CRA ARCHITECTS

CLEMONS, RUTHERFORD & ASSOCIATES, INC.

ARCHITECTS
▪
PLANNERS
▪
INTERIOR DESIGNERS
▪
CONSTRUCTION MANAGERS

2027 Thomasville Road
Tallahassee, FL 32308
p: 850-385-6153
f: 850-386-8420
www.craarchitects.com

PROJECT MANUAL

GADSDEN COUNTY BOARD OF COUNTY COMMISSIONERS

NEW EMS FACILITY

JOE ADAMS ROAD
QUINCY, FL.

CRA PROJECT NUMBER 23065

(100% CONSTRUCTION DOCUMENTS)

VOLUME 2

PAGE LEFT BLANK INTENTIONALLY

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ball valves.

B. Butterfly valves.

C. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 08 31 00 - Access Doors and Panels.

C. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

D. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

E. Section 22 07 19 - Plumbing Piping Insulation.

F. Section 22 10 05 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. TFE: Tetrafluoroethylene.

I. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

D. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.

E. ASME B31.9 - Building Services Piping; 2020.

F. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

G. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

H. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

I. MSS SP-67 - Butterfly Valves; 2022.

J. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

K. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

L. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

M. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

N. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided; 2018.

O. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

P. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.06 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

B. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate or plug.
   2. Dead-End: Single-flange butterfly (lug) type.
   3. Throttling: Provide globe, angle, ball, or butterfly.
   4. Swing Check (Pump Outlet):
      a. 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
      b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
      c. 2-1/2 inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

C. Domestic, Hot and Cold Water Valves:
   1. 2 inch and Smaller:
      a. Ball: One piece, full port, brass with stainless-steel trim.
   2. 2-1/2 inch and Larger:
      a. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.

D. Sanitary Waste Water Valves:
   1. 2 inch and Smaller:
      a. Ball: One piece, full port, brass with brass trim.
   2. 2-1/2 inch and Larger:
      a. Iron Ball: Class 150.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
   1. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.

D. Valve-End Connections:
   1. Threaded End Valves: ASME B1.20.1.
   2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
   3. Solder Joint Connections: ASME B16.18.

E. General ASME Compliance:

F. Potable Water Use:
   1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
   2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

2.03 BRASS, BALL VALVES

A. One Piece, Full Port with Brass Trim and Push-to-fit or Threaded Connections:
   1. Comply with MSS SP-110.
   2. CWP Rating: 200 psi.
   3. Body: Forged brass.
   4. Seats: PTFE.
   5. Stem: Brass.
   6. Ball: Chrome-plated brass.
   7. Operator: Handle.

2.04 BRONZE, BALL VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

B. One Piece, Reduced Port with Bronze Trim:
   1. Comply with MSS SP-110.
   2. WSP Rating: 400 psi.
   3. CWP Rating: 600 psi.
   4. Body: Bronze.
   5. End Connections: Pipe press.
   6. Seats: PTFE.

2.05 IRON, BALL VALVES

A. Class 125, Full Port, Stainless Steel Trim:
   1. Comply with MSS SP-72.
   2. CWP Rating: 200 psi.
   3. Body: ASTM A536 Grade 65-45-12, ductile iron.
   4. End Connections: Flanged.
   5. Seats: PTFE.
   6. Operator: Lever with locking handle.

2.06 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Wafer Style:
   1. Class 125, or Class 150 flanges.
   2. Comply with MSS SP-67, Type I.
   3. Wafer Style, Service Pressure Ratings:
      a. 150 psi for sizes 14 to 24 inch.
   4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
   5. Stem: One or two-piece stainless steel.
   6. Seat: EPDM.
   7. Disc: Aluminum-bronze.
   8. Finish: Epoxy coated.
   9. Operator: Gear operator with handwheel over direct-mount actuator base.

2.07 BRONZE, SWING CHECK VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125:
   1. Pressure and Temperature Rating: MSS SP-80, Type 3.
   2. Design: Y-pattern, horizontal or vertical flow.
   3. WOG Rating: 200 psi.
   4. Body: Bronze, ASTM B62.
   5. End Connections: Threaded.
   6. Disc: Bronze.

2.08 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.
   1. Comply with MSS SP-71, Type I.
   2. Description:
      a. CWP Rating: 200 psi.
      b. Design: Clear or full waterway.
      c. Body: ASTM A126, gray iron with bolted bonnet.
      d. Ends: Flanged as indicated.
      e. Trim: Bronze.
      f. Gasket: Asbestos free.
      g. Closer Control: Factory installed, exterior lever, and weight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Install check valves where necessary to maintain direction of flow as follows:
   1. Swing Check: Install horizontal maintaining hinge pin level.
   2. Orient plate-type into horizontal or vertical position, between flanges.

D. Provide chainwheels on operators for valves 4 inch and larger where located 96 inches or more above finished floor, terminating 60 inches above finished floor.

END OF SECTION 22 05 23

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Strut systems for pipe or equipment support.

B. Beam clamps.

C. Pipe hangers.

D. Pipe supports, guides, shields, and saddles.

E. Anchors and fasteners.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

L. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

M. UL (DIR) - Online Certifications Directory; Current Edition.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.05 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
   1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
   2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

D. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
   1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
   2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

2.02 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

A. Strut Channels:
   1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
   2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

B. Hanger Rods:
   1. Threaded zinc-plated steel unless otherwise indicated.

C. Channel Nuts:
   1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.03 BEAM CLAMPS

A. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

B. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.04 PIPE HANGERS

A. Clevis Hangers, Adjustable:
   1. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
   2. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.05 PIPE CLAMPS

A. Riser Clamps:
   1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
   2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   3. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

2.06 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

B. U-Bolts:
   1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.

C. Pipe Supports:
   1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
   2. Liquid Temperatures Up to 122 degrees F:
      a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
      b. Support From Below: MSS SP-58 types 35 through 38.

D. Pipe Supports, Thermal Insulated:
   1. General Requirements:
      a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
      b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
      c. Provide pipe supports for 1/2 to 30 inch iron pipes.
      d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
   2. PVC Jacket:
      a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
      b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
      c. Minimum Thickness: 60 mil, 0.06 inch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

END OF SECTION 22 05 29

This page intentionally left blank

SECTION 22 05 48
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

1.05 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

D. Equipment Isolation: As indicated on drawings.

2.02 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

B. Vibration Isolators for Nonseismic Applications:

1. Resilient Material Isolator Pads:
   a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
   b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
   c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.

2.03 ACOUSTICAL AND VIBRATION ISOLATORS

A. General Requirements:

1. Acoustical Isolation System: Through-stud isolators, pipe clamps, riser clamp pads, neoprene and felt lining material and associated support brackets.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
   1. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
   2. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
   3. Adjust isolators to be free of isolation short circuits during normal operation.
   4. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.02 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 22 05 48

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tags.

B. Pipe markers.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Tags:
   1. Piping: 3/4 inch diameter and smaller.

B. Pipe Markers: 3/4 inch diameter and higher.

2.02 TAGS

A. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

2.03 PIPE MARKERS

A. Comply with ASME A13.1.

B. Identification Scheme, ASME A13.1:
   1. Primary: External Pipe Diameter, Uninsulated or Insulated.
   2. Secondary: Color scheme per fluid service.
      a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install tags in clear view and align with axis of piping

END OF SECTION 22 05 53

This page intentionally left blank

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cellular glass insulation.

B. Flexible elastomeric cellular insulation.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

2.03 JACKETING AND ACCESSORIES

A. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Joining: Longitudinal slip joints and 2 inch laps.
   3. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

C. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with aluminum jacket.

D. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

END OF SECTION 22 07 19

SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.
B. Sanitary waste piping, above grade.
C. Domestic water piping, buried within 5 feet of building.
D. Domestic water piping, above grade.
E. Storm drainage piping, buried within 5 feet of building.
F. Storm drainage piping, above grade.
G. Propane gas piping, above grade.
H. Natural gas piping, above grade.
I. Pipe flanges, unions, and couplings.
J. Pipe hangers and supports.
K. Pipe sleeve-seal systems.
L. Ball valves.
M. Balancing valves.
N. Flow-balancing valves.
O. Pressure reducing valves.
P. Pressure-temperature valves.

1.02 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
E. ASME B31.1 - Power Piping; 2022.
F. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023.
G. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.
H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
J. ASTM B32 - Standard Specification for Solder Metal; 2020.
K. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.
L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
N. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
O. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

P. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

Q. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.

R. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2019a.

S. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

T. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

V. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2021.

W. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2023.

X. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2019.

Y. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2023.

Z. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2023.

AA. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.

BB. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2017.

CC. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

DD. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

EE. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

FF. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

GG. NFPA 58 - Liquefied Petroleum Gas Code; 2024.

HH. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

II. NSF 372 - Drinking Water System Components - Lead Content; 2022.

JJ. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Pipe: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
   1. Joints: ASTM B32, alloy Sn95 solder.

B. CPVC Pipe: ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M.
   1. Fittings: CPVC; ASTM D2846/D2846M, ASTM F437, ASTM F438, or ASTM F439.
   2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.
   3. Wraped with sound attenuation insulation.

2.08 PROPANE GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: NFPA 58, threaded or welded to comply with ASME B31.1.

