted and wired controls and electrical devices as specified in this section.
- D. Refer to Division-26 sections for other electrical work including motor starters, disconnects, wires/cables, raceways, and other required electrical devices; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of split system cooling units, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.4 STANDARDS:

- A. ARI Compliance: Provide capacity ratings for split system cooling units in accordance with ARI Standard 210 for Unitary Air Conditioning and Air Source Heat Pump Equipment.
- B. UL Compliance: Provide split system cooling units which are UL-listed and labeled.

1.5 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, furnished specialties and accessories; and installation and start-up instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to split system cooling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of split system cooling units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. Maintenance Data: Submit maintenance data and parts list for each split system cooling unit, control, and accessory; including "trouble-shooting" maintenance guide. Include this data and product data in maintenance manual; in accordance with requirements of Division 1.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Handle split system cooling units and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged split system cooling units or components; replace with new.
- B. Store split system cooling units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading split system cooling units, and moving units to final location for installation.

1.7 SPECIAL PROJECT WARRANTY:

- A. Warranty on Motor/Compressor: Provide written warranty, direct from the manufacturer, agreeing to replace, within warranty period, motors/compressors with inadequate and defective materials and workmanship, including labor, leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. The Contractor shall respond to the site for any system outage event within 4 hours of the event.
- B. Warranty Period: 5 years parts and labor from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS

A. General Description

1. All components included herein are designed, manufactured and independently tested, rated and certified to meet the seismic compliance standards of the International Building Code. Components designated for use in systems that are life safety, toxic, high hazard, combustible or flammable shall meet the on line, anchorage and load path requirements for life safety as defined in IBC sections 1621.1.6, 1621.3.3, 1707.7.2, and IBC Commentary, Volume II, section 1621.1.6, IBC notes pertaining to the release of hazardous material. All components used as part of a system other than the above shall meet as a minimum, all load path and anchorage standards for components as outlined in IBC section 1621.3.3 & 1707.7.2.
2. All completed component assemblies shall be clearly labelled for field inspection. Seismic Compliance Labels shall include the manufacturer's identification, designation of certified models, definitive information describing the product's compliance characteristics, and the Independent Certifying Agency's name and report identification.
3. In addition to all seismic requirements for IBC Certification listed elsewhere in the project specification, manufacturer's submittals shall include :
4. Certificate of Compliance from the Independent Certifying Agency clearly indicating that components supplied on this project are included in the component manufacturer's Certificate of Compliance.
5. Clear installation instructions including all accessory components that are part of the overall component installation.

B. Unit Construction

1. Fabricate unit with 16 gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
2. Panels and access doors shall be constructed as a 2-inch (50-mm) nominal thick; thermal broke double wall assembly, injected with foam insulation for an R-value of not less than R-13. Fiberglass or open cell foam insulations are not acceptable. The outer panel shall be constructed of G90 galvanized 18-gauge steel. The inner liner shall be constructed of G90 galvanized steel. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 6 inches of negative static pressure or 5 inches of positive static pressure. Deflection shall be measured at the midpoint of the panel height. The casing leakage rate shall not exceed .5 cfm per square foot of cabinet area at 6 inches of negative static pressure or 5 inches of positive static pressure (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure). Module to module assembly shall be accomplished with an overlapping, full perimeter, insulated, internal splice joint sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
3. Entire unit shall have a full perimeter base rail, with height as scheduled on the drawings, for structural rigidity and condensate trapping.
4. Access Doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size (4.5" minimum) handle assembly. Door shall swing outward for unit sections under negative pressure (inward for unit sections under positive pressure). Doors limited from swinging inward (such as side access filter sections) on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.
5. Construct drain pans from stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section. Drain connection centerline shall be a minimum of 3" above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 2" thickness of insulation under drain pan.

C. Supply Fan

1. Provide fans as scheduled. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Manufacturer must ensure maximum fan RPM is below the first critical speed.
2. Bearings shall be self-aligning, grease lubricated, ball or roller bearings with extended copper lubrication lines to access side of unit. Grease fittings shall be attached to the fan base assembly near access door.
3. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry.

D. Bearings and Drives

1. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards, [L-50 life at 200,000 hours – all DWDI fans] [L-50 life at 500,000 hours – DWDI fans on unit sizes 003 - 035], [L-50 life at 400,000 hours all belt-drive airfoil plenum fans and DWDI fans on unit sizes greater than 035] [L-

50 life 1,000,000 hours – DWDI fans on unit sizes 003 – 035] [L-50 life at 600,000 hours – all inline fans], heavy duty pillow block type, self-aligning, grease-lubricated ball bearings.

2. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.
3. V-Belt drives shall be cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. [Fixed sheaves, matched belts, and drive rated based on motor horsepower] [Variable and adjustable pitch sheaves selected so required RPM is obtained with sheaves set at mid-position and rated based on motor horsepower. Contractor to furnish fixed sheaves at final RPM as determined by balancing contractor]. Minimum of 2 belts shall be provided on all fans with 10 HP motors and above. Standard drive service factor shall be [1.1 S.F. (for 1/4 HP – 7.5 HP)] [1.3 S.F. (for 10HP and larger)], calculated based on fan brake horsepower.

E. Electrical

1. The air handler(s) shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.
2. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.
3. Fan motors shall be 1800 rpm, open drip-proof (ODP). Motors shall be high efficiency to meet EPA Act requirements.
4. Manufacturer must provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.

F. Cooling and Heating Sections

1. Provide access to coils as shown on drawings of unit for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior and gasket sleeve between outer wall and liner where each pipe extends through the unit casing to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
2. Refrigerant Coils:
 - a. Certification - Acceptable refrigerant coils are to be certified in accordance with ARI Standard 410 and bear the ARI label. Coils exceeding the scope of the manufacturer's certification and/or the range of ARI's standard rating conditions will be considered provided the manufacturer is a current member of the ARI Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with ARI Standard 410. Manufacturer must be ISO 9002 certified.
 - b. Coils designed for use with Refrigerant R410a. Fins shall have a minimum thickness of 0.0075" of aluminum plate construction with full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary-to-secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tube shall not be visible between fins.
 - c. Refrigerant coils shall be provided with round seamless 5/8" O.D. copper tubes on 1-1/2" centers, staggered in the direction of airflow. All joints shall be brazed.
 - d. Sweat type copper suction connections located at the bottom of the suction headers for gravity oil drainage. Coils shall be uniformly circuited in a counterflow manner and a single circuit or dual circuit interlaced as required to match condensing unit circuiting and capacity reduction. Pressure type liquid distributors used. Coils shall be tested with 315 pounds air pressure under warm water, and suitable for 250 psig working pressure.

G. Additional Sections

1. Mixing box section shall be provided with or without (as shown on drawings) factory mounted low leak airfoil blade outside and return air dampers of galvanized steel in a galvanized frame. Dampers shall be hollow core airfoil blades, fully gasketed and have continuous vinyl seals between damper blades. Dampers shall have stainless steel jamb seals along end of dampers. Linkage and ABS plastic end caps shall be provided when return and outside air dampers sized for full airflow. Return and outside air dampers of different sizes must be driven separately.
2. Filter sections shall be of same construction as air handling unit and provided with full size hinged access doors on both sides for full access. Provide 2" deep rack for 2" pleated disposable filters as scheduled. Provide 1" header type racks with integral seals suitable for single header type. 4" deep pleated after filters as scheduled. Contractor to provide magnehelic gauges across filter banks per specifications.
3. Access sections shall provide access between components shall be a minimum length as shown on drawings. Access doors of galvanized steel for flush mounting, with gasket, latch and full size (minimum of 4.5") handle assembly.

2.2 CONDENSING UNITS

A. General Description

1. Furnish and install, as shown on the plans, factory-assembled, air-cooled scroll compressor, R-410A condensing units in the size and quantity specified. Each unit shall consist of hermetic scroll compressor(s) with air-cooled condenser section.
2. The complete unit shall be UL listed.

B. Design Requirements

1. Provide a complete condensing unit as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced above, and any local codes in effect.
2. Refer to the schedule of performance on the drawings.

C. Condensing Section

1. Air Cooled Condenser

- a. The condensing section shall be open on the sides and bottom to provide access and to allow airflow through the coils. Condenser coils shall be constructed with 3/8" copper tubing mechanically bonded to aluminum plate type fins for maximum heat transfer or of all aluminum microchannel type construction. Spine fin or spiral fins condenser coils will not be considered. Each condenser coil shall be factory leak tested with high-pressure air under water.
- b. Condenser fans shall be direct drive, propeller type designed for low tip speed, vertical air discharge, and include service guards. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motor shall be direct drive, single phase, permanently lubricated "PSC" motors with inherent thermal overload.
- c. Unit shall have standard pressure controls that cycle the condenser fan motors to maintain condensing pressures for operation down to 40°F ambient.
- d. Condenser fan motor shall be direct drive, single phase permanently lubricated "PSC" motors with inherent thermal overload.
- e. Unit shall be complete with liquid and suction line isolation valves.

2. Scroll Compressors

- a. Unit shall have heavy-duty non-proprietary scroll compressor(s). Digital scroll compressors are not acceptable. Provide crankcase heaters.
- b. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission
- c. Capped connections shall be external to the unit providing for field connection of refrigerant piping.
- d. Unit shall have a liquid and suction line service valves.

D. Controls

1. Unit shall be equipped with a 24V terminal strip for field supplied and installed controls. All safeties shall be of non-proprietary electro-mechanical design. Microprocessor type controls or safeties will not be considered permitted. Provide minimum number of stages of control as scheduled on the drawings.
2. Provide phase failure relay for all three phase motors. Relay shall be fully adjustable to open the contacts when any phase to phase or phase to ground voltage drops below 20% nominal. The relay drop out point shall be adjustable from 0% to 50%. Relay shall be provided with an adjustable time delay of 0 to 120 seconds before opening to avoid nuisance outages. Relay shall be fully automatic to open and fully automatic to reset.

E. Electrical

1. All wiring shall comply with UL requirements. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point terminal block for main power connection. A terminal board shall be provided for low voltage control wiring.

F. Manufacturers:

1. Subject to compliance with requirements, provide indoor split system units of one of the following:
 - a. Daikin
 - b. Trane
 - c. Carrier

PART 3 - EXECUTION

3.1 INSPECTION:

- A. General: Examine areas and conditions under which split system cooling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

- A. Install in strict accordance with manufacturer's requirements, shop drawings, and contract documents
- B. Adjust and level unit in alignment on supports.
- C. Coordinate electrical installation with electrical contractor.
- D. Coordinate controls with control contractor.

3.3 STARTUP

- A. Install proper charge of refrigerant and oil.
- B. Provide testing and starting of machine, and instruct the Owner in its proper operation and maintenance.
- C. Coil Coating: Provide coating on all evaporator and condenser coils, as described herein.
 - 1. All condenser coils and air handling coils with more than 25% outside air shall be specified with a factory-applied coating resistant to a salt air environment. Coil coating shall be proven in similar salt exposure applications for minimum 10,000 hours salt spray test in accordance with ASTM B-117.
 - 2. The coil coating company shall prove experience in salt resistant coatings for a period of over 10 years. The coating vendor shall provide a written 5 year warranty on all coil coatings with coil replacement (parts and labor included). Coating shall be performed in a controlled factory environment and shall be a "dip" or "flow" coat process that fully covers coil fins, tubes and casing. Pre-coating fins without final "dip" coating is not acceptable. Field application coatings shall be limited to additional coverage of equipment, touch-up, and warranty work. Coating shall be: epoxy (E-coat) process with urethane U.V. top coats, polyelastomer (equal to Bronze-Glow), Thermoguard or phenolic epoxy (equal to "Heresite" products).
 - 3. The condensing units shall be sized to compensate for capacity losses due to coatings. Any degradation of equipment performance shall be clearly indicated in that equipment's shop drawing.
 - a. Standard, uncoated aluminum fin, copper tube coils are not acceptable for exterior condensers coils.

3.4 FIELD QUALITY CONTROL:

- A. General: Start-up split system cooling units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

3.5 CLOSEOUT PROCEDURES:

- A. Training: Provide services of manufacturer's technical representative for 1-half day to instruct Owner's personnel in operation and maintenance of each type of split system cooling unit.
- B. Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

3.6 SPARE PARTS:

- A. General: Furnish to Owner, with receipt, the following spare parts for each split system cooling unit:
 - 1. Two sets of filters for each unit. One set to be installed at the time of start-up of the equipment and the other set to be installed when the building is turned over to the Owner.

END OF SECTION

SECTION 26 0500 - BASIC METHODS AND REQUIREMENTS (ELECTRICAL)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. Furnish and install all electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, cable, panelboards, etc., and arrangement for specified items in general are shown on drawings.
- D. All ampacities herein specified or indicated on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are not permitted.

1.2 MINIMUM REQUIREMENTS

- A. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), Florida Building Code, and National Fire Protection Association (NFPA) are a minimum installation requirement standard. Design drawings and other specification sections shall govern in those instances where requirements are greater than those specified in NEC.
- B. The rules and regulations of the Federal, State, local, civil authorities and utility companies in force at the time of execution of the contract shall become a part of this specification. In addition, the following codes and standards shall apply:
 - 1. Florida Building Code (FBC) 6th Edition (2017): This code includes the 2017 FBC Building, Mechanical, Plumbing, Energy Conservation, Fuel Gas, Accessibility, and Test Protocols volumes. Further, see "Referenced Standards" in the FBC Building Chapter 35; FBC Mechanical Chapter 15; FBC Plumbing Chapter 14; FBC Energy Conservation Chapter 6; and FBC Fuel Gas Chapter 8) (Effective December 31, 2017).
 - 2. 6th Edition of the Florida Fire Prevention Code (FFPC): This code also includes the Florida versions of NFPA 1 and NFPA 101. (Effective December 31, 2017).
 - 3. 2014 National Electric Code.
- C. No work shall be done unless the Superintendent of the Contractor is on the job site. Work shall be properly protected, all rubbish removed promptly, and exposed work shall be carefully cleaned prior to final acceptance.
- D. The term "provide" shall include labor, materials, and equipment necessary to furnish and install, complete and operable, the item or system indicated.
- E. In decisions arising from discrepancies, interpretation of Drawings and Specifications, substitutes, and other pertinent matters, the decision of the Owner's representative's approval shall be final.

1.3 SPECIFICATIONS AND DRAWINGS

- A. Plans show location of fixtures and equipment and are intended to depict the general intent of the work in scope, layout and quality of workmanship. They are not intended to show in minute detail every or all accessories intended for the purpose of executing the work, but it is understood that such details are a part of this work.
- B. Where Drawings and Specifications conflict, it shall be the responsibility of this Contractor to bring such conflict to the attention of the Architect/Engineer for clarification. In general, the Architectural Drawings shall take precedence over the Mechanical Drawings with reference to building construction. All changes from the Drawings necessary to make the work conform with the building as constructed and to fit the work of other trades or to conform to the rules of authorities having jurisdiction, shall be made by the Contractor at his own expense.
- C. Keep a record of the locations of concealed work and of any field changes in Contract Drawings and Specifications for each trade and, upon completion of the job, supply "As-Built" Drawings and Specifications showing in pencil on sepia reproducibles, any deviations from the original Drawings, indicating in the Specifications each manufacturer's name underlined or inserted whose product was used on the job. These Drawings shall indicate dimensions of buried utility lines from building walls. One set of sepia reproducibles of the original tracings will be furnished upon request for this purpose.

1.4 STANDARDS

- A. All material and equipment shall be listed, labeled or certified by Underwriters Laboratories, Inc., where such standards have been established. Equipment and material which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally

recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed: Equipment is "listed" if of a kind mentioned in a list which:
 - a. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.
 - b. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
2. Labeled: Equipment is labeled if:
 - a. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
 - b. The laboratory makes periodic inspections of the production of such equipment.
 - c. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
3. Certified: Equipment is "certified" if:
 - a. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - b. Production is periodically inspected by a nationally recognized testing laboratory.
 - c. It bears a label, tag, or other record of certification.
4. Nationally recognized Testing Laboratory: A testing laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.
5. Reference to "Architect" or "Architect/Engineer", shall refer to the "Engineer".

1.5 QUALIFICATIONS (PRODUCTS AND SERVICES)

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least five years, unless otherwise noted elsewhere in the specifications or on the drawings.
- B. Product Qualification:
 1. Manufacturer's product shall have been in satisfactory operation on three installations of similar size and type, as this project, for approximately three years.
 2. The Owner reserves the right to require the contractor to submit a list of installations where the products have been in operation before approval of said products.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.6 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts should be available. Items not meeting this requirement, but which otherwise meet technical specifications, and merits of which can be established through reliable test reports or physical examination of representative samples, will be considered.
- B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
 1. All components of an assembled unit need not be products of the same manufacturer, however, the assembled unit shall be the responsibility of a single manufacturer and warranted as such.
 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
 3. Components shall be compatible with each other and with the total assembly for the intended service.
 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. All factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

1.7 EQUIPMENT REQUIREMENTS

- A. Equipment voltage ratings shall be in accordance with the requirements indicated on the drawings or as specified.
- B. Prior to bid, written approval shall be obtained by the Contractor for any equipment that differs from those specified on the drawings and specifications. The Contractor shall be prepared to submit samples of the equipment when requested at no cost to the Architect/Engineer.
 1. The Contractor shall furnish drawings showing all installation details, shop drawings, technical data and other pertinent information as required to determine that the equipment is equivalent in quality and function to the equipment specified.

2. Approval by the Architect/Engineer of the equal equipment does not relieve the Contractor of the responsibility of furnishing and installing the equipment at no additional cost to the Owner.
3. Any other items required for the satisfactory installation of the equal equipment shall be furnished and installed at no additional cost to the Owner. This includes but shall not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and correlation with other work, subject to the jurisdiction and approval of the Architect/Engineer.
- C. Catalogue numbers, where given, are intended to give a basis for design, quality and function. Any other incidental equipment needed for a complete and functional installation shall be provided at no additional cost.

1.8 EQUIPMENT PROTECTION

- A. Equipment and material shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.
- B. During installation, equipment, controls, controllers, circuit protective devices, etc., shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing, operating and painting.
- C. Damaged equipment shall be, as determined by the Architect/Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
- D. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
- E. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

- A. Arrange, phase and perform work to assure electrical service for other buildings at all times.
- B. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions.
- C. Coordinate location of equipment and conduit with other trades to minimize interferences.
- D. Obtain and pay for all required installation inspections and deliver certificates approving installations to the Owner unless directed otherwise.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings. Where architectural features govern location of work, refer to architectural drawings.
- B. Working spaces shall not be less than specified in the National Electrical Code for all voltages specified.
- C. Inaccessible Equipment:
 1. Where the Owner/Architect/Engineer determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
 2. "Conveniently accessibility" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and duct work.
- D. Equipment and Material:
 1. New equipment and material shall be installed, unless otherwise specified.
 2. Equipment and material shall be designed to assure satisfactory operation and operating life for environmental conditions where being installed. NEC and other code requirements shall apply to the installation in areas requiring special protection such as explosion-proof, watertight and weatherproof construction.
- E. Utility Services:
 1. Contact electric utility company and make arrangements for all electrical service work, including all requirement for new electrical services. The Contractor shall be responsible for scheduling and coordination of all the work with the utility. Make application or assist the Owner in making application for services as required. Determine utility connection requirements and include in the base bid all Contractor costs to the Owner for utility services as best as can be determined prior to bid, as indicated on the drawings, and as are customary and standard costs.
 2. Include all costs for temporary service, temporary routing of service or any other requirements of a temporary nature associated with the utility service.
- F. Continuity of Service:
 1. No service shall be interrupted or changed without permission from the Architect and the Owner. Written permission shall be obtained before any work is started.
 2. When interruption of services is required, all persons concerned shall be notified and a prearranged time agreed upon.

3. Provide any required temporary power or communications circuits or extensions necessary to accommodate the phasing of construction. Refer to architectural drawings and specification for additional details for the required phasing.

G. Concrete Work:

1. Provide all cast-in-place concrete shown on the documents unless noted otherwise. Concrete work shall conform to all applicable Division 2 and 3 specification sections.
2. Provide all anchor bolts, metal shapes and templates required to be cast in concrete or used to form concrete for support of electrical equipment.

1.11 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the National Electrical Code, install an identification nameplate which will clearly indicate information required for use and maintenance of items such as switchboard, panelboards, cabinets, safety switches, separately enclosed circuit breakers, motor starters, communications systems cabinets, control devices and other significant equipment.
- B. Nameplates shall be laminated white phenolic resin with a black core with engraved lettering, a minimum of 3/16-inch high. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions. Hand written marker is not acceptable.

1.12 SUBMITTALS

- A. The Architect/Engineer's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site. Submittals shall be made for all equipment and systems as indicated in the respective specification section.
- B. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Architect/Engineer to ascertain that the proposed equipment and materials comply with specification and drawing requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- C. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval. Submittals shall be submitted for all applicable products and materials specified in each individual section of these specifications.
- D. Make submittals for the equipment and materials in accordance with the following:
 1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 3. The submittals shall include the following:
 - a. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required. Provide any additional information specifically requested in the individual specification section or on the drawings.
 - b. Elementary and interconnection wiring diagrams for fire alarm, sound system, TV system and other communication systems and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 - c. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
 4. Electronic PDF submittal files shall be named utilizing the specification number followed by a sequential number for the submittal made under the given specification number followed by "r#" if it is a resubmittal, and then followed by a brief description of the submitted item.
 - a. The description shall indicate the actual item submitted, shall not be general in nature, and does not have to be that of the specification section heading.
 - b. Using the example, "26 0526-4r2 Grounding Electrodes"; 26 0526 – Grounding is the relevant specification, the "4" shows it was the fourth submittal for specification section 26 0526 02, "r2" shows it was the second resubmittal, and the description indicates what item is submitted.
 - c. Each specification item shall be submitted in a separate PDF file. PDF files with multiple specification items will be returned without review.
 - d. Each file shall have sufficient space allowance for the Architects and Engineer's review stamp(s).
 - e. Each file shall have the Construction Managers review stamp(s) and indicate information required by specification 26 0526.1.12.G.
- E. Shop drawings on paper 11"x17" or smaller in size shall be submitted in a tabbed and indexed three ring binder. The binder shall not exceed 11-5/8" height. Partial submittals are unacceptable. The index shall indicate the related specification section number.
- F. The Construction manager will certify that all Division 26 shop drawings are in conformance with the plans and specifications. Deviations from the plans and specifications shall be noted, and the specific area of the

deviation clouded and in contrasting color (green) with a complete explanation for the reasons for the deviation. Any redesign of the system shall be Certified by a Professional Engineer currently registered in the State of Florida, and will be accompanied by the fees as described in "F" above.

- G. Carefully examine all shop drawings and mark-up as necessary before submitting to the Architect/Engineer for review. The consultant will only consider shop drawings bearing the contractor's stamp of approval.
- H. The engineer's review shall not relieve the contractor from the responsibility for deviations from drawings and specifications. The engineer's review shall be construed to apply only to general arrangement and shall not relieve the contractor from the responsibility for the correctness of details and dimensions and provision of the correct equipment.
- I. The contractor shall retain copies of all reviewed shop drawings on the job site for reference.
- J. In addition to the requirement of SUBMITTALS, the Owner reserves the right to request the manufacturer to arrange for the Owner's representative(s) to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.
- K. Operation and Maintenance Manuals:
 - 1. Maintenance manuals shall be complete and shall be furnished in a loose leaf binder or in the manufacturer's standard binder. Information shall be sufficient to enable a qualified technician to perform normal first line maintenance and repair. A parts list shall be included which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
 - 2. Operation manuals shall be clear and concise and shall describe, in detail, the information required to properly operate the equipment specified. The manuals shall include complete catalog cuts and as-built wiring diagrams.
 - 3. Operation and maintenance manuals shall be submitted for approval prior to final close-out.

1.13 CUTTING, PATCHING, EXCAVATION, BACKFILL, AND LAYOUT

- A. Refer to Section 01731 for Cutting and Patching requirements. Provide openings and excavation required for the installation of the electrical work. Patch work and backfill as required. Finished work shall match the existing adjoining work.
- B. Verify all conditions affecting the work to be performed under this contract.
- C. Carefully verify measurements at the site, determine the exact location of chases and openings required. Provide sleeves, inserts, supports, concrete work, and hangers as required. No columns, beams, joists, building foundations nor any other structural building component shall be cut, drilled or disturbed in any way without prior approval. Conflicts shall immediately be brought to the attention of the Architect/Engineer.
- D. All excavation on sites containing existing buildings and existing services, shall be done with hand shovel to avoid damage to existing services. Where hand shovel is not practical extreme caution shall be taken when performing excavation. The contractor will be responsible for locating any existing utilities and adjusting manhole and handhole locations and conduit routing as necessary. Any damage incurred by the Contractor shall be repaired by the Contractor in a manner approved by the Architect/Engineer at no cost to the Owner and with no extension of time limitation.

1.14 EXPERIENCE

- A. The Contractor performing this work shall be a licensed, reputable firm, regularly performing the type of work incorporated in this project and who also maintains, as part of the firm, a service department with qualified personnel who regularly perform this type of work. The Contractor shall, upon request, show evidence of at least two jobs of similar character and size installed within the preceding two years.

1.15 ELECTRICAL WORK FOR MECHANICAL SYSTEMS

- A. Factory installed starters, controllers, and control equipment mounted in manufactured mechanical equipment necessary for Division 23 equipment operation shall be furnished under that respective Division.
- B. Power wiring for motors and installation of starters not provided integral with equipment shall be under Division 26 Electrical.
- C. Temperature, humidity, pressure and similar controls essential to the operation of mechanical systems, and wiring and conduit thereof, including interlock wiring, shall be under Division 23 of specifications, installed in accordance with requirements of Division 26.
- D. Motors shall be furnished under Division 23 of capacity required to operate equipment specified, but shall not be less than that specified.
- E. All low voltage (120V and under) temperature control wiring for Division 26 equipment shall be provided under by that respective Division.
- F. Division 23 shall provide conduit when required for control wiring, installed in accordance with Division 26 requirements.

1.16 MOTORS

- A. All motors shall be furnished and installed under Division 23 Mechanical and shall be wired under Division 26 Electrical.

1.17 REMOVAL OF RUBBISH

- A. Contractor shall keep premises free from accumulations of waste material or rubbish caused by his employees or work. At completion of work, he shall remove all his tools, scaffolding, surplus materials, and rubbish from building and site. He shall leave premises and his work in a clean orderly condition acceptable to the Architect/Engineer.

1.18 QUIET OPERATION AND VIBRATION

- A. All equipment provided under this section shall operate under all conditions of load free of objectionable sound and vibration. Sound and vibration conditions considered objectionable shall be corrected in an approved manner.
- B. Vibration and sound control shall be by means of approved vibration eliminators or sound attenuators in a manner as specified and as recommended by the manufacturer.

1.19 CLEANING AND ADJUSTMENTS

- A. Upon completion of the work, Contractor shall clean and re-lamp all light fixtures, clean and identify all equipment, adjust and test all equipment and apparatus which he has installed and make certain such apparatus and mechanisms are in proper working order and ready to test.
- B. During construction protect all conduit and equipment from damage and dirt. Cap the open ends of all conduit and equipment.

1.20 STORAGE OF MATERIALS

- A. All materials stored on site shall be properly protected from injury or deterioration. Materials shall not be stored in contact with ground or floor.
- B. Do not remove manufacturer's packing materials until ready to install. Materials showing signs of corrosion, improper handling or storage shall be replaced at no cost to the Owner.
- C. Provide continuous protection for all equipment already installed.

1.21 WATERPROOFING

- A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Owner before the work is done.
- B. Provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight. Waterproof flashing materials shall be compatible with base materials.

1.22 TESTS

- A. Contractor shall make all tests required to establish the adequacy, quality, safety, completed status and satisfactory operation of all systems to the satisfaction of the Architect/Engineer. Provide all instruments, labor and services necessary to conduct tests.
- B. All conductors for the main electrical services, all building feeders, plus all conductors 150 amp rated and up, shall be megger tested to test insulation and connection integrity prior to permanent energization.
 - 1. Cables 600 Volts or Less: Cables 600 volts or less in size #1/0 and larger shall be meggered using an industry standard "megger" with 1000V internal generating voltage. Readings shall be recorded and submitted to the Engineer for acceptance prior to energizing same. Values are less than 200 Mohms shall be automatic failure. Submit 5 copies of tabulated megger test values for all cables identified by the feeder name (Panel or equipment tag). Tester shall be a Megger MIT200 Series tester, or equivalent with auto discharge ensures all circuits are safely discharged after testing. 1000 V insulation test range shall have a high voltage warning prior to test voltage being applied.

1.23 INSTRUCTIONS

- A. Fully instruct Owner's personnel in the care and operation of electrical systems, including all communications, sound and fire alarm systems and furnish a letter to the Architect/Engineer advising the particular person(s) who have received such instruction.

1.24 WARRANTY

- A. Equipment shall be started, tested, adjusted, and placed in satisfactory operating condition. Furnish a letter addressed to the Architect/Engineer advising that the completed systems have been installed in accordance with the Plans and Specifications and that they are in proper operating condition. The Owner shall receive a written warranty covering all defects in workmanship and material for a minimum period of one year from date of substantial completion. Any defects appearing within this year period shall be repaired or replaced without additional cost to the Owner. Refer to individual specification sections for additional warranty requirements. Longer, extended warranty periods shall apply where specified in any individual specification section.

1.25 ACCEPTANCE

- A. Before requesting final inspection:
 - 1. Complete all work required. If any items are held in abeyance as incomplete for final inspection, list such items together with explanation for delay.
 - 2. Submit statement that equipment is properly installed, adjusted, tested and operation is satisfactory.
 - 3. See Division 00 – Close Out Procedures.
 - 4. Submit copy of other data as may be outlined in these specifications.
- B. Copies of the above data shall be submitted to the Architect/Engineer prior to requesting final inspection.

1.26 SINGULAR NUMBER

- A. Where any device or part of equipment is referred to in these specifications in the singular number (such as "the switch"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.28 MULT-WIRE BRANCH CIRCUITS

- A. All multi-wire branch circuits shall comply with Article 210.4 of the 2011 National Electrical Code. Provide all required handle ties where applicable multi-wire branch circuits are indicated on the drawings.

END OF SECTION

SECTION 26 0519 - WIRES AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. This section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 23 and 26 section making reference to electrical wires and cables specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical wire and cable work is indicated by drawings and schedules.
- B. Types of electrical wire, cable, and connectors specified in this section include the following:
 - 1. Copper conductors.
 - 2. Fixture wires.
 - 3. Flexible cords and cables.
 - 4. Wirenut connectors.
- C. Applications of electrical wire, cable, and connectors required for project are as follows:
 - 1. For motor-branch circuits.
 - 2. For power distribution circuits
 - 3. For lighting circuits
 - 4. For appliance and equipment circuits

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical wires and cables.
- D. UL Compliance: Comply with applicable requirements of UL Std 83, "Thermoplastic-Insulated Wires and Cables", and Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors".
- E. UL Compliance: Provide wiring/cabling and connector products which are UL-listed and labeled.
- F. NEMA/ICEA Compliance: Comply with NEMA/ICEA Std Pub/ No.'s WC 5, "Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy", and WC-30, "Color Coding of Wires and Cables", pertaining to electrical power type wires and cables.
- G. IEEE Compliance: Comply with applicable requirements of IEEE Stds 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
- H. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8, and D-753. Provide copper conductors with conductivity of not less than 98% at 20oC (68oF).

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Wire and Cable:
 - a. American Wire and Cable Co.
 - b. Anaconda-Ericsson Inc; Wire and Cable Div.
 - c. Belden Div; Cooper Industries
 - 2. Connectors:
 - a. AMP, Inc.
 - b. Appleton Electric Co.
 - c. Burndy Corporation
 - d. Thomas and Betts Corp.

2.2 WIRES, CABLES, AND CONNECTORS

- A. General: Provide electrical wires, cables, and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a

complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20oC (68oF).

- B. Building Wires: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements:
 - 1. Type THHN, THWN, THHW, XHHW, THHN/THWN: Unless otherwise indicated, all conductors for dry locations requiring a conductor temperature rating 75oC (167oF) or less. Insulation shall be flame retardant, moisture and heat resistant, thermoplastic. Conductor shall be annealed copper.
 - 2. Type THWN, THHW, XHHW, THHN/THWN: Unless otherwise indicated, all conductors for wet or dry locations requiring a conductor temperature rating of 75oC (167oF) or less. Insulation shall be flame retardant, moisture and heat resistant thermoplastic. Conductor shall be annealed copper.
 - 3. Type THHN, THHW, XHHW: Unless otherwise indicated, all conductors for dry locations requiring a conductor temperature rating of 90oC (194oF) or less. Insulation shall be flame retardant, moisture and heat resistant thermoplastic. Conductor shall be annealed copper.
 - 4. Type XHHW-2: Unless otherwise indicated, all conductors for wet locations requiring a conductor temperature rating of 90oC (194oF) or less. Insulation shall be flame retardant, moisture and heat resistant thermoplastic. Conductor shall be annealed copper.
 - 5. Conductors for use at 600 volts or below shall be 600 volt rated. Wire No. 12 and smaller may be solid or stranded and wire No. 10 and larger shall be stranded only. Stranded conductors shall terminate in crimp type lugs.
 - 6. Motor circuit branch wiring and associated control wiring: Provide type THHN insulation in dry and damp locations. Provide type THHW insulation in wet locations. All motor wiring to be stranded copper.
 - 7. Wiring in fluorescent fixture channels: Provide conductors with a 90°C temperature rating, type THHN or TFFN insulation.
- C. Cables: Provide UL-type factory-fabricated cables of sizes, ampacity ratings, and materials and jacketing/sheathing as indicated for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements, NEC and NEMA standards.
- D. Connectors:
 - 1. General: Provide UL-type factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following, those types, classes, kinds, and styles of connectors to fulfill project requirements:
 - a. Type: Pressure.
 - b. Class: Insulated.
 - c. Kind: Copper (for Cu to Cu connection).
 - d. Style: Butt connection.
 - e. Style: Elbow connection.
 - f. Style: Combined "T" and straight connection.
 - g. Style: "T" connection.
 - h. Style: Split-bolt parallel connection.
 - i. Style: Tap connection.
 - j. Style: Pigtail connection.
 - k. Style: Wirenut connection.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRES AND CABLES

- A. General: Install electrical cables, wires, and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UI, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.
- C. Pull conductors simultaneously where more than one conductor is being installed in the same raceway.
- D. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.
- E. Use pulling means including, fish tape, cable, rope and basket weave or wire/cable grips which will not damage cables or raceway. Any cable damaged during installation shall be completely replaced.
- F. Keep conductor splices to minimum. No joints shall be made in conductor except at junction boxes, outlet boxes or splice boxes. Newly installed conductors shall not be spliced unless specifically noted on the drawings. Splices shall not be permitted underground.

- G. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced.
 - H. Use splice and tap connectors which are compatible with conductor material.
 - I. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.
 - J. At least eight inches (8") of slack wire shall be left in every outlet box whether it be in use, or left for future use.
 - K. Color code wiring as follows:
 - 1. 120/208 volt, 3 phase, 4 wire: phase A-black, phase B-red, phase C-blue, neutral-white; ground conductor-green.
 - 2. 277/480 volt, 3 phase, 4 wire: phase A-brown, phase B-orange, phase C-yellow, neutral-gray; ground conductor-green.
 - L. Wire and cable boxes and reels shall bear the date of manufacture and must not bear dates by more than one year preceeding contract date.
 - M. Minimum conductor sizes, except as specifically identified on the drawings, shall be as follows:
 - 1. No. 12 - Branch circuits of any kind, except as specified otherwise below.
 - 2. No. 14 - Signal systems, fire alarm system, unless specifically noted otherwise.
 - 3. No. 10 - Exit light circuits, emergency circuits, security lighting, and exterior light circuits.
- 3.2 FIELD QUALITY CONTROL
- A. Prior to energization, test wires and cables for electrical continuity and for short-circuits.

END OF SECTION

SECTION 26 0526 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. Division 26 Basic Electrical Materials and Methods section apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of grounding work is indicated by drawings and schedules.
- B. Types of grounding specified in this section include the following:
 - 1. Solid grounding
- C. Applications of grounding work in this section including the following:
 - 1. Underground metal water piping
 - 2. Metal building frames
 - 3. Grounding electrodes
 - 4. Grounding rods
 - 5. Service equipment
 - 6. Enclosures
 - 7. Equipment
 - 8. Communications systems

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground rods and plate electrodes, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with electrical grounding work similar to that required for project.
- C. NEC Compliance: Comply with NEC requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL-listed and labeled.
- D. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical grounding and bonding.
- E. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on grounding systems and accessories.
- B. Shop Drawings: Submit layout drawings of grounding systems and accessories including, but not limited to, ground wiring, copper braid and bus, ground rods, and plate electrodes.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering grounding products which may be incorporated in the work include, but not limited to, the following:
 - 1. Burndy Corp.
 - 2. Crouse-Hinds Co.
 - 3. Electrical Components Div.; Gould Inc.
 - 4. Thomas and Betts Corp.

2.2 GROUNDING SYSTEMS

- A. Materials and Components:
 - 1. General: Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.

- B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.
- C. Ground Rods: Solid copper or copper clad, minimum 3/4" dia. x 10'. Provide longer rods if necessary for required resistivity.
- D. 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.
- E. Provide exothermic weld type connections where indicated on the drawings.
- F. Provide ground bars as specified on the drawings.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer must examine areas and conditions under which electrical grounding connections are to be made and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL GROUNDING

- A. General: Install electrical grounding systems where shown, in accordance with applicable portions of NEC, with NECA's "Standard of Installation", and in accordance with recognized industry practices, to ensure that products comply with requirements and serve intended functions.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding system work with other work.
- C. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- D. All ground connections shall be made on surfaces which have been cleaned of all paint, dirt, oil, etc., so that connections are bare metal to bare metal contact. All ground connections shall be tight and shall be made with U.L. listed grounding devices, fittings, bushings, etc.
- E. Duplex receptacles of any amperage shall be grounding type and shall have a separate grounding contact. A separate jumper shall be installed between the grounding terminal on the device and the metallic box. The Contractor may provide U.L. listed self-grounding receptacles in lieu of providing the separate jumper.
- F. Single and duplex receptacles shall have all grounded metal mechanically bonded together. Pressure bonding only is not acceptable.
- G. In all cases where flexible metallic conduit, nonmetallic rigid conduit or liquid tight flexible conduit is used, a green wire ground conductor shall be used to provide ground continuity between the equipment of device and the conduit raceway system.
- H. Provide a separate green wire ground conductor for each branch circuit originating from each panelboard. This ground shall be used to ground the device or load fed, and shall be bonded to components of the raceway system, such as junction boxes, starter or disconnect switch enclosures, equipment cases, etc. The green wire ground conductor shall terminate in the panelboard at the green wire ground bus. Ground conductors for branch circuits shall be of size indicated in NEC, except minimum size ground conductor shall be No. 12 AWG.
- I. Each branch feeder originating at the switchboard(s) or main panelboard shall have a green wire ground conductor originating at the ground bus in the switchboard and terminating at the green wire ground bus in the panelboard. This green wire ground conductor shall be of size indicated in NEC except in no instance smaller than No. 8 AWG.
- J. The green wire ground conductor is in addition to the neutral conductor and in no case shall the neutral conductor serve as the grounding means.
- K. Multiple conductors in a single lug not permitted. Each grounding conductor shall terminate in its own terminal lug.

END OF SECTION

SECTION 26 0529 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. This section is a Division 26 Basic Electrical Materials and Methods section, and is a part of each Division 26 section making reference to electrical supporting devices specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of supports, anchors, sleeves, and seals is indicated by drawings and schedules and/or specified in other Division 26 sections.
- B. Types of supports, anchors, sleeves, and seals specified in this section include the following:
 - 1. Clevis hangers
 - 2. C-clamps
 - 3. I-beam clamps
 - 4. One-hole conduit straps
 - 5. Round steel rods
 - 6. Lead expansion anchors
 - 7. Toggle bolts
 - 8. Wall and floor seals
- C. Supports, anchors, sleeves, and seals furnished as part of factory-fabricated equipment, are specified as part of that equipment assembly in other Division 26 sections.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of electrical supporting devices.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

- A. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is Installer's option.
- B. Supports: Provide supporting devices of types, sizes, and materials indicated; and having the following construction features:
 - 1. Clevis Hangers: For supporting 2" rigid metal conduit; galvanized steel; with 1/2" dia. hole for round steel rod; approximately 54 pounds per 100 units.
 - 2. Reducing Couplings: Steel rod reducing coupling, 1/2" x 5/8"; black steel; approximately 16 pounds per 100 units.
 - 3. C-Clamps: Black malleable iron; 1/2" rod size; approximately 70 pounds per 100 units.
 - 4. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.
 - 5. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.
 - 6. Hexagon Nuts: For 1/2" rod size; galvanized steel; approximately 4 pounds per 100 units.
 - 7. Round Steel Rod: Black steel; 1/2" dia.; approximately 67 pounds per 100 feet.
 - 8. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.
- C. Anchors: Provide anchors of types, sizes, and materials indicated, with the following construction features:
 - 1. Lead Expansion Anchors: 1/2", approximately 38 pounds per 100 units.
 - 2. Toggle Bolts: Springhead; 3/16" x 4", approximately 5 pounds per 100 units.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering anchors which may be incorporated in the work include, but are not limited to, the following:
 - 1. Abbeon Cal Inc.
 - 2. Ackerman Johnson Fastening Systems, Inc.

3. Elcen Metal Products Co.
4. Expansion Bolt Co.
5. Ideal Industries, Inc.
6. Joslyn Mfg. and Supply Co.
7. McGraw Edison Co.
8. Rawlplug Co., Inc.
9. Star Expansion Co.
- E. Sleeves and Seals: Provide sleeves and seals, of types, sizes, and materials indicated, with the following construction features:
 1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe, or buting passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
- F. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 12-gage hot-dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with standard finish, and with the following fittings which mate and match U-channel.
 1. Fixture hangers
 2. Channel hangers
 3. Thinwall conduit clamps
 4. Rigid conduit clamps
 5. Conduit hangers
 6. U-bolts
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering channel systems which may be incorporated in the work include, but are not limited to, the following:
 1. Greenfield Mfg. Co.; Inc.
 2. Midland-Ross Corp.
 3. OZ/Gedney Div.; General Signal Corp.
 4. Power-Strut Div.; Van Huffel Tube Corp.
 5. Unistrut Div.; GTE Products Corp.
- H. Pipe Sleeves: Provide pipe sleeves of one of the following:
 1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal: 3" and smaller, 20-gage; 4" to 6", 16-gage; over 6", 14-gage.
 2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
 3. Iron Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.
 4. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
- I. Sleeve Seals: Provide sleeves for piping which penetrates foundation walls below grade, or exterior walls. Calk between sleeve and pipe with non-toxic, UL-classified calking material to ensure watertight seal.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

- A. Install hangers, anchors, sleeves, and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work. Coordinate support locations with other structural and mechanical trades. Supports shall not be attached to mechanical or electrical piping, conduit, ductwork, ceiling grid system or any other non-structural member.
- C. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.
- D. **Exterior supporting devices shall be hot dipped galvanized steel or stainless steel.**

END OF SECTION

SECTION 26 0530 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. This section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 23 and 26 section making reference to electrical connections for equipment specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Applications of electrical power connections specified in this section include the following:
 - 1. From electrical source to motor starters.
 - 2. From motor starters to motors.
 - 3. To lighting fixtures.
 - 4. To grounds including earthing connections.
 - 5. To equipment of communication, CCTV and alarm systems.
- C. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division 23 and other Division 26 sections, and are work of this section.
- D. Motor starters and controllers, not furnished as integral part of equipment, are specified in applicable Division 26 sections, and are work of this section.
- E. Refer to Division 23 specification sections and drawings for motor starters and controllers furnished integrally with equipment; not work of this section. Connections to this equipment is work of this section.
- F. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 26 sections, and are work of this section.
- G. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 26 sections, and are work of this section.
- H. Refer to other Division 26 and Division 23 sections for low voltage control system wiring; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 2 years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.
- C. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters, and disconnect switches.
- D. IEEE Compliance: Comply with Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and terminations.
- E. ANSI Compliance: Comply with applicable requirements of ANSI/NEMA and ANSI/EIA standards pertaining to products and installation of electrical connections for equipment.
- F. UL Compliance: Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors", including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL-listed and labeled.
- G. ETL Compliance: Provide electrical connection products and materials which are ETL-listed and labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. AMP Incorporated
 - 2. Appleton Electric Co.
 - 3. Arrow-Hart Div., Crouse-Hinds Co.
 - 4. Burndy Corporation
 - 5. General Electric Co.

6. Gould, Inc.
7. Harvey Hubbell Inc.
8. Square D Company
9. Thomas and Betts Corp.

2.2 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable insulating tubing, cable ties, solderless wirenuts, and other items and accessories as needed to complete splices and terminations of types indicated.
- B. Metal Conduit, Tubing, and Fittings:
 1. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division 26 basic electrical materials and methods section "Raceways", and in accordance with the following listing of metal conduit, tubing, and fittings:
 - a. Rigid steel conduit.
 - b. Rigid metal conduit fittings.
 - c. Electrical metallic tubing.
 - e. Liquid-tight flexible metal conduit.
 - f. Liquid-tight flexible metal conduit fittings.
 - g. Flexible metal conduit.
 - h. Flexible metal conduit fittings.
- C. Wires, Cables, and Connectors:
 1. General: Provide wires, cables, and connectors complying with Division 26 basic electrical materials and methods section "Wires and Cables".
 2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes and ratings, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20oC (68oF).
 3. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC, and NECA's "Standard of Installation", to ensure that products fulfill requirements.
- B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- D. Provide the following electrical work as work of this section, complying with requirements of Division 23 sections:
 1. Power supply wiring from power source to power connection on chiller, fans, air handling units, pumps, duct heaters, water heaters, air compressor, air dryer, and unit control panels. Include starters, disconnects, time clocks, receptacles and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer. Make all final electrical connections.
- E. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Architect/Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
- F. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced. No new conductors shall be spliced unless specifically noted on the drawings.

- G. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
 - H. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing, and maintenance.
 - I. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.
 - J. Provide flexible conduit for motor connections, and other electrical equipment connections, where subject to movement and vibration.
 - K. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration, and also where connections are subjected to one or more of the following conditions:
 - 1. Exterior location.
 - 2. Moist or humid atmosphere where condensate can be expected to accumulate.
 - 3. Corrosive atmosphere.
 - 4. Water spray.
 - 5. Dripping oil, grease, or water, including kitchen areas.
- 3.3 FIELD QUALITY CONTROL
- A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION

SECTION 26 0533 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and
- C. This section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26 section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of raceway work is indicated by drawings and schedules. Types of raceways specified in this section include the following:
 - 1. Electrical metallic tubing (EMT).
 - 2. Liquid tight flexible metal conduit.
 - 3. Rigid metal conduit.
 - 4. Flexible metal conduit.
 - 5. Rigid non-metallic conduit.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical raceway work similar to that required for this project.
- C. Codes and Standards:
 - 1. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.
 - 2. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL-listed and labeled.
 - 3. NEC Compliance: Comply with applicable requirements of NEC pertaining to construction and installation of raceway systems.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of raceway system required. Include data substantiating that materials comply with requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thicknesses) for each service indicated. Die-cast fittings are not acceptable.
- B. Rigid Steel Conduit: Provide rigid steel, zinc-coated, threaded type conforming to FS WW-C-581, ANSI C80.1 and UL 6.
- C. Rigid Metal Conduit Fittings: Cast malleable iron, galvanized or cadmium plated, conforming to FS W-F-408, ANSI C80.4.
 - 1. Use compression type fittings for raintight connections.
 - 2. Use compression type fittings for other miscellaneous exterior connections.
- D. Electrical Metallic Tubing (EMT): FS WW-C-563, ANSI C80.3 and UL 797.
- E. EMT Fittings: FS W-F-408, ANSI C80.4. Die cast or malleable iron.
 - 1. Use compression fittings for raintight connections.
 - 2. Use compression type for concrete type connections.
 - 3. Use compression type fittings for miscellaneous exterior connections.
 - 4. Set screw fitting may be used only where conduits and associated fittings are installed inside (interior) and concealed from view.
- F. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC). Shall be Sealtite or equal.
- G. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G. Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.

- H. Flexible Metal Conduit: FS WW-C-566 and UL 1. Formed from continuous length of spiral wound, interlocked zinc-coated strip steel.
 - I. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.
 - 1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
 - 2. 45o or 90o Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
- 2.2 NONMETALLIC CONDUIT
- A. General: Provide nonmetallic conduit, ducts, and fittings of types, sizes, and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements which comply with provisions of NEC for raceways.
 - B. Electrical Plastic Conduit:
 - 1. Heavy Wall Conduit: Schedule 40, 90 C, UL-rated, construct of polyvinyl chloride and conforming to NEMA TC-2, for direct burial, or normal above ground use, UL-listed and in conformity with NEC Article 352, ANSI C33.91.
 - C. PVC Conduit and Tubing Fittings: NEMA TC 3, mate and match to conduit or tubing type and material.
- 2.3 MANUFACTURERS
- A. Subject to compliance with requirements, provide conduit bodies of one of the following:
 - 1. Appleton Electric; Div of Emerson Electric Co.
 - 2. Arrow-Hart Div; Crouse-Hinds Co.
 - 3. Bell Electric Div; Square D Co.
 - 4. Gould, Inc.
 - 5. Killark Electric Mfg. Co.
 - 6. O-Z/Gedney Div; General Signal Co.
 - 7. Spring City Electrical Mfg. Co., or equivalent.

PART 3 - EXECUTION

- 3.1 INSPECTION
- A. Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways. Notify Architect in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- 3.2 INSTALLATION OF RACEWAYS
- A. General: Install raceways as indicated; in accordance with manufacturer's written installation instructions, and in compliance with NEC, and NECA's "Standards of Installation". Install units plumb and level, and maintain manufacturer's recommended clearances.
 - B. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.
- 3.3 INSTALLATION OF CONDUITS
- A. General: Install concealed conduits in new construction work, either in walls, slabs, or above hung ceilings. Run conduits concealed in existing work where practical or specifically indicated on the drawings.
 - 1. Mechanically fasten together metal conduits, enclosures, and raceways for conductors to form continuous electrical conductor. Connect to electrical boxes, fittings, and cabinets to provide electrical continuity and firm mechanical assembly.
 - 2. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
 - 3. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in raceways every 200' of linear run or wherever structural expansion joints are crossed.
 - B. Conduit Installation: Follow minimum requirements in all areas as follows:
 - 1. Use rigid steel galvanized conduit where exposed anywhere exterior, where exposed at exterior mechanical equipment (condensing unit yards), where exposed at pavilions, where exposed at light poles, where exposed to weather or subject to saturation with liquids/rain, and where exposed to potential mechanical damage. Also use rigid steel galvanized conduit for all risers from underground, except as allowed for conduits used for communications systems. All rigid elbows and rigid risers to cabinets shall be applied with bitumastic paint where below grade.

2. Use steel EMT above hung ceilings in offices, corridors, toilets, and other areas with hung ceilings. EMT may be used in mechanical and electrical rooms, except for the central plant and other areas requiring rigid steel galvanized conduit as in (1.) above.
3. Use PVC heavy wall direct buried rated (Schedule 40) when raceways run below grade, under floors on grade or in concrete. All bends and elbows greater than 45 degrees shall be galvanized rigid steel conduit. All risers from underground to cabinets and boxes when conduit is to be exposed shall be rigid steel conduit.
4. Underground telecommunications conduits for voice/data, fire alarm, intercom, and TV may be all direct buried rated Schedule 40 PVC.
5. Conduit in walls to recessed panels and boxes shall be in accordance with NEC. PVC up to first point of termination with 4'-0" maximum in wall and EMT above 4'-0".
6. Use flexible conduit in movable partitions and from outlet boxes to lighting fixtures, and final 24" of connection to motors, control items or any equipment subject to movement or vibration, and in cells of precast concrete panels. Flexible conduit shall not exceed 6 feet long.
7. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:
 - a. Exterior location.
 - b. Moist or humid atmosphere where condensate can be expected to accumulate. Mechanical rooms.
 - c. Corrosive atmosphere.
 - d. Subjected to water spray or dripping oil, water, or grease, including kitchen equipment connections.
8. Use hot-dipped galvanized conduit where conduit is routed outdoors or in any way exposed to weather.
9. Surface mounted raceways in finished areas are not permitted.
10. Electrical contractor will be responsible for the following for all underground conduits:
 - a. Trenching and Excavation
 - b. Backfill
 - c. Compaction
 - d. Entrances into and exits from buildings shall be underground, concealed.
11. MC or AC cable shall not be permitted.
- C. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.
- D. Field bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
- E. Minimum conduit size shall be 1/2" unless noted otherwise. Homeruns shall be a minimum 3/4".
- F. Fasten conduit terminations in sheet metal enclosures by two (2) locknuts, and terminate with bushings and grounded. Install locknuts inside and out side enclosure.
- G. Conduits are not to cross pipe shafts, or ventilating duct openings.
- H. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.
- I. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.
- J. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
- K. Install conduits so as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
- L. Exposed Conduits in Unfinished Areas:
 1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
 2. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
 3. Support all conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed following: up to 1": 6'-0"; 1-1/4" and over: 8'-0". All conduits shall be adequately supported to prevent any noticeable deflection, vibration or rattle.
 4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
 5. Exposed conduits on the outside of buildings is not permitted.
- M. Conduit Fittings:
 1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
 2. Bushings for terminating conduits smaller than 1- 1/4" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.
 3. Install insulated type bushings for terminating conduits 1-1/4" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
 4. All bushings of standard or insulated type to have screw type grounding terminal.
 5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs to be specifically designed for their particular application.
- N. Concealed Conduits:

1. Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure watertightness.
2. Conduit in concrete slabs: Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond. Conduits must have a minimum of three-quarter inch (3/4") concrete cover.
3. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness. Conduit shall not be run in slabs less than 3 inches thick.
- O. Painting of Conduit & Boxes:
 1. Fire Alarm: All new fire alarm conduit, including underground conduit, shall be spot painted red at a minimum of every 4 feet, nominally. Underground conduit shall be spot painted red after it is laid in trench and made up tight. All fire alarm junction boxes shall be painted red.
 2. Intercom/Paging System: All new junction boxes above ceiling shall be painted black.
 3. Other communications systems: All new junction boxes above ceiling shall be painted brown.
 4. Security System: All new junction boxes above ceiling shall be painted pink.
 5. 208Y/120 volt Power: All new junction boxes above ceiling shall be painted blue.
 6. 480Y/277 volt Power: All new junction boxes above ceiling shall be painted green.
 7. Emergency Power – life safety (if applicable): All new junction boxes above ceiling shall be painted yellow.
 8. Emergency Power – 208Y/120 volt (if applicable): All new junction boxes above ceiling shall be painted grey.
 9. Emergency Power – 480Y/277 volt (if applicable): All new junction boxes above ceiling shall be painted orange.
- P. Provide a continuous yellow marker tape with metallic tracer 6 inches above all new underground conduit.
- Q. Underground Duct Banks and Underground Conduits: All underground conduits shall be installed per the National Electrical Code, in accordance with standard industry practices and in accordance with other sections of these specifications. Conduits in duct banks shall be neatly and securely installed in straight lines with manufactured elbows used for all turns and bends. Provide all required trenching, excavation, backfill, compaction, supports, manholes, etc. for a complete installation. Trenching, excavation, backfill and compaction shall be performed in accordance with applicable Division 01 and Division 31 sections of these specifications.
 1. Coordinate routing of site raceways with all site piping including new chilled water piping and fire protection piping, plus existing sanitary, storm, and other site utilities. Hand dig in congested areas.
- R. Low Voltage Control:
 1. Mechanical contractor (Division 23) to provide and install all necessary wire and raceway (EMT conduit) for low voltage control such as thermostats, timers etc., unless specifically shown otherwise on the drawings. Raceways shall be installed in accordance with Division 26 sections. Final wire connections shall be by mechanical contractor.

3.4 INSTALLATION OF RACEWAYS AND WIREWAYS

- A. General: Mechanically assemble metal enclosures, and raceways for conductors to form continuous electrical conductor, and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.
 1. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
 2. Install expansion fittings in all raceways wherever structural expansion joints are crossed.
 3. Make changes in direction of raceway run with proper fittings, supplied by raceway manufacturer. No field bends of raceway sections will be permitted.
 4. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported. Supporting conduits from ceiling grid, other conduits, ductwork or other non-structural members will not be permitted.
 5. Use boxes as supplied by raceway manufacturer wherever junction, pull or device boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface raceway installations.
 6. Provide watertight seals in all conduits which cross from one temperature to another temperature extreme, such as coolers and freezers.
 7. All fire wall and smoke wall penetrations shall be sealed using a UL Listed fire stopping method. Method shall be submitted and approved by the Architect/Engineer.
 8. All empty conduits shall have a 1/8" nylon pull rope installed, including all underground conduits.

3.5 COMMUNICATIONS SYSTEMS RACEWAY

- A. Communications systems raceways shall be provided for each voice/data, fire alarm, or other system outlet or device indicated on the drawings.

END OF SECTION

SECTION 26 0535 - ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. This section is a Division 26 Basic Electrical Materials and Methods section, and is a part of each Division 26 section making reference to electrical wiring boxes and fittings specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical box and associated fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings specified in this section include the following:
 - 1. Outlet boxes and outlet box covers.
 - 2. Junction boxes and junction box covers
 - 3. Pull boxes
 - 4. Floor boxes
 - 5. Bushings
 - 6. Locknuts
 - 7. Knockout closures
 - 8. Manholes and handholes

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings, of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects utilizing electrical boxes and fittings similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- D. UL Compliance: Comply with applicable requirements UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL-listed and labeled.
- E. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No.'s OS1, OS2, and Pub 250 pertaining to outlet and device boxes, covers, and box supports.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

- A. Outlet Boxes: Provide galvanized coated flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.
 - 1. Recessed outlet boxes shall be a minimum 4" square by 2-1/2" deep with reducer ring for a standard outlet coverplate. Where surface mounted devices are necessary provide 2-1/2" x 4" x 2-1/2" deep box to fit a standard coverplate. Shallow boxes shall not be permitted for communications outlet boxes.
 - 2. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.
- B. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding.
 - 1. Recessed outlet boxes shall be a minimum 4" square by 2-1/2" deep with reducer ring for a standard outlet coverplate. Where surface mounted devices are necessary provide 2-1/2" x 4" x 2-1/2" deep box to fit a standard coverplate. Shallow boxes shall not be permitted for communications outlet boxes.

2. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering outlet boxes which may be incorporated in the work include, but are not limited to, the following:
 1. Appleton Electric;
 2. Bell Electric;
 3. Eagle Electric Mfg. Co.; Inc.
 4. Midland-Ross Corp.
 5. OZ/Gedney; General Signal Co.
 6. Pass and Seymour, Inc.
 7. RACO Div.; Harvey Hubbell Inc.
 8. Thomas & Betts Co.
- D. Raintight Outlet Boxes: Provide corrosion-resistant cast-metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering raintight outlet boxes which may be incorporated in the work include, but are not limited to, the following:
 1. Appleton Electric;
 2. Crouse-Hinds Co.
 3. Bell Electric;
 4. Harvey Hubbell, Inc.
 5. OZ/Gedney; General Signal Co.
 6. RACO Div.
- F. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes; with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws, and washers.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering junction and pull boxes which may be incorporated in the work include, but are not limited to, the following:
 1. Appleton Electric; Emerson Electric Co.
 2. Arrow-Hart Div.; Crouse-Hinds Co.
 3. Electric; Square D Company
 4. OZ/Gedney; General Signal Co.
 5. Spring City Electrical Mfg. Co.
- H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering floor boxes which may be incorporated in the work include, but are not limited to, the following:
 1. Arrow-Hart Div.; Crouse-Hinds Co.
 2. Harvey Hubbell, Inc.
 3. Midland-Ross Corp.
 4. Spring City Electrical Mfg. Co.
- I. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connections, of types and sizes, to suit respective installation requirements and applications.
- J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering bushings, knockout closures, locknuts, and connectors which may be incorporated in the work include, but are not limited to, the following:
 1. Arrow-Hart Div.; Crouse-Hinds Co.
 2. Appleton Electric Co.; Emerson Electric Co.
 3. Bell Electric; Square D Co.
 4. Midland-Ross Corp.
 5. OZ/Gedney Co.; General Signal Co.
- K. Manholes and Handholes: Manholes and handholes for exterior use shall be pre-cast concrete with steel traffic rated covers, as manufactured by Brooks or equal. Pre-manufactured composite type boxes (Quazite or approved equal) are permitted where suitable and rated for the use indicated. Manholes and handholes shall be the size necessary for the number of conduits and conductors indicated on the drawings which will enter the enclosure, plus the necessary capacity for the spare conduits and the associated estimated conductor fill. Provide manholes with the appropriate drainage and knockouts for conduits and other necessary access. Traffic covers shall be engraved with the appropriate identification, such as "ELECTRIC" or "COMMUNICATIONS". Provide plastic protective grommet on all conduit ends for all communications systems conduit inside manholes. Fire alarm conduits shall be marked.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

- A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weathertight boxes and fittings for interior and exterior locations exposed to weather or moisture. Provide weatherproof boxes for all exterior outlet boxes for power and systems, including fire alarm and intercom system boxes.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.
- F. Avoid installing boxes back-to-back in walls. Provide not less than 24" (600 mm) separation.
- G. Position recessed outlet boxes accurately to allow for surface finish thickness. All outlet boxes shall be provided with bracket support behind the box for additional structural support. Mounting boxes directly to the metal framing on one side only is not acceptable. Boxes shall be additionally supported on the back side.
- H. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- I. Outlet boxes shall be structurally supported to the metal studs using a back bracket or other additional means of support. Side mounted attachment only to the metal studs is not acceptable.
- J. Each circuit in pull box shall be marked with a tag guide denoting panels which they connect to.
- K. Manholes and handholes shall be installed for all underground conduit installations. The minimum number of manholes and handholes shall be as indicated on the drawings. The contractor shall provide any additional handholes or manholes necessary for ease of installation, code compliance or due to voluntary or required re-routing of the underground conduits at no additional cost to the Owner.
- L. Any boxes located on the exterior or otherwise exposed to the weather shall be cast aluminum or cast iron, weatherproof type. Standard stamped steel boxes will not be accepted.

END OF SECTION

SECTION 26 0553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. Division 26 Basic Electrical Materials and Methods section apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical identification work is indicated by drawings and schedules.
- B. Types of electrical identification work specified in this section include the following:
 - 1. Electrical power, control, and communication conductors.
 - 2. Operational instructions and warnings.
 - 3. Equipment/system identification signs.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical identification products of types required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.
- C. UL Compliance: Comply with applicable requirements of UL Std 969, "Marking and Labeling Systems", pertaining to electrical identification systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electrical identification products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Brady, W.H. Co.

2.2 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

2.3 ENGRAVED PLASTIC-LAMINATE SIGNS

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, white face and black core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 - 1. Thickness: 1/8", except as otherwise indicated.
 - 2. Fasteners: Self-tapping stainless steel screws or permanent rivets. Contact-type permanent adhesive will not be acceptable.

2.4 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

- A. General Installation Requirements:
 - 1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions and requirements of NEC.
 - 2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
 - 3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

3.2 OPERATIONAL IDENTIFICATION AND WARNINGS

- A. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and doors of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

3.3 EQUIPMENT/SYSTEM IDENTIFICATION

- A. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/4" high lettering, on 1" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
1. Switchboard (including all individual circuit breakers and main breaker), panelboards (including all individual circuit breakers and main breaker on distribution panels), electrical cabinets, disconnect switches and enclosures.
 2. Access panel/doors to electrical facilities. Provide building disconnect signage as indicated on the drawings.
 3. Transformers
 4. Equipment disconnects and starters.
 5. Timeclocks, contactors and lighting controls.
 6. Other control stations, such as purge fans, etc.
 7. Panelboards
 8. Lighting contactors.
 9. All low voltage systems panels and terminal cabinets
- B. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

END OF SECTION

SECTION 26 0923 - LIGHTING CONTROL DEVICES

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. Time switches.
 - 2. Photoelectric switches.
 - 3. Standalone daylight-harvesting switching and dimming controls.
 - 4. Indoor occupancy and vacancy sensors.
 - 5. Digital timer light switches.
 - 6. Low voltage on/off lighting control
 - 7. Low voltage on/off with dimming control
 - 8. Lighting contactors.
 - 9. Emergency shunt relays.
- B. Related Requirements:
 - 1. Section 26 2726 "Wiring Devices" for manual line voltage light switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Show installation details for the following:
 - a. Occupancy sensors (if applicable).
 - b. Vacancy sensors (manual on/auto off controls).
 - c. Low voltage dimmers and controls, including emergency shunt bypass relays, including for dimming
 - d. Line voltage sensors (if applicable).
 - e. Line voltage emergency shunt bypass relays
 - 2. Interconnection diagrams showing field-installed wiring method and connections for each individual control scheme, including emergency power bypass controls.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Submit layout drawings for all occupancy sensors with manufacturers recommended coverage and device. Indicated low voltage versus line voltage devices. Provide typical wiring diagrams for each specific control type, including any bypass circuits for emergency lighting. Show locations of all power packs and all emergency bypass devices on the layout drawing.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: For manufacturer's warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control software.
 - b. Faulty operation of lighting control devices, including but not limited to delayed on/off, delayed dimming, flickering of lights, flickering of dimming above 10% dim.
 - 2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
 - 1. Listed and labeled as defined in NFPA 70 and marked for intended location and application.
 - 2. Contact Configuration: SPST, DPST, DPDT, as required for the number of circuits indicated.
 - 3. Contact Rating: 30-A inductive or resistive, 240-V ac, 20-A ballast load, 120-/240-Volt, as required.
 - 4. Programs: Eight on-off set points on a 24-hour schedule, and an annual holiday schedule that overrides the weekly operation on holidays.
 - 5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
 - 6. Provide with a positive manual on-off switch, voltage as required or specified on the drawings, minimum fully rated 20 amps per pole. Provide additional poles as required or specified on the drawings
 - 7. Astronomic Time: All channels.
 - 8. Automatic daylight savings time changeover.
 - 9. Power Backup: Super capacitor (no batteries).
 - 10. Manufactured by: Tork EWZ101, approved equal by Intermatic.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. By Tork or Intermatic.

2.3 DAYLIGHT-HARVESTING SWITCHING CONTROLS

- A. Not applicable.

2.4 DAYLIGHT-HARVESTING DIMMING CONTROLS

- A. Not applicable.

2.5 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. General Requirements for Sensors:
 - 1. Wall or Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
 - 2. Dual technology or Passive Infrared where indicated
 - 3. Separate power pack.
 - 4. Hardwired connection to compatible switch and/or power pack. On/off switches and on/off dimmer switches shall be 100% compatible with the sensors.
 - 5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 6. Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Set at 30 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. NOTE: PROVIDE VACANCY SENSORS IN ALL LOCATIONS REQUIRED BY THE FLORIDA ENERGY CODE. Set at 15 minutes.
 - 7. Sensor Output: Sensor is powered from the power pack.
 - 8. Power Input to power packs: Line voltage lighting circuit.
 - 9. Power Pack: Dry contacts rated for 20-A ballast or LED. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 10. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 - 12. Bypass Switch: Override the "on" function in case of sensor failure.
 - 13. Manufactured by Acuity Brands – Sensorswitch
 - 14. When occupancy sensors are indicated for corridors or egress hallways, provide bi-directional hallway type, auto on, auto off sensors for all corridors. Corridors shall use passive infrared type.
- B. Dual-Technology Type: All occupancy sensors shall be dual technology type where indicated. Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology. Adjust all sensitivities in the field.
 - 2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of aver-

age size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).

3. Detection Coverage: Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 10 foot high ceiling. Provide for detection coverage for higher ceilings and larger areas as required by the areas indicated on the drawings. Use sensors with larger coverage, add sensors, and adjust sensors as necessary.
4. Manufactured by: Acuity Brand - Sensorswitch

- C. Wall mounted switch type occupancy sensors: All occupancy sensors for restrooms and some storage rooms shall be line voltage wall mounted switch type with integral passive infrared occupancy sensor. These devices can be line voltage or low voltage. Sensors shall be set at 30 minutes.

2.6 DIGITAL TIMER LIGHT SWITCH

- A. Description: Not used.

2.7 LIGHTING CONTACTORS

- A. Description: Electrically operated and mechanically held, lighting contactors, complying with NEMA and UL 508. Provide NEMA rated contactors. IEC type not acceptable, except where part of a manufactured system, such as a lighting control cabinet.
 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
 5. Provide interconnection to time-clock for on/off programmed control.
- B. Interface with DDC System for HVAC: Not applicable.
 1. Monitoring: On-off status, Points as required.
 2. Control: On-off operation, Points as required.
- C. Lighting contactors shall be Square D Class 8903 (LG series), or equal by Seimens, General Electric. Electrically held, with hand-off-auto, and control power transformer. Provide with 24 volt control coil for control via the HVAC control system.

2.8 EMERGENCY SHUNT BYPASS RELAY

- A. Coil Rating: 120 or 277 V, as required. UL924 Listed.
- B. Provide emergency bypass relays to bypass all switching and dimming when normal local utility power is lost and the luminaires are required to operate automatically on battery back-up.
- C. Emergency relays shall be mounted in a separate, dedicated junction box. The box shall be labeled "EM" and shall be located directly above the switches in an accessible location.
- D. Bypass relays for low voltage switching and dimming circuits shall be IOTA ETS-20-DR, or Nine 24, Inc Model BLTCv3, subject to compatibility with approved lighting controls
- E. Bypass relays for line voltage switches shall be Wattstopper ELCU-200, or IOTA ETS-20, subject to compatibility with approved lighting controls..