2.09 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

2.10 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:
   1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.11 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

C. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
   3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
   4. Wall Support for Pipe Sizes Up to 3 inch: Cast iron hook.
   5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
   2. Masonry Screw Type Anchors: Comply with ICC-ES AC106.
   3. Other Types: As required.

2.12 PIPE SLEEVE-SEAL SYSTEMS

A. Modular Mechanical Seals:
   1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
   3. Size and select seal component materials in accordance to service requirements.
   4. Glass reinforced plastic pressure end plates.

2.13 BALL VALVES

A. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.14 FLOW-BALANCING VALVES

A. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.15 PRESSURE REDUCING VALVES

A. 2 inch and Smaller:
   1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
   2. Pressure Reducing Pilot-Operator:
      a. Operating Range: 5 to 50 psi.
      b. Connected into brass or bronze pilot piping and fittings.
      c. Fixed flow restrictor, pressure gauges, and isolation valves.

B. 2 inch and Larger:
   1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2. Pressure Reducing Pilot-Operator:
    a. Operating Range: 5 to 50 psi.
    b. Connected into brass or bronze pilot piping and fittings.
    c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.16 PRESSURE-TEMPERATURE VALVES

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

C. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

D. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

E. Pipe Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

3.02 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Gas Distribution Systems:
1. Test Preparation: Close each appliance valve or disconnect and cap each connected appliance.
2. General Systems:
    a. Inject a minimum of 10 psi of compressed air into the piping system for a duration of 15 minutes and verify with a gauge that no perceptible pressure drop is measured.
    b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound.

C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.03 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

3.04 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.05 SCHEDULES

A. Pipe Hanger Spacing:
1. Metal Piping:

a. Pipe Size: 1/2 inch to 1-1/4 inch:
    1) Maximum Hanger Spacing: 6.5 ft.
    2) Hanger Rod Diameter: 3/8 inches.
b. Pipe Size: 1-1/2 inch to 2 inch:
    1) Maximum Hanger Spacing: 10 ft.
    2) Hanger Rod Diameter: 3/8 inch.
c. Pipe Size: 2-1/2 inch to 3 inch:
    1) Maximum Hanger Spacing: 10 ft.
    2) Hanger Rod Diameter: 1/2 inch.
d. Pipe Size: 4 inch to 6 inch:
    1) Maximum Hanger Spacing: 10 ft.
    2) Hanger Rod Diameter: 5/8 inch.

2. Plastic Piping:
    a. All Sizes:
        1) Maximum Hanger Spacing: 6 ft.
        2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION 22 10 05

SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 2 PRODUCTS

1.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

END OF SECTION 22 10 06

This page intentionally left blank

SECTION 22 13 44 - SEWAGE LIFT STATION WITH SUBMERSIBLE PUMPS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required to install, place in operation, and field test submersible wastewater pumps as hereinafter specified. The station shall be complete with pumps, motors, piping, valves, electrical work (including motor controls), structures, lifting chains, guide rails, valve vault, access covers, connections and appurtenances, tested and ready for service.

B. These specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in these specifications or not.

1.2 SITE CONDITIONS

A. Prior to submitting their bid, the Contractor shall satisfy themselves as to the character and amount of different soil material, groundwater and the subsurface conditions to be encountered in the work to be performed. Information and data, when furnished, are for the Contractor's general information. However, it is expressly understood that any interpretation or conclusion drawn therefrom is totally the responsibility of the Contractor.

1.3 SUBMITTALS

Shop Drawings - Contractor shall submit shop drawings and product data for all equipment furnished under this section including, but not limited to,

1. Wet well.
2. Valve Vault.
3. Electrical Controls.
4. All Piping.
5. Pump Performance Curves.
2. Pump Outline Drawing.
3. Station Drawing for Accessories.
4. Electrical Motor Data.
5. Typical Installation Guides.
6. Technical Manuals and Parts List.
8. Printed Warranty.
9. Management system certificate ISO 9001.
10. Manufacturer's Equipment Storage Recommendations.
11. Manufacturer's Standard Recommended Start-Up Report Form.

Lack of the above requested submittal data is cause for rejection.

1.4 OPERATING AND MAINTENANCE DATA

A. Contractor shall compile data and related information appropriate for owner's maintenance and operation of products furnished under contract and furnish an Operation and Maintenance

Manual in accordance with this section.

B. Manual preparation shall be done by trained and experienced personnel familiar with the requirements of this section. The Manual should be an 8 1/2 X 11 bound volume with neatly typed text and should include all manufacturers data. Drawings and schematics should be bound to the manual and folded to 8 1/2 X 11 inches.

C. The contractor shall supply, install, and construct 1 sanitary sewage pump station(s).

D. Each sewage pump station shall be completely issued with discharge connections, discharge pipes, guide bars, safety grit and cable holder to assemble 2 submersible waste water pumps.

E. For each pump station the contractor shall supply and install a separate valve vault.

F. The contractor shall supply and install 2 submersible sewage pumps

G. The submersible pumps shall have a semi open multi vane self-cleaning impeller designed to transport wastewater with fibrous materials like wet wipes.

H. The impeller shall be wear resistant and made of high chromium cast iron with at least 24% chrome against sand and grit which is expected to enter the pump station with the sewage or the storm water. Impellers that have surface hardening (by thermal, coating, etc.) will not be allowed.

I. Each pump shall be capable to lift 23 **US gpm** at a total dynamic head of 87 **feet**.

1.5 EQUIPMENT INSTALLATION CERTIFICATE

A. The manufacturer shall provide a written report, through the Contractor and endorsed in writing by the Contractor, certifying that the equipment has been property installed and checked and is ready for placement into routine permanent service.

B. The pumps shall be provided with prorated 60 months (5 years) warranty against defects in materials and or workmanship. Unless otherwise specified, all other equipment shall be warrantied for 12 months (1 year). The warranty shall be in printed form and previously published as the manufacturer's standard warranty for all similar units manufactured, latest revision. Upon warranty occurrence, the manufacturer's authorized service center shall remove the pump, repair, reinstall and provide start up on the repaired pump. A detailed failure analysis shall be submitted to the Owner for their records summarizing corrective action taken.

C. The manufacturer shall guarantee clog-free operation for a period of 24 months from the date of start-up of the pumps by the local authorized factory representative. A certificate shall be provided to the Owner on the day of start up with the local contact information and effective date. If the impeller clogs with typical solids or modern trash debris normally found in domestic wastewater during this period, an authorized representative shall travel to the jobsite, remove the pump, clear the obstruction and reinstall the pump at no cost for the Owner. A written report shall be provided to the Owner detailing the service call with pictures for verification purposes.

1.6 MANUFACTURER'S STARTUP SERVICES

A. The Contractor shall furnish services of manufacturer's technical representative to inspect the completed installation, correct or supervise correction of any defects or malfunctions, and instruct operating personnel in proper operating and maintenance procedures.

1.7 QUALIFICATION REQUIREMENTS

A. The manufacturer shall provide data on alternate equipment manufacturer's experience. Only Manufacturers with 10 or more years of experience who have furnished at least 5 similar lift stations shall be considered.

B. After installation, a pump station start-up shall be performed by the installing contractor under the supervision of the manufacture's authorized representative. 8 hours of field service shall be provided by an authorized, factory trained representative of the pump manufacturer. Services shall include, but not be limited to, inspection of the completed pump station installation to ensure that it has been performed in accordance with the manufacturer's instructions and recommendations, supervision of all field-testing and activation of the Pump Manufacturer's Warranty. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly without exceeding the full load amperage rating of the motor. The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

1.8 REFERENCES

1. American Society for testing and material (ASTM) International
    1. A 48: Standard Specification for Gray Iron Castings.
    2. A743: Standard Specification Iron-Chromium Nickel, Corrosion Resistant,

2. American National Standards Institute (ANSI):
    1. B16.1: Standard for Cast Iron Pipe Flanges and Flanged Fittings, 125 lb.

3. Hydraulic Institute: Current Standards.
    1. HI 14.6: Hydrodynamic Pumps for Hydraulic Performance Acceptance Tests.
    2. HI 11.6: Submersible Pump Tests

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. The pumping units required under this section shall be complete including pumps and motors designed in accordance with Standards of the Hydraulic Institute. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the work to be done. Ample room shall be provided for inspection, repairs, and adjustments.

B. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed, and all other pertinent data shall be attached to each pump and motor.

2.2 PUMPS

A. Each station shall be equipped with **2** submersible, close-coupled wastewater pumps. The Contractor shall furnish and install two, totally submersible sewage pumps. The required head, GPM, voltage, and other specifications shall be as listed on the drawings. Acceptable manufactures are Liberty, Flygt, Wilo/EMU, ABS, Hydromatic, Barnes or equal.

B. Each pump shall be equipped with a 2**.0 HP** submersible electric motor, capable to operate on a **230** volt, 1 phases, 60 hertz voltage supply. Pumps shall be capable of handling raw, unscreened sewage. The design shall be such that pumping units will be automatically connected to the discharge piping when lowered into place on the discharge connection.

The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed and no need for personnel to enter the pump well. Each pump shall be fitted with a stainless-steel wire rope or space-lay cable of adequate strength and length to permit raising the pump for inspection.

C. The hydraulic of the pump shall be capable of handling raw domestic wastewater and storm water with fibrous materials like wet wipes**.**

D. The impeller blades shall be self-cleaning upon each rotation as they pass across a sharp relief groove in the Insert ring and shall keep the impeller blades clear of debris. The insert ring shall have a guide pin which moves fibers from the center of the impeller to the leading edges of the impeller. The impeller shall move axially upwards to allow larger debris to pass through and immediately return to normal operating position. The clearance between the insert ring and the impeller leading edges shall be adjustable.

E. The impeller shall be wear resistant and made of high chromium cast iron with at least 24% chrome against sand and grit which is expected to enter the pump station with the sewage or the storm water. Impellers that have surface hardening (by thermal, coating, etc.) will not be allowed.

F. The pump shall be capable to operate without any limitation between 50% and 125% of the Best efficiency point (B.E.P) of the performance curve.

	Flow in USgpm	TDH in feet	Hydraulic efficiency %	NPSHre in feet
Required Duty Point	23	87	55	0 (Submerged)
Guaranteed duty point acc. HI <10kW B	To be filled in by supplier	To be filled in by supplier	To be filled in by supplier	To be filled in by supplier
Best efficiency point of offered pump (B.E.P.)	To be filled in by supplier	To be filled in by supplier	To be filled in by supplier	To be filled in by supplier

G. The required shaft power (P2) in the guaranteed duty point shall be less than 1.82 **HP**. The motor speed shall be max. : **3,500 rpm**. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output HP and efficiency. This chart shall also include data on starting and no-load characteristics

H. The impeller shall be mounted on the motor shaft. Couplings shall not be accepted.

I. The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. It shall be permanently submersible according standard IEC 60034 and protection class IP 68.

J. The stator windings shall be insulated with moisture resistant Class H insulation rated for 356°F.

K. The motor shall be capable of no less than 30 evenly spaced starts per hour and be able to operate throughout the entire pump performance curve from shut-off through run-out even when the motor is not submerged

L. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.

M. It shall be possible to lift and lower the pumps on parallel guide bars and connect them to wet well mounted discharge connection. There shall be no need for personal to enter the wet well when removing or reinstalling the pumps.

N. The pump housing shall be prepared for the assembling of a sump mixing valve. The discharge flange of the pump housing shall be 4”.

O. The junction chamber containing the terminal board shall be hermetically sealed from the motor by an elastomeric compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer.

P. The motor shall be protected by 3 thermal switches embedded in the stator set to open at 260°F and one leakage sensor floating type located in the stator chamber. The sensor and the switches shall be connected to the control panel which shall stop the motor and send an alarm when the sensors are activated.

Q. The pump shall be Explosion approved according FM CLASS 1. DIV 1 "C" & "D"

R. The cable entry shall consist of dual cylindrical elastomer sleeves, flanked by washers, all having a close tolerance fit against the cable and the cable entry. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

S. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated and have a nominal L10 lifetime of 50,000 hours. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable. The pump manufacturer shall warrant the pumps being supplied to the owner against defects in workmanship and materials for a period of five (5) years or 10,000 hours under normal municipal use, operation and service. The manufacturer shall submit the published warranty with the submittal drawings.

T. The shaft shall be sealed by a tandem mechanical shaft seal system consisting of two seals, each having an independent spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal function.

U. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. Seal lubricant shall be non-hazardous.

V. Where a seal cavity is present in the seal chamber, the area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

W. The Materials of construction shall be as follows:

a. Pump housing: ASTM A-48, Class 35B
b. Impeller and insert ring: A 532 ALLOY III A (25% Chrome)
c. Stator housing: ASTM A-48, Class 35B
d. Shaft: ASTM A479 S43100-T.
e. Shaft seal: Pump side: - Corrosion resistant Tungsten carbide WCCR
f. Shaft seal Motor side: - Corrosion resistant Tungsten carbide WCCR

X. All castings must be blasted before coating. All wet surfaces are to be coated with two-pack oxyrane ester Duasolid 50. The total layer thickness should be at least 120 microns. Zink dust primer shall not be used.

Y. The motor shall be equipped with at least 30 feet of screened cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

Z. Each completed and assembled pump/motor unit shall undergo the following factory tests at the manufacturer's plant prior to shipment. The Manufacturer shall provide on demand a copy of his quality control plan for these tests and an ISO 9001 factory certificate:

a. Minimum 3-point hydraulic performance test
b. No-Leak seal integrity test
c. Electrical integrity test

2.3 SUBMERSIBLE PUMP GUIDE BAR ASSEMBLY AND LIFTING EQUIPMENT

A. Each pumping unit shall be equipped with a stainless-steel guide bar assembly as recommended by the pump manufacturer. All material used to fabricate the upper guide holder and cable holder shall be stainless steel. All bolts, anchors, and other fasteners shall be stainless steel. Each pump shall be fitted with a sufficient length of stainless steel lifting chain or lifting cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

2.4 ACCESS FRAME AND COVER

A. The lift station shall be equipped with a standard aluminum access frame and cover. Door leaves shall be a minimum of 1/4-inch thick AASHTO aluminum diamond plate. Doors shall have lifting aids of tubular aluminum construction, with compression springs to assist in opening and closing. Hinges shall be heavy-duty stainless steel with tamper-proof fasteners. All hardware shall be stainless steel. Doors should open to 90 degrees and lock in that position by a stainless-steel positive locking arm and release handle. Doors shall have a stainless-steel lifting handle and stainless-steel snap-lock, with removable key handle and plug. Access frame and cover shall be manufactured by Halliday Products Inc., U.S. foundry, or by an approved equal.

2.5 LEVEL CONTROL SYSTEM

A. Functional Description: The level control system shall start and stop the pump motors in response to changes in wet well levels, as set forth herein.

1. Type: The level control system shall be the mercury switch float type, incorporating intrinsically safe floats secured to a vertical pipe in the wet well. Rising and falling liquid level in the wet well causes switches within the floats to open and close, providing start and stop signals for the level control components. As an alternate the pump manufacturer may provide a submersible pressure transmitter system completely compatible with the control system.

2. Sequence of Operation: The level control system shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "pump stop level", the system shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level rise to the "lag pump start level", the system shall start the second pump so that both pumps are operating to pump down the well. Both pumps shall stop at the same "stop" level.

3. Automatic Pump Alternation: The level control system shall utilize the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.

B. Float Switches: Pump station manufacturer shall furnish four float switch assemblies for installation by the contractor. Each switch assembly shall contain a mercury-type switch sealed in a polypropylene housing, and not less than 20 feet of cable. Station manufacturer shall also furnish polypropylene cord grips and polypropylene mounting hardware for switch assemblies. Sufficient length of non-corrosive pipe for mounting switch assemblies in the wet well shall be furnished by the installing contractor. As an alternate, the pump manufacturer may provide a submersible pressure transmitter system completely compatible with the control system.

C. Circuit Design: Circuit design in which the application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.

D. High Water Alarm with Alarm Silence: Pump station manufacturer shall furnish a float switch assembly, intrinsically safe relay, for high water alarm function. Should the wet well level rise to the high-water alarm level, the float switch assembly and intrinsically safe relay shall energize the signal relay. The signal relay shall complete a 115-volt AC circuit for external alarm devices. The signal relay shall maintain the alarm signal until the wet well level has been lowered and the circuit has been manually reset.

1. An alarm silence switch and relay shall be provided to permit maintenance personnel to de-energize the external alarm device while corrective actions are underway. After silencing the alarm device, manual reset of the signal relay shall provide automatic reset of the alarm silence relay.

2.6 PUMP CONTROL SYSTEM

A. SCOPE

The work in this section shall include furnishing and placing into operation the monitoring and control panel of a pump station with **2** submersible wastewater pumps. The controller shall alternate the pumps and operate the pumps always at its best efficiency. The control panel shall be provided with the pumps and equipment by the pump manufacturer.

B. REFERENCES

1. Electrical work shall be in accordance with Division 16 - Electrical
2. UL 508A and 698A
3. NFPA 70 - NEC (2017)

4. NFPA 820
5. ISA 5.1 and 5.4

C. SUBMITTALS

Submittals shall include but not be limited to the following:

1. Shop drawings
2. Bill of Material (BOM)
3. Wiring diagrams
4. Outline and dimension drawings
5. Enclosure mounting details

D. DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, protect and handle products to site
2. Store in a clean, dry space.
3. Lift only with lugs provided for the purpose.
4. Handle carefully to avoid damage to internal components, enclosure and finish.

E. QUALIFICATION REQUIREMENTS

1. The manufacturer shall provide data on alternate equipment manufacturer's experience. Only Manufacturers with 10 or more years of experience who have furnished at least 5 similar lift stations will be considered. Evidence of experience and operational data may be required from the manufacturer to determine the suitability and efficiency of the equipment offered.
2. The Manufacturer shall be able to offer Alarm Transmission Service via CLOUD (Internet) for a monthly fee. Information such as SMS or email shall be available 24 hours / 7 days with and update interval: 60 seconds

F. INSTALLATION

1. After installation, a pump station start-up shall be performed by the installing contractor under the supervision of the manufacture’s authorized representative shall be provided by an authorized, factory trained representative of the pump manufacturer. Services shall include, but not be limited to, inspection of the completed pump station installation to ensure that it has been performed in accordance with the manufacturer’s instructions and recommendations, supervision of all field-testing and activation of the Pump Manufacturer’s Warranty. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly without exceeding the full load amperage rating of the motor. The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.
2. All electrical work performed shall be in full accordance to the requirements of the Division 16 (Electrical) Specifications.