2.9 LOW VOLTAGE DIMMING CONTROLS

- A. Provide low voltage wall mounted lighting control stations with integral manual on/ auto off and 0-10 volt dimming control. Stations shall be compatible with the power packs, vacancy sensors, LED drivers and LED lamps. Dimmers for LED lighting shall be matched with the LED driver and LED types. Submit all dimmers for LED for approval. Submittal shall have written documentation that the dimmer is suitable for use with the specific LED driver and LED's being used in the dimmed fixture. Station shall be bone color, and provided with a Decora style coverplate, stainless steel. Provide for 3-way control where required by the drawings. Manufactured by: Acuity Brand – Sensorswitch. Switch shall be white with a type 302 stainless steel coverplate. (All colors shall be approved by the Architect)

2.10 LOW VOLTAGE LIGHTING CONTROLS

- A. Provide low voltage wall mounted lighting control stations with integral manual on/ auto off. Stations shall be compatible with the power packs, vacancy sensors, LED drivers and LED lamps. Submittal shall have written documentation that the switch is suitable for use with the specific LED driver and LED's being used in the fixture. Station shall be bone, and provided with a Decora style coverplate, stainless steel. Provide for 3-way control where required by the drawings. Manufactured by: Acuity Brand – Sensorswitch. Switch shall be white with a type 302 stainless steel coverplate. (All colors shall be approved by the Architect)

2.11 LOW VOLTAGE LIGHTING CONTROL POWER PACKS

- A. Provide low voltage power packs for the control of the occupancy sensors, daylight harvesting (where indicated), on/off wall stations, and on/off dimming control stations. Power packs shall be Class 1 high voltage (120/277 volt) to Class 2 low voltage (15 Vdc), plenum rated. Power packs shall meet all codes and all National Electrical Code requirements. Provide single or dual circuit as required. Provide for emergency power circuits and bypass relay controls for automatic illumination of all emergency egress lighting in the event of utility power failure. Manufactured by: Acuity Brand – Sensorswitch.
- B. Provide bypass for all battery operated emergency lighting.

2.12 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519.
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG.
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG.
- D. All low voltage conductors shall be plenum rated, unless installed completely enclosed in raceway. All conductors shall be properly supported to structure and not supported to any lights, ductwork, piping, raceways, etc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

- A. Comply with NECA 1.

3.4 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Commissioning agent will evaluate lighting control devices and witness tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Tests shall be performed (and performed again if required) in the presence of the commissioning agent.
- D. Lighting control devices will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 3 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 2426 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Materials and Methods section apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of panelboard, load-center and enclosure work, including cabinets and cutout boxes is indicated by drawings and schedules.
- B. Types of panelboards and enclosures in this section include the following:
 - 1. Service-entrance panelboards
 - 2. Power-distribution panelboards
 - 3. Lighting and appliance panelboards
- C. Refer to other Division 26 sections for cable/wire, connectors, and electrical raceway work required in conjunction with panelboards and enclosures; not work of this section. Refer to Section 262813 - Overcurrent Protective Devices for circuit breakers to be installed in panelboards.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of panelboards and enclosures, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects utilizing panelboards similar to that required for this project.
- C. NEC Compliance: Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC requirements pertaining to installation of wiring and equipment in hazardous locations.
- D. UL Compliance: Comply with applicable requirements of Std No. 67 "Electric Panelboards", and Stds No.'s 50, 869, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures. Provide units which are UL-listed and labeled.
- E. NEMA Compliance: Comply with NEMA Stds Pub/No. 250, "Enclosures for Electrical Equipment (1000 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".
- F. Federal Specification Compliance: Comply with FS W-P-115, "Power Distribution Panel", pertaining to panelboards and accessories.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on panelboards. Data must include a complete panel layout indicating the circuit breakers and corresponding circuit numbers. Include ratings of each circuit breaker including short circuit capability. Indicate all options to be supplied with the panelboard. Indicate overall panelboard bus rating and main type and rating. Show complete dimensional information. Any deviation from dimensions shown on the drawings shall be specifically pointed out in the submittal. Indicate the panelboard short circuit capacity rating and specify if this is fully rated or a series rating. Series ratings shall be completely documented with test results proving UL listed series rating capabilities included in the submittal. Clearly indicate the panel name for each submittal.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide panelboard products of one of the following (for each type and rating of panelboard and enclosure):
 - 1. Cutler Hammer
 - 2. General Electric Company
 - 3. ITE/Seimens
 - 4. Square D Company
- B. All circuit breakers shall be the bolt-on type.

2.2 PANELBOARDS

- A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; 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. Power Distribution Panelboards: Provide dead-front safety type power distribution panelboards as indicated, with panelboard switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn solderless pressure type main lug connectors approved for copper conductors. Select unit with feeder connecting at top of panel. Equip with copper bus bars with not less than 98% conductivity, and with full-sized neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide bolt-on type molded-case main and branch circuit-breaker types for each circuit, with toggle handles that indicate when tripped. Where multiple-pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Provide panelboards with bare uninsulated copper grounding bars suitable for bolting to enclosures. Select flush or surface mounted type enclosures, required on the drawings, fabricated by same manufacturer as panelboards, which mate properly with panelboards. Any panel 600 amp and larger shall be a distribution type panel. Any 400 amp panel with two or more sub-feed breakers of 125 amps or more each shall be a distribution type panel. Distribution panels shall be a power distribution type panel, such as Square D I-Line, GE Spectra Series, or equal.
- C. Lighting and Appliance Panelboards: Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types, and arrangements shown; with anti-burn solderless pressure type lug connectors approved for 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 or multi-pole circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required; provide bare copper uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate properly with panelboards. Loadcenters are not acceptable.
- D. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage, minimum 16-gage thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with wire gutters and without multiple knockouts. Provide fronts with adjustable trim clamps, doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed piano door hinges. 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 flush recessed or surface mounting, as indicated on the drawings. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate properly with panelboards to be enclosed.
- E. Panelboard Accessories: Provide panelboard accessories and devices including, but not necessarily limited to, cartridge and plug time-delay type fuses, circuit-breakers, ground-fault protection units, etc., as recommended by panelboard manufacturer for ratings and applications indicated. All panelboards shall be provided with a separate copper ground bus bar.
- F. Panelboard Ratings: All branch circuit panelboards shall be fully rated or series rated for the short circuit current indicated or the specific rating specified on the panel schedule, whichever is greater. Service entrance and distribution panelboards shall be fully rated for the short circuit current indicated or the specific rating specified on the panel schedule, whichever is greater. Series ratings will not be acceptable for service entrance or distribution panels. When series ratings are claimed, complete manufacturers data shall be submitted for verification of the series ratings claimed.
- G. Breakers for existing panelboards, switchboards and motor control centers shall be manufactured by the existing gear manufacturer. Breakers shall have the same or higher fault current rating. Provide all required existing panelboard manufacturer supplied mounting hardware (bus straps) and filler plates.
 - 1. Provide filler plates for any existing openings in any existing panelboards (switchboards and motor control centers). All open breaker or buss spaces shall be closed with a filler plate.
- H. Surge Suppression: Where shown on the drawings, panels shall be provided with a surge suppressor mounted external to the panelboard. Integral or internally mounted TVSS devices will not be accepted.
 - 1. In all cases, all required UL Listings shall be maintained for both the panelboards and the surge suppressors.
 - 2. In all cases, all warranties shall be maintained for both the panelboards and the surge suppressors.
 - 3. In all cases, all National Electrical Code requirements shall be maintained for both the panelboards and the surge suppressors.
 - 4. In all cases, all surge suppressors shall meet the requirements of Specification Section 26 4313. Entire panel submittal will be subject to rejection based upon this requirement.
 - 5. In all cases above, the panelboards shall meet the requirements of this specification section and shall be furnished by an approved panelboard manufacturer listed in this section.
 - 6. In all cases above, the panelboards and the surge suppression devices shall be submitted for approval as a package at the same time. One will not be approved without the other.
 - 7. Provide a three pole, 30 amp circuit breaker to serve the surge suppressor. Utilize #10 awg conductors for phase, neutral and ground.

8. See Specification Section 26 4313 for more requirements.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer must examine areas and conditions under which panelboards and enclosures are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF PANELBOARDS

- A. General: Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standard of Installation", and in compliance with recognized industry practices, to ensure that products comply with requirements.
- B. Coordinate installation of panelboards and enclosures with cable and raceway installation work.
- C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.
- D. Anchor enclosures firmly and securely to walls and structural surfaces, ensuring that they are permanently and mechanically secure and plumb.
- E. Provide properly wired electrical connections within enclosures.
- F. Provide typewritten circuit directory card in panel door upon completion of installation work.
- G. Where panels are mounted flush in the wall, a minimum of three (3) spare 3/4" conduit shall be installed stubbed out a minimum of eight (8) inches above ceiling.

3.3 GROUNDING

- A. Provide equipment grounding connections for panelboards as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A and B to assure permanent and effective grounds.

3.4 FIELD QUALITY CONTROL

- A. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.
- B. Prior to energization of panelboards, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
- C. Prior to energization, check panelboards for electrical continuity of circuits for short-circuits.
- D. Subsequent to wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.
- E. Prior to final acceptance completely fill out the circuit directories accurately depicting the equipment connected to each circuit. Circuit directories shall be typewritten.

END OF SECTION

SECTION 26 2616 - CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. Division 26 Basic Electrical Materials and Methods section apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of circuit and motor disconnect switch work is indicated by drawings and schedules.
- B. Types of circuit and motor disconnect switches in this section include the following:
 - 1. Equipment disconnects.
 - 2. Appliance disconnects.
 - 3. Motor-circuit disconnects.
- C. Wires/cables, raceways, and electrical boxes and fittings required in connection with circuit and motor disconnect work are specified in other Division 26 Basic Electrical Materials and Methods sections.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of circuit and motor disconnect switches of types and capacities required whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing circuit and motor disconnect work similar to that required for this project.
- C. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.
- D. UL Compliance: Comply with requirements of UL 98, "Enclosed and Dead-Front Switches". Provide circuit and motor disconnect switches which have been UL-listed and labeled.
- E. NEMA Compliance: Comply with applicable requirements of NEMA Std's Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)".

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on circuit and motor disconnect switches.
- B. Wiring Diagrams: Submit power and control wiring diagrams for circuit and motor disconnects including connections to power and control panels, and feeders.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering circuit and motor disconnects which may be incorporated in the work include the following:
 - 1. General Electric Co.
 - 2. ITE/Seimens
 - 3. Square D Company

2.2 FABRICATED SWITCHES

- A. Heavy-Duty Safety Switches: Provide surface-mounted, heavy-duty type, sheet-steel enclosed safety switches, of types, sizes and electrical characteristics indicated; fusible or non-fusible type as indicated, amperes as indicated, 60 Hz, 3-blades, 4-poles, solid neutral; and incorporating quick-make, quick-break type switches; construct so that switch blades are visible in OFF position with door open. Equip with operating handle which is integral part of enclosure base and whose operating position is easily recognizable, and is padlockable in OFF position; construct current carrying parts of high-conductivity copper, with silver-tungsten type switch contacts, and positive pressure type reinforced fuse clips. Provide NEMA Type 3R enclosures, where applicable. Provide grounding kit. Provide 240 volt rated switches for 208Y/120 volt systems and 600 volt rated switches for 277Y/480 volt systems.
 - 1. Fuses: Provide fuses for safety switches, sized as recommended by the manufacturer of the equipment to be protected, of classes, types, and ratings needed to fulfill electrical requirements for service indicated. Provide R-clips for all fuse holders.

PART 3 - EXECUTION

3.1 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECT SWITCHES

- A. Install circuit and motor disconnect switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate circuit and motor disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.
- C. Install disconnect switches for use with motor-driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.
- D. Provide a nameplate indicating the equipment served and protected.

3.2 GROUNDING

- A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for electrical disconnect switches where indicated.

3.3 FIELD QUALITY CONTROL

- A. Subsequent to completion of installation of electrical disconnect switches, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance; otherwise remove and replace with new units and retest.
- B. Painting: repair all scratches to factory painted and primed finish with factory supplied touch-up paint.

END OF SECTION

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. This section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Receptacles, including surge suppression type if applicable.
 - 2. Ground-fault circuit interrupters
 - 3. Switches
 - 4. Wallplates
 - 5. Plugs and connectors

1.3 QUALITY ASSURANCE

- A. Installer's Qualifications: Firm with at least 2 years of successful installation experience on projects utilizing wiring devices similar to those required for this project.
- B. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.
- C. UL Compliance: Comply with applicable requirements of UL 20, 486A, 498, and 943 pertaining to installation of wiring devices. Provide wiring devices which are UL-listed and labeled.
- D. IEEE Compliance: Comply with applicable requirements of IEEE Std 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to electrical wiring systems.
- E. NEMA Compliance: Comply with applicable portions of NEMA Stds Pub/No. WD 1, "General-Purpose Wiring Devices", WD 2, "Semiconductor Dimmers for Incandescent Lamps", and WD 5, "Specific-Purpose Wiring Devices".
- F. FS Compliance: Comply FS W-C-596 (Series) and FS W-S-896 (Series) pertaining to electrical power connectors and toggle switches.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on electrical wiring devices.
 - 1. Receptacles
 - 2. Ground-fault circuit interrupters
 - 3. Switches
 - 4. Wallplates
 - 5. Plugs and connectors

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide wiring devices of one of the following (for each type and rating of wiring device):
 - 1. Arrow-Hart Div
 - 2. Eagle Electric Co.
 - 3. Hubbell
 - 4. Leviton
 - 5. Pass - Seymour

2.2 FABRICATED WIRING DEVICES

- A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds Pub/No. WD 1. Provide white color devices and brushed satin finish stainless steel coverplates, except as otherwise indicated; **all color selections to be verified by Contractor with Architect/Engineer prior to ordering.**
- B. Receptacles:

1. Heavy-Duty Duplex: Provide specification grade duplex receptacles, 2-pole, 3-wire, grounding, 20-amperes, 125-volts, with metal plaster ears, design for side and back wiring with spring loaded, screw activated pressure plate, with NEMA configuration 5-20R unless otherwise indicated. Hubbell or equal.
 - a. General receptacles shall be white with a stainless steel coverplate.
 - b. Controlled receptacles shall be marked with a controlled receptacle marking, per NEC 406.3, E. Receptacles shall be green.
 - c. All receptacles shall be tamper resistant per NEC 406.12, C. (Child Care Facilities)
2. Ground-Fault Interrupters: Provide "feed-thru" type ground-fault circuit interrupters, with heavy-duty duplex receptacles, capable of protecting connecting downstream receptacles on single circuit, and of being installed in a 2-3/4" deep outlet box without adapter, grounding type UL-rated Class A, Group 1, rated 20 amperes, 120-volts, 60 Hz; with solid-state ground-fault sensing and indication; with 5 milliamperes ground-fault trip level; equip with NEMA configuration 5-20R. Device must have a positive trip identification and reset. Receptacles shall be white with a brushed satin stainless steel cover plate. New receptacles in existing spaces shall match the existing receptacle colors.
3. Special Receptacles: Special configuration receptacles shall be standard NEMA plug configuration as specified on the drawings or as required. Provide heavy duty, specification grade receptacles, with black nylon face and brushed satin stainless steel cover plate.
4. Receptacles shall be white with a brushed satin stainless steel cover plate.
- C. Switches:
 1. Snap: Provide specification grade, general-duty flush single-pole, quiet type toggle switches, 20-amperes, 120-277 volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, switch handle, and side-wired screw terminals.
 2. 2-way: Provide specification grade, general-duty flush double-pole AC quiet switches, 20-amperes, 120-277 volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, switch handles, side-wired screw terminals, with break-off tab features, which allows wiring with separate or common feed.
 3. Three-way: Provide specification grade, general-duty flush 3-way AC quiet type switches, 20-amperes, 120-277 volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, lock type switch handles, sidewired screw terminals, with break-off tab features, which allows wiring with separate or common feed.
 4. Four-way: Provide specification grade, general-duty flush 4-way AC quiet switches, 20-amperes, 120-277 volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, switch handles, side-wired screw terminals, with break-off tab features, which allows wiring with separate or common feed.
 5. Touch Snap: Provide soft-touch snap switches, cap able of effortless-fingertip operation; single-pole AC quiet, with lighted rocker switch handles; sidewired screw terminals for connecting copper-clad aluminum wire, 20-amperes, 120-277 volts rating. Equip with plaster ears.
 6. Switches to be color to match existing switches with satin finish stainless steel coverplate.
- D. Combination Devices: Provide specification grade, general-duty 3-way quiet switch, 20-amperes, 120-277 volts AC, with toggle switch handle, and 3-wire grounding receptacle, 20 amperes, 120-volts, equip with plaster ears, and with break-off tab feature which allows wiring with separate or common feed, with NEMA configuration 5-20R.
- E. LED Lamp Dimmers: Refer to specification section 26 09 23..
- F. Time Switches, Time Clocks: Refer to specification section 26 09 23.

2.3 WIRING DEVICE ACCESSORIES

- A. Wallplates: Provide wallplates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as required. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates. Provide plates possessing the following additional construction features:
 1. Material and Finish: 0.04" thick, type 302 satin finished stainless steel.
 2. All receptacles shall have coverplates marked with a permanent, typed label or engraving with panel, circuit #, and panel location.
- B. Floor Service Outlets: Provide flush type floor service receptacle outlets and fittings of types and ratings indicated. Construct of die cast aluminum, satin finish and of the size necessary for the slab thickness provided. Provide one or two gang box as indicated on the drawings with 20-ampere, 125-volt, duplex receptacle, NEMA configuration 5-20R for power, unless indicated otherwise. Provide data or telephone outlets as indicated with a 3/4" diameter bushed hole for data and a standard telephone outlet for telephone. Boxes shall be sized as required for the number of outlets and number of conductors to enter and leave the box. Provide brass cover plate with snap cover which shall be a protective cover which will prevent breakage of the installed wiring devices. Provide brass tile or carpet flange as required. See device legend on drawings for more floor box requirements.

- C. Outdoor receptacles that are in "wet" locations without protection from the weather shall be provide with a UL listed and approved "in-use" weatherproof cover, cast metal, lockable, type, and shall be GFI protected. Plastic covers will not be acceptable.
- D. Outdoor receptacles that are in "damp" locations where they are exterior but covered from the weather (i.e. band shelter, picnic pavilions) shall be provide with a UL listed and approved damp location rated weatherproof hinged cover, metal type, and shall be GFI protected (NOT in-use type). Plastic covers will not be acceptable.

2.4 OCCUPANCY SENSORS AND DAYLIGHT SENSORS

- A. Refer to Specification 26 09 23 for occupancy sensors and lighting controls.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES

- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.
- C. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
- D. Install galvanized steel wallplates on any exposed surface mounted devices.
- E. Install wallplates after painting work is completed.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B. Use properly scaled torque indicating hand tool.
- G. Contractor to provide ground fault protective type receptacles for any location within 2'-0" of sinks or other source of water. Feed through protection from one ground fault protected receptacle on a circuit is not acceptable.
- H. Mounting height of boxes for devices as shown on legend, unless otherwise noted on the plan. Refer to architectural drawings to avoid interferences with millwork. Where two or more devices are shown at the same location, use gang box and one face plate. Verify all device locations with Owner prior to rough-in. Exact device locations may be adjusted by the Owner to avoid interferences or for general convenience at no additional cost to the Owner.
- I. Floor boxes shall be installed flush with the slab and shall strictly follow manufacturer's installation instructions. Boxes shall be installed at right angles to the building lines and multiple boxes shall be in-line straight and even. Boxes observed to be installed crooked shall be removed and reinstalled.

3.2 PROTECTION OF WALLPLATES AND RECEPTACLES

- A. Upon installation of wallplates and receptacles, advise Contractor regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 GROUNDING

- A. Provide equipment grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Std 486 A to assure permanent and effective grounds.

3.4 TESTING

- A. Prior to circuitry, test wiring for electrical continuity, for short-circuits and for grounding. Ensure proper polarity of connections is maintained. Prior to energization, test wiring devices to demonstrate compliance with requirements.

3.5 WARRANTY

- A. All wiring devices, including dimmers and any dimming system, shall have a minimum one year parts and labor warranty.

END OF SECTION

SECTION 26 2813 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Hillsborough County Bidding and Contractual Requirements and general provisions of Section 01 0000 Procurement and Contracting Requirements shall apply to all work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- C. This section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 23 and Division 26 section making reference to overcurrent protective devices specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of overcurrent protective device work is indicated by drawings and schedules.
- B. Types of overcurrent protective devices in this section include the following:
 - 1. Circuit Breakers:
 - a. Air, molded-case, for installation in panels.
 - b. Air, molded-case, for individual, separately enclosed mounting.
 - c. For installation in existing panels.
 - 2. Fuses:
 - a. Class RK1 and RK5, dual-element time-delay.
- C. Refer to other Division 26 sections for cable/wire and connector work required in conjunction with overcurrent protective devices; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of overcurrent protective devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for project.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of overcurrent protective devices.
- D. UL Compliance: Comply with applicable requirements of UL 489, "Molded-Case Circuit Breakers and Circuit-Breaker Enclosures", and UL 198D, "High-Interrupting-Capacity Class K Fuses". Provide overcurrent protective devices which have been UL-listed and labeled.
- E. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub Nos. AB 1, AB 2, and SG 3 pertaining to molded-case and low-voltage power type circuit breakers.
- F. FS Compliance: Comply with Federal Specification W-C-375B/GEN pertaining to molded-case circuit breakers.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on overcurrent protective devices, including: amperes, voltages and current ratings, interrupting ratings, current limitations, internal inductive and non-inductive loads, time-current trip characteristics curves, and mounting requirements.
- B. Maintenance Stock, Fuses: For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than one unit of each.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:
 - 1. Circuit Breakers:
 - a. General Electric Co.
 - b. ITE/Seimens
 - c. Square D Co.
 - 2. Fuses:
 - a. Bussmann Div.; McGraw-Edison Co.
 - b. Cefco
 - c. Gould, Inc.

2.2 CIRCUIT BREAKERS

- A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings, and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.
- B. Molded-Case Circuit Breakers: Provide factory assembled, molded-case circuit breakers of frame size indicated; rated 600 volts or 240 volts as required, 60 Hz, 3-poles with interrupting ratings as shown on drawings. Provide breakers with permanent thermal and instantaneous magnetic 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 trip indication. Handle ties are not permitted. Provide push-to-trip button on cover for mechanical tripping circuit breakers. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40oC. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated. Circuit breakers shall have the short circuit interrupting rated indicated on the drawings or as required for the short circuit current available.
- C. Molded-Case Circuit Breakers for Installation in Existing Panelboards or Switchboards: Shall meet the same specifications as in Part B above. Shall be manufactured by the same manufacturer as the panelboard or switchboard. When the existing panel or switchboard style is obsolete and the existing circuit breaker type is not available the contractor shall provide a circuit breaker of similar type as existing. The breaker shall be provided with all the required mounting hardware to mount the breaker in the existing space. Provide all required filler plates and mounting hardware. The breaker shall meet or exceed the ratings, including fault current, of the existing breakers.
- D. Provide all accessories indicated on the drawings, including accessories indicated on the panel schedules, such as shunt trips, ground fault protection, undervoltage trips, etc. Accessories shall be manufactured by the same manufacturer as the circuit breaker.

2.3 FUSES

- A. General: Except as otherwise indicated, provide fuses of types, sizes, ratings, and average time/current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials, and construction in accordance with published product information, and with industry standards and configurations.
- B. Class RK5 Dual-Element Time-Delay Fuses: Provide UL Class RK-5 dual element time-delay fuses rated 600 V, 60 Hz, amperes as required by the manufacturer of the equipment being protected, with 200,000 RMS symmetrical interrupting current rating for protecting motors.
- C. Class RK1 Dual-Element Time-Delay Fuses: Provide UL Class RK-1 dual element time-delay fuses rated 600 V, 60 Hz, amperes as required by the manufacturer of the equipment being protected, with 200,000 RMS symmetrical interrupting current rating for protecting service entrance or as otherwise noted.

2.4 EXISTING EQUIPMENT

- A. Circuit breakers to be installed in existing equipment shall be manufactured by the existing equipment manufacturer and shall have short circuit interrupting ratings equal to or greater than the existing breakers.

PART 3 - EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES

- A. Install overcurrent protective devices as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.
- B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices with other work.
- C. Fasten circuit breakers without causing mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cabling.
- D. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of units.
- E. Install fuses, if any, in fused circuit breakers.

3.2 ADJUST AND CLEAN

- A. Inspect circuit-breaker operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

3.3 FIELD QUALITY CONTROL

- A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION

SECTION 26 2913 – MOTOR CONTROLLERS AND CONTACTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

- A. The work, apparatus and materials which shall be furnished under these specifications and accompanying drawings shall include all items specified hereinafter and shown on the drawings. All other materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete electrical systems as indicated on the drawings and as specified herein.
- B. Coordinate all required interlocks with Division 23. Motor starters shall contain the necessary auxiliary contacts and control coil voltage to interface with the HVAC temperature control system and fire alarm control system.

1.3 DESCRIPTION OF WORK

- A. Extent of motor controller work is indicated by drawings and schedules. Types of motor controllers specified in this section include the following:
 - 1. Manual motor starters.
 - 2. Combination disconnect/FVNR motor starters.

1.4 QUALITY ASSURANCE

- A. Manufacturers: General Electric, Square D, Allen Bradley.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical motor controller work similar to that required for this project.
- C. Codes and Standards:
 - 1. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to motor controllers.
 - 2. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to motor controllers. Provide motor controllers and components which have been UL-listed and labeled.
 - 3. NEC Compliance: Comply with applicable requirements of NEC pertaining to construction and installation of motor controllers.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of motor controller required. Include data substantiating that materials comply with requirements.

PART 2 - PRODUCTS

2.1 INDIVIDUAL MOTOR CONTROLLERS

- A. Manual motor starters for 115 volts, single phase motors one horsepower and smaller, shall be single pole, horsepower rated switches with thermal overload units and heaters. Starters shall be Square D Class 2510 with stainless steel cover plates. Equal by Seimens or Cutler Hammer.
- B. Magnetic full voltage starters for three phase motors shall be three pole, horsepower rated, magnetically operated with three thermal overload units and heaters. Starters shall be Square D Class 8536. Equal by Seimens or Cutler Hammer. Provide On-Off-Auto selector switch, pilot lights to indicate starter's position (Red (Off), Green (On)), a minimum of two normally open and two normally closed auxiliary contacts, control power transformer fused on primary and secondary, control coil, and individual solid state electronic overloads (do not use "heaters"). Provide control power and coil voltage as required for interlock with the HVAC temperature control system and fire alarm system. Starters shall be the Nema size indicated on the drawings but shall be a minimum size one. Provide phase failure relay to open the contacts when any phase to phase voltage drops below or above 20% nominal. The relay drop out point shall be adjustable from 0% to 50% and shall have a time delay adjustable from 1 second to 60 seconds.
 - 1. Select electronic overloads to meet the requirements of the specific motors to be protected. Standard factory selections may not be acceptable and sometimes need to be smaller than the standard overload. Coordinate required overload selections and provide the correct device for each motor. Provide solid state electronic overloads. Heaters are not acceptable.
- C. Combination magnetic, full voltage starters for three phase motors shall be three pole horsepower rated, magnetically operated contacts, with three thermal overload units and heaters. A three pole horsepower rated, fusible disconnect switch shall also be included integral within the enclosure. Provide fuses sized as

recommended by the motor manufacturer. Starters shall be Square D Class 8538. Equal by Seimens or Cutler Hammer. Provide On-Off-Auto selector switch, pilot lights to indicate starter's position (Red (Off), Green (On)), a minimum of two normally open and two normally closed auxiliary contacts, control power transformer fused on primary and secondary, control coil, and electronic overloads (do not use "heaters"). Provide control power and coil voltage as required for interlock with the HVAC temperature control system and fire alarm system. Starters shall be the Nema size indicated on the drawings but shall be a minimum size one. Provide phase failure relay to open the contacts when any phase to phase voltage drops below or above 20% nominal. The relay drop out point shall be adjustable from 0% to 50% and shall have a time delay adjustable from 1 second to 60 seconds.

- D. Provide enclosure type suitable for the environment in which it is installed. Enclosure shall be interlocked so the door cannot be opened without turning the unit off. This interlock shall be capable of being defeated by properly trained personnel.

PART 3 - EXECUTION

3.1 MOTOR CONTROLLERS, CONTACTORS AND ASSOCIATED CONTROLS

- A. Unless otherwise indicated, motor controllers shown on the drawings shall be furnished and installed under this section. The full load current and starting characteristics of each motor shall be verified for proper selection of motor over load devices. The Contractor shall furnish and install all steel shapes, etc., necessary for a support of all motor controllers.
- B. Unless otherwise indicated, all control devices, such as thermostats, firestats, etc., shall be installed in place and wired under other sections of the specifications. Coordinate required starter auxiliary contacts and coil voltages for a properly operational system.
- C. Motor controllers shall be installed in accordance with all applicable NEC installation requirements.

3.2 IDENTIFICATION OF EQUIPMENT

- A. Identification shall be provided for all motor controllers installed by the Contractor. Identification shall consist of white laminated plastic plates with black engraved letters.

END OF SECTION

SECTION 26 3100 - PHOTOVOLTAIC POWER SYSTEM

PROVIDE AN ALTERNATE ADDITIVE PRICE FOR THE PHOTOVOLTAIC POWER SYSTEM

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. All electrical specification sections apply to this section.
- B. Architectural and structural specifications pertaining to the roof and roofing works, apply to this section.
- C. Refer to the Design Criteria Package (DCP) drawings for more requirements. Where there is a conflict between these specifications and the drawings, the more stringent requirement shall apply.

1.2 SUMMARY

- A. Section Includes:
 - 1. PV modules (laminates in mounting frames).
 - 2. Optimizers
 - 3. Inverters.
 - 3. Mounting structures and materials.
 - 4. Electrical requirements.
 - 5. Mechanical requirements.
 - 6. Engineering, drawings, installation, permitting, and testing.
 - 7. Signed and sealed complete permit drawings.
- B. These performance specifications are intended to cover the engineering, design, equipment, hardware, documentation, labor and supervision required for the complete installation of a grid-connected Solar PV system, for the minimum total KW DC watts, as indicated below for this facility location. There shall be no energy storage devices (e.g. batteries) used in these systems.
 - 1. Northwest Area Head Start, Tampa, FL: 13.94 KW DC watts.
- C. Systems shall have an output into the facility power system at 208 volt, 3 phase for the electrical service condition, per the design criteria drawings.
- D. All systems should be designed for outdoor installation in the Hillsborough County area. Annual ambient temperatures can range from 30° F to 100° F, and humidity levels into and above 90%. Supplied equipment must be rated and warranted to withstand and operate under these conditions.
- E. Comply with all requirements of the local authority having jurisdiction, the local utility company, the Owner, the architect, and the engineer.
- F. The Contractor shall be a licensed electrical contractor and shall have a Florida Solar Contractor's License: Certified Solar Contractor (CV).
- G. The PV system modules shall carry a current certification by FSEC.
- I. Contact the local power company, arrange and apply for, and coordinate all utility requirements for an interconnection into the power grid, including but not limited to, a local Solar PV disconnect near the power company meter, an interconnection agreement(s), connections fees, and other utility procedural requirements.
- J. Net metering will be required and shall be provided.
- K.

1.3 CODES AND STANDARDS

- A. 6th Edition of the Florida Building Code, 2017
- B. 6th Edition of the Florida Fire Prevention Code, 2017
- C. National Electrical Code, 2014, including Articles 695 and 705.
- D. The Laws of Florida (§377.705, FS) require that all solar systems manufactured or sold in the state of Florida comply with Solar Equipment Standards promulgated by the Florida Solar Energy Center (FSEC). The Contractor shall comply with the FSEC requirements and standards.

1.4 DEFINITIONS

- A. ETFE: Ethylene tetrafluoroethylene.
- B. FEP: Fluorinated ethylene propylene.
- C. IP Code: Required ingress protection to comply with IEC 60529.
- D. MPPT: Maximum power point tracking.
- E. PTC: USA Performance Test Conditions for PV. KW DC output under performance test conditions.

- F. PV: Photovoltaic.
- G. STC: Standard Test Conditions defined in IEC 61215. KW DC output under standard conditions, or name-plate rating.
- H. $\text{KW AC (watts)} = \text{PTC KW DC (watts)} \times \text{Inverter Efficiency}$
- I. DCP: Design Criteria Package. This includes drawings and specifications.
- J. AHJ: Local authority having jurisdiction over the permit, inspections, and certificate of occupancy or other required building department approvals and acceptance.

1.5 GENERAL REQUIREMENTS

- A. Refer to the general conditions, supplementary conditions, and other applicable sections of the contract documents for bid submittal requirements.
 - 1. Solar PV system shall be a total turnkey design-build system, including all required professional engineering (drawings signed and sealed by a Florida registered professional engineer for structural, electrical (including the complete Solar PV system), and architectural.
 - 2. Provide proof of Florida Solar Contractor's License and Florida Solar Energy Center PV module and system certification.
 - 3. Submit an overview of major system components and principles of operation.
 - 4. Provide a complete list of all equipment, components, electrical components, mechanical hardware and other equipment required for installing the systems. Include description and make for all the equipment provided, model/part number and source are also required for the PV modules and the inverter.
 - 5. Provide product data cut sheets for each component.
 - 5. Provide a summary of PV system performance data calculation (i.e. PVwatts calc) of the total AC energy production (KWh) per month for the system, plus the total annual AC energy production for the system.
 - 6. Provide preliminary drawings indicating proposed layout of entire system, including PV arrays in parallel, and location of equipment hardware and control equipment (inverters) with respect to the array.
 - a. Preliminary drawings must clearly define the configuration of the system modules in parallel with power optimizers connected to the inverters. Full engineering calculations are not required at this stage. The purpose of the drawings is to define the bidders approach to the Solar PV system and to identify any proposed deviations from the DCP.
 - b. Indicate the proposed location of each major system component for review by Owner.
 - 7. Perform specific site visits to the facility to review existing conditions. Coordinate with the existing building construction, including PV equipment location, roof area required, location for array mounting, raceway routing, and system circuit breaker interconnection location in building panelboard or switchboard.
 - 8. Provide a letter that lists any and all proposed deviations from the DCP, or proposed alternative. Include an explanation of why the deviation is proposed (i.e. more cost effective, more efficient, code required, etc.)

1.6 SHOP DRAWINGS AND SUBMITTALS

- A. Product Data: For each type of product for the solar PV system.
 - 1. Overview of major system components and principles of operation.
 - 2. Complete list of all equipment, components, electrical components, mechanical hardware and other equipment required for installing the systems (must include description and make for all the equipment provided, model/part number and source are also required for the PV modules and the inverter).
 - 3. Catalog cut sheets of all equipment, components, electrical components, mechanical hardware and other equipment required.
 - 4. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for PV panels.
 - 5. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 6. Solar PV system energy production performance data calculation (i.e. PVwatts calc) of the total AC energy production (KWh) per month for the system, plus the annual AC energy production for this specific system in this specific location and building orientation.
 - 7. Provide surge protection on each main panel, if not existing.
- B. Shop Drawings: For all PV system equipment and modules.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Diagram indicating proposed layout of entire system, including PV array, Power Optimizers, inverter(s), and location of equipment hardware and control equipment with respect to the array.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 4. Details of fabrication and assembly.
 - 5. Include drawings for power, signal, and control wiring.
 - 6. Complete power riser diagram indicating all associated building electrical systems components, and complete details of the solar PV system.

7. Electrical power riser, schematics, and diagrams showing all major components and devices, including conductor types and sizes, connections of individual modules and array source circuits, terminations at junction boxes, connection to the inverter(s), surge suppression devices, and the PV system interface with the utility grid. Identify the required automatic shutdown and disconnect from the grid for any and all utility loss of power and also when the emergency power transfer switch transfers to the emergency generator power supply.
 8. All raceways and conductors shall be sized and identified. Perform all required calculation including deratings and voltage drop for all system circuits and feeders.
 9. Mechanical drawings showing details of module/array mechanical support.
 10. Warranty information on individual components as required in this bid document, and the solar PV system as a whole.
 11. Proof of solar and electrical contractors license, with license number, type of license and expiration date.
 12. Complete assembly and installation instructions for mounting array, junction boxes and enclosures, routing conduit, wiring arrays, and terminating conductors at array, combiner boxes and system control panel.
 13. Procedure for testing/commissioning, operating, disconnecting, servicing and maintaining complete system and individual components.
 14. Submit the proposed acceptance test form for review. The acceptance test form shall be as provided for on the Florida Solar Energy Center web site for PV system Acceptance Testing, or a similar test report.
 - C. Provide complete system building permit and construction drawings, including electrical drawings as required for permit and construction. All drawings shall be submitted in an electronic format, both PDF and AutoCAD (DWG), and shall be made available to the Owner, Architect/Engineer, Contractor and related subcontractors. Drawings shall be coordinated with the existing building construction. Provide all required hard copies, signed and sealed by the required Florida registered professionals (electrical, architectural, structural) as necessary for permit and construction. Digital seals will be accepted if accepted by the local AHJ.
 - D. Provide all required engineering calculations, including power loads (service, feeders, and branch circuits, as applicable), circuit conductor sizing, raceway and box sizing, voltage drop, and energy production.
 - E. A copy of the interconnection agreement between the owner and the utility must be provided.
 - F. Warranty: Copy of manufacturer's special materials and workmanship warranty and minimum power output warranty. Copy of supplier/contractor/installer warranty. Include warranty for modules, inverters, disconnects, cabling, and all other system equipment and hardware.
- 1.7 ACCEPTANCE, CLOSEOUT SUBMITTALS, AND ATTIC STOCK (PRIOR TO FINAL ACCEPTANCE)
- A. Operation and Maintenance Data: For complete system equipment and devices, including PV modules shall be included in operation and maintenance manuals. Provide two complete copies of all installation, operations and maintenance manuals
 - B. Field quality-control reports.
 - C. As-built drawings indicating overall layout of entire system, including PV array, and location of equipment hardware, controls, etc.
 - D. A copy of the accepted and executed interconnection agreement between the owner and the utility must be provided.
 - E. An acceptance test must be performed on the system once the installation is complete and a report provided at substantial completion. This includes measuring the short circuit currents and open-circuit voltages on all source circuits while measuring irradiance and module temperature. This also includes measuring the instantaneous DC input and AC output of the system to determine its efficiency. The acceptance test form submittal shall be as provided for on the Florida Solar Energy Center web site for PV system Acceptance Testing, or a similar prior approved test report.
 - F. A copy of the permit obtained from the appropriate authority having jurisdiction for system installation.
 - G. A copy of the system warranties including parts and labor. Include contact name, phone number and e-mail address for the person/company to be contacted for warranty service.
 - H. Attic Stock: Provide two extra solar panels/modules for overstock for each site.
 - I. Procedure for operating, disconnecting, servicing and maintaining complete system and individual components.
 - J. Provide up to 4 hours of training on the operation and maintenance of the solar PV system. Written log of training provided, the date(s) training was provided, location(s), and an attendee list.
- 1.8 WARRANTY
- A. Manufacturer's Special Materials and Workmanship Warranty: Manufacturer agrees to repair or replace components of PV modules and all other system components and hardware that fail in materials or workmanship within specified warranty period.
 1. Manufacturer's materials and workmanship warranties include, but are not limited to, the following:
 - a. Faulty operation of PV modules.
 - b. Degradation of performance.

- c. Mechanical failure of components or mounting hardware.
 - d. Electrical failures or faulty performance.
- 2. Solar Module Warranty Period: Each PV module shall be warranted by the manufacturer for at least 80% of its rated power for 20 years and a 25 year linear power warranty from date of Substantial Completion.
- 3. Inverters: 10 years from the date of substantial completion.
- 4. Power Optimizers: 25 years from the date of substantial completion.
- 5. Solar Hardware: 10 years.
- 6. All other system components, such as disconnects, cabling, and all other system equipment and hardware: 10 years parts and labor.
- B. Installer's warranty: Installer agrees to repair or replace components of the system, including PV modules and inverters, which fail due to the installer's workmanship within a period 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLAR PV SYSTEM DESCRIPTION AND OTHER REQUIREMENTS

- A. Grid-Tied PV System:
 - 1. Connected via a utility meter to the electrical utility. Net metering shall be required and provided.
 - 2. An array to generate the total nominal rated KW DC indicated for each site, as a minimum.
 - 3. Provide all required system components, but not limited to:
 - a. PV modules.
 - b. Array frame and mounting supports.
 - c. Power optimizers.
 - d. Inverter(s).
 - e. Overcurrent protection.
 - f. Combiner box, if necessary.
 - g. Aggregation panel, if necessary.
 - h. Mounting structure.
 - i. Utility meter PV disconnect.
 - j. DC wiring, AC wiring, raceways, boxes.
 - k. Other components as required.
- B. The system must use power optimizers and solar arrays connected in parallel, designed specifically for utility grid interconnection of photovoltaic arrays and be capable of automatic, continuous, and stable operation over the range of voltages, currents, and power levels for the size and type of array used. Single string type inverters are not permitted.
- G. Shall be compliant with IEEE Std. 929-2000 (Recommended Practice for Utility Interface of Photovoltaic Systems) and have UL1741 (Standard for Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems). Shall also comply with IEEE Std. 519 (Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems) and the latest applicable ANSI and FCC standards and addenda dated prior to the award of the purchase order for this procurement.
- H. Shall have an automatic visual indicator showing whether the system is on-line or not.
- I. The controls, inverter, AC and DC disconnects, and any other required electronics shall be installed near the array. Where they are exposed to weather and possible vandalism the contractor will provide a suitable pad-mountable, lockable enclosure for housing these components (where permitted). Solar disconnect cannot be locked. This enclosure shall provide any venting and weather sealing required by the electronics enclosed. All electrical enclosures shall be rated as NEMA 3R or better and have superior strength and corrosion resistance properties.
 - 1. All component locations shall be prior approved by the Owner.
- J. PV system shall be installed at each site. Provide for roof mounting the array in a manner that is acceptable with the Owner, Architect and Structural Engineer. The array shall be mounted on the structure at the optimal fixed tilt plane, be mounted parallel and perpendicular to roof, and shall be oriented either to the South or the West or both, as local conditions dictate.
- K. Provide surge protection on the main panel for each site, if not existing.

2.2 MANUFACTURED UNITS – PV MODULES

- A. Subject to compliance with requirements, provide PV modules by one of the following. Note that any PV module must be currently certified by FSEC. If a product is no longer certified prior to or during the shop drawing review process, the module shall be replaced with a certified module. The following is a partial list. Please note that the FSEC updates, adds, and removes modules from time to time. If a product is listed below, but is no longer on the FSEC list at the time of bid, then the module shall not be utilized.
 - 1. Aleo Solar.
 - 2. BP Solar USA.
 - 3. Canadian Solar

4. Evergreen Solar, Inc.
 5. GE Energy; General Electric Company.
 6. JA Solar
 7. LONGI Solar
 7. Mitsubishi Electric Corporation.
 8. REC Solar US LLC.
 9. Sanyo North America Corporation.
 10. Sharp Electronics Corporation.
 11. SunPower Corporation.
 12. Suntech Power.
 13. Trina Solar Limited.
 14. United Solar Ovonic LLC.
 15. Other Manufacturers tested and certified by the Florida Solar Energy Center.
 - B. Cell Materials: Mono-crystalline
 - C. Module Construction:
 1. Nominal Size: 39 inches wide by 77 inches long by 1.6" deep.
 2. Nominal Weight: 49.6 lb
 3. Coordinate sizes and configuration with the DCP Drawings. Module selection and size may be adjusted based upon the basis of design to fit the existing conditions and optimize the efficiencies and output.
NOTE: 340 watt per module was used as a basis for the DCP, but sizes shall be adjusted based upon the basis of design to fit the existing conditions and optimize the efficiencies and output.
 - D. Insulating Substrate Film: Flexible or Rigid. Polyester or polyimide.
 - E. Conducting Substrate Film: Flexible or Rigid. Fluoropolymer, ETFE, orFEP.
 - F. Front Panel: 0.125-inch-thick glass.
 - G. Backing Material: 0.125 inch - thick glass;
 - H. Bypass Diode Protection: Internal.
 - I. Junction Box:
 1. Size: As required.
 2. Fully potted, vandal resistant.
 3. Flammability Test: UL 1703.
 - J. Output Cabling:
 1. 0.158 inch diameter minimum.
 2. Quick, multiconnect, polarized connectors.
 3. Two-Conductor Harness: No traditional return wire is needed from the end of a row back to the source combiner.
 - K. Series Fuse Rating: As required.
- 2.3 PV MODULES - PERFORMANCE AND OTHER GENERAL REQUIREMENTS
- A. NRTL (Nationally Recognized Testing Laboratory) Listing: Entire assembly shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for electrical and fire safety, Class C, according to UL 1703.
 - B. FM approved for NFPA 70, Class 1, Division 2, Group C and Group D hazardous locations.
 - C. The PV modules should be framed flat-plate crystalline silicon modules. Thin- film modules will not be considered for this project
 - D. The PV modules shall meet or exceed the requirements of Underwriter Laboratories (UL) Standard 1703 Standard for Safety for Flat-Plate Photovoltaic Modules and either IEEE Standard 1262-1995 IEEE Recommended Practice for Qualification of Photovoltaic (PV) Modules and Panels or IEC 1215 Crystalline Silicon Terrestrial Photovoltaic (PV) Modules- Design Qualification and Type Approval.
 - E. Each PV module shall include bypass diodes installed in the module junction box.
- 2.4 PV MODULES - CAPACITIES AND CHARACTERISTICS
- A. Minimum Electrical Characteristics. Based upon a maximum 380 W DC module. Other module sizes should be similar ratings.
 1. Rated Open Circuit Voltage (V_{oc}): 49 V dc
 2. Maximum System Voltage: 1500 V dc
 3. Maximum Power at Voltage (V_{pm}): 40.4 V dc
 4. Short-Circuit Temperature Coefficient: 0.057%/deg C
 5. Rated Short-Circuit Current (I_{sc}): 10.0 A.
 6. Rated Operation Current (I_{mp}): 7.68 amps.
 7. Maximum Power at STC (P_{max}): 380 W.
 8. Tolerance of Pmax: +/- 2 percent.
 9. Maximum Series Fuse Rating: 20 A
 10. Module Efficiency: 19.6 percent.

11. Wind Loading or Surface Pressure: 50 lbf/sq. ft.
- B. Normal Operating Temperature Characteristics (NOTC):
 1. Temperature at Nominal Operating Cell Temperature: 45 +/-2 C
 2. Temperature Coefficient (NOTC P_{max}): -0.370% per deg C
 3. Temperature Coefficient (NOTC V_{oc}): -0.286%/deg C
 4. Temperature Coefficient (NOTC I_{sc}): 0.057%/deg C

2.6 MODULE FRAMING

- A. PV laminates mounted in anodized extruded-aluminum frames.
 1. Entire assembly UL listed for electrical and fire safety, Class C, according to UL 1703, complying with IEC 61215.
 2. Frame strength shall equal or exceed the requirements of all certifying agencies.
 3. Finish: Anodized aluminum.
 - a. Alloy and temper recommended by framing manufacturer for strength, corrosion resistance, and application of required finish.

2.7 ARRAY CONSTRUCTION

- A. Framing:
 1. Material: Extruded aluminum. All connectors and fasteners shall be corrosion resistant, hot dipped galvanized steel or stainless steel.
 2. Maximum System Weight: Less than 4 lb/sq. ft.
 3. Raceway Cover Plates: Galvanized steel.
- B. Roof Mounting:
 1. No roof penetrations. Use "C" type clamp system
 2. Self-ballasting.
 3. Rated for wind load for Hillsborough County, Florida, as required by the 6th Edition (2017) Florida Building Code.
 4. Roof mounting of the solar PV system components shall not void any existing roofing warranties.
 5. Mounting shall not interfere with existing roof drains, water drainage, expansion joints, air intakes, and any existing electrical or mechanical systems.
 6. A 3 foot clear path shall be maintained to and around all roof-top equipment. Shop drawings shall indicate the access point to the roof equipment for maintenance and replacement of equipment, and shall indicate the clearances to and around the equipment.
 6. Service Life: 20 years.

2.8 INVERTER

- A. Basis of Design: Modular Distributed Type with Power Optimizer and solar arrays connected in parallel. Solar Edge three phase inverters – SE Series – with 208 volt or 480 volt output as required for site.
- B. Control Type: Maximum power point tracker control. Must be specifically designed to work with power optimizers.
- C. Inverter Electrical Characteristics:
 1. Maximum Voc: 600 V DC
 2. Output Line Connections: 3 phase, 4 wire; balanced
 3. Rated AC Power Output: 14,400 W
 4. Maximum Input Current: 38 A.
 5. Provide with Primary and Secondary (master/slave) configuration with integral combiner and load balance.
 6. Maximum DC Power (Module STC): 19,400 W
 7. Nominal Output Voltage: 208 V AC or 480 V AC as required
 8. Maximum Output Current per phase: 40 A
 9. CEC Weighted Efficiency: 97.5 percent.
- D. Operating Conditions:
 1. Operating Ambient Temperatures: Minus 40 to plus 140 deg F
 2. Relative Humidity: 0 to 100 percent, noncondensing.
- E. Enclosure:
 1. NEMA 250, Type 3R.
 2. Enclosure Material: Galvanized steel, Aluminum, or Stainless Steel
 3. Cooling Methods:
 - a. Passive cooling or user replaceable fans.
 4. Protective Functions:
 - a. AC over/under voltage.
 - b. AC over/under frequency.
 - c. Ground over current.

- d. Overtemperature.
 - e. AC and dc overcurrent.
 - f. DC over voltage.
 - 5. Standard liquid crystal display, four lines, 20 characters, with user display and on/off toggle switch.
 - F. Disconnects:
 - 1. Low-voltage disconnect.
 - 2. Low-voltage reconnect.
 - 3. High-temperature disconnect.
 - 4. High-temperature reconnect.
 - G. Regulatory Approvals:
 - 1. IEEE 1547.1.
 - 2. IEEE 1547.3.
 - 3. UL 1741.
 - H. Characteristics and Protection:
 - 1. Inverter Dimensions: Arrange enclosure to fit in the area allocated for the system equipment. Refer to concept DCP drawings.
 - 2. Protect inverters from direct sunlight.
 - 3. Secure inverters from theft and vandalism.
 - 4. Provide for built-in inverter operational performance data that can be acquired at the inverter and also displayed remotely (remotely monitored).
 - 5. Provide integrated arc-fault protection and rapid shutdown per the NEC.
 - 6. Provide with an integrated safety switch.
 - 7. Provide with integral surge protection.
 - 8. Provide with smart energy management via RS485, Ethernet, and built-in cellular
- 2.9 SYSTEM OVERCURRENT PROTECTION
- A. Combiner Box (if required) and Other Equipment:
 - 1. Fuses: Sized (amperage) as required for the system protection per NEC.
 - 2. Circuit Breakers: Sized (amperage) as required for the system protection per NEC.
 - 3. All PV system devices and enclosures shall be capable of being locked.
- 2.10 MOUNTING STRUCTURES
- A. Roof Mount: Extruded aluminum, including all required rails, tilt legs, and roof standoffs. All roof mounting shall be reviewed and prior approved by the project architect and Owner.
 - B. No roof penetrations. Roof penetrations will not be permitted.
- 2.11 COMMUNICATIONS INTERFACE – EDUCATIONAL DISPLAY
- A. Provide for seamless communications with the PV system to an educational display to allow for system monitoring and display on a “green-screen” type display. Provide web-based communications ports for the necessary connections and interface. Provide all communications circuits and devices to enable the system to communicate and display the data. Provide any required hardware, software, programming, and licensing agreements to allow for owner’s connections and communications via the internet/web. Minimum data that shall be available:
 - 1. Current KW output into the power distribution system.
 - 2. Current inverter efficiency.
 - 3. Current month KWh produced and output to the power system.
 - 4. Current year KWh produced and output to the power system.
 - 5. Last full year (12 month) KWh produced and output to the power system.
 - B. Provide a minimum 55” flat screen monitor that will display the system data for review and monitoring by the Owner and general public. Locate the display in the location indicated in the DCP with the final, exact location to be approved by the Owner. Provide for power (receptacle and circuit), communications (Cat 5e or Cat 6 cabling and outlet), and mounting bracket.
 - C. The system shall also provide the capability for the Owner to connect the educational communications data into the Owner’s local area network for remote review and monitoring.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site shall be visited and reviewed in detail for the design of the Solar PV system.
- B. Examine substrate areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- C. Do not begin installation until mounting surfaces have been properly prepared.
- D. Examine modules and array frame before installation. Reject modules and arrays that are wet, moisture damaged, or mold damaged.

- E. Examine roofs, supports, and supporting structures for suitable conditions where PV system will be installed.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. PV module will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports by manufacturer's field service rep and submit at substantial completion, and include in final closeout documents.
- E. Any metal shavings resulting from work shall be cleaned from enclosure interiors, top surfaces of enclosures, the ground surface, roofs and any additional areas where oxidized or conductive metal shavings may cause rust, electrical short circuits or other damage.
- F. Construction staging of concentrated loads on roof shall be minimized. Special attention shall be paid to roof loading during installation such that heavy items are not loaded in a manner that would overload the roof.

3.3 PV SYSTEM ELECTRICAL REQUIREMENTS

- A. The electrical design and installation instructions for the PV systems shall conform to the 2014 National Electric Code (NFPA 70). Article 690 of the NEC shall apply specifically to the photovoltaic system safety, protection, control and interface with other sources. Other articles of the NEC also apply. The PV system electrical design shall also comply with the IEEE Std. 1374-Current Edition (Guide for Terrestrial Photovoltaic Power System Safety).
 - 1. Comply with all Disconnecting Means requirements.
 - 2. Comply with all site and equipment signage requirements.
- B. All electrical components, including overcurrent protection, disconnect, surge suppression devices, conduit, wiring and terminals must have UL or equivalent listing and have appropriate voltage, current and temperature ratings for the application. Special attention should be given to appropriate ratings for components used in DC circuits.
- C. All wiring shall be listed for a minimum operation of 600 volts and temperature rating of 90° C in wet locations, but sized using the 75° C current rating. All current carrying conductors shall be enclosed in conduit, including module interconnections. DC PV wiring shall be 1000 volt rated and temperature rating of 90° C in wet locations.
- D. Ampacity calculations must take into account appropriate de-ratings as required. All conductors in the system are subject to a 125% NEC de-rate, and all DC source circuit conductors and overcurrent devices must include an additional 125% de-rate for solar radiation enhancement. Appropriate temperature de-ratings for conductors used in module junction boxes must be considered for peak module operating temperatures, as well as de-ratings for instances where more than three current-carrying conductors are enclosed in a conduit.
- E. Voltage drop in array DC source circuits should be limited to no more than five percent (5%), including losses in conductors and through all fuses blocking diodes and termination points.
- F. All overcurrent devices shall have trip ratings no greater than the de-rated ampacity of the conductors that it protects.
- G. All modules (also known as panels, or source circuits) must include fusing and fault protection as required by UL and NEC to prevent damage to wiring or other system components.
- H. Array ground-fault protection devices should be included as required by the NEC. These devices must be capable of detecting array ground faults, shunting the fault current to ground, and disabling the array until the fault has been cleared.
- I. All terminations must use listed box terminal or compression type connections. Twist on wire splices, crimped, soldered or taped connections are not permitted for the required field installed wiring. Proper torque specifications should be provided for all of the required field connections.
- J. All module frames, panel/array support structures, metal enclosures, panel boards and the system cabinet should be provided with connections for bonding to a common grounding conductor and terminating at the ground rod at the utility service entrance point. In addition, provisions for grounding the neutral of the system output shall be provided. The DC negative circuit may be common to the AC neutral in the system design and under no circumstances should multiple connections to ground be provided for current carrying conductors in the system.
- K. Contact local utility and identify and provide all work required by the utility for connection to the system.
- L. Loss of Line: The system shall not operate without the line voltage present. The system shall sense a "loss of line" (utility) condition and shall automatically disconnect from the line. In the event of multiple PCSs and/or balanced load on a common line, the system shall contain circuits (such as Sandia Voltage Shift and Sandia Frequency Shift) that will cause the system voltage or frequency to drift downwards under loss of line

conditions and cause it to cease energizing the grid within two seconds after loss of line. The system restart shall occur automatically after restoration of line voltage and frequency for at least five minutes.

- M. Engine Generator Safety: Provide all the required circuits, contact closures, and communications to automatically shut-down the PV power production input into the electrical distribution system when the facility is operating on emergency generator power. The system shall sense an emergency power condition (i.e. transfer switch is in the emergency position, and shall automatically disconnect from the line. The shut-down procedure shall cause the PV system to cease energizing the grid within two seconds after utility power is lost.

3.4 PV SYSTEM MECHANICAL REQUIREMENTS

- A. Provide the all mounting hardware for mounting the photovoltaic arrays. Provide all other hardware required for assembling the photovoltaic modules and panels and structurally attaching them to the base support structure/roof.
- B. The PV array, including modules, hardware and attachments shall be designed to withstand wind loads as indicated on the building construction drawings and as required by the 2017 Florida Building Code, and shall comply with all local and state codes.
- C. Array mounting hardware supplied by the bidder should be compatible with the site considerations and environment.
- D. Special attention should be paid to minimizing the risk from exposed fasteners, sharp edges, and potential damage to the modules or support structure. Stainless steel fasteners and an aluminum support structure shall be provided. The use of ferrous metals, wood or plastic components will not be accepted.
- E. As these are high profile, publicly visible installations, the aesthetics of the overall installation is extremely important. To create a uniform appearance of the array, spacing between individual modules and panels should be kept to a minimum and shall be uniform. As much as possible, all mechanical hardware, conduit, junction boxes and other equipment should be concealed beneath and/or behind the array.
- F. The array layout should be consistent with the ordering (and labeling) of source circuits in the array combiner boxes.
- G. Ease of access for array troubleshooting and maintenance shall be provided by allowing access to the back of the array for module junction box servicing, and removal/replacement of individual source circuits (panels) and modules.
- H. The array shall be mounted on stand-offs three (3) to five (5) inches off the roof, to allow array ventilation. This prevents excessive temperatures that decrease output and increase module degradation.

END OF SECTION

SECTION 26 4313 - SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes transient voltage surge suppressors for low-voltage (600Volts and below) power equipment
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" transient voltage surge suppressors.
 - 2. Division 26 Section "Panelboards"

1.3 SUBMITTALS

- A. Must have ten day prior approval to submit on project.
- B. Request for submittals must be in writing and attached with independent documentation of the following items.
- C. Drawings: Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection notes, wire size and wiring diagram.
 - 1. SPD's with dimensions that exceed the available space to mount the device within the required maximum lead lengths will be rejected and not accepted. Verify maximum lead lengths can be met prior to bid.
- D. Equipment Manual: The manufacturer shall furnish an installation manual with installation notes, start-up and operating instructions for the specified system. Installation instructions shall clearly state whether the system requires an external overcurrent device to maintain the system's UL 1449 listing. SPD requiring external overcurrent devices are not acceptable.
- E. Verification that all SPD are UL 1449 3rd Edition listed and rated with a 20kA (In) nominal discharge rating for compliance to UL96A Lightning Protection Master Label and NFPA 780. Also provide UL 1449 3rd Edition VPR showing the following maximum VPR (clamping voltage) as follows:
 - 1. 120Vsystem 600V (L-N)
 - 2. 277Vsystem 1200V (L-N)
- F. SPD manufacturer shall provide UL 3rd Edition documentation as part of submittal.
- G. Manufacturer's Warranty Statement, showing a 10 year replacement warranty for modules or unit are damaged by transient voltages

1.4 STANDARDS

- A. Underwriters Laboratories 1449 - (UL 1449 3rd edition safety standard for surge protection devices – 2009)
- B. NEC article 285. National Electrical Code 2014 SPD shall be labeled with a minimum 200kAIC rating.
- C. NFPA 780 Standard for the installation of lightning protection systems
- D. UL96A - Lightning Protection System Master Label
- E. IEEE (Institute of Electrical and Electronic Engineering Inc.) C62.41.1 and C62.41.2 – 2002, IEEE C62.45 – 2002, IEEE C62.33 & C62.35
- F. All manufacturers must comply with above listed standards and any additions current revisions of industry standards. All products that do not comply with current industry standards will not be accepted.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

1.6 PROJECT CONDITIONS

- A. Placing into Service: Do not energize or connect service entrance equipment, panel boards, control terminals, or data terminals to their sources until the surge protective devices are installed and connected.
- B. Service Conditions: Rate surge protective devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage (MCOV): Not less than 115 percent
 - 2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
 - 3. Humidity: 0 to 85 percent, non-condensing.
 - 4. Altitude: Less than 20,000 feet (6000 m) above sea level.

1.7 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

- B. Coordinate surge protective devices with Division 26 Section "Panelboards" and "Switchboards".

1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer shall provide a product warranty for a period of not less than ten (10) years from date of installation. Warranty shall cover unlimited replacement of SPD modules during the warranty period. Those firms responding to this specification shall provide proof that they have been regularly engaged in the design, manufacturing and testing of SPD for not less than five (5) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. PQ Protection
B. ASCO/APT

2.2 SERVICE ENTRANCE SUPPRESSORS – LABELED TYPE SPD1 ON DRAWINGS

Panel Amperage	≥3,000Amps	2500-1600Amps	1200-400Amps
Service Entrance	400kA/Modular	300kA/modular	200kA/modular

- A. Provide service entrance rated, UL Type 1 SPD's as shown and indicated on contract drawings.
- B. Minimum surge current ratings per phase shown above, three phase, wye systems per phase rating shall equal L-N and L-G modes added together. No other methods are acceptable for per phase surge current rating calculations.
- C. SPD's shall be a multi-stage parallel connected device.
- D. SPD's UL 1449 3rd Edition VPR (clamping voltage) shall be a maximum rating of:
1. 120Vsystem 600V (L-N)
 2. 277Vsystem 1200V (L-N)
- E. SPD's shall mount external to the panel; internally mounted SPD's are not acceptable.
- F. SPD voltages shall be verified by location on drawings, one-line diagrams and equipment schedules.
- G. SPD shall be modular design with field replaceable modules per phase and per mode.
- H. SPD shall have redundant status indicators on the front of the enclosure and shall monitor and indicate whether suppression capabilities have been compromised.
- I. SPD shall contain protective components that utilize multiple thermally protected metal oxide varistors (MOV) per mode.
- J. SPD's relying upon external and/or supplementary installed safety overcurrent protection do not meet the intent of this specification.
- K. SPD's that are limited to being connected to breaker whether or not an integral disconnect switch is supplied do not meet the intent of this specification.
- L. SPD's shall have an UL "In" rating (nominal discharge) of 20kA.
- M. SPD shall have dry contacts for remote monitoring via the Campus security system (Ademco panels). Coordinate the required contact type with the existing security panels.
- N. Service Entrance SPD's shall have audible alarms and surge counters.
- O. SPD's shall have a metal, NEMA 4 rated enclosure.
- P. SPD shall be designed and equipped with integral disconnecting means.
- Q. Protection modes: The SPD shall provide Line to Neutral (L-N) (Wye), Line to Ground (L-G) (Wye or Delta), Line to Line (L-L) (Delta) and Neutral to Ground (N-G) (Wye) protection.

2.3 DISTRIBUTION, BRANCH PANEL AND/OR AUXILLARY PANELS – LABELED TYPE SPD2 ON DRAWINGS

Panel Amperage	1200-800A	600A	400-100A
Distribution	200kA	200kA	200kA
Branch Panels		100kA	100kA

- A. Provide UL Type 2 SPD's as shown and indicated on contract drawings. Any panel indicated to be 600 amp or larger, and any panel that is the service disconnect panel for the building shall be considered a "Distribution" type.
- B. SPD's minimum surge current ratings per phase shown above, three phase, wye systems per phase rating shall equal L-N and L-G modes added together. No other methods are acceptable for per phase surge current rating calculations.
- C. SPD's shall be a multi-stage parallel connected device.
- D. SPD's shall mount external to the panel; internally mounted SPD's are not acceptable.

- E. SPD voltages shall be verified by location on drawings, one-line diagrams and equipment schedules.
- F. SPD shall be a compact, non-modular design
- G. SPD shall have per phase status indicators on the front of the enclosure and shall monitor and indicate whether suppression capabilities have been compromised.
- H. SPD shall contain protective components that utilize multiple thermally protected metal oxide varistors (MOV) per mode.
- I. SPD's relying upon external and/or supplementary installed safety overcurrent protection do not meet the intent of this specification.
- J. SPD's shall have an UL "In" rating (nominal discharge) of 20kA.
- K. SPD shall have dry contacts for remote monitoring capabilities.
- L. SPD's shall have a metal, NEMA 4 rated enclosure
- M. Protection modes: The SPD shall provide Line to Neutral (L-N) (Wye), Line to Ground (L-G) (Wye or Delta), Line to Line (L-L) (Delta) and Neutral to Ground (N-G) (Wye) protection.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

- A. Review all installation information in manufacturer's installation manual prior to installing SPD's.
- B. Verify all voltages before connecting to avoid injury and damage to equipment.
- C. The SPD's shall be installed external to switchboard, distribution and panelboard.
- D. Internally mounted SPD's will not be accepted.
- E. The service entrance/switchboard/switchgear SPD's shall be installed with the shortest lead length possible and shall avoid any unnecessary or sharp bends. SPD's shall be connected to breakers with a 30 amp, 3 pole breaker for connection means.
- F. The distribution, panelboard and auxiliary SPD's shall be installed with the shortest lead length possible from the panel it is protecting and shall avoid any unnecessary or sharp bends. SPD's shall be connected to breakers with a 30 amp, 3 pole breaker for connection means.
- G. Ground resistance shall be 5 Ohms or less.
- H. Refer to manufacturer's installation manual for further installation details.

3.2 FIELD QUALITY CONTROL

A INSTALLATION

- 1. After installing surge protective devices, but before electrical circuitry has been energized, test for compliance with manufacturers' installation instruction requirements and recommendations.

B MANUFACTURERS FIELD SERVICE

- 1. Engage a factory authorized service representative to inspect equipment installation. Report results in writing
- 2. Verify that electrical wiring installation complies with manufacturer's installation requirements.

END OF SECTION

SECTION 26 5100 - INTERIOR BUILDING LUMINAIRES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Electrical Materials and Methods section apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of interior lighting fixture work is indicated by drawings and schedules.
- B. Types of interior lighting fixtures in this section include the following:
 - 1. LED
- C. Applications of interior lighting fixtures required for project including the following:
 - 1. General lighting
 - 2. Supplementary lighting
 - 3. Task lighting
 - 4. Emergency lighting

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of interior lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with interior lighting fixture work similar to that required for project.
- C. NEC Compliance: Comply with NEC as applicable to installation and construction of interior building lighting fixtures.
- D. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub Nos. LE 1 and LE 2 pertaining to lighting equipment.
- E. ANSI/IES Compliance: Comply with ANSI 132.1 pertaining to interior lighting fixtures.
- F. ANSI/UL Compliance: Comply with ANSI/UL standards pertaining to interior lighting fixtures for hazardous locations.
- G. UL Compliance: Provide interior lighting fixtures which have been UL-listed and labeled.
- H. CBM Labels: Provide fluorescent-lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on interior building lighting fixtures, lamps and ballasts. Catalog numbers on the fixture schedule are intended to describe the general fixture requirements. The fixture description, catalog number and actual use and location of the fixture shall be utilized as the full luminaire specification requirements. Provide required accessories and options as necessary to meet the full specification and drawing requirements.
 - 1. Submit complete catalog and technical data on lamps and drivers.
- B. Shop Drawings: Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet.
- C. Point-by-point foot-candle calculations shall be submitted for any fixtures or areas when requested by the engineer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers/Catalog Numbers: Subject to compliance with requirements, provide fixtures manufactured by manufacturers as indicated on the fixture schedule. Catalog numbers given on the fixture schedule are intended to provide the general description of the required fixture and its quality. Additional accessories, mounting hardware, options, etc., not specifically described by the catalog number but required for a properly operating and installed fixture or as described by additional notation on the drawings or in the specifications, shall be provided.
 - 1. Substitutions will not be considered without a full submittal package, complete with point-by-point calculations. Any substitutions that are considered must be prior approved by written addendum.

2.2 INTERIOR LIGHTING FIXTURES

- A. General: Provide lighting fixtures, of sizes, types, and ratings indicated; complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, starters and wiring.

- B. LED: LED luminaires shall be rated/tested to LM-79 standards
Provide energy saving LED-lamp drivers, compatible with the LED lamps and luminaire; Type 1, Class P; sound-rated A, and with internal thermal protection. All LED lamp type and associated driver for each individual type luminaire shall be of the same manufacturer and type. Drivers shall also meet the following requirements:
1. Operate LED lamps with no detectable flicker and provide for dimming where specified. Driver shall be compatible with the dimmers provided and installed. Provide written documentation of compatibility.
 2. Driver manufacturer shall have been producing LED drivers in the U.S. for more than three years with a low failure rate.
 3. Drivers shall be approved and listed by UL.
 4. Drivers shall comply with all applicable state and federal efficiency standards.
 5. Drivers shall comply with FCC and NEMA limits governing electromagnetic and radio frequency interference and shall not interfere with operation of other normal electrical equipment.
 6. Drivers shall meet all applicable ANSI and IEEE standards regarding harmonic distortion and surge protection, but in no case shall have total harmonic distortion exceeding 10%.
 7. Drivers shall not be affected by lamp failure and shall yield normal published expected lamp life.
 9. Drivers shall operate at an input frequency of 60 HZ and an input voltage of 108 to 132 volts.
 10. Driver assembly shall carry a minimum three year warranty, including labor allowance.
- C. Fusing: All LED drivers shall be fused or be provided with automatic electronic thermal overload protection. Drivers shall be capable of being disconnected at the luminaire for service and replacement.

2.3 LED LAMPS

- A. Lamps: Provide LED lamps that comply with LM-80 standards. **LED lamps shall be rated for a minimum of 50,000 hours life. Lamps shall be provided with a minimum 3 year warranty.**

PART 3 - EXECUTION

3.1 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.
- B. Coordinate with other electrical work as appropriate to properly interface installation of interior lighting fixtures with other work.
- C. Fasten fixtures securely to building structural support; and ensure that pendant fixtures are plumb and level. Provide all required mounting hardware and steel channel to supplement structural support where necessary. Fixtures shall not be supported from ductwork, piping, conduits, ceiling grid or any other non-structural building member. Fixtures may be supported from the ceiling grid only if the grid is properly supported from the building structure at a minimum of two corners at every fixture plus other supplemental support where deemed necessary. In addition, fixtures supported from a properly supported grid shall have grid hold-down clips installed. Hold-down clips shall be specifically manufactured for this purpose and shall be supplied with the fixtures.
- D. Coordinate fixture installation with mechanical duct work, diffusers, return grilles, communication systems devices, etc., to avoid any interferences.
- E. Pendant mounted direct/indirect fixtures (when applicable) shall be supported directly to the building structure, or via supplemental structural steel (uni-strut, kindorf). Any and all exposed supplemental steel or pendants, boxes, raceway, etc., shall be painted to match the surrounding area, or painted the color as directed by the architect.