G. WARRANTY

1. When installed in accordance with all the provisions of this section, related sections and the supplier’s installation manual, the warranty on the Monitoring and Control equipment shall be 12 months.
2. The warranty period shall start from the date of equipment delivery to the job site.

2.7 CONTROL PANEL

To be provided by the pump manufacturer, but at a minimum should contain the following elements.

A. Panel Enclosure

1. The electrical control equipment shall be mounted within NEMA 4X, dead front type control enclosures fabricated of 316 stainless steel. Enclosure doors shall be gasketed with neoprene, hinged, and equipped with captive closing hardware. Control compartments shall incorporate removable back panels on which control components shall be mounted. Back panel shall be secured to enclosures with stainless steel collar studs.

B. Motor Branch Components

1. All motor branch components shall be of the highest industrial quality, securely fastened to removable subplate with screws and lock washers.
2. The sub-plate shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any components.

C. Circuit Breaker Components

1. Properly sized heavy duty air circuit breakers shall be provided for each of the following: main and emergency power breaker, breakers for each pump, control breaker, and duplex receptacle breaker. The main breaker and emergency power breaker shall be connected with a factory assembled walking beam interlock to prevent simultaneous energization of both breakers. Breakers shall be mounted on auxiliary back plate with cutouts through the dead front panel so that breaker faces will be flush with the dead front. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering.

D. Duplex Receptacle

1. A weatherproof Duplex GFI Receptacle providing 115 volts, 60 hertz, single phase current shall be mounted to the side of the enclosure or as shown on the plans. Receptacle circuit shall be protected by a 15-ampere thermal-magnetic circuit breaker.

E. Emergency Power Generator Receptacle

1. A weatherproof Emergency Power Generator Receptacle shall be furnished and mounted on the side of the side enclosure.

F. Motor Starters

1. An open frame, across the line, NEMA rated magnetic starter shall be furnished for each pump motor. Starters are to be NEMA size 1 and above with auxiliary contacts. Power contacts shall be double-break cadmium oxide silver. All motor starters shall be equipped to provide under voltage release and overload protection on all three phases. Overload reset button should be mounted through the dead front door.

G. Pump Run Indicators

1. Control panel shall be provided with one pilot light for each pump motor. Light shall be wired in parallel with the related pump motor starter to indicate that the motor is or should be running.

H. Pump Mode Selection

1. Pump mode selector switches shall be connected to permit manual start and manual stop of each pump individually, and to select automatic operation of each pump under control of the level control system. Manual operation shall override all shutdown systems, but not the motor overload relays.

I. Alternator Relay

1. Pump alternator relay shall be of electromechanical industrial design. Relay contacts shall be rated 10 amperes minimum at 120 volts non-inductive.

J. Sequence Selection

1. A switch shall be provided to permit the station operator to select automatic alternation of the pumps, to select pump number 1 to be the lead pump for each pumping cycle, or to select pump number 2 to be the lead pump for each pumping cycle.

K. Elapsed Time Meters

1. Six-digit elapsed time meters (non-reset type) shall be connected to each motor starter to indicate the total running time of each pump in "hours" and "tenths of hours".

L. High Pump Temperature Protection

1. The control panel shall be equipped with circuitry to override the level control system and shut down the pump motor(s) when required to protect the pump from damage caused by excessive temperature. A thermostat shall be mounted on each pump to detect its temperature, and a signal relay shall be supplied for each thermostat. If the pump temperature should rise to a level which could cause pump damage, the thermostat shall cause the signal relay to drop out the motor starter. An electrical or mechanical indicator, visible on the front of the control panel shall indicate that the pump motor has been stopped because of a high temperature condition. The pump shall remain locked out until the pump has cooled and the circuit has been manually reset. Automatic reset of such a circuit shall not be acceptable.

M. Overload Relays

1. Overload relays shall be of bimetallic ambient compensated type. Overload relays shall be manually reset only.

N. Control Circuitry

1. The control circuit shall be protected by a thermal-magnetic air circuit breaker which shall be connected in such a manner as to allow control power to be disconnected from all control circuits.
2. Provide control circuitry for remote located alarm light, alarm horn, and silence push button switch.

O. Wiring

1. The pump station as furnished by the manufacturer shall be completely wired except for the power feeder lines to the branch circuit breakers and final connections to remote

alarm devices. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications set forth by the National Electric Code (NEC).

P. Wire Identification and Sizing

1. Control circuit wiring inside the panel, except for internal wiring of individual components, shall be 14 gauge minimum, Type MYW of THW, 600 volts. Wiring in conduit shall be 12 gauge minimum.

Q. Phase Monitor

1. A line voltage rate phase sequence and loss monitor shall be provided. The monitor will be pre-wired to take the starters out of service if a phase is reversed, lost or drops below 83 percent of nominal voltage. The unit will automatically restore when normal conditions are restored.

R. Surge Protector

1. An electronic epoxy encapsulated surge protector shall be provided to protect the control circuitry in the pump control panel. The protector shall be of solid-state construction with two stages separated by an indicator that will not saturate under full load conditions. The final stage shall utilize a series of high-speed silicon avalanche devices. Total response time shall be 5 nanoseconds or less. A neon indicator shall signal a failure.

2.8 MONITORING & CONTROL / PUMP DRIVE

A. The station is equipped with 2 pumps. Each pump shall be equipped with a pump drive unit sized to match the submersible electric motor and designed for a power supply from 480V 60 Hz 3 phase.

B. The pump drive shall provide all level control functionality, hand/auto operation, pump alternation, pump over temperature monitoring, seal leakage monitoring, pump self-cleaning, and pipe cleaning algorithms. The pump drive shall also include capability to monitor station inflow, pump speed and energy consumption in order to automatically operate the pump station at optimal energy efficiency.

C. One Pump drive per pump should be used to allow full redundancy and alternation.

D. It shall be tested and approved in accordance with international standards , the European safety directive 98/37/EC, the Low Volt-age Directive 2006/95/EC, the EMC Directive 2004/108/EC and in accordance with the European standards: EN 61800-5-1:2003; EN 61800-3; EN 55011:2007; EN60529 and EN 60204-1

E. The software shall be programmed with all parameters and settings pre-configured for an efficient operation.

F. It shall be freestanding for wall mounting or cabinet installation construction an equipped with an air ventilated system.

G. Without any limitation or derating it shall operate in ambient temperature of up to 104°F.

H. It shall include provision for external communication to higher-level system. Communication shall be via 2-wire RS-485 connection to the pump drive. Communication shall be available as MODBUS RTU.

I. Serial communication capabilities shall include, but not be limited to set Start- and stop level, Pump clean interval, speed and ramp times as well as PID control parameters.

J. The communication telegram shall include process variable feed-back like Sump level, power (kW), Output speed/frequency, current (A), % torque, relay outputs, digital inputs and drive status and fault information.

K. Following function shall be provided by the equipment:

1. High/Low Level Sump Control:

a. The pump drive shall provide automatic level control via means of a submersible pressure transducer (4-20mADC). User-programmable Start Level shall indicate the point at which the pump will start. Upon activation the pump shall run at maximum speed for a pre-determined period, then ramp down to the energy efficient Optimal speed, calculated by the pump drive. When the water level reaches the Stop Level, the pump shall stop. The Optimal Speed shall either be calculated by the pump drive or manually entered by the user.

b. In case of high inflow, the pump drive shall increase pump speed until the water level begins to decrease. When the water level reaches the Stop Level, the pump shall stop.

c. In case of very high inflow, in a duplex installation, when a single pump is unable to overcome the inflow conditions even at maxi-mum speed, additional pumps shall be activated and run at maxi-mum speed until the Stop Level is reached. If water levels continue to rise, a High Level Alarm shall be activated.

d. The pump drive shall incorporate a Minimum Speed function that prevents the pump from operating at speeds too low to move water based on the pump curve.

2. Run Time Averaging and random start levels

a. The pump drive shall provide capability to balance run times for even wear. This shall be an internal function of the drive and not require external devices, such as an alternating relay.

b. Each drive shall determine its own random start level independent of each other. New random start levels shall be determined after each pump cycle. The pump with the lowest random start level shall be first to start on any given pump cycle. The second pump shall remain in Standby capacity in case the lead pump shall not be able to lower the water level as described in the section above. By recalculating the random start levels every pump cycle the operating hours of the pumps shall be balanced and the settling of “Grease-rings” in the station shall be avoided.

3. Pump Cleaning Function:

a. The Pump drive shall incorporate a “self-cleaning” function to remove debris from the impeller. The cleaning shall be triggered by following circumstances:

- Soft Clogging: When motor current is increasing over a certain period of time defined by the pump supplier.
- Hard Clogging: When motor current is increase drastically and pump stops.

b. The cleaning function shall consist of forced stopping, reversal and forward runs timed to allow for debris to fall from the impeller. After cleaning cycle is complete, drive shall resume to automatic operation.

4. Sump Cleaning Function:

a. The pump drive shall incorporate a sump cleaning function to ensure surface solids and grease is regularly removed from the sump. The sump cleaning function shall perform regularly when enabled by the operator. Sump cleaning shall consist of the following functions:

- Sump cleaning is triggered when internal timer expires and during a normal pump down cycle
- Pump is automatically ramped to maximum speed
- Pump runs at maximum speed for designated time or until the pump are snoring."
- When Sump Cleaning is over, the pump is shut off and resumes normal operation.

5. Pipe Cleaning Function:

a. The pump drive shall incorporate a pipe cleaning function to avoid discharge pipe sedimentation and clogging due to reduced pump speed. This shall be an automatic feature that initiates with every pump cycle. Upon reaching Pump Start Level, the drive shall operate the pump at 100% speed for a determined time before ramping down to the most energy efficient speed for the duration of the cycle.

6. Energy efficient speed finder:

a. The pump drive shall provide a function that automatically calculates the most energy efficient speed for the pump based on station inflow characteristics. The speed shall be constantly adjusted to account for changes of the inflow without requiring operator adjustment.

b. This function shall also prevent the drive from running off of the system curve and ensure the maximum hydraulic efficiency.

7. Alarms & Monitoring:

a. The pump drive shall provide alarms and monitoring for the drive, pump and sump. Alarms shall be presented on the LCD display, via a Summary Alarm relay and via Modbus registers. All alarms, when occurring, shall remain active until reset.

Alarms shall have a built-in 4 second delay to prevent nuisance tripping.

Alarms shall be as follows:

1. Motor monitoring:
   a. Motor Temperature too high
   b. Leakage in stator housing
2. Sump monitoring:
   a. High sump Level (via float switch or transducer)
   b. transducer sensor error (connection failure, faulty values)
3. Pump drive monitoring:
   a. overcurrent or overload trip
   b. over- or under voltage

c. ambient or drive temperature too high
d. ambient temperature too low.
e. input phase loss
f. max torque exceeded

L. USER INTERFACE

1. The pump drive shall incorporate an (OLED) LCD screen to dis-play drive operating status, alarms, liquid level and parameters.

2. The pump drive shall include 7 pushbuttons with the following functions: Pump Start, Pump Stop, Hand (Manual) Operation, Auto Operation, Menu Access, Increase Value, and Decrease Value.

3. Pump Start Level, Operating Parameter Adjustment and Alarm History shall be accessed via menu structure. Menu shall have at least 2 levels of security, limiting access to qualified personnel only.

4. The LCD screen shall display status information in 4 modes: Off, standby, active auto and active Manual.

5. The information shown shall be as follows:

OFF:	Firmware name, Status (“STOP”), Rating (kW/hp)
STANDBY:	Status and Name, Operating Mode, Sump Level
Auto/Manual:	Status and Name, Operating Mode, Motor Freq. Power, Sump Level, Current

2.9 LEVEL CONTROL

A. Each station shall be equipped with 2 Float switches for backup level sump control approved according LVD EN61058.

B. CSA approved according Class I Zone 0, Gr. IIC and Div.1 Gr A, B, C&D

C. Material of casing: Polypropylene.

D. Degree of protection: NEMA 6.

E. They shall be applicable for liquids with a density of 0.95 – 1.10 g/cm3. The Level control shall include 40 feet submersible cable.

2.10 LEVEL TRANSMITTER

A. Each station shall be equipped 1 Level transmitter approved acc. EN 61000-6-2, EN 61000-6-3, EN 61326-1. It shall be approved for explosive areas according UL Class 1, 2 and 3 Division 1 Group A-D T4/T5/T6

B. Output 4–20 mA direct current, proportional to the measured level. Low supply voltage 8–30 V DC – or battery operation.

C. It shall be suitable for waste water with a diaphragm made of ceramic.

D. Insulated > 100 MΩ at 500 V DC. Material of sensor body: Ryton PPS.

E. Degree of protection: NEMA 6.

F. The transmitter shall include 35 feet submersible cable.

2.11 CABINET

A. The Monitoring & Control and the telemetry and 2 pump drives shall be assembled in a cabinet. It shall be made of Reinforced plastic or stainless steel and it shall be prepared for

an installation on a concrete floor.

B. Beside the Monitoring & Control unit it shall have enough space for the customer-installed telemetry equipment and include.

- 1 backup battery for the telemetry unit.
- Red-dome style flashing alarm light
- Alarm Horn or Bell with Alarm silence button
- Intrinsically safe barrier for UL 913 requirements
- Anti-condensation heater and thermostat
- Generator receptacle and Emergency circuit breaker (walking-beam interlocked with Main breaker)
- Enclosure legs
- Power switch, which can be locked in the off position by a pad-lock.
- 1 light group with socket

C. The inner dimension of the cabinet shall reserve at least 10% back panel space for future adjustments.

D. All components on the front of the machine should be provided with function plate.

PART 3 - EXECUTION

3.1 INSPECTION AND TESTING

A. Upon completion of installation, the Contractor, in the presence of the Engineer and a qualified manufacturer's representative, shall perform a preliminary test on the system to insure the functioning of all component parts to the satisfaction of the Engineer.

B. Approval of the preliminary test by the Engineer shall not constitute final acceptance of the equipment furnished.

C. After the system is in full operation, a full operating test shall be performed in the presence of the Engineer and a qualified manufacturer's representative. The Contractor shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted, by repairing or replacing the defective component, and retesting as required until the equipment meets the satisfaction of the Engineer. A minimum of one complete 8-hour day shall be furnished to satisfy the full load operating test requirements.

D. Operating personnel shall be trained in operation and maintenance of equipment at startup. Instruction shall be given in operation, service, adjustments, and routine maintenance. Recommended spare lists and maintenance schedules shall be provided.

PART 4 - WETWELL

A. Precast concrete manhole barrel shall conform to specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C-478, except as otherwise specified below.

B. The minimum wall thickness for the various size barrel sections shall be 8 inches or as shown on the drawings. Lifting holes for handling shall be non-penetrating.

C. Barrel sections shall have tongue and groove joints, with "Ram-Nek" as manufactured by the K.T. Snyder Company, Houston, Texas, or approved equal; or O-ring gaskets set in preformed indentations conforming to ASTM C-443 standard specifications, or Federal Specification SS-S-

0210 (GSA-FSS).

D. Concrete shall conform to ASTM C-94, Type II cement, with a compressive strength of 4,000 psi. Mortar shall be composed of one-part cement to two parts sand.

E. The date of manufacture and the name of the manufacturer or trademark shall be clearly marked on the outside of each precast section when the form is removed and on the inside after painting. Sections shall be cured by an approved method for at least 2 days prior to painting and shall not be shipped until at least 2 days after having been painted. Sections shall not be shipped until at least 7 days after removal from the forms.

F. Precast concrete slabs over top section shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading. The tops of bases shall be suitably shaped to mate with the precast barrel section.

G. Inside the wet well all exposed surfaces (including bottom of top lab) shall be lined with a protective coating. Liners shall be shown, labeled, and dimensioned on the shop drawings submitted for approval to the Engineer. Approved lining products include:

Manufacturer	**Model**	**Material**	**Application**
Argu America	Sure-Grip/Ultra-Grip	HDPE	Min. 2mm for Manhole Min. 3mm for Pump Station
Quadex, LLC	Structure Guard	Epoxy	Min. 2mm for Manhole Min. 3mm for Pump Station
Raven Lining Systems	Raven 405	Epoxy	Min. 2mm for Manhole Min. 3mm for Pump Station

H. Where pipes enter or exit wet well, a "Kor-N-Seal" molded neoprene boot with stainless steel internal and external bands as manufactured by the National Pollution Control Systems, Inc., Nashua, New Hampshire, or a polyurethane joint with a short transition joint as manufactured by Mooreform Corporation, Centralia, Illinois, or an approved equal (or superior) connection shall be provided.

J. Where pipes or conduits enter or exit top section, the annular space shall be grouted and water and gas tight. Grout shall be Thoroseal or equal.

PART 5 – VALVE VAULT

A. Each discharge pipe from the sewage pump station shall be connected to a check valve and a gate/plug valve in a separate valve vault. The valve vault shall be fabricated in concrete and shall be large enough to allow entry for routine maintenance and inspection. The valve vault shall be equipped with an integral drain and check valve to facilitate drainage from the valve vault back into the pump station.

B. The check valves shall be Ball-type or ValMatic flap-type. The gate/plug valves shall be ¼-turn eccentric plug-type. All valves shall be made of cast iron with flanges according ANSI and be connected to a single 4” discharge pipe which shall last at least 5 feet outside the valve vault. The pipes shall be made of either DIP, PE 100 or Stainless steel AISI 316.

C. The valve vault cover shall be of ¼-inch thick Type-5086 aluminum diamond plate with an integral Safe-Hatch access cover.

END OF SECTION

SECTION 22 15 00
GENERAL-SERVICE COMPRESSED-AIR SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rotary-screw air compressors.

B. Pipe and fittings.

C. Unions and couplings.

D. Air outlets.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 22 05 23 - General-Duty Valves for Plumbing Piping.

C. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

B. ASME B31.1 - Power Piping; 2022.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

D. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for reciprocating air compressors.

PART 2 PRODUCTS

2.01 ROTARY SCREW AIR COMPRESSORS

A. Manufacturers:
   1. Ingersoll Rand, Inc: www.ingersollrandproducts.com/#sle.
   2. Quincy Compressor, LLC: quincycompressor.com/#sle.