3.2 ADJUST AND CLEAN

- A. Clean interior lighting fixtures of dirt and debris upon completion of installation
- B. Protect installed fixtures from damage during remainder of construction period.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- B. At the time of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Architect/Engineer.
- C. Refer to Division-1 sections for the replacement/restoration of lamps in interior lighting fixtures, where used for temporary lighting prior to time of Substantial Completion.
- D. Any and all exposed mounting hardware and supplemental steel mounting hardware (uni-strut, kindorf, etc.) shall be painted to match the surrounding areas or painted the color as directed by the architect. Exposed mounting hardware shall be prior approved by the architect before installation.

3.4 GROUNDING

- A. Provide tight equipment grounding connections for each interior lighting fixture installation.

3.5 COMMISSIONING

- A. Commissioning of the project will be required in accordance with the Florida Energy Code. Refer to the commissioning specification for more requirements, and other applicable specification sections. Provide all required materials, testing and labor to complete the commissioning procedures.

END OF SECTION

SECTION 26 5600 - EXTERIOR BUILDING LUMINAIRES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 00 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Materials and Methods section apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of exterior luminaire work is indicated by drawings and schedules.
- B. Types of exterior luminaires in this section include the following:
 - 1. LED
- C. Applications of exterior luminaires required for project including the following:
 - 1. Outdoor supplementary lighting

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of exterior luminaires of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with exterior luminaire work similar to that required for project.
- C. NEC Compliance: Comply with NEC as applicable to installation and construction of exterior building luminaires.
- D. UL Compliance: Provide exterior luminaires which are UL-listed and labeled.
- E. CBM Labels: Provide ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.4 SUBMITTALS

- A. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters. Full specification data sheets.
- B. Details of attaching luminaires and accessories.
- C. Details of installation and construction.
- D. Luminaire materials.
- E. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - 1. Submit complete point-by-point photometric calculations utilizing the LLF and LDD factors provided by the engineer.
 - 2. Testing Agency Certified Data: Photometric data shall be certified by a qualified independent testing agency.
 - 3. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 4. Submit all lamp and driver information complete
- F. LED drivers, including energy-efficiency data.
- G. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
- H. Materials, dimensions, and finishes of poles.
- I. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
- J. Anchor bolts for poles, if applicable.
- K. When applicable, submit manufactured poles and pole foundations. Provide complete lighting pole and pole base shop drawings for each pole type and location, where the location conditions differ. Provide pole and pole base wind load rating calculations signed and sealed by a Florida registered professional engineer.
 - 1. Provide geotechnical soil testing or other tests if necessary or required by the engineer of record for the poles and pole bases, where applicable.
- L. Wiring Diagrams: For control and switching wiring.
- M. Samples: The Engineer shall be provided with a sample of each fixture for review upon request. Each Sample shall include lamps and drivers. Lamps and drivers may be requested separately. The samples shall be retrieved by the contractor upon completion of review.
- N. Point-by-point foot-candle calculations shall be provided for all exterior lighting, including walk areas and event lawn.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers/Catalog Numbers: Subject to compliance with requirements, provide fixtures manufactured by manufacturers as indicated on the fixture schedule. Catalog numbers given on the fixture schedule are intended to provide the general description of the required fixture and its quality. Additional accessories, mounting hardware, options, etc., not specifically described by the catalog number but required for a properly operating and installed fixture or as described by additional notation on the drawings or in the specifications, shall be provided.
 - 1. Point-by-point calculations will be required to be submitted. Engineer will provide the design criteria and maintenance factors.
 - 2. Substitutions will not be considered without a full submittal package, complete with point-by-point calculations. Any substitutions that are considered must be prior approved by written addendum.

2.2 EXTERIOR LUMINAIRES

- A. General: Provide luminaires, of sizes, types, and ratings indicated; complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, drivers/ballasts, starters and wiring. The level of quality, general material, and manufacturing of the fixtures shall be as per the basis of design fixture, lamp and ballast and driver selection.
 - 1. LED luminaires shall be rated/tested to LM-79 standards.
- B. LED lamps shall be rated for a minimum 50,000 hours, or as indicated on the drawings, and shall be rated/tested/listed in accordance with LM-80 as a minimum. Provide lamps and drivers suitable for use in the outdoor environment.
- C. Poles: Site lighting poles shall be installed straight and plumb, and shall be as scheduled on the drawings. The pole and base shall be rated for the prevailing wind load as required by the Florida Building Code for the EPA of the luminaires and bracket arm, for the current version in affect at the time the project bids. Structural design for wind load ratings of the pole and base shall be performed by a Florida registered professional engineer and signed and sealed proof of compliance shall be submitted with the lighting shop drawings.
- D. Driver/Lamp Warranty: Provide a minimum five year lamp and ballast/driver (where applicable) guarantee. This warranty shall be provided as an assembly with the ballast and lamp manufacturer agreeing to provide the required warranty with the associated ballast or lamp.
- E. Fixture and Pole Warranty: Provide a minimum five year luminaire and light pole guarantee, including bollards. This warranty shall be provided as an assembly with the ballast and lamp, or separately from the driver & lamp.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXTERIOR LUMINAIRES

- A. Install exterior luminaires 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 luminaires fulfill requirements.
- B. Coordinate with other electrical work as appropriate to properly interface installation of exterior luminaires with other work.
- C. Fasten fixtures securely to required structural supports; and check to ensure that solid pendant fixtures are plumb.
- D. All poles shall be straight and plumb.
- E. Complete all control connections, including connection to the HVAC controls for on/off controls. Test all controls, program all timing for on/off periods based upon the Owner's request, and verify proper operation.

3.2 ADJUST AND CLEAN

- A. Clean exterior luminaires of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during remainder of construction period.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of exterior luminaires, and after building circuitry, apply electrical energy to luminaires to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- B. At the time of Substantial Completion, replace lamps in exterior luminaires which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Engineer.
- C. Refer to Division 00 sections for the replacement/restoration of lamps in exterior luminaires, where used for temporary lighting prior to time of Substantial Completion.

3.4 GROUNDING

- A. Provide tight equipment grounding connections for each exterior luminaire installation.

3.5 COMMISSIONING

- A. Commissioning of the project will be required in accordance with the Florida Energy Code. Refer to the commissioning specification, section 23 0800 for more requirements, and other applicable specification sections. Provide all required materials, testing and labor to complete the commissioning procedures.

END OF SECTION

SECTION 28 3111

FIRE ALARM AND SMOKE DETECTION SYSTEMS

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
 - A. An addressable fire alarm and smoke detection and supervisory system.
- 1.2 REFERENCES.(FIRE ALARM SHALL COMPLY WITH THE FOLLOWING)
 - A. NFPA 70 - National Electrical Code, 2014
 - B. NFPA 72 - National Fire Alarm Code, 2013.
 - C. Florida Fire Prevention Code – 6th Edition (2017), with the National Fire Protection Association (Fire Code) NFPA 101, Florida Specific Edition
 - D. Florida Building Code – 6th Edition (2017). Shall take precedence where conflicts arise.
- 1.3 REGULATORY REQUIREMENTS
 - A. System: UL listed.
 - B. Conform to requirements of NFPA 101 and the Local Fire Marshall.
- 1.4 DESCRIPTION OF SYSTEM
 - A. The system shall be an addressable, microprocessor based fire alarm control system with transient protection on each circuit and walk-through test capability. The system shall have the capability to control and supervise all the addressable devices and non-addressable appliance and auxiliary control circuits. Each component of the system shall be UL listed for its use. The system shall have a Dynamic LCD display and be located in a constantly attended location while the building is occupied.
- 1.5 QUALIFICATIONS
 - A. Manufacturer: Company specializing in smoke detection and fire alarm systems with five (5) years documented experience.
 - B. Installer: Company specializing in smoke detection and fire alarm systems with five (5) years documented experience with projects of equivalent scope of work and size and certified by the Florida State Licensing Board as fire alarm installing contractor. The actual installer shall be licensed to install fire alarm systems and shall be certified by the system manufacturer to install the system. Proof of certification and licensure shall be provided upon request.
- 1.6 SUBMITTALS
 - A. Submit six (6) copies shop drawings and product data.
 - B. Provide complete point to point wiring diagrams, data sheets, and equipment ratings, layout, dimensions, and finishes. Indicate the location of surge protection devices.
 - C. Submit manufacturer's installation instructions.
 - D. Submit manufacturer's certificate that the system meets or exceeds specified requirements - certification per NFPA 72.
 - E. Submit copy of Contractor's license before work begins.
 - F. Submit battery calculations indicating the required battery, including the specified spare capacity. Use the actual measured alarm and stand-by power for the existing building in the calculations.
 - G. Submit voltage drop calculations.
 - H. Provide training for four (4) people on the operation, maintenance, and repair of the system at the Contractor's expense.
- 1.7 PROJECT RECORD DRAWINGS
 - A. Contractor shall provide five (5) sets of as-built drawings to the Owner upon completion of project.
 - B. As-builts shall include the location of end-of-line devices, surge protection devices and exact conduit and wire routing. Numbers and types or conductors shall be indicated for each circuit.
- 1.8 OPERATION AND MAINTENANCE DATA
 - A. Provide seven (7) copies of operation and maintenance data prior at the completion of construction for all point devices, CPUs, and all other equipment.
 - B. Include operating instructions, and maintenance and repair procedures.
 - C. Provide manufacturer representative's letter stating that the system is operational.
 - D. Maintain system for a minimum of one (1) year, after complete acceptance by the Owner, in accordance with NFPA 72.

- E. Provide, at the end of the first year after construction completion, a yearly certification as outlined by the State Fire Marshal's Rule 4A-48.
- F. Provide a CD with a copy of the final programming, including any software access codes necessary for the Owner to access the required program.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Products shall be delivered to job site in manufacturers original shipping packages.
- B. Provide storage and protection of products, as needed.

1.10 SPECIAL REQUIREMENTS

- A. The Fire Alarm System herein specified shall be furnished by a manufacturer of Fire Alarm Systems who has been conducting business in the Tampa Bay area for at least five (5) years. A complete stock of parts for the systems furnished shall be in inventory at the facilities of the supplier. The equipment manufacturer shall have service facilities within a fifty (50) mile radius with parts in stock and trained service personnel and shall respond to a service call within twenty-four (24) hours after request during the warranty period (four (4) hours for an emergency request).
- B. Installation to be performed only by Manufacturer's authorized and certified installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fire Lite MS-9600 series.
 - B. Silent Knight IntelliKnight 5820XL series.
 - C. Edwards EST series.
 - D. Notifier NFS series.
- All with voice signal annunciation, both pre-recorded and live capabilities.

NOTE: System shall be a non-proprietary brand. No exceptions. Approval of manufacturer's equipment does not any way relieve the Contractor from meeting the performance criteria as outlined in the Plans and Specifications.

2.2 FIRE ALARM CONTROL PANEL (FACP)

- A. The system shall be an addressable, microprocessor based fire alarm control system with voice annunciation (both pre-recorded and live), with transient protection on each circuit and walk-through test capability. The system shall have the capability to control and supervise all the addressable devices and non-addressable appliance and auxiliary control circuits. Each component of the system shall be UL listed for its use. The system shall have a Dynamic LCD display in plain english language. Control panel construction shall be modular with solid state, microprocessor based electronics and shall conform to all requirements made necessary by the Fire Marshall. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. A local audible device shall sound during alarm, trouble or supervisory conditions. This audible device shall sound differently during each condition to distinguish one (1) condition from another without having to view the panel. This audible device shall also sound during each keypress to provide an audible feedback to ensure that the key has been pressed properly. The panel shall be complete with all required cards for the points necessary for all the devices indicated. Provide the necessary hard wired circuits for all the indicating appliance and auxiliary control devices. Provide the necessary supervised auxiliary control relays for all monitoring and control requirements. Provide a disable switch for system speakers at the Fire Alarm Control Panel. Label switch 'ALARM SILENCE SWITCH'. (If the switch is left in the disable position during normal system operation, a trouble signal shall sound at the control panel.). All equipment shall be utilized for its intended purpose and shall not be field modified. The fire alarm control panel cabinet shall not be used as a splice or junction box of any kind.
 - 1. Provide a semi-recess mounted cabinet with a hinged, lockable front door.
 - 2. Provide a minimum of 8 amps of power supply/battery charging current.
 - 3. Expansion Capability & Spare Capacity: Each initiation, indicating, addressable, Remote Power Supplies/Boosters, etc.. shall each have 20% spare capacity for future expansion. The spare capacity shall be clearly depicted on shop and as-built drawings.
 - 4. Fire alarm annunciator (FAVP): Provide an annunciator panel that provides for local live voice annunciation (microphone) and will annunciate all of the building alarms, troubles, and supervisory signals, and allow for alarm silence. The FAVP shall annunciate all functions of the fire alarm system. The FAVP shall identify in plain English language all alarms, troubles, and supervisory alarms. The FAVP shall be capable of silencing the alarms.
 - 5. Provide a USB connection for trouble shooting on a Microsoft Windows based computer. Provide detailed documentation on a CD ROM showing how each component of the fire alarm system has been

programmed. The disc, which will be used for troubleshooting, shall be placed in a protective sleeve and secured to the inside of the FACP panel door.

7. System shall have memory to store at least 1,000 events.
8. Provide the required number of addressable signal circuits plus one spare circuit.
9. Audio Annunciation and Control
 - a. Provide a master one-way emergency audio control unit as part of the main alarm control panel. The emergency audio control shall contain a paging microphone and shall be capable of generating and delivering multi-channel audio messages simultaneously over copper and/or fiber media to remote parts of the facility. The control unit shall be located in the main reception office area.
 - b. All audio messages and live pages shall originate at the one-way audio control unit. The one-way audio control unit shall store up to 32 minutes of pre-recorded audio messages digitally as WAV files. These messages shall be automatically directed to various areas in a facility under program control. The unit shall have the capacity to store up to 200 individual audio messages and to simultaneously play back seven (7) different messages in addition to live page message.
 - c. During non-alarm conditions, the control unit shall continuously distribute a default audio message to all amplifiers, providing total audio path supervision. To enhance system survivability, each remote FACP cabinet containing an amplifier shall play the default audio message in the event of a fire AND a control network system failure.
 - d. The one-way emergency audio control shall provide control switches to direct live paging messages as follows:
 - aa. "All Call" to direct the page messages to all areas in the facility, overriding all other messages and tones.
 - bb. "Page to Evacuation Area" to direct the message to the evacuation area(s), overriding all other messages and tones.
 - cc. "Page to Alert Area" to direct page messages to the area(s) receiving the alert message and tones, overriding all other messages and tones.
 - dd. "Page to Balance Building" to direct page messages to the area(s) in the facility NOT receiving either the evacuation area or alert area messages.
 - e. The system shall automatically deliver a preannounce tone of 1000 Hz for three seconds when the emergency operator presses the microphone PTT key. A 'ready to page' LED shall flash during the preannounce phase, and turn steady when the system is ready for the user's page delivery. The system shall include a page deactivation timer which activates for 3 seconds when the emergency user release the microphone talk key. Should the user subsequently press the microphone key during the deactivation period a page can be delivered immediately. Should the timer complete its cycle the system shall automatically restore emergency signaling and any subsequent paging will be preceded by the pre-announce tone. A VU display shall indicate voice level to the emergency operator.
 - f. The one-way audio control unit shall be capable of supporting remote microphone inputs and a line level audio input
- B. The following primary controls shall be visible through a front access panel:
 1. Eighty character liquid crystal display. Individual red system alarm LED.
 2. Individual yellow supervisory service LED. Individual yellow trouble LED.
 3. Green "power on" LED.
 4. Alarm acknowledge key.
 5. Supervisory acknowledge key.
 6. Trouble acknowledge key.
 7. Alarm silence key.
 8. System reset key.
 9. Printer Board.
- C. The control shall provide the following:
 1. Setting of time and date.
 2. LED testing. Alarm, trouble, and abnormal condition listing.
 3. Enabling and disabling of each monitor point separately.
 4. Activation and deactivation of each control point separately.
 5. Changing operator access levels.
 6. Walk test enable.
 7. Running diagnostic functions.
 8. Displaying software revision level.
 9. Displaying historical logs.
 10. Displaying card status.
 11. Point listing.

12. Indicating appliance silence switch.
- D. For maintenance purposes, the following lists shall be available from the point lists menu.
 1. All points listed by address.
 2. Monitor point list.
 3. Signal/speaker list.
 4. Auxiliary control list.
 5. Feedback point list.
 6. Pseudo point list.
 7. LED/switch status list.
 8. One touch function to bypass Audibles/Visuals
 9. One touch function to restore Audibles/Visuals
 10. One touch function to bypass Elevator Recall
 11. One touch function to restore Elevator Recall
 12. One touch function to bypass (RESET switches) Air Handling Unit Shut Down
 13. One touch function to restore Air Handling Unit Shut Down
 14. One touch function to bypass any door holders.
 15. One touch function to restore door holders.
 16. One touch function to bypass annunciation to Security panels.
 17. One touch function to restore annunciation to Security panels.

2.3 INITIATION DEVICES AND ACCESSORIES - ADDRESSABLE

- A. Manual Pull Station: Semi-flush mounted, supervised, normally open single action, addressable type manual pull station. Manual stations shall be single action and shall be constructed of impact resistant lexan with raised white lettering and a smooth high gloss finish. The station shall have a hinged front with key lock. Stations which utilize screwdrivers, Allen wrenches, or other commonly available tools shall not be accepted. Stations shall be keyed alike with the fire alarm control panel. When the station is operated, the handle shall lock in a protruding manner to facilitate quick visual identification of the activated station.
- B. Heat Detector: Easy installation, low profile with wide base to cover mounting plate and box. Detectors shall be white and shall be self-restoring operation. Detectors shall be a combination rate of rise/fixed temperature with thermostats rated at 135 degrees F, except when the plans call for a 194 or 200 degrees F rating (HT). Rate of rise setting shall be selectable at either 15 degrees F per minute or 20 degrees F per minute, factory set at 15 degrees F. The detector shall be the addressable type for use with an addressable system and shall be UL 521 listed for this purpose.
 1. Heat detectors installed in hazardous environments shall be the explosion proof type.
- C. Smoke Detectors: NFPA 72; photoelectric type with plug-in base, supervised visual indication of detector actuation, suitable for mounting on four inch (4") outlet box.
 1. Detectors shall be listed to U.L. Standard 268 and shall be documented compatible with the control equipment to which it is connected. Detectors shall be listed for this purpose by Underwriters Laboratories, Inc. The detectors shall obtain their operating power from the fire alarm panel supervised detection loop. The operating voltage shall be 24 VDC (nominal). Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal to be generated at the control panel. Detectors shall be the addressable type for use on an addressable type system.
 2. Each detector shall have a flashing status indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch.
 3. To minimize nuisance alarms, voltage, EMI and RF transient suppression techniques shall be employed as-well-as a smoke verification circuit and an insect screen. The detector design shall provide full solid-state construction and compatibility with other normally open fire alarm detection loop devices (heat detectors, pull stations, etc.). The detector head shall be easily disassembled to facilitate cleaning.
- D. Duct Mounted Smoke Detectors: Duct mounted smoke detectors shall be of the solid state photoelectric type and shall operate on the light scattering photodiode principle. The detectors shall be the same as the smoke detectors described in Section 2.03, C., above. Detectors shall be 4 wire operation, addressable type for use on an addressable type system. The detectors shall be mounted in a duct housing with an integral red LED which shall pulse continuously to indicate power on and glow continuously to indicate alarm or sensor trouble condition. The detectors shall be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive materials shall be used. Detectors shall be provided with the capability of performing automatic fan shutdown either directly from the detector or via the main control panel.
 1. Provide a remote alarm indicator with a test switch for each duct mounted smoke detector.
 2. Provide a sampling tube sized for the required duct width and rated for the air velocity present in the duct.

2.4 INDICATING APPLIANCES AND ACCESSORIES

A. Speakers and Strobes:

1. Speaker-Ceiling

- a. Provide low profile ceiling mounted speaker at the locations shown on the drawings.
- b. Speakers shall mount in a North American 4" x 2 1/8" square electrical box, or a 960A-4RF round flush box, and protrude less than 1.6" from the finished ceiling.
- c. The speaker output shall be switch selectable from the following available settings: 2W (91dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (80dBA) at 10 ft. when measured in reverberation room per UL-1480. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position. Adjust all speaker outputs in the field as necessary.
- d. The speaker shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.
- e. The low profile ceiling mounted speaker shall be Notifier. White in color.

2. Speaker-Strobe-Wall

- a. Provide low profile wall mounted speaker-strobes at the locations shown on the drawings.
- b. The low profile speaker-strobes shall mount in a North American 4" x 2 1/8" square electrical box, without trims or extension rings, and protrude less than 1" from the finished wall. Exterior devices shall be installed in a weatherproof, watertight box.
- c. The speaker output shall be switch selectable from the following available settings: 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.
- d. The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 110cd. Selected strobe rating shall be visible when the speaker-strobe is in its installed position. Light shall be evenly distributed throughout the required volume using cavity and mask "FullLight" technology to prevent hot spots. Strobes using specular reflectors shall not be considered as equal.
- e. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules
- f. Speaker and strobe power, speaker silencing, and strobe synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.
- g. Exterior devices shall be weatherproof, waterproof type.
- h. The low profile wall mounted speaker-strobes shall be Notifier. White in color.

3. Speaker-Strobe-Ceiling

- a. Provide low profile ceiling mounted speaker-strobes at the locations shown on the drawings.
- b. Speaker-strobes shall mount in a North American 4" x 2 1/8" square electrical box, or a 960A-4RF round flush box, and protrude less than 1.6" from the finished ceiling.
- c. The speaker output shall be switch selectable from the following available settings: 2W (91dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (80dBA) at 10 ft. when measured in reverberation room per UL-1480. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.
- d. The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 95cd or 95cd, 115cd, 150cd, & 177cd. Selected strobe rating shall be visible when the speaker-strobe is in its installed position.
- e. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules
- f. Strobe power and synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.
- g. The low profile ceiling mounted speaker-strobes shall be Notifier. White in color.

C. Strobe Lights:

1. Visual Flashing Lamps (Xenon Strobe): Visual indicating appliances shall be comprised of xenon flashtube and be entirely solid state and field adjustable. These devices shall be UL listed for use as a fire alarm indicating appliance and be capable of either ceiling or wall mounting. The lexan lens shall be pyramidal in shape to allow better visibility.

2. Shall operate on 24 VDC nominal.
3. Shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria:
 - a. The maximum pulse duration shall be 2/10ths of one second.
 - b. Unless otherwise specified on the drawings or required for ADA compliance, the intensity shall be a minimum of 75 candela.
 - c. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
 - d. Strobes shall be synchronized wherever required by NFPA-72.
4. Must be UL listed for system or current design with ADA required flash rate and intensity. Must be field adjustable.
5. White in color.

D. Audible/Visual Combination Devices:

1. Audio/Visual Alarm Indicating Appliance: Audio/Visual units shall provide a common enclosure for the fire alarm audible and visual alarm devices. The housing shall be designed to accommodate either horns, bells, chimes, or speakers. The unit shall be complete with a tamper resistant, pyramidal shaped lexan lens with "Fire" lettering visible from a 180 degree field of view. The front panel or bezel which is constructed of cast metal or LEXAN maybe inverted so that the lens is below the audible device. The lamp assembly shall incorporate a built-in reflector for more efficient light propagation and a special shock-mounting arrangement to resist lamp failure due o vibration. Unit shall be complete with all mounting hardware including backbox. Audio/Visual unit shall be UL Listed as a fire alarm indicating appliance.
2. Shall meet the applicable requirements of Section B listed above for audibility.
3. Shall meet the requirements of Section C listed above for visibility.
4. Notifier with the ADA required flash rate and intensity. White in color.

2.5 MISCELLANEOUS DEVICES AND ACCESSORIES

- A. Relays and Control Modules for auxiliary control: Provide auxiliary control relays or control modules for door release, hood fire suppression supervision, end of line supervision and other required control functions indicated on the drawings or otherwise specified. All auxiliary control circuits shall be indicated on the annunciator as a separate zone or shall be addressable using a monitor module so the device can be identified quickly and accurately.
- B. Provide wall mounted, magnetic door holder/automatic door release devices. Door holder shall have a minimum 25 lbs. holding force. Provide variable stem length coordinated with the door requirements.
- C. Monitor Module (Individual Addressable Module)
 1. Addressable Monitor modules shall be provided to connect one supervised circuit of a conventional alarm or trouble initiating device (any N.O. dry contact device), such as tamper switches and water flow switches, etc., to the Fire Alarm Control Panel.
 2. The Monitor Module shall mount in a 4-inch square, 2-1/8" deep electrical box.
 3. The conventional alarm initiating device may be wired for Style D or Style B operation. The Monitor module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the Fire Alarm Control Panel shall use to identify the type of device. Modules that use binary jumpers or dip-switches are subject to installation errors are not acceptable. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor module is operational and in regular communication with the control panel.
 4. For difficult to reach areas, the Monitor Module shall be available in a miniature package and shall be no larger than 2-3/4" x 1-1/4" x 1/2". This version need not include Style D or an LED.
- D. Provide all required supervised control circuits for air handler shutdown. Provide a remote indicator whenever the duct mounted detector is concealed from view. Remote indicator shall be located in an accessible and readily visible location.
- E. Provide for supervision of all sprinkler system water flow switches and tamper switches. Refer to fire protection drawings for quantities of valves and switches. Provide supervision of the valve tamper switch on site at the backflow preventer.

2.6 BATTERY BACK-UP

- A. The system shall be battery back-up for 24 hours plus five (5) minutes of alarm capabilities after a 24 hour standby period (per NFPA 72) with all system indicating appliances operating, including strobes, plus 30% spare capacity. Batteries shall be completely sealed, rechargeable type and maintenance free.

2.7 LIGHTNING PROTECTION

- A. Provide surge suppression devices on each initiating device loop and each indicating appliance circuit.
- B. Provide lightning protection on the 120 volt power circuit to the control panel main power supply.

- C. All lightning protection shall be manufactured and listed for use with the fire alarm system by EDCO, DiTEK or approved equal. Devices shall be terminal strip mounted and shall be mounted in a terminal cabinet separate from the control panel, as required to meet UL requirements.
 - D. Lightning protection devices shall be UL listed. The clamping voltage shall be coordinated with the system voltage to avoid nuisance clamping. Devices found to clamp too quickly shall be replaced.
- 2.8 DIGITAL ALARM COMMUNICATOR TRANSMITTER (DACT)
- A. Provide required monitoring and signaling capability for connection of the fire alarm control panel to the off site remote monitoring company. Provide conduit and cabling from the fire alarm control panel to the DACT. Provide for cellular communications connections for the remote monitoring signal. Coordinate connection requirements with Owner's IT personnel.
- 2.9 FIRE ALARM CABLE
- A. All fire alarm conductors shall meet the requirements of the local fire marshal and the National Electrical Code.

PART 3 - SEQUENCE OF OPERATION

- 3.1 ENTIRE BUILDING
- A. All pull stations, heat detectors, smoke detectors, and duct smoke detectors shall, when placed in an alarm mode, sound the building general alarm, flash strobe lights, shutdown AHUs, release door holders, shutdown gas, and annunciate the address of the initiating device to the FACP.
 - 1. Activate all programmed indicating appliance circuits until silenced.
 - 2. Actuate all programmed strobe units until the panel is reset.
 - 3. Annunciate the active initiating devices.
 - B. All pull stations, heat detectors, smoke detectors, and duct smoke detectors shall, when placed in a trouble mode, indicate the address of the device experiencing trouble to the FACP.
 - C. Duct smoke detectors shall be interlocked to shutdown their respective units on alarm. The shutdown circuit shall be supervised and controlled directly from the FACP.
 - D. Provide all required gas shutdown, elevator power shutdown, elevator recall, and other required auxiliary functions.
 - E. Provide all control functions required by Florida Building Code.

PART 4 - PROGRAMMING

- 4.1 THE SYSTEM SHALL BE FULLY PROGRAMMED AND COMPLETELY OPERATIONAL PRIOR TO ACCEPTANCE. THE FACP AND CPU SHALL HAVE THE CAPABILITY TO BE FULLY PROGRAMMABLE BY OWNER'S PERSONNEL. PROVIDE ALL NECESSARY SOFTWARE ACCESS TO THE OWNER FOR RE-PROGRAMMING BY THE OWNER. PROVIDE ALL REQUIRED PROGRAMMING AND RE-PROGRAMMING FOR ALL INSPECTIONS AND FINAL ACCEPTANCE BY THE OWNER, ENGINEER, AND FIRE MARSHAL AT NO ADDITIONAL COST TO THE OWNER.
- 4.2 THE MANUFACTURER SHALL PROVIDE THE NECESSARY DOCUMENTATION AND TRAINING TO ALLOW THE OWNER'S PERSONNEL TO MAINTAIN AND CHANGE SOFTWARE.
- 4.3 PROGRAM DATA SHALL BE STORED IN NON-VOLATILE MEMORY WITH BATTERY BACK-UP. PROGRAM DATA SHALL NOT BE LOST DUE TO TEMPORARY OUTAGES, SURGES, DIPS, ETC.

PART 5 - EXECUTION

- 5.1 INSTALLATION OF FIRE ALARM AND DETECTION SYSTEMS
- A. Install fire alarm and detection systems as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC and NECAs "Standard of Installation" and NFPA-72.
 - B. Wiring Systems and Materials
 - 1. Wiring shall be in accordance with requirements of the National Electrical Code and NFPA Regulation 72. The fire alarm system, including components, conduit, boxes and wiring shall be completely installed and wiring and conduit shall be properly tagged and color coded. The Electrical Contractor shall make final connections as shown and required by the equipment manufacturer's wiring instructions.
 - 2. Wiring shall be color coded as follows:
 - C. New Systems
 - 1. Manual Stations, Smoke & Heat Detectors: Orange (Black/Red)
 - 2. Horns & Flashing Lights: Yellow/ Blue (Blue/White)
 - 3. Smoke Detector Power: Red & Black
 - 4. Door Holders: White (Purple/Yellow)

- 5. All Shutdown Circuits (AHU 's, Valves, etc.): Purple (Orange/Brown)
- 6 Control Panel Power: Black/White
- D. All wire shall be terminated with crimp type open-end spade lugs using tool approved by plug manufacturer. Wire terminating at the control panel or terminal cabinets shall be identified as to circuit and use.
- E. Wiring run to terminal cabinets shall terminate on barrier-type terminal strips. Provide new terminal strips where required.
- F. All wiring to be installed in conduit with continuous ground.
- G. All junction box covers shall be painted red. All lengths of conduits shall have at least one red stripe.
- H. AHU shutdown relays and equipment control relays shall be mounted within three (3) feet of controlled device. AHU shutdown relays shall be wired on a separate circuit.
- I. Visual flashing lamps and speakers shall be wired on alternate circuits to provide coverage in the event of the failure of one circuit. Provide the required number of circuits for the indicated number of alarm indicating devices.
- J. Provide conduit, wire and circuit breakers to connect fire alarm control panels to a dedicated circuit. The fire alarm circuit breaker shall be accessible to authorized personnel only and shall be marked FIRE ALARM CIRCUIT CONTROL. Provide handle lock for circuit breaker handle.
- K. Air handler shutdown shall be controlled from the main Fire Alarm Control Panel. A disconnect switch shall be provided as part of the Fire Alarm Control Panel to allow testing of the system without disruption of air conditioning service or to operate air handlers when system cannot be quickly restored to normal. When the disconnect switch is in the disconnect position, a disarrangement trouble signal shall continue to sound at the panel until the switch is restored to normal. Each panel shall incorporate required modules for air handler shutdown whether or not air handlers exist so that no modifications or additions shall be required for shutdown of air handlers installed in the future. Label switch "FAN DISCONNECT".

5.2 QUALITY ASSURANCE

- A. NEC Compliance comply with NEC as applicable to construction and installation of fire alarm and detection system components and accessories.
- B. UL Compliance and Labeling - Provide fire alarm and detection system components which are UL listed and labeled. Installation is to be by a UL listed installer.
- C. Misc. compliance - The fire alarm system is to be installed in accordance with the equipment manufacturer's written instructions and comply with all applicable portions of the NECAs "Standard Installation" and all local codes and ordinances.

5.3 FIELD QUALITY CONTROL

- A. Inspect relays and signals for malfunctioning, and where necessary adjust units for proper operation to fulfill project requirements. Any fine adjustment shall be performed by specially trained personnel in direct employ of manufacturer of the fire alarm detection system equipment. The Manufacturer's representative shall perform a quality inspection off the final installation and, in the presence of the Electrical Contractor, Architect/Engineer, and Owner's Representatives, shall perform a complete functional test of the system. A system certification verifying the proper system operation shall be required prior to acceptance by the Owner.

5.4 SYSTEM GUARANTEE

- A. All components, parts, and assemblies supplied by the Manufacturer shall be guaranteed against defects in materials and workmanship for a period of twelve (12) months commencing the date of substantial completion. Warranty service shall be provided by a qualified factory trained representative of the equipment manufacturer. Service response time shall be a maximum of four (4) hours before arrival to site.
- B. Testing: The Contractor shall perform all electrical and mechanical tests required by the equipment manufacturer's form and National Fire Protection Association - 72. All test and report costs shall be in the contract price. A checkout report shall be prepared by the installation technicians and submitted in triplicate, one (1) copy of which will be registered with the equipment manufacturer. The report shall include, but not be limited to:
 - 1. A complete list of equipment installed and wired.
 - 2. Indication that all equipment is properly installed and functions and conforms with these specifications.
 - 3. Test result of individual initiating devices and indicating appliances.
 - 4. Serial numbers, locations by zone and model number for each installed detector.
 - 5. Response time on thermostats and flame detectors (if used).
 - 6. Technician's name, certificate number and date.
 - 7. System will not be accepted until this certification is received.
- C. Documentation: After completion of the tests and adjustments listed above, the Contractor shall submit the following information to the Owner.

1. A copy of the test report described in this specification and a Certificate of Compliance prepared as per National Fire Protection Association Standard 72, and State Fire Marshal's Rule 4A-48 to be complete at final test.
2. Affixed to FACP a standard service tag, as described in rule 4A-48 for fire alarm contractors by the Office of the State Fire Marshal.
3. Final tests and inspection shall be held in presence of the Owners' representatives and to their satisfaction. The Contractor shall supply personnel and required auxiliary equipment for this test without additional cost to the Owner.
4. To assure that wire size, power supply, number of devices on a circuit, etc. are suitable to support 100% of devices being in alarm or operated simultaneously, this test shall include the following:
 - a. Place all sensors and monitor modules in alarm. Each shall display it's address and alarm condition. At least the first ten (10) devices on each circuit shall also have their alarm LEDs lighted.
 - b. Operate all control modules for the alarm or operated condition. Each module shall display it's address and condition.
 - c. Reset all alarmed and operated devices. The panel shall display the address or zone of any off-normal devices.
 - d. Test a representative number of sensors for alarm verification by momentarily testing for alarm. The sensor shall not initiate an alarm. Then, test by placing the sensor in alarm such that it remains in alarm for the selected verification time. The sensor shall initiate an alarm.
 - e. Acceptance of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a ninety (90) day test period without any unwarranted alarms. Should unwarranted alarm(s) occur, the Contractor shall readjust or replace the detector(s) and begin another ninety (90) day test period. As required by the Engineer the Contractor shall recheck the detectors using the fire test after each readjustment or replacement of detectors. This test shall not start until the Owner has obtained beneficial use of the building under tests.
 - f. If the requirements provided in the paragraph above are not completed within thirty (30) days after beginning the tests described therein, the Contractor shall replace the system with another acceptable manufacturer and the process repeated until acceptance of the equipment by the Owner.
 - g. Before final acceptance of work; the Contractor shall deliver seven (7) copies of a composite "Operating and Shop Maintenance Manual." Each manual shall contain, but not be limited to:
 - h. A statement of guarantee including date of termination and name and phone number of the person to be called in the event of equipment failure.
 - i. Individual factory issued manuals containing all technical information on each piece of equipment installed. In the event that such manuals are not obtainable from the factory, it shall be the responsibility of the Contractor to compile and include them. Advertising brochures or operational instructions shall not be used in lieu of the required technical manuals.
 - j. One (1) copy of all approved shop drawings, instruction sheets, operating instructions, and spare parts bulletins.
 - k. A training session, for personnel selected by the Owner, shall be presented by a fully qualified, trained representative of the equipment manufacturer who is thoroughly knowledgeable of the specific installation.
 - l. Provide a written description of standard control panel functions and user instructions at each FACP. These instructions shall be written in standard laymen's English so that an unfamiliar operator can accomplish basic functions such as reset.
- D. Warranty: All equipment and systems shall be warranted by the Contractor for a period of one (1) year following the date of final acceptance. The warranty shall include parts, labor, prompt field service, pick-up, and delivery.
 1. Provide one (1) year of testing as per National Fire Protection Association 72, which shall consist of:
 2. At the end of the one year warranty period provide a Test and Written report which certify that all initiating devices have been tested and which indicate the result of the inspection as required by the Owner. Provide the required certification tag. Problems discovered during this testing and inspection shall be covered under the warranty. It is the contractor's responsibility to perform this testing prior to the end of the one year warranty or provide an extended warranty if the test is performed after the warranty period was scheduled to expire.

END OF SECTION

SECTION 31 1000 - DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. The work covered by this Section of the specifications consists of furnishing all material, labor, tools, equipment, plant, appliances and services necessary to complete all demolition and relocation work required in the Drawings and specified herein. The CONTRACTOR shall examine the various Drawings, visit the site and determine for himself the extent of the work, the extent of work affected therein and all conditions under which he is required to perform the various operations.
- B. Existing site structures and appurtenances affected herein are indicated generally on the Construction Plans.

1.3 QUALITY ASSURANCE

- A. Permits and Licenses: CONTRACTOR shall obtain all necessary permits and licenses for performing the work and shall furnish a copy of same to the OWNER prior to commencing the work. The CONTRACTOR shall comply with the requirements of the permits.
- B. Notices: CONTRACTOR shall issue written notices of planned demolition to companies or local authorities owning utility conduit, wires or pipes running to or through the project site. Copies of said notices shall be submitted to the Engineer.
- C. Utility Services: CONTRACTOR shall notify utility companies or local authorities furnishing gas, water, electrical, telephone or sewer service to remove any equipment owned by them in structures to be demolished and to remove, disconnect, cap or plug their services to facilitate demolition.

1.4 JOB CONDITIONS

- A. Sequence of Construction: Demolition, removal and relocation work shall be coordinated with the OWNER and an agreed upon sequence of construction to minimize down time at the site.

1.5 DISPOSITION OF DEMOLISHED MATERIALS

- A. Salvaged materials designated as property of the OWNER shall be stored in areas designated by the OWNER. The CONTRACTOR shall promptly remove all other materials from the site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

- A. SALVAGE:

1. Material to be salvaged shall be removed with the minimum amount of damage and stored on the site as directed by the OWNER. Material stored on the ground shall be placed on blocks, and all stored material shall be stacked and placed in an orderly manner. Salvaged equipment and materials which can be damaged by the weather shall be stored in a weather-tight building or area on site until removed by the CONTRACTOR. Any salvaged items that are determined to be of no value to the OWNER after removal and OWNER's inspection, shall be removed from the site by the CONTRACTOR.

3.2 PERFORMANCE

- A. General: Demolition shall result in the complete removal and disposal of existing structures and appurtenances from the site as indicated on Drawings, the salvaging of indicated items and the cleanup after completion of the demolition work.
- B. MODIFICATIONS:
 1. The cutting and removal of existing work necessary for modifications and installation of new work shall be made with a minimum of damage to the work that is to remain. Any damage done to existing facilities which are to remain shall be repaired at the CONTRACTOR's expense to the satisfaction of the OWNER.
 2. Debris created within facilities, which are to remain in service during the modification work, shall be removed at the end of each day's operation.
 3. The CONTRACTOR shall follow other specific instructions for the modification work given in other Sections of these specifications and as shown on the Drawings.

3.3 CLEANUP

- A. Site shall be left in a clean condition satisfactory to the OWNER and the ENGINEER OF RECORD, free from demolished materials, rubbish or debris. Site shall be graded to meet adjacent contours and provide flow for surface drainage.
- B. The CONTRACTOR shall restore items intended to remain that have been damaged by demolition work.
- C. All interrupted utility services shall be returned to their pre-existing state and disconnect temporary services, unless otherwise specified.

END OF SECTION

SECTION 31 1100 - CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. SCOPE

This Section includes all clearing and grubbing work indicated on the Plans and as required, complete with cutting and removal of trees, shrubs, vegetation, stumps, logs, brush, roots and undergrowth, the removal of pavement, underdrains, underground utilities, and the disposal of materials.

B. RELATED WORK SPECIFIED ELSEWHERE

- 1. General Earthwork: Section 31 2000
- 2. Site Grading: Section 31 2200
- 3. Earthwork for Paving: Section 31 2216

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTIONS

3.1 EXECUTION OF WORK

A. GENERAL

- 1. Areas designated for improvements on the Plans shall be cleared of all trees, shrubs, vegetation, stumps, logs, brush, roots, buildings, concrete foundations, underdrains, underground utilities, and debris.

- 2. Clearing and Removal

Within areas for roadways, sidewalks, and parking areas where the finished grade is five (5) feet or less in height above the existing ground, trees, stumps, and roots shall be removed to a depth of not less than 12 inches below the existing ground. Within areas for roadways sidewalks, and parking areas, where the finished grade is more than five (5) feet in height above existing ground, trees and stumps shall be cut off flush with the existing ground surface. For embankment areas outside of the roadways, sidewalks, and parking areas, trees and stumps shall be cut off flush with the existing ground surface, or as indicated on the Plans or as directed by the ENGINEER OF RECORD.

Within areas designated for a building pad the trees; stumps, roots, vegetation and other debris shall be removed completely. Within areas designated for buildings and training fields the existing trees, stumps, roots, buildings, concrete foundations, underdrains, underground utilities, etc. shall be removed to a depth of not less than 3 feet below existing grade.

3. Removal of Trees, Stumps, and Other Vegetation

Where trees cannot be felled without danger to traffic or injury to other trees, structures or property, they shall be cut down in Sections. The removal of stumps and roots may be accomplished by the use of a shredding machine meeting the approval of the ENGINEER OF RECORD.

All logs, stumps, poles, brush, and other unsatisfactory material occurring in the Contract Limits shall be removed and shall be disposed of by the CONTRACTOR. Material shall be disposed of outside of the Contract Limits as specified in Section 312000, General Earthwork.

4. Holes and Trenches

All holes and trenches remaining after the grubbing operation in embankment areas shall have the sides broken down or leveled, and shall be refilled with acceptable material. The material shall be moistened and properly compacted according to the minimum standards outlined in the specifications in layers by tampers or rollers to the density required under roadways, parking areas, and other special areas. The same construction procedure shall be applied to all holes and trenches remaining in excavation areas where the depth of holes exceeds the depth of proposed excavation.

END OF SECTION

SECTION 31 2000 - GENERAL EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. SCOPE

This Section includes general earthwork complete with: preserving topsoil; removal and disposal of structures and obstructions; protection of existing sewers; tiles and mains; protection of existing building and improvements; protection of trees and other types of vegetation; protection of utility lines; requirements for pavement replacement; restoration of driveways and parking areas; restoration of sidewalks; restoration of lawns and disturbed areas; soil erosion and sedimentation control; and removal, transportation, and disposal of excess excavation.

B. Related Work Specified Elsewhere

- 1. Dewatering: Section 31 2319
- 2. Bituminous Paving: Section 32 1113

1.3 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

Florida Department of Transportation (FDOT)

Hillsborough County Technical Specifications

Southwest Florida Water Management District

B. Requirements of Regulatory Agencies

The CONTRACTOR, at his expense, shall prepare all plans, obtain all approvals, secure all permits, and post all bonds or deposits required to comply with PART IV, Chapter 373 Florida Statutes (F.S.), the Florida Environmental Land and Water Management Act of 1972 (380.012 F.S. et seq.), and related statutes.

1.4 SUBMITTALS

A. Reports

- 1. Written permission for the use of all disposal and borrow sites shall be obtained and copies shall be furnished to the OWNER and the ENGINEER OF RECORD.

1.5 JOB CONDITIONS

A. Protection

1. Protection of Plant Life

All trees, shrubs, and other types of vegetation not within the limits of the Work or not designated on the Plans or by the ENGINEER OF RECORD to be removed, shall be carefully protected from damage or injury during the various construction operations. Any tree, shrub or other type of vegetation not designated to be removed but which is damaged by the CONTRACTOR'S operation shall be repaired or replaced by the CONTRACTOR, at his expense, as directed by the OWNER or the ENGINEER OF RECORD. A STAGING PLAN SHALL BE SUBMITTED BY THE CONTRACTOR.

2. Protection of Existing Structures and Improvements

All existing culverts, sewers, drainage structures, manholes, water gate wells, hydrants, water mains, utility poles, overhead lines, underground conduits, underground cables, pavement, or other types of improvements within the construction limits, not designated on the Plans or directed by the ENGINEER OF RECORD to be removed, shall be carefully protected from damage during the construction operations.

Any type of existing structure or improvement not designated to be removed, but which is damaged by the CONTRACTOR'S operations shall be repaired or replaced by the CONTRACTOR, at his expense. THE CONTRACTOR SHALL SURVEY THE EXISTING SITE AND SHALL REPORT TO THE OWNER AND THE ENGINEER OF RECORD ANY PRE-EXISTING DAMAGE TO THE SITE INFRASTRUCTURE OR IMPROVEMENTS.

B. Maintaining Drainage

All existing open drains, field and roadway ditches, drainage tile, sewers, enclosed drains, natural and artificial watercourses, surface drainage or any other types of drainage within the limits of the Work shall be maintained and free to discharge during the excavating, backfilling and compacting operations.

Any drainage facility not designated to be abandoned, but which is damaged, and/or any drainage interrupted by the CONTRACTOR'S operation shall be immediately repaired, replaced, or cleared by the CONTRACTOR, as directed by the ENGINEER OF RECORD. All costs incurred shall be incidental to the excavating, backfilling and compacting or grading operations.

1.6 GUARANTEE

Existing trees destroyed by neglect of the CONTRACTOR or his subcontractor's, will be replaced by the CONTRACTOR. Replacement of tree species and location shall be determined by the OWNER

PART 2 - PRODUCTS

2.1 MATERIALS

Granular material shall conform to the Hillsborough County Technical Specifications for Sanitary Sewers, attachment #9 Backfill Specifications. Granular material shall be material within the following gradation limits, passing a No. 4 sieve-95% (min) passing a No. 200 sieve - 5% (max) and meeting the approval of the ENGINEER OF RECORD.

PART 3 - EXECUTION

3.1 PREPARATION

A. General

The CONTRACTOR and the OWNER shall meet before commencement of site clearing to discuss locations of top soil spoils, construction circulation and materials storage in relation to the preservation of existing plant materials. This meeting shall be requested by the CONTRACTOR two (2) weeks prior to site clearing operations commence. THE CONTRACTOR'S STAGING PLAN SHALL BE SUBMITTED PRIOR TO THE SCHEDULING OF THIS MEETING.

B. Dewatering

The area within the vicinity of the new Work shall be dewatered prior to commencing any construction activities. The depth of the dewatering shall be sufficient to allow the Work area to remain in a dry condition during the various construction operations. The costs incurred for furnishing, installing, maintaining and removing the dewatering equipment shall be at the CONTRACTOR'S expense. See Section 312319 for additional specifications

3.2 PERFORMANCE

A. General

The various construction operations shall be restricted to the areas indicated on the Plans. If additional area is required, the CONTRACTOR shall furnish the OWNER with written permission obtained from the property owner for any part of the operations he conducts outside of the limits indicated on the Plans. Barriers shall be installed in locations as directed by the ENGINEER OF RECORD or governing agency having such authority.

B. Existing Topsoil On-Site

Topsoil encountered along the route of the construction shall be pushed back and preserved for use in restoration following completion of the construction. The topsoil must remain on the project site during construction.

C. Existing Utilities

When existing utilities are shown on the Plans, their locations are approximate only, as secured in the field investigation and from available public records. The CONTRACTOR, prior to the start of construction, shall contact Sunshine One Facilities Locating Service and/or the public agency or utility having jurisdiction to request the verification of all utilities within the construction area.

When existing utility lines, structures or utility poles are encountered during the performance of the Work, the CONTRACTOR, at his expense, shall perform his operations in such a manner that the service will be uninterrupted.

The CONTRACTOR shall expose all existing utility lines prior to any excavation operation, to determine any conflict with the proposed improvement. The CONTRACTOR shall be responsible for any relocation required as a result of any conflict of existing utilities with the proposed improvement.

Should it become necessary to move any utility structure, line or pole, whether called for on the Plans or otherwise found necessary to be moved, the CONTRACTOR shall make all

arrangements with the specific utility for the moving. All costs incurred for such moving shall be at the CONTRACTOR'S expense unless indicated otherwise. However, before disturbing a utility line, structure or pole, the CONTRACTOR shall furnish the OWNER with satisfactory evidence, in writing, that proper arrangements have been made with the Owner of the utility.

D. Existing Sewers, Tile and Mains

Existing sanitary sewers, storm sewers, drain tile, septic tank bed tiles, water mains or building services or leads, that are encountered during the performance of the Work that require relocation or are damaged, shall be restored with new materials equal in quality and type to the materials encountered.

The new material shall be installed as specified on the Plans or as directed by the ENGINEER OF RECORD. The bedding and backfill material, unless otherwise specified, shall be an approved granular material, compacted to 95% of its maximum unit weight.

Seepage bed tile and water mains shall be replaced in accordance with the requirement of the appropriate local Department of Health.

The relocation or protection of existing sewers, tiles, tile field, water mains or building services and leads shall be at the CONTRACTOR'S expense, unless otherwise indicated in the Contract Documents.

F. Existing Structures

Existing surface and subsurface structures may be shown on the Plans, in locations considered most probable from information secured in the field investigation and from available public records. Neither the correctness nor completeness of such information is guaranteed or implied. All structures shall be protected, preserved, restored, or removed by the CONTRACTOR, at his expense, as directed by the Plans or by the ENGINEER OF RECORD.

Unless otherwise specified on the Plans, CONTRACTOR at his expense, shall remove any abandoned culvert, pipe, sewer, structure or part of a structure which is to be replaced or rendered useless by the new construction.

The structure shall be broken down to at least 12 inches below the subgrade. All pipes connected to the structure shall be plugged with a brick, masonry or concrete bulkhead, approved by the ENGINEER OF RECORD. The remainder of the excavation shall be backfilled with a granular material, compacted in place, and shall meet with the approval of the ENGINEER OF RECORD.

If a structure is to be removed from a system that is to remain in service, a bypass system, approved by the OWNER and the ENGINEER OF RECORD shall be installed and maintained by the CONTRACTOR, during the rebuilding period.

Salvaged materials derived there from shall become the property of the CONTRACTOR and unless otherwise specified on the Plans or in the Summary of Work shall be disposed of by the CONTRACTOR, at his expense.

G. Trees

All trees excepting those specified on the Plans to be removed shall be effectively protected by the CONTRACTOR during his construction operations. Individual trees to be preserved shall have tree protection barriers installed at the drip line of each tree.

H. Fences

Fences shall be removed and replaced or shall be removed as indicated on the Plans. If any of the existing material is damaged or destroyed, the CONTRACTOR shall replace the material at his expense.

Where fencing is encountered during construction, and its removal was not called for on the Plans or was not directed by the OWNER OR DESIGNATED REPRESENTATIVE, it shall be replaced or restored, at the CONTRACTOR'S expense, to a condition comparable to that prior to construction. All temporary construction fencing shall be maintained in good condition during the construction. After the fence removal or relocation operations are complete, all surplus material shall be removed and disposed of by the CONTRACTOR, at his expense, unless otherwise called for on the Plans.

Any holes or voids resulting from the fence removal operation shall be backfilled with a suitable material, approved.

Where fences are encountered that are being used to provide security and pedestrian control, the same shall be immediately replaced following the disturbance. During the disturbance, the CONTRACTOR, at his expense, shall provide, install and maintain a temporary fence, meeting the approval of the OWNER.

I. Removing Pavement

The removal of concrete and bituminous pavement as called for on the Plans or as directed by the Engineer/Consultant, shall consist of removing and disposing of pavement and shall include base courses, surface courses, integral and separate curbs, integral and separate curb and gutters, sidewalks and end headers.

The pavement shall be removed to an existing joint or cut to a true line, either perpendicular or parallel to the direction of travel, with the vertical face resting a minimum of 18 inches onto undisturbed ground, as indicated on the Plans, or as directed by the ENGINEER OF RECORD. The cutting shall be accomplished by using a power driven concrete saw, approved by the ENGINEER OF RECORD. The depth of the saw cut shall be a minimum of six (6) inches, or as directed by the ENGINEER OF RECORD, to ensure that the removal of the old pavement will not disturb or damage the Section of pavement remaining in place.

Residual concrete pavement shall not be less than five (5) feet measured transversely, nor less than six (6) feet longitudinally measured from a joint.

In removing a concrete base course, where part of the existing bituminous surface is to remain in place, the bituminous surface shall be cut the full depth by the use of a power driven saw, approved by the ENGINEER OF RECORD along a line parallel to and at least one (1) foot from either side of the base course removal.

Old pavement with a concrete cap shall be considered as only one pavement, whether or not there is a separation layer of earth, aggregate, or bituminous material between the old material and the concrete cap.

Where integral curb is to be removed flush with the existing concrete pavement, the operation shall be performed by saw cutting or by a mechanical means, approved by the ENGINEER OF RECORD, so as to leave a neat and flush cleavage plane, without damage to the underlying pavement.

Where integral curb and gutter are to be removed, the operation shall be performed by saw cutting. The limits of the removal shall be as called for on the Plans or as directed by the

ENGINEER OF RECORD. However, in no case shall the width of removal be less than 18 inches for Sections with rolled or straight curb or less than 24 inches for mountable curbs.

If during the pavement removal operation any concrete or bituminous pavement or surfacing is damaged beyond the removal limits designated on the Plans or directed by the ENGINEER OF RECORD, the damaged pavement or surfacing shall be removed and replaced at the CONTRACTOR'S expense subject to approval and acceptance of the OWNER and the ENGINEER OF RECORD.

Any earth which may be removed during the pavement removal operation shall be replaced by backfilling to the proposed subgrade with a suitable material, approved by the ENGINEER OF RECORD, at the CONTRACTOR'S expense.

J. Guardrail

Beam guardrail and cable guardrail shall be relocated or shall be removed as specified on the Plans or as directed by the ENGINEER OF RECORD. If any of the existing material is damaged or destroyed, the CONTRACTOR shall replace the material at his expense.

Where guardrail is encountered during construction, and its removal was not called for on the Plans or was not directed by the ENGINEER OF RECORD, it shall be replaced or restored, at the CONTRACTOR'S expense, to a condition comparable to that prior to construction. After the guardrail removal or relocation operations are complete, all surplus material shall be removed and disposed of by the CONTRACTOR, at his expense, unless otherwise called for on the Plans or as directed by the ENGINEER OF RECORD.

Any holes or voids resulting from the guardrail removal operation shall be backfilled with a suitable material approved by the ENGINEER OF RECORD.

K. Adjust Structures

Structures to be adjusted shall be as called for on the Plans, or as directed by the ENGINEER OF RECORD. Adjustment of structures shall apply where the elevation of the casting is either raised 12 inches or less, or lowered six (6) inches or less.

The existing frame and cover shall be carefully removed and stored, and shall be reinstalled on the same structure, unless a new frame and cover are called for on the Plans. The brick or concrete adjustment rings shall be set in mortar or installed as recommended by the manufacturer.

The outside surface of the new brick or block structures shall receive a masonry plaster coat, a minimum of 2 inch thick.

The structure shall be properly backfilled with a granular material, compacted in place and meeting the approval of the ENGINEER OF RECORD.

The flow in the entire system shall be maintained, at the CONTRACTOR'S expense, while performing any part of the Work. Also, the structure shall be cleaned and all unsuitable material shall be disposed of at the CONTRACTOR'S expense.

L. Reconstruct Structures

Structures to be reconstructed shall be as called for on the Plans or as directed by the ENGINEER OF RECORD. Reconstruction of structures shall apply where the elevation of the casting must be raised in excess of 12 inches or lowered in excess of six (6) inches.

The existing frame and cover shall be carefully removed and stored, and shall be reinstalled on the same structure unless a new frame and cover are called for on the Plans, or as directed by the ENGINEER OF RECORD.

The existing corbel entrance Sections or precast concrete chimney type entrance shall be removed along with any additional brick courses or precast concrete Sections necessary to achieve the amount of reconstruction called for on the Plans, or as directed by the ENGINEER OF RECORD. The necessary brick Work and precast concrete Sections shall be installed to meet the design grade.

Manhole steps shall be furnished and shall be installed, as necessary, to comply with the Plans, or as directed by the ENGINEER OF RECORD. The brick or concrete adjustment rings shall be set in mortar or installed as recommended by the manufacturer and as approved by the ENGINEER OF RECORD.

The outside surface of the new brick or block structures shall receive a masonry plaster coat, a minimum of 2 inch thick. The structure shall be properly backfilled with a granular material, compacted in place, and meeting the approval of the ENGINEER OF RECORD. The flow in the entire system shall be maintained, at the CONTRACTOR'S expense, while performing any part of the Work. Also, the structure shall be cleaned and all unsuitable material shall be disposed of at the CONTRACTOR'S expense.

M. Holes

Earth removed during any phase of the excavation or removal operations, resulting in a hole or void, shall be replaced by backfilling to the proposed subgrade with a suitable granular material approved by the ENGINEER OF RECORD. The material shall be placed by the controlled density method or other effective means having the approval of the ENGINEER OF RECORD and shall be compacted to 95% of maximum unit weight.

The furnishing, placing and compacting of the backfill material shall be at the CONTRACTOR'S expense.

N. Restoration

Areas not paved shall be restored in accordance with the type and location specified herein unless indicated otherwise on the Plans. The disturbed areas may be shaped by Machine Grading or another method approved by the ENGINEER OF RECORD to achieve the cross Section, line and grade shown on the Plans. All areas shall be restored with topsoil and sod.

Any excess material from the restoration operation shall be disposed of by the CONTRACTOR at his expense. The disturbed areas shall be graded to receive topsoil and sod. The topsoil and sod shall conform to the requirements specified on the Plans and in Section 329200, Grassing and Mulching.

The CONTRACTOR, at his expense, shall furnish, place, and compact any additional fill, meeting the approval of the ENGINEER OF RECORD, needed to restore the disturbed areas to the cross Sections called for on the Plans or as determined by the ENGINEER OF RECORD.

O. Soil Erosion and Sedimentation Control

If the permit is required, the CONTRACTOR, at his expense, shall prepare all plans, obtain all approvals, secure all permits and post all bonds and deposits required to comply with Part IV, Chapter 373 Florida Statutes and the Florida Environmental Land and Water Act of 1972 (380.012 F.S. et seq.) and related statutes.

The CONTRACTOR shall provide the OWNER, DESIGN CRITERIA PROFESSIONAL REPRESENTATIVE AND THE ENGINEER OF RECORD with a copy of the soil erosion permit issued by the enforcing agencies for the Project, prior to commencing any type of earthwork on the Project.

P. Excess Excavation

Excess excavation shall be defined as all surplus earth material realized from the construction that is free of brush, roots, stumps, broken concrete, pipe, debris, and other extraneous material.

The CONTRACTOR shall transport all excess excavation to a site(s) approved by the OWNER. The excess excavation shall be graded by the CONTRACTOR to provide positive surface drainage of the site(s). The grading shall be done such that adjacent properties are not damaged or affected. The grading shall include removal of all surface irregularities to provide a smooth surface (+ 0.25 foot). The CONTRACTOR shall be responsible for obtaining and paying for any required permits. Field grading shall be completed based on plan specifications.

Proper disposal of all excess excavation, including transportation, grading, protection of adjacent properties and soil erosion control, shall be considered as a final cleanup item. No additional payment will be made for this item.

Q. Disposal of Unsatisfactory Material

Any brush, roots, stumps, broken concrete, pipe, debris, and other extraneous material from the construction shall become the property of the CONTRACTOR, and shall be disposed of at proper repository. Removal and disposal of this material shall be considered as part of final cleanup. No additional payment will be made for this item.

OWNER and ENGINEER OF RECORD approval of the final site(s) condition in writing will be required prior to final payment authorization.

3.3 MAINTENANCE

Maintain tree protection barriers during the entire course of construction. Any part of a barrier, which has been damaged or destroyed, will be replaced at the start of the next working day.

Do not allow vehicular or pedestrian violation of the tree protection barrier. Do not store materials within tree protection barrier limits.

END OF SECTION

SECTION 31 2200 - SITE GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes site grading as indicated on the Plans, complete with removing and salvaging topsoil, rough grading and finish grading.

- B. Related Work Specified Elsewhere

- 1. Clearing and Grubbing: Section 31 1100
 - 2. General Earthwork: Section 31 2000
 - 3. Erosion Control: Section 31 2500

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Site Grading

Sites shall be graded as specified on the Plans or as directed by the ENGINEER OF RECORD. The CONTRACTOR shall carry out the grading operation to prevent standing water and soil saturation detrimental to structures and improvements. Provisions shall be made to preserve and protect existing trees and other existing vegetation specified on the Plans or directed by the ENGINEER OF RECORD not to be removed. The CONTRACTOR shall submit to the OWNER for approval a staging plan illustrating soil stockpile areas, and how landscaping shall be protected prior to initiating work.

- B. Removing and Salvaging Topsoil

Topsoil shall be salvaged in an amount equivalent to the quantity required by the Plans. Topsoil salvaged in excess of that required by the Plans or as required by the ENGINEER OF RECORD will be disposed of by the CONTRACTOR at his expense.

Before removing topsoil, all vegetation shall be reduced to a height of approximately four (4) inches and all such vegetation and all brush, stones, rocks, and any other objectionable litter or foreign material shall be removed and disposed of before the ground is broken for topsoil removal. Equipment and methods of operations shall be such as to avoid the lifting of the subsoil. If soil or weather conditions are unsuitable, the CONTRACTOR shall cease stripping until directed by the OWNER that stripping can resume.

Topsoil shall be removed within the grading limits for cuts and shall be removed to a width and depth specified on the Plans or as directed by the ENGINEER OF RECORD.

The topsoil shall be stockpiled within the limits of construction in areas designated on the Plans, or used on the slopes as shown on the Plans or as directed by the ENGINEER OF RECORD. Stockpiles shall be located and shaped so as to avoid diversion of storm water runoff, either in or out of the limits of construction, towards buildings, creation of standing water or interference of controlled irrigation. The stockpile shall avoid placing topsoil around trunks and root areas of trees to be preserved.

Topsoil shall be kept separate from other excavated materials which are to be used for embankment and shall be completely removed from any designated area prior to the beginning of regular excavation or embankment in the area.

The topsoil stockpiles shall be located as near the original locations as possible and no payment will be made for overhaul.

C. Rough Grading

The site shall be graded as necessary to comply with the Plans or as directed by the ENGINEER OF RECORD. The rough grade shall be established by cut or fill, approximately parallel to proposed finished grades and to elevations which allow for thickness of topsoil and installation of site or roadway improvements.

In fill areas all debris shall be removed from the area to be filled. All material detrimental to site improvement shall be removed from the site and acceptably disposed of as specified in Section 31 2000, General Earthwork.

Original ground on sloping sites shall be scarified and benched or otherwise treated to provide adequate bond and to prevent slippage of fill.

Fill material shall be free of debris or other detrimental material and shall have reasonable moisture content when placed. All fill shall be compacted to a density not less than 100% of the maximum unit weight and placed in layers no less than nine (9) inches and no greater than 15 inches.

D. Finish Grading

The subgrade shall be smoothed parallel to the proposed finished grades and elevations specified on the Plans. The subgrade shall be scarified to assure bond with the topsoil prior to spreading of the topsoil.

The topsoil shall be spread uniformly to provide a smooth, even surface at a finish grade specified on the Plans or acceptable to the ENGINEER OF RECORD. Topsoil shall be spread only after the OWNER has approved the subgrade. After spreading, the topsoil shall be compacted lightly as necessary to minimize settlement. Final grades shall not vary more than 1/10 of a foot from the elevations indicated on the Plans.

END OF SECTION

SECTION 31 2216 - EARTHWORK FOR PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes Earthwork for Paving complete with excavation; subgrade undercut and backfill, embankments; subbase; ditching; restoration; complete with materials, field quality control and appurtenances.

- B. Related Work Specified Elsewhere

- 1. Clearing and Grubbing: Section 31 1100
- 2. General Earthwork: Section 31 2000
- 3. Dewatering: Section 31 2319
- 4. Base Courses: Section 32 1100

1.3 Quality Assurance

- A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ASTM - American Society for Testing and Materials

AASHTO - American Association of State Highways and Transportation Officials

FDOT - Florida Department of Transportation

1.4 SUBMITTALS

- A. Test Reports

- 1. Sieve Analysis

The testing laboratory shall provide the OWNER (2) copies and ENGINEER OF RECORD (1) copy of the test results of the compaction of the backfill. The testing for compaction shall be performed by a testing laboratory approved by the OWNER. The test results shall be signed and sealed by a Professional Engineer.

- 2. Compaction and Moisture Testing

The testing laboratory shall provide the OWNER (2) copies and ENGINEER OF RECORD (1) copy of the test results of the compaction of the backfill. The testing

for compaction shall be performed by a testing laboratory approved by the OWNER. The test results shall be signed and sealed by a Professional Engineer.

3. Bearing Value

The testing laboratory shall provide the OWNER (2) copies and ENGINEER OF RECORD (1) copy of the test results of the compaction of the backfill. The testing for compaction shall be performed by a testing laboratory approved by the OWNER. The test results shall be signed and sealed by a Professional Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Granular Materials

Granular material shall be material passing a 1-inch sieve and at least 12% retained on a No. 200 sieve and meeting the approval of the ENGINEER OF RECORD

PART 3 - EXECUTION

3.1 CONTRACTORS VERIFICATION

A. Existing Improvements

The CONTRACTOR shall expose existing sewers and structures to which the new Work is to be connected and notify the OWNER and ENGINEER OF RECORD so he may verify the vertical and horizontal locations of the existing system and shall inform the CONTRACTOR as to the necessary adjustments required to align the new Work with the existing system.

3.2 PERFORMANCE

A. General

1. CONTRACTOR shall rough grade as close as possible to finished subgrade leaving a minimum to be removed in fine grading.
2. During the excavation operation, including the placing of the subbase, the Work area shall be kept free of water. A dewatering system shall be provided and maintained by the CONTRACTOR at his expense. The dewatering system shall remain in operation as directed by the OWNER and ENGINEER OF RECORD.
3. The finish subgrade surface shall not vary more than 1-inch in ten (10) feet.

B. Pavement Excavation

Pavement excavation shall consist of all Work required to construct the earth grade and its appurtenances true to the lines, grades, and cross sections called for on the Plans and in accordance with these Specifications. Excavation shall consist of the following items, any or all of which may be included or incidental to it; removing trees, stumps, hedges, roots, salvaging and stockpiling topsoil, subgrade or subbase stabilization, excavation for structures, trimming and finishing earth grade, fine grading, right-of-way ditching and restoration, and the disposal of all unsuitable material.

All large stones, trees, stumps, brush, shrubs, logs, matted roots, other vegetation and debris occurring between lines three (3) feet outside the grading limits shall be completely

removed and properly disposed of as specified in Section 311100, Clearing and Grubbing.

All earth and other existing materials shall be excavated for the full depth and width of the cross section as shown on the Plans.

Excess excavated material shall be removed from the project by the CONTRACTOR along approved routes to disposal sites approved by the OWNER. Disposal of excess excavation and maintenance of the dump sites shall be considered incidental to the price paid for excavation and shall be as specified in Section 312000, General Earthwork.

C. Salvaging and Stockpiling Topsoil

Topsoil, within the grading limits for cuts, and where the fill is less than five (5) feet in height to the top of road surface, shall be removed to a depth and width specified on the Plans. Topsoil from peat and muck areas shall not be removed. All vegetation shall be cut to a height of approximately six (6) inches and all such vegetation, brush, stones, rocks, and any other objectionable litter or foreign material shall be removed before the ground is broken for removal of topsoil. All vegetation, stones and rocks, and other objectionable litter or foreign material shall be disposed of by the CONTRACTOR. Equipment and methods of operations shall be such as to avoid the lifting of subsoil. Topsoil shall be stockpiled in an approved location within the limits of the project or placed in the slopes as directed by the OWNER and ENGINEER OF RECORD upon completion of the Work; all stockpile areas shall be restored to a neat and satisfactory condition. Topsoil salvaged in excess of that required by the Plans will be disposed of by the CONTRACTOR at his expense.

D. Utility Poles

The CONTRACTOR shall coordinate any removal or relocation required as a result of any conflict of existing utility poles with proposed improvements.

E. Removing Structures

Structures and sewers to be removed shall be called for on the Plans or as directed by the ENGINEER OF RECORD. Any active sewers shall not be removed without written consent of the OWNER and THE ENGINEER OF RECORD.

The structure shall be broken down to at least 12 inches below the subgrade. All pipes connected to the structure shall be plugged with a brick and masonry bulkhead approved by the ENGINEER OF RECORD.

If a structure is to be removed from a system that is to remain in service, the service shall be reconnected. A bypass system, approved by the ENGINEER OF RECORD, AND THE OWNER shall be installed and maintained by the CONTRACTOR, during the rebuilding period.

in The broken down structure and void shall be backfilled with a granular material, compacted place and shall meet with the approval of the ENGINEER OF RECORD

F. Holes

Earth removed during any phase of the excavation or removal operations, resulting in a hole or void, shall be replaced by backfilling to the proposed subgrade with a suitable granular material approved by the ENGINEER OF RECORD. The material shall be compacted to 100% of maximum unit weight.

The furnishing, placing and compacting of the backfill material shall be at the

CONTRACTOR'S expense.

G. Preparing Paving Subgrade

All muck, peat and other unsuitable material within the paving area shall be removed, displaced or otherwise treated, as shown on the Plans or as directed by the ENGINEER OF RECORD.

All muck, peat, material and other unsuitable material shall be disposed of outside the site limits or shall be spread uniformly in designated places on the site when so directed and approved by the ENGINEER OF RECORD and approved by the OWNER.

Oil road surfacing or gravel, crushed stone, or other non-rigid type, occurring within the area of the roadbed and underlying proposed embankment less than 1-foot in depth, and which is not to be salvaged and incorporated in the new Work, shall be plowed or scarified full depth, spread and compacted to form a uniform foundation, before any new construction is placed thereon.

Old pavement and other rigid structures, occurring within the area of the building site or new construction less than 1-foot in depth and which are not to be incorporated into the new Work, shall be broken up and removed.

H. Unsuitable Subgrade Excavation

Unsuitable subgrade excavation shall be the operation of removing unsuitable soils below the level of the ground after topsoil has been stripped in fill areas where the embankment is to be five (5) feet or less in height to plan grade, and the removal of unsuitable soils, below the subgrade elevation, as determined by the ENGINEER OF RECORD in cut areas after the subgrade has been established.

In fill areas, after topsoil has been stripped in accordance with paragraph 3.02.C. of this Section, the ENGINEER OF RECORD will inspect the work area to certify the adequacy of the native soils and to determine the extent of any additional excavation of unsuitable soils prior to placing the first lift of any fill material

In cut areas after the subgrade elevation has been established by the mass grading operation, the ENGINEER OF RECORD will inspect the subgrade to determine the extent of any additional excavation of unsuitable soils.

The areas excavated of unsuitable material shall be backfilled with material similar to the adjacent soil, except that when directed by the ENGINEER OF RECORD for areas where free water due to seepage is present, the excavation shall be backfilled with Granular Material approved by the ENGINEER OF RECORD and drainage shall be provided. The backfill shall be compacted to not less than 100% of the maximum unit weight, unless otherwise specified.

I. Embankments

Embankments shall be constructed with sound earth. The materials shall be deposited and compacted as specified in FDOT Section 120.

Where stones are prevalent, the material shall be carefully placed so that all large stones will be well distributed and the crevices completely filled with smaller stones, earth, sand or gravel so as to form a solid embankment. Any rock or fragmental material of such size as would prohibit it from being placed in layers of the specified depth shall not be placed in the embankment. In no case shall stones over three (3) inches in diameter be placed within 12

inches of the surface of the earth grade within the areas between lines two (2) feet outside of the edges of proposed roadbed.

The material for embankments of five (5) feet or less and the bottom four (4) feet of embankments of more than four (4) feet above the surface of the ground upon which the embankment is to be constructed shall have not more than the optimum moisture content at the time of compaction.

The material for that part of the embankment more than five (5) feet above the surface of the ground upon which the embankment is to be constructed shall have a moisture content of not greater than three (3) percent above optimum at the time of compaction, except that the moisture content of the top three (3) feet of the embankment shall not exceed optimum by more than two (2) percent.

If the material contains an excess of moisture, it shall be dried to the required moisture content before being compacted.

Each layer of material containing the required amount of moisture shall be compacted to not less than 100% of the maximum unit weight, unless otherwise specified, before the succeeding layer is started.

When the original ground upon which the embankment is being placed, or any section of compacted embankment, or the soil in cut sections becomes rutted or distorted by the CONTRACTORS equipment, the method of operation shall be changed to eliminate this condition. The CONTRACTOR shall reshape and recompact any areas so rutted or distorted at his own expense. This shall be done before any succeeding layers are placed.

Where the embankment is to be five (5) feet or less in height to the plan grade, the topsoil shall be stripped from the entire fill area. The depth of the topsoil to be removed shall be as shown on the Plans. or as directed by the ENGINEER OF RECORD After the topsoil is removed, the entire area upon which the embankment is to be constructed shall be compacted to not less than 90% of the maximum unit weight, to a depth of nine (9) inches.

Where the embankment is to be more than five (5) feet in height to the plan grade, the original ground over the entire area upon which the embankment is to be constructed shall be compacted to not less than 90% of the maximum unit weight, to a depth of nine (9) inches.

The maximum unit weight when used as a measure of compaction or density of soils shall be understood to mean the maximum unit weight per cubic foot as determined by the current Method of Test for the Compaction and Density of Soil, AASHTO Designation, T99, Method C, modified to include all the material passing the 1-inch sieve.

J. Borrow Excavation

When provided for in the Proposal, materials that are secured from locations outside of the project limits for the purpose of completing embankments and other items will be considered as borrow excavation. All borrow pits and the materials to be removed there from shall be subject to the inspection of the ENGINEER OF RECORD AND THE OWNER and shall be secured by the CONTRACTOR, unless otherwise provided.

Borrow excavation will be measured by volume in cubic yards compacted in place, based on the neat lines called for on the Plans or as authorized by the ENGINEER OF RECORD. To facilitate the accurate measurement of borrow quantities, the CONTRACTOR shall perform all the regular excavation and grading with existing materials for any designated area and the ENGINEER OF RECORD will cross section these areas prior to the CONTRACTOR

furnishing and placing the required borrow material. The ENGINEER OF RECORD will then resection the completed area and compute the volume of borrow material in its compacted-in-place state. Any borrow material placed beyond the neat lines called for on the Plans or which is not authorized by the ENGINEER OF RECORD in writing will not be measured and computed as borrow excavations. Measurement of borrow material by truck count will not be acceptable.

Public and private roads used by the CONTRACTOR between the sources of borrow and the Project shall be maintained by the CONTRACTOR, at his expense, including repairs of any damage caused by his operations, and application of a dust palliative when necessary, as determined by the ENGINEER OF RECORD

K. Subgrade

The area to be paved shall be excavated and graded to the line, grade and cross section as indicated on the Plans.

When called for on the Plans or in the Specifications the designated portions of the roadbed shall be stabilized to provide a firm and unyielding subgrade, having the required bearing value specified on the plans. This work shall be accomplished in accordance with FDOT Section 160.

The subgrade between lines two (2) feet on either side of the proposed edge of pavement or curb shall be compacted to 95% of the maximum unit weight for a depth of seven inches.

The subgrade shall be completed ahead of placing forms a distance equal to the distance of one (1) days average paving operation. Prior to the paving operation, the subgrade shall be shaped and compacted to the Plan cross section by approved mechanical means.

L. Subbase

Subbase material shall be evenly spread and compacted.

The thickness of each layer placed shall be determined by the required density obtained but shall not exceed 15 inches in depth, loose measure.

The subbase shall be constructed to the alignment, grade and cross-section specified. Should the subgrade at any time prior or during the placing of the subbase become soft or unstable so that rutting occurs in the subgrade, or if the subgrade material is forced up into the subbase material, the operation shall immediately cease and the mixed material shall be removed and disposed of. The subgrade shall be corrected and new subbase material placed and compacted, and shall be considered incidental to the construction of the Project.

M. Roadway Ditching

Ditching shall be constructed at the locations called for on the Plans or as directed by the ENGINEER OF RECORD. The ditch may be shaped by Machine Grading or another method approved by the ENGINEER OF RECORD to achieve the cross section, line and grade shown on the Plans.

The excess material from the ditch construction shall be disposed of by the CONTRACTOR at his expense.

The ditch section shall be graded to receive either topsoil and seed or topsoil and sod. The topsoil, seed, sod, fertilizer and mulch shall conform to the requirements specified in Section 329200, Grassing and Mulching.

The CONTRACTOR, at his expense, shall furnish, place and compact any additional material needed to construct the ditch at the location and cross sections called for on the Plans.

N. Machine Grading

The Work of machine grading shall consist of light grading of such character that, in general, the excavation from ditches and roadbed will be utilized in shaping shoulders and adjacent shallow fills and the work can be performed by a blade grader or similar equipment. Machine grading shall apply on the Sections shown on Plans or specified in the Proposal.

The Work shall include all necessary scarifying, plowing, disking, moving and shaping the earth to develop the cross section shown on Plans. Ditches shall be in reasonably close conformity with the line and grade as shown on the Plans or as directed and must drain runoff waters to outlets shown on the Plans or designated by the ENGINEER OF RECORD. The roadbed shall be finished to grade with a blade grader or equivalent equipment. All intersections, approaches, entrances, and driveways shall be graded as shown or as directed, except that loading and hauling of earth will not be required as part of this Work.

O. Trimming and Finishing Earth Grade

After the earth grade has been constructed to the required grade, all stones and rocks more than three (3) inches in diameter, appearing on the surface of the subgrade shall be removed.

The earth grade and the subgrade shall be trimmed to the grade called for on the Plans. The subgrade, where a subbase is required, shall be trimmed to the established grade within + 0.1 foot. Where a subbase is not required, the subgrade shall be trimmed to the established grade within + 3/4 inch.

The earth grade outside the subgrade shall be trimmed, all irregularities made smooth and the entire site or roadway completed to the required lines, grades, and cross sections. Backslopes and fill slopes shall be finished as specified or required.

3.3 FIELD QUALITY CONTROL

A. Testing

During the course of the Work, testing will be required for compaction and moisture of the backfill and subgrade materials, sieve analysis of the backfill and subgrade materials, and bearing value of the subgrade. The taking of samples and the testing required shall be performed by the CONTRACTOR'S testing laboratory approved by the OWNER or the ENGINEER OF RECORD.

The ENGINEER OF RECORD shall determine the location and number of samples to be made. The testing laboratory shall furnish the OWNER with (2) copies and the ENGINEER OF RECORD with (1) copy of the results of all tests. Testing procedures shall conform to current FDOT Standards for Construction. The cost for testing and sampling shall be at the expense of the OWNER.

B. Defective Work

Any portion of the backfill or subgrade, which is deficient in the specified density or bearing value, shall be corrected by methods meeting the approval of the ENGINEER OF RECORD.

Any extra testing or sampling required by the OWNER or ENGINEER OF RECORD because of deficiencies shall be at the CONTRACTORS expense.

END OF SECTION

SECTION 31 2300 - STRUCTURE EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes excavation for structures, removal and disposal of excavated materials, backfilling, backfill materials and compaction.

- B. Related Work Specified Elsewhere

- 1. Clearing and Grubbing: Section 31 1100
- 2. General Earthwork: Section 31 2000
- 3. Site Grading: Section 31 2200
- 4. Dewatering: Section 31 2319

1.3 QUALITY ASSURANCE

- A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ASTM - American Society of Testing and Materials

AASHTO - American Association of State Highway Transportation Officials

FDOT- Florida Department of Transportation

Hillsborough County Technical Specifications

1.4 SUBMITTALS

- A. Test Reports

- 1. Compaction

The testing laboratory shall provide the OWNER (2) copies and ENGINEER OF RECORD (1) copy of the test results of the compaction of the backfill. The testing for compaction shall be performed by a testing laboratory approved by the OWNER. The test results shall be signed and sealed by a Professional Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bedding Material

Bedding material for use below the water table or in wet trenches shall be pea rock, drainfield limerock or similar material as approved by the Owner's Engineer. Pipe bedding material for use in dry trenches shall be limerock screenings, sand or other fine inorganic material as approved by the Owner's Engineer.

B. Additional Backfill Material

Additional backfill material shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M 145 and shall be free from vegetation and organic material. No stones or rocks shall be larger than 6-inches in diameter, and when placed within 1-foot of piping and appurtenances stones or rocks shall be no larger than 2-inches in diameter (1-inch for PVC).

C. Portland Cement Concrete Mixture

Provide Portland Cement Concrete having a 28-day compressive strength of 3000 psi and conforming to FDOT Standard Specifications for concrete work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Dewatering

The area within the vicinity of the new Work shall be dewatered in accordance with Section 312319 prior to the excavation operation. The depth of the dewatering shall be sufficient to allow the excavation to remain in a dry condition during the construction of the structure, including the excavating, backfilling and compacting operations.

3.2 PERFORMANCE

A. Excavation

All excavation shall be backfilled in accordance with the Hillsborough County Technical Specifications unless noted otherwise.

Excavation shall include the site clearing and grubbing, the excavating and disposing of all materials encountered, the supporting and protecting of all structures and/or utilities encountered above and below the ground surface, and the removal of water from the construction site. Excavation shall also include the removal of existing structures, as shown on the Plans or as directed by the ENGINEER OF RECORD. Rock excavation, if applicable, shall be performed as a part of the excavation in accordance with specifications contained elsewhere.

The CONTRACTOR shall keep the limits of his excavation operations within a reasonable close conformity with the location and grade, of each structure.

The excavated materials shall be temporarily stored in a manner that will not cause damage to trees, shrubs, fences, improvements, utilities, private property or traffic. The excavated materials shall not be placed at such locations that will endanger the banks of the excavation by imposing loads thereon.

The excavation shall be of sufficient size to allow for the construction of the new work, the

placing and compacting of the backfill and for the dewatering operation.

When concrete is to bear on or against an excavated surface other than rock, special care shall be taken not to disturb the surface. The final removal of the foundation material to grade shall not be made until just prior to the placing of the concrete.

Concrete shall not be placed until the depth of the excavation has been checked and the suitability of foundation material has been reviewed by the ENGINEER OF RECORD.

The elevations for the bottom of footings shall be subject to such changes as are necessary to insure a satisfactory foundation. Any changes required shall be reviewed by the ENGINEER OF RECORD prior to making the change.

The surface of all rock or other hard material upon which concrete is to be placed shall be freed from all loose fragments, cleaned and cut to a firm surface. The surface shall be level, stepped or serrated, as shown on the Plans.

All unsound material underlying proposed structures shall be removed and replaced with suitable material approved by the ENGINEER OF RECORD, in layers not exceeding six (6) inches in depth. Each layer shall be compacted to 100% of maximum unit weight unless indicated otherwise on the Plans, or within these specifications.

B. Sheeting, Shoring, and Bracing

The CONTRACTOR shall furnish, place and maintain at all times such sheeting, shoring, and bracing of the excavated area as may be required for safety of the workmen and for protection of the new Work or adjacent structures, including pavement, curbs, sidewalks, pipelines and conduits next to, or crossing the excavated area, and for the protection and safety of pedestrian and vehicular traffic.

The CONTRACTOR shall be responsible for the complete design of all the sheeting, shoring, and bracing Work. Prior to installing the sheeting, shoring or bracing, the CONTRACTOR shall submit Plans for this Work to the ENGINEER OF RECORD for his information.

Sheeting, shoring and bracing shall conform to current federal or state regulations for safety.

Where indicated on the Plans and where necessary in the Work, install and leave sheeting, shoring and bracing in place. No extra compensation shall be paid to the CONTRACTOR for sheeting, shoring or bracing left in place.

Supports for pipes, conduits, etc., crossing the excavated area shall conform to the requirements of the owners of such facilities and if necessary, shall be left in place.

The furnishing, placing, maintaining and removing of sheeting, shoring and bracing materials shall be at the CONTRACTOR'S expense.

The CONTRACTOR shall not remove the sheeting, shoring or bracing until the structure has obtained sufficient strength to support the external loads. The sheeting, shoring and bracing material shall not come in contact with the structure, but shall be installed so that no concentrated loads or horizontal thrusts are transmitted to the structure.

C. Cofferdams

A cofferdam shall consist of the maintenance, installation and removal of a substantially watertight enclosure or a well-point system or similar system, which will permit construction of the substructure, above seal or subfooting, in the dry and without damage to the Work.

Alternate methods, where used in lieu of cofferdams, will be permitted by Authorization only. Such Authorization will be considered only after receipt of applicable permits for the alternate method.

Stream diversion and earth dikes, where used in lieu of cofferdams or a well-point system will be permitted by authorization only. Such authorization will be considered only after receipt of the appropriate permits for such construction.

The interior dimensions of cofferdams shall be such as to give sufficient clearance for the construction of forms and the inspection of their exteriors, and to permit dewatering outside of the forms.

Cofferdams or cribs, which are tilted or moved laterally during the process of sinking, shall be righted or enlarged so as to provide the necessary clearance.

Cofferdams shall not be braced to substructure forms. They shall be constructed so as to protect the Work in place against damage from high water and to prevent injury to the foundation by erosion. No timber bracing shall extend into or remain in the finished concrete.

Cofferdams shall be removed in such a manner as not to disturb or mar the finished concrete. When called for on the Plans or where necessary in the Work, cofferdam sheeting shall be left in place.

The furnishing, construction, maintenance and removal of the cofferdams including pumping shall be at the CONTRACTOR'S expense.

If the CONTRACTOR elects to use a well-point system or similar system, he shall be responsible for any claims for damages resulting there from.

D. Backfill

Backfill material shall be placed only after the new Work and backfill material have been inspected by the ENGINEER OF RECORD. Excavated material, determined by the ENGINEER OF RECORD as suitable for backfill may be used.

Backfill shall not be placed against any portion of the new Work until the required curing; surface finishing and waterproofing of such portions have been completed. Backfill, which will place an unequalized horizontal loading on the new Work, shall not be placed until the concrete has attained at least 70% of its design strength. To equalize horizontal loadings, the required backfill around the new Work shall be placed on opposite sides at the same time.

Granular material acceptable to the testing and inspection agency ENGINEER OF RECORD shall be used for backfilling the new Work unless otherwise indicated on the Plans or within these specifications.

All spaces excavated and not occupied by the new Work or by the specified backfill material, shall be backfilled with suitable material from the excavation.

After the backfill has been placed and compacted to the flow line elevation of any weepholes indicated on the Plans, the back end of each weephole shall be covered with not less than two (2) cubic feet of No. 6 or 7 coarse aggregate.

Large stones, boulders, broken rocks, concrete, and masonry shall not be used in the backfill.

The backfill shall be carried up to the surface of the adjacent ground or to the elevation of the proposed finished grade, and its top surface shall be neatly graded. Fills around all new Work shall be trimmed to the lines shown on the Plans or as directed by the ENGINEER OF RECORD

E. Compacting Backfill

Backfill material shall be placed in accordance with the methods specified in the Hillsborough County Technical Specifications or the agency having jurisdiction.

The backfill material shall be compacted to 98% of its maximum unit weight.

The maximum unit weight, when used as a measure of compaction or density of soils, shall be understood to mean the maximum unit weight per cubic foot as determined by AASHTO T180.

Compaction of the backfill will not be paid for separately, but shall be considered incidental to the Work of backfilling and shall include all the Work of manipulating the soil to obtain the specified densities. No additional compensation will be allowed for any delay required to obtain the specified moisture content or the specified density.

F. Cleanup

Immediately following the placing and compacting of the backfill, the excess material shall be removed and disposed of by the CONTRACTOR, at his expense, as specified in 312000, General Earthwork.

The construction area shall be graded and left in a neat, workmanlike condition.

3.3 FIELD QUALITY CONTROL

A. Testing

During the course of the Work, testing will be required for compaction or density of the backfill. The taking of samples and the testing required shall be performed by an independent testing laboratory approved by the OWNER, AND THE ENGINEER OF RECORD. The cost for testing and sampling shall be at the expense of the CONTRACTOR.

The testing laboratory shall furnish the OWNER (2) copies and ENGINEER OF RECORD (1) COPY of the results of all tests. Test results shall be signed and sealed by a Professional Engineer. Testing procedures shall conform to current Hillsborough County Technical Specifications.

B. Defective Work

Any portion of the backfill which is deficient in the specified density shall be corrected by the methods meeting the approval of the ENGINEER OF RECORD. Any extra testing or sampling required because of apparent deficiencies shall be at the CONTRACTOR'S expense. Material damaged by backfill compaction or other work is subject to rejection by the OWNER, AND/OR THE ENGINEER OF RECORD.

END OF SECTION

SECTION 31 2319 - DEWATERING

PART I - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes all dewatering work complete with design of dewatering systems, constructing and operation of dewatering systems, abandonment of dewatering systems, protection of personnel and structures, environmental protection and restoration.

- B. Related Work Specified Elsewhere

- 1. General Earthwork: Section 31 2000
- 2. Structure Excavation and Backfill: Section 31 2300

1.3 QUALITY ASSURANCE

- A. Design of Dewatering Construction

The CONTRACTOR shall be responsible for the complete design of all structures and methods proposed for dewatering the project site, including the implementation of all materials, tools and equipment proposed for use in the Work. Temporary wiring associated with the dewatering shall comply with applicable portions of the National Electrical Code.

- B. Requirements of Regulatory Agencies

- 1. Soil Erosion and Sedimentation Control

All dewatering systems design and construction shall conform to the provisions of Part IV, Chapter 373 Florida Statutes (F.S.) and the Florida Environmental Land and Water Management Act of 1972 (380.012 F.S. et seq.) and related statutes. Where applicable, the CONTRACTOR shall obtain and pay for all permits and inspections for dewatering construction in accordance with the provisions of Part IV, Chapter 373 Florida Statutes (F.S.), the Florida Environmental Land and Water Management Act of 1972 (380.012 F.S. et seq.), related statutes, and all local government agencies having jurisdiction. No additional claim for compensation shall be allowed because of the CONTRACTOR'S failure to obtain or pay for such permits and inspections.

- 2. Federal, State, and Local Regulations

Dewatering operations shall conform to the requirements of all federal, state, and local agencies having jurisdiction.

1.4 JOB CONDITIONS

- A. Protection

Take all steps necessary, during the Work of this Section, to protect surrounding property and adjacent buildings, private water supplies, roads, drains, sewers, structures and appurtenances. Adequate measures shall be taken to protect such property and construction from the effects of the dewatering operations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONTRACTOR'S VERIFICATION

A. Existing Drainage Conditions

Prior to beginning any work, verify in the field the location, type and capacity of all existing drainage facilities and conditions, which will affect the Work of this Section. No allowances shall be made for conditions found during the progress of the dewatering operations because of the CONTRACTOR'S failure to verify such conditions.

The CONTRACTOR shall submit a staging plan and schedule prior to commencement of the work for OWNER and ENGINEER OF RECORD'S approval. The plan shall indicate areas to be dewatered and discharge areas. The CONTRACTOR shall promptly correct or modify, at no additional cost to the OWNER, operations that impact or affect facility events or operations.

B. Existing Structure and Utilities

The CONTRACTOR shall make field verification of all existing structures and utilities at the site of the Work, which are scheduled to remain, and which may be affected by the Work of this Section. The CONTRACTOR shall be responsible for any damage to existing structures and/or utilities caused because of his Work and shall repair such damage at his expense to the satisfaction of the OWNER and ENGINEER OF RECORD.

3.2 PERFORMANCE

A. Drainage of Excavations

The CONTRACTOR shall maintain all finished excavation Work free of water during the preparation of the subgrade and until the completion of the Work. No ground or surface water shall be discharged into any existing sanitary sewer. No unit of Work shall be constructed under water except as otherwise directed by the ENGINEER OF RECORD. Provide and maintain adequate dewatering equipment to remove and dispose of all surface or groundwater entering excavations, trenches or other parts of the Work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the construction is complete. All excavations which extend down to or below the static groundwater elevation shall be dewatered by lowering and maintaining the groundwater level beneath such excavations at a distance of not less than 12 inches below the bottom of the excavation or as directed by the ENGINEER OF RECORD. Drainage system methods shall not cause any damage to wells, adjacent property, or facility events or operations. All outlet drainage piping and conduit shall be kept clean and free from sediment. The CONTRACTOR shall be held responsible for the condition of all pipes, conduits and structures, which he may use for drainage.

B. Dewatering Sumps and Pump Wells

Sumps and pump wells used as a part of the dewatering system shall be strongly sheathed and braced to protect the construction while in use. Tops of well casings must be covered to prevent people, animals, and debris from entering and shall be two to three feet above ground. Sumps and wells, when abandoned shall be backfilled and compacted to the satisfaction of the OWNER and ENGINEER OF RECORD.

C. Drilling

Methods used in drilling wells associated with dewatering systems shall be the responsibility of the CONTRACTOR and shall be acceptable to the ENGINEER OF RECORD. Drilling methods shall insure proper placement of well materials and shall not involve displacement of earth formations. Drilling shall be done with first class equipment of proper type and in good condition, acceptable to the ENGINEER OF RECORD.

D. Pumping

Equipment for pumping and pumping methods associated with dewatering systems shall be the responsibility of the CONTRACTOR and shall be acceptable to the ENGINEER OF RECORD. The CONTRACTOR shall construct or furnish adequate discharge piping to conduct and dispose of the water so as to prevent damage to existing structures or property. Pumping equipment shall be first class, acceptable to the ENGINEER OF RECORD, of proper type and size for the Work and in good condition. Provide all anchors and supports for pumping equipment.

E. Filling and Grading

Upon completion of dewatering Work for the Project, abandon and/or fill all holes, trenches, ditches and other earth excavations created by the Work of this Section not scheduled to remain. Do all filling, backfilling and grading to restore excavations and earth banks to the lines and levels indicated on the Plans and as directed by the ENGINEER OF RECORD. All earth fills shall be compacted to a density equal to that of the surrounding undisturbed earth.

END OF SECTION

SECTION 31 2333 - TRENCHING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes open trench construction, complete with trenching, sheeting, shoring, bracing, backfilling, backfill materials and compaction.

- B. Related Work Specified Elsewhere

- 1. Clearing and Grubbing: Section 31 1100
- 2. Dewatering: Section 31 2319
- 3. General Earthwork: Section 31 2000

1.3 QUALITY ASSURANCE

- A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ASTM - American Society of Testing and Materials

AASHTO - American Association of State Highway Transportation Officials

FDOT - Florida Department of Transportation

OSHA - Occupational Safety and Hazard Administration

Hillsborough County Technical Specifications

1.4 SUBMITTALS

- A. Test Reports

- 1. Compaction

The testing laboratory shall provide the OWNER (2) copies and ENGINEER OF RECORD (1) copy of the test results of the compaction of the backfill. The testing for compaction shall be performed by a testing laboratory approved by the OWNER. The test results shall be signed and sealed by a Professional Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bedding Material

Bedding material for use below the water table or in wet trenches shall be pea rock, drainfield limerock or similar material as approved by the Owner's Engineer. Pipe bedding material for use in dry trenches shall be limerock screenings, sand or other fine inorganic material as approved by the Owner's Engineer.

B. Additional Backfill Material

Additional backfill material shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M 145 and shall be free from vegetation and organic material. No stones or rocks shall be larger than 6-inches in diameter, and when placed within 1-foot of piping and appurtenances stones or rocks shall be no larger than 2-inches in diameter (1-inch for PVC).

C. Portland Cement Concrete Mixture

Provide Portland Cement Concrete having a 28-day compressive strength of 3000 psi and conforming to FDOT Standard Specifications for concrete work.

PART 3 - EXECUTIONS

3.1 PREPARATION

A. Dewatering

The area within the vicinity of the trenching operation shall be dewatered in accordance with Section 312319 prior to the trenching operation. The depth of the dewatering shall be sufficient to allow the trench excavation operation including backfilling and compacting to proceed in a dry condition.

3.2 PERFORMANCE

A. Trench Excavation

Open cut trench excavation shall include the site clearing and grubbing, the excavating and disposing of materials encountered, the supporting and protecting of all structures and/or utilities encountered above and below the ground surface, and the removal of water from the construction site.

The trench shall be excavated in reasonable close conformity with the lines and grades on the Plans or as established by the ENGINEER OF RECORD

The excavated materials shall be temporarily stored along the trench in a manner that will not cause damage to trees, shrubs, fences, improvements, utilities, private property or traffic.

The excavated materials shall not be placed at such locations that will endanger the trench banks by imposing loads thereon.

The trench shall be of sufficient width to provide adequate working space to permit the installation of the pipe and the compaction of the bedding material under and around the pipe. However, the width of the trench from below the pipe bedding to 12 inches above the top of the pipe shall not exceed the dimensions shown on the plans.

To support the additional load of the backfill when the maximum trench width as specified for

rigid pipe is exceeded, the CONTRACTOR shall install, at his expense, concrete encasement which shall completely surround the pipe and shall have a minimum thickness at any point of 1/4 of the outside diameter of the pipe or four (4) inches, whichever is greater, or at his expense, install another type bedding, approved by the ENGINEER OF RECORD. The concrete encasement shall consist of 3,000-psi strength concrete.

To support the additional load of the backfill when the maximum trench width as specified for flexible or semi-rigid pipe is exceeded, the CONTRACTOR shall install, at his expense, standard pipe bedding to the full width between undisturbed trench walls or at least 2.5 pipe diameters on each side of the pipe.

When, through the CONTRACTOR'S construction procedure or because of unsuitable existing ground conditions, it becomes impossible to maintain alignment and grade properly, the CONTRACTOR, at his expense, shall excavate below the normal trench bottom grade and shall fill the void with a large size aggregate or 2,500 psi concrete as approved by the ENGINEER OF RECORD to insure that the pipe when laid in the proper bedding will maintain correct alignment and proper grade.

All trench excavations, including those for shafts and structures, shall be adequately braced and/or sheeted where necessary to prevent caving or squeezing of the soil.

B. Sheeting, Shoring, and Bracing

The CONTRACTOR shall furnish, place and maintain at all times such sheeting, shoring, and bracing of the trench and/or shaft as may be required for safety of the workmen and for protection of the new Work or adjacent structures, including pavement, curbs, sidewalks, pipelines and conduits next to, or crossing the trench area, and for the protection and safety of pedestrian and vehicular traffic.

The CONTRACTOR shall be responsible for the complete design of all the sheeting, shoring, and bracing Work. Prior to installing the sheeting, shoring or bracing, the CONTRACTOR shall submit Plans for this Work to the ENGINEER OF RECORD for review and the OWNER for their information.

Sheeting, shoring and bracing shall conform to current federal or state regulations for safety.

Where indicated on the Plans and where necessary in the Work, install and leave sheeting, shoring and bracing in place. No extra compensation shall be paid to the CONTRACTOR for sheeting, shoring or bracing left in place.

Supports for pipes, conduits, etc., crossing the trench shall conform to the requirements of the owners of such facilities and if necessary, shall be left in place.

The furnishing, placing, maintaining and removing of sheeting, shoring and bracing materials shall be at the CONTRACTORS expense.

The CONTRACTOR shall not remove the trench sheeting, shoring or bracing unless the pipe has been properly bedded and the trench backfilled to sufficiently support the external loads. The sheeting, shoring and bracing material shall not come in contact with the pipe, but shall be installed so that no concentrated loads or horizontal thrusts are transmitted to the pipe.

C. Backfilling Trenches

All excavations shall be backfilled in accordance with the Hillsborough County Technical Specifications unless noted otherwise.

Backfill material shall be placed on Sections of bedded pipes only after such pipe bedding and backfill materials have been approved by the ENGINEER OF RECORD

The backfill shall be carried up to the surface of the adjacent ground or to the elevation of the proposed finished grade, and its top surface shall be neatly graded.

The trench backfilling shall follow the pipe laying as closely as possible. However, at no time shall the pipe laying in any trench precede backfilling of that trench by more than 100 feet, unless otherwise directed by the ENGINEER OF RECORD

The backfill material shall be compacted to 98% of its maximum unit weight unless otherwise shown on the plans and shall be placed in accordance with the Hillsborough County Technical Specifications.

The maximum unit weight, when used as a measure of compaction or density of soils, shall be understood to mean the maximum unit weight per cubic foot as determined by AASHTO T-180.

Compaction of the backfill will not be paid for separately, but shall be considered incidental to the Work of backfilling and shall include all the Work of manipulating the soil, to obtain the specified densities. No additional compensation will be allowed for any delay required to obtain the specified moisture content or the specified density.

D. Cleanup

Immediately following the placing and compacting of the backfill, the excess material shall be removed and disposed of by the CONTRACTOR, at his expense, as specified in Section 312000, General Earthwork.

The construction area shall be graded and left in a neat, workmanlike condition.

3.3 FIELD QUALITY CONTROL

A. Testing

During the course of the Work, testing for compaction or density of the backfill will be required. The taking of samples and the testing required shall be performed by the CONTRACTOR'S testing laboratory approved by the OWNER'S REPRESENTATIVE. The cost for testing and sampling shall be at the expense of the CONTRACTOR

The testing laboratory shall furnish the OWNER (2) copies of the results of all tests. Test results shall be signed and sealed by a Professional Engineer. Testing procedures shall conform to AASHTO T180 and to current Hillsborough County Technical Specifications.

B. Defective Work

Any portion of the backfill, which is deficient in the specified density, shall be corrected by the methods meeting the approval of the ENGINEER OF RECORD. Any extra testing or sampling required because of apparent deficiencies shall be at the CONTRACTOR'S expense. Materials damaged by backfill compaction or other work are subject to rejection by the OWNER and ENGINEER OF RECORD.

END OF SECTION

SECTION 31 2500 - EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. The work of this section consists of furnishing all necessary labor, equipment, material and transportation necessary to provide temporary and permanent erosion and sediment control as required by appropriate government agency permits, the plans and as noted in this specification.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Install temporary erosion and sediment control items prior to clearing and commencing earthwork or as soon as practical as sitework progresses.

2.2 PROTECTION

- A. Stabilization of Denuded Areas: No disturbed area may be denuded for more than thirty (30) calendar days, (excluding rights-of-way) unless otherwise authorized by the Owner's Engineer. During construction, denuded areas shall be covered by mulches such as straw, hay, filter, seed and mulch, sod or some other permanent vegetation. Within sixty (60) calendar days after final grade is established on any portion of a project site, that portion of the site shall be provided with established permanent soil stabilization measures per the original site plan, whether by impervious surface or landscaping.
- B. Protection and Stabilization of Stockpiles: Fill material stockpiles shall be protected at all times by on-site drainage controls which prevent erosion of the stockpiled material. Control of dust from such stockpiles may be required, depending upon their location and the expected length of time the stockpiles will be present. In no case shall an unstabilized stockpile remain after thirty (30) calendar days.
- C. Protection of Existing Storm Sewer Systems: During construction, all storm sewer inlets shall be protected by approved sediment traps such as secured hay bales, sod, stone, etc., which shall be maintained and modified as required by construction progress, and which must be approved by the Owner's Engineer.
- D. Sediment Trapping Measures: Sediment basins and traps, perimeter berms, filter fences, berms, sediment barriers (hay bales), vegetative buffers and other measures intended to trap sediment and/or prevent the transportation of sediment onto adjacent properties, or into existing water bodies, must be installed, constructed or, in case of vegetative buffers, protected from disturbance, as a first step in the land alteration process.
- E. Working in or Crossing Waterways or Waterbodies: Land alteration and construction shall be minimized in both permanent and intermittent waterways and the immediately adjacent buffer of 25 feet from top of bank of the waterways and the buffer area whenever possible, and barriers shall be used to prevent access. Where channel work cannot be avoided, precautions must be taken to stabilize the work area during land alteration, development

and/or construction to minimize erosion. If the channel and buffer area are disturbed during land alteration, they must be stabilized within three (3) calendar days after the in channel work is completed.

Silt curtains or other filter/siltation reduction devices must be installed on the downstream side of the in channel alteration activity to eliminate impacts due to increased turbidity. Whenever stream crossings are required, properly sized temporary culverts shall be provided by the Contractor and removed when construction completed. The area of the crossing shall be restored to a condition as nearly as possible equal to that which existed prior to any construction activity.

- F. Swales, Ditches and Channels: All swales, ditches and channel leading from the site shall be sodded within three (3) days of excavation. All other interior swales, etc., including detention areas will be sodded prior to issuance of as Certificate of Occupancy.
- G. Underground Utility Construction: The construction of underground utility lines and other structures shall be done in accordance with the following standards:
 - 1. No more than 500 lineal feet of trench shall be open at any time;
 - 2. Wherever consistent with safety and space consideration, excavated material shall be cast to the uphill side of trenches. Trench material shall not be cast into or onto the slope of any stream, channel, road ditch or waterway.

2.3 PERFORMANCE

- A. Maintenance: All erosion and siltation control devices shall be checked regularly, especially after each rainfall and will be cleaned out and/or repaired as required.
- B. Compliance: Failure to comply with the aforementioned requirements may result in a fine and/or more stringent enforcement procedures such as, but not limited to, issuance of a "Stop Work Order".

END OF SECTION

SECTION 31 3116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following for termite control:
 - 1. Soil treatment.

1.3 DEFINITIONS

- A. EPA: Environmental Protection Agency.
- B. PCO: Pest control operator.

1.4 SUBMITTALS

- A. Product Data: Treatments and application instructions, including EPA-Registered Label.
- B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.
- C. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.
- B. Applicator of termite treatment shall contract directly with the GC or CM, not with a subcontractor.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.
- B. Prior to each application, applicators must notify the construction superintendent of similar responsible party of the intended termiticide application and sites of application and instruct the responsible person to notify workers and other individuals on site to leave the area to be treated during application until the termiticide is absorbed into the soil

1.7 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
- C. Identification: the Warranty shall identify the chemical used and the building number(s) to which it was applied.
- D. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide one of the following non-repellant chemicals:
 - 1. Imidacloprid (such as Premise 75), diluted to the strongest allowable concentration according to the manufacturer's written instructions.
 - 2. Fipronil (such as Termidor 80 WG), diluted to the strongest allowable concentration according to the manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other

conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

1. Do not treat soil that is too moist or if there is standing water.
- B. Product is to be delivered to the site in its original labeled containers.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.
- C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.
- D. Prior to each application, applicator shall notify the Contractor of the intended termiticide application and intended sites of application and instruct the Contractor to notify workers and other individuals on site to leave the area to be treated during application and until the termiticide is absorbed into the soil.
- E. Subcontractor shall mix the chemical on site from original, unopened, labeled containers. Construction Manager is responsible for enforcing this requirement and verifying dilution rates.
- F. Notify the School Board Inspections Department 48 hours prior to applying the chemical. Owner will observe application.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.
- B. Scope: Protect against subterranean termites for all new construction and whenever the soil under existing construction is disturbed.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.
 1. Slabs-on-Grade: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 - a. When treating foundations deeper than 4 feet, apply the termiticide as the backfill is being replaced, or failing this, treat the foundation to a minimum depth of 4 feet after the backfill has been installed by trenching and rodding into the trench or trench along the foundation walls and around pillars and other foundation elements at the rate prescribed from grade to a minimum depth of 4 feet.
 - b. When the top of the footing is exposed, treat the soil adjacent to the footing to the bottom of the footing. Do not treat below the footings.
 3. Masonry: Treat CMU cells in stem walls to the top of the footing. Apply at the strongest allowable concentration and rate according to manufacturer's instructions. Apply so that the emulsion will reach the top of the footing.
 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Horizontal Barriers: Create a horizontal barrier whenever treated soil will be covered, such as footing trenches, slabs, and the soil beneath stairs, crawlspaces and sidewalks adjacent to the building.
 1. Apply at the strongest allowable concentration and rate according to manufacturer's instructions. If the fill is washed gravel or other coarse material, apply a sufficient amount of dilution to reach the soil substrate beneath the coarse fill.
 2. Applications shall be made per manufacturer's instructions. If slab will not be placed the same day as treatment, cover treated soil with a waterproof barrier such as polyethylene sheeting. If the slab is not placed within 24 hours of treatment, re-treat the area.
- C. Vertical Barriers: Create vertical barriers around the base of foundations, plumbing, utility entrances, back-filled soil against foundation walls and other critical areas.
 1. Apply 4 gallons of dilution per 10 linear feet per foot of depth to ensure complete coverage.

2. When trenching and rodding into the trench, or trenching, ensure that the emulsion reaches the top of the footing. Space rod holes to achieve a continuous termiticidal barrier, but in no case more than 12 inches apart.
3. Avoid soil washouts around the footings.
4. Trenches need not be wider than 6 inches. Emulsion shall be mixed with the soil as it is being replaced in the trench.
5. For a monolithic slab, an inside vertical barrier may not be required.
- D. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- E. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- F. Post warning signs in areas of application.
- G. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application or if not covered within 24 hours.
- H. Do not apply soil treatment if the ground conditions in the area to be treated are too moist or if standing water is present.

END OF SECTION

SECTION 32 1100 - BASE COURSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes base courses constructed by one (1) of the following methods:

- 1. Limerock Base

The work specified in this Section consists of the construction of a base course composed of limerock or asphalt base course(s). It shall be constructed on the prepared subgrade, in accordance with these specifications and in conformity with the lines, grades, notes and typical cross section shown in the plans.

- 2. Limerock Stabilized Base

The work specified in this Section consists of the construction of a base course composed of roadbed soil stabilized with limerock, in accordance with these specifications and in conformity with the lines, grades, notes and typical cross section shown in the plans.

- 3. Crushed Concrete Base

The work specified in this Section consists of the construction of a base course composed of crushed concrete, on the prepared subgrade, in accordance with these specifications and in conformity with the lines, grades, notes, and typical cross sections shown in the plans.

When the specified compacted thickness of the base is greater than six (6) inches the base shall be constructed in two (2) or more courses. The thickness of the first course shall be approximately one-half the total thickness of the finished base, or enough additional to bear the weight of the construction equipment without disturbing the subgrade.

- 4. Shell Base

The work specified in this Section consists of the construction of a base course composed of shell. It shall be constructed on the prepared subgrade, in accordance with these specifications and in conformity with the lines, grades, notes, and typical cross sections shown in the plans. When the base is to be constructed to a compacted thickness greater than 6-1/2 inches it shall be constructed in two (2) courses.

- 5. Shell Stabilized Base

The work specified in this Section consists of the construction of a base course by stabilizing the soil material with shell, in accordance with these specifications and in

conformity with the lines, grades, notes, and typical cross sections shown in the plans.

6. Soil-Cement Base

The work specified in this Section consists of the construction of a base course composed of a combination of soil and Portland cement, uniformly mixed, moistened, compacted, finished, and cured, in accordance with these specifications, and shaped to reasonably close conformance with the lines, grades, thicknesses, and typical cross sections shown in the plans or established by the OWNER.

B. Related Work Specified Elsewhere

1. GENERAL EARTHWORK: Section 31 2000
2. EARTHWORK FOR PAVING: Section 31 2216
3. BITUMINOUS PAVING: Section 32 1113
4. PORTLAND CEMENT CONCRETE PAVING: Section 32 1133

1.3 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ASTM - American Society of Testing and Materials

AASHTO - American Association of State Highways and Transportation Officials

FDOT - Florida Department of Transportation

B. Allowable Tolerances

1. Base Courses

The finished surface shall be shaped to conform to within a tolerance of 3/4 inch in ten (10) feet to the cross section and grades called for on the Plans.

1.4 SUBMITTALS

A. Test Reports

1. Thickness

The testing lab shall provide the OWNER with (2) copies and ENGINEER OF RECORD (1) copy of the test results of the thickness of the compacted base. The core drilling and testing for thickness shall be performed by the CONTRACTOR'S testing laboratory approved by the OWNER. Test results shall be signed and sealed by a Professional Engineer.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. The base course material shall be transported to the point where it is to be used, over

material previously placed if practicable, and dumped on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will be permitted when, in the ENGINEER OF RECORD'S opinion, these operations will not be detrimental to the base.

1.6 JOB CONDITIONS

A. Environmental Requirements

1. Temperature

Comply with the requirements for aggregate base course installations due to outside ambient air temperatures specified under Article 3.03 of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Limerock Base

The limerock material shall meet the requirements of FDOT Section 911. At the CONTRACTORS option limerock of either Miami or Ocala formation may be used, but limerock of only one (1) formation may be used on any contract. (Limerock may be referred to hereinafter as rock.)

B. Limerock Stabilized Base

The stabilizing material used for this construction shall consist of limerock meeting the requirements of FDOT Section 911, as specified for the material to be used in this work.

C. Crushed Concrete Base

The materials used shall conform with the requirements specified in FDOT Section 204 and FDOT Section 901-5. Before any base course material is used it shall first have been tested by the CONTRACTOR'S laboratory and approved by the OWNER AND/OR ENGINEER OF RECORD.

D. Shell Base

The shell material shall meet the requirements of FDOT Section 913. Where specifically called for in the plans, coquina shell (meeting the requirements of FDOT Section 915) shall be used; otherwise, coquina shell may be permitted at the CONTRACTORS request, if so approved by the ENGINEER OF RECORD.

E. Shell Stabilized Base

The shell material used shall conform with the requirements of FDOT Section 913. All roadbed material to be incorporated with the shell shall have at least the bearing value required by the plans for the subgrade.

F. Soil-Cement Base

The materials used shall conform with the following requirements:

1. Portland cement, Type I or Type I-P FDOT Section 921.
2. Water shall be free from substances deleterious to hardening of the soil-cement

mixture.

3. Emulsified Asphalt Grade SS-1* or SS-1H* FDOT 916-4. *Diluted in equal proportion with water.
4. Soil: the soil used for base course construction shall be either the material existing in the location to be occupied by the base, a suitably friable material obtained from pits furnished by the CONTRACTOR or a combination of these. If the material existing in the location to be occupied by the base does not meet the requirements set out below, it shall be removed and replaced with suitable soil.

Material pits furnished by the CONTRACTOR shall be approved prior to use. Material pits shall be excavated in a manner so as to achieve a uniformly mixed material with reasonably consistent characteristics. Any blending of strata shall be done in accordance with a procedure approved by the ENGINEER OF RECORD.

Specific Requirements for Soil:

Organic Material:	Maximum 3%
Gradation:	
Passing 2-inch sieve	100% (minimum)
Passing No. 4 sieve	55% (minimum)
Passing No. 10 sieve	37% (minimum)

Soils occurring as topsoil (surface soil) shall generally not be approved.

PART 3 - EXECUTION

3.1 CONTRACTOR'S VERIFICATION

A. Excavation

Prior to the placing of any base material, examine the excavation for the grades, lines, and levels required to receive the new work. Ascertain that all excavation and compacted subgrades are adequate to receive the new work. Correct all defects and deficiencies before proceeding with the Work.

B. Subgrade Conditions

Prior to the placing of any base material, examine the subgrade to ascertain that it is adequate to receive the base to be placed. If the subgrade remains wet after all surface water has been removed, the ENGINEER OF RECORD may require the installation of edge drain.

C. Existing Improvements

Investigate and verify locations of existing improvements, including structures, to which the new work will be in contact.

Necessary adjustments in line and grade, to align the new work with the existing improvements must be approved by the ENGINEER OF RECORD, prior to any changes.

3.2 PREPARATION

A. Subgrade

The subgrade shall be fine graded to the cross section indicated on the Plans, and shall be thoroughly compacted prior to the placing of the base material.

3.3 INSTALLATION

A. General

The width, thickness and type of base materials shall be indicated on the Plans or as directed by the ENGINEER OF RECORD

No base material shall be placed until the subgrade, or subbase, or existing surface has been approved by the ENGINEER OF RECORD

B. Limerock and Shell Base Courses

The base course shall be placed by a mechanical spreader or other approved means, in uniform layers to such a depth that when compacted, the base course will have the thickness shown on the Plans.

The depth of any one (1) layer, when compacted, shall not be more than six (6) inches. If the required compaction cannot be obtained for the full depth of the base course spread, the thickness of each course shall be reduced or at the approval of the ENGINEER OF RECORD, adequate equipment shall be used to compact the aggregate to the required unit weight.

The subgrade shall be shaped to the specified crown and grade and maintained in a smooth condition. If hauling equipment causes ruts or holes in the subgrade, the hauling equipment will not be permitted on the subgrade, but shall be operated on the base course behind the spreader.

The base course shall be compacted to at least 98% of maximum unit weight as determined by AASHTO T180, by the use of approved pneumatic-tired compaction equipment or vibratory compactors.

The optimum moisture content shall be maintained until the prescribed unit weight is obtained and each layer shall be compacted until the maximum unit weight is attained before placing the succeeding layer.

When approved by the ENGINEER OF RECORD, additional water may be applied by an approved means, to the base course to aid in the compaction and shaping of the material.

Motor graders or other approved equipment shall be used to shape the base course and maintain it until the surface course is placed.

When hauling material over the base course or subgrade, the CONTRACTOR shall limit the weight and speed of his equipment to avoid damage to the subgrade or base course. If the subgrade or base course becomes rutted due to the CONTRACTORS operation, the subgrade or base course shall be removed and replaced, acceptable to the ENGINEER OF RECORD AND at the CONTRACTORS expense.

C. Limerock and Shell Stabilized Base Courses

The area to be stabilized shall have been completed to the lines shown in the plans and to a grade parallel to the finished elevation of the stabilized base, before the stabilizing material is added. The elevation of the roadbed shall be such that the base will conform to the requirements of the typical cross section when the work is completed. Any surplus

excavated materials resulting from this work shall be disposed of as specified in Article 3.02 of Section 32 22 16, Earthwork for Paving.

The base material shall be mixed using a heavy-duty rotary tiller or other equipment approved by the ENGINEER OF RECORD.

The stabilizing material shall be placed on the areas to be stabilized, and spread uniformly to the loose depth shown in the plans or ordered by the ENGINEER OF RECORD. The stabilizing material shall then be thoroughly mixed with the soil. The mixing shall be done as soon as practicable but not later than one week after the stabilizing material is placed on the road. At no time shall more stabilizing material be spread in advance of the mixing operations than can be mixed in with the soil within one (1) week.

The mixing operations shall be repeated as often as may be necessary to distribute the stabilizing material uniformly throughout the soil, as determined by the testing and inspection agency and/or the ENGINEER OF RECORD. The material shall be further manipulated until uniform distribution of the stabilizing material throughout the width and depth of the base course is secured.

Mixing of the soil, limerock or shell and water may be accomplished by the central plant mix method in lieu of mixing in place, provided that a uniform mixture, containing the proper amount of water, is obtained.

After mixing is completed the surface shall be so shaped that after being compacted it will conform to the grade and typical cross section shown in the plans.

The depth of mixing of the stabilizing material shall be in accordance with the following table:

SPECIFIED BASE THICKNESS (INCHES)	REQUIRED MIXING DEPTH (INCHES)	
	MINIMUM	MAXIMUM
6	5-1/2	7-1/2
8	7-1/4	9-3/4
10	9	12

In the event that the measured depth of mixing is less than the minimum specified above, the CONTRACTOR shall remix the base course, as directed by the ENGINEER OF RECORD, until the stabilizing material is distributed throughout the base course to the required depth.

Where the measured depth of mixing exceeds the maximum limits specified in the table, the CONTRACTOR shall, at his own expense, add 1-inch, loose measure, of stabilizing material for each inch of mixing depth in excess of the allowable depth (but in no case less than 1-inch of material, for any excess depth), and shall mix the added material in the top six (6) inches of the base, as specified above. The volume of stabilizing material, which is added, to compensate for excess mixing depth will not be included in the pay quantity, nor will any additional compensation be allowed for the extra mixing required.

After the spreading and mixing of the limerock or shell are completed, compaction shall be accomplished by rolling with either a grid-type roller or a sheepfoot roller, properly weighted, and with water being added as required. This rolling shall be to the extent directed by the ENGINEER OF RECORD. Final rolling shall be accomplished with traffic rollers and any other compaction equipment, which will obtain the specified density.

The material shall have approximately the optimum moisture content and the proper loose consistency, as determined by the ENGINEER OF RECORD, before being compacted. Wetting or drying will be required when the material does not have the proper moisture content to insure the required density. If the material is deficient in moisture, water shall be added and uniformly mixed-in by disking the base course to its full depth. If the material contains an excess of moisture, it shall be caused to dry before being compacted. Wetting or drying operations shall involve manipulation of the entire width and depth of the base as a unit. As soon as proper conditions of moisture are attained the material shall be compacted to a density not less than 98% of the maximum density as determined by AASHTO T 180. The minimum density, which will be acceptable at any location outside the traveled roadway, such as intersections, crossovers, etc., shall be 95% of such maximum.

Each course of multiple-course base shall be compacted as specified above. Prior to the placing of material for the overlying course, the density tests shall have been made on the lower course and the ENGINEER OF RECORD shall have determined that the specified compaction requirements have been met. In the compaction of the upper course the operations of wetting, disking, etc., shall not be such as to disturb the density in the lower course. For multiple-course base the density shall be determined separately for each layer.

The areas being stabilized shall be kept well drained at all times. Wherever ruts or low spots are found the areas affected shall be brought to grade and, if necessary, shall be reshaped and recompact. The surface of the completed stabilized base, when subjected to traffic, shall be kept moist until the prime coat is applied, so as to prevent dusting and raveling. The base shall be sprinkled with water occasionally, if so directed by the ENGINEER OF RECORD. The prime coat shall be applied only when the base meets the specified density requirements and moisture content in the top of the base does not exceed 90% of the optimum moisture for the base material. The CONTRACTOR shall maintain the stabilized base to a true and satisfactory surface and to the specified density until the wearing surface is constructed.

D. Crushed Concrete Base

The composition of the crushed concrete base material shall meet the requirements of FDOT Section 204 and FDOT Section 901-5. The placement and density of the crushed concrete base shall meet the requirements of FDOT Section 200.

The crushed concrete base course shall be placed by a mechanical spreader or other approved means, in uniform layers to such a depth that when compacted, the base course will have the thickness shown on the Plans. Spreading by other means shall be permitted only where and as directed by the ENGINEER OF RECORD.

The depth of any one (1) layer, when compacted, shall not be more than six (6) inches. If the required compaction cannot be obtained for the full depth of the base course spread, the thickness of each course shall be reduced or at the approval of the ENGINEER OF RECORD, adequate equipment shall be used to compact the aggregate to the required unit weight.

The subgrade shall be shaped to the specified crown and grade and maintained in a smooth condition. If hauling equipment causes ruts or holes in the subgrade, the hauling equipment will not be permitted on the subgrade, but shall be operated on the base course behind the spreader.

The base course shall be compacted to at least 100% of maximum unit weight as determined by AASHTO T180, by the use of approved pneumatic-tired compaction equipment or vibratory compactors.

The optimum moisture content shall be maintained until the prescribed unit weight is obtained and each layer shall be compacted until the maximum unit weight is attained before placing the succeeding layer.

When approved by the ENGINEER OF RECORD, additional water may be applied by an approved means, to the base course to aid in the compaction and shaping of the material.

Motor graders or other approved equipment shall be used to shape the base course and maintain it until the surface course is placed.

When hauling material over the base course or subgrade, the CONTRACTOR shall limit the weight and speed of his equipment to avoid damage to the subgrade or base course. If the subgrade or base course becomes rutted due to the CONTRACTOR'S operation, the subgrade or base course shall be removed and replaced, acceptable to the OWNER AND/OR THE ENGINEER OF RECORD at the CONTRACTOR'S expense.

E. Soil-Cement Base

The soil-cement mixture shall be proportioned in accordance with Strength Design or Brush Loss Criteria as set out below.

The CONTRACTOR shall submit for approval a design mix for the soil he proposes to use in soil-cement construction prepared by CONTRACTOR'S testing laboratory approved by the OWNER AND/OR THE ENGINEER OF RECORD. The design mix submittal shall include the results of tests run to verify that the soil meets the requirements set out in Article 2.01 of this Section and the results or tests used to establish the cement content. The design mix shall be submitted to the ENGINEER OF RECORD for approval a minimum of 60 calendar days prior to beginning of soil-cement construction for Brush Loss Design Method of 15 calendar days prior to beginning of soil-cement construction for Strength Design Method.

Laboratory testing for design mix evaluation shall be accomplished using water from the source proposed for use during construction.

The cement content shall be expressed in percentage of the dry-weight of the soil. For mixed-in-place construction, calculation of the rate of application of cement shall be based on the maximum density of the soil, determined in accordance with AASHTO T 99 and a thickness 1-inch greater than the thickness of the soil-cement base course shown in plans.

1. Strength Design

When the soil-cement mixture is to be proportioned in accordance with strength design, the minimum cement content shall be determined by Florida Department of Transportation Method of Test 697-007. The design compressive strength set out in the plans shall be achieved in seven (7) days. The cement content shall not be less than five (5) percent by weight.

2. Brush Loss Criteria

When the soil-cement mixture is to be proportioned in accordance with this criteria, the minimum cement content shall be determined according to AASHTO T135 (Wetting and Drying Tests of Compacted Soil-Cement Mixtures). The soil-cement loss at the completion of 12 cycles of testing shall conform to the following limits:

AASHTO Soil Groups A-1, A-2-4, A-2-5, and A-3 not over 14%.

AASHTO Soil Groups A-2-6, A-2-7, A-4, and A-5 not over 10%.

AASHTO Soil Groups A-6 and A-7 not over 7%.

The cement content shall not be less than five (5) percent by weight.

If the soil material used in producing a soil-cement mixture is being obtained from a commercial source where soil properties are consistently uniform and the mixture is processed in a central mix plant that automatically weighs components and automatically records the weight of each component on a printed ticket, tape or other digital record the minimum five (5) percent cement content specified above shall not apply.

Before base construction operations are begun, the subgrade shall have been completed. The subgrade shall be firm enough to support the equipment used in the soil-cement base operations without appreciable distortion or displacement. Any unsuitable material shall have been removed and replaced with suitable material.

When the base is to be constructed of central plant-mix soil-cement, the subgrade shall be moist for a depth of at least 1-inch at the time the mixed course material is placed thereon.

The area over which base is to be constructed shall be graded and shaped to an elevation which will provide a base in conformance with the grades, lines, thicknesses, and typical cross Section shown on the plans. All roots, sticks, and other deleterious matter shall be removed during processing.

Mixing of the soil, cement, and water shall be accomplished either by the mixed-in-place or the central plant-mix method.

The percentage of moisture in the soil at the time of cement application shall not exceed the quantity that will permit a uniform and intimate mixture of soil and cement during mixing operations. For clay soils it shall not exceed the optimum moisture content for the soil-cement mixture. For sandy soils the moisture content shall be within two (2) percentage points above or below, the optimum moisture content. With certain types of soils, the ENGINEER OF RECORD may designate a moisture range other than those specified above.

During seasons of probability of freezing temperature, no cement or soil-cement mixture shall be spread unless the temperature is at least 40 degrees F in the shade and is rising.

At completion of moist-mixing, the soil shall be so pulverized that 100% passes a 1-inch sieve and a minimum of 80% percent passes a No. 4 sieve, exclusive of gravel or stone retained on the No. 4 sieve.

The operations specified herein shall be continuous and shall be completed within a period of four (4) hours starting from the time mixing commences.

F. Mixed in Place Soil-Cement Base

Where feasible, the entire width of the base shall be processed in a single operation. The specified quantity of cement shall be spread uniformly on the soil at the required rate of application, by means of an approved method. Spread cement that becomes displaced shall be replaced before mixing is started.

After the cement has been applied, mixing shall begin within 60 minutes unless otherwise directed by the ENGINEER OF RECORD. The soil and cement shall be initially mixed until the cement has sufficiently blended with the soil to prevent formation of cement balls when additional water is applied; then water added if necessary and the soil-cement mixture remixed.

Processing may be to full depth in one (1) course provided that satisfactory distribution of cement and water and the specified density can be obtained. If not, construction shall be in courses of such thickness that satisfactory results are obtained. Provisions shall be made to achieve adequate bonding between courses.

Immediately after mixing of the soil and cement, any additional water that is necessary shall then be added. If the moisture content exceeds that specified, the soil-cement mixture shall be manipulated by remixing or blading, as required to reduce the moisture content to within the specified range. Excessive concentrations of water shall be avoided. During the time of application of water and after all mixing water has been applied, mixing shall continue until a uniform and intimate mixture of soil, cement, and water has been obtained.

At the option of the CONTRACTOR, as an alternative to the above-described procedure he may use an approved machine that will blend the cement and the soil and then add and mix-in any additional water that is necessary.

G. Central Mixed Soil-Cement Base

The soil, cement and water shall be mixed in a pugmill, of either the batch or continuous-flow type. The plant shall be equipped with feeding and metering devices, which will accurately proportion the soil, cement, and water in the quantities specified. Soil and cement shall be mixed sufficiently to prevent cement balls from forming when additional water is added. Mixing shall continue until a uniform and intimate mixture of soil, cement, and water is obtained. The materials shall be mixed a minimum of 30 seconds.

The mixture shall be hauled to the roadway in trucks equipped with protective covers. The mixture shall be placed on the moistened subgrade in a uniform layer by an approved spreader. Not more than 30 minutes shall elapse between the placement of soil-cement in adjacent passes of the spreader at any location, except at longitudinal construction joints. The layer of soil-cement shall be uniform in thickness and surface contour and in such quantity that the completed base will conform to the required grade and cross section. Dumping of the mixture in piles or windrows upon the subgrade will not be permitted.

Compaction of the soil-cement mixture shall begin immediately after mixing is completed. In no case shall more than 60 minutes elapse between the last pass of moist-mixing and the start of compaction of the soil-cement mixture at a particular location.

At the start of the final compaction operation, the percentage of moisture in the mixture and in unpulverized soil lumps, based on dry weights, shall not be more than two (2) percentage points above or below the optimum moisture content. The optimum moisture content and maximum density shall be determined in the field by the methods prescribed in AASHTO T 134, on representative samples of the soil-cement mixture obtained from the area being processed.

The loose mixture shall be uniformly compacted to not less than 98% of the maximum density. During compaction operations, shaping may be required to obtain uniform compaction and required grade and cross section.

After compaction, the surface of the soil-cement shall be shaped to the required lines, grades, and cross section. In all cases where soil-cement mixture is added to any portion of the surface, the surface shall be lightly scarified with a spring-tooth harrow, spike drag, or other approved device, such that the surface is uniformly loosened prior to addition of material and prior to initial set of the soil-cement mixture. The resulting surface shall then be compacted to the specified density. Rolling shall continue until all rutting ceases and until the entire base conforms to the density requirements. With certain granular soils the ENGINEER OF RECORD may determine that minor tire marks are acceptable.

The moisture content of the surface material shall be maintained at not less than two percentage points below its specified optimum moisture content, during finishing operations. Surface compaction and finishing shall be done in such manner as to produce a smooth, dense surface, free of compaction planes, cracks, ridges, and loose material.

If the time limits set forth herein are exceeded, the base shall be left undisturbed for a period of seven (7) days, after which it will be examined by the ENGINEER OF RECORD to determine its suitability. If it is found suitable the CONTRACTOR shall be fully compensated providing the base meets all other requirements specified herein. If found unsuitable the base shall be removed and replaced by the CONTRACTOR without additional compensation. The CONTRACTOR may, at his option, remove and replace the deficient base rather than wait the 7-day test cure.

At the end of each day's construction a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face. The construction joint shall be located such as to exclude all of that part of the base at the end of the run, which does not meet the requirements of the specifications and the typical Section.

After compacting and finishing have been completed, and not later than the beginning of the next calendar day after the construction of any Section of base, the surface shall be tested with a template cut to the required crown and with a 15-foot straightedge laid parallel to the centerline, and all irregularities greater than 1/4 inch shall be immediately corrected with a blade adjusted to the lightest cut which will insure a surface that does not contain depressions greater than 1/4 inch under the template or the straightedge. In the testing of the surface the measurements will not be taken in small holes caused by individual rocks having been pulled out by the blade. The material removed shall be discarded.

During the period when finishing and surface correction operations are being accomplished, the surface of the base shall be kept continuously moist by sprinkling as necessary. Subsequent to this period it shall be protected from drying for seven days, by application of either 1) cut back asphalt, Grade RC-70, applied at the rate of 0.15 to 0.20 gallon per square yard; or 2) a mixture containing equal parts of emulsified asphalt, Grade SS-1, and water, applied at the rate of 0.20 to 0.25 gallon of the diluted mixture per square yard. The actual rate of application shall be as directed and shall provide complete coverage without excessive runoff. At the time the bituminous material is applied, the soil-cement surface shall be dense, and free of all loose and extraneous material, and

shall contain sufficient moisture to prevent excessive penetration of the bituminous materials.

Should it be necessary to allow construction equipment or other traffic to use the completed base before the bituminous material has cured sufficiently to prevent pickup or displacement; the bituminous material shall be sanded, using approximately ten (10) pounds of clean sand per yard.

The curing material shall be maintained by the CONTRACTOR during the 7-day protection period. No traffic shall be permitted on the base subsequent to completion of the finishing operations for a period of seven (7) days. As an exception to this requirement the equipment necessary for correction of surface irregularities, application of water and application of curing materials will be allowed provided that the tire contact pressures of such equipment does not exceed 45 pounds per square inch. After the 7-day curing period the base may be opened to traffic provided that it either is protected or has hardened sufficiently to prevent marring or distorting of the surface by equipment or traffic.

The CONTRACTOR shall maintain the base to a true and satisfactory surface until the wearing surface is constructed. Should any repairs or patching be necessary they shall extend to the full depth of the base and shall be made in a manner that will assure restoration of a uniform base course conforming to the requirements of these specifications. In no case shall repairs be made by adding a thin layer of soil-cement to the completed work. The CONTRACTOR may, at his option, make full depth repairs to small or minor areas, such as at manholes, inlets, or the like, with concrete.

H. Maintenance during Construction

The base course shall be continuously maintained in a smooth and firm condition during all phases of the construction operation.

The CONTRACTOR, at his expense, shall provide additional materials to fill depressions or bind the aggregate, when directed by the ENGINEER OF RECORD.

I. Cleanup

Immediately following the compacting of the base course, the voids on both sides of the base course shall be backfilled with sound earth of topsoil quality.

The backfill shall be compacted, leveled and left in a neat, workmanlike condition.

3.04 FIELD QUALITY CONTROL

A. Testing

During the course of the work, testing will be required for compaction or density and for thickness of material. The testing and coring required shall be performed by the CONTRACTOR'S testing laboratory approved by the OWNER AND/OR THE ENGINEER OF RECORD. The cost for testing and coring shall be at the expense of the CONTRACTOR.

A minimum of 1-depth (thickness) measurement will be made every 400 linear feet per traffic lane. The lane width shall be as indicated on the Plans. or as determined by the ENGINEER OF RECORD. If two (2) lanes are constructed

simultaneously, only one (1) test is necessary to represent both lanes. For areas such as intersections, entrances, cross-overs, ramps, widening strips, acceleration and deceleration lanes, at least 1-depth measurement will be taken for each 1,200 square yards of such areas or fraction thereof. The location of the depth measurement will be at the discretion of the ENGINEER OF RECORD

B. Defective Work

1. Thickness

Measurements of base course thickness will be made to the nearest 1/4-inch. Depths may be 1/2 inch less than the thickness indicated on the Plans provided that the average of all measurements taken at regular intervals shall be equal to or greater than the specified thickness. In determining the average in place thickness, measurements, which are more than 1/2 inch in excess of the thickness indicated on the Plans, will be considered as the specified thickness plus 1/2 inch.

Locations of the depth measurements will be as specified herein unless otherwise directed by the ENGINEER OF RECORD. Sections found to be deficient in depth shall be corrected by the CONTRACTOR using methods approved by the ENGINEER OF RECORD.

2. Weight

When the aggregate material is measured by weight in tons, the pay weights for aggregates will be the scale weight of the material, including admixtures, unless the moisture content is more than six (6) percent. Moisture tests will be made at the start of weighing operations and at any time thereafter when construction operations, weather conditions or any other cause may result in a change in the moisture content of the material. If the tests indicate moisture content in excess of six (6) percent, the excess over six (6) percent will be deducted from the scale weight of the aggregate until such time as moisture tests indicate that the moisture content of the material is not more than six (6) percent.

END OF SECTION

SECTION 32 1113 - BITUMINOUS PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes bituminous paving complete with bituminous materials; bituminous mixtures; installation of bituminous base course, bituminous structural and friction courses, and bituminous curbs; construction of bituminous pavement, sidewalks, drive approaches, and tennis courts.

- B. Related Work Specified Elsewhere

- 1. Earthwork for Paving: Section 31 2216
- 2. Base Courses: Section 32 1100

1.3 QUALITY ASSURANCE

- A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ASTM - American Society of Testing & Materials

AASHTO - American Association of State Highway and Transportation Officials

FDOT - Florida Department of Transportation

- B. Allowable Tolerances

Following the final rolling, the surface will be tested longitudinally using a 15-foot straightedge at locations selected by the ENGINEER OF RECORD. The variation of the surface from the testing edge of the straightedge between any two (2) contacts with the surface shall at no point exceed the following limits:

For Bituminous Base Course Mixtures:

Multiple Courses: 3/8 inch for top course
3/4 inch for lower courses

For Bituminous Aggregate or Bituminous Concrete Pavement Mixtures:

Multiple Courses: 3/16 inch for top course
1/4 inch for lower courses

Single Course: 3/16 inch

Variations in excess of the specified tolerance shall be corrected as directed by the.
ENGINEER OF RECORD

1.4 SUBMITTALS

A. Reports

1. At the request of the OWNER AND/OR ENGINEER OF RECORD, the CONTRACTOR shall provide certification that the various materials to be used conform to the ASTM Standards referred to in the Specifications.
2. The CONTRACTOR shall provide the OWNER or the ENGINEER OF RECORD with the certified batch plant delivery tickets prior to the placing of the materials.
3. The CONTRACTOR shall supply the OWNER OR the ENGINEER OF RECORD with a certified job mix design for each type of bituminous mixture used on this Project.

B. Test Reports

1. Mix Design and Thickness

The testing lab shall provide the OWNER WITH (2) copies AND THE ENGINEER OF RECORD WITH (1) copy of the test results of the mix design and the thickness of the bituminous paving material. The core drilling, testing for mix design and thickness shall be performed by the CONTRACTOR'S testing laboratory approved by the OWNER'S AND/OR THE ENGINEER OF RECORD Test results shall be signed and sealed by a Professional Engineer.

1.5 JOB CONDITIONS

A. Environmental Requirements

1. Temperature

Comply with the requirements for bituminous concrete installation due to outside ambient air temperatures specified under Article 3.03 of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Coarse Aggregate

The coarse aggregate gradation shall conform to ASTM D692 and to coarse aggregate as specified in FDOT, Section 901.

B. Fine Aggregate

The fine aggregate gradation shall conform to ASTM D1073, AASHTO M29, and to fine aggregate as specified in FDOT, Section 902.

C. Mineral Filler

The mineral filler gradation shall conform to AASHTO M17 and to mineral filler as specified in FDOT, Section 917.

D. Bituminous Materials

1. Asphalt Cement

Viscosity grades for asphalt cement for use in pavement construction shall conform to ASTM D3381, AASHTO M226, and as specified in FDOT, Section 916.