B. Type: Single stage, fixed speed, belt-drive assembly.

C. Electrically driven, air-cooled compressor unit; factory-assembled with air intake, intake filters, after-cooler, oil separator, oil cooler, moisture separator with drain trap, oil charging valve, gauges, sight glasses, vibration isolators, controls, and safeties.

D. Mounting: Skid mounted.

E. Electrical:
   1. Factory mount disconnect switch with terminal box with each circuit identified and spare to accommodate field-installed components. Ground each component to base of assembly.

2.02 PIPE AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, Grade B, Type E, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.

2. Joints: Threaded or welded to ASME B31.1.

2.03 UNIONS AND COUPLINGS

A. Unions:

B. Flexible Connector: Neoprene with brass threaded connectors.

2.04 AIR OUTLETS

A. Quick Connector: 3/8 inch brass, snap-on connector with self closing valve, Style A.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install compressor unit on concrete housekeeping pad. See Section 03 30 00.

C. Install compressor unit on vibration isolators. Level and bolt in place. See Section 22 05 48.

D. Make air cock and drain connection on horizontal casing.

E. Install line size gate valve and check valve on compressor discharge. See Section 22 05 23.

F. Connect condensate drains to nearest floor drain.

G. Install valved drip connections at low points of piping system. See Section 22 05 23.

H. Install compressed air couplings, female quick connectors, and pressure gauges where outlets are indicated.

I. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

3.02 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.

C. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

D. Cap and seal ends of piping when not connected to mechanical equipment.

END OF SECTION 22 15 00

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial electric water heaters.

B. In-line circulator pumps.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Commercial Electric Water Heaters:
   1. Type: Factory-assembled and wired, electric, vertical storage.
   2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
   3. Performance:
   4. Electrical Characteristics:
   5. Accessories:
      a. Drain valve.
      b. Temperature and Pressure Relief Valve: ASME labeled.
   6. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

2.02 IN-LINE CIRCULATOR PUMPS

A. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

B. Impeller: Bronze.

C. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

D. Seal: Carbon rotating against a stationary ceramic seat.

E. Drive: Flexible coupling.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.

B. Coordinate system, equipment, and piping work with applicable electrical, fuel, gas, vent, drain, and waste support interconnections as included or provided by other trades.

C. Pumps:
   1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION 22 30 00

This page intentionally left blank

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 25%. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Prefabricated Trapeze-Framed Metal Strut Systems:
   1. Strut Channel or Bracket Material:
   2. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C. Hanger Rods:
   1. Threaded zinc-plated steel unless otherwise indicated.

D. Pipe Hangers:
   1. Split Ring Hangers:
      a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
      b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
      c. Provide hanger rod and nuts of the same type and material for a given pipe run.

d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

E. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Steel: Use beam-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.
5. Wood: Use wood screws.
6. Plastic and lead anchors are not permitted.
7. Powder-actuated fasteners are not permitted.
8. Hammer-driven anchors and fasteners are not permitted.
9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Comply with MFMA-4.
b. Channel Material: Use galvanized steel.
c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

G. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

END OF SECTION 23 05 29

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolators.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATORS

A. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

B. Vibration Isolators for Nonseismic Applications:
   1. Resilient Material Isolator Pads:
      a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
      b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
      c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

END OF SECTION 23 05 48

This page intentionally left blank

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Tags.

C. Automatic Controls: Tags. Key to control schematic.

D. Control Panels: Nameplates.

E. Major Control Components: Nameplates.

F. Thermostats: Nameplates.

G. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch.

C. Background Color: Black.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

2.04 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Use tags on piping 3/4 inch diameter and smaller.

D. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 23 05 53

This page intentionally left blank

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

C. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
    a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
    b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
    c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

D. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

F. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

J. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

M. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.03 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.

B. Air Moving Equipment:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Air flow, specified and actual.
   5. Return air flow, specified and actual.
   6. Outside air flow, specified and actual.
   7. Total static pressure (total external), specified and actual.
   8. Inlet pressure.
   9. Discharge pressure.
   10. Fan RPM.

C. Return Air/Outside Air:
   1. Identification/location.
   2. Design air flow.
   3. Actual air flow.
   4. Design return air flow.
   5. Design outside air flow.
   6. Actual outside air flow.
   7. Outside air temperature.
   8. Required mixed air temperature.
   9. Actual mixed air temperature.

D. Exhaust Fans:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Air flow, specified and actual.
   5. Total static pressure (total external), specified and actual.
   6. Inlet pressure.
   7. Discharge pressure.
   8. Fan RPM.

E. Air Distribution Tests:
   1. Air terminal number.
   2. Room number/location.
   3. Terminal type.
   4. Terminal size.
   5. Design air flow.
   6. Test (final) air flow.
   7. Percent of design air flow.

END OF SECTION 23 05 93

This page intentionally left blank

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Weather barrier coatings.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   2. Johns Manville; _____: www.jm.com/#sle.
   3. Owens Corning Corporation; _____: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1,200 degrees F.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.

D. Indoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

E. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.

B. Vapor Barrier Jacket:

2.04 DUCT LINER

A. Note: Choose the liner type - Elastomeric Foam, Glass Fiber, or Phenolic Foam.

B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
   1. Fungal Resistance: No growth when tested according to ASTM G21.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

C. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

END OF SECTION 23 07 13

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Weather barrier coatings.

D. Jacketing and accessories.

E. Engineered wall outlet seals and refrigerant piping insulation protection.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

C. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

D. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2008 (Reapproved 2019).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.03 ENGINEERED WALL OUTLET SEALS AND REFRIGERANT PIPING INSULATION PROTECTION

A. Basis of Design: Airex Manufacturing, Inc; www.airexmfg.com/#sle.
   1. Pipe Penetration Wall Seal and Insulation Protection System: Airex Pro-System Kit.

B. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
   1. Outlet Cover Color: Gray.

C. Insulation Protection System: Refrigerant piping insulation PVC protective cover.
   1. PVC Insulation Cover Color: White with full-length velcro fastener.
   2. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.

2.04 ACCESSORIES

A. General Requirements:
   1. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
   2. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
   3. Supply materials that are asbestos free.

B. Corrosion Inhibitors:
   1. Corrosion Control Gel:
      a. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Inserts and Shields:
   1. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

E. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

END OF SECTION 23 07 19

SECTION 23 11 23
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

A. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.

B. Section 33 52 16 - Gas Hydrocarbon Piping.

1.03 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing; 2019.

B. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.

C. ANSI Z223.1 - National Fuel Gas Code; 2024.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

E. ASME B31.1 - Power Piping; 2022.

F. ASME B31.9 - Building Services Piping; 2020.

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

J. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

K. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

L. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

M. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

N. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.
   1. Fittings: ASTM A234/A234M, wrought steel welding type.
   2. Joints: ANSI Z223.1, welded.
   3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.02 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.

2. Joints: Threaded or welded to ASME B31.1.

B. Flexible Gas Piping:
1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

2.04 BALL VALVES

A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, brass, bronze, or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blowout proof stem, lever handle with balancing stops, solder, threaded, or grooved ends with union.

2.05 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Compliance Requirements:
1. Appliance Regulator: ANSI Z21.18/CSA 6.3.

B. Materials in Contact With Gas:
1. Housing: Aluminum, steel (free of non-ferrous metals).
2. Seals and Diaphragms: NBR-based rubber.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Group piping whenever practical at common elevations.

C. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

D. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

E. Provide access where valves and fittings are not exposed.

F. Provide support for utility meters in accordance with requirements of utility companies.

G. Sleeve pipes passing through partitions, walls and floors.

H. Inserts:
1. Provide inserts for placement in concrete formwork.

I. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.

3.02 APPLICATION

A. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.03 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators in accordance with Section 33 52 16. Gas service distribution piping to have initial minimum pressure of 7 inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.04 SCHEDULES

A. Pipe Hanger Spacing:
1. Metal Piping:

a. Pipe Size: 1/2 inches to 1-1/4 inches:
   1) Maximum Hanger Spacing: 6.5 ft.
b. Pipe Size: 1-1/2 inches to 2 inches:
   1) Maximum Hanger Spacing: 10 ft.
c. Pipe Size: 2-1/2 inches to 3 inches:
   1) Maximum Hanger Spacing: 10 ft.

END OF SECTION 23 11 23

This page intentionally left blank

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Check valves.

G. Filter-driers.

H. Engineered wall seals and insulation protection.

I. Exterior penetration accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 07 19 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. AHRI 710 (I-P) - Performance Rating of Liquid-Line Driers; 2009.

B. AHRI 711 (SI) - Performance Rating of Liquid-Line Driers; 2009.

C. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

D. ASME B31.9 - Building Services Piping; 2020.

E. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

F. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

G. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

K. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

L. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturer's catalog data including load capacity.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

B. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

2.02 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

2.03 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
   1. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8-inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.

C. Pipe Supports and Anchors:
   1. Provide hangers and supports that comply with MSS SP-58.
      a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   5. Vertical Support: Steel riser clamp.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 REFRIGERANT

2.05 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.06 VALVES

A. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

2.07 STRAINERS

A. Straight Line or Angle Line Type:
   1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.08 CHECK VALVES

A. Globe Type:
   1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

2.09 FILTER-DRIERS

A. Performance:
   1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710 (I-P) (AHRI 711 (SI)).
   2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
   3. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.