2. Liquid Asphalts

Liquid asphalts for use in pavement construction shall conform to ASTM D2026, D2027, and D2028, AASHTO M81 and M82, and as specified in FDOT, Section 916.

3. Emulsified Asphalt

Emulsified asphalt for use in pavement construction shall conform to ASTM D244, and as specified in FDOT, Section 916.

2.2 MIXES

A. Composition of Mixtures

Bituminous pavement mixtures shall be mixed and placed in accordance with applicable requirements specified in FDOT Sections 280, 320, 330, 331, 332, 333, 335, 337, and 339 as applicable.

The CONTRACTOR may elect to blend aggregates. When the CONTRACTOR so elects, the aggregate the composition and quality of the bituminous mixture, the blending operation, and the use of hot bins shall meet the requirements as specified herein and be approved by the ENGINEER OF RECORD. The specified aggregates, mineral filler (if required), and asphalt cement shall be combined as necessary to produce a mixture proportioned within the master gradation range limits shown in Table A and meeting the uniformity tolerance limits shown in Table C; bituminous mixtures shall also meet the mix design criteria specified in Table B.

Composition limits in Table A are shown in percent by weight, based on the total aggregate, including mineral filler, in the mixture.

The bituminous mixture specified on the Plans or in the Proposal, when tested at optimum asphalt content in accordance with ASTM D 1559, shall meet the requirements for stability, flow, and voids in mineral aggregate (VMA), as specified in Table B.

Mixtures failing to meet the requirements specified in Table B will be rejected and the CONTRACTOR will be required to submit additional samples of aggregates until a material is found which will produce a mixture meeting the Table B requirements.

If there is a change in the source of any of the aggregates, a new job-mix formula will be required.

Table A
MASTER GRADATION RANGE
FOR BITUMINOUS MIXTURES

PERCENT BY WEIGHT TOTAL AGGREGATE PASSING SIEVES*

TYPE	3/4	2	3/8	NO. 4	NO. 10	NO. 40	NO. 80	NO. 200
S-I	100	80-100	75-93	47-75	31-53	19-35	7-21	2-6
S-II**	83-98	80-100	62-78	47-63	33-49	19-35	9-18	2-6
S-III		88-100	88-100	60-90	40-70	20-45	10-30	2-6
TYPE II		90-100	90-100	80-100	55-90			2-12
TYPE III		80-100	80-100	65-100	40-75	20-45	10-30	2-10
SAHM		100						0-12
ABC-1		100						0-12
ABC-2		100			55-90			
ABC-3***	70-100			30-70	20-60	10-40		0-10
FC-2****		100	85-100	10-40	4-12			2-5
PC-1	100	88-100	75-93	47-75	31-53	19-35	7-21	2-7
PC-2			90-100	80-90	60-80	24-60	10-40	3-12
PC-3			80-100	65-90	40-75	20-45	10-30	2-10

*In inches, except where otherwise indicated. Number sieves are U.S. Standard sieve series.

**100% passing 1-1/2 inch sieve and 97-100% passing the 1-inch sieve.

***100% passing 1-1/2 inch sieve.

****The design range for the No. 10 sieve may be increased for lightweight aggregates.

Table B
MIX DESIGN CRITERIA FOR
DENSE-GRADED AGGREGATES

MIX TYPE	MINIMUM MARSHAL STABILITY (LBS.)	FLOW (0.01 IN.)	MINIMUM VMA (%)	AIR VOIDS (%)	MINIMUM EFFECTIVE ASPHALT CONTENT (%)
S-I	1,500	8-14	14	3-55.0	
S-II	1,500	8-14	13	3- 5	5.0
S-III	1,500	8-14	15	3- 7	5.5
TYPE II	500 - 750	7-16	18	5-16	6.0
TYPE III	750 - 1,000	7-16	15	5-12	5.5
SAHM	300 - 500	7-16	15	5-16	6.0
ABC-1	500	7-16	15	5-16	6.0
ABC-2	750	7-16	15	5-14	5.5
ABC-3	1,000	8-14	14	3- 7	5.0
FC-2	-	-	-	-	-
PC-1	1,800	8-14	14-20	3-5	5-9
PC-2	1,000	8-16	18-30	3-7	5-9
PC-3	1,500	8-16	15-23	4-8	5-9

*If Type S-I Asphaltic Concrete is to be the final pavement surface, the range of air voids shall be four (4) percent to six (6) percent.

Table C
UNIFORMITY TOLERANCE LIMITS
FOR BITUMINOUS MIXTURE

PERCENTAGE PASSING DESIGNATED SIEVES						BITUMEN CONTENT
MIXTURES TYPE	RANGE	3/8-IN	NO.10	NO.40	NO.200	

S-I S-II S-III	1*	+5.0	+5.0	+4.0	+2.0	+0.4
ABC-3 FC-2	2**	+5.1- 8.0	+5.1- 8.0	+4.1- 7.0	+2.1- 3.0	+0.41- 0.6
II III SAHM ABC-1	1*	+7.0	+5.0	+5.0	+2.0	+0.4
ABC-2	2**	+7.1-	+5.1-	+5.1-	+2.1-	+0.41-

*Range 1: Maximum allowable deviations permitted from Job Mix Formula within the Master Gradation Range.

**Range 2: Suspend mix production and make necessary changes.

***The bitumen content may exceed 0.6% above the design content but shall not exceed 0.6% above the optimum bitumen content.

After the job-mix formula is established, the aggregate gradation and the bitumen content of the bituminous mixture furnished for the Work shall be maintained within the uniformity tolerance limits permitted for the job-mix formula as specified herein under Table C, within the master gradations range as specified in Table A, and within the bitumen content specified in Table B. If two (2) consecutive aggregate gradations on one (1) sieve or bitumen contents as determined by the field extractions are not within the uniformity tolerance limits, the CONTRACTOR shall suspend all operations (work days will be charged during the down time). Before resuming any production, the CONTRACTOR shall make all necessary alterations to the materials or plant so that the job-mix formula can be maintained within the deviations permitted under Table C, within the master gradation range shown in Table A and within the bitumen content specified in Table B.

The CONTRACTOR shall provide uniformity in the gradations of the aggregates placed in the cold feed bins so that the combination of aggregates produced for the mixture by blending the aggregates from two (2) or more cold feed bins will be uniformly fed by means of adjustable feeders onto a belt supplying the asphalt plant. The feeders shall be equipped with cutoffs which will automatically stop the operations to the asphalt plant at any time the flow of any aggregate fraction is changed so as to affect the uniformity of the finished product.

The CONTRACTOR has the option of using hot bins for proportioning the aggregates to meet the specified tolerances.

Aggregate gradation tests will be made on aggregate extracted from samples of bituminous mixture taken from the trucks. At initial start of production and at other times when tests indicate that the aggregate gradation is fluctuating, truck samples will be taken at a frequency of one (1) sample per 250 tons of mixture, but not more than four (4) samples per day. During other periods where tests indicate the aggregate gradation is stable, truck samples will be taken at a frequency of one (1) sample per 500 tons of mixture, but no more than two (2) samples per day.

The OWNER reserves the right to require the CONTRACTOR to discontinue the use of

blended aggregate as provided herein and furnish graded aggregate from approved stockpiles, if in the opinion of the OWNER'S AND/OR ENGINEER OF RECORD the blended aggregate as incorporated in the bituminous mixture does not meet the requirements specified herein.

Any mixture exceeding the maximum tolerances listed in Range 2 under Table C, or exceeding the maximum limits specified for the master gradation range will be rejected.

Exact mixture proportions will be based on composite samples of aggregate and the particular bituminous material called for on the Plans and in the Proposal.

The mixture proportions shall be varied as directed by the ENGINEER OF RECORD between the limits designated in Table C, except that if highly absorptive aggregate is used, the ENGINEER OF RECORD may specify higher bitumen content without any change in the Contract unit price.

For bituminous concrete curb mixtures, asphalt additives consisting of powdered native bitumen may be used in the mixture in amounts approved by the ENGINEER OF RECORD.

PART 3 - EXECUTION

3.1 CONTRACTORS VERIFICATION

A. Excavation

Prior to the installation of any bituminous surface courses or bases, examine the excavation for the grades, lines and levels required to receive the new Work. Ascertain that all excavation and compacted subgrades are adequate to receive the bituminous concrete pavement to be installed. Correct all defects and deficiencies before proceeding with the Work.

B. Subgrade Conditions

Prior to the installation of any bituminous surface courses or bases, examine the subgrade to ascertain that it is adequate to receive the bituminous concrete pavement to be installed. If the subgrade remains wet after all surface water has been removed, the CONTRACTOR will install underdrains.

C. Surface Conditions

Prior to the installation of any bituminous mixtures for surface courses or bases, examine the surface the improvement is to be placed on and ascertain that it is adequate to receive the improvement to be installed.

D. Existing Improvements

Investigate and verify location of existing improvements, including structures, to which the new Work is to be connected. Adjustments in line and grade to align the new Work with the existing improvements must be in accordance with the CONTRACTOR's contract documents approved by the ENGINEER OF RECORD, prior to any changes.

3.2 PREPARATION

A. Preparation of Foundations

1. For bituminous base course mixtures required to be placed directly on the subgrade,

the density, grade and cross section shall meet the approval of the ENGINEER OF RECORD at the time of placement of any mixture.

2. Prior to placing any bituminous mixture, the surface of the existing pavement including joints and cracks shall be thoroughly cleaned of all dirt and debris.
3. All existing structures within the limits of the new Work shall be adjusted as specified in the Plans or as directed by the ENGINEER OF RECORD.

B. Preparation of Base

Prior to the placing of any prime coats or any bituminous surface or base course mixtures, the density, grade and cross section of the subgrade or base shall meet the approval of the ENGINEER OF RECORD at the time of placement of any material. Surfaces that have become too wet or too dry shall be reworked to provide the required density.

C. Chipping Concrete Pavement for Joints

If butt joints are specified on the Plans, or by the ENGINEER OF RECORD, the old surface shall be cut back for at least five (5) feet to a depth of at least 1-inch, for the full width of the joint.

D. Edge Trimming

Trimming and truing the edge of an existing bituminous surface shall be performed as required to give a straight, sharp edge at the proper elevations.

The existing base under the bituminous surface shall be left undisturbed.

E. Removing Bituminous Surfacing

When removing an existing bituminous pavement, the edges of the area to be removed shall be cut along straight lines, either perpendicular or parallel to the direction of travel, for the full depth of the bituminous surfacing with the cut edge a minimum of 18 inches back from the disturbed edge of pavement. The cutting of the edges of the area and the breaking up of the bituminous material within the area and the removing and disposing of the unsuitable material are included in the Work of removing bituminous surfacing.

F. Removing Bituminous Patches

Where the removal of bituminous patching material is specified on the Plans or as directed by the ENGINEER OF RECORD it shall be saw cut along the edges of the patched area to prevent the tearing of the adjoining pavement surfaces during the removal operation. The cutting, removing and disposing of bituminous surfacing and unsuitable materials are included in the Work of removing bituminous patches.

G. Hand Patching

Where the filling of holes and depressions in the base or the replacing of the patches is specified on the Plans or as directed by the ENGINEER OF RECORD, the filler material shall be an approved bituminous mixture. The mixture selected will be dependent on the depth and size of the patch and the type of mixture and penetration grade of the asphalt cement required. The patches shall be compacted to the required grade by use of a machine vibrator or approved roller.

H. Joint Clean out

Where joint Clean-out is specified on the Plans or as directed by the ENGINEER OF RECORD, the joint sealants and foreign material shall be removed to a depth of up to 1-inch by approved mechanical or hand methods. The removal and disposal of unsuitable materials and the removal and disposal of bituminous surface patches adjacent to joints are included in the Work for joint Clean out.

I. Repairing Pavement Joints

Where existing pavement joints and cracks are to be repaired, as specified on the Plans or as directed by the ENGINEER OF RECORD, the existing bituminous surface and any loose or spalled concrete around the joints and cracks shall be removed. Each joint or crack shall be cleaned and shall be filled with an approved mixture using a penetration grade asphalt and the mixture shall be compacted with a vibratory machine or by an approved method.

J. Preparation of Cover Materials

Cover materials used for seal coating shall be sufficiently dry when it comes in contact with bituminous material. The moisture content shall not exceed three (3) percent by weight, dry basis. Satisfactory means shall be provided for the protection of the coating materials against excessive moisture by covering stockpiles, by aeration or through manipulation.

3.3 INSTALLATION

A. General

1. The width, thickness and type of bituminous paving improvement shall be specified on the Plans, indicated in the Proposal or as directed by the ENGINEER OF RECORD.
2. Existing improvements, including structures, shall be protected to prevent their surfaces from being discolored during application of bituminous materials.

B. Equipment Requirements

The CONTRACTOR shall furnish sufficient equipment for the placing of the bituminous paving material and the construction of bituminous curbing. The equipment shall be on the job site and ready for normal operation before the placing of material is started. All equipment shall be in good working order. The equipment shall be subject to inspections and testing during construction. The equipment shall be of sufficient capacity that the operation can be continuous and a rate of production obtained which insures good workmanship, and eliminates overloading of the equipment or frequent interruptions or delays. The equipment shall conform to the requirements as specified in FDOT, Section 320.

1. Flasher Lights for Bituminous Concrete Equipment

On bituminous construction where traffic is being maintained, chip spreaders, distributors and rollers shall be equipped with at least one (1) approved flashing, rotating, or oscillating amber light and pavers shall be equipped with at least one (1) such light on each side of the paver. The lights shall be mounted so that the warning signal will be visible to traffic in both directions. The lights shall be in operation all the while the Work is in progress.

2. Hauling Equipment

Trucks used for hauling bituminous mixtures shall have tight, clean, smooth beds

which have been thinly coated with an approved release agent, to prevent the mixture from adhering to the beds. Each truck shall have an adequately secured cover of such size and material as to completely protect the mixture from the weather and to retard the escape of heat from the mixture. Hauling units creating a hazard on the Project, or adversely affecting the quality of the Work shall be removed from the Project.

3. Pressure Distributor

The distributor shall be mounted upon a vehicle which is capable of maintaining the uniform speeds required for proper application of the bituminous material.

The pressure distributor shall have a capacity of at least 800 gallons. It shall be equipped with heating facilities capable of maintaining the bituminous material at the specified temperature. A positive displacement type pump, installed so as to permit circulation of the material in the tank and between the tank and the spray bar, shall be provided. The pump power shall be independent of the vehicle power or the pump shall be operated by a power take-off from the vehicle motor in such a manner that uniform distribution of the bituminous material, at the rate specified, will be obtained. Full circulating spray bars shall be available for application widths of 3 to 24 feet in 1-foot increments. The nozzles shall produce a uniform fan spray, and the shutoff shall be instantaneous, with no dripping. Nozzles in various sizes between 1/8 and 1/4 inch, inclusive, shall be available.

The spray bar shall be set at the proper height to provide a uniform application at the specified coverage rate.

4. Pavers

The paver shall be an approved self-powered machine capable of spreading and finishing the mixture in a uniform layer at the desired thickness and cross section and ready for compaction. The use of any machine in poor mechanical or worn condition will not be permitted. The paver shall be of such design that the supporting wheels, treads, or other devices ride on the prepared base. The full width of surface being applied shall be screeded by an oscillating or vibrating screed. The paver shall at all times produce a uniformly finished surface, free from tearing or other blemishes that would require handwork. The screed shall be adjustable to provide for tilting to secure the proper drag or compressive action necessary to produce the desired surface texture.

The paver shall be equipped with a hopper and an automatic material-depth control device so that each distributing auger and corresponding feeder shall respond automatically to provide for a constant level of mix ahead of the screed unit to the full width of the lane being paved. In order to ensure that adequate material shall be fed to the center portion of the lane being paved, reverse pitch augers or paddles shall be installed at the inside of one (1) or both ends of the auger shafts to force the mix to the middle portion of the lane. If necessary to prevent segregation of the mix as it drops off the feed conveyor, baffle plates shall be installed at the required location.

When extensions are added to the paver, they shall be provided with the same vibrating screed or tamper action as the main unit of the paver, except for paving variable width areas. The extensions shall also be equipped with a continuation of the automatically controlled spreading augers. The screed and any extensions shall be provided with an approved method of heat distribution.

Unless specified otherwise, bituminous pavers shall be equipped with an

automatically controlled and activated screed and strike-off assembly capable of grade reference and transverse slope control. A manufacturer approved grade referencing attachment, not less than 30 feet in length, shall be used for all lower courses and the first lane of the wearing course. After the first lane of the surface course has been placed, a 10-foot, or longer, grade resurfacing attachment may be substituted for constructing subsequent adjacent lanes of surface course mixture.

A self-propelled mechanical spreader capable of maintaining the proper width, depth, and slope without causing segregation of the material, may be used for base courses and for surface courses less than eight (8) feet in width.

When surfacing ramps or shoulders, or when the grade of a concrete gutter or other existing installation must be met, the manner of use of the automatic grade reference and slope control devices shall be determined by the CONTRACTOR.

Whenever a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually for the remainder of the normal working day, provided this method of operation will produce results meeting the specification requirements.

5. Crushing Equipment

The crushing equipment shall be an approved rotary reduction machine having positive depth control adjustments in increments of 2 inch and capable of reducing material which is at least six (6) inches in thickness. The machine shall be of a type designed by the manufacturer specifically for reduction in size of pavement material, in place, and be capable of reducing the pavement material to the specified size. The cutting drums shall be enclosed and shall have a sprinkling system around the reduction chamber for pollution control. The rate of forward speed must be positively controlled in order to ensure consistent size of reduced material. The machine must be equipped with an accurate tachometer, which is mounted, in full view of the operator. The crushing equipment shall meet the approval of the ENGINEER OF RECORD.

6. Mixers

Mixers shall be self-propelled and a combination scarifier, pulverizer, mixer, and liquid distributor. Unless otherwise specified, a minimum of two (2) mixers will be required.

If asphalt cement is used as a stabilizer, one (1) mixer shall be a self-propelled single-pass stabilizer, combining a cutting rotor, a blending rotor, and at least one (1) mixing rotor in the mixing chamber.

The spray bar for distribution of the liquid shall operate in such a manner that all asphalt will be uniformly applied through the mixer at the time of mixing.

The equipment for distributing the bituminous material shall be adjustable and shall measure accurately the amounts of bituminous material being applied. The bitumen pump shall be a positive displacement type pump. It shall be equipped in such a manner as to make it possible to check accurately the rate of application of the bitumen at any time. The mixer shall meet the approval of the CONTRACTOR.

7. Joint Heaters

Joint heaters shall be infrared or other approved heaters, equipped with an automatic ignition and extinguishing system to ensure that the heater operates only

when the paver is moving. It shall be of sufficient length and heating capacity to adequately soften the edge of the mat. The heater shall be oriented parallel to the joint edge. The bituminous pavement shall not be heated by a direct open flame.

8. Rollers

a. Steel-Wheel

Steel-wheel rollers shall weigh at least eight (8) tons and shall be self-propelled, vibratory or static, tandem rollers or shall be self-propelled static 3-wheel rollers. Steel-wheel rollers shall be free from backlash, faulty steering mechanism, or worn king bolts. The steering device shall respond readily and permit the roller to be directed on the alignment desired. Rollers shall be equipped with wheel sprinklers and scrapers. Roller wheels shall be smooth and free from openings or projections which will mar the surface of the pavement.

Vibratory rollers shall have a shutoff to deactivate the vibrators when the roller speed is less than 0.5 mph and shall have provisions to lock in the manufacturers recommended speed, the vibrations per minute, and the amplitude of vibration (dynamic force) for the type of bituminous mixture being compacted.

b. Pneumatic-Tired

The pneumatic-tired roller shall be of the self-propelled type with a total weight, including ballast, not greater than 30 tons. It shall be equipped with a minimum of seven (7) wheels situated on the axles in such a way that the rear group of tires will not follow in the tracks of the forward group, but will be so spaced that a minimum tire path overlap of 2 inch is obtained. The tires shall be smooth and shall be capable of being inflated to or adapted to achieve a pressure necessary to provide ground-contact pressures of at least 80 pounds per square inch. The tire pressures shall not vary by more than five (5) pounds per square inch between individual tires. The CONTRACTOR shall furnish the OWNER and ENGINEER OF RECORD charts or tabulations showing the contact areas and the contact pressures for the full range of tire inflation pressures and tire loadings for the type and size roller used.

The roller shall be equipped with a mechanism capable of reversing the motion of the roller smoothly. The roller shall be equipped with wheel sprinklers and scrapers or mats.

9. Chip Spreader

The chip spreader shall be self-propelled and shall be equipped with pneumatic tires.

The spreader shall be equipped with a screen mounted below the metering gage.

The spreader shall be capable of spreading the cover material uniformly at widths of 3 to 12 feet, or separate spreaders shall be provided for the specific widths required.

The rate of discharge of the spreader shall be adjustable to spread uniform layers of 10 to 50 pounds per square yard.

10. Drag

An approved drag to level and properly distribute the cover material shall be available for use. Such a drag may be made from one (1) layer of chain link fencing eight (8) feet wide and at least ten (10) feet long, so constructed and hitched as to cover half the road width when dragged over the surface, or may be a brush broom drag of approved design.

11. Bituminous Concrete Curbing Machine

The bituminous concrete curbing machine shall be self-propelled and shall be capable of laying and satisfactorily compacting curved and straight line curb to the cross section specified on the Plans. It shall be equipped with templates for the cross sections required.

12. Miscellaneous Equipment

Sufficient equipment for handling and hauling covered material shall be provided to insure prompt and continuous covering of bituminous materials. A self-propelled power broom, straightedges for testing, thermometers, and all necessary small tools to completely and satisfactorily finish the Work shall be provided by the CONTRACTOR.

C. Bituminous Prime Coat or Bond Coat

The prepared foundation shall be treated with bituminous material for prime coat or bond coat as specified. A bond coat shall be applied to each layer of bituminous mixture before the succeeding layer is placed.

Bituminous prime coat and bond coat shall conform to the requirements of FDOT, Section 300, and as specified herein.

The bituminous material shall be applied uniformly by means of a pressure distributor, and only in such areas as may be inaccessible to the regular distributor operation shall the bituminous material be applied by means of the hand spraying apparatus of the distributor. Where necessary to accommodate traffic, the surface shall be treated half-width, or as directed by the ENGINEER OF RECORD. The foundation shall be free from moisture when the treatment is applied. Under no circumstances shall pools of bituminous material be allowed to remain on the surface.

1. Prime Coat

The amount of prime coat to be applied per square yard shall be as specified on the Plans or as directed by the ENGINEER OF RECORD.

When prime coat is applied, the surface course shall not be placed until the prime coat has been properly cured. No blotting of the prime coat with aggregate in lieu of proper curing will be permitted.

2. Bond Coat

The bond coat shall be applied at the rate specified by the ENGINEER OF RECORD. This rate will be between 0 and 0.10 gallons per square yard on the bituminous or concrete foundation and between 0 and 0.05 gallons per square yard between subsequent courses.

The bond coat material shall be applied ahead of the paving operation for a distance of at least 1,500 feet, depending on traffic conditions, as determined by the

ENGINEER OF RECORD. The surfacing shall not be placed until the bond coat has cured.

D. Transportation of Mixtures

The transportation of the mixtures as specified shall be in accordance with FDOT, Sections 320-6.4 and 330-7.

E. Placing Bituminous Mixtures

Pavers will be required to have an automatically controlled and activated screed and strike-off assembly except when placing mixtures for: (1) variable width sections, (2) sections of pavement less than 1,000 feet in length, (3) placing the first course of a base course mixture on an earth grade or on a sand subbase, or (4) placing base course mixtures in widths less than eight (8) feet.

1. Placing Bituminous Base Course Mixtures

Bituminous base course mixtures shall not be placed in lifts exceeding three (3) inches unless otherwise approved by the ENGINEER OF RECORD. Approval to place lifts in excess of three (3) inches will be based on the ability of the CONTRACTOR to place and compact the base course to the required cross section and within the specified tolerances.

For lifts of 2-1/2 inches or greater, a berm of shoulder material shall be banked against the outside edge of each layer of mixture placed unless the sequence of operations is such that the edges of the material are adequately confined and supported in some other manner. The width of material placed shall be twice the height of the bituminous layer being placed but in no case less than a 6-inch width.

2. Placing Bituminous Mixtures

When the application rate for a bituminous pavement exceeds 220 pounds per square yard, the pavement shall be constructed in two (2) or more courses, unless otherwise specified on the Plans or as directed by the ENGINEER OF RECORD.

The bituminous mixture shall be placed by an approved self-propelled mechanical paver to such a depth that when compacted, it will have the thickness specified. The mixture shall be dumped into the center of the hopper and care shall be exercised to avoid overloading the paver and spilling the mixture upon the base. The paver speed shall be adjusted at the discretion of the CONTRACTOR to that speed which, in his opinion, gives the best results for the type of paver being used and which coordinates satisfactorily with the rate of delivery of the mixture to the paver to provide a uniform rate of placing the mixture without intermittent operation of the paver.

When delays result in slowing paving operations such that the temperature of the mat immediately behind the screed falls below 170 degrees F, paving shall be stopped and a transverse construction joint placed.

Bituminous mixture shall be placed in one or more layers as called for on the Plans, or as directed by the ENGINEER OF RECORD. To take out irregularities in the existing road surface, wedging with bituminous mixture shall be done by placing several layers with the paver. Corrections to the foundation by wedging with bituminous material shall be made by placing, compacting, and allowing the material to cool prior to paving.

Bituminous mixtures shall be placed using two (2) pavers in echelon or one (1) paver equipped with an approved joint heater. The CONTRACTOR may omit the use of the joint heater if the temperature of the previously placed mat does not fall below 170 degrees F prior to placement of the adjacent course.

Echelon paving will be permitted at the direction of the ENGINEER OF RECORD.

Cold joints will be permitted along acceleration and deceleration lanes, lanes less than full width, irregularly shaped section, and at transverse joints. The edges of the initial mat for all cold joints shall be painted with bituminous material before the bituminous mixture is placed in the adjacent section. In placing the bituminous mixture adjacent to all joints, hand raking or brooming will be required to provide a dense smooth connection.

Connections with existing surfaces at the beginning and ending of resurfacing sections and at intersections shall be made by feathering out the mix, by constructing a butt joint., or as directed by the ENGINEER OF RECORD.

When placing the bituminous mixture in a lane adjoining a previously placed lane, the mixture shall be placed such that it uniformly overlaps the first lane by two (2) to four (4) inches and is placed at a height above the cold mat equal to the breakdown roller depression on the hot mat. The overlapping material shall be bumped, back onto the hot lane so that the roller will compress the excess material into the hot side of the joint. If, at the opinion of the ENGINEER OF RECORD the overlap is excessive, the excess material shall be trimmed so as to leave an edge having a uniform thickness. The excess material shall be discarded; it shall not be spread across the surface course.

If the lanes are being constructed with two or more pavers in echelon, the loose depths of bituminous material from each paver shall match at the longitudinal joints.

F. Placing Cover Coat for Sand Asphalt Bituminous Mixture

Prior to rolling a sand asphalt mixture, the CONTRACTOR shall apply a uniform coating of dry precoated sand. The rate of application for the precoated sand shall be between 0.5 and 2 pounds per square yard,, as directed by the ENGINEER OF RECORD. The precoated sand shall be uniformly applied by a mechanical spreader. Spreaders which leave ridges or mounds of the precoated sand will not be permitted. In areas where the mixture is manually placed it shall receive its initial compaction using special compacting equipment before the precoated sand is applied. The precoated sand shall then be applied and the compaction shall be completed using approved methods.

G. Rolling and Compacting of Bituminous Mixtures

Each layer of bituminous mixture shall be compacted with approved rollers. At least two (2) rollers will be required when the mixture lay-down rate exceeds 800 square yards per hour.

Steel 3-wheel rollers may be used for initial compaction immediately following the paver.

The final rolling operation on each layer of bituminous mixture shall be accomplished by use of tandem steel-wheel rollers or by use of vibratory rollers operated in the static mode.

Roller wheels shall be kept properly moistened with water.

Pneumatic-tired rollers shall be operated in a competent manner and shall not mark or rut

the surface or displace the pavement edges. The pneumatic-tired roller shall be ballasted to obtain the required ground-contact pressures as directed by the ENGINEER OF RECORD. To obtain a uniformly textured mat and the desired pavement density, the ENGINEER OF RECORD may direct the CONTRACTOR to raise or lower tire pressures at any time during the rolling operations. The roller operations shall be conducted in such a manner as to prevent scuffing or chatter marks in the pavement surface. The number of passes made by the pneumatic-tired roller shall not be less than two (2) round trip passes over each area. Rolling of the mixture shall begin as soon after placing without undue displacement, picking up the mat, or cracking. Rolling shall start longitudinally at the extreme sides of the lanes and proceed toward the center of the pavement, overlapping on successive trips by at least 2 the width of the drive wheel of the roller. Alternate trips of the roller shall be of slightly different lengths. The maximum roller speed shall not exceed the manufacturers recommended speed for the type of mixture or thickness of layer being placed.

When compacting an adjoining lane, the longitudinal joint shall be rolled first with the roller supported mainly on the cold lane with only three (3) to six (6) inches of the roller extending onto the freshly placed bituminous material.

Finish rolling with pneumatic-tired rollers shall continue until all roller marks are eliminated.

Pneumatic-tired rollers will not be permitted on friction courses.

Areas too narrow to be rolled directly by standard 8-ton tandem rollers shall be compacted by self-propelled trench rollers of suitable width, approved by the ENGINEER OF RECORD, and weighing not less than 300 pounds per inch of width.

Skin patching on an area that has been rolled will not be permitted. Any mixture that becomes mixed with foreign material or is in any way defective shall be removed and replaced at the CONTRACTORS expense.

See Article 3.04 of this Section for compaction test.

H. Weather and Seasonal Limitations

Bituminous mixtures shall not be placed nor the prime coat or bond coat applied when rain is threatening or when the moisture on the existing surface would prevent satisfactory bonding.

I. Heating Bituminous Materials

Bituminous material which requires heating before application shall be heated in such a manner as to insure a uniform temperature throughout the entire mass with efficient and positive control at all times. It shall be heated to a temperature consistent with the type of material used and only to such temperature as will insure the necessary fluidity. Excessively high temperatures shall be avoided. A thermometer shall be provided to enable the ENGINEER OF RECORD to observe the temperature at any time. Any bituminous material which has been overheated will be rejected. Asphalt emulsion shall be circulated continuously when heated above atmospheric temperature so as to prevent it from separating.

The heating of asphalt emulsion to the required temperature for application shall be done entirely in the distributor unless a uniform temperature is maintained in the storage tank by means of a circulating heater. Any asphalt emulsion which has been damaged by continuous heating for too long a time or by alternate heating and cooling will be rejected.

J. Patching

Where patching is required on a bituminous surface or concrete surface because of small holes or pitted surface, the holes shall be cleaned of all dirt and foreign material.

The bituminous patching material shall be placed, struck off and compacted so that when completed, the patch shall be flush with the adjacent pavement. The compaction may be done with a hand tamper, vibratory compactor or roller.

When patching is required for repairing a cut in the pavement, made for the construction of underground structures and utilities, the granular backfill shall be compacted to not less than 95% of the maximum unit weight. An aggregate base material of not less than 12 inches compacted thickness, or a bituminous base of the specified thickness, shall be used.

The top of the base shall be 2 to 2-1/2 inches below the surface of the adjacent pavement. Bituminous patching material shall be placed and compacted. The surface of the bituminous patch shall be smooth and shall not vary more than 1/4 inch from the crown and grade of the adjacent pavement. Any variations over 1/4 inch from the established grade shall be corrected as directed by the ENGINEER OF RECORD

K. Seal Coating

Seal coating shall consist of one (1) or more applications of bituminous material applied to the prepared surface and one (1) or more coverings of coarse or fine aggregate applied to the bituminous material.

The bituminous materials and the aggregate to be used will be specified. The bituminous material specified for surface coat shall be uniformly applied by means of the pressure distributor in the number of applications provided and in the amount per square yard directed by the ENGINEER OF RECORD. Each application of bituminous material shall cure sufficiently to prevent displacement or pickup by traffic or construction equipment before a succeeding application of bituminous material is made.

Following the application of surface coat bituminous material, the cover material shall be uniformly spread over the surface by means of approved mechanical spreaders, in the amount per square yard as specified. or as directed by the ENGINEER OF RECORD. Truck wheels shall ride on spread cover material and not on bituminous material.

Any irregularities or deficiencies in the uniformity of the cover aggregate on the surface shall be corrected by hand spreading and dragging.

Following the spreading of each course of cover material, the surface shall be rolled by means of approved rollers.

Rolling shall immediately follow the placing of cover material before the bituminous material has set. At no time shall there be more than 300 feet of unrolled cover material. No cover material shall be left unrolled for more than five (5) minutes.

Sufficient rolling shall be done to embed the cover material in the bituminous material without crushing the aggregate.

For areas deficient in cover material after completion of the surface treatment, additional cover material shall be added. For areas with excessive cover material, the excess cover material shall be removed before the next seal is applied. The adding and removing of cover materials shall be executed at the direction of the ENGINEER OF RECORD.

The final application of cover material shall be swept with a power broom.

The completed surface shall be maintained with a drag, broom or other approved equipment to keep the material well distributed on the road until all cover material possible has been embedded in the bituminous material. The length of time required for this maintenance will be from two (2) to five (5) days, as directed by the ENGINEER OF RECORD, depending on the weather and the materials used.

L. Bituminous Aggregate Base Course Stabilized in Place

Stabilizing of a bituminous aggregate base course, in place, shall consist of scarifying, pulverizing, crushing, adding new material, and shaping to the Plan grade for stabilizing with bituminous material, and shall include shaping, rolling, and compacting the stabilized aggregate to the proper elevation and slope.

The additional materials required shall be furnished at the CONTRACTORS expense.

The bituminous materials and the aggregates to be used shall be specified on the Plans.

1. Materials

The bituminous materials used in base course stabilization shall meet the requirements specified in Article 2.02, Mixes, of this Section, and as specified in FDOT, Section 160.

The rate of application of the bituminous material shall be determined by the ENGINEER OF RECORD, with the residual bitumen added being between two (2) percent and five (5) percent by weight of the bituminous mixture.

Additional aggregate, if required by the ENGINEER OF RECORD, shall be as specified in FDOT, Section 914.

2. Scarifying and Pulverizing

The material shall be scarified and uniformly pulverized to a maximum size of two (2) inches, except that five (5) percent of the material may be oversized, provided that the oversized material is not so large as to adversely affect the stability and structural integrity of the mixture nor hamper the shaping operations.

The material shall be scarified and uniformly pulverized, in one (1) or more passes, to the depth specified on the Plans. or as directed by the ENGINEER OF RECORD.

The maximum length or width of roadbed to be scarified and pulverized at any one (1) time shall be specified on the Plans or as directed by the ENGINEER OF RECORD.

3. Grading

The crushed material shall be rough graded to within 3/4 of an inch of the grades and cross sections called for on the Plans or as directed by the ENGINEER OF RECORD. Excessive materials shall be removed and disposed of at the CONTRACTORS expense. Additional aggregate shall be placed, if necessary, to attain the required cross sections.

After the material has been balanced, it shall be thoroughly mixed. In restrictive areas, the material to be mixed may be bladed into a windrow to provide working room for the mixer.

4. Mixing with Bituminous Materials

Prior to adding the bituminous material, the moisture content of the pulverized material shall be adjusted by aerating or adding water, or as directed by the ENGINEER OF RECORD.

The bituminous material shall be added only to that material which can be completely mixed, aerated, dried, and compacted in one (1) day, and shall be added through the mixer at the rate and within the temperature range directed by the ENGINEER OF RECORD.

The aggregate-bituminous mixture shall be bladed into a windrow and mixed with the mixer, the operation proceeding from one (1) side of the Work area to the other until the mixture presents a uniform composition.

Windrowing will not be required where asphalt cement is used, nor for shoulder stabilization, unless directed otherwise by the ENGINEER OF RECORD.

5. Mixture Aeration

Aeration of asphalt emulsion mixtures shall continue until the mixture is dried to the moisture content approved by the ENGINEER OF RECORD, within the range of two (2) percent to five (5) percent, based on dry weight.

6. Shaping, Rolling, and Compacting

Rolling and compacting shall conform to paragraph 3.03.G. of this Section unless otherwise specified on the Plans or as directed by the ENGINEER OF RECORD.

Mixing, shaping, and compacting shall be done while the bituminous material is in a workable state. When asphalt cement is used, final shaping and compaction shall be accomplished immediately after the addition of the bituminous material.

The mixed material shall be shaped and compacted in reasonably close conformity with the lines, grades, and cross sections shown on the Plans or as established by the ENGINEER OF RECORD.

Stabilized material trimmed from the grade shall be used adjacent to the shoulder to complete the cross section as shown on the Plans. Excess material shall be removed and disposed of by the CONTRACTOR at his expense.

Rolling shall be done with a pneumatic-tired roller or by a means approved by the ENGINEER OF RECORD.

The aggregate-bituminous mixture shall be compacted to not less than 98% of the unit weight obtained by the AASHTO T 180 test method. The test shall be made on the aggregate-bituminous mixture at the field moisture content existing during the compacting operation. Required density shall be maintained until the material has been surfaced.

After final rolling, the ENGINEER OF RECORD will test the surface longitudinally using a 10-foot straightedge at selected locations. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall at no point exceed 3/4 inch except that where the Work consists of only stabilizing the shoulder area, the tolerance shall be 3/8 inch.

7. Curing

Prior to the placing of the surface, the OWNER AND/OR ENGINEER OF RECORD may require the base be opened to traffic. At the direction of the OWNER AND/OR ENGINEER OF RECORD, imperfections in the base shall be repaired by the CONTRACTOR at his expense.

8. Weather Limitation

Bituminous material shall not be applied to the grade or to the aggregate when rain is threatening or when the air temperature is lower than 55 degrees F.

M. Bituminous Concrete Curb – Not Used

N. Bituminous Approaches, Sidewalks, and Shoulders

This Work shall consist of constructing a bituminous surface pedestrian walkway as specified on the Plans, or as directed by the ENGINEER OF RECORD. The bituminous surface course shall be placed on a prepared foundation. All bituminous surface pedestrian walkways shall have vehicular load bearing capacity.

1. Materials

The bituminous materials used shall be as specified on the Plans. Materials acceptable for use are specified in Article 2.01, Materials, of this Section.

2. Mixtures

The specific materials to produce the bituminous approach mixture shall be combined in accordance with FDOT, Section 320.

3. Preparation of Foundation

The existing pavement or base course shall be prepared to receive the bituminous surface course as specified in Article 3.02, Preparation, of this Section.

4. Prime and Bond Coats

The bituminous prime and bond coats used shall meet the requirements specified in Article 2.01, Materials, and 3.03, Installation, of this Section, and as specified in FDOT, Section 300. Care shall be taken to prevent spreading of bituminous material on adjoining surfaces. At the direction of the ENGINEER OF RECORD, the prime coat may be omitted.

5. Placing Bituminous Mixture

The bituminous mixture shall be placed to the thickness specified on the Plans or as directed by the OWNER AND/OR ENGINEER OF RECORD. Placing the bituminous mixture shall conform to Article 3.03, Installation, of this Section.

O. Cleanup

The area adjacent to the new Work shall be backfilled with sound earth of topsoil quality.

The backfill shall be compacted, leveled and left in a neat, workmanlike condition.

P. Opening Pavement to Traffic

The OWNER reserves the right to open the pavement to traffic at any time during the construction operation, with 48-hour notice on non scheduled events.

3.04 Field Quality Control

A. Testing

During the course of the Work, testing will be required for mix designs, aggregate gradation, and physical properties, bitumen content, compaction or density, and thickness of material. The testing and coring required shall be performed by the CONTRACTOR'S testing laboratory approved by the OWNER AND/OR ENGINEER OF RECORD. The cost for testing and coring shall be at the expense of the CONTRACTOR. The testing laboratory shall furnish the OWNER WITH (2) COPIES.

The ENGINEER OF RECORD shall prepare a field report describing paving and grading activities when a new activity is started or as required in the specifications Section.

Testing procedures shall conform to current FDOT Standards for Construction.

1. Bituminous Materials

Testing of asphalt cements, liquid asphalts, asphalt emulsions, tars shall conform to FDOT, Section 331.

2. Density

Rolling shall proceed until the required compaction is attained and the amount of rolling required based on the use of a nuclear gage or on using a specified minimum number of rollers. When the total tonnage for the Project is in excess of 1,000 tons, or as directed by the ENGINEER OF RECORD, the nuclear gage method will be used to govern the compactive requirements.

a. Nuclear Gage Method

By use of a modified Marshall Test, the control density for the bituminous mixture to be placed will be determined.

During the CONTRACTORS start-up operations, a rolling procedure to attain the control density will be established. The rolling procedure will be based on the number and type of rollers used and the rolling pattern. The goal of the compactive effort will be to establish a rolling procedure which will achieve 100% of the control density but in any case, the density achieved shall not be less than 95% of the control density. Density values less than 98% will be sufficient cause for the Testing Agency or ENGINEER OF RECORD to require an adjustment in the number or type of rollers being used or in the rolling pattern.

Once the procedure has been established on the start-up section, the procedure shall be used for the remainder of the mixture to be placed, unless subsequent tests indicate a need to change the number of rollers or the rolling pattern.

If difficulties are encountered or if there is a significant change in aggregate or bitumen content, the ENGINEER OF RECORD will determine the control density for the new mixture and require the CONTRACTOR to again establish the number and type of rollers and the rolling pattern required on the new mixture to attain the

control density. The compactive procedures thus determined shall be used when placing the remainder of that mixture.

Density checks will be made at the discretion of the OWNER's REPRESENTATIVE to determine if the compactive procedure being used is achieving the required density, or if a change in procedure is necessary.

Each layer of bituminous mixture shall be compacted to at least 95% of the control density, using the established procedure.

B. Price Adjustments

1. Asphalt Cement

Samples of asphalt cement will be taken prior to incorporation into the mixture and from the bituminous mixture. Where results of tests on these samples deviate from specification requirements, the affected material will be subject to price adjustments on the following basis:

a. Tests on Asphalt Taken Prior to Incorporating Into the Mixture

When the penetration test results for penetration-graded asphalts, or the viscosity test results conducted at 60 degrees C on viscosity-graded asphalts, deviate from the limits specified in FDOT, Section 916, Bituminous Materials, by ten (10) percent or more, the mixture produced will be evaluated by the Testing Agency and if in the judgment of the ENGINEER OF RECORD or the OWNER the defective pavement warrants removal, the CONTRACTOR shall remove and replace the affected area at his expense. If it is determined that the removal is not required, the Contract unit price of the affected mixture will be reduced by ten (10) percent.

2. Bituminous Materials Other Than Asphalt Cement

a. Viscosity, Penetration, and Ductility Requirements

When the bituminous material in the bituminous mixture deviates by ten (10) percent or more from the requirements for viscosity, penetration, and ductility specified in FDOT, Section 916, Bituminous Materials. The ENGINEER OF RECORD will evaluate the constructed product in which the bituminous material is used. If in the judgment of the ENGINEER OF RECORD removal is required, the removal and replacement will be at the expense of the CONTRACTOR. If the ENGINEER OF RECORD determines the constructed product can remain, the Contract unit price of the bituminous mixture will be decreased by ten (10) percent.

END OF SECTION

SECTION 32 1133 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes both plain and reinforced Portland cement concrete paving complete with concrete material admixtures, joints, forms, equipment requirements, field quality control and appurtenances required to complete the Portland cement concrete paving Work indicated on the Plans.

Provide 4-inch thick 3,000 PSI concrete at exclusively pedestrian sidewalk areas.

- B. Related Work Specified Elsewhere

1. Earthwork for Paving: Section 31 2216
2. Base Courses: Section 32 1100

1.3 QUALITY ASSURANCE

- A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications.

ASTM - American Society of Testing & Materials

AASHTO - American Association of State Highway and Transportation Officials

ACPA - American Concrete Paving Association

FDOT - Florida Department of Transportation

1.4 SUBMITTALS

- A. Reports

1. At the request of the OWNER OR the ENGINEER OF RECORD, the CONTRACTOR shall provide certification that the various materials to be used conform to the ASTM Standards referred in the Specifications.
2. The CONTRACTOR shall submit a list of his source of material supply to the OWNER OR the ENGINEER OF RECORD for approval prior to placing any order.
3. The CONTRACTOR shall provide the OWNER OR the ENGINEER OF RECORD, prior to the actual delivery of the ready mixed concrete, the mix design as required by paragraph 5.3.2 of ASTM C94.

B. Test Reports

1. Thicknesses and Compressive Strength

The testing lab shall provide the OWNER with (2) copies AND ENGINEER OF RECORD (1) copy of the test results of the thickness and compressive strength of the concrete. The core drilling, testing for thickness and compressive strength, shall be performed by the CONTRACTOR'S testing laboratory approved by the OWNER and/or the ENGINEER OF RECORD. Test results shall be signed and sealed by a Professional Engineer.

2. Water Quality

The testing lab shall provide the OWNER with (2) copies AND the ENGINEER OF RECORD (1) copy of with two (2) copies of the test results of the quality of water to be used in the concrete offsite. The sampling and testing of water quality shall be in accordance with AASHTO T-26 requirements and shall be performed by the CONTRACTOR'S testing laboratory approved by the OWNER and/or the ENGINEER OF RECORD. Test results shall be sealed by a Professional Engineer.

C. Request for Material Variance

All requests for variances in the materials, as specified, shall be made in writing to the OWNER and the ENGINEER OF RECORD. Two (2) copies of the request shall be submitted for the OWNER and the ENGINEER OF RECORD review and approval.

1.5 JOB CONDITIONS

A. Environmental Requirements

1. Temperature

Comply with the requirements for concrete installation due to outside ambient air temperatures specified under Article 3.03 of this Section.

B. Protection

1. Protection Against Rain

Comply with the requirements for protecting new Work against damage from rain, as specified under Article 3.03 of this Section.

2. Protection Against Cold Weather

Comply with the requirements for protecting new Work against damage from cold weather, as specified under Article 3.03 of this Section.

PART 2 - PRODUCTS

2.1 Materials

A. Cement

Cement shall be Portland cement conforming to ASTM C150, Type I, Type IS, or Type II as specified in FDOT, Section 921.

B. Fine Aggregates

The fine aggregate shall be silica sand meeting the requirements of FDOT, Sections 902-1 and 902-2 as applicable.

C. Coarse Aggregate

The coarse aggregate gradation shall conform to ASTM C33 and to coarse aggregate, 3M, 5 or 9, as specified in FDOT, Section 901.

D. Water

Water to be used for mixing and curing concrete shall be reasonably clean and free from oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product. Waters from sources approved by the Local Health Department as potable may be used without testing. Water requiring testing shall be tested in accordance with the current Method of Test for Quality of Water to be used in Concrete, AASHTO T-26, and specified in FDOT, Section 923.

E. Concrete Admixtures

1. Air-Entraining Admixtures

Air-entraining admixtures for concrete shall conform to ASTM C260 and as specified in FDOT, Section 924.

2. Concrete Accelerators

- a. Chemical admixtures, other than calcium chloride, for accelerating the set of Portland cement concrete shall conform to ASTM C494, Type C or Type E.
- b. Calcium chloride in flake or pellet form shall conform to ASTM D98, Grade A, Class I or Class II.

3. Water-Reducing and Water-Reducing Retarding Admixtures

Water-reducing admixtures and water-reducing retarding admixtures shall conform to the requirements as specified in FDOT, Section 924.

4. Pozzolanic Admixtures

Pozzolanic admixtures (fly ash) shall conform to ASTM C618, Type F, and as specified in FDOT, Section 345.

F. Concrete Curing Compounds

1. White Membrane Curing Compound

White membrane curing compound for curing concrete shall conform to AASHTO M148, Type II, and as specified in FDOT, Section 925.

2. Transparent Curing Compound for Base Course

Transparent membrane curing compound for curing base course concrete shall conform to AASHTO M148, Type I, and as specified in FDOT, Section 925.

G. Steel Reinforcement

1. Bar Reinforcement

Bar reinforcement for pavement tie bars and for bars for use as dowels for load transfer in pavement expansion joints and contract joints shall conform to Grade 60 of ASTM A615, and as specified in FDOT, Section 931.

2. Wire Reinforcement

Cold-drawn steel wire for concrete reinforcement used to support dowel bars shall conform to ASTM A82.

3. Mesh Reinforcement

Weld steel wire fabric for concrete mesh reinforcement shall conform to ASTM A185, and as specified in FDOT, Section 931, and shall be fabricated as shown on the Plans.

4. Bar Mat

Hard grade billet steel, hard grade axle steel or rail steel used in the fabrication of steel bar or rod mats for concrete reinforcement shall conform to ASTM A184. Steel bar or rod mats shall be fabricated as shown on the Plans.

H. Steel Hook Bolts

Hook bolts shall conform to ASTM A706, or Grade 60 of ASTM A615, A616, or A617. Hook bolts shall be 5/8 inch diameter. Along the edge of existing concrete, hook bolts with self drilling concrete anchors shall be used.

I. Joint Fillers

1. Pre-molded Joint Fillers

Pre-molded joint filler material shall be of the thickness as specified on the Plans and conforming to the requirements of FDOT, Section 932.

a. Fiber Joint Filler

Fiber joint filler material shall conform to ASTM D1751.

b. Bituminous Filler

Bituminous pre-molded joint filler material shall conform to ASTM D994 and AASHTO M33.

c. Polyethylene Filler

Polyethylene pre-molded joint filler shall be a flexible, low density, expanded, extruded polyethylene plank. The polyethylene plank shall be formed by the expansion of polyethylene base resin in an extrusion process and shall be homogeneous, closed cell and multi-cellular.

2. Hot-Poured Joint Sealants

Hot-poured type joint sealant shall conform to ASTM D3405 or D3406 and as specified in FDOT, Section 932.

3. Cold-Applied Joint Sealants

Cold-applied, single component type, joint sealant shall conform to ASTM D1850.

J. Coatings for Dowel Bars

Coatings for dowel bars shall conform to the materials as specified in FDOT, Section 350-12.4.

2.2 MIXES

A. Concrete Mix

Concrete shall contain a minimum of 5.5 sacks, 94 pounds per sack, of cement per cubic yard and shall yield a minimum compressive strength of 3,000 psi when cured in a moist room at a temperature within a range of 65 degrees to 75 degrees F for a period of 28 days.

Cement shall be Portland cement ASTM C150, Type I, Type IS, or Type II. If high-early strength concrete is desired, Type III is required.

High-early strength concrete can be obtained by the addition of 1-sack of cement, Type I, per cubic yard of concrete.

The air content of the concrete shall be from three (3) to six (6) percent. The slump of the concrete shall be between 0 and 3-1/2 inches where machine methods are used for striking off and consolidating the concrete. If the ENGINEER OF RECORD permits hand finishing, the slump may be increased to six (6) inches.

Ready-mixed concrete shall be in accordance with ASTM C94, Alternate 2, and shall yield a minimum compressive strength of 3,000 psi when cured in a moist room at a temperature within a range of 65 degrees to 75 degrees F for a period of 28 days. The ENGINEER OF RECORD shall be provided with the mix design for review and approval, prior to the actual delivery of the concrete. Ready-mixed concrete will be certified in accordance with FDOT, Section 345-3.

PART 3 - EXECUTION

3.1 CONTRACTOR'S VERIFICATION

A. Excavation and Forming

Prior to the installation of any concrete, examine the excavation and forms for the grades, lines, and levels required to receive the new Work. Ascertain that all excavation and compacted sub-grades are adequate to receive the concrete to be installed.

Correct all defects and deficiencies before proceeding with the Work.

B. Sub-grade Conditions

Prior to the installing of any concrete, examine the sub-grade to ascertain that it is adequate to receive the concrete to be installed. If the sub-grade remains wet after all surface water has been removed by dewatering, the ENGINEER OF RECORD will require the installation

of underdrain.

C. Existing Improvements

Investigate and verify location of existing improvements, including structures, to which the new Work is to be connected. Make necessary adjustments in line and grade to align the new Work with the existing improvements after approval by the ENGINEER OF RECORD.

3.2 PREPARATION

A. Forms

The forms shall be of metal, straight and free from warp, clean and of sufficient strength to resist springing during the process of depositing concrete against them.

The forms shall be the full depth of the concrete.

B. Batch Plant

An adequate site for the batch plant shall be obtained by the CONTRACTOR, at his expense. The site shall be maintained, and the plant operated in accordance with the conditions and requirements established by the community in which the plant is located.

C. Fine Grading

The sub-grade shall be fine graded to the cross section shown on the Plans and shall be thoroughly compacted prior to the placing of forms or concrete.

3.3 INSTALLATION

A. General

1. The width, thickness, and type of concrete pavement shall be specified on the Plans. or as directed by the ENGINEER OF RECORD.
2. The operation to construct the new Work shall be restricted to the existing right-of-way. If additional area is required, the CONTRACTOR shall furnish the OWNER with written permission from the property OWNER for any part of the operation he conducts outside the established right-of-way.
3. The CONTRACTOR shall maintain traffic access at all intersections. Vehicle access shall also be maintained to all commercial and public properties and elsewhere as designated by the OWNER.

B. Equipment Requirements

The CONTRACTOR shall furnish sufficient equipment for the placing of concrete pavement. The equipment shall be on the job site and ready for normal operation before the paving operation is started. All equipment shall be in good working order. The equipment shall be subject to inspections and testing during construction.

The equipment shall be of sufficient capacity that the paver can operate continuously and obtain a rate of production that insures good workmanship and eliminates overloading of equipment or frequent interruptions or delays.

Equipment operating on or near the pavement shall be equipped with rubber-tired wheels.

1. Forms

Except when paving with a slip-form paver, forms shall be used and shall be made of metal, having an approved section, which shall insure their rigidity under impact, thrust and weight of the heaviest machine carried on them. The thickness of the metal shall be not less than 1/4 of an inch, except that a minimum thickness of 3/16 of an inch will be permitted if the form is a trapezoidal cross section.

Forms shall have a minimum length of ten (10) feet and a depth not less than the edge thickness of the Work prescribed, except as hereinafter specified for pavement with integral curb. The width of the base in direct bearing on the soil shall be not less than 0.75 of the form depth except that a width of less than eight (8) inches will not be permitted.

Forms which do not meet the required edge thickness of pavements having integral curb may be increased in depth a maximum of six (6) inches by the addition of continuous wooden planking rigidly connected to the metal form, whose base width is not less than eight (8) inches, with a minimum of five (5) equally spaced bolts. The sub-grade may be a maximum of 1-inch lower than the bottom of the built-up forms. The width of the wooden base shall be equal to or greater than the base width of the metal form, except that a nominal depth and width of less than 2" x 10" will not be permitted for the final plank in direct bearing on the soil. The wooden planking shall be sound, capable of carrying the loads imposed and shall be approved by the ENGINEER OF RECORD prior to fastening to the metal form.

When such built-up forms do not provide the necessary stability against movement along their vertical face they shall be replaced with forms capable of sustaining the loads imposed thereon.

Each 10-foot section of form shall have at least three (3) stake pockets. The forms shall be straight, free from distortion, and shall show no vertical variation greater than 1/8 of an inch in 10-foot lengths from the true plane surface on the top of the form when tested with a 10-foot straightedge and shall show no lateral variation greater than 1/4 of an inch from the true plane surface on the vertical face of the form when tested with a 10-foot straightedge.

Approved flexible forms and hand finishing will be required on all pavements where the radius for the edge of the pavement is less than 200 feet.

The method of connection between form sections shall be such that a locked joint is formed free from vertical movement in excess of 1/8 of an inch and from horizontal movement in excess of 1/4 of an inch under the impact, thrust and weight of the heaviest machine carried on the forms.

Sufficient forms shall be provided so that it will not be necessary to remove them in less than 12 hours, or longer if required, after the concrete has been placed.

2. Sub-grade Roller or Compactor

This equipment shall be self-propelled steel-wheeled or a pneumatic-tired roller weighing not less than eight (8) tons or a self-propelled vibratory compactor of adequate size to compact the sub-grade to the required density.

3. Form Grader

The form grader shall be capable of shaping the base for the forms to the proper

elevation and for a width of not less than 1-foot.

A form grader is not required for construction of residential street concrete pavement.

4. Sub-grade Planer

A steel-shod sub-grade planer supported by two (2) flanged wheels resting on the side forms shall be provided for use immediately in advance of placing concrete on the sub-grade. The steel shod template shall be adjustable to fit the shape of the bottom of the pavement and shall have adequate connection to a rigid frame to maintain the crown. The planer shall be of sufficient weight to plane off all high spots encountered.

5. Base Trimmer

For slip-form construction, a base trimmer will be required. This base trimmer shall be capable of trimming the base to the required cross section.

6. Metal or Wooden Track

Metal or wooden track or duckboards capable of supporting the hauling equipment without rutting the sub-grade shall be provided in sufficient quantity to properly protect the sub-grade.

7. Water Supply Equipment

The pumps and pipe lines shall be of such capacity and nature as to insure an ample supply and adequate pressure of water, simultaneously, for all the requirements of machinery, mixing, sprinkling sub-grade, and all other requirements of the Work. Water may be supplied in tank wagons to augment inadequate pipe lines or to replace them entirely if a sufficient number of units are employed.

8. Finishing Machine

The finishing machine shall be power driven and of an approved type which will strike-off and compact the concrete with a screeding and troweling action. The machine shall be capable of finishing the concrete in the manner specified herein, and shall provide a minimum of two (2) oscillating screeds.

For construction of residential street concrete pavement a modified finishing machine with less than two (2) oscillating screeds may be used, provided that the concrete is struck off and consolidated with results which, in the opinion of the ENGINEER OF RECORD, are comparable to results obtained with a 2-screed finishing machine. Production shall be limited to 250 feet or less of 2-lane pavement per hour of continuous operation.

9. Concrete Spreader

An approved concrete spreader with a strike-off board or a separate strike-off shall be used to level each layer of concrete, before placing of reinforcement, and before finishing the concrete. It shall have sufficient weight and rigidity to retain its shape under working conditions to properly strike off the concrete.

A concrete spreader is not required for the construction of residential street concrete pavement.

10. Vibratory Screed

An approved hand-propelled vibratory screed shall be provided for use in gapped areas at driveways and intersections, where machine methods are not feasible to screed and consolidate the concrete. Gaps finished by this method shall be limited to one joint spacing in length and one (1) single lane width. The screed shall consist of a steel-shod strike board having a minimum thickness of two (2) inches and equipped with a gasoline engine capable of producing at least 5,000 vibrations per minute. Other vibratory screeds may be approved by the ENGINEER OF RECORD

11. Membrane Sprayer

A mechanically pumped pressure sprayer capable of applying a continuous uniform film of curing compound will be required. The equipment shall provide adequate stirring of the compound during application.

12. Slip-Form Paving Equipment

When pavement is placed by the slip-form method, the slip-form paving equipment shall spread, consolidate, screed, and mechanically float the freshly-placed concrete in such a manner that only a minimum of hand finishing will be necessary to provide a dense and homogeneous pavement. The machine shall be equipped to vibrate the concrete for the full width and depth of the pavement being placed.

13. Floats

The mechanical float shall be a combination float finisher. Where a mechanical float is an integral part of a slip-form paver, a separate mechanical float will not be required.

A float finisher shall consist of a machine having two (2) screeds and be equipped with a suspended pan float. The second screed and the pan float shall be suspended in such a manner that they operate independently of the side forms.

A mechanical float will not be required for the construction of residential street concrete pavement.

14. Hand Strike Board

An approved steel-shod strike board with suitable handles for its operation shall be provided for use in areas where it is not feasible to use either a finishing machine or a vibratory screed.

15. Bulkheads

Bulkheads for construction joints shall be of lumber not less than two (2) inches nominal thickness, shaped to conform to the cross section of the pavement, and so designed as to permit dowel bars of a load transfer device, or tie bars, when required, to extend through the joint. Slots shall be cut in the header so it can be adjusted up or down as required.

16. Footbridge

A movable bridge shall be provided to satisfactorily finish the pavement. The bridge shall be designed and constructed so that it will not come in contact with the concrete.

17. Transverse Float

This float shall be made of metal and shall be at least ten (10) feet in length and of the box or channel type with a floating face at least six (6) inches in width. It shall be constructed so as to be light in weight, rigid and free from warps.

18. Vibrator

The vibrator for consolidating the concrete along the faces of the forms and adjacent to joints shall be an approved electric or mechanical vibrator of an internal type, not less than two (2) inches in diameter. It shall have a minimum frequency of 5,000 vibrations per minute for a tube two (2) inches in diameter, 3,600 vibrations per minute for a tube four (4) inches in diameter, or a proportionate frequency of an intermediate size. A minimum of 7,000 vibrations per minute is required for speed vibrators. At least two (2) vibrators shall be provided for each concrete paving unit on the project. The vibrators used adjacent to the forms in conventional paving shall be connected with the equipment on which they are mounted such that vibration of the concrete will start automatically with the forward movement of the equipment and stop automatically whenever forward movement stops.

19. Form Tamper

A mechanical form tamper of approved design will be required on all projects. It shall be capable of thoroughly and uniformly compacting the soil under the forms.

20. Strike-Off for Reinforcement

An approved strike-off shall be used to level the concrete before placing the pavement reinforcement. It shall be adjustable and shall be supported by two (2) flanged wheels on each end which rest on the side forms. It shall have sufficient weight and rigidity to retain its shape under working conditions and properly strike off the concrete. An approved hand strike-off resting on the forms shall be used for irregular areas. The strike-off may be a part of the concrete spreader or a finishing machine.

21. Lane Tie Bar Installer

When not placed on approved chairs, lane tie bars shall be installed by use of an approved mechanical device.

22. Reinforcement Carrier

Reinforcement not placed on chairs shall be transferred from the hauling equipment to a movable bridge which spans the pavement being cast or placed by other approved means which will not result in contamination of the concrete. The bridge shall be capable of carrying the reinforcement load without appreciably deflecting the forms.

23. Joint Filling and Sealing Equipment

The equipment for filling and sealing joints shall be available for inspection and testing at least 48 hours prior to its use.

The heating kettle shall be of the indirect-heating or double boiler type, using oil as the heat transfer medium. It shall have a thermostatically controlled heat source, a built-in automatic agitator, and thermometers installed to indicate both the temperature of the melted sealing material and that of the oil bath. The CONTRACTOR shall demonstrate that the equipment proposed for use will consistently produce a joint sealer of proper pouring consistency.

The hot-poured sealing materials shall be poured at the required temperature for application by the use of a separate pouring pot or from the heating kettle. The pouring equipment shall force the sealing material to the bottom of the joint and completely fill it to the surface of the pavement. The pouring equipment shall be able to make a second application of the sealing material after the first application has cooled and settled below the surface of the pavement.

The rate of application shall be controlled so as to completely fill the joint and not spill the material on the surface of the pavement.

The hot-poured sealing material shall be applied directly from the heating kettle; the kettle shall be equipped with a pressure pump, hose and nozzle suitable for forcing the sealing material to the bottom of the joint and completely filling the joint. The hose and nozzle shall maintain the temperature of the sealing materials so that the loss in temperature is not over ten (10) degrees F between the nozzle and the heating tank. Heat from a direct flame on the nozzle shall not be used to maintain the proper temperature of the sealing material. The heating equipment shall be mounted on rubber-tired wheels, and only rubber-tired equipment shall be used to move the heating equipment on the pavement.

24. Preformed Neoprene Joint Sealing Equipment

Equipment for applying the lubricant and installing the preformed joint seal may be either power or hand operated equipment suitable for installing the joint seal as recommended by the manufacturer.

25. Sandblasting Equipment or Power Wire Brush

Sandblasting equipment shall be of proper size and capacity to obtain the cleaning specified and shall operate at a nozzle pressure adequate for the performance of the Work. Nozzles shall be of proper diameter in relation to the width of joint and shall be replaced as necessary due to enlargement by wear.

A power wire brush may be used in place of sandblasting equipment.

26. Compressors

Air compressors shall be portable and capable of furnishing sufficient air to maintain a nozzle pressure adequate to remove all loose fragments of concrete and foreign material from the joints. Suitable traps shall be employed to maintain the compressed air free of oil and moisture.

27. Power Broom

A mechanical broom with pickup suitable for cleaning the pavement will be required.

28. Concrete Saw

Two (2) self-propelled concrete saws which are adequately powered to cut hardened concrete to a minimum depth as shown on the Plans will be required. The minimum thickness of the saw blade shall be 3/16 of an inch. Saws shall be equipped with suitable guards.

29. Miscellaneous Equipment

All other small tools to completely and satisfactorily finish the Work, including straight-edges for testing pavement and forms, shall be provided by the CONTRACTOR.

C. Placement of Forms

Forms shall be placed and checked for line and grade at least 500 feet in advance of placing concrete.

Forms shall be adequately staked and braced to resist the pressure of concrete and the thrust of the equipment.

Forms shall have uniform bearing on the sub-grade throughout their entire length and width.

After setting the forms to grade, thoroughly tamp both the inside and outside with an approved mechanical form tamper.

Forms shall be thoroughly cleaned before they are placed.

Forms shall be neatly and tightly joined, and shall be securely staked by at least three (3) stakes per form.

Forms shall be oiled before concrete is placed against them.

Forms shall be checked for line and grade, after being set.

Forms showing a variance from the staked line by more than 1/4 inch or from the staked grade by more than 1/8 inch in ten (10) feet shall be adjusted.

Where the use of flexible forms are required, sufficient back bracing shall be provided to prevent undue deflection of the forms during placement of the concrete.

D. Placing Concrete

Placing of concrete should not commence or continue until the condition of the sub-grade has been approved by the ENGINEER OF RECORD. The concrete shall be spread or distributed as soon as placed. If a mechanical spreader is not used, the concrete shall be deposited in a manner that requires a minimum of rehandling to avoid segregation and separation of materials. The concrete shall be deposited to a height sufficiently above grade so that when consolidated and finished it shall conform to the required finished grades.

Concrete along the faces of forms and adjacent to joints shall be consolidated and compacted to fill all voids.

Forms shall not be vibrated to consolidate the concrete.

When the pavement is placed in two layers, the first layer may be cast three (3) to six (6) inches narrower on each side than the proposed pavement slab, so that the full depth of pavement, at the edges, will be cast with the second layer. The equipment shall vibrate concrete placed full depth for the complete width and depth of the pavement being placed. For concrete placed in two (2) layers, only the second layer will be required to be vibrated.

The placing of concrete shall be continuous as much as possible between transverse joints.

Whenever a temporary halt in operation occurs, the concrete and unfinished end of the slab shall be covered with wet burlap or plastic.

If the interruption of Work continues for more than 20 minutes, a construction joint shall be placed, provided the proposed construction joint is 15 feet or more from the last joint for

reinforced pavement and at least ten (10) feet or more from the last joint in plain concrete pavement. Sections of pavement shorter in lengths will not be permitted and, if constructed, shall be removed and replaced at the CONTRACTORS expense.

Integral curbs, where specified or required, shall be constructed monolithic with the pavement slab. The curb material shall be placed before the pavement has started its initial set and shall be of the same mix as the concrete pavement.

Base and back forms will be required when constructing straight curbs, and back forms with templates of the required curb shape shall be used when constructing rolled and mountable curbs. The curb concrete shall be spaded sufficiently to eliminate all voids and tamped to bring the mortar to the surface, after which the curb shall be given a final finish to match the texture of the pavement.

After removing forms, any visible areas of honeycomb or minor defects shall be immediately filled with mortar, having 1-part of Portland cement and two (2) parts fine aggregate, and shall be applied with a wooden float.

Where adjacent pavement lanes are constructed in separate pours, no equipment shall be operated upon recently placed concrete until the pavement has attained at least 85% of the design strength as determined by testing cores taken from the project, or until the pavement is 14 days old, at the option of the ENGINEER OF RECORD.

Any equipment wheels operating on the pavement shall operate at least 1-foot from the edge of the pavement. The equipment wheels shall be rubber-tired.

The paver shall not be permitted on the new slab until the pavement has attained full design strength. The paver shall not operate on any new slab without using wood mats having an approved thickness and width to insure that the pavement will not be marked or structurally damaged.

Pavers are not permitted to operate on residential streets.

If the curing compound is damaged, it shall be repaired by spraying additional curing compound on the damaged areas as soon as the Work is completed.

The filler strip on pavement widening projects shall be poured as soon as possible but not later than the first working day following the placing of the slab.

At all intersections and where access is required to property along the Project, construction shall be completed by gapping the proposed pavement, as directed by the ENGINEER OF RECORD. Load transfer contraction of end-of-pour joint devices shall be placed at the gapped ends of the pavement.

In lieu of pavement gapping, the CONTRACTOR may elect to place a temporary bridge, of an acceptable design approved by the ENGINEER OF RECORD, to provide access. Furnishing, placing, maintaining and removing the bridge shall be at the CONTRACTORS expense.

E. Placing Pavement Reinforcing

Where reinforcement is required, the sheets or mats shall be placed at the depth below the surface of the finished pavement, as shown on the Plans.

Pavement reinforcement shall be shipped and delivered to the Work in flat sheets or mats.

Adjacent sheets or mats shall be lapped, as indicated on the Plans, and shall be fastened to each other in no less than two (2) places in each pavement lane.

Where the width of pavement varies, the reinforcement requirements shall be the same as called for on the Plans. Split sheets or mats may be used to conform to the particular pavement configuration. Side laps shall not be less than the spacing of the longitudinal wires or bars.

On widening Projects where the pavement slab is less than six (6) feet in width, 2 inch diameter longitudinal reinforcing bars may be substituted for standard reinforcement, providing the bars are spaced not more than 12 inches center to center. The first bar shall be not more than three (3) inches from the edges of the widened slab, and the bars shall be lapped a minimum of 12 inches.

Reinforcement shall be installed by one of the following methods:

1. Chair Mounted Method

Chairs upon which reinforcement is to be mounted shall support the reinforcement and shall have such bearing on the base that there will be no undue penetration of the base. The maximum spacing of the chairs shall be sufficient to maintain the reinforcement at the specified depth. The reinforcement shall be placed directly from the hauling unit unto the chairs.

2. Two-Layer Method

When reinforcement is placed between two (2) layers of concrete, the first layer shall be mechanically spread and struck off to the required depth below the proposed finished surface for the entire width of pavement being placed. The reinforcement shall be placed directly from the carrier onto the struck off concrete.

Any area where the use of the mechanical spreader or mechanical strike-off is not feasible, the reinforcement shall be mounted on chairs.

All projects shall be bid on the basis of the chair-mounted method. Other methods of installing reinforcement may be permitted upon written authorization of the ENGINEER OF RECORD

F. Joints

All longitudinal and transverse joints shall conform to the details and shall be constructed at the locations shown on the Plans or as directed by the ENGINEER OF RECORD.

All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement.

Transverse joints shall be constructed at right angles to the centerline of the pavement, unless otherwise called for on the Plans or as directed by the ENGINEER OF RECORD. The joints shall not vary more than 1/4 of an inch from a true line.

The surface of the pavement adjacent to all joints shall be finished to a true surface. Where indicated on the Plans, joints shall be edged to the radius shown or a minimum 1/4-inch radius. The surface across the joints shall be tested with a 10-foot straightedge as the joints are finished and any irregularities shall be corrected before the concrete has hardened.

When pavement is laid in partial width slabs, transverse joints in the succeeding slabs shall be placed in line with the like joints of the first slab. In the case of widening existing pavements, transverse joints shall be placed as shown on the Plans, or as directed by the ENGINEER OF RECORD

Keyways, where required, shall be accurately formed with templates of metal, wood, or paper securely pinned in place. The gauge or thickness of the material in the templates shall be such that the full keyway, as specified, is formed in the correct location.

1. Longitudinal Joints

Longitudinal joints shall be sawed, longitudinal lane tie joint with tie bars or bulkhead construction joints with hook bolts. Where called for on the Plans, or as directed by the ENGINEER OF RECORD, a keyway shall be constructed in the bulkhead construction joint.

a. Longitudinal Lane Tie Joints with Tie Bars

Longitudinal lane tie joints with tie bars shall be planes of weakness formed by sawing a groove in the hardened concrete according to the alignment, width and depth shown on the Plans.

Tie bars of the type, diameter and length called for on the Plans shall be placed at the required depth parallel to the finished surface, at right angles to the joint and at the uniform spacing also called for on the Plans or as directed by the ENGINEER OF RECORD.

Bar chairs shall be used to support the lane tie bars or the lane tie bars may be installed by use of a mechanical device approved by the ENGINEER OF RECORD

The placing of lane tie bars in the concrete by hand methods will not be permitted.

The joint shall be sawed as soon as the concrete will not spall or at least three (3) days after placement, and shall be completed before traffic of any kind uses the pavement. Immediately following the sawing of the joint, the slurry resulting from the sawing operation shall be completely removed from the joint and the immediate area by flushing with a jet of water under pressure. The joint shall be blown out with a jet of compressed air to remove the flushing water. After the joint is dry it shall be cleaned out with a jet of compressed air with a working pressure of at least 90 psi and then shall be sealed with an application of an approved rubber-asphalt type compound. The sealing compound shall be applied with approved pressure type equipment with the nozzle extending into the groove and the groove shall be filled until the sealer overlaps the pavement about 1/8 of an inch.

b. Longitudinal Bulkhead Construction Joints with Hook Bolts

Longitudinal bulkhead construction joints with hook bolts shall be used in part-width construction of concrete pavement and elsewhere as shown on the Plans or as directed by the ENGINEER OF RECORD. The size, spacing and depth of the hook bolts below the surface of the pavement shall be as shown on the Plans.

For slip-form paving, lane ties of an approved type may be substituted for hook bolts and shall be spaced at 30-inch centers, unless otherwise indicated on the

Plans. Lane ties for slip-form paving shall be placed in the concrete with a pneumatic powered installer or equipment producing equal results. Lane ties, which are not set with adequate consolidation of the concrete or are not within 30 degrees of being perpendicular to the pavement edge in a horizontal plane, shall be replaced with drilled in expansion anchored lane ties.

Where a bulkhead joint is to be constructed, hook bolts and couplings shall be attached to the forms and shall be held in position during the placing and finishing of the concrete so as to permit the removal of the pavement forms without damage to the concrete or hook bolt assembly. The ends of the couplings shall be protected so that the concrete, dirt or other materials cannot enter the couplings and prevent a satisfactory connection with either hook bolt.

Where hook bolts or lane ties are installed for use in future pavement widening, in curb or curb and gutter construction, a rust preventive oil shall be inserted into the open end of the couplings immediately after removal of the pavement forms by means of a hand operated pump in sufficient quantity to completely cover the internal threads. After application of the protective oil, neoprene or plastic plugs shall be inserted into the ends of the couplings to completely seal the opening without protruding outside of the couplings more than 3/8 inch.

The concrete shall be edged with a tool having the radius of curvature and depth of lip shown on the Plans. The second pour of concrete shall be edged with a longer lipped edging tool than that used on the first concrete pour.

After the concrete has cured for the required time, all extraneous material shall be removed from the joint and the joint then sealed with an approved hot poured or cold applied elastic type compound. The use of sandblasters and a jet of compressed air will be required to clean the joint before sealing.

2. Transverse Joints

Transverse joints shall be contraction joints, plane of weakness joints, dummy joints, expansion joints, construction joints, end of pour joints and pressure relief joints.

a. Contraction Joints

Contraction joints shall consist of a load transfer unit and a joint groove formed by sawing. Contraction joints shall be constructed as indicated on the Plans and shall be spaced a maximum of every 12' , or as provided for elsewhere.

The load transfer unit shall be plastic coated dowel bars, spaced and arranged in the positions indicated on the Plans, accurately held in place by an approved metal device so as to be perpendicular to the plane of the cross section of the pavement and parallel to the centerline at a distance from the surface equal to 2 the thickness of the slab.

This device shall consist of connected transverse and longitudinal members arranged to hold each dowel so firmly that its final position after concreting operations shall not vary more than 1/8 of an inch per foot of length from its designated line and grade. The device shall be such as will permit the joint to be completely assembled alongside the Work, and it shall be sufficiently rigid so that the joint can be lifted into place on the sub-grade as a unit.

One (1) end of each dowel bar shall be free to move in the slab as the concrete contracts and expands. To accomplish this, 2/3 the length of each dowel shall be

thoroughly lubricated with liquid asphalt or other approved lubricant. The liquid asphalt coating shall be applied to a sawed end of the dowel bar or, in the case of dowel bars with sheared ends, a metal cap shall be placed on the coated end of the dowel bar. The coating shall be sufficiently dry before using the dowels so that it will not be removed by handling and placing the dowels in the joint. The bars shall be installed so that the alternate bar on each side of the joint shall be the coated end of the bar.

b. Plane of Weakness Joint

This joint shall be placed in plain concrete pavements only and is to be constructed immediately after the finishing operation has been completed. A groove shall be formed in the plastic concrete with a metal forming bar to the depth indicated on the Plans. A pre-molded bituminous filler strip shall be placed in the groove formed by the metal bar, from a bridge operating on the pavement forms. The concrete shall then be floated against the sides of the filler, and the joint edged to a 1/8 inch radius.

c. Dummy Joint

This joint shall be placed in reinforced concrete payments only where called for on the Plans. It shall be constructed immediately after the finishing operation has been completed by forming a groove in the plastic concrete with a metal forming strip into which expanded polystyrene or other approved temporary filler is placed. The material shall be installed flush with the surface of the pavement and the area on both sides of the joint shall be finished. Transverse joints with a temporary filler shall not be edged. The pavement reinforcement shall be continuous through this joint.

d. Expansion Joints

This joint shall consist of a load transfer unit and pre-molded fiber filler, except that the pre-molded fiber filler without the load transfer unit shall be used for joints in concrete capping, end connections with structures or existing pavements, plain concrete pavements, and other places shown on the Plans where installation of the load transfer unit is not feasible.

The load transfer units shall be assembled and the plastic-coated bars lubricated with liquid asphalt or other approved lubricant. The liquid-asphalt-coated end of each bar shall be provided with a close fitting metal cap. The fiber filler shall extend the full depth and width of the joint. After installation, the top shall be not less than 2 inch and no more than 1-inch below the finished surface. It shall be furnished in lengths not less than the lane widths being poured. Where additional partial lengths are necessary, the minimum length of load transfer unit and pre-molded fiber filler shall be sufficient to span two (2) dowel bar spacings. Where more than one (1) section is allowed and used in a joint, the sections shall be securely joined together.

In curb lanes with integral curb, the fiber filler used in the pavement shall extend completely through the curb section. The fiber filler placed in the curb above the slab shall be 1 inch in width.

During installation, the joint shall be held in place by an approved installing device which shall be securely staked. The top edge of the filler shall be protected, while the concrete is being placed, by a metal channel cap of at least 10 gauge material having flanges not less than 12 inches in depth. The channel cap shall

be shaped to the proposed crown of the pavement and shall extend over the full length of the filler.

e. Pressure Relief Joint

The method of constructing a pressure relief joint shall be as indicated on the Plans.

The pressure relief joint material shall be flexible, low-density, expanded, extruded polyethylene plank. This joint material shall be cut off to 1/2 inch below the top of the pavement surface and shall extend entirely through and to within 1/2 inch of the face and top of the curb.

f. Construction and End-of-Pour Joints Reinforced Concrete Pavement.

Construction joints in reinforced pavement shall be formed by placing a bulkhead and installing a load transfer device, as specified for contraction joints, except that the ends of the dowel bars shall not be lubricated. The load transfer device shall be so installed that each dowel bar will be embedded in the concrete for 2 of its length. When the next pour is made, a space for hot-poured rubber joint filler shall be provided by placing temporary filler in the fresh concrete. End-of-pour joints shall be constructed using 2-piece dowels and a bulkhead and shall be placed where it is anticipated that three (3) days or more will elapse between the castings of adjacent pours.

Construction and end-of-pour joints shall be sealed as specified for transverse contraction joints.

g. Construction Joints, Plain Concrete Pavement

Construction joints in plain concrete pavements shall be formed by placing a bulkhead, fiber keyway, and installing 1/2 inch diameter deformed bars, 30 inches in length, at 18 inch intervals across the end of the pavement.

The pavement across the end of both slabs shall be thickened and the joint shall be edged and sealed.

3. Transverse Joint through an Integral Curb

All transverse joints in a concrete pavement shall extend entirely through the integral curb. The material used to construct the joint in the curb shall be of the same kind as provided for the pavement.

Bituminous fiber filler shall be used to construct the expansion joints in the integral curb of reinforced concrete pavements. The thickness of the fiber filler material in the curb above the gutter shall be 1 inch. The joint material shall be precut so as to conform to the geometric shape and cross sectional area of the curb, and shall be placed in intimate contact with the filler material in the pavement.

The edges of all transverse joints in the integral curb shall be rounded with an approved finishing tool, having a radius per the plans.

G. Consolidating and Finishing

The sequence of operations after the placing of concrete shall be: striking off and consolidating, floating, straight edging and finishing with burlap drag, edging and final

finishing with burlap drag.

1. Striking Off and Consolidating

Mechanical methods shall be employed to strike off and consolidate or compact the concrete, except in gapped areas or where the pavement width will not permit the use of machine methods. Gaps less than one (1) joint opening in length may be finished by hand methods, provided they are finished in single lane widths.

a. Finishing Machine Method

Mechanical methods shall be employed to strike off, consolidate and compact the concrete to such an elevation that when all finishing operations are completed, the surface will conform to the required finished grade and cross section. At least four (4) inches of concrete above the finished pavement grade shall be maintained ahead of the screed for its entire length. In consolidating the surface of the pavement, on residential street construction when a single screed finishing machine is used, it shall operate over each section of the pavement twice. Only sufficient mortar shall be worked to the surface to provide a dense smooth finish. Excessive operation of the machine over a given area will not be permitted. Segregated particles of coarse aggregate which may collect in front of the screed shall be thoroughly mixed by hand with the mass of concrete already on the subgrade.

b. Hand Method

If it not possible to use mechanical equipment on irregular areas, an improved and self-propelled vibratory screed shall be employed to strike off and properly consolidate the concrete surface to the required finish grade. Where it is not possible to use a vibratory screed, a hand strike board of an approved design, will be permitted. The entire area of the pavement shall be consolidated to insure an absence of voids. Strike boards shall be moved forward with a combined longitudinal and transverse motion, with neither end raised from the side forms during the process. A slight amount of excessive concrete shall be kept in front of the front edge at all times. When striking off and consolidating by hand, pours will be limited to single lanes or 3 of intersections.

2. Floating

After striking off and consolidating, the surface shall be made uniform by longitudinal or transverse floating by a mechanical method unless the pavement is permitted to be constructed in single lane widths.

Where mechanical floating is an integral part of the operation of a slip form paver, separate mechanical floating methods will not be required.

Mechanical longitudinal floating will not be required for residential street construction.

When mechanical equipment is not used for floating, a transverse float at least ten (10) feet in length shall be operated across the pavement by starting at the edge and slowly moving to the center and back again to the edge. The float shall then be moved ahead 1/2 of its length and the operation repeated.

Care shall be taken to preserve the crown and cross section of the pavement. The float finishing operation shall not proceed until the concrete has attained a consistency so that no excess concrete is carried ahead of the float but the entire surface can be

floated and sealed.

3. Testing Surface with Straightedge and Finishing with Burlap Drag.

Immediately following the float finishes and while the concrete is still plastic, the CONTRACTOR shall test the slab surface for trueness by means of a 10 foot straightedge or acceptable float.

The straightedge shall be placed at the center of the slab with the blade parallel to the centerline and pulled slowly and uniformly to the edge. This operation shall be repeated until the surface of the concrete is free from irregularities and makes contact at all points with the bottom of the straightedge. The straightedge shall then be moved forward 1/2 its length and the operations repeated.

Depressions found the surface shall be filled with fresh concrete and consolidated by floating with a long-handled float not less than 10 feet in length. This float may also be used to smooth sections of the surface which may have become rough or torn by dragging with the straightedge.

Pavement constructed by the slip-form method, the edge settlement shall be determined as soon as practical after paving operations begin. Edge settlement in excess of 1/2 inch shall be corrected before the concrete has hardened. When edge settlements in excess of 1/3 inch persist, paving shall be suspended and operational corrections made before the ENGINEER OF RECORD will permit the resumption of paving. If the CONTRACTOR consistently fails to construct pavement within these tolerances, the use of slip-form methods shall be discontinued and pavement placed by means of conventional forms. When paving is accomplished by the slip-form paving method, all mortar paste shall be wiped from the sides of the slab.

The surface shall then be tested for smoothness with the straightedge. During this operation, the contact of the straightedge with the concrete shall be uniform over the entire length tested. At the time of testing, the surface shall be free from soft mortar or excessive water. The testing straightedge shall be used for this purpose only.

Where the float finisher method is not utilized, as soon as the hand floating is completed, all laitance, surplus water, and inert material shall be worked entirely off the pavement and the surface made smooth by dragging with a rigid straightedge ten (10) feet in length and the surface shall be tested.

As soon as all excessive moisture has disappeared and while it is still possible to produce a uniform surface of gritty texture, the pavement shall be finished by dragging a seamless strip of damp burlap or cotton fabric, not less than five (5) feet nor more than six (6) feet in width, over the full width of the pavement. The burlap or cotton drag shall be pulled by a bridge supported on the pavement formed. The fabric shall be renewed as often as necessary to obtain the required texture.

4. Edging and Final Finishing with Burlap Drag

Immediately after the initial finishing with burlap, the edges of the slab and all specified joints shall be finished with an edging tool to the radii indicated on the Plans. The pavement shall then be given a final finish by dragging the damp burlap or cotton fabric over that portion of the pavement disturbed by the edging operation.

H. Surface Requirements

All high spots in the surface, exceeding 1/8 inch from the straightedge but not more than

2inch in ten (10) feet shall be removed or reduced by rubbing with a carborundum brick and water until contact with coarse aggregate is made. If contact with coarse aggregate is made, such high spots shall be removed by an approved surface grinding machine before acceptance of the pavement.

High spots in excess of 1/2 inch in ten (10) feet will be evaluated by the ENGINEER OF RECORD and if the Work is rejected, it shall be removed and replaced at the CONTRACTOR'S expense. Also, the CONTRACTOR shall take immediate steps to eliminate the cause of the defective surface.

I. Curing

After the finishing operations have been completed and immediately after the free water has left the surface, the surface of the slab shall be completely coated and sealed with uniform layer of white membranes curing compound.

The compound shall be applied in a continuous uniform film by means of mechanically pumped pressure sprayer equipment at a rate of one gallon per 200 square feet of surface. The curing compound shall not be thinned. The equipment shall provide adequate stirring of the compound during application. The equipment for applying the compound must be on the Project and approved by the ENGINEER OF RECORD before work is started.

Hand-spray equipment will be permitted only for the application of the curing compound over the sides of the slab, and for any minor damaged areas. If rain falls on the newly coated pavement before the film has dried sufficiently to resist damage, or if the film is damaged in any other way, the CONTRACTOR will be required to apply a new coat of material to the affected areas. The treated surface shall be protected by the CONTRACTOR from injury for period of at least (7) days. All traffic, either foot or otherwise, will be considered as injurious to the film of the applied compound. A minimum of foot traffic will be permitted on the dried film as necessary to properly carry on the Work including removal of any high spots, provided and damage to the film is immediately repaired by the application of a second coat of compound.

Immediately after the forms are removed, the entire area of the side of the slab shall be located with curing compound at the rate specified for the pavement surfacing.

The CONTRACTOR shall provide on the Project sufficient burlap or cotton coverings for the protection of the pavement in case of rain or breakdown of the spray equipment.

Failure to provide proper curing will be considered as sufficient cause for immediate suspension of the concreting operations.

J. Removal of Forms

Forms may be removed from freshly placed concrete after it has set for 12 hours, provided it can be done without damage to the pavement or curb edge. If during form removal the pavement or curb edge is being damaged, the form removal shall cease until the concrete has attained greater strength. The period of time for moving forms may be increased or decreased. when ordered by the ENGINEER/CONSULTANT. Immediately after removal of the forms, the ends of all joints shall be cleaned and visible areas of honeycomb or minor defects shall be filled with mortar, composed of 1 part Portland cement and two (2) parts fine aggregate from the same source as used in the pavement, applied with a wooden float. Immediate steps shall be taken by the CONTRACTOR to correct the conditions contributing to these defects. The sides of the pavement shall be sprayed with curing compound immediately upon removal of the forms, except where honeycombed areas are to be pointed, and then immediately cured.

Forms and pins shall not be placed on new pavement that is being cured with membrane.

K. Sawing Joints

All contraction joints, longitudinal lane-tie joints with tie-bars, and end of pour joints shall be sawed.

Joints shall be sawed before any traffic is permitted on the pavement. The concrete saw will be permitted on the pavement to saw the joints, but the water supply truck will not be permitted on the pavement until the compressive strength is not less than 3,000 psi. When permitted on the pavement, the water supply truck must be kept a minimum of 50 feet behind the sawing operation. At least two (2) approved concrete saws shall be available for use at all times, and one (1) saw shall be capable of sawing a joint groove 2 -1/2 inches deep.

The saw cut for transverse end-of-pour joints shall be made to receive the joint sealing material.

Longitudinal lane-tie joints with the tie bars shall be sawed in accordance with the alignment and dimensions indicated on the Plans.

For joints formed in one (1) operation, the joint groove shall be sawed before any transverse cracks develop. Raveling or spalling along the joint shall be repaired as specified in Section 3.0.3.L of this Section.

1. Transverse contraction joints shall be sawed in two stages:

- a. The first stage shall be a relief cut directly over the center of the load transfer assembly. The initial relief cut shall be made as soon as the saw can be placed on the freshly poured concrete, and the sawing shall continue as long as the pavement can support the saw without making or appreciably raveling of the joint.

When water is not used in the sawing operation, membranes curing compound shall be applied immediately.

When water is used in the sawing operation, the slurry resulting from the sawing operation shall be completely removed from the cut and from the immediate area by flushing with a jet of water. Additional membrane curing compound shall be applied within 12 hours after the relief cut has been made.

- b. Second stage sawing of joints shall not start until the concrete has cured for a minimum of 48 hours.

The joint groove shall be centered over the relief cut and sawed to the specified dimensions shown on the Plans plus any increase in width of the relief cut due to shrinkage or contraction the groove width tolerance shall be less than 1/16 -inch.

Joints sawed without the use of water shall be blown clean of all foreign material by a jet of compressed air.

If water was used in sawing operation, the slurry resulting from the sawing operation shall be completely removed from the groove and the immediate area by flushing with a jet of water and then blown dry with compressed air.

All transverse joint grooves shall receive a final cleaning with a jet of compressed

air adequate to remove all foreign material, just prior to permanent sealing.

If the specified seal is not installed within seven (7) days of final sawing, the joint groove shall be temporarily sealed with a suitable material or device to prevent the infiltration of foreign material.

Traffic shall not be permitted over the full width joint grooves prior to the installation of either the permanent seal or a temporary seal.

L. Patching Joints

After the joints have been sawed and cleaned, they shall be inspected for spalls and voids.

All loose, unsound or damaged concrete shall be removed to the satisfaction of the ENGINEER OF RECORD.

Spalls and voids will be classified as minor, intermediate or major spalls and shall be repaired accordingly.

1. Minor Spalls

Any spalls or voids which have increased the specified size of the joint groove beyond any of the following limits, but less than 36 square inches, shall be repaired by patching with an approved epoxy mortar before the seal is installed.

- a. Spalls which extend more than 1/3 inch from the joint face and over 1/2 inch below the surface of the pavement.
- b. Spalls which extend more than 1/3 inch from the joint face and two (2) inches more in length, regardless of the depth of spall below the surface of the pavement.
- c. Void areas larger than 1/2 inch in diameter in the upper 1 inch of the joint face or larger than 1 inch in diameter regardless of location.

The spalled concrete surface shall be thoroughly cleaned by sandblasting, power-wire brushing, or hand-wire brushing. The patch area shall then be blown clean with a jet of compressed air. A heavy polyethylene sheet or a rigid material shall be inserted into the joint groove and held tightly against the joint face that is to be patched.

The concrete shall be clean and dry when the epoxy resin mortar is placed.

The epoxy binder will be a mixture of two (2) parts epoxy resin to 1 part curing agent by volume.

The epoxy resin compound shall be mixed in a clean metal or polyethylene container with approved stirrer operating at 250 to 500 rpm. While the epoxy resin is being mixed, the curing agent compound shall be gradually added. The mixture shall then be stirred for a minimum of three (3) minutes until it is uniform.

After the epoxy binder is thoroughly mixed, a small portion shall be reserved for priming. The dry silica sand shall be reserved for priming. The dry silica sand shall be uniformly blended into the balance of the mixture to give an epoxy mortar of stiff or trowellable consistency. One (1) part of mixed binder to about 3.5 parts

of dry sand, by volume, will usually give a workable mix.

The spalled surface shall be primed with the freshly mixed epoxy binder scrubbed into the surface with a suitable applicator to insure complete wetting and coverage of all areas to which the epoxy mortar must bond. Immediately after priming, the epoxy mortar shall be placed in the spalled area and finished to the shape of the original pavement surface. If the bond coat is not tacky when the mortar is placed, a second application shall be made. The edge of the patch shall conform to the rest of the joint groove. Dry silica sand shall be sprinkled onto the fresh epoxy mortar surface to eliminate any gloss. After the epoxy mortar has cured sufficiently so that it will not be damaged during sealing operations, the polyethylene insert shall be carefully removed. All joints shall receive a final cleaning with a jet of compressed air to remove all foreign material.

When the temperature of the air and the pavement is above 50 degrees F, the hot-poured elastic type joint seal may be placed on the day following the placing of the epoxy resin mortar patch. When the temperature of the air and the concrete is below 50 degrees F, the time of curing required for the epoxy mortar shall be as determined by the ENGINEER OF RECORD.

2. Intermediate Spalls

Any spalls larger than 36 square inches but not extending below the reinforcing mat shall be repaired by sawing and chiseling out the unsound concrete and patching with Portland cement mortar.

A saw cut at least 1-inch deep shall be made parallel to the joint groove at the outer extremity of the spalled area. The concrete shall be chipped out to the saw cut so that a vertical face is present at the back of the repair area, and the two (2) ends of the repair area shall be trimmed to approximately vertical faces.

The area to be repaired shall be sandblasted to remove all loose particles and then blown clean with a jet of compressed air to remove the sand and all other foreign materials. The repair area shall be flushed with clean water and the excess water shall be blown out with compressed air.

A heavy polyethylene sheet or a rigid material shall be inserted into the joint groove and held tightly against the joint face that is to be patched.

The bottom and vertical faces of the repair area shall be primed with a grout of creamy consistency made with a 1:1 mixture of Portland cement and silica sand with water.

The prime coat will be scrubbed into the surface with a suitable applicator to insure complete wetting and coverage of all areas to which the Portland cement mortar must bond. The cement grout shall be carefully applied to the rough surfaces of the spall area and shall be applied immediately prior to placing of fresh mortar so that the prime coat is wet when covered by mortar.

The Portland cement patching material shall be tamped into the repair area and finished level to the pavement surface. This Portland cement mortar shall consist of 1-part Portland cement to two (2) parts silica sand with a water content of not more than four (4) gallons per sack of cement. A liquid air-entraining agent to maintain an air content of 8% to 11% shall be added. Calcium chloride in an amount of one (1) percent of the cement content may be added as an accelerator, if approved by the ENGINEER OF RECORD.

The edge of the patch at the joint face shall conform with the rest of the joint groove. White membrane curing compound shall be sprayed on the patch surface immediately after the mortar is cast and finished. After 72 hours the polyethylene form shall be carefully removed and all patched joints shall receive a final cleaning with a jet of compressed air to remove all foreign material.

3. Major Spalls

When a joint is damaged beneath the depth of the reinforcing mat, it shall be considered a major repair. These major repairs shall be handled on an individual basis under the direction of the ENGINEER OF RECORD.

M. Sealing Joints

All transverse expansion, contraction, construction and longitudinal bulkhead construction joints shall be filled and sealed with an approved hot-poured elastic type compound. All longitudinal lane-tie joints shall be pressure filled and sealed with either an approved hot-poured or cold-applied elastic type compound. These sealing compounds shall not be placed when the atmospheric or pavement temperatures are less than 50 degrees F or when the weather is rainy or foggy.

1. Sealing Transverse Expansion, Contraction, End-of-Pour and Longitudinal Bulkhead Construction Joints

After the shoulders are completed and the pavement has cured, the joints and pavement surfaces on each side of the joints shall be cleaned of all extraneous matter. The cleaning shall be done by sandblasting or other methods approved by the ENGINEER OF RECORD that will be equally effective in cleaning the concrete. The dust and sand present after the sandblasting or cleaning shall be removed by a jet of compressed air. Hand tools shall be used to remove stones and other foreign materials from the joint groove.

Immediately after the joints are cleared with the compressed air, and with the surface of the concrete in the joint dry, the joint shall be sealed with an approved hot-poured elastic type compound.

The hot-poured compound shall be melted in an approved double boiler type kettle. Direct heating will not be permitted. Also, any sealing material heated in excess of the safe heating temperature shall not be used in the Work.

During the process of pouring the joints, the ENGINEER OF RECORD may, at his discretion, require that sufficient compound be taken from the melting unit to make flow tests. The ENGINEER OF RECORD may require that to modify his method of heating or of charging the heating unit with compound that will produce satisfactory results.

Pouring shall be from the melting kettle equipped with an approved pressure pump hose and nozzle. When authorized by the ENGINEER OF RECORD, The sealing compound may be poured with a hand-type pouring pot for curbs and short miscellaneous joint lengths, provided a satisfactory joint is obtained. Pouring of the sealing compound shall be done so as to fill the joint to 1/4 inch below top of pavement. Any sealing compound spilled on the surface of the pavement shall be removed immediately. After the first pour has cooled to the temperature of the pavement and settled, a second pour shall be made to bring the sealing compound to 1/4 inch of the surface of the pavement.

Traffic shall not be permitted over the poured joint until the compound has hardened sufficiently to rest pickup.

2. Sealing Longitudinal Lane-Tie Joints

All longitudinal land-tie joints shall be cleaned and immediately filled with either an approved hot-poured or cold-applied elastic type compound. The sealing compounds shall be applied with pressure equipment, capable of completely filling the joint.

To protect hot-poured and cold-applied sealing compound while it is curing and to prevent pickup by traffic, the sealed joint shall be covered with a strip of paper, 1-1/2 inches wide, or other approved means, immediately following application of the compound. The paper strip shall be left in place until worn off by traffic.

N. Traffic Control

All measures necessary to protect and maintain traffic and to protect the Work shall be in accordance with FDOT, Section 102.

O. Protection Against Rain

The CONTRACTOR shall adequately protect the new concrete from the effects of rain before the concrete has sufficiently hardened. For this Work, the CONTRACTOR shall have available on the job site at all times enough burlap or 6-mil thick polyurethane film to cover and protect one day's Work. When rain appears eminent, all operations shall stop and personnel shall begin covering. As soon as the rain ceases, the concrete shall be uncovered and the surface burlap dragged where necessary. Curing compound shall be applied to any areas where the compound has been disturbed or washed away. Protection of the new concrete against rain shall be at the CONTRACTOR'S expense.

P. Cold Weather Protection

Any time there is a danger of temperatures falling below 35 degrees F, the CONTRACTOR shall have available on-site a sufficient amount of clean, dry straw or hay or polyethylene film or other approved materials to cover at least one (1) day's production. Cold weather protection shall be at the CONTRACTOR'S expense. The source of the temperature shall be taken from forecasts prepared by the local weather bureau, recognized as the Official Weather Bureau for the area the new Work is being constructed. The predicted low temperature shall be that forecast to occur during the next 24 hours.

1. General

To accelerate hardening of the concrete when the temperature of the air in the shade and away from artificial heat is between 45 degrees F and 40 degrees F, calcium chloride shall be added to the mix at the rate approved by the ENGINEER OF RECORD. The calcium chloride shall be spread on the materials immediately before discharging into the drum of the mixer. A method approved by the ENGINEER OF RECORD, shall be used for measuring the amount of dry calcium chloride to be added to each batch of concrete. The calcium chloride shall not be placed in contact with the cement.

Immediately after finishing of the concrete and as soon as hardening of the concrete will permit, the pavement shall be covered and the protective covering shall remain in place until the concrete has developed a compressive strength of not less than 3,000 pounds per square inch or for a minimum period of 14 days or as directed by the ENGINEER OF RECORD.

The protective covering shall be placed around and over the forms and it shall extend beyond the edge of the pavement for a distance at least equal to the depth of covering required.

When removing forms, the protective covering should be removed for as short a time as possible and should be replaced promptly to prevent loss of heat.

The mixing and placing of concrete shall stop in sufficient time each day to permit finishing of the concrete and the placing of the required protective covering during daylight hours or as directed by the ENGINEER OF RECORD.

The requirements specified herein for the curing and protection of concrete in cold weather is minimum requirements, and the CONTRACTOR shall be responsible for the quality and strength of the concrete placed. Any concrete injured by frost action shall be removed and replaced at the CONTRACTOR'S expense.

2. Ordinary Protection

When the predicted low temperature is to be below 35 degrees F at any time within 72 hours after placing the pavement, the pavement shall be protected and such protective covering shall remain in place until the concrete has developed a compressive strength of not less than 3,000 pounds per square inch, or for a minimum period of 14 days or as directed by the ENGINEER OF RECORD.

3. Special Protection

The temperature of the concrete at the time it is placed on the subgrade shall be not less than 50 degrees F, or more than 85 degrees F.

In order to maintain a mix temperature between 50 degrees F and 85 degrees F, the mixing water on the aggregates, or both, shall be heated as required by the ENGINEER OF RECORD. The water and the aggregates shall be heated to a temperature of not more than 150 degrees F. The heating of aggregates shall be done by the use of steam pipe under the aggregate piles, or by free steam discharge into the aggregate piles, or by steam pipe in the batching bins. The heating of the water and the aggregates shall be controlled so that there will not be any large differences in temperature from batch to batch. The ENGINEER OF RECORD will determine the method to be used in heating the aggregate.

When there is any danger of the predicted low temperature dropping below 35 degrees F, all the necessary materials for covering and protecting the concrete, equipment for heating the water and aggregates, when required, and calcium chloride shall be on the Project and available for immediate use for the required method of curing and cold weather protection before any pavement is placed.

When temperatures are such that special protection is required as specified above, all concrete placed within the preceding 72 hours shall be similarly protected.

When special protection is started, it shall be continued until design strength is reached in accordance with the above requirements unless warmer temperatures prevail for a period of at least 48 hours. Permission to eliminate special protection for such a period shall be as directed by the ENGINEER OF RECORD.

Protection of the new concrete against cold weather including ordinary and special

protection shall be at the CONTRACTOR'S expense.

Q. Concrete Temperature Limitations

Concrete shall not be placed when the temperature of the concrete at the point of placement is above 90 degrees F. Methods for controlling the temperature shall be submitted for the review and approval of the ENGINEER OF RECORD prior to their use.

R. Curb Drop

Curb drops shall be provided for existing and future sidewalk ramps, for approaches for existing driveways and at other locations as directed by the ENGINEER OF RECORD.

Curb drops for sidewalks shall be in accordance with the current rules and regulations of the Florida Department of Transportation. Curb drops for drive approaches shall be centered with the existing driveway at the property line.

The width of the residential curb drop shall be equal to the width of the driveway determined at the property line plus four (4) feet. Unless otherwise directed by the CONTRACTOR ENGINEER OF RECORD, the minimum width of the residential curb drop shall be 14 feet.

S. Shoulders

The shoulders shall be constructed according to the lines, grades and cross section shown on the Plans and as specified for the particular type of shoulder material required. The shoulders shall be done in such sequence with the surfacing operations that they will be completed not more than seven (7) days after the expiration of the curing period, unless otherwise directed by the ENGINEER OF RECORD.

T. Cleanup

After the concrete has gained sufficient strength, but no sooner than within 12 hours, the fixed forms shall be removed and the spaces on both sides shall be immediately backfilled with sound earth of topsoil quality. The backfill shall be compacted, leveled and left in a neat, workmanlike condition.

At a seasonally correct time approved by the ENGINEER OF RECORD the disturbed area shall be raked, have topsoil placed thereon, fertilized and seeded or sodded.

U. Opening Pavement

The OWNER, reserves the right to require that curing operations be discontinued when the concrete has reached 85% of the design strength, and to require that the shoulders be completed and the slab be opened to traffic.

3.4 Field Quality Control

A. Testing

1. During the course of Work, testing will be required of standard test cores and cylinders, by the CONTRACTOR'S testing laboratory approved by the OWNER. The cost of testing and coring shall be at the expense of the CONTRACTOR.

For each lane of Work:

- a. A minimum of one (1) cylinder for testing compressive strength shall be made for

each 500 linear feet, or fraction thereof., or as directed by the ENGINEER OF RECORD.

- b. A minimum of two (2) cores for testing compressive strength and for checking thickness shall be drilled each 500 feet, or fraction thereof.

The making of cylinders, the drilling of cores and testing shall be at the expense of the CONTRACTOR.

Slump tests for consistency of Portland cement concrete shall be made in accordance with ASTM C143 and C172.

2. Defective Work

In the event the test results on a core indicates a deficiency in either thickness or compressive strength or in the event the test results on a cylinder indicates a deficiency in compressive strength, the following adjustments in the unit price for concrete shall be made based on the average of three (3) cores:

- a. Thickness:

Under Required Thickness	Percent of Reduction in Unit Price
0" to 1/4"	None
by more than a 1/4", but not exceeding a 2"	20
by more than a 2", but not exceeding 1"	50
by more than 1"	Remove and Replace

- b. Compressive Strength

Under Required Compressive Strength	Percent of Reduction in Unit Price
0 to 150 psi	None
by more than 150 psi, but not exceeding 300 psi	20
by more than 500 psi	Remove and Replace

Other places shown on the Plans where installation of the load transfer unit is not feasible.

The load transfer units shall be assembled and the plastic-coated bars lubricated with liquid asphalt or other approved lubricant. The liquid-asphalt-coated end of each bar shall be provided with a close fitting metal cap. The fiber filler shall extend the depth and width of the joint. After installation, the top shall be not less than 2 inch and no more than 1-inch below the finished surface. It shall be furnished on lengths not less than the lane widths being poured. Where additional partial lengths are necessary, the minimum length of load transfer unit and pre-molded fiber filler shall be sufficient to span two (2) dowel bar spacings. Where more than one (1) section is allowed and used in a joint, the sections shall be securely joined together.

Reduction in the unit price are additive, that is if an area is deficient by 3/8 of an inch and is under strength by 200 psi, the total reduction is 20% or a reduction of 40%.

The area of a deficient core shall be determined by the drilling and testing of two (2) additional cores, one (1) on each side of the deficient core and 20 feet from it, when possible.

The extra core drilling and testing shall be at the CONTRACTOR'S expense.

END OF SECTION

SECTION 32 1313 - CONCRETE SIDEWALKS AND SLABS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

- A. Furnish all labor, material equipment and transportation and perform all work necessary for the construction of the sidewalks/walkways and slabs to the lines and grades as shown on the Construction Drawings. Also, please reference the Geotechnical Report. Information provided within the geotechnical report supersedes this specification.

1.3 SUBMITTALS

- A. Submit certificates by the producers or manufacturers that the furnished materials meet the specific requirements of the Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete: Class I (3000 psi) as specified in the FDOT Standard Specifications for Road and Bridge Construction, Latest Edition, Section 345.
- B. Reinforcement: Steel bars and welded wire fabric conforming to the requirements of FDOT Standard Specifications for Road and Bridge Construction, Latest Edition, Section 415.
- C. Preformed Joint Filler: Non-extruding and resilient bituminous type conforming to the requirements of ASTM D 1751.
- D. Membrane Curing Compound: Clear fugitive dye conforming to the requirements of AASHTO M 148, Type 1-D, Class A.
- E. Vapor Retarders: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Subgrade Condition:
 - 1. Maintain the finished subgrade in a smooth, compact condition and restore any areas which are disturbed prior to placing of the concrete. Uniformly apply water ahead of the pouring operations as directed by the Engineer to keep the subgrade moist at the time the concrete is placed. Remove large boulders and other obstructions to a minimum depth of 6-inches below the finished subgrade elevation, and backfill the space with sand, base course material or other suitable material thoroughly compacted by rolling or tamping.

2. Trim the subgrade accurately to the required elevation with a 1/4-inch tolerance. Trim high areas to proper elevation. Fill low areas with suitable material and compact to the specified density, or fill with concrete integrally with the placing of the pavement.
- B. Setting Forms: Set the forms accurately to line and grade and so that they rest firmly, throughout their entire length, upon the compacted subgrade surface. Join forms neatly and tightly and brace them to resist the pressure of the concrete and the finished operations. Obtain the Engineer's approval for the alignment and grade of all forms before and immediately prior to the placing of concrete.
- C. Slipforming: The slipforming method will be allowed, provided that an acceptable finished product, true to line, grade, and cross section is consistently produced.
- D. Mixing Concrete: Mix in accordance with the requirements of the FDOT Standard Specifications for Road and Bridge Construction, Latest Edition, Section 345.

3.2 INSTALLATION

- A. Placing Concrete:
 1. Distribute the concrete on the subgrade to such depth that, when it is consolidated and finished, the thickness required by the Drawings will be obtained at all points and the surface will at no point be below the grade specified for the finished surface. Deposit the concrete on the subgrade in a manner which will require as little rehandling as possible and is continuous between transverse joints, without the use of intermediate bulkheads.
 2. Place reinforcement as shown on the Drawings and maintain at this location during the placing and finishing operations.
 3. Thoroughly consolidate concrete against and along the faces of all forms by means of vibrators. Do not permit vibrators to come in contact with the subgrade or a side form, or vibrate at any one location so long as to produce puddling or the accumulation of excessive grout on the surface. Do not operate the vibrator longer than 15 seconds in any one location.
- B. Striking-off, Consolidating and Finishing Concrete: Immediately after the placing, strike off, consolidate and finish the concrete to produce a finished product conforming to the cross section, width and surface finish required by the Drawings and Specifications.
- C. Straightedging and Surface Corrections:
 1. After floating has been completed and the excess water removed, but while the concrete is still in a plastic state, test the surface of the concrete for trueness with an accurate 10-foot straightedge. Hold the straightedge in successive positions parallel to the centerline, in contact with the surface, and test the whole area from one side of the slab to the other as necessary. Advance along the walkway in successive stages of not more than one-half the length of the straightedge. Immediately fill any depressions with freshly mixed concrete and strike-off, consolidate and refinish. Cut down high areas and refinish. Continue straightedge testing and surface correction until the entire surface appears to conform to the required grade and cross section. Correct all surface irregularities exceeding 1/4-inch in 10-feet.
- D. Final Finish: As soon as the water sheen has disappeared and just before the concrete becomes non-plastic, finish all edges, including expansion joint edges, with an edging tool

having a radius of ½-inch. Finally give the top a light broom finish perpendicular to the forms.

E. Joints:

1. Transverse Construction Joints: Construct at the end of all pours and at other locations where the pouring operation are stopped for as long as 30 minutes, but not within five feet of any other transverse joint or of either end of a section of walk or slab. If sufficient concrete has not been placed to form a slab at least five feet long, remove the excess concrete, back to the last preceding joint. Form the joints by placing a wood or metal bulk-head accurately and securely in place, in a plane perpendicular to the profile and centerline of the walk or slab. Tool edges of construction joints with a 1/8-inch radius.
2. Transverse Control Joints: Form at appropriate intervals as planes of weakness created by an edging tool. Cut the fresh concrete perpendicular to the surface of the walk or slab, to a depth of 1/4 to 1/3 the depth of the slab.
3. Transverse Expansion Joints: Form by placing preformed joint filler, one-half inch thick, around all structures and at intervals not exceeding 100 feet.

F. Curing:

1. After the finishing operations have been completed and as soon as the concrete has hardened sufficiently that marring of the surface will not occur, cover the entire surface and the edges of the newly placed concrete and cure with membrane curing compound.
2. Apply curing compound uniformly to the surfaces to be cured, in a continuous film, at the rate of application and in the manner recommended by the manufacturer.
3. Do not apply the curing compound during periods of rainfall. Should the film become damaged from any cause within the required curing period, immediately repair the damaged portions with additional compound. Upon removal of side forms immediately coat the sides of the slabs exposed, providing a curing treatment equal to that provided for the surface.

- G. Form Removal: After the concrete has sufficiently set a minimum of 12-hours, remove the forms and backfill the space on each side. Compact and grade the earth in a satisfactory manner without damage to the concrete work. Fill honeycombs with sand cement mortar. Plastering will not be allowed on the face of the walk or slab. Remove rejected walk or slab and replace without additional compensation.

- H. Note: Install vapor retarder under all covered concrete sidewalks. Install vapor retarder sheets according to ASTM E 1643. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

END OF SECTION

SECTION 32 1613 - CONCRETE CURB

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. The work included in this Section consists of furnishing all labor, material equipment and transportation for the construction of the curb, curb and gutter, and traffic separator to the lines and grades as shown on the Drawings.

1.3 SUBMITTALS

- A. All materials specified shall be certified by the producer or manufacturer that the furnished material meets the specific requirements of the specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete: Concrete shall be Class B that conforms to the requirements of FDOT Standards.
- B. Reinforcing Steel And Welded Wire Fabric: Reinforcing steel bars and welded wire fabric shall conform to the requirements of FDOT Standards.
- C. Preformed Joint Filler: Preformed joint filler shall be non-extruding and resilient bituminous type and shall conform to the requirements of AASHTO 153 or AASHTO Designation M 213.
- D. Joint Sealer for Gutters:
 - 1. Hot Poured Type: Joint sealer shall conform to the requirements of AASHTO Designation M 173. Cold Applied Type: In lieu of the hot poured type, joint sealer shall be a one or two part polysulfide base self leveling sealant for horizontal surfaces that has been developed for foot and vehicular traffic. The sealant shall be listed on the Thiokol approved product list.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Subgrade Condition:
 - 1. The finished subgrade shall be maintained in a smooth, compact condition and any areas which are disturbed prior to placing of the concrete shall be restored at the Contractor's expense. The subgrade shall be moist at the time the concrete is placed. Water shall be uniformly applied ahead of the pouring operations as directed by the Owner's Engineer.
 - 2. The subgrade shall be accurately trimmed to the required elevation with a 1/4 inch tolerance. High areas shall be trimmed to proper elevation. Low areas may be filled with suitable material and compacted to the specified density or filled with concrete

integrally with the placing of the pavement.

- B. Setting Forms: The forms shall be accurately set to line and grade and such that they rest firmly, throughout their entire length upon the compacted subgrade surface. Forms shall be joined neatly and tightly and braced to resist the pressure of the concrete and the finished operations. The alignment and grade of all forms shall be approved before and immediately prior to the placing of concrete.
- C. Slipforming: The slipforming method will be allowed, provided that an acceptable finished product, true to line, grade, and cross section is consistently produced.
- D. Mixing Concrete: Concrete shall be mixed in accordance with the requirements of FDOT Standards.

3.2 INSTALLATION/APPLICATION

- A. Placing Concrete:
 - 1. The concrete shall be distributed on the subgrade to such depth that, when it is consolidated and finished, the thickness required by the Drawings will be obtained at all points and the surface will at no point be below the grade specified for the finished surface. The concrete shall be deposited on the subgrade in a manner which will require as little rehandling as possible. Placing of the concrete shall be continuous between transverse joints, without the use of intermediate bulkheads.
 - 2. Reinforcement shall be placed as shown on the Drawings and shall be maintained at this location during the placing and finishing operations.
 - 3. Concrete shall be thoroughly consolidated against and along the faces of all forms by means of vibration. Tamping or vibration at any one location shall not continue so long as to produce puddling or the accumulation of excessive grout on the surface.
- B. Striking-Off, Consolidating And Finishing Concrete:
 - 1. Immediately after the placing, the concrete shall be struck off, consolidated and finished, to produce a finished product conforming to the cross section, width and surface finish required by the Drawings and Specifications.
 - 2. After the concrete has sufficiently set a minimum of 12-hours, the Contractor shall remove the forms and shall backfill the space on each side. The earth shall be compacted and graded in a satisfactory manner without damage to the concrete work. Honeycombs shall be filled with sand cement mortar. Plastering will not be allowed on the face of the curb. Rejected curb, curb and gutter or valley gutter shall be removed and replaced without additional compensation.
- C. Final Finish: As soon as the water sheen has disappeared and just before the concrete becomes non-plastic, a light broom finish shall be given to the surface.
- D. Joints:
 - 1. Transverse Construction Joints: Transverse construction joints shall be constructed at the end of all pours and at other locations where the pouring operation are stopped for as long as 30 minutes. Construction joints, however, shall not be placed within ten feet of any other transverse joint or of either end of a section of curb. If sufficient concrete has not been placed to form a slab at least ten feet long, the

excess concrete, back to the last preceding joint, shall be removed. The joints shall be formed by placing a wood or metal bulk-head accurately and securely in place, in a plane perpendicular to the profile and center line of the pavement. Construction joints shall be sawed, in a manner similar to contraction joints, so that a groove will be formed for holding the joint sealing compound.

2. Transverse Contraction Joints: Transverse contraction joints shall be constructed at ten foot intervals and shall consist of planes of weakness created by sawing the surface of the hardened concrete. The cut shall be perpendicular to the surface of the pavement, and shall extend to a depth of six inches below the top of the curb and one and one-half inches below the gutter.
 - a. It shall be the Contractor's responsibility to see that the sawing equipment does not damage the curb and to saw the transverse contraction joints as soon as the curb, curb and gutter has hardened to the degree that tearing and raveling are not excessive and before uncontrolled shrinkage cracking begins. If, at any time, uncontrolled cracking occurs, the Contractor will be required to modify his methods.
3. Transverse Expansion Joints: One-half inch expansion joints shall be formed by placing preformed joint filler at the ends of each radius return, around all structures, and at intervals not exceeding 500 feet.
4. Cleaning And Sealing Joints: Joints in gutters which are to be sealed, shall be filled with joint sealing material before the roadway is opened to traffic and as soon after completion of the curing period as is feasible. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign material (including any membrane curing compound) and the joint faces shall be clean and surface-dry when the sealer is applied.
 - a. The sealing material shall be applied to each joint to conform to the details shown on the Drawings and in accordance with the manufacturer's recommendation. The pouring shall be done in such manner that the material will not be spilled on the exposed surfaces of the concrete. Any excess material on the surface of the concrete gutter shall be removed immediately and the gutter surface cleaned.

All cracks occurring in the gutter prior to its acceptance shall be cleaned out and sealed as specified above, except that the cracks and fractures shall be completely filled with joint sealer and any excess filler material cut down level with the gutter surface.

E. Curing:

1. After the finishing operations have been completed and as soon as the concrete has hardened sufficiently that marring of the surface will not occur, the entire surface and the edges of the newly placed concrete shall be water cured by misting or covering with a double thickness of burlap, cotton mats, or other approved material kept thoroughly saturated with water.
2. The forms shall be kept wet until removed and upon removal, the curing specified herein shall be started immediately.
3. Concrete shall be cured for a period of seven (7) days for normal Portland cement or four (4) days for high early strength cement.

4. Concrete poured in the dry shall not be submerged until it has attained sufficient strength to adequately sustain the stress involved, nor shall it be subjected to flowing water across the surface for four (4) days.

END OF SECTION

SECTION 32 1723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. This Section specifies the furnishing and application of permanent reflective pavement marking traffic paints, thermoplastic, glass spheres and reflective pavement markers.

1.3 QUALITY ASSURANCE

- A. Pavement marking traffic paints, thermoplastic, glass spheres and reflective markers shall be applied in accordance with Pasco County Standards and Specifications for Road and Bridge Construction, latest edition, of the Florida Department of Transportation, the Manual of Uniform Traffic Control Devices and the Florida Manual on Traffic Control and Safe Practices for Street and Highway Construction and Supplemental Specifications thereto.

1.4 SUBMITTALS

- A. Submit certificates stating that materials meet Florida Department of Transportation Specifications Sections 706, 711, 971-12, 971-13 and 971-14.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. White and Yellow Permanent Reflective Pavement Markings Paint: Traffic paint codes T1 (white) and T2 (yellow) shall meet with requirements of Section 971-12 in the FDOT Standard Specifications for Road and Bridge Construction.
- B. Thermoplastic: The thermoplastic compound used shall meet the requirements set of Section 711 of the FDOT Standard Specifications for Road and Bridge Construction.
- C. Markers: Reflectorized pavement markers shall meet the requirements of Section 706 of the FDOT Standard Specifications for Road and Bridge Construction.

END OF SECTION

SECTION 32 3019 - TRAFFIC SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. This Section specifies the furnishing and installation of permanent roadway signs, sign supports, reflectorized delineators, reflector buttons, reflective sheeting and their associated hardware.

1.3 QUALITY ASSURANCE

- A. Roadway signs, sign supports, reflectorized delineators, reflector buttons, reflective sheeting and their associated hardware shall be in accordance with the following:
 - 1. The Standard Specifications for Road and Bridge Construction, (latest edition) Florida Department of Transportation supplemental specifications thereto.
 - 2. Manual of Uniform Traffic Control Devices for Street and Highway Construction Maintenance and Utility Operations.
 - 3. FDOT Manual on Traffic Controls and Sage Practices for Street and Highway Construction Maintenance and Utility Operations.
 - 4. Standard Highway Signs Manual published by the U.S. Department of Transportation.
 - 5. Reference Guide: Standard Alphabets for Highway Signs and Pavement Markings, published by the U.S. Department of Transportation.

1.4 SUBMITTALS

- A. Submit certificates stating that the roadway signs, sign supports, reflectorized delineators, reflector buttons, reflective sheeting and their associated hardware meet the specifications of the publications as specified in Section 1.02A above.
- B. Submit certificates stating that the street name signs and their associated hardware meet the requirements of the local government agency having jurisdiction or as shown on the drawings, whichever is more stringent.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Signs, sign supports, reflectorized delineators, reflector buttons, reflective hardware sheeting and their associated hardware shall be in accordance with the requirements of the publications as specified in Section 1.02-A above.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all roadway signs, sign supports, reflectorized delineators and reflector buttons in accordance with the requirements of the Standard Specifications for Road and Bridge Construction, (latest edition) of the Florida Department of Transportation, the Manual of Uniform Traffic Control Devices and supplemental specifications thereto.
- B. Install all street name signs in accordance with the requirements as noted on the drawings or of the local governmental agency having jurisdiction, whichever is more stringent, providing there is no conflict with the Florida Department of Transportation specifications or regulations.

END OF SECTION

SECTION 32 3113 - CHAIN LINK FENCES AND GATES

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Posts, rails, and frames.
 - B. Barbed wire.
 - C. Accessories.
- 1.2 RELATED REQUIREMENTS
 - A. Section 03 3000 - Cast-in-Place Concrete: Concrete anchorage for posts.
- 1.3 REFERENCE STANDARDS
 - A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - C. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - D. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
 - E. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
 - F. CLFMI CLF-SFR0111 - Security Fencing Recommendations.
 - G. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric).
- 1.4 SUBMITTALS
 - A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
 - B. See Section 01330 - Submittal Procedures.
 - C. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
 - D. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.
 - E. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines _____.
- 1.5 QUALITY ASSURANCE
 - A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

- 2.1 COMPONENTS
 - A. Line Posts: 1.9 inch diameter.
 - B. Corner and Terminal Posts: 2.38 inch diameter.
 - C. Fabric with Pre-Inserted Slats: 2 inch diamond mesh interwoven wire, 6 gauge, 0.1920 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.
 - 1. Privacy Slats: High-density polyethylene (HDPE), woven into fabric.
- 2.2 MATERIALS
 - A. Posts, Rails, and Frames: _____:
 - B. Posts, Rails, and Frames: ASTM F1083 Schedule 40 hot-dipped galvanized steel pipe, welded construction, minimum yield strength of 30 ksi.
 - 1. Full weight (1.2 oz) hot dipped galvanized.
 - C. Line Posts: Type I round in accordance with FS RR-F-191/1D.
 - D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.
 - E. Wire Fabric: _____:
 - F. ASTM A392 zinc coated steel chain link fabric.
 - 1. Full weight (1.2 oz) hot dipped galvanized.
 - 2. 6' knuckle, 9 gauge galvanized.
 - 3. For locations indicated on Drawings.
 - G. Wire Fabric: ASTM F 668 polymer-coated steel chain link fabric.
 - 1. For locations indicated on Drawings
 - 2. Color: Black
 - H. Type specified in Section 03 3000.
- 2.3 COMPONENTS
 - A. Line Posts: 1.9 inch diameter.

1. Length: 6'-0" (at 4'-0" high fence).
 2. Length: 8'-0" (at 6'-0" high fence).
 - B. Line Posts at Roll-Gates: 2-1/2 inch diameter.
 1. Length: 6'-0" (at 4'-0" high fence)
 2. Length: 8'-0".
 - C. Corner and Terminal Posts: 2.38 inch diameter.
 1. Length: 7'-0" (for 4'-0" fence).
 2. Provide Dome Caps.
 - D. Gate Posts: 3-1/2 inch diameter.
 - E. Top and Brace Rail: 1 5/8" inch diameter, plain end, sleeve coupled.
 - F. Gate Frame: 1 5/8" inch diameter full weight welded frame.
 1. Bracing: 1-5/8" diameter. Roll gates to have one horizontal brace and one vertical brace, except 24' wide gates which are to have one horizontal brace and three vertical braces.
 2. Provide industrial hinges and all necessary fittings.
 - G. Fabric: 2 inch diamond mesh interwoven wire, 6 gauge, 0.1920 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.
 1. Height: 4'-0".
 2. Height: 6'-0".
 3. Height: 8'-0".
 - H. Tension Wire: 6 gage, 0.1920 inch thick steel, single strand.
 - I. Offset bands: 3" galvanized, industrial.
 - J. Center bands: 2", 2 1/2", and 3" galvanized, industrial.
 - K. Rail End Fittings: 1 5/8" galvanized, industrial.
 - L. Sleeves: 1 5/8" galvanized, industrial.
 - M. Nuts and Bolts: galvanized, fully tightened.
 - N. Tie Wire: 9 gauge aluminum, double wrapped, both ends.
- 2.4 ACCESSORIES
- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
 - B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; heavy malleable steel.
 1. Including: Loop Caps, Dome Caps, Rail End Fittings, Tension Bars.
 2. All material to be US Industrail top grade.
 - C. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; Provide panic hardware at gates indicated on Drawings.
- 2.5 FINISHES
- A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 oz/sq ft.
 - B. Components and Fabric (at locations identified on Drawings) : Vinyl coated over coating of 1.8 oz/sq ft galvanizing.
 - C. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.
 - D. Accessories: Same finish as framing.
 - E. Color(s): Black.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Place fabric on outside of posts and rails.
- C. All fencing is to be attached to the inside of posts at playcourts.
- D. Fencing adjacent to asphalt paved areas is to be set 1'-6" from the edge to allow future resurfacing.
- E. Set intermediate posts plumb . Slope top of concrete for water runoff.
- F. Set intermediate posts plumb.
 1. Set posts in 1'-0" diameter concrete.
 - a. Top of concrete: 3" below finished grade.
 - b. Concrete Mix: small gravel, sand, and cement.
 2. Set posts at 10'-0" centers or less.
- G. Line Post Footing Depth Below Finish Grade: ASTM F567.
 1. Set tops of Line Posts at 3'-8" above grade (for 4'-0" fence), 5'-8" above grade (for 6'-0" fence).
 2. Provide loop caps at all line posts for 1-5/8" diameter top rail.
- H. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.
 1. Set tops of Corner and Terminal Posts at 4'-4" above the ground (for 4'-0" fence), 6'-4" above the ground (for 6'-0" fence).
 2. All corners are to be center braced with 1-5/8" diameter rails.
 3. Provide full height tension bars at each coner and terminal post.

4. Provide corner posts at each side of gates.
 5. Provide Terminal Posts every 150'-0" in a straight run.
 - I. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts. Brace with 1-5/8" diameter rails.
 - J. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
 1. Top rail is to terminate at all corner and terminal posts. Provide rail end fitting at each termination of the top rail.
 - K. Install center brace rail on corner gate leaves.
 - L. Do not stretch fabric until concrete foundation has cured 28 days.
 - M. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
 1. All fence fabric is to be set at ground level.
 2. Lined level at top.
 3. All fabric is to be tied not less than 2'-0" apart on horizontal and vertical members.
 - N. Position bottom of fabric 2 inches above finished grade.
 - O. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 24 inches on center.
 - P. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
 - Q. Install bottom tension wire stretched taut between terminal posts.
 - R. Do not attach the hinged side of gate to building wall; provide gate posts.
 - S. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.
 - T. Gates wider than 6'-0":
 1. Provide solid rubber wheel barrow tire and axle installed in gate frame to support the gate.
 - U. Clean up job when finished. Level dirt around posts.
 - V. Install gate locking device specified in Section 08711 - Door Hardware.
- 3.2 TOLERANCES
- A. Maximum Variation From Plumb: 1/4 inch.
 - B. Maximum Offset From True Position: 1 inch.
 - C. Do not infringe on adjacent property lines.

END OF SECTION

SECTION 33 1000 - WATERMAIN

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes all water main Work complete with water main piping, valves, hydrants, thrust blocks, joint restraint, valve wells, structures, fittings, joints, joint materials, nuts, bolts, glands, gaskets, plugs and accessories as shown and required. This Section also includes bedding and laying of water main piping, hydrostatic testing of new water main piping systems, and flushing and chlorination of water main piping systems.

- B. Related Work Specified Elsewhere

- 1. Dewatering: Section 31 2319
- 2. Trenching, Backfilling and Compacting: Section 31 2333

1.3 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies

- 1. Cleaning and Disinfection

Conform to the applicable requirements of state and local health authorities having jurisdiction for disinfection and testing.

- B. Reference Standards

Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:

ANSI - American National Standards Institute

ASTM - American Society for Testing and Materials

AWWA - American Water Works Association

City of Tampa Technical Specifications

1.4 SUBMITTALS

- A. Schedules

- 1. Tabulated Laying Schedule

Where concrete water main pipe is used in the water main Work, a Tabulated Laying Schedule, showing stationing, deflection, elevation, slope and description of

pieces shall be submitted to the ENGINEER OF RECORD AND THE OWNER. Pipe manufacture shall not be started until the laying schedule has been reviewed and approved by the ENGINEER OF RECORD.

2. Corporation Stops (Tapping Outlets)

A complete schedule of all tapping outlets installed in concrete water main piping shall be kept by the CONTRACTOR and submitted to the ENGINEER OF RECORD at the end of each water main piping section of the Project or on the last day of each week, whichever occurs first.

3. Manufacturer's Data

Provide product data "cut sheets" for materials and products being used on the project. Materials and products shall meet or exceed City of Tampa requirements.

B. Affidavits

1. Butterfly Valves

Submit manufacturer affidavit showing compliance with AWWA C504, where applicable.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials

1. Concrete Pipe

Provide two (2) percent of pipe lengths to be delivered as short pieces with a length ten (10) feet or less. These short pieces shall be in addition to those required under the Tabulated Laying Schedule.

B. Storage of Materials

1. Water Main Piping

Pipe shall be stored in a manner to minimize infiltration of dirt, debris and other extraneous materials.

Piping materials shall not be stacked higher than four (4) feet. Suitable racks, chairs and other supports shall be provided to protect preformed pipe mating surfaces from damage. Store bottom tiers off the ground, alternate tiers and chock tier ends.

2. Hydrants, Valves and Accessories

Store all hydrants, valves, wells and prefabricated structures off the ground, drained and kept free of water to protect against damage. Hydrants, valves, wells, their accessories and appurtenances shall be kept in their original containers until ready for installation.

3. Gasket, Glands, and Seals

All joint and sealing materials subject to ultra-violet or ozone attack and used in the water main system shall be protected from the sunlight, atmosphere and weather, stored in suitable enclosures until ready for installation.

C. Handling of Materials

1. Loading and Unloading

Load and unload piping using suitably approved hoists and skidding. Piping shall not be dropped, bumped or allowed to impact against itself. Damaged piping shall be rejected by the ENGINEER OF RECORD.

2. Lifting Devices

Lifting devices shall be suited to the Work and shall protect surfaces from damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Scope

It is the intent of this Article to specify in detail the various types of pipe, joints, and fittings which have been indicated throughout the Plans and Specifications. This Article shall not be construed as allowing any alternate type of material to that which is indicated on the Plans or elsewhere in the Specifications. All materials specified shall be in conformance with the City of Tampa Technical Specifications for Water Mains.

B. Ductile Iron Piping Systems

1. Ductile Iron Pipe

Pipe shall be AWWA C151 / ANSI A21.51, with double thickness cement mortar lining and 1-mil thickness minimum of coal tar enamel inside and outside. Pipe shall have the minimum wall thickness and nominal inside diameter for the pipe class indicated on the Plan. All ductile iron pipe shall be Class 52 unless noted otherwise.

2. Joints

Mechanical, compression gasket type, conforming to AWWA C111/ANSI A21.11 except that slots with the same width as the diameter of the bolt holes in mechanical joints shall not be allowed in the bell flange.

Push-on, compression gasket type conforming to AWWA C111/ANSI A21.11 with spigot of pipe marked to visually determine when the spigot is fully seated in the bell of the adjoining section.

Flanged, conforming to AWWA C115/ANSI B16.1 shall be DIP.

3. Fittings

Ductile iron, pressure rating of 250 psi conforming to AWWA C110/ANSI A21.10 and AWWA C111 /ANSI A21.11, with double thickness cement mortar lining and coal tar enamel coating on the inside and outside of fittings. All fittings shall have AWWA C110/ANSI A21.10 laying lengths equivalent to those listed for mechanical joint fittings.

Flanged joints shall meet the requirements of ANSI B16.1. Bolts and nuts shall meet the requirements of ASTM A 307, Grade B. Gaskets shall be rubber with cloth

insertions and shall be full face meeting the requirements of ANSI 16.21.

4. Sleeve-type couplings shall be as specified in the City of Tampa Technical Specifications for Water Mains.
5. Nuts and Bolts

High strength low alloy steel conforming to AWWA C111/ANSI A21.11.

C. Flexible Joint Piping Systems

1. Pipe

Ductile iron conforming to AWWA C151 / ANSI A21.51, with double thickness cement mortar lining and 1-mil minimum outside coating of coal tar enamel. Pipe shall have the minimum wall thickness and nominal inside diameter for the pipe class indicated on the Plans.

2. Joints

Flexible, ball and retainer type boltless joint.

D. Cement Mortar Pipe Linings

Cement mortar linings for cast iron and ductile iron pipe shall conform to the requirements of AWWA C104 /ANSI A21.4 of the thicknesses specified and shall be permanently set prior to the application of any additional pipe coating.

E. Coal Tar Enamel Coatings

1. Primers
AWWA C203, Type A.
2. Coal Tar Enamel
AWWA C203, Type I.

Pipe coatings shall be shop applied. Prime all surfaces. Coal tar enamel coatings shall be hot applied. Coatings shall be applied uniformly over all surfaces and when set, shall be firm, tenacious and tough; shall not sag at 140 degrees F and shall not check or peel at 20 degrees F. Coatings after drying for 48 hours, shall have no deleterious effect upon the quality, color, taste or odor of potable water.

F. Bituminous Paint

Two (2) coats of cold-applied bituminous paint may be applied to the exterior surfaces of ductile iron pipes and fittings in lieu of hot applied coal tar enamel provided all the other requirements of paragraph 2.01.E. of this Section are met. Bituminous paint shall be prepared from coal tar enamel and suitable solvents conforming to AWWA C203, Type I.

G. Polyvinyl Chloride (PVC) Piping Systems

1. Pipe and Couplings

Rigid polyvinyl chloride bell and spigot type pressure pipe and couplings conforming to AWWA C900, for four (4) inches and larger pipe or ASTM D2241 for pipe smaller than four (4) inches, of the types and pressure class indicated on the Plans.

Compounds used for production of PVC pipe and components shall be suitable for potable water products as required in Sections 3 and 4 of NSF Standard 14. Spigot end of pipe shall be marked to visually determine when the spigot is fully seated in the bell of the adjoining pipe.

2. Joints

Push-on or mechanical elastomeric gasket type, conforming to ASTM D3139.

3. Fittings

a. Polyvinyl Chloride

Two hundred (200) pound Pressure Class conforming to AWWA C900 of types and sizes indicated on the Plans.

b. Gaskets

Elastomeric seal type conforming to ASTM F477.

c. Lubricants

Manufacturer's standard non-toxic conforming to AWWA C900.

H. Valves and Hydrants

1. Bronze Bodied Gate Valves

Valves shall be composed of brass conforming to ASTM B62 (85-5-5) and to federal specification WW-V-541, Class A, Type I, wedge disc, nonrising stem gate.

2. Resilient - Seated Line Valves

Valves shall conform to AWWA Standard C 509 with nonrising stems.

3. Fire Hydrants

Dry barrel breakaway compression type with counter clockwise opening fire hydrants conforming to AWWA C502-85 with approved U.L. Listed (AWWA, U.L., and F.M. colophons must be cast in upper barrel of each hydrant.

4. Tapping Sleeves

Mechanical joint sleeves shall be furnished complete with valve, stops, caps, plugs and joint accessories as indicated on the Plan. The sleeve shall be of a 2-section type.

I. Valve Boxes

Gray iron castings conforming to ASTM A48, Class 20. Overall length shall be adjustable to meet grade.

J. Corporation Stops

Corporation stops, couplings and plugs shall be water service bronze of type and size detailed on the Plans.

K. Service Clamps

The clamps shall be compatible with the main and service lead, with straps of a ductile material to avoid crushing the main out-of-round. A molded gasket of rubber or neoprene shall completely encircle the tapped opening to insure a watertight connection. The use of lead gaskets is not allowed.

L. Curb Stops

Water service bronze of types and sizes detailed on the Plans.

M. Threaded Fittings

Where indicated on the Plans, threads for water main service fittings shall conform to the requirements of AWWA C800 and AWWA C800 Appendix for Materials.

N. Water Service Pipe

1. Soft Copper

Type K conforming to ASTM B-88, with flared fittings.

2. Polyvinyl Chloride

Conforming to ASTM D2241 or D1785 Schedule 40.

O. Restraints, Clamps, Rods, and Ties

1. Cast iron or steel as recommended by pipe manufacturer. Balls and fittings shall be bronze alloy or corrosion protected steel.

Restraints for mechanical joint pipe and fittings and push on joint pipe and fittings shall be in accordance with the City of Tampa Technical Specifications for Water Mains.

P. Structures

Material for water main structures shall conform to the requirements listed below:

1. Clay Brick

Grade MS of ASTM C32 recessed and/or cored as approved.

2. Concrete Block

ASTM C139, Type II, shape and scored as detailed and as approved.

3. Precast Concrete Units

ASTM C478, circular with circular reinforcement as detailed. Provide lifting holes in precast units where indicated.

4. Covers and Frames

Provide types and sizes as detailed on the Plans. Covers shall be Class 30, ASTM A48 gray iron castings. The castings shall be neatly made and free from cracks,

cold sheets, holes and other defects. Surfaces of castings shall be ground to assure proper fit and to prevent rocking. Units shall be frostproof and shall be provided with tapping screws and anchors where indicated on the Plans.

Q. Bolts, Studs, and Nuts

Bolts, studs, and nuts shall be as specified on the Plans and shall conform to the requirements of AWWA C500 and the ASTM standards listed below:

Bronze ASTM B98
Steel ASTM A307, Grade B
Cadmium Plating ASTM A165, Grade N.S.
Zinc Coating ASTM A153 or A164, Type G.S.

Tee head bolts and nuts shall be high strength, low alloy steel conforming to ANSI/AWWA C111/A21.11.

R. Granular Material

Granular material shall be in accordance with the City of Tampa Technical Specifications and meeting the approval of the ENGINEER OF RECORD

2.2 ACCEPTABLE MANUFACTURERS
(CONTRACTOR TO VERIFY CURRENT CITY APPROVED LIST)

A. Flexible Joint

Acceptable manufacturers include: F141, Clow, Usiflex, U.S. Pipe, or equal.

B. Bronze Bodied Gate Valves

Acceptable manufacturers include: Hammond IB645, American 3FG, NIBBCO T-113, Grinne 3000.

C. Resilient Seated Line Valves

Acceptable manufacturers include: Clow 6100, 6103, and 6110, Kennedy Kenseal - II, American AFC-500, U.S. Pipe Metroseal 5460, M&H - 3067.