2.10 ENGINEERED WALL SEALS AND INSULATION PROTECTION

A. Basis of Design: Airex Manufacturing, Inc; www.airexmfg.com/#sle.
   1. Pipe Penetration Wall Seal and Insulation Protection System: Airex Pro-System Kit.

B. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
   1. Outlet Cover Color: Gray.

C. Insulation Protection System: Mechanical line insulation and PVC cover.
   1. PVC Insulation Cover Color: White with full-length velcro fastener.
   2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
   3. Water/Vapor Permeability: Comply with ASTM E96/E96M.
   4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.
   5. Flame Spread and Smoke Development Rating of 25/450: Comply with ASTM E84.
   6. Adhesive free.

2.11 EXTERIOR PENETRATION ACCESSORIES

A. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

3.02 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test and repair piping until no leakage.

END OF SECTION 23 23 00

This page intentionally left blank

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

C. Air plenums and casings.

D. Ducts for kitchen exhaust applications.

1.02 RELATED REQUIREMENTS

A. Section 23 07 13 - Duct Insulation: External insulation and duct liner.

B. Section 23 33 00 - Air Duct Accessories.

C. Section 23 37 00 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 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; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

D. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

F. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

H. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

I. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for duct materials.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 33 19.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Round: Plus or minus 2 in-wc of galvanized steel.
   2. Rectangular: Plus or minus 1/2 in-wc of galvanized steel.
   3. Flexible Duct (Fabric and wire): Plus or minus 1/2 in-wc; see Section 23 37 00.

E. Duct Sealing and Leakage in accordance with Static Pressure Class:

1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
    a. Supply Air: 1/2 in-wc pressure class, galvanized steel.
    b. Return and Relief Air: 1/2 in-wc pressure class, galvanized steel.
    c. General Exhaust Air: 1/2 in-wc pressure class, galvanized steel.
    d. Transfer-air and Sound Booths: 1/2 in-wc pressure class, fibrous glass.

F. Duct Fabrication Requirements:
1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 METAL DUCTS

A. Material Requirements:
1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Round Metal Ducts:
1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.
2. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

C. Round Spiral Duct:
1. Round spiral lock seam duct with galvanized steel outer wall.

D. Connectors, Fittings, Sealants, and Miscellaneous:
1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
2. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
    a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
    b. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

2.03 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, polyethylene film, mechanically fastened and rolled using galvanized steel to form spiral helix.
1. Pressure Rating: 10 in-wc positive and 5 in-wc negative.
2. Maximum Velocity: 5500 fpm.
3. Temperature Range: Minus 20 degrees F to 250 degrees F.

2.04 AIR PLENUMS AND CASINGS

A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.

B. Minimum Fabrication Requirements:

1. Fabricate acoustic plenum or casing with reinforcing turned inward.
2. Provide 16-gauge, 0.059-inch sheet steel back facing and 22-gauge, 0.029-inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers.
3. Construct panels 3 inches thick, packed with 4.5 pcf minimum glass fiber insulation media, on inverted channel of 16-gauge, 0.059-inch sheet steel.
4. Mount floor-mounted plenum or casings on 4-inch high concrete curbs. At floor, rivet panels on 8-inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18-gauge, 0.052-inch expanded metal mesh supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.

C. Access Doors:
1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.
3. Provide clear wire glass observation ports, minimum 6 by 6 inch size.

2.05 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

A. Provide ductwork, fittings, and appurtenances in accordance with NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.

B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.

C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.

D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.

E. Kitchen Hood and Grease Exhaust Duct:
1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.
2. Round, Single-Wall, Premanufactured Grease Exhaust Duct:
   a. UL Listed and labeled to UL 1978.
   b. Construct of 20-gauge, 0.035-inch Type 304 stainless steel.
3. Rectangular, Single-Wall, Premanufactured Grease Exhaust Duct:
   a. UL Listed and labeled to UL 1978.
   b. Construct of 18-gauge, 0.050-inch stainless steel using continuous external welded joints in rectangular sections.
4. Grease Exhaust Duct Access Doors:
   a. Listed when tested in accordance with UL 1978.
   b. Install hinged access doors where indicated or required for access for cleaning and inspection of duct.
   c. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION 23 31 00

This page intentionally left blank

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backdraft dampers - metal.

B. Backdraft dampers - fabric.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Fire dampers.

G. Flexible duct connectors.

H. Smoke dampers.

I. Volume control dampers.

J. Air measuring control dampers.

1.02 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

G. UL 555C - Standard for Safety Ceiling Dampers; Current Edition, Including All Revisions.

H. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 BACKDRAFT DAMPERS - METAL

A. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.02 BACKDRAFT DAMPERS - FABRIC

A. Fabric Backdraft Dampers: Factory-fabricated.
   1. Blades: Neoprene coated fabric material.
   2. Birdscreen: 1/2 inch nominal mesh of galvanized steel or aluminum.
   3. Maximum Velocity: 1000 fpm (5 mps) face velocity.

2.03 COMBINATION FIRE AND SMOKE DAMPERS

2.04 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.05 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.06 FIRE DAMPERS

A. Ceiling (Radiation) Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame and 16-gauge, 0.0598-inch flap, two layers of 0.125-inch thick ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
   1. Rated for three hour service in compliance with UL 555C.

B. Horizontal Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame, stainless steel closure spring, and lightweight, heat-retardant, non-asbestos fabric blanket.

C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1-inch pressure-class ducts up to 12 inches in height.

D. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.07 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.08 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.

C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.09 VOLUME CONTROL DAMPERS

A. Products for Automatic Controls: See Section 25 35 23.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers:

D. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.

2.10 AIR MEASURING CONTROL DAMPERS

A. Factory-Mounted Assembly Requirements:
   1. Damper Unit or Multi-Unit:
      a. Construction: Flanged-to-duct frame made of extruded aluminum with V or 3V blades for low to medium pressure applications, zinc-plated steel hardware, frame-mounted shaft bearings, frame-assembly sleeve, and silicone seals at frame and blade ends.
      b. Control: Opposed blade modulation by damper actuator(s) from air measuring sensor transmitter-controller unit.
   2. Air Measuring Sensor Transmitter-Controller:
      a. Transmitter: Five percent accuracy, adjustable zero and span, 10 to 1 turndown, 0.1 percent of calibrated span linearity, 30 to 50 millisecond response time, minimum overpressure of 150 percent over highest range value, alphanumeric indicating display, wired or wireless connectivity for configuration, and terminal strip within enclosed electronic components.
      b. Controller: Configure to control hardware-linked damper actuator(s) based on locally typed or software-defined setpoint. Access for user to do local or remote proportional, integrative, and derivative control-loop tuning.

c. Hardwired External Damper Actuator Output: Two-wire, 4 to 20 mA.
d. BTU Metering: Provide temperature sensor for field mounting upstream or downstream of heating or cooling source.

B. Service Temperature Range: Minus 20 to 160 degrees F.

C. Enclosure Rating for Transmitter-Controller and Damper Actuator(s):
1. General: UL 50 or UL 50E listed for use in non-hazardous locations.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch size access door for hand and shoulder access, or as indicated on drawings. Provide minimum 4 by 4 inch size access door for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Demonstrate re-setting of fire dampers to Owner's representative.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

END OF SECTION 23 33 00

This page intentionally left blank

SECTION 23 81 29
VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source outdoor units.

B. Refrigerant piping.

C. Refrigerant branch units.

D. Indoor units.

1.02 RELATED REQUIREMENTS

A. Section 23 08 00 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 1230 - Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment; 2021.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).

E. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2022, with Errata (2024).

F. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ITS (DIR) - Directory of Listed Products; Current Edition.

H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.
   2. Company that provides system design software to installers.

B. Installer Qualifications: Trained and approved by manufacturer of equipment.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. LG Electronics U.S.A., Inc: www.lghvac.com/#sle.

2.02 VARIABLE REFRIGERANT FLOW SYSTEM

A. Minimum System Requirements:
   1. System Testing, Capacity Rating, and Performance:
      a. AHRI 1230 when cooling capacity is equal or greater than 65,000 Btu/h.
      b. AHRI 210/240 when cooling capacity is below 65,000 Btu/h.

2. Safety Certification: Bear UL 1995 tested and ITS (DIR) listed certification label.
3. Outdoor Units: Furnish installation and surface support hardware products in accordance with ASCE 7 for 160 wind restraint.
4. Cooling Mode Interior Performance:
    a. Daytime Setpoint: 72 degrees F, plus or minus 2 degrees F.
    b. Setpoint Range: 57 degrees F to 77 degrees F.
    c. Night Setback: 78 degrees F.
    d. Interior Relative Humidity: 50 percent, maximum.