D. Fire Hydrants

Acceptable manufacturers include: Clow Medallion, U.S. Pipe Metropolitan-250, American B-84-B, Mueller A-426.

E. Valve Boxes

Acceptable manufacturers include: F2450, Clow, Series 6860, Tyler, or equal.

F. Corporation Stops

Acceptable manufacturers include: Hays; Crane; Mueller; Ford; or equal.

G. Service Clamps

Acceptable manufacturers include: Twin Seal, Clow, Service Clamps, Mueller, or equal.

H. Curb Stops

Acceptable manufacturers include: Ford, Mueller, or equal.

I. Sleeve-type couplings

Acceptable manufacturers include: Dresser Industries Inc. style 38, Smith-Blair type 411.

J. Restrained Mechanical Joint

Acceptable manufacturers include: American Cast Iron Pipe Company, Clow F-1058

K. Restrained Joint Pipe

Acceptable manufacturers include: Clow F-128 "Super Lock Joint", American Cast Iron Pipe "Lok-Fast Joint", and US Pipe and Foundry "TR Flex."

PART 3 - EXECUTIONS

3.1 CONTRACTOR'S VERIFICATION

A. Excavation and Bedding

Prior to the installation of any water main piping or materials, examine all trenches and other excavations for the proper grades, lines, levels and clearances required to receive the new Work. As certain that all excavation bottoms, compacted subgrades and pipe bedding are adequate to receive water main materials to be installed. Correct all defects and deficiencies before proceeding with the work.

B. Existing Water Mains

Expose the existing water main piping and structures to which the new Work is to be connected and notify the ENGINEER OF RECORD AND THE OWNER of the same. The ENGINEER OF RECORD will verify the vertical and horizontal locations of the existing system and shall inform the CONTRACTOR as to the necessary adjustments required to align the new water main work with the existing system.

3.2 PREPARATION

A. Pipe Ends

Remove all lumps, blisters excess coatings from the socket and plain ends of pipe. Wire brush and wipe clean the outside surfaces of all plain ends and the inside surfaces of all socket ends before installation. Any pipe or fitting which has acquired a coating of mud or other adhesive foreign material shall be scrubbed clean with heavily chlorinated water.

B. Examination of Materials

All pipe fittings, valves, hydrants, accessories and appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective or damaged materials shall be marked and held for inspection by the ENGINEER OF RECORD. Damaged materials are subject to rejection by the ENGINEER OF RECORD AND/OR OWNER. Damaged materials shall be replaced by the CONTRACTOR at the CONTRACTOR'S expense.

3.3 INSTALLATION

A. General

1. Pipe Cleanliness

Foreign matter shall be prevented from entering the pipe while it is being placed in the trench. During and after laying operations, no debris, clothing or other materials shall be placed in the pipe.

2. Pipe Plugs

During the progress of all water main work, watertight plugs shall be carried along and inserted in the end of each pipe as it is laid to prevent foreign matter or rodents from entering the pipe. This watertight plug shall be fastened in the end of the water main in such a manner as to prevent it from floating or being otherwise displaced whenever construction operations are temporarily halted, such as at noon or at the end of the days Work.

3. Pipe Bearing

Each section of pipe, when placed to grade and line, shall have firm bearing on the trench bedding throughout its length between bell holes.

4. Pipe Cutting

Cutting of pipe shall be done with approved tools and by approved methods suitable for the pipe material. Pipe cutting methods that produce a smooth, square cut end without damage to the pipe and that minimize airborne particles shall be employed. Pipe cutting shall be performed using the recommendations of the manufacturer of the type of pipe materials being cut and according to the best trade practices.

a. Pipe Linings and Coatings

When cutting pipe or fittings, care shall be taken to prevent damage to linings and coatings. Damage to linings shall be cause for rejection of the complete Section. Damage to exterior coatings shall be corrected to original Specifications.

b. Gaskets

Where pipe using a resilient gasket to effect the seal is cut, the cut pipe end shall be tapered at a 30-degree angle with the centerline of the pipe, and ground smooth, on the outside end to remove any sharp edges or burrs which might damage the gasket.

5. Pipe Laying

Unless otherwise specified, pipe shall be laid with bell ends facing in the direction of laying. After a length of pipe is placed in the trench, the spigot shall be centered in the bell end of the adjacent pipe section, the pipe shoved into position and brought to true alignment and secured with sand tamped under and on both sides of the pipe except at bell holes. Adequate support shall be provided for all water main pipe.

6. Pipe Bedding

After the bottom of trench has been excavated and filled to the required grade with

four (4) inches of select sand backfill approved by the ENGINEER OF RECORD, meeting the requirements of granular material (City of Tampa Technical Specifications for Water Mains) thoroughly compacted by tamping, the pipe shall be installed strictly in accordance with the manufacturers recommendations. After the pipe is laid, the sand backfill shall be continued to a point 12 inches above the top of pipe barrel.

Particular care shall be taken to assure filling and tamping all spaces under, around and above the top of the pipe. Backfill shall be as indicated on the Plans and in the Specifications. Continuous and uniform bedding shall be provided in the trench for all buried pipe.

7. Bolts, Studs, and Nuts

Install bolts, studs, and nuts of the type specified per the manufacturer's installation and torquing requirements. All steel bolts, studs, and nuts shall be painted with bituminous paint after installation.

8. Polyethylene Encasement

Polyethylene Encasement conforming to AWWA C105 shall be installed on all pipe and fittings within the sections shown on the plans or as directed by the ENGINEER OF RECORD and in accordance with the City of Tampa Technical Specifications for Water Mains.

9. Restrained Joints

Provide restrained joints as shown on the plans. Connection shall be made in accordance with manufacturer's recommendations.

10. Water Main Marking

Ductile iron pipe shall be spiral wrapped with 2" blue vinyl tape as per City of Tampa Technical Specifications for Water Mains. Polyvinyl Chloride Pipe shall be marked with 3" detectable tape installed 12" over top of the pipe.

B. Ductile Iron Pipe

1. Push-On Joints

Joints shall be made by means of a compression type push-on resilient gasket. Gasket shall be pre-lubricated before installation using a lubricant recommended by the pipe manufacturer. The seated joint shall be identified by the visible mark on the spigot of the installed pipe section.

2. Mechanical Joints

Joints shall be made with bolts, molded resilient gasket and ductile iron follower gland. All nuts shall be screwed up finger tight before using a wrench. The gland and rubber gasket shall be brought up evenly at all points around the bell flange and then torqued per the manufacturers recommendations. The normal range of bolt torques to be applied to standard cast iron bolts in a joint and the lengths of wrenches that should satisfactorily produce the ranges of torques are as follows:

Pipe Size	Bolt Size	Range of Torque	Length of Wrench
-----------	-----------	-----------------	------------------

3 inch	5/8 inches	45-60 ft. lb.	8 inches
4-24 inch	3/4 inches	75-90 ft. lb.	10 inches
30-36 inch	1 inch	100-120 ft. lb.	12 inches
42-48 inch	1-1/4 inches	120-150 ft. lb.	14 inches

Exposed portions of bolts shall be covered with mastic.

3. Flexible Joint Pipe

Flexible joint pipe shall be assembled, handled and installed in accordance with the printed recommendations, which accompanies the pipe and is provided by the manufacturer of the piping materials being installed. Methods of handling and installation shall be acceptable to the ENGINEER OF RECORD

C. Polyvinyl Chloride Pipe

Polyvinyl chloride pipe shall be laid with gasketed joints in complete accordance with the pipe manufacturers published instructions. The joints shall be sufficiently lubricated using the pipe manufacturers recommended lubricant.

Gaskets for pipe joints shall be inserted with the painted edge facing the end of the bell. Each length of pipe shall be pushed home individually. The pipe shall be positioned so that the reference mark on the spigot end is in line with the bell end.

D. Valves, Hydrants, Fittings, and Appurtenances

1. Valves

All valves shall be installed to the grade, lines, levels and locations indicated on the Plans.

Valve connections shall be as specified for the piping materials used. Valves shall be set with the stem plumb on permanent, firm foundations as indicated on the Plans.

Where required, valves shall be supported with special supports as indicated on the Plans and as approved by the ENGINEER OF RECORD. Valves shall be installed so as not to receive support from the connecting pipe. In no case shall valve installation be used to bring misaligned pipe into alignment.

2. Hydrants

All hydrants shall be installed plumb to the lines, levels, grades and locations indicated on the Plans. Hydrants shall be set to the established grade, shall have their nozzles parallel to or at right angles to and facing the grade or curb.

Where necessary to adjust for proper hydrant grade and location, the CONTRACTOR shall install additional fitting and spigot pipe between the water main and road box.

The CONTRACTOR shall plumb all hydrants at the time they are set with a plumb line or other means acceptable to the ENGINEER OF RECORD. Upon substantial completion of cleanup, the CONTRACTOR shall recheck all hydrants for plumb and grade and shall make all adjustments as directed by the ENGINEER OF RECORD at this time. The Work of constructing fire hydrants shall not be considered complete until these final adjustments for plumb and grade have been made. No

extra compensation will be paid to set hydrants plumb and to grade.

3. Relocation of Hydrants

Relocation of hydrants shall include the provision of new hydrant shoes and restraints. Provide all new materials required for hydrant relocation. Reinstall hydrants at the new locations to the lines and levels shown. Make all joint connections to new or existing water mains, joints, couplings, etc. as shown and as required. Provide all anchorage and restraint for a complete installation.

4. Valve Boxes

Install valve boxes to the grade, lines, levels and locations indicated on the Plans. Valve boxes shall not transmit shock or stress to the valve and shall be set plumb with covers centered over operating nuts and flush with the indicated surface elevations. Valve boxes that shift or fill during backfilling shall be uncovered and reset.

5. Corporation Stops

Corporation stops shall be located on water main piping where indicated on the Plans or as directed by the ENGINEER OF RECORD.

Install a minimum of two (2) corporation stops in each valve well.

One (1) inch tapping outlets shall be installed at approximately 20-foot intervals along the entire length of the concrete water main. These tapping outlets shall be constructed as detailed on the plans and shall be positioned 45 degrees off vertical. The location of the tapping outlets shall be marked by means of No. 4 reinforcing rod. The rod shall be placed in a vertical position immediately adjacent to, but not touching, the water main and the top, six (6) inches below finished grade.

6. Service Clamps

Where service clamps are to be installed, the entire circumference of the main shall be free of all loose material. Installation of the clamp and tapping of the main shall be in accordance with manufacturers' recommendations.

7. Curb Stops

Install curb stops of the types and sizes indicated on the Plans.

8. Fittings, Strapping, and Lugged Pipe

a. Fittings

Install all fittings to the lines, levels and locations indicated on the Plans. Installation of fittings shall be with the type of joint specified for piping. Fittings shall be provided with restraints as specified herein as indicated on the Plans and as required for a functional installation.

b. Strapping, Lugged Pipe and Fittings

Where indicated on the Plans and as directed by the ENGINEER OF RECORD, bends in water main piping and piping runs subject to impact reaction shall be secured by means of metal strapping. Install all necessary

bands, tie rods, nuts and washers required. No metal strapping shall be used in direct contact polyvinyl chloride pipe.

Where lugged pipe and special fittings are indicated on the Plans, furnish and install all necessary tie rods, nuts and washers.

9. Anchors and Thrust Blocks

Anchors, encasements and restraints shall be provided at the locations and dimensions as indicated on the Plans. Anchoring, encasement and restraint methods shall be as detailed. All bearings shall be as shown. Anchors, encasements and restraints shall rest on firm, stable, compacted subgrade and shall be provided for all standard and special fittings.

E. Water Main Structures

Construct water main valve wells and structures to the grades, lines and levels indicated on the Plans and as specified. Structures shall be complete with concrete bases, reinforcing, frames, covers, adjustment rings, etc., as shown and as required for a complete installation. Water main structures shall conform to the dimensions indicated on the Plans and as described below.

1. Brick

Prior to laying, all brick shall be thoroughly wetted and the surfaces allowed to dry only sufficiently to prevent slippage on the mortar.

Broken or chipped brick shall not be used on the faces of the structure.

Brick shall be laid in neat, even consecutive courses with full and close mortar joints. Courses shall be level throughout, except as shown or otherwise required. Stagger joints in adjoining courses by 1/2 a brick as nearly as practicable. At least one (1) course in every seven (7) shall be stretcher courses with intervening courses laid as headers. Length of brick closure pieces shall be not less than the width of one (1) whole brick and, wherever practicable, closures as headers shall be made from whole brick.

Unless otherwise indicated, joints shall be not more than 1/2 inch thick and shall be of a uniform thickness throughout the structure. Joints shall be provided as indicated on the Plans. Exposed surfaces shall be true and smooth. Rake all joints to receive plaster coat.

Prior to applying plaster coat, brick shall be thoroughly wetted with water and the surface allowed to dry sufficiently to effect proper bonding.

2. Concrete Block

Construct concrete block structures in the locations and according to the details on the Plans. The first course of concrete blocks shall be placed on the prepared base or footings in a full bed of mortar. Mortar joints shall be full and close in all courses. Courses shall be level throughout. Stagger joints in adjoining courses by 1/2 the length of the block as nearly as practicable.

Joints shall be uniform in thickness throughout the structures. Strike all joints and properly point to provide true, smooth surfaces.

3. Precast Concrete Units

Construct as detailed on the Plans. Provide mortar joints struck smooth. Provide two (2) to four (4) courses of 8-inch brick at top of structure for future adjustment.

4. Plaster Coat

Cement mortar plaster coat shall be applied to the exterior surfaces of all gate wells and other water main structures indicated on the Plans. Plaster coat shall be 1/2-inch thick and shall be applied to the outer surfaces of the structures.

5. Inlet and Outlet Pipe

Pipe placed in structures for inlet or outlet connections shall extend through the walls and beyond the outside wall surfaces a sufficient distance to allow for complete connections. Openings between pipes and walls shall be sealed with a full bed of cement mortar. Pipe shall be supported by concrete supports.

F. Air Release Assembly

Provide all materials and construct air release assemblies where indicated on the Plans. Install all valves, fittings, caps, plugs and piping as required. Fittings and joint materials used for air release assemblies shall be as specified herein for the water main piping materials used.

G. Blow-Off Assembly

Provide all materials and construct blow-off assemblies where indicated on the Plans. Blow-off assemblies and pipe shall be installed to the lines, levels and elevations shown, install all valves, fittings, reducers, piping, plugs, joints, etc. as detailed. Blow-off assemblies shall be installed on stable, undisturbed earth materials with changes in directions and returns provided with bedding and restraints as indicated on the Plans, as specified herein and as required for a complete installation. Blow-off assemblies shall include valve boxes as detailed.

H. Tapping Valve Assembly

Install all tapping valve assemblies of sizes and to the lines, elevations, locations and details indicated on the Plans. The tapping sleeve shall be assembled around the main, and the tapping performed in strict accordance with the manufacturers recommendations. Tapping shall be accomplished without interruption of service.

I. Anchors, Encasements, and Restraints

Plugs, tees, sleeves, bends, caps, straps and lug piping shall be provided with suitable anchors, encasements and restraints as indicated on the Plans. Anchoring, encasement and restraint methods shall be as detailed. All bearings shall be as shown. Anchors, encasements and restraints shall rest on firm, stable, compacted subgrade and shall be provided for all standard and special fittings.

J. Water Service Lines

1. General

When so indicated in the Proposal(s), or on the Plans, the CONTRACTOR shall provide water service lines in accordance with Article 3.03.K.2. and 3.03.K.3. of this Section. Otherwise, water service lines are not required.

2. New Water Main

a. General

Water service lines shall be installed after the water main has been successfully tested and put into service, including the installation of fire hydrants. The service lines shall be of the type indicated on the Plans, and shall be 3/4 inch diameter unless otherwise indicated on the Plans.

Water service lines shall be provided for all lots or parcels at the locations indicated on the Plans, within these Contract Documents or as directed by the ENGINEER OF RECORD. Service lines shall extend from the water main to within 1-foot of the limits of a right-of-way or easement at minimum 5-foot depth terminating with a curb stop as specified herein. A water main test shall be conducted by the CONTRACTOR and witnessed by THE ENGINEER OF RECORD to confirm water pressures are maintained during game day event. Corrective work required shall be the CONTRACTOR'S expense and retesting will be required if specified criteria is not met.

b. Installation Method

Water service lines under concrete or asphalt pavements shall be installed by boring or tunneling (per City of Tampa Standards), unless otherwise indicated on the Plans or directed by the ENGINEER OF RECORD

Backfilling of open cut construction shall be in accordance with Section 312333, Trenching, Backfilling, and Compacting, after the service line, including curb stop, has been laid and approved by the ENGINEER OF RECORD. Prior to backfilling the service line the CONTRACTOR shall request an inspection by the ENGINEER OF RECORD and obtain approval of the service line.

Alternative methods such as hydraulic jacking; air jetting; piston mole; etc., may be used to install water service lines if approved by the ENGINEER OF RECORD.

The proposed method must be approved by the governmental agency having jurisdiction over the work area and the CONTRACTOR must demonstrate that, in the opinion of the ENGINEER OF RECORD, the method is suitable for local soil and ground conditions.

To be found suitable for local conditions, the method must be demonstrated to perform within acceptable horizontal and vertical accuracy limits, must not compress soil beyond acceptable limits, and must not leave voids in the soil. Water jetting shall not be permitted. Final installation of the service pipe must be in accordance with manufacturer's recommendations and no joints or fittings shall be allowed under roadway surfaces.

3. Replacement Water Mains

Existing water mains shall be kept in service until all water services have been connected to the new mains. The CONTRACTOR shall repair all water services damaged during the installation of the new water mains. Only after the new mains have been accepted and put into service, will service connections be made to the new mains.

The connection of existing service lines to the new mains shall be made within the street rights-of-way or within the easements, utilizing the existing curb stops. All existing lead water service lines shall be abandoned and new water service lines installed from the new water main to the existing curb stops.

Backfill, method of construction under pavements, and new water service lines shall be as specified in Article 3.03.K.2. of this Section.

3.4 FIELD QUALITY CONTROL

A. Hydrostatic Testing

After the pipe has been laid and backfilled, the pipe shall be hydrostatically tested for leakage. The CONTRACTOR shall furnish the pump, pipe connection, hydrants, valves and any other necessary apparatus including gages and meters and all personnel necessary for conducting the test. Before applying the test pressure, all air shall be expelled from the pipe. If necessary to accomplish this, taps shall be made at points of higher elevation and afterwards plugged. The test shall be made in accordance with the City of Tampa Technical Specifications for Water Mains. Any faulty pipe fitting, gate valves or other accessories which permit leaks during testing shall be replaced by the CONTRACTOR with sound material and the test shall be repeated until specified requirements are met. The maximum permissible leakage measured by a water meter for the section of main tested under pressure, shall not exceed the rate specified by the formula indicated in Section 4.2.2 of AWWA Specification C600. Copies of test data shall be forwarded to the OWNER AND THE ENGINEER OF RECORD.

B. Water for Testing

Water for testing shall be obtained from a potable water supply. The CONTRACTOR shall provide all water required at his own expense and shall make all necessary arrangements with the authority which controls the source of water system and shall be governed in his use of water by all rules and regulations imposed thereon by said authority. The CONTRACTOR shall provide and remove temporary connections between the source water system and the mains constructed under this Contract. All temporary connections shall meet the approval of the ENGINEER OF RECORD, the authority controlling the source water system and Public Health authorities having jurisdiction.

C. Defective Work

Any portion of the pipe which does not meet the leakage requirements specified shall be corrected/repared at the CONTRACTOR's expense by the methods meeting the approval of the ENGINEER OF RECORD AND THE OWNER. Any extra testing or sampling required because of apparent deficiencies shall be at the CONTRACTOR'S expense.

3.5 CLEANING AND DISINFECTION

A. Flushing

After completion of water main installation, flush the new mains, valves, hydrants and appurtenances completely and as acceptable to the ENGINEER OF RECORD. Heavily chlorinated water discharged from a disinfected system shall be controlled adequately to protect any surface water resource or adjacent property from potential environmental damage, or from creation of a hazard to traffic. Remove and dispose of all temporary installations at completion of the flushing operation.

After flushing, and prior to final approval of the system, the CONTRACTOR shall pump down

all fire hydrants and verify that the hydrant valve is properly seated to prevent the hydrant standpipe from filling with water.

B. Disinfection

After satisfactory hydrostatic testing and flushing of the new water main, disinfect the complete system by introduction of a chlorine-water solution throughout the water main piping. The liquid mixture shall be applied by means of a solution-feed chlorinating device. The chlorine solution shall be applied through a corporation stop at the beginning of the main or valved section thereof. A slow flow of water shall be let into the main approximately at the point of injection of the chlorine solution, at a rate such that the chlorine dosage of the entering water shall be at least 50 parts per million. An open discharge shall be maintained at the far end of the section of main being chlorinated, and the introduction of chlorine solution and water shall continue until the water discharging at the far end shall carry the required dosage of chlorine. As the main is filled with chlorinated water, each outlet from the main shall be opened and sufficient water drawn off to assure that the full dosage of chlorine reaches each outlet. Back pressure causing a reversal of flow in the main being chlorinated shall be prevented, and pressure in the main shall be held down to a point which will make it impossible for chlorinated water to be forced into other sections of the main or water system.

The chlorine treated water shall remain in the main at least 24 hours, and at the end of that time the chlorine residual at pipe extremities and other representative points shall be at least 25 ppm. If the chlorine residual shall be less than 25 ppm at the end of 24 hours, further application of chlorine shall be made and the retention period repeated until the required 25 ppm residual is obtained.

Should the initial treatment of all or any section of the mains, in the opinion of the ENGINEER OF RECORD, prove ineffective, the chlorination procedure shall be repeated until confirmed tests show that water sampled from the new mains conforms to the foregoing requirements.

The CONTRACTOR shall collect water samples and cause analyses to be made at his own expense. Testing laboratory and sample collection shall meet the approval of public health authorities having jurisdiction. Copies of testing data and public health authority's acceptance shall be forwarded to the owner.

C. Water for Cleaning and Disinfection

Water for cleaning and disinfection shall be obtained from a potable water supply. The CONTRACTOR shall provide all water required at his own expense and shall make all necessary arrangements with the authority which controls the source of water system and shall be governed in his use of water by all rules and regulations imposed thereon by said authority. The CONTRACTOR shall provide and remove temporary connections between the source water system and the mains constructed under this contract. All temporary connections shall meet the approval of the ENGINEER OF RECORD, the authority controlling the source water system, and Public Health authorities having jurisdiction.

D. Bacteriological Analysis

Prior to placing a water main in service, not less than two (2) consecutive water samples taken 24 hours apart for bacteriological analysis shall be collected and each analysis shall show results meeting state drinking water standards.

The CONTRACTOR shall collect water samples and cause analyses to be made at his own expense. Testing laboratory and sample collection shall meet the approval of public agency having jurisdiction. Copies of testing data shall be forwarded to the OWNER AND THE

HILLSBOROUGH COUNTY
NORTHWEST AREA HEAD START

DECEMBER 21, 2020
PERMIT SET

ENGINEER OF RECORD.

END OF SECTION

SECTION 33 3000 - SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes sanitary sewer Work indicated on the Plans complete with pipe, joints, structures, pipe bedding, installation, and television inspection and testing.

- B. Related Work Specified Elsewhere

- 1. Dewatering: Section 31 2319
- 2. Structure Excavation and Backfill: Section 31 2300
- 3. Trenching, Backfill and Compacting: Section 31 2333

1.3 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies

- 1. Testing

Testing shall conform to the applicable requirements of State and local authorities having jurisdiction, and shall include such tests as: air, exfiltration and infiltration.

- B. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ANSI - American National Standard Institute

ASTM - American Society for Testing and Materials

FDOT - Florida Department of Transportation

Hillsborough County Technical Specifications

- C. Source Quality Control

Laboratory test each lot, with a minimum of three (3) pieces, each size, material and class of gravity pipe required in the Work.

1.4 SUBMITTALS

- A. Product Data

Submit manufacturer's data to ENGINEER OF RECORD for pipe bulk heading devices in accordance with Article 3.03.E. of this Section. Submit manufacturers Certification and Certified test reports for each size, material and class of gravity pipe required in the Work as per the requirements of and shall be in conformance with the Hillsborough County Technical Specifications.

B. Reports

1. A complete field report of the location of all wyes, risers and sewer services shall be submitted to the OWNER, ENGINEER OF RECORD at the end of each sewer section of the Project or on the last day of each week, whichever occurs first.

The complete field report shall include witnessing by the CONTRACTOR of the ends of all building leads placed. Witnessing shall consist of recording three (3) horizontal distances to the nearest foot from the end of the sewer services to three (3) permanent structures, with the lines of measurement at minimum angles of 45 degrees with respect to one another.

Witnessing shall also include recording of the depth to nearest 2 foot from the invert at the end of the lead to the finish ground above the end of the lead. No payment will be made for unwitnessed installation or for improper witnessed installations.

2. As part of the television inspection, a wye location report shall be submitted to the ENGINEER OF RECORD AND OWNER. The report shall contain the precise location of each wye, notes, photographs, and other pertinent information.
3. Submit two (2) copies of the laboratory test reports required per paragraph 1.02.C. of this Section to the OWNER.

C. Shop Drawings

Shop Drawings shall be provided to ENGINEER OF RECORD on all manholes and connection to manholes as per and shall be in conformance with the Hillsborough County Technical Specifications.

1.5 PRODUCT STORAGE AND HANDLING

A. Storage of Materials

1. Sanitary Sewer Piping

Piping material shall not be stacked higher than four (4) feet. Suitable racks, chairs, and other supports shall be provided to protect preformed pipe mating surfaces from damage. Store bottom tiers off the ground, alternate tiers and chock tier ends.

2. Gaskets

All joint and sealing materials used in the sanitary sewer system shall be protected from sunlight and stored in cool and clean place until ready for installation.

B. Handling of Material

1. Loading and Unloading

Load and unload piping using suitably approved hoists, skids, etc. Piping shall not be dropped, bumped or allowed to impact against itself. Damaged piping will be

rejected by the ENGINEER OF RECORD.

2. Lifting Devices

Lifting devices shall be suited to the Work and shall protect surfaces from damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Scope

It is the intent of this Article to specify in detail the various types of sewer pipe and joints, which have been indicated throughout the Plans and Specifications. This Article shall not be construed as allowing any alternate type of material to that which is indicated on the Plans or elsewhere in the Specifications.

B. Plastic Pipe System

1. ABS Pipe

- a. Truss pipe shall be ASTM D2680, Acrylonitrile- Butadiene-Styrene (ABS). The pipe shall be of a double wall construction, braced with a truss-type structure with all three (3) formed in one (1) extrusion. The truss voids are filled with lightweight concrete to provide additional compressive strength and bracing.
- b. Solid wall pipe shall conform to ASTM D2751, SDR 23.5, Acrylonitrile-Butadiene-Styrene (ABS).
- c. Joints for Acrylonitrile-Butadiene-Styrene (ABS) composite pipe shall be ASTM D2680, Type S.C., a solvent-cemented joint in which pipe solvent cements into a coupling socket to form the joint closure. Installation of the solvent cement shall be in strict accord with the manufacturer's recommendations.

2. PVC Pipe

- a. All PC Pipe shall be in conformance with the Hillsborough County Technical Specifications
- b. Pipe in sizes 6-inch through 15-inch shall be ASTM D3034 SDR35, and in sizes 18-inch through 27-inch shall be ASTM F679 SDR35, polyvinyl chloride pipe (PVC).
- c. Joints for polyvinyl chloride pipe (PVC) shall be ASTM D3212, push-on type. A joint in which an elastomeric ring gasket is compressed in the annular space between a bell end or socket and a spigot end of pipe.
- d. All pipe and fittings shall be marked in conformance with the Hillsborough County Technical Specifications.

C. Structures

Material for sanitary sewer structures shall conform to the requirements listed below:

1. Clay Brick

Brick shall be ASTM C32, Grade MS, recessed and/or cored .as approved by the ENGINEER OF RECORD.

2. Concrete Brick

Brick shall be ASTM C55, Grade S-11, recessed and/or cored.

3. Precast Concrete Units

Precast concrete units shall conform to ASTM C478, and shall be circular with circular reinforcement. The minimum wall thickness shall be six (6) inches for stack depth sections up to 12 feet and eight (8) inches for depths over 12 feet. Base slab shall be eight (8) inches thick for depths up to 25 feet and 12 inches thick for depths greater than 25 feet.

Precast doghouse sections shall be used for existing sewer 15 inches and smaller on straight-through runs for a depth up to 20 feet and on right angle runs, with a maximum of four (4) cutouts for depths up to 12 feet. Openings in precast doghouse sections shall be cast in the section before curing and no breaking or chipping of sections will be allowed after the section has cured.

The size of the opening shall be cast as indicated on the Plans.

Precast bottom sections shall be cast with the bottom end flat to provide bearing of the full wall thickness. The openings for sewer pipe shall be cast in the manhole and the bottom section by the manufacturer.

Six (6) inch thru 24-inch connections to manholes shall use a mechanically compressible flexible joint, as indicated on the Plans.

Riser sections of a manhole shall have modified grooved tongue joints with O-ring gaskets or a tongue and groove joint with a butyl rubber based gasket type sealant meeting the requirements of AASHTO M-198 and having a nominal size of 1-inch.

Eccentric cone sections of a manhole shall have modified grooved tongue joints with O-ring gaskets and be provided with 4-stud inserts cast in the top. The top shall have a smooth finished surface.

Concrete grade rings shall have smooth finished top and bottom surfaces. Grade rings shall be provided with O-ring gaskets.

Precast manhole tees will be allowed on straight-through runs with no angle at the manhole and where stubs or openings in manhole are above the tee section.

Precast concrete manhole tee units shall conform to ASTM C76, Class IV and shall be circular with circular reinforcement. The precast tees must be a monolithic pour with wire cage inspection prior to concrete placement. Joints for tee shall be the same as the joints on the sanitary sewer.

4. Manhole Frames and Covers

Manhole frames and covers shall conform to ASTM A48, Class 30, gray iron and shall be of the types and sizes as indicated on the Plans. The castings shall be neatly made and free from cracks, cold sheets, holes and other defects. Surfaces of casting shall be ground to assure proper fit and to prevent rocking.

For manholes using a bolted down frame and cover shall be installed with a bolted waterproof frame with a pressure tight cover as indicated on the Plans.

D. Steel Pipe

Pipe shall conform to ASTM A120, black and hot-dipped galvanized welded and seamless pipe of standard weight.

E. Bolt, Studs, Nuts

Bolt, studs and nuts shall conform to the following ASTM Standards:

Cadmium Plating: ASTM A165, Grade N.S.

Zinc Coating: ASTM A153 or A164, Type G.S.

F. Concrete

The concrete shall conform to the Hillsborough County Technical Specifications no admixtures without ENGINEER OF RECORD'S review.

G. Concrete Reinforcement

In accordance with FDOT Section 931, use ASTM A615, Grade 60 for bars and ASTM A185 for welded wire fabric.

H. Granular Material

Granular material shall be material with having the following gradation limits passing a No. 4 sieve - 95 % (min) passing a No. 200 sieve - 5% (max) and meeting the approval of the ENGINEER OF RECORD and shall be in conformance with Hillsborough County Technical Specifications.

PART 3 - EXECUTION

3.1 CONTRACTOR'S VERIFICATION

A. Excavation and Bedding

Prior to the installation of any sanitary sewer piping, structures, or materials, examine all trenches and other excavations for the proper grades, lines, levels and clearances required to receive the new Work. Ascertain that all excavation bottoms, compacted subgrades and piping bedding are adequate to receive the sanitary sewer materials to be installed. Correct all defects and deficiencies before proceeding with the Work.

B. Existing Sanitary Sewers

The CONTRACTOR shall expose the existing sanitary sewer and structures to which the new Work is to be connected and notify the ENGINEER OF RECORD of same. The ENGINEER OF RECORD will verify the vertical and horizontal locations of the existing system and shall inform the CONTRACTOR as to the necessary adjustments required to align the new sanitary sewer work with the existing system.

C. Pipe Class and Joints

Prior to the installation of any sanitary sewer piping, ascertain that the class of pipe, joint material and bedding are as specified herein and as indicated on the Plans.

3.2 PREPARATION

A. Pipe Ends

The outside surface of the spigot end and the inside surface of the bell end shall be cleaned and free of any foreign material, other than sealant recommended by the manufacturer, prior to installation.

B. Examination of Material

All pipe, frames, covers, accessories, and appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective or damaged material will be rejected by the ENGINEER OF RECORD.

3.3 INSTALLATION

A. General

1. Pipe Bearing

Each section of pipe, when placed to grade and line, shall have firm bearing on the trench bedding throughout its length.

2. Pipe Cutting

Cutting of pipe shall be done with approved tools and by approved methods suitable for the pipe material. Pipe cutting methods that produce a smooth, square-cut end without damage to the pipe and that minimize airborne particles shall be employed. Pipe cutting shall be performed using the recommendations of the manufacturer of the type of pipe materials being cut and according to the best trade practices. When cutting of pipe or fittings, care shall be taken to prevent damage to the lining and the exterior surface. Damage to either shall be cause for rejection of complete section.

3. Dewatering

During the preparation of the pipe bedding and until the trench has been satisfactorily backfilled, the trench shall be kept free of water and sewage. A dewatering system, in accordance with Section 02140, Dewatering, shall be provided and maintained by the. The dewatering system shall remain in operation as directed by the ENGINEER OF RECORD.

4. Pipe Laying

a. Rigid Pipe

Installation of rigid pipe shall conform to ASTM C12. All pipe shall be laid to the line and grade called for on the Plans. Each pipe as laid, shall be checked by the CONTRACTOR with line and grade pole or laser system to insure that this result is obtained. When employing a laser system, the CONTRACTOR shall have an alternate and independent means of checking the line and grade. The finished work shall be straight and shall be sighted through between manholes.

Construction shall begin at the outlet end and proceed upgrade with spigot ends pointing in direction of flow. Bell holes shall be excavated so that the full length of the barrel will bear uniformly on the pipe bedding material.

All pipe shall be jointed by means of a resilient gasket. The resilient gasket shall be lubricated and installed to form a watertight joint between the bell and spigot of the pipe. The bell of the pipe in place shall be cleaned and properly lubricated prior to the installation of the next pipe spigot. The pipe shall be centered in the bell or groove. After the spigot is well entered into the bell and the gasket is fully compressed and brought to final shape, check the gasket for proper position around the full circumference of the joint. Complete installation by pushing the pipe tightly together to form a smooth and continuous invert.

Mechanical means shall be used for pulling home all pipe where manual means will not result in pushing and holding the pipe home. Mechanical means shall consist of a cable placed inside of the pipe with a suitable winch, jack, or come along for pulling the pipe home and holding the pipe in position.

After laying of pipe, care shall be taken so as not to disturb its line and grade. Any pipe found off grade or out of line shall be relaid. When adapters are required to properly connect the new pipe to an existing pipe of other materials or manufacture, the nominal inside diameter of adapters shall be the same size as the nominal pipe diameter to which it is to be connected.

b. Flexible Pipe

Installation of flexible pipe shall conform to ASTM D2321.

Except as otherwise specified herein, installation of ABS shall be made in complete accordance with the published installation guide of the pipe manufacturer. Unless specified otherwise on the plans, all PVC pipe shall be installed with Class "C" bedding and shall be in conformance with in conformance with the Hillsborough County Technical Specifications.

Joints for ABS pipe shall be made by first applying a coat of primer to the inside of the socket and to the outside of the spigot end of the pipe. Without delay, apply a coating of cement to the same surfaces in sufficient quantity that when the spigot is fully inserted into the socket, a bead of excess cement will form around the complete circumference of the outside junction of the spigot and socket. Remove the excess cement and allow the assembly to cure 24 hours.

Joints for PVC pipe shall be made by using a lubricant immediately before joining. Apply lubricant only on the spigot, coating the entire circumference of the spigot bevel plus 1-inch behind the taper. Insert lubricated spigot into the bell, and using normal force insert spigot until insertion stripe mark is flush with the bell entrance.

When jointing ABS pipe, rotate the pipe when inserting it approximately 1/4 to 2 turns.

Taps to ABS and PVC pipes, where fittings are not provided, shall be made with chemically welded saddle fittings unless otherwise indicated on the

Plans. Holes for saddle connections shall be by mechanical hole cutters, or by keyhole saw or saber saw. Holes for saddles shall be laid out with a template and shall be deburred and beveled to provide a smooth hole shaped to conform to the fitting. After the cemented saddle has been fixed to the pipe surface, quickly install band clamps each side of the saddle and tighten.

5. Pipe Bedding

a. Rigid Pipe Bedding

Pipe bedding shall conform to ASTM C12, except as noted.

Class A

The pipe shall be bedded in crushed stone bedding material placed on the trench bottom. The bedding material shall have 100% passing a 3/4 inch sieve and 95% retained on a No. 4 sieve. The bedding shall have a minimum thickness beneath the pipe of six (6) inches or 1/4 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline.

The top half of the pipe shall be covered with a monolithic plain concrete arch having a thickness of at least four (4) inches or 1/4 of the inside diameter of the pipe, whichever is greater, at the pipe crown and a minimum width equal to the outside diameter of the pipe plus eight (8) inches or 1-1/4 of the diameter of the pipe, whichever is greater.

Class B

The pipe shall be bedded in crushed stone bedding material placed on the trench bottom. The bedding material shall have 100% passing a 3/4 inch sieve and 95% retained on a No. 4 sieve. The bedding shall have a minimum thickness beneath the pipe of six (6) inches or 1/8 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline. Backfill from pipe horizontal centerline to a level not less than 12 inches above the top of the pipe shall be select sand backfill meeting the requirements of granular material.

This material shall be placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of pipe.

Class C

The pipe shall be bedded in select sand backfill, approved by the ENGINEER OF RECORD, meeting the requirements of granular material, placed on the trench bottom. The bedding shall have a minimum thickness beneath the pipe of six (6) inches or 1/8 of the outside diameter of the pipe, whichever is greater, and the bedding shall extend to a level not less than 12 inches above the top of the pipe. This material shall be placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of pipe.

b. Flexible Pipe Bedding

Pipe bedding shall conform to ASTM D2321, except as noted.

Class I

The pipe shall be bedded in crushed angular stone material placed on the trench bottom. The bedding shall have 100% passing a 3/4 inch sieve and 95% retained on a 1/4 inch sieve.

The bedding shall have a minimum thickness beneath the pipe of six (6) inches, and shall extend up the sides of the pipe until the top of pipe is covered by a minimum thickness of 12 inches.

Where allowable trench widths are exceeded, Class I bedding shall be used to the full width between undisturbed trench walls. Concrete cradle bedding shall not be used.

A continuous and uniform bedding shall be provided in the trench for all buried pipe.

Class II

The pipe shall be bedded in crushed angular stone material placed on the trench bottom. The bedding shall have 100% passing a 3/4 inch sieve and 95% retained on a 1/4 inch sieve. The bedding shall have a minimum thickness beneath the pipe of six (6) inches, or 1/8 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline. Backfill from pipe horizontal centerline to a level not less than 12 inches above the top of the pipe shall be select sand backfill approved by the ENGINEER OF RECORD, meeting the requirements of granular material. This material shall be placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of pipe.

Where allowable trench widths are exceeded, Class I bedding shall be used to the full width between undisturbed trench walls. Concrete cradle bedding shall not be used.

Continuous and uniform bedding shall be provided in the trench for all buried pipe.

Class III

The pipe shall be bedded in select sand backfill, approved by the ENGINEER OF RECORD meeting the requirements of granular material, placed on the trench bottom. The bedding shall have a minimum thickness beneath the pipe of six (6) inches or 1/8 of the outside diameter of the pipe, whichever is greater, and the bedding shall extend to a level not less than 12 inches above the top of the pipe. This material shall be placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of the pipe.

Where allowable trench widths are exceeded, Class III bedding shall be used to the full width between undisturbed trench walls. Concrete cradle bedding shall not be used.

Continuous and uniform bedding shall be provided in the trench for all buried pipe.

B. Manhole Structures

Construct sanitary sewer manhole structures to the grades, lines and levels indicated on the Plans, or as specified herein. Structures shall be complete with concrete bases, reinforcing, frames, covers, and adjustment rings, as shown and as required for a complete installation. Sanitary manholes as called for on the Plans shall carry a stub opening as specified herein. Wye openings in manholes are prohibited unless indicated on Plans. Sanitary sewer structures shall conform to the dimensions indicated on the Plans and as described below.

Manholes shall be completed and ready for final inspection either before 400 feet of additional sewer construction is completed or within one (1) week after the manhole is constructed, whichever comes first.

1. Brick

Prior to laying, all brick shall be thoroughly wetted and the surfaces allowed to dry only sufficiently to prevent slippage on the mortar. Broken or chipped brick shall not be used on the face of the structure.

Brick shall be laid in neat, even consecutive courses with full and close mortar joints. Courses shall be level throughout, except as shown or otherwise required. Stagger joints in adjoining courses by 2 a brick as nearly as practicable. At least one (1) course in every seven (7) shall be stretcher courses with intervening courses laid as headers. Length of brick closure pieces shall be not less than the width of one (1) whole brick and, wherever practicable, closures as headers, shall be made from whole brick.

Unless otherwise indicated, joints shall be not more than 2 inch thick and shall be of a uniform thickness throughout the structure. Joints shall be provided as indicated on the Plans. Exposed surfaces shall be true and smooth. Rake all joints to receive plaster coat.

Prior to applying plaster coat, brick shall be thoroughly wetted with water and the surface allowed to dry sufficiently to effect proper bonding.

2. Concrete Block

The first course of concrete block shall be placed on the prepared base in a full bed of mortar. Mortar joints shall be full and closed in all courses. Courses shall be level throughout. Stagger joints in adjoining courses by 2 the length of the block as nearly as practicable.

Joints shall be uniform in thickness throughout the structure. Strike all joints and properly point to provide true, smooth surfaces.

Prior to applying plaster coat, block shall be thoroughly wetted with water and the surface allowed to dry sufficiently to effect proper bonding.

3. Precast Concrete Units

Construct as detailed on the Plans.

Where precast doghouse sections cannot be used, the manhole shall be brick or block to eight (8) inches above top of highest pipe.

4. Plaster Coat

Cement mortar plaster coat shall be applied to the exterior surfaces of the brick and/or concrete block sections of all manholes indicated on the Plans. Plaster coat

shall be 2 inch thick.

5. Castings

Provide and install all iron covers, frames, adjusting rings, and anchors to the elevation indicated on the Plans, or as specified herein. Castings shall be set on 1-inch diameter rubber O-ring gasket, resting on adjustment rings. The casting shall be anchored to the precast concrete cone section as indicated on the Plans.

6. Inlet and Outlet Pipe

Pipe, 6-inch thru 24-inch diameters, shall be connected to manholes using an approved mechanically compressible flexible joint as indicated on the Plans. The pipe shall be properly supported with compacted sand backfill from undisturbed ground so that any settlement will not disturb the connection.

7. Flow Channel

Concrete flow channels shall be constructed in each manhole, as indicated on the Plans. For manholes with outlet pipe diameter of 24 inches or less, the concrete flow channel shall be constructed up to the springline of the pipe, with a 3/4 inch to 1-1/4 inch gap provided at the pipe ends to maintain joint flexibility.

8. Stub Opening

Stub openings shall be at least two (2) pipe, with a minimum length of ten (10) feet, and the first joint located approximately 18 inches from the outside manhole wall. The end of the stub shall have a manufactured bell, which shall be plugged with a watertight manufacturer plug that is blocked to prevent movement.

C. Vent Assembly

Provide all materials and construct vent assemblies where indicated on the Plans. Install all piping, fittings, joints, vents, etc. as detailed. Vent assemblies shall be installed on undisturbed earth and provided with restraints as indicated on the Plans, as specified herein and as required for a complete installation. Vent assemblies shall be connected to manholes as indicated on the Plans.

D. Drop Connection Assembly

Provide all materials and construct drop connection assembly where indicated on the Plans. Install all piping, fittings, joints, etc., as detailed. Tapping of existing manholes for drop connections shall be made by drilling holes through the wall of the manhole at 4-inch centers along the periphery of the opening, to create a plane of weakness joint, before breaking out section. Non-shrink grout shall be used to seal the opening and a 3,500 psi concrete collar 12 inches thick shall be poured around the pipe. Drop connections to existing or new manholes shall be made as indicated on the Plans.

E. Bulkheads

A solid masonry or approved water and airtight bulkhead shall be placed at each point of beginning and at each stub that is constructed or as indicated on the Plans.

At the completion of construction and testing, all the bulkheads shall be removed, unless otherwise indicated on the Plans or as directed by the ENGINEER OF RECORD.

F. Wyes

One (1) 6-inch precast wye or tee branch shall be provided for each lot or parcel 100 feet or less in width that is served by the sewer or every hundred feet for lots or parcels in excess of 100 feet in width that is served by the sewer, unless otherwise indicated on the Plans or specified.

In all cases, unless otherwise indicated, wyes shall be placed as near as practical to the lower 1/3 point of vacant lots or parcels to be served, and it shall be the responsibility of the CONTRACTOR to see that the wyes are so placed. Wyes to developed lots or parcels shall be placed as directed by the ENGINEER OF RECORD.

If the CONTRACTOR fails to place any wyes as herein outlined he shall return to the site and place additional wyes, in an approved manner, at his expense.

If a concrete pipe with an inset opening is being used, a compression type joint shall be cast into bell end of the opening. Wye openings shall be closed with a precast 6-inch stopper, as recommended by the manufacturer, to make a watertight closure.

G. Risers

Risers shall be installed where the sewer is more than 12 feet below the established grade or future grade, and carried to between nine (9) and ten (10) feet of the established grade or future grade, as indicated on the Plans. Six (6) inch pipe with approved compression type joints, or equal cast-in-bell joints with similar fittings shall be installed in the manner indicated on the Plans.

Riser openings shall be closed with a precast stopper, as recommended by the manufacturer, to make a watertight closure.

H. Services

All services shall be 6-inch diameter pipe and shall be laid on a uniform slope of 1/8 inch per foot unless greater slope will provide depth considered adequate by the ENGINEER OF RECORD.

Services shall be provided to within 1-foot of property line for all lots or parcels on both sides of the street, unless otherwise indicated on the Plans. If in an easement, the service shall be provided to within 1-foot of the easement line.

Service depth, shall be as shown by the Plans. or as directed by the ENGINEER OF RECORD.

Services under or within five (5) feet of concrete or asphalt pavements shall be installed by boring or tunneling.

Each service shall be closed with a precast stopper, as recommended by the manufacturer, to make a watertight closure.

I. Wye, Riser or Service Marker

Prior to the backfilling of a wye, riser or service, a 2"x 2" (minimum cross section) wooden marker shall be placed from a point immediately in front of the service connection to 1-foot below the finish ground surface. The top of the marker shall be painted green, and labeled sanitary sewer service with station number. DO NOT rest the marker on any portion of the

service connection or stopper.

3.4 FIELD QUALITY CONTROL

A. General

After all the pipe, structures, and services have been laid, constructed and backfilled, the system shall be cleaned, final inspected and tested. The cleaning, inspection and testing shall consist of the following parts: cleaning, first inspection, television inspection and testing.

A manhole section is defined as the length of sewer connecting two manholes. Cleaning of sanitary sewer lines shall be conducted on the lines specified. The designated sanitary sewer lines shall be cleaned using high velocity, mechanically powered or hydraulically propelled sewer cleaning equipment as specified. Selection of the equipment used shall be based on the conditions of the lines at the time the work commences. Cleaning of sewer lines shall be accomplished by trapping and collecting all sand, debris, grease and other material, at the next manhole downstream of the line being cleaned, and removal and proper disposal of said materials.

The cleaning operations shall also provide a means by which the sewer line can be threaded, i.e., a cable inserted in the line so that the television camera may be pulled through.

The first inspection shall be completed and all repairs made in ample time so that the television inspection of the underground portion of the system, as hereinafter defined, can be completed within four (4) weeks of the completion of the construction. Television inspection shall be considered completed when the necessary construction repairs have been made and the installation retelevized when required, and the system is acceptable for the testing phase. When retelevision is necessary, an additional two (2) weeks will be allowed for completion. Testing of the system as hereinafter described shall immediately follow the television inspection and shall be completed within a 2-week period.

Failure to maintain a schedule in compliance with the terms of this item will automatically cause the stoppage of other work at the particular site in question until such time as the final inspection of the completed underground portion of the system has progressed to within acceptable limits.

1. Sewer Line Cleaning

The designated sewer manhole sections using equipment and methods approved satisfactory to the ENGINEER OF RECORD and OWNER, shall be cleaned using high-velocity jet equipment for 18-inch diameter sewer and smaller. The equipment shall be capable of removing dirt, grease, rocks, sand, roots and other materials and obstructions from the sewer lines and manholes, and restore the sewer to a minimum of 95 percent of the original carrying capacity, as required for first inspection, and restore the sewer to a minimum of 95 percent of the original carrying capacity, as required for first inspection.

The equipment shall have a selection of two or more high-velocity nozzles capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun capable of producing flows from fine spray to a solid stream for washing and scouring manhole walls and floor. The equipment shall carry its own water tank, auxiliary engines, pumps and hydraulically driven hose reel.

The CONTRACTOR shall contact the OWNER regarding a source of water. All

costs incurred in obtaining and delivering the hydrant meter water shall be borne by the CONTRACTOR. A gate valve shall be used by the CONTRACTOR when operating any hydrant. Proper hydrant operating procedures shall be obtained from the local water department.

Precautions shall be taken to insure that the water does not cause damage of flooding to the public or private property being served by the manhole section involved. Sewers or service laterals damaged as a result of the CONTRACTOR'S operations shall be immediately repaired by the CONTRACTOR at no cost to the Owner. Damage caused by the materials (liquid or solid) that are blown or pushed back into resident's homes through the sewer laterals which is the responsibility of the CONTRACTOR at no cost to the Owner.

All sludge, dirt, sand, roots, rocks, grease, and other solid or semi-solid material resulting from the cleaning operation shall be trapped and removed at the down stream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment shall not be permitted.

Under no circumstances shall sewage or solids be dumped onto the ground surface, streets or into ditches, catch basins or storm drains. All solids or semi-solids resulting from the cleaning operations shall be vacuumed into a water tight vacuum truck. The excess liquid shall be returned to the sewer system. The CONTRACTOR shall not be allowed to accumulate debris, sand, etc., on the site of work, except in totally enclosed containers and as approved by the ENGINEER OF RECORD and OWNER. Disposal of the solids or semi-solids shall be at a suitable site and paid for by the CONTRACTOR. All materials shall be removed from the site no less than at the end of cleaning operations shall be removed from the site and disposed of at a location approved by the Hillsborough County Utilities Department.

CONTRACTOR will transport to a Hillsborough County disposal site. Cost shall be borne by the CONTRACTOR. Disposal of all debris will be arranged for and paid for by the CONTRACTOR.

If there is interference in the sewer line that will not allow the cleaning equipment to pass, then the equipment shall be backed out of the line and an attempt shall be made to clean the line from the manhole at the other end. If the entire length of the sewer line cannot be cleaned, the CONTRACTOR shall take the necessary steps to cause the cleaning and televising work to proceed at no cost to the Owner.

Should the cleaning equipment become lodged within the pipe or manhole, the CONTRACTOR shall take whatever steps are necessary to quickly remove the equipment and restore any damages to approved conditions.

Cleaning logs, required as a part of the cleaning work, shall be produced by the CONTRACTOR and shall be printed records which will clearly identify the work performed including documentation of the degree of cleaning required. The logs shall be transmitted to and become the property of the OWNER at the end of the project.

2. First Inspection

The CONTRACTOR shall have the underground portion of the sewer system cleaned and ready for the first inspection within two (2) weeks after the completion of each 2,000-foot section of sewer installed.

The first inspection shall consist of a visible and audible check of the sewers and manholes to ascertain, all lift holes jointed, the channeling of the manhole bottoms completed, all visible or audible leaks stopped, all pipe has been placed straight and true to the proper grades and elevation, the required adjusting rings and frame and cover properly installed, all trenches and structures backfilled in a workmanlike manner and that the system has been thoroughly cleaned.

The first inspection shall be considered completed when all the repairs have been made and the system is ready for television inspection.

3. Television Inspection

The CONTRACTOR shall provide for television inspection of the various sanitary sewer lines installed under this Contract. The CONTRACTOR shall arrange for, engage and pay all expenses involved for the services of a competent company to perform this television inspection.

The inspection shall be carried out under the direction of the ENGINEER OF RECORD with all television inspection being observed by the OWNER, ENGINEER OF RECORD, and the CONTRACTOR. Any television viewing performed in the absence of the any of the above will not be considered as a part of the final inspection.

The inspection shall involve the visual observation by closed circuit television of all sanitary sewer, six (6) inches in diameter to 24 inches in diameter inclusive, installed as a part of this Contract and tape or digital copy to be turned over to Owner. Inspection shall be video taped on standard VHS format in color with date view with accurate footage display and PVC pipe shall have a deflection test using a 72% (go no go) test mandrel of appropriate size, visible on video at all times. Other pertinent data to be recorded on the audio portion of the tape shall include owners name, project name and phase number, manhole numbers, and distances between manholes. The inspection shall be performed at a rate of speed which will allow examination of all points of infiltration, cracked or crushed pipe, standing water, defective joints, and misalignment in line or grade, location of all wye openings and any defects or items of poor workmanship which may appear shall be notated on the audio portion of the tape. Any items which, in the opinion of the ENGINEER OF RECORD, require repair shall be precisely located and photographed along with a detailed statement of the condition. The CONTRACTOR shall take immediate action to repair all such defects including excessive infiltration at any specific location, even though the infiltration limits as hereinafter specified have not been exceeded for the entire length of sewer being inspected. Dips and sags with 1" or more of trapped water shall be caused for rejection and shall be corrected to meet required specifications. Following completion of the correction, the OWNER or the ENGINEER OF RECORD, will require a second television inspection of any repaired areas.

The CONTRACTOR shall arrange for and pay all costs involved in performing this reinspection at no cost to the Owner.

As a part of the television inspection, the precise location of each wye shall be noted in relation to the downstream manhole with each lateral being viewed "up" for a maximum of one (1) joint. These locations shall be entered on the Wye Location Sheet "a" supplied by the CONTRACTOR and verified by comparison with the locations as established at the time of construction. Any discrepancies in location between the field location record and the television inspection record shall be reconciled and the proper location of the wye determined as a part of the television

inspection. Two (2) copies of all notes, photographs, wye locations and other pertinent information shall be made as a part of the television inspection, and shall be turned over to the OWNER within ten (10) days. Each section of work must be kept on a separate tape upon the completion of the inspection of each line.

Complete logs of TV work must be kept and must include accurate measurements of line length, lateral connections, problems, etc. Logs must accurately show line section, flow direction, measurement direction, date, time, operator, and street name. Lateral connections and problems must be listed using clock reference for location. Hammer tap connections must be so listed and their direction, either right or left, must be indicated. Depth and conditions of all manholes must be noted on logs. Logs shall be produced by the CONTRACTOR and shall be printed records which will clearly show the location of each joint, service connection, repair, damaged pipe, roots and other discernable features.

Lighting for the camera shall be suitable to allow a clean picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the OWNER and, if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.

The camera shall be moved through the line in either direction with the use of an articulating head camera, stopping when necessary to permit proper documentation of the sewer's condition. In all cases, the camera will be stopped and positioned at each lateral to view the greatest distance possible up each service. In no case will the television camera be pulled at a speed greater than 30 feet per minute.

Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the CONTRACTOR shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire manhole section, the inspection shall be delayed until the CONTRACTOR corrects the problem at no cost to the OWNER.

When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.

Measurement between manhole centers shall be above ground, by the CONTRACTOR, by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a working meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the OWNER.

Problems must be rated, by operator, on a scale of one to ten, with one meaning minor and ten being major. Accurate "tape footage" must be kept and listed for all tap locations and for all problems encountered. Logs must contain all pertinent information so as to allow accurate cross-indexing and cataloging of all accumulated data. Line sections are to be plugged and all TV work must be accomplished in dry pipe.

If any low sections are encountered it will be necessary for CONTRACTOR to "jet"

any standing water way to allow for inspection of 360 degrees of all pipes.

Approval for payment for installed pipe will be made only after a complete review of all submitted logs and video tapes for the appropriate line sections. Should the ENGINEER OF RECORD determine, upon review, that the data submitted is inadequate due to log errors or omissions, improper or insufficient cleaning, equipment malfunctions, poor video quality, poor visibility of the pipe conditions, excessive flow, poor video tape quality such as breaks in the continuous recording or poor or inadequate audio recording, no sound, no measurements or other problems resulting in inaccurate or incomplete data, the CONTRACTOR shall schedule whatever inspection, with any required cleaning, for the particular line section. The CONTRACTOR shall perform the rework within five (5) working days after receipt of the written notification by the OWNER.

Television inspection shall be considered completed when the necessary construction repairs have been made and the installation retelevised when required, and the system is acceptable for the testing phase.

Any retelevising of the lines due to poor cleaning, video tape quality or insufficient logs as determined by the ENGINEER OF RECORD shall be at the expense of the CONTRACTOR.

4. Testing

The CONTRACTOR shall provide the necessary supervision, labor, tools, equipment and the materials necessary for the tests which shall be conducted in the presence of the ENGINEER OF RECORD or performed by a reputable test lab in conformance with the Hillsborough County Technical Specifications. The ENGINEER OF RECORD shall be notified two (2) working days in advance of all testing. The following tests shall be performed and approved prior to placing any system in service:

Leakage tests shall be conducted on all new sewer lines and existing lines which have not been previously approved. All sewers shall be subjected to air, exfiltration or infiltration tests, or a combination of same, prior to acceptance. All sewers over 24-inch diameter shall be subjected to infiltration tests. All sewers of 24-inch diameter or smaller, where the groundwater level above the top of the sewer is over seven (7) feet, shall be subjected to infiltration tests. All sewers of 24-inch diameter or less, where the groundwater level above the top of the sewer is seven (7) feet or less, shall be subjected to air tests or exfiltration tests.

a. Exfiltration/Infiltration Test

If an exfiltration test is performed, the maximum exfiltration rate shall be the same as the permitted from infiltration. For the purposes of exfiltration testing, the internal water level shall be equal to the highest structure service water level plus two (2) feet as measured from the top of pipe.

Maximum allowable infiltration shall not exceed 200 gallons per inch of diameter per mile of pipe between manholes per 24 hours for any section of the system and shall include the infiltration from all manholes and other appurtenances.

b. Air Test

The procedure for air testing of sewers shall be in conformance with the

Hillsborough County Technical Specifications:

All services shall be properly plugged and blocked to withstand the air pressure. The sewer line shall be tested in increments between manholes.

The line shall be cleaned and plugged at each manhole. Such plugs shall be designed to hold against the test pressure and shall provide an airtight seal. One (1) of the plugs shall have an orifice through which air can be introduced into the sewer. An air supply line shall be connected to the orifice. The air supply line shall be fitted with suitable control valves and a pressure gauge for continually measuring the air pressure in the sewer. The pressure gauge shall have a minimum diameter of 3-1/2 inches and range of 0-10 psig. The gauge shall have minimum divisions of 0.10 psig and an accuracy of + 0.04 psig.

The sewer shall be pressurized to 4.0 psig greater than the greatest back pressure caused by groundwater over the top of the sewer pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize between 3.5 and 4.0 psig. If necessary, air shall be added to the sewer to maintain a pressure of 3.5 psig or greater.

After the stabilization period, the air supply control valve shall be closed so that no more air will enter the sewer. The sewer air pressure shall be noted and timing for the test begun. The test shall not begin if the air pressure is less than 3.5 psig, or such other pressure as is necessary to compensate for groundwater level.

The time required for the air pressure to decrease 1.0 psig during the test shall not be less than the time shown in the tables listed in the NCPI Publication titled Low Pressure Air Test for Sanitary Sewers.

Manholes on sewers to be subjected to air tests shall be equipped with a 1/2 inch diameter galvanized capped pipe nipple extending through the manhole wall, three (3) inches into the manhole and at an elevation equal to the top of the sewer pipe. Prior to the air test, the groundwater elevation shall be determined by blowing air through the pipe nipple to clear it and then connecting a clear plastic tube to the pipe nipple. The tube shall be suspended vertically in the manhole and the groundwater elevation determined by observing the water level in the tube. The air test pressure shall be adjusted to compensate for the maximum groundwater level above the top of the sewer pipe to be tested.

After all tests are performed and the sewer is ready for final acceptance, the pipe nipple shall be removed and the hole in the manhole wall shall be plugged with hydraulic cement.

If a sewer fails to pass any of the previously described tests, the CONTRACTOR shall determine the location of the leaks, repair them and retest the sewer. The tests shall be repeated until satisfactory results are obtained.

B. Deflection Test for Plastic Pipe

Plastic pipe shall be tested for deflection, but no sooner than thirty days following the backfilling of the pipe. Maximum allowable deflection (reduction in vertical inside diameter) shall be five (5) percent. Locations with excessive deflection shall be excavated and repaired by re-bedding and/or replacement of the pipe.

3.5 SCHEDULES

A. Allowable Pipe Materials

Allowable pipe materials for this Project, based on size and depth of cut, are listed in the attached schedule or on the Plans. The schedule also lists pipe strength and bedding class requirements for the various types of pipe.

END OF SECTION

SECTION 33 4000 - STORMWATER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Scope

This Section includes storm sewer Work indicated on the Plans complete with pipes, joints, structures, pipe bedding, final inspection and appurtenances.

- 1. Measurement and Payment:
- 2. Dewatering: Section 31 2319
- 3. Structure Excavation and Backfill: Section 31 2300
- 4. Trenching, Backfill and Compacting: Section 31 2333

1.3 QUALITY ASSURANCE

- A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ANSI - American National Standard Institute

ASTM - American Society of Testing & Materials

AASHTO - American Association of State Highway Transportation Officials

FDOT - Florida Department of Transportation

Hillsborough County Technical Manual

SWFWMD – Southwest Florida Water Management District

- B. Source Quality Control

Laboratory test not less than one (1) percent, with a minimum of three (3) pieces each size, material and class of gravity pipe required in the Work.

1.4 REGULATORY REQUIREMENTS

- A. All work pertaining to this section for Work to be performed within a Florida Department of Transportation Right-of-Way shall be performed in accordance with the Florida Department of Transportation Standard Specifications for Road & Bridge Construction, latest edition.
- B. All work pertaining to this section for Work to be performed within the Hillsborough County

Right-of-Way shall be performed in accordance with the Hillsborough County Stormwater Management Technical Standards.

- C. All work pertaining to this section shall comply with provisions authorized through Part IV, Chapter 373 Florida Statutes, and other applicable regulations.

1.5 SUBMITTALS

A. Reports

1. A complete field report accurately recording the actual locations of pipe runs, connections, and invert elevations shall be submitted to the OWNER and the ENGINEER OF RECORD and the at the end of each installed section of the work or on the last day of each week, whichever occurs first. Upon completion of all work four complete sets of drawings and information conforming to the standards set out on the SWFWMD Statement of Completion and Transfer to Operation Entity, shall be submitted to the ENGINEER OF RECORD and the OWNER within 10-days after completion of construction.
2. Submit two (2) copies of the laboratory test reports required per Paragraph 1.02.B. of this Section to the OWNER and the ENGINEER OF RECORD.

B. Shop Drawings

Complete Shop Drawings for all materials pertaining to this section shall be submitted to the ENGINEER OF RECORD AND THE OWNER

1.6 PRODUCT STORAGE AND HANDLING

A. Storage of Materials

1. Storm Sewer Piping

Piping material shall not be stacked higher than four (4) feet or as recommended by the manufacturer, whichever is lowest. Suitable racks, chairs, and other supports shall be provided to protect preformed pipe mating surfaces from damage. Store bottom tiers off the ground, alternate tiers and chock tier ends.

2. Gaskets

Jointing and sealing materials used in the storm sewer system shall be protected from sunlight and stored in as cool and clean a place as practicable until ready for application.

B. Handling of Material

1. Loading and Unloading

Load and unload materials using suitable approved equipment. Material shall not be dropped, bumped or allowed to impact against itself. Damaged material will I be rejected by the ENGINEER OF RECORD.

2. Lifting Devices

Lifting devices shall be suited to the Work and shall protect surfaces from damage.

PART 2 - PRODUCTS

2.1 MATERIALS

It is the intent of this Article to specify in detail the various types of storm water conduit and joints, which have been indicated throughout the Plans and Specifications. This Article shall not be construed as allowing any alternate type of material to that which is indicated on the Plans or elsewhere in the Specifications.

A. Concrete Pipe

1. Non-Reinforced Concrete Pipe Systems

a. Pipe

Pipe shall conform to ASTM C14, extra strength Class 3 non-reinforced concrete pipe.

b. Joints

Premium joints for circular pipe shall conform to ASTM C443 limited as follows: Section 5.1 of C443, Physical Requirements for Gaskets, shall be replaced with Section 6.9 of C361, Rubber Gaskets. Also, Section 5 of C443 shall be limited to a modified grooved tongue to receive a rubber gasket. The modified grooved tongue and bell ends of the pipe shall be made smooth and shall not have over a 3-1/2 degree slope for sizes 10-inch to 24-inch formed to fit the rubber gasket to tolerances as determined by the manufacturer. Pipe tongue shall not be out of round by more than + 1/16 inch. The thickness of the bell shall be at least 90% or the pipe wall thickness or 2-1/2 inches, whichever is greater. Pipe bell and tongue shall be reinforced. The reinforcing steel shall be lapped a minimum of two (2) inches.

Premium joints for elliptical pipe shall conform to FDOT Specification Section 942-2.

2. Reinforced Concrete Pipe

a. Pipe

Reinforced concrete pipe shall conform to ASTM C76. Ten (10) inch diameter, shall have steel and concrete as specified for 12-inch diameter ASTM C76, Class III thru V, Wall B, circular reinforced. Twelve (12) inch thru 30-inch diameter pipe shall be Class III thru V, Wall B, circular reinforced. Thirty-six (36) inch thru 108-inch diameter pipe shall be Class III thru V, Wall B, circular reinforced or elliptical reinforced. When elliptical reinforcement is used, the following method of indexing the steel and the pipe barrel shall be used.

A dummy lift pin form shall be set in the outer pipe wall form projecting into the pipe wall a minimum of 1-3/4 inches and a maximum of 2-1/4 inches. An additional spacer chair shall be welded to the elliptical steel cage at the proper location so as to engage the dummy lift pin form during the pipe casting operation.

It is the intent of the spacer chair and dummy lift pin arrangement to provide

a means of assuring the final position of the elliptical steel cage within the barrel of the pipe and, further, for providing a means of indexing the pipe in the field to assume proper placement of the pipe.

For pipe 114 inches or larger in diameter, the design information in accordance with Section 6 of ASTM Specification C76, shall be submitted to the ENGINEER OF RECORD for approval, prior to fabrication. The design of all pipes shall meet the D-load requirements for the class of pipe indicated on the Plans.

- b. Reinforced concrete elliptical pipe shall conform to ASTM C507.

- c. Precast Concrete Box Section

Precast concrete box sections shall meet the requirements of ASTM C789 or ASTM C850, as applicable.

- d. Joints

See Paragraph 2.01.B.1.b. of this Section for requirements of premium joints for circular pipes 24 inches or less.

For circular pipe sizes 27 inches to 108 inches, the modified groove and bell ends of the pipe shall be smooth and shall not have over a 2-degree slope, formed to fit the rubber gasket to tolerances as determined by the manufacturer.

For circular pipe sizes under 36-inch diameter, the bell and tongue shall be reinforced. Where the reinforcing steel for the tongue, barrel and bell is not continuous, the steel shall be lapped a minimum of two (2) inches. Only lubricant, as supplied by the pipe manufacturer, shall be used on the groove and on the tongue in making up joints, and the joints shall be coupled in accordance with the pipe manufacturer's requirement.

See Paragraph 2.01.B.1.b. of this Section for requirements for a premium joint for non-circular concrete pipe.

The inside annular space of all concrete pipe 36-inch diameter and larger shall have the inside annular space filled with cement mortar and troweled flush. Mortar shall consist of 1-part Portland cement and two (2) parts of plaster sand. Mortar for inside joints shall be mixed with only enough water for dry packing.

B. Corrugated Metal Pipe

1. Corrugated Galvanized Steel Pipe

- a. Pipe

Corrugated galvanized steel pipe with circular cross section and reformed corrugated galvanized steel pipe with pipe-arch shape shall conform to the requirements of AASHTO M36, and as specified in FDOT Sections 430 and 943. A minimum of two (2) circumferential corrugations shall be rolled on each end of each section of pipe.

- b. Joints

The joints shall be made by use of coupling bands. The coupling bands shall be of the same material as specified for the pipe and shall prevent infiltration of the side fill material. Coupling bands fitting the configuration of the pipe to be jointed shall include two (2) O-ring neoprene gaskets for each joint.

2. Bituminous Coated Corrugated Steel Pipe

a. Pipe

Bituminous coated corrugated steel pipe with circular cross section and reformed corrugated steel pipe with pipe-arch shape shall conform to the requirements of AASHTO M36, AASHTO M190, Type C and as specified in FDOT Section 943-5. A minimum of two (2) circumferential corrugations shall be rolled on each end of each section.

b. Joints

See Paragraph 2.01.C.1.b. of this Section.

3. Epoxy-Bonded Corrugated Steel Pipe

a. Pipe

Epoxy-coated corrugated steel pipe with circular cross section and reformed corrugated steel pipe with pipe-arch shape shall conform to the requirements of AASHTO M36, AASHTO T241, AASHTO M218, and as specified in FDOT Sections 430 and 944. The pipe shall be of black steel with a minimum of two (2) circumferential corrugations rolled on each end of each section of pipe.

b. Joints

See Paragraph 2.01.C.1.b of this Section.

4. Aluminized Corrugated Steel Pipe

a. Pipe

Aluminized corrugated steel pipe with circular cross section and reformed corrugated steel pipe with pipe-arch shape shall conform to the requirements of AASHTO M36, AASHTO T241, AASHTO M218, AASHTO M274, Type 2 and as specified in FDOT Section 944. A minimum of two (2) circumferential corrugations shall be rolled on each end of each section.

b. Joints

See Paragraph 2.01.C.1.b. of this Section.

5. Corrugated Aluminum Pipe

a. Pipe

Corrugated aluminum alloy pipe with circular cross section and reformed corrugated aluminum alloy pipe with arch-pipe shall conform to the requirements of AASHTO M196 and as specified in FDOT Section 945.

b. Joints

See Paragraph 2.01.C.1.b. of this Section.

C. Polyethylene Pipe

1. Corrugated High Density Polyethylene Pipe

a. Pipe

Corrugated high density polyethylene pipe with circular cross section shall conform to the requirements of AASHTO M294 Type S. The pipe shall have a smooth interior and an annular-corrugated exterior, and manufactured with virgin polyethylene compounds.

b. Joints

The joints shall be bell and spigot, with the bell being an integral part of the pipe. The bell and spigot joint shall incorporate a manufacturer installed gasket.

c. Fittings

Fabricated fittings shall be welded on the interior and exterior at all junctions.

d. Material Properties

Pipe and fitting material shall be high density polyethylene conforming to the requirements of ASTM D3350 Cell Classification 324420C; or ASTM D Type III, Class C, Category 4, Grade P33.

D. Structural Plates for Field Assembly of Pipe, Pipe-Arches, and Arches

The plates, bolts and nuts to be used and field assembled circular pipe, pipe-arches and arches shall meet all applicable requirements of AASHTO. M167 and as specified in FDOT Sections 944 and 945.

E. End Sections

1. Precast Concrete End Section

a. The precast concrete end section shall conform to ASTM C76, Class II.

b. The joint for connection to pipe shall be as specified in Section paragraph 2.01.B.1.b. of this Section.

2. Metal End Section

a. Metal end sections shall conform to AASHTO M36.

b. Joint

See Paragraph 2.01.C.1.b. of this Section.

3. Precast Concrete Ring

Precast concrete rings shall consist of a ring of concrete, of the dimensions shown on the Plans, cast around a section of the kind of pipe to be used in the culvert. Rings for concrete pipe culverts may be cast as a monolithic unit with the pipe.

F. Structures

Material for storm water structures shall conform to the requirements below and the details indicated on the Plan.

1. Clay Brick

Brick shall conform to ASTM C32, Grade MS, recessed or cored.

2. Concrete Brick

Brick shall conform to ASTM C139, Portland cement conforming to ASTM C150, Type II. Bricks shall be solid.

3. Precast Concrete Units

a. Manhole Base and Riser Unit

Precast concrete manhole base and riser units shall conform to ASTM C478, and shall be circular with circular reinforcement. For manhole depths to 32 feet, the wall thickness of the sections shall be six (6) inches minimum. The joints on precast sections shall be the same as the joints on storm water conduits.

b. Manhole Cone Unit

Precast concrete manhole cone units shall conform to ASTM C478. See paragraph 2.01.G.4.a. of this Section for joint requirements.

c. Manhole Tees

Precast concrete manhole tee units shall conform to ASTM C76, Class IV and shall be circular with circular reinforcement. Shop Drawings shall be provided for all manhole tees.

See Paragraph 2.01.G.4.a. of this Section for joint requirements.

d. Concrete Base

Precast concrete base unit shall conform to ASTM C478.

e. Concrete Top Slab

Precast concrete top slab unit shall conform to ASTM C478.

f. Concrete Grade Rings

Concrete grade rings shall conform to ASTM C478. See paragraph 2.01.G.4.a of this Section for joint requirements.

g. Frames and Covers

Frames and covers for manholes, catch basins, and inlets shall conform to ASTM A48, Class 30, gray iron and shall be of the types and sizes as indicated on the Plans. The castings shall be neatly made and free from cracks, holes and other defects. Surfaces of casting shall be ground to assure proper fit and to prevent rocking.

G. Cast -In - Place Concrete

In accordance with FDOT Section 345, use Class II; 3,500-psi strength; Type I cement; 6.0 sacks cement per cubic yard; 5 coarse aggregate; silica sand fine aggregate; three (3) percent to six (6) percent air content; 3-inch maximum slump; no admixtures. without the ENGINEER OF RECORD,S approval.

1. Concrete Reinforcement

In accordance with FDOT Section 931, use ASTM A615, Grade 60 for bars and ASTM A185 for welded wire fabric.

2. Granular Material

Granular material shall be material passing a 1-inch sieve and at least 35% retained on a No. 200 sieve and meeting the approval of the ENGINEER OF RECORD.

PART 3 - EXECUTION

3.1 PREPARATION

A. Dewatering

During the preparation of the pipe bedding and until the trench has been satisfactorily backfilled, the trench shall be kept free of water. A dewatering system, in accordance with Section 02 14 00, Dewatering, shall be provided and maintained by the CONTRACTOR. The dewatering system shall remain in operation as directed by the ENGINEER OF RECORD.

B. Existing Storm Sewers and Drains

Expose the existing storm sewer and structures to which the new Work is to be connected. and notify the ENGINEER OF RECORD and OWNER of same. The ENGINEER OF RECORD will verify the vertical and horizontal locations of the existing system and shall inform the CONTRACTOR the necessary adjustments required to align the new storm sewer Work with the existing work.

C. Pipe Ends

The outside surface of the spigot end and the inside surface of the bell end of the pipe shall be cleaned and free of any foreign materials, other than the sealant recommended by the manufacturer, prior to installation.

D. Examination of Material

All pipe, frames, covers, accessories, and appurtenances shall be examined carefully for damage and other defects immediately prior to installation. Defective or damaged material shall be marked and held for inspection by the ENGINEER OF RECORD. Defective or

damaged materials are subject to rejection by the ENGINEER OF RECORD.

3.2 PERFORMANCE

A. Excavation

Excavation shall be in accordance with Section 312300 for storm water conduits and all other storm water management structures.

B. CONTRACTOR's Verification - Excavation and Bedding

Prior to the installation of any storm sewer piping, structures, or materials, examine all trenches and other excavations for the proper grades, lines, levels and clearances required to receive the new Work. As certain that all excavation bottoms, compacted subgrades and pipe bedding are adequate to receive the storm sewer materials to be installed. Correct all defects and deficiencies before proceeding with the Work.

C. Installation

1. Pipe Bearing

Each section of pipe, when placed to grade and line, shall have firm bearing on the trench bedding throughout its length. Large stones and other hard matter that could damage piping or impede consistent backfilling or compaction shall be removed from the work area.

2. Pipe Cutting

Cutting of pipe shall be done with approved tools and by approved methods suitable for the pipe material. Pipe cutting methods that produce a smooth, square-cut end without damage to the pipe and that minimize air-borne particles shall be employed. Pipe cutting shall be performed using the recommendations of the manufacturer of the type of the pipe materials being cut and according to the best trade practices. When cutting pipe, care shall be taken to prevent damage to the interior and exterior surfaces. Damage to either shall be cause for rejection of a complete section of pipe.

3. Pipe Laying

Installation of pipe shall conform to ASTM C12, and as recommended by the pipe manufacturer.

The pipe shall be protected during handling against impact shocks and free fall. Hooks shall not be permitted to come in contact with premolded joint surfaces.

Pipes having premolded joint rings or attached couplings shall be handled so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material. Care shall be taken to avoid dragging any pipe on the ground or allowing it to be damaged by contact with gravel, crushed stone, or other hard objects.

All pipe shall be laid to the line and grade called for on the Plans. Each pipe as laid shall be checked by the CONTRACTOR with line and grade pole or laser system to insure that this result is obtained. When employing a laser system, the CONTRACTOR shall have an independent and alternate means of checking the line and grade. The finished work shall be straight and shall be sighted through between

manholes.

Construction shall begin at the outlet end and proceed upgrade with spigot ends pointing in direction of flow. Bell holes shall be excavated so that the full length of the barrel will bear uniformly on the subgrade.

Lubricants, primers or adhesives as recommended by the pipe or joint manufacturer shall be used immediately prior to jointing.

The pipe shall be centered in the bells or grooves and pushed tight together to form a smooth and continuous invert. After laying of pipe, care shall be taken so as not to disturb its line and grade. Any pipe found off grade or out of line shall be relaid properly by the CONTRACTOR.

Mechanical means shall be used for pulling home all pipe where manual means will not result in pushing and holding the pipe home. Mechanical means shall consist of a cable placed inside of the pipe with a suitable winch, jack, or come along for pulling the pipe home and holding the pipe in position.

Circular concrete pipe with elliptical reinforcement shall be installed with the lift holes to the top of the pipe. The manufacturer's marks designating the top and bottom of the pipe shall not be more than five (5) degrees from the vertical plane through the longitudinal axis of the pipe. After the pipe is installed, the lift holes shall be sealed with suitable concrete plugs.

Type HE elliptical pipe shall be installed with the longer axis placed horizontally within a tolerance of \pm five (5) degrees.

Type VE elliptical pipe shall be installed with the longer axis placed vertically within a tolerance of \pm five (5) degrees.

4. Pipe Bedding and Cover

Pipe bedding shall conform to ASTM C12, except as noted.

Class A

The pipe shall be bedded in crushed stone bedding material placed on the trench bottom. The bedding material shall have 100% passing a 3/4 inch sieve and 95% retained on a No. 4 sieve. The bedding shall have a minimum thickness beneath the pipe of four (4) inches or 1/4 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline. The top half of the pipe shall be covered with a monolithic plain concrete arch having a thickness of at least four (4) inches or 1/4 of the inside diameter of the pipe, whichever is greater, at the pipe crown and a minimum width equal to the outside diameter of the pipe plus eight (8) inches or 1-1/4 of the diameter of the pipe, whichever is greater.

Class B

The pipe shall be bedded in crushed stone bedding material placed on the trench bottom. The bedding material shall have 100% passing a 3/4 inch sieve and 95% retained on a No. 4 sieve. The bedding shall have a minimum thickness beneath the pipe of four (4) inches or 1/8 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline. Backfill from pipe horizontal centerline to a level not less than 12 inches above the top of the pipe shall be natural bank run sand meeting the requirements of granular material. and approved by the ENGINEER OF RECORD. This material shall be

placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of pipe.

Class C

The pipe shall be bedded in natural bank run sand, approved by the ENGINEER OF RECORD, meeting the requirements of granular material, placed on the trench bottom. The bedding shall have a minimum thickness beneath the pipe of four (4) inches or 1/8 of the outside diameter of the pipe, whichever is greater, and the bedding shall extend to a level not less than 12 inches above the top of the pipe. This material shall be placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of pipe.

Continuous and uniform bedding shall be provided in the trench for all buried pipe. Materials damaged by backfill compaction are subject to rejection by the ENGINEER OF RECORD.

5. Structures

Construct storm water manholes, catch basins, inlets and structures to the grades, lines and levels indicated on the Drawings and as specified. Structures shall be complete with concrete bases, reinforcing, frames, covers, adjustment bricks, etc. as shown and as required for a complete installation. Storm sewer structures shall conform to the dimensions indicated on the Plans. Materials damaged by backfill compaction are subject to rejection by the Owners Representative.

Brick

Prior to laying, all brick shall be thoroughly wetted and the surfaces allowed to dry only sufficiently to prevent slippage on the mortar.

Broken or chipped brick shall not be used on the face of the structure.

Brick shall be laid in neat, even consecutive courses with full and close mortar joints. Courses shall be level throughout, except as shown or otherwise required. Stagger joints in adjoining courses by 2 a brick as nearly as practicable. Length of brick closure pieces shall be not less than the width of one (1) whole brick and, wherever practicable, shall be made from whole brick.

Unless otherwise indicated, joints shall be not more than 2-inch thick and shall be of a uniform thickness throughout the structure. Joints shall be provided as indicated on the Plans. Exposed surfaces shall be true and smooth. Rake all joints to receive plaster coat.

Prior to applying plaster coat, brick shall be thoroughly wetted with water and the surface allowed to dry sufficiently to effect proper bonding.

Precast Concrete Units

Construct as detailed on the Plans. Provide mortar joints struck smooth. Provide three (3) to five (5) courses of 8-inch brick or concrete grade rings at top of structure for future adjustment of castings.

Plaster Coat

A cement mortar plaster coat shall be applied to the exterior surfaces of the brick and block sections of all storm structures as indicated on the Plans. Plaster coat shall be 2-inch thick.

Castings

Provide and install to the elevations indicated on the Plans, all cast iron covers, and frames, as required. Castings shall be set in a full bed of cement mortar 2 inch thick, minimum. Mortar joints shall be struck smooth.

Inlet and Outlet Pipe

Pipes to 42 inches in diameter, shall be connected to storm structures using a grouted joint, as indicated on the Plans. The pipe shall be properly supported, so that any settlement will not disturb the connection.

For pipe, 48 inches in diameter or larger, the pipe shall be installed as an integral part of the manhole which shall be constructed of 3,500 psi concrete and reinforcing, as indicated on the Plans.

Manhole tees, as indicated on the Plans, may be used for pipe 42 inches in diameter or larger. Connection to manhole tees shall be made using tees and pipe having the same type of joint. The pipe and tee shall be properly supported with concrete as indicated on the Plans.

Flow Channels

Flow channels shall be constructed in all structures not requiring a sump and shall be constructed as indicated on the Plans.

Backfilling

Backfilling operations shall be in accordance with Section 312300 above storm water conduit and for all other structures.

3.3 Field Quality Control

A. General

After all the pipe and structures have been laid, constructed and backfilled, the system shall be final inspected. The storm water system shall be ready for the final inspection within two (2) weeks after the completion of the final backfill operation.

The final inspection shall consist of a visible and audible check of the conduits and structures to ascertain that the steps have been placed, all lift holes jointed, the channeling of the manhole bottoms as specified on the plans completed, all visible or audible leaks stopped, all conduits have been placed straight and true to the proper slopes and elevations, the required brick courses for adjustment, the frame and cover properly installed, the required end section installed, all trenches and structures backfilled in a workmanlike manner and that the system has been thoroughly cleaned.

The final inspection shall be considered complete when all the repairs have been made.

B. Construction Tolerances

1. Maximum variation from intended slope gradient of conduit run between structures or termination at an end section: constructed conduit gradient must slope in

intended direction and support a self cleaning velocity of 2.0 feet per second assuming free outfall and without significantly compromising design flood conditions approved by permit.

2. Maximum offset of conduit from true horizontal alignment: 1-inch.
3. Maximum variation in profile of structure from intended position: ½ inch.

END OF SECTION

APPENDIX ONE

Report of Geotechnical Exploration, dated July 10, 2020 (Arehna Engineering, Inc.)



REPORT OF GEOTECHNICAL EXPLORATION

**HC NW HEAD START AT CHURCH PARK
TOWN N COUNTRY, FLORIDA**

AREHNA PROJECT NO. B-20-040

July 10, 2020

Prepared For:

Wilder Architecture, Inc.

1315 E. Seventh Avenue, Suite 106

Tampa, Florida 33605

Prepared By:

AREHNA Engineering, Inc.

5012 West Lemon Street

Tampa, Florida 33609

July 10, 2020

Mr. Jovanny Betancourt, AIA
Wilder Architecture, Inc.
1315 E Seventh Avenue, Suite 106
Tampa, Florida 33605

813-242-6677
jb@wilderarchitecture.com

Subject: **Report of Geotechnical Exploration**
HC NW Head Start at Church Park
5631 Webb Road
Town N' Country, Florida
AREHNA Project B-20-040

Dear Mr. Betancourt,

AREHNA Engineering, Inc. (AREHNA) is pleased to submit this report of our geotechnical exploration for the proposed project. Services were conducted in general accordance with AREHNA Proposal B.Prop-20-052 submitted June 12, 2020. The purpose of our geotechnical study was to obtain information on the general subsurface conditions at the project site.

This report presents our understanding of the project, outlines our exploratory procedures, documents the field data obtained and includes our recommendations for site preparation, and pavement and foundation design.

AREHNA appreciates the opportunity to have assisted you on this project. Should you have any questions with regards to this report, or if we can be of any further assistance, please contact this office.

Best Regards,

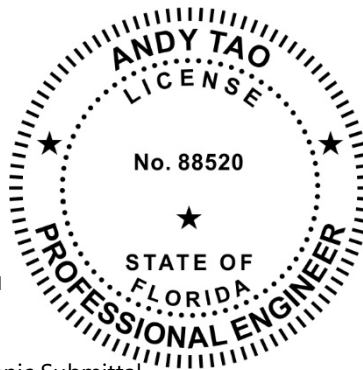
AREHNA ENGINEERING, INC.


FLORIDA BOARD OF PROFESSIONAL ENGINEERS CERTIFICATE OF AUTHORIZATION No. 28410

This item has been digitally signed and sealed by:

Andy Tao, P.E.
Geotechnical Engineer
Florida Registration

On the date adjacent to the seal.
Printed copies of this document are not considered
signed and sealed and the signature must be verified
on any electronic copies.




Wyatt J Liptak, E.I.
Staff Geotechnical Engineer

Distribution: 1 – Addressee – Electronic Submittal
1 – File



TABLE OF CONTENTS

	Page
1.0 PROJECT INFORMATION AND SCOPE OF WORK.....	1
1.1 Site Description and Project Characteristics.....	1
1.2 Scope of Work.....	1
2.0 FIELD EXPLORATION AND LABORATORY TESTING.....	3
2.1 Field Exploration.....	3
2.2 Laboratory Testing.....	3
3.0 SUBSURFACE CONDITIONS	4
3.1 USGS Topographic Data.....	4
3.2 USDA Natural Resources Conservation Service Data	4
3.3 Subsurface Conditions.....	4
3.4 Double Ring Infiltration Test Results.....	4
3.5 Groundwater Conditions.....	5
3.6 Estimated Seasonal High Groundwater Level.....	5
4.0 DESIGN RECOMMENDATIONS	6
4.1 General.....	6
4.2 Shallow Foundation Design	6
4.3 Settlement.....	6
4.4 Pavements.....	7
5.0 GENERAL SITE PREPARATION	9
5.1 On-Site Soil Suitability	9
5.2 General.....	9
5.3 Ground Water Control	10
5.4 Dewatering.....	10
5.5 Excavations.....	10
6.0 BASIS FOR RECOMMENDATIONS	11

LIST OF APPENDICES

APPENDIX

USDA & USGS Vicinity Maps – Sheet 1
Boring Location Plan – Sheet 2
Soil Boring Profiles – Sheets 3A through 3C
Summary of Double Ring Infiltration Test Results
Field and Laboratory Test Procedures



1.0 PROJECT INFORMATION AND SCOPE OF WORK

1.1 SITE DESCRIPTION AND PROJECT CHARACTERISTICS

The project site is located at Church Park, 5631 Webb Road, in Town N' Country, Florida, as indicated on the **Boring Location Plan, Sheet 2** in the **Appendix**. The proposed project consists of a one-story building with associated parking and drive aisle areas, along with the addition of a stormwater pond.

Wall loads for the proposed building are to be on the order of 3.5 kip per linear foot. Based on the Overall Site Plan dated June 11, 2020 by Wilder Architects and the Boundary and Topographic Survey dated 4/26/2019 by Northwest Surveying Inc., we understand that the finished floor elevation of the building is at EL. +13.0 and the fill required will range from 2 to 6 feet.

1.2 SCOPE OF WORK

The purpose of our geotechnical study was to obtain information on the general subsurface conditions at the proposed project site. The subsurface materials encountered were evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

- Identification of the existing ground water levels and estimated normal seasonal high groundwater fluctuations.
- General location and description of potentially deleterious materials encountered in the borings which may have an impact on the proposed construction.
- Vertical infiltration rates using Double Ring Infiltration (DRI) testing. Horizontal infiltration will be estimated based on correlations to the vertical infiltration results.
- General site preparation recommendations including the suitability of soils for structural fill.
- General pavement recommendations.
- Allowable capacities and foundation settlement for foundations supporting the proposed building.
- Foundation installation and testing recommendations.

The following services were performed to achieve the above-outlined objectives:

- Requested utility location services from Sunshine811.
- Performed four Standard Penetration Test (SPT) borings within the proposed building footprint. The borings extended to approximate depths of 20 to 30 feet below the existing ground surface. Samples were collected, and SPT resistances measured at approximate intervals of two feet for the top ten feet, and five feet, thereafter. The top six feet were manually augered to avoid any possible conflicts with existing utilities. The boreholes were backfilled upon completion.
- Performed three hand auger borings extending to depths of 3.5 to 5 feet within the proposed parking lot area.
- Performed one Double Ring Infiltration (DRI) test at a depth of 1.5 feet within the proposed location of the stormwater pond. A hand auger boring to a depth of



approximately 5 feet was performed at the location to provide subsurface soil information at the DRI location.

- Visually classified and stratified soil samples in the laboratory using the Unified Soil Classification System (USCS) and conducted a laboratory testing program on representative samples consisting of natural moisture content, sieve analysis (#200), and Atterberg Limits test.
- Reported the results of the field exploration and engineering analysis. The results of the subsurface exploration are presented in this report prepared by a professional engineer specializing in geotechnical engineering.



2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 FIELD EXPLORATION

Our scope of work included performing four SPT borings to depths of 20 to 30 feet below existing grades, three hand auger borings extending to depths of approximately 3.5 to 5 feet below the existing round surface, and one DRI test.

The SPT borings were performed with the use of a Power Drill Rig using Bentonite "Mud" drilling procedures. Samples were collected and SPT resistances measured at approximate intervals of two feet for the top ten feet, and five feet, thereafter. The upper six feet of each SPT boring was manually augered to avoid any possible conflicts with unmarked utilities. The soil sampling was performed in general accordance with ASTM Test Designation D-1586, entitled "Penetration Test and Split-Barrel Sampling of Soils." Upon completion, the boreholes were backfilled with bentonite chips and left level with the surrounding grades.

The DRI test was performed by installing a 12-inch diameter steel ring and a 24-inch diameter steel ring concentrically into the ground to the desired test depth. Water was then added to a desired level in both rings and held constant. The volume of water added to the inner ring versus time was then recorded. This procedure was repeated every 15 minutes for the first hour, and every 30 minutes for ensuing hours, for a total of 4 hours or until a stabilized infiltration rate was achieved. The DRI test was performed in general accordance with ASTM D-3385, entitled "Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer."

The hand auger borings were performed by manually advancing a 3-inch diameter, 6-inch long sampler into the soil until the sampler was full. The sampler was then retrieved and the soils in the sampler were removed and visually classified. The soil sampling was performed in general accordance with ASTM Test Designation D 1452, entitled "Soil Investigation and Sampling by Auger Borings." The boreholes were backfilled after the borings were completed.

Representative portions of the samples collected were sealed in glass jars, labeled and transferred to AREHNA's Tampa office for classification by a Geotechnical Engineer.

A Field Exploration Plan indicating the approximate locations of the soil borings is presented on **Sheet 2** in the **Appendix**. Borings were located by utilizing a hand-held Global Positioning Systems (GPS).

2.2 LABORATORY TESTING

Laboratory testing was performed on representative samples and consisted of natural moisture content, Atterberg Limits and single sieve (#200) gradation. The results of the laboratory testing are presented on **Sheets 3A through 3C** in the **Appendix** of this report.



3.0 SUBSURFACE CONDITIONS

3.1 USGS TOPOGRAPHIC DATA

The topographic survey map published by the United States Geological Survey, **Sheet 1** in the **Appendix**, was reviewed for ground surface features at the proposed project location. Based on this review and the nature of the site, natural ground surfaces at the project is approximately between +5 and +10 feet.

3.2 USDA NATURAL RESOURCES CONSERVATION SERVICE DATA

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) survey for Hillsborough County indicates that the soils at the project site consist of the following soil units:

Soil Unit Number	Soil Name	Depth to High Water Table (feet)
27	Malabar fine sand, 0 to 2 percent slopes	0.25 – 1.5

The soil survey also indicates that the average annual precipitation is 42 to 63 inches. The soils encountered in our borings are consistent with the soil units described above. The USDA Soil Survey map for the project site is attached as **Sheet 1** in **Appendix A**.

3.3 SUBSURFACE CONDITIONS

A pictorial representation of the subsurface conditions encountered by the borings is shown on the **Soil Boring Profiles, Sheets 3A through 3C** in the **Appendix**. These profiles and the following soil conditions highlight the general subsurface stratification.

The Standard Penetration Test (SPT) borings generally encountered loose to dense sand with varying amounts of fines (SP-SM, SP-SC, SM) from depth of 2 to 8 feet below existing ground surface. Standard Penetration resistances (N-values) ranged between 7 blows per foot (bpf) to 39 bpf. Underlying the sand layer, SPT borings encountered soft to very hard limestone to termination depths of approximately 20 to 30 feet. N-values varied between 2 blows per foot to 50 blows for 1-inch of penetration. Boring B-01 encountered an interbedded layer of very loose fine sand with clay (SP-SC) with an N-value of 4 blows per foot from 13 to 18 feet below the existing ground surface.

3.4 DOUBLE RING INFILTRATION TEST RESULTS

The following table summarizes the DRI test results:

Test Location	Depth Below Ground Surface, feet	Measured Vertical Infiltration Rate, inch/hr	Estimated Horizontal Infiltration Rate, inch/hr
DRI-01	1.5	5.0	7.5



The vertical infiltration rate is the actual rate, as measured in the field. No factor of safety has been applied. The horizontal infiltration rate was then estimated based on the vertical infiltration rate and soil types encountered.

AREHNA recommends a factor of safety of at least 2.0 be used for the design infiltration/conductivity rates.

A summary of the DRI test is attached in the **Appendix**.

3.5 GROUNDWATER CONDITIONS

The groundwater table was encountered at depths of approximately 2 to 3 feet below the existing ground surface at the time the borings were performed in all SPT borings and hand auger borings except HA-02. HA-02 did not encounter the groundwater table within the explored depth. Fluctuations in groundwater levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, and other site-specific factors. Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should assume that variations will occur.

3.6 ESTIMATED SEASONAL HIGH GROUNDWATER LEVEL

Based on soils information obtained from the site, and our experience in the area, we estimate that the seasonal high groundwater level will be encountered at a depth between 1 and 1.5 feet below existing ground surface, at the locations where the borings were performed.



4.0 DESIGN RECOMMENDATIONS

4.1 GENERAL

The geotechnical evaluation is based upon the previously presented project information as well as the field data obtained during this geotechnical exploration. At the time this report was prepared, structural loads were not available. We understand that wall loads for the proposed building will be on the order of 3.5 kip per linear foot. We have assumed a column load of 50 kips.

If final structure locations or foundation loads are significantly different from those described, or if the subsurface conditions during construction are different from those revealed by our borings, we should be notified immediately so that we might review our recommendations presented in this report.

Following the complete removal of existing vegetation, root systems, and other deleterious materials, the site should be proofrolled and compacted. Any areas that appear unstable under proofrolling should be replaced with compacted fill. Our recommended site preparation is presented in Section 5.0, General Site Preparation.

4.2 SHALLOW FOUNDATION DESIGN

Following our recommended General Site Preparations, the proposed building can be constructed on a system of conventional spread or strip footings and interior slab support on grade. The foundation system should bear on acceptable existing soils or structural fill soils compacted to a density of at least 95 percent of the modified proctor maximum dry density (ASTM D-1557). Provided that the site preparation is performed in accordance with the recommendation contained in this report, the foundations may be designed using a maximum allowable bearing capacity of 2,500 pounds per square foot (psf).

Shallow foundation elements should be embedded so that they bear at a minimum depth of 18 inches below the adjacent compacted grades on all sides. Strip or wall footings should be a minimum of 24 inches wide and pad or column footings should be a minimum of 30 inches wide; however, the pad or column footings should be sized to maintain similar bearing pressure as the wall footings. These minimum footing sizes should be used regardless of whether the maximum allowable bearing pressures are fully developed in all loading conditions. These minimum footing sizes tend to provide adequate load bearing area to develop overall bearing capacity and account for minor variations in the bearing materials.

4.3 SETTLEMENT

The settlement of shallow foundations supported on sandy soils should occur rapidly during construction as dead loads are imposed at the footing locations. Provided that the recommended subsurface preparation operations are properly performed, we estimate total settlements will be on the order of 1 inch or less, with differential settlements on the order of 50 percent of the total settlements over 50 feet.



4.4 PAVEMENTS

We have not been provided with design traffic loading. In our experience, the following minimum recommended pavement sections should work successfully for most sites, so they are suggested for this project.

These recommendations assume an adequately drained pavement surface and at least 12 inches of separation between the seasonal high groundwater level and crushed concrete base, as well as at least 18 inches of separation between the seasonal high groundwater level and limerock base.

TYPICAL PAVEMENT SECTION

Pavement Section	Component	Recommended Thickness (in.)
Standard Duty Flexible Pavement Section	Asphalt	1.5
	Base (LBR \geq 100)	6.0
	Stabilized Subgrade (LBR \geq 40)	6.0
Heavy Duty Flexible Pavement Section	Asphalt	2.0
	Base (LBR \geq 100)	8.0
	Stabilized Subgrade (LBR \geq 40)	12.0
Standard Duty Rigid Pavement Section	Concrete	5.0
	Subgrade (LBR \geq 20)	12.0
Heavy Duty Rigid Pavement Section	Concrete	6.0
	Subgrade (LBR \geq 20)	12.0

Subgrade: Sandy existing soils and sandy engineered fill soils should be acceptable for construction and support of a flexible (limerock or crushed concrete base) pavement section after proper proofrolling and subsurface preparation. Alternatively, a rigid concrete section may be used.

Fill soils should consist of reasonably clean fine sands (inorganic, non-plastic sands containing less than 12 percent material passing the No. 200 mesh sieve). For flexible pavements, we recommend that any fill below the stabilized subgrade be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). The upper foot of pavement subgrade should be compacted to 98% ASTM D1557.

Traffic should not be allowed on the subgrade before the base is placed to avoid rutting.

Base: For flexible pavements, we recommend that either limerock or crushed concrete be considered for the base. We recommend that the base be at least 6 inches thick. Material should meet Florida Department of Transportation (FDOT) Standard Specification, Section 200 requirements, including compaction to 98 percent of its maximum dry density as determined by the Modified Proctor Test (ASTM D-1557) and a minimum Limerock Bearing Ratio (LBR) of 100. Crushed concrete should have an LBR value of 150 and be graded in accordance with Florida Department of Transportation (FDOT) Standard Specifications Section 204.

A No.57 washed stone or washed crushed concrete may be used as a base beneath the rigid concrete pavement section. We recommend the base be at least 4 inches thick.



Asphaltic Concrete: The asphaltic concrete structural course should consist of Type SP – 12.5 asphaltic concrete material. A minimum asphalt thickness of 1.5 inches should be used in areas of light duty applications. The asphaltic concrete should meet standard FDOT material requirements and placement procedures as outlined in the 2019 Edition of the FDOT Standard Specifications for Road and Bridge Construction.

Portland Cement Concrete: If rigid pavement is used, we suggest that concrete with an unconfined compressive strength of at least 4,000 lb/in² be placed over properly compacted subgrade soils. It is recommended that a minimum thickness of 5 inches be utilized in areas of light duty applications, and a minimum of a 6-inch thickness for areas with moderate to heavy duty applications.

The key to a successful rigid pavement is properly spaced control joints, a good concrete mix, and proper workmanship. We recommend a maximum longitudinal to transverse pattern ratio of 1.2 to 1. We further recommend that the jointed section area ideally be on the order of 250 square feet but no more than 400 square feet. Joints that intersect the edge should do so perpendicular to the edge. The joints should have a minimum cut depth of at least 1 inch or 1/5 of the slab thickness, whichever is greater. The joints should be cut within 8 hours of concrete placement. The requirements of FDOT Standard Specification Section 346 should also be met as appropriate.

It is suggested that a rigid pavement be utilized in dumpster areas, including the areas in which dumpster trucks or other large vehicles load, backup and turn around.



5.0 GENERAL SITE PREPARATION

5.1 ON-SITE SOIL SUITABILITY

The borings indicate that the soils in the upper 2 feet at this site should be generally suitable for fill. Classification indicates the soils present at the project site consist of fine sands classified as SP and SP-SM based on the Unified Soil Classification System (USCS). Suitable structural fill materials should consist of fine to medium sand with less than 12 percent passing the No. 200 sieve and be free of rubble, organics, clay, debris and other unsuitable material. Any off-site materials used as fill should be approved by AREHNA prior to acquisition.

5.2 GENERAL

The initial step in site preparation should be the complete removal of all existing pavement, topsoil, roots, debris, and other deleterious materials from beneath and to a minimum of five feet beyond the development perimeter. Prior to construction, the location of any existing foundations, underground irrigation, tanks, drainage, or other utility lines within the construction area should be established. In this regard it should be noted that, if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion which subsequently may result in excessive settlements. The structure areas should then be inspected and thoroughly proofrolled as directed by a Geotechnical Engineer. Our recommendations listed in this section should be used as a guideline for the project general specifications prepared by the Design Engineer:

- The entire site should be proofrolled with a large vibratory roller with a 4 foot diameter drum and a static weight of at least 8 tons. At least 8 complete coverages (4 in each perpendicular direction) should be performed over the entire building and parking areas prior to raising site grades. Proofrolling should continue for the required number of passes and until the soil at a depth of 12 inches below the compaction surface has attained a minimum of 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). Careful observations should be made during proofrolling to help identify any areas of soft-yielding soils that may require over excavation and replacement. The vibratory mechanism should be disabled while proofrolling near the existing building so damage does not occur. Careful observations and monitoring of the adjacent building should be performed during proofrolling operations.
- Following satisfactory completion of proofrolling, additional fill should be placed and compacted as needed to achieve the desired grades. Fill should generally consist of dry fine sand with less than 12 percent passing the No. 200 sieve, free of rubble, organics, clay, debris and other unsuitable material. Fill should be tested and approved prior to acquisition.
- Approved sand fill should be placed in loose lifts not exceeding 12 inches in thickness and should be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). The upper foot of pavement subgrade should be compacted to at least 98 percent of Modified Proctor. Density tests to confirm compaction should be performed in each fill lift before the next lift is placed.



- Prior to beginning compaction, soil moisture contents should be adjusted in order to facilitate proper compaction. A moisture content within 2 percentage points of the optimum indicated by the Modified Proctor Test (ASTM D-1557) is recommended prior to compaction of the natural ground and fill.
- Immediately prior to placing steel reinforcement, it is suggested that the bearing surfaces of all footing and floor slab areas be compacted using hand-operated mechanical tampers. In this manner, any localized areas which have been loosened by excavation operations should be adequately recompacted.
- A materials testing laboratory should be retained to provide on-site observation of earthwork and ground modification activities. Density tests should be performed in the top one foot of compacted existing ground, in each fill lift, and at the bottom of foundation excavations and utility trenches.

5.3 GROUNDWATER CONTROL

Depending upon the seasonal conditions, runoff from adjoining sites and pavements may cause significant surface water until drainage structures are emplaced. Soils exposed in the bases of all satisfactory foundation excavations should be protected against any detrimental change in conditions, such as physical disturbance or rain. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, all footing concrete should be placed the same day that the footing excavation is made. If this is not possible, the footing excavations should be adequately protected.

5.4 DEWATERING

The groundwater level was encountered in the SPT borings at a depth of approximately 2.5 feet. Depending on the time of year that construction is performed, some dewatering may be required. Dewatering can be accomplished using a sanded wellpoint system supplemented by a gravel bottom layer and pumping from a sump.

Groundwater fluctuations will likely occur due to seasonal variations, runoff, and other factors and should be considered when planning earthwork activities. The impact of runoff from adjacent properties, nearby water bodies, and other site-specific conditions which may affect groundwater recharge are beyond the scope of this exploration and should be considered when planning and designing a dewatering system.

5.5 EXCAVATIONS

The limestone formation was generally encountered in the boring at a depth of 4 feet below the existing ground surface. Excavations that are planned to extend deeper than 4 feet below the existing ground surface will likely encounter this limestone formation and may require the use of pneumatic or hydraulic equipment designed for the removal of hard rock.



6.0 BASIS FOR RECOMMENDATIONS

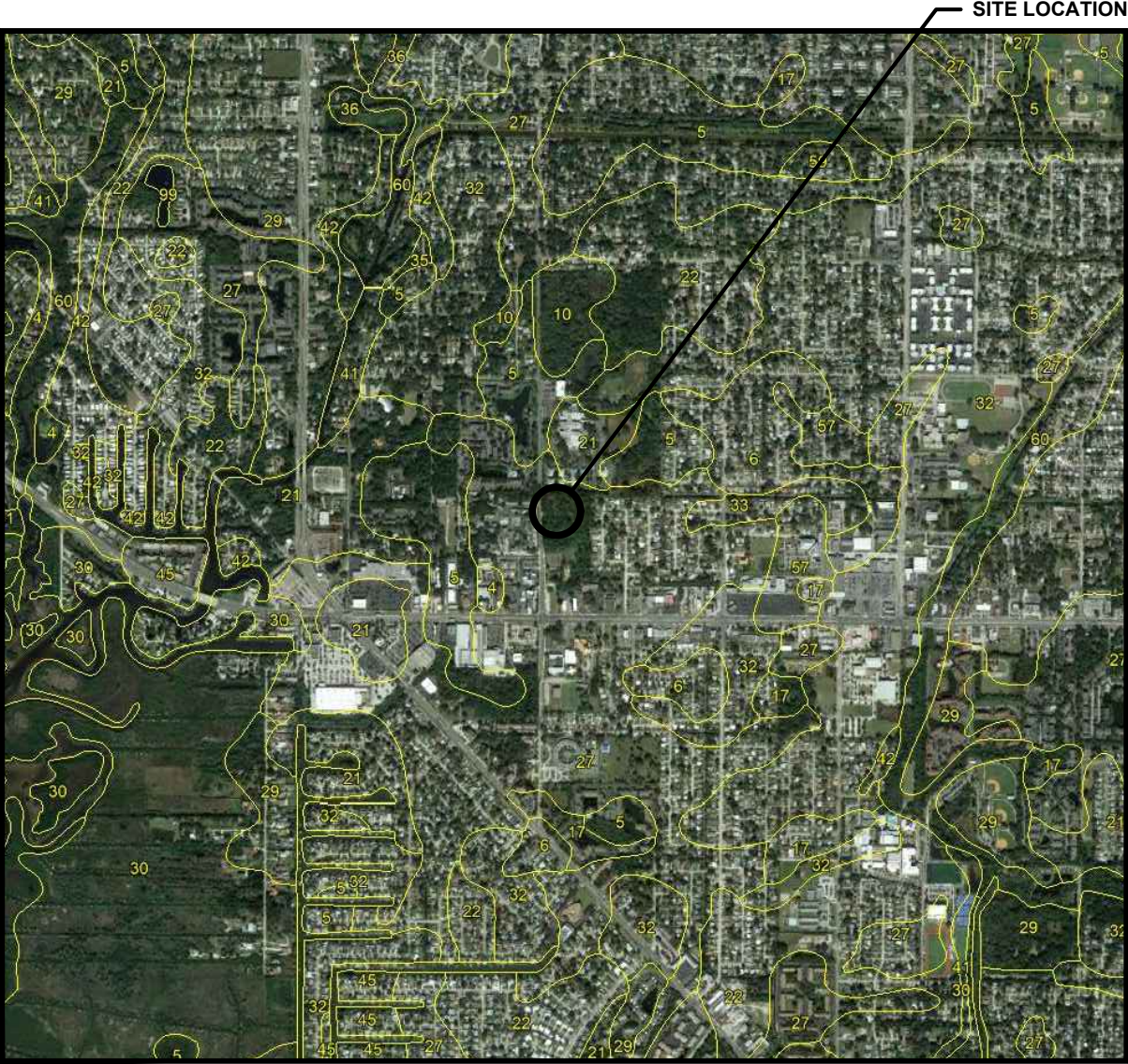
The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions across site will be different from those where the borings were drilled, and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process itself may alter soil conditions. AREHNA is not responsible for the conclusions, opinions or recommendations made by others based on the data presented in this report.



APPENDIX

USDA & USGS Vicinity Maps – Sheets 1
Boring Location Plan - Sheet 2
Soil Boring Profiles – Sheets 3A Thru 3C
Summary of Double Infiltration Test Results
Field and Laboratory Procedures

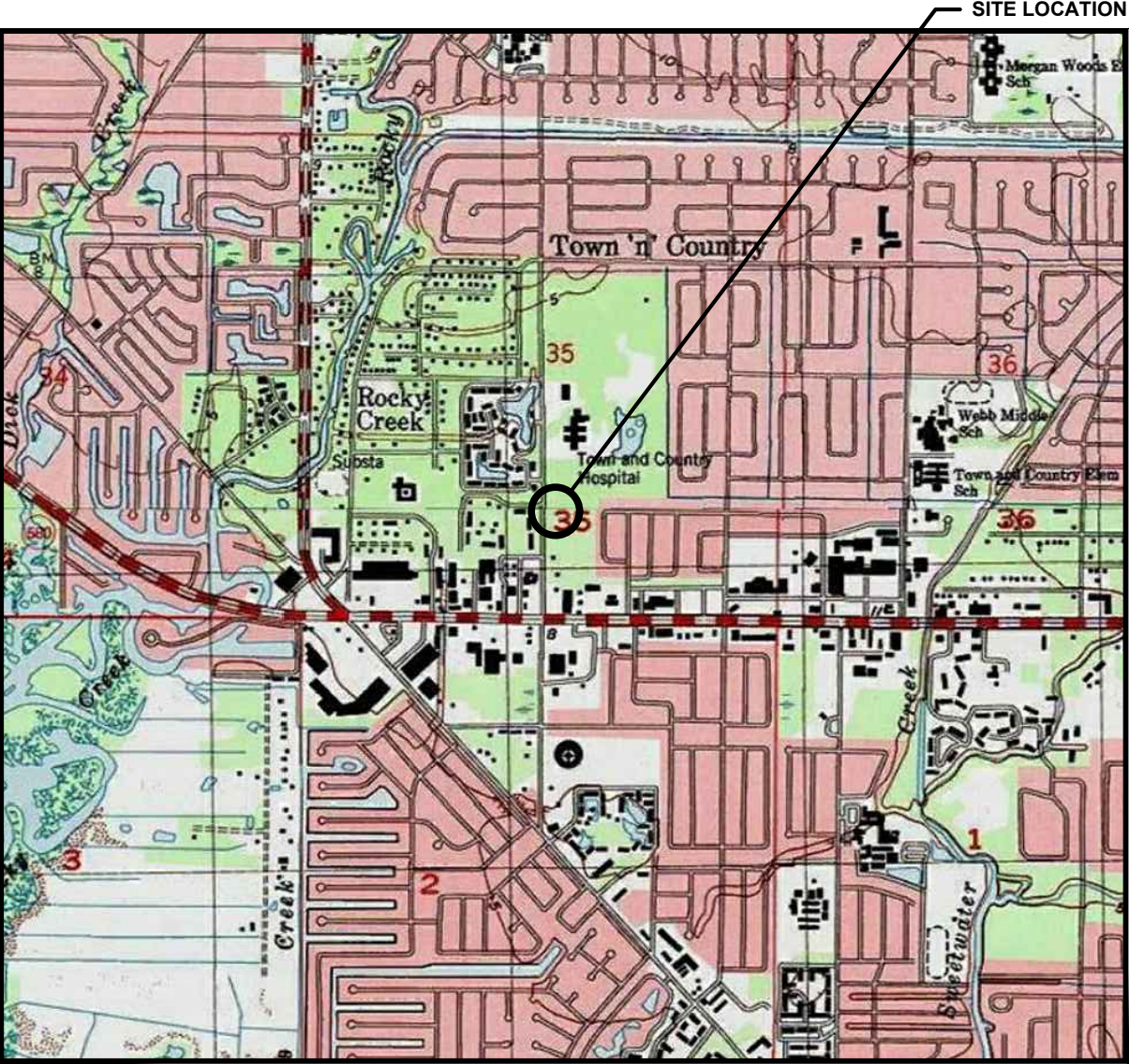
USDA SOIL SURVEY MAP



REFERENCE: USDA SOIL SURVEY OF HILLSBOROUGH COUNTY, FLORIDA

TOWNSHIP: 28 S
RANGE: 17 E
SECTION: 35

USGS TOPOGRAPHIC MAP



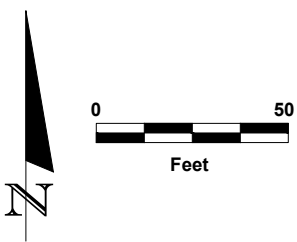
REFERENCE: "CITRUS PARK, FLORIDA" USGS QUADRANGLE MAP

TOWNSHIP: 28 S
RANGE: 17 E
SECTION: 35




REFERENCE: "GANDY BRIDGE, FLORIDA" USGS QUADRANGLE MAP

TOWNSHIP: 28 S
RANGE: 17 E
SECTION: 35


REVISIONS				PREPARED BY: <div> AREHNA Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 Fax 813.944.4959 Certificate of Authorization No. 28410</div>	USDA & USGS VICINITY MAPS	NAME			DATE	PROJECT NAME		PROJECT NO.	SHEET NO.
NO.	DATE	DESCRIPTIONS	APPROVED			DESIGNED BY:	AT	6/2020	HEAD START CHURCH PARK TOWN N' COUNTRY, FLORIDA	B-20-040	1		
						DRAWN BY:	DG	6/2020					
						CHECKED BY:	AT	6/2020					
						SUPERVISED BY: Andy Tao, P.E.							







LEGEND

-  APPROXIMATE LOCATION OF SPT BORING
-  APPROXIMATE LOCATION OF AUGER BORING
-  APPROXIMATE LOCATION OF DOUBLE RING INFILTRATION TEST

E:\AREHNA\Projects\2020\B-20-040 - Head Start Church Park\B-20-040.dwg (S-BLP) 6/13/2020 - 1:50pm

REVISIONS				PREPARED BY: <div> AREHNA Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 Fax 813.944.4959 Certificate of Authorization No. 28410</div>	BORING LOCATION PLAN	NAME DATE			PROJECT NAME	PROJECT NO.	SHEET NO.
NO.	DATE	DESCRIPTIONS	APPROVED			DESIGNED BY:	AT	6/2020	HEAD START CHURCH PARK TOWN N' COUNTRY, FLORIDA	B-20-040	2
						DRAWN BY:	DG	6/2020			
						CHECKED BY:	AT	6/2020			
						SUPERVISED BY: Andy Tao, P.E.					

LEGEND

	FINE SAND (SP/SP-SM/SP-SC)		WEATHERED LIMESTONE
	SILTY SAND (SM)		LIMESTONE

SP UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2488) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND/OR LABORATORY TESTING

▽ GROUNDWATER TABLE AT THE TIME OF DRILLING

GNE GROUNDWATER TABLE NOT ENCOUNTERED

N SPT N-VALUE IN BLOWS/FOOT FOR 12 INCHES OF PENETRATION

HA HAND AUGERED TO AVOID UTILITY CONFLICTS AND SAFETY REASONS

50/4 NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION

←100 LOSS OF CIRCULATION OF DRILLING FLUID (%)

|| CASING

-200 FINES PASSING THE #200 STANDARD SIEVE (%)

NMC NATURAL MOISTURE CONTENT (%)

LL LIQUID LIMIT (%)

PI PLASTICITY INDEX (%)

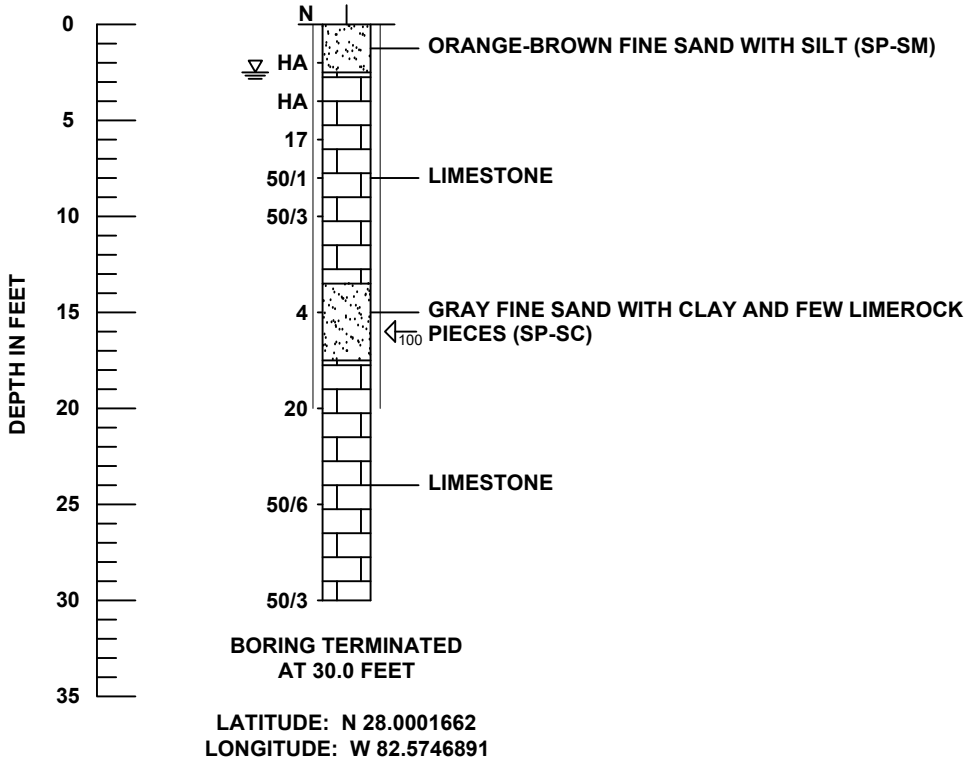
PL PLASTICITY LIMITS (%)

NP NON PLASTIC

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	LESS THAN 4 4 to 10 10 to 30 30 to 50 GREATER THAN 50	LESS THAN 3 3 to 8 8 to 24 24 to 40 GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT SOFT FIRM STIFF VERY STIFF HARD	LESS THAN 2 2 to 4 4 to 8 8 to 15 16 to 30 GREATER THAN 30	LESS THAN 1 1 to 3 3 to 6 6 to 12 12 to 24 GREATER THAN 24
LIMESTONE CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
SOFT MEDIUM HARD VERY HARD	LESS THAN 20 20 to 50 51 to 50/3" GREATER THAN 50/3"	LESS THAN 17 17 to 41 42 to 50/6" GREATER THAN 50/6"

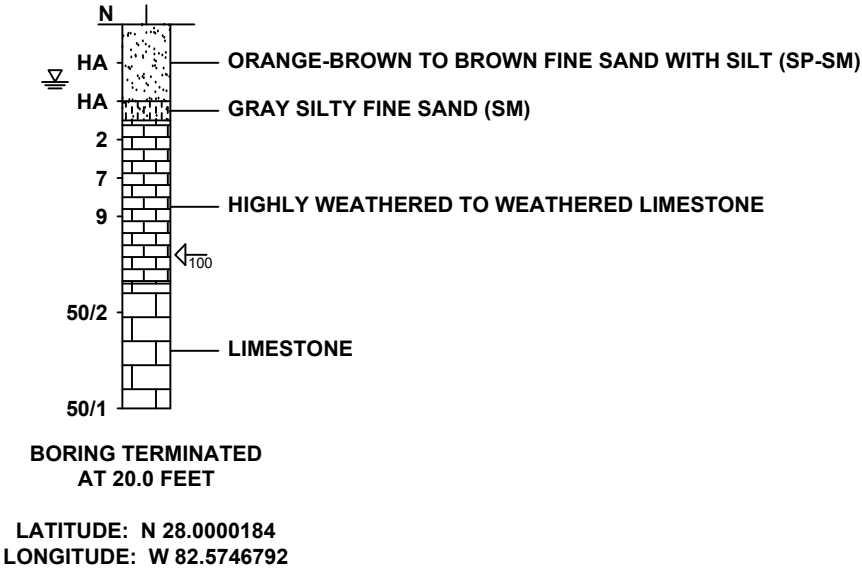
B-01

6/19/20



B-02

6/19/20

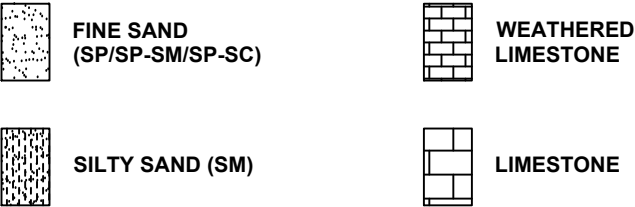


Soil Profile Notes:

- The profiles depicted are of a generalized nature to highlight the major subsurface stratification features and material characteristics. The soil profiles include soil description, stratifications and penetration resistances. The stratifications shown on the boring profiles represent the conditions only at the actual boring location. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual.
- Groundwater levels generally fluctuate during periods of prolonged drought and extended rainfall and may be affected by man-made influences. In addition, a seasonal effect will also occur in which higher groundwater levels or temporary perched conditions are normally recorded in rainy seasons.
- The Boring Locations Presented are Approximate and Based on Hand Held GPS with an Accuracy of +/- 10 Feet.

REVISIONS				PREPARED BY: <div> AREHNA Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 Fax 813.944.4959 Certificate of Authorization No. 28410</div>	SOIL BORING PROFILES	NAME			DATE	PROJECT NAME	PROJECT NO.	SHEET NO.
NO.	DATE	DESCRIPTIONS	APPROVED			DESIGNED BY:	AT	6/2020	HEAD START CHURCH PARK TOWN N' COUNTRY, FLORIDA	B-20-040	3A	
						DRAWN BY:	DG	6/2020				
						CHECKED BY:	AT	6/2020				
						SUPERVISED BY: Andy Tao, P.E.						

LEGEND



SP UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2488) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND/OR LABORATORY TESTING

GROUNDWATER TABLE AT THE TIME OF DRILLING

GROUNDWATER TABLE NOT ENCOUNTERED

N SPT N-VALUE IN BLOWS/FOOT FOR 12 INCHES OF PENETRATION

HA HAND AUGERED TO AVOID UTILITY CONFLICTS AND SAFETY REASONS

50/4 NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION

LOSS OF CIRCULATION OF DRILLING FLUID (%)

CASING

-200 FINES PASSING THE #200 STANDARD SIEVE (%)

NMC NATURAL MOISTURE CONTENT (%)

LL LIQUID LIMIT (%)

PI PLASTICITY INDEX (%)

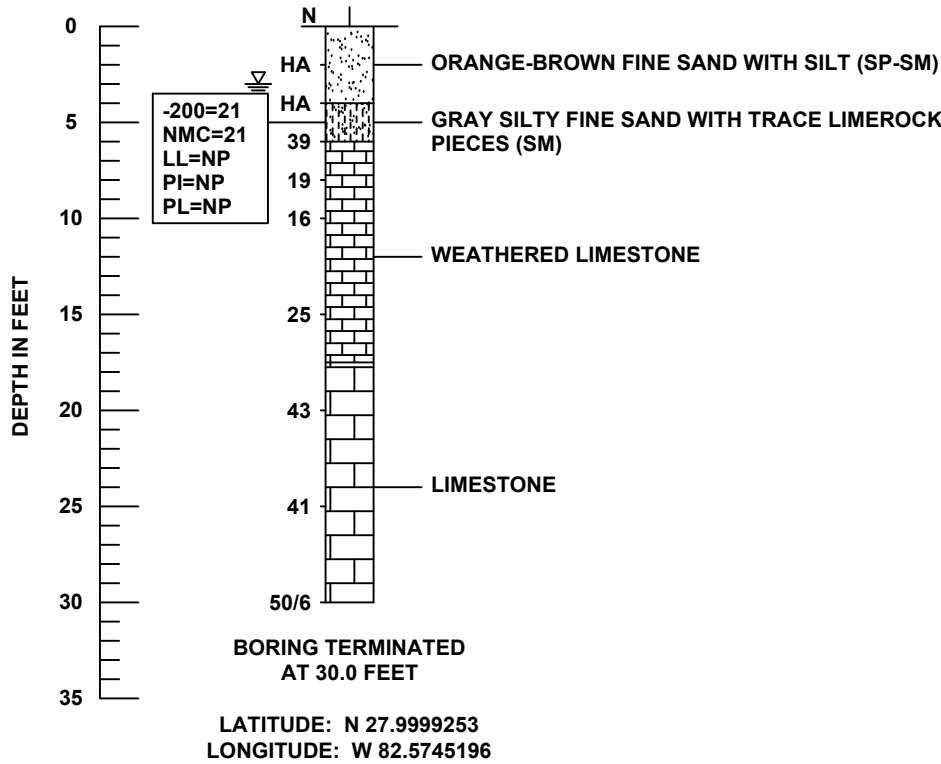
PL PLASTICITY LIMITS (%)

NP NON PLASTIC

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	LESS THAN 4 4 to 10 10 to 30 30 to 50 GREATER THAN 50	LESS THAN 3 3 to 8 8 to 24 24 to 40 GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT SOFT FIRM STIFF VERY STIFF HARD	LESS THAN 2 2 to 4 4 to 8 8 to 15 16 to 30 GREATER THAN 30	LESS THAN 1 1 to 3 3 to 6 6 to 12 12 to 24 GREATER THAN 24
LIMESTONE CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
SOFT MEDIUM HARD VERY HARD	LESS THAN 20 20 to 50 51 to 50/3" GREATER THAN 50/3"	LESS THAN 17 17 to 41 42 to 50/6" GREATER THAN 50/6"

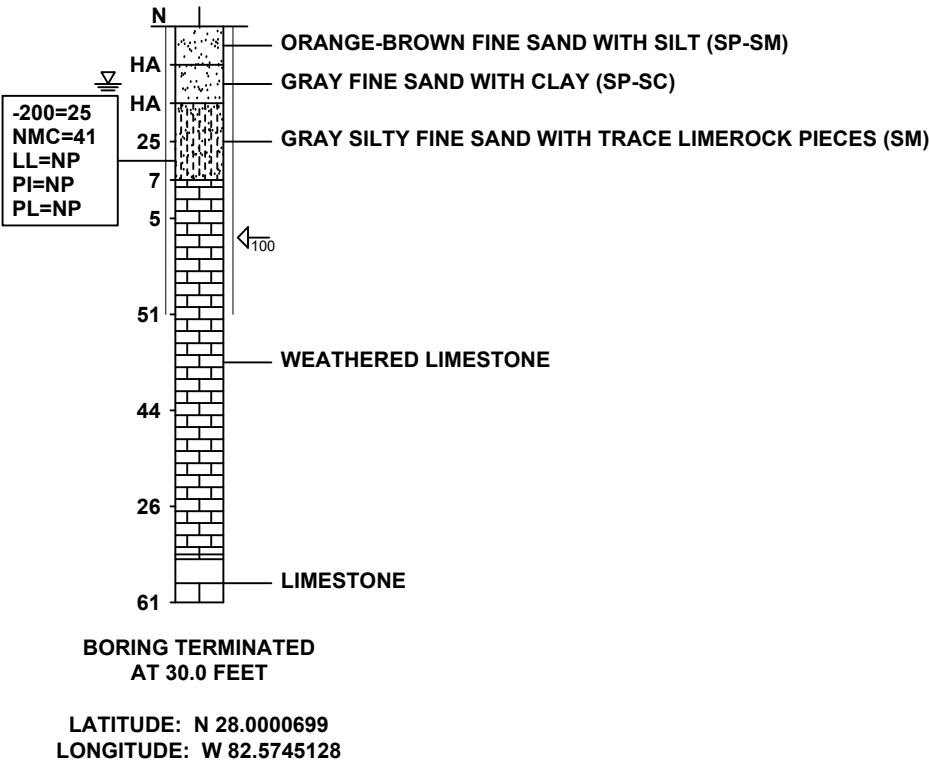
B-03

6/19/20



B-04

6/19/20



Soil Profile Notes:

- The profiles depicted are of a generalized nature to highlight the major subsurface stratification features and material characteristics. The soil profiles include soil description, stratifications and penetration resistances. The stratifications shown on the boring profiles represent the conditions only at the actual boring location. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual.
- Groundwater levels generally fluctuate during periods of prolonged drought and extended rainfall and may be affected by man-made influences. In addition, a seasonal effect will also occur in which higher groundwater levels or temporary perched conditions are normally recorded in rainy seasons.
- The Boring Locations Presented are Approximate and Based on Hand Held GPS with an Accuracy of +/- 10 Feet.

REVISIONS				PREPARED BY: <div> AREHNA Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 Fax 813.944.4959 Certificate of Authorization No. 28410</div>	SOIL BORING PROFILES	NAME DATE			PROJECT NAME	PROJECT NO.	SHEET NO.
NO.	DATE	DESCRIPTIONS	APPROVED			DESIGNED BY:	AT	6/2020	HEAD START CHURCH PARK TOWN N' COUNTRY, FLORIDA	B-20-040	3B
						DRAWN BY:	DG	6/2020			
						CHECKED BY:	AT	6/2020			
						SUPERVISED BY: Andy Tao, P.E.					

E:\1-Arehna\Projects\2020\B-20-040 - Head Start Church Park\B-20-040.dwg (SC-SOU) 6/13/27 Jul 08, 2020 - 1:50pm

LEGEND



FINE SAND
(SP/SP-SM/SP-SC)



WEATHERED
LIMESTONE



SILTY SAND (SM)



LIMESTONE

SP UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2488) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND/OR LABORATORY TESTING

GROUNDWATER TABLE AT THE TIME OF DRILLING

GNE GROUNDWATER TABLE NOT ENCOUNTERED

N SPT N-VALUE IN BLOWS/FOOT FOR 12 INCHES OF PENETRATION

HA HAND AUGERED TO AVOID UTILITY CONFLICTS AND SAFETY REASONS

50/4 NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION

LOSS OF CIRCULATION OF DRILLING FLUID (%)

CASING

-200 FINES PASSING THE #200 STANDARD SIEVE (%)

NMC NATURAL MOISTURE CONTENT (%)

LL LIQUID LIMIT (%)

PI PLASTICITY INDEX (%)

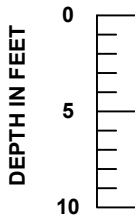
PL PLASTICITY LIMITS (%)

NP NON PLASTIC

	SAFETY HAMMER	AUTOMATIC HAMMER
GRANULAR MATERIALS- RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	LESS THAN 4 4 to 10 10 to 30 30 to 50 GREATER THAN 50	LESS THAN 3 3 to 8 8 to 24 24 to 40 GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
VERY SOFT SOFT FIRM STIFF VERY STIFF HARD	LESS THAN 2 2 to 4 4 to 8 8 to 15 16 to 30 GREATER THAN 30	LESS THAN 1 1 to 3 3 to 6 6 to 12 12 to 24 GREATER THAN 24
LIMESTONE CONSISTENCY	SPT N-VALUE (BLOWS/FT.)	SPT N-VALUE (BLOWS/FT.)
SOFT MEDIUM HARD VERY HARD	LESS THAN 20 20 to 50 51 to 50/3" GREATER THAN 50/3"	LESS THAN 17 17 to 41 42 to 50/6" GREATER THAN 50/6"

HA-01

6/19/20



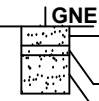
DARK GRAY TO DARK BROWN FINE SAND WITH SILT (SP-SM)
BROWN TO LIGHT BROWN FINE SAND (SP)
BROWN FINE SAND WITH FEW TO SOME LIMEROCK (SP-SM)
BROWN FINE SAND (SP)

BORING TERMINATED
AT 5.0 FEET

LATITUDE: N 28.0001277
LONGITUDE: W 82.5748944

HA-02

6/19/20



GRAY TO DARK GRAY FINE SAND WITH SILT AND TRACE
TO SOME SHELL (SP-SM)
DARK BROWN FINE SAND WITH SILT (SP-SM)
BROWN TO DARK BROWN FINE SAND WITH SILT AND
TRACE LIMEROCK (SP-SM)

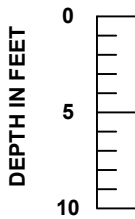
BORING TERMINATED
AT 3.5 FEET

LATITUDE: N 27.9998336
LONGITUDE: W 82.5748857



HA-03

6/19/20



GRAY TO BROWN FINE SAND WITH SILT (SP-SM)
LIGHT BROWN FINE SAND (SP)
GRAY SILTY FINE SAND (SM)
GRAY FINE SAND WITH CLAY (SP-SC)

BORING TERMINATED
AT 5.0 FEET

LATITUDE: N 27.9994328
LONGITUDE: W 82.5748728

DRI-01

6/19/20



GRAY FINE SAND WITH SILT AND TRACE ROOTS (SP-SM)
BROWN FINE SAND WITH TRACE ROOT (SP)
BROWN FINE SAND (SP)


BORING TERMINATED
AT 3.5 FEET

LATITUDE: N 27.9995544
LONGITUDE: W 82.5748789



Soil Profile Notes:

- The profiles depicted are of a generalized nature to highlight the major subsurface stratification features and material characteristics. The soil profiles include soil description, stratifications and penetration resistances. The stratifications shown on the boring profiles represent the conditions only at the actual boring location. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual.
- Groundwater levels generally fluctuate during periods of prolonged drought and extended rainfall and may be affected by man-made influences. In addition, a seasonal effect will also occur in which higher groundwater levels or temporary perched conditions are normally recorded in rainy seasons.
- The Boring Locations Presented are Approximate and Based on Hand Held GPS with an Accuracy of +/- 10 Feet.

REVISIONS				PREPARED BY:  AREHNA Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 Fax 813.944.4959 Certificate of Authorization No. 28410	SOIL BORING PROFILES	NAME DATE			PROJECT NAME		PROJECT NO.	SHEET NO.
NO.	DATE	DESCRIPTIONS	APPROVED			DESIGNED BY:	AT	6/2020	HEAD START CHURCH PARK TOWN N' COUNTRY, FLORIDA	B-20-040	3C	
						DRAWN BY:	DG	6/2020				
						CHECKED BY:	AT	6/2020				
						SUPERVISED BY: Andy Tao, P.E.						

The graph displays the incremental infiltration rate over a 210-minute period for two different configurations. The 'INNER RING' scenario (solid blue line) shows a fluctuating rate, generally staying below 7 inches per hour, with a peak of approximately 6.7 inches per hour at 60 minutes. The 'ANNULUS BETWEEN RINGS' scenario (dashed red line) shows a much higher and more variable rate, with peaks reaching 15.5 inches per hour at 150 and 210 minutes, and a sustained high rate of 9 inches per hour between 120 and 180 minutes.

Elapsed Time (minutes)	INNER RING (inches / hour)	ANNULUS BETWEEN RINGS (inches / hour)
0	0.0	0.0
15	7.8	9.0
30	2.2	9.0
45	5.3	9.0
60	6.7	9.0
75	5.4	9.0
90	6.7	10.3
105	2.2	9.0
120	6.7	9.0
135	3.0	10.3
150	5.3	15.5
165	3.0	9.0
180	5.3	9.0
195	5.3	9.0
210	5.3	15.5

[illegible]

SUBSURFACE PROFILE	
DEPTH (ft)	SOIL DESCRIPTION
0-5	Brown to Light Gray Fine Sand (SP)
Boring Terminated at 5 feet	

TEST INFORMATION	
TEST DATE:	06/16/20
WEATHER:	Sunny, warm
TECHNICIAN(S):	W. Buckley
LIQUID TYPE:	Water
RING DIAMETERS	
-- INNER RING:	12"
-- OUTER RING:	24"
LIQUID DEPTHS	
-- INNER RING:	6"
-- OUTER RING:	6"
TEST DEPTH:	2'

<p>AREHNA Engineering, Inc. 5012 West Lemon Street Tampa, Florida 33609 Phone: (813) 944-3464 Fax: (813) 944-4959</p>		
	PROJECT NAME: Church Park	TEST NO.: _____ DRI-01
	PROJECT LOCATION: Town N' Country, Florida	TEST LOCATION: _____
		WATER TEMPERATURE / pH: _____
	AREHNA PROJECT NO.: B-20-040	INFILTRATION RATE: _____
CLIENT: Wilder Architechture, Inc.	PREPARED BY/ DATE: _____	CHECKED BY/ DATE: _____

FIELD PROCEDURES

Standard Penetration Test (SPT) Borings

The SPT borings are performed in general accordance with ASTM D-1586, "Penetration Test and Split-Barrel Sampling of Soils." A rotary drilling process is used and bentonite drilling fluid is circulated in the boreholes to stabilize the sides and flush the cuttings. At regular intervals, the drilling tools are removed and soil samples are obtained with a standard 2-feet long, 2-inch diameter split-tube sampler. The sampler is first seated 6 inches and then driven an additional foot with blows of a 140-pound hammer falling under its own weight a distance of 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance." The penetration resistance, when properly interpreted, is an index to the soil strength and density.

Auger Boring

The auger borings are performed in general accordance with ASTM D-1452, "Standard Practice for Soil Investigation and Sampling by Auger Borings". Auger borings are advanced manually using a bucket-type hand auger. The soils encountered are identified, in the field, from cuttings brought to the surface by the augering process. Representative soil samples from the auger borings are placed in glass jars and transported to our laboratory where they are examined by an engineer for classification.

Double Ring Infiltration (DRI) Testing

The DRI tests are performed in general accordance with ASTM D3385 "Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer". The 24-inch diameter outer ring is set on the prepared and roughened surface and is driven into the soil to a depth of 6-inches. Care is taken not to disturb the soil adjacent to ring walls. The ring is then checked visually for levelness. The 12-inch diameter inner ring is then set concentrically within the outer ring and pushed and/or driven into the soil using methods described in the above paragraph to set the inner ring into the soil. The inner ring is then checked visually for level and location within the outer ring. Water is poured into both rings using a splash guard to reduce scouring of the soil surface during the testing. The inner ring and annular space is then simultaneously filled with water to a depth of 12 inches. Water is added during the testing to maintain the 12-inch depth and volume that is added during specific intervals is recorded. This water volume represents the volume infiltrated into the soils, and is converted to an infiltration velocity.



LABORATORY PROCEDURES

Water Content

The water content is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the solid particles. This test is conducted in general accordance with FM 1-T265.

Atterberg Limits (Plasticity)

A soil's Plasticity Index (PI) is the numerical difference between the Liquid Limit (LL) and the Plastic limit (PL). The LL is the moisture content at which the soil will flow as a heavy viscous fluid and is determined in general accordance with ASTM D-4318. The PL is the moisture content at which the soil begins to crumble when rolled into a small thread and is also determined in general accordance with FM 1-T 90.

Fines Content

In this test, the sample is dried and then washed over a No. 200 mesh sieve. The percentage of soil by weight passing the sieve is the percentage of fines or portion of the sample in the silt and clay size range. This test is conducted in general accordance with ASTM D-1140.