2.03 AIR-SOURCE OUTDOOR UNITS

A. Manufacturers:
1. Air Conditioner, Cooling Outdoor Units:
2. Heat Pump, Cooling or Heating Outdoor Units:
    a. LG Electronics U.S.A., Inc: www.lghvac.com/#sle.
3. **Basis of Design Shall be LG**
    a. Acceptable standards shall be supplied based upon the performance characteristics and features of the LG model number(s) specified, LG model families specified, and as otherwise specified herein. Alternate suppliers shall request permission to bid, in writing, from the engineer at least 10 days prior to the bid date. This request by the contractor to bid an alternate supplier to the basis of design, listed or not listed, shall not relieve the contractor of supplying all materials, options, controls, sequences, efficiencies and intents of the original specifications written or implied by LG model number or model family or as otherwise specified. The written request and engineers' written response to such request shall be included in all submittal documents for approval.
4. **Alternate Equipment Bid Instruction**
    a. The contractor shall provide basis of design bid as specified and with specified products. If the contractor should wish to propose any alternate products to the basis of designed products they shall provide a separate and complete Bid detailing the proposed alternate products and the associated adjustment of price to support the change from basis of design products. The contractor bids the alternate product with full knowledge that the proposed product may not be acceptable or approved. In no event shall the contractor be entitled to additional compensation to supply such specified products, options, sequences or intents. Any and all additional cost, to any party, because of any product submitted on or supplied other than that of the original specified products shall be the responsibility of the contractor without recourse. It is agreed that any and all disputes regarding any differences between the specified products, options, sequences or intents and that proposed as an alternate shall be arbitrated by the engineer of record. It shall be further agreed by all parties that all decisions of arbitration shall be final and binding. Any product proposed as an alternate shall have been offered, as a VRF product, in the United States for a minimum of (5) years.
5. **System Performance Documentation**
    a. The manufacturer shall provide published outdoor unit performance data in table format which states the product heating and cooling capacities expressed in British thermal units per hour (BtuH) and power consumption expressed in kilowatts (kW) at a minimum of 8 possible combinations of allowed conditions between 50% and 130% connection ratio (VRF systems). Possible combinations of allowed condition variables include Combination Ratios expressed as a percentage value, Outdoor Ambient Temperature expressed in degrees Fahrenheit (°F), and indoor unit Entering Air wet and dry bulb temperature expressed in degrees Fahrenheit (°F). Any product whose system design and engineering manuals or guides where published data tables are expressed in units other than these specified will not be accepted.
    b. Any product whose published documentation requires the design engineer to apply a correction factor derived from a published curve or tabular data for combination ratio,

outdoor ambient temperature, and/or entering air temperature against rated conditions to obtain performance at any possible combination of allowed conditions will not be accepted.

6. **Submittals**
   a. A complete submittal package shall be compiled and 10 copies shall be forwarded to the general contractor who shall supply the architect with the submittals for dissemination to all parties. The submittal shall be a collection of documents that represent the technical aspects of each product or collection of products to be used on the project. All performance submissions shall be calculated at the design temperatures, Nominal performance data shall not be accepted. The submission and approval of said submittals does not relieve the contractor of supplying all requirements set forth in the specification and drawings. Any substitutions offered by the contractor shall include, as a separate document, any and all differences between the submitted products and the specified products including but not limited to, all dimensions, electrical, control, weights, warranties, country of origin.
   b. If submittals contain any proposed alternate equipment specifications, calculations, dimensions, electrical specifications, sound specifications or any other mandated submission which are not accepted, are noted or rejected for any reason the contractor shall be allowed to correct any deficiency and re-submit a second time. Should there be any irregularities found on second submission, the contractor will be directed to and agrees to submit on the original specified products, including any changes or revisions, and provide those specified products without any additional compensation.
7. **Delivery, Storage and Handling**
   a. Provide a dry and clean place for the products. Comply with manufacturer's instructions on handling to prevent products from damaging. If product is damaged upon arrival, reject the shipment. If hidden damage is found after removing the product from the container, retain container and all packing material. Contractor is responsible for filing a claim with the freight carrier.
8. **Upon Job Completion**
   a. Provide the owner with an LG tablet containing a copy of approved submittal, LGMV Mobile (VRF system service diagnostics) software, project mechanical and control drawings, all as-built piping drawings, AHRI seismic certificates and Florida Wind Loads as required by state, installation, operation and maintenance manuals, troubleshooting guides, service manuals and engineering manuals in PDF format.
   b. Provide the owner with an LG tablet containing a copy of the approved submittal package, a full set of drawings and specifications, on boarding software, custom documents, such as control drawings, shop drawings, wiring diagrams, BMS software, GUI image files, commissioning reports, refrigerant charge calculations, refrigerant piping design and as-built reports, O&M's, troubleshooting guides, service manuals, and equipment engineering manuals in .pdf format. Tablet shall also include a licensed copy of deluxe version of the VRF equipment manufacturer's service diagnostics.
9. **STANDARDS/CERTIFICATIONS**
10. **Certified Product Performance Ratings**
    a. All VRF (Variable Refrigerant Flow) and VSMS (Variable Speed Multi-Split and Mini-Split) products shall have published performance ratings certified by AHRI (Air-Conditioning, Heating, and Refrigeration Institute) and listed in the AHRI certified product directories available at www.ahridirectory.org.
11. **Production Facility Certifications**
    a. All system components shall be manufactured in production facilities maintaining the following ISO certifications:
    b. ISO 9001 Quality Management System
    c. ISO 14001 Environmental Management System
12. **UL Compliance**

a. All system shall comply with Underwriters Laboratories (UL) 1995 5th edition of the Standard for Safety for Heating and Cooling Equipment Standard for Safety and bear the Electrical Testing Laboratories (ETL) and/or Canadian Standards Association (CSA) mark on the product name plate. Current withdrawal date set for December 31, 2023, where UL 60335-2-40 4th edition becomes effective January 1st, 2024.

13. **Electrical Standard**
14. All system electrical power wiring shall be installed in accordance with the NFPA 70 National Electrical Code (NEC) or applicable state and local building codes.
15. **Corrosion Quality Control**
    a. Outdoor unit painted surfaces shall be factory tested for a minimum of 1000 hours using the accelerated salt spray test procedure as documented in ASTM Standard B-117 using the Surface Scratch Test Procedure. Photographic evidence shall be available upon request by the Engineer of Record.
    b. Photographic evidence shall include images of the test sample showing the surface scratch area at zero (0) hours, 400 hours, and 1000 hours. Post-test images of the sample must show no significant deterioration of the coating material, blistering, flaking, peeling, or rust formation along the test scratch.

B. Air Conditioning Type:
   1. DX refrigeration unit piped to one or more compatible indoor units either directly or indirectly through one or more intermediate refrigeration branch units.

C. Unit Cabinet:
   1. Capable of being installed with wiring and piping to the left, right, rear or bottom.
   2. Designed to allow side-by-side installation with minimum spacing and vibration isolation.
   3. Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
   4. Sound Pressure Level: 55 dB measured at 3 feet from front of unit.

D. Heat Sink Side:
   1. Condenser Fans:
      a. Provide minimum of 2 fans for each condenser within the outdoor unit.
      b. Minimum External Static Pressure: Factory set at 0.12 in-wc.
      c. Fan Type: Vertical discharging, direct-driven propeller type with variable speed operation using DC-controlled ECM motors mechanically connected using permanently lubricated bearings having whole assembly protected with fan guards.
   2. Condenser Coils:
      a. Hi-X seamless copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.

E. Refrigeration Side:
   1. Factory assembled and wired with instrumentation, switches, and controller(s) to handle unit specifics with direct coordination of remote controller(s) from indoor unit(s).
   2. Refrigeration Circuit: ECM driven dual scroll compressors, fans, condenser heat sink coil, expansion valves, solenoid valves, distribution headers, capillaries, filters, shutoff valves, oil separators, service ports, and refrigerant regulator.
   3. Refrigerant: R-410a factory charged. Controller to alarm when charge is below capacity.
   4. Variable Volume Control: Modulate compressed refrigerant capacity automatically to maintain constant suction and condensing pressures under varying refrigerant volume required to handle remote loads. Include defrost control.
   5. Provide refrigerant subcooling to ensure the liquid refrigerant does not flash when supplying to use indoor units.
   6. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle, oil return, or defrost is not permitted due to potential reduction in space temperature.
   7. Power Failure Mode: Automatically restarts operation after power failure without loss of programmed settings.

8. Safety Devices: High pressure sensor with cut-out switch, low pressure sensor with cut-out switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, overcurrent protection for the inverter and antirecycling timers.
9. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.

F. Local Controls:

G. Power:
1. Electrical Requirement: 208 to 230 VAC, 3-phase, 60 Hz.
2. Outdoor Mounted: Provide fused NEMA 250 Type 4X disconnect switch.

2.04 REFRIGERANT PIPING

A. Two-Pipe Run: Provide low-pressure vapor and high-pressure vapor gas pipes for each indoor unit selected for seasonal heating or cooling service.

B. Three-Pipe Run: Provide low-pressure vapor, high-pressure vapor gas, and liquid pipes for each indoor unit selected for off-season heating and cooling changeover service.

C. Refrigerant Flow Balancing: Provide refrigerant piping joints and headers specifically designed to ensure proper refrigerant balance and flow for optimum system capacity and performance; T-style joints are prohibited.

2.05 INDOOR UNITS

A. Minimum Unit Requirements:
1. DX Evaporator Coil:
   a. Copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
   b. 2-, 3-, or 4-row cross fin design with 14 to 17 fins per inch and flare end-connections.
   c. Provide thermistor on liquid and gas lines wired into local controller.
   d. Refrigerant circuits factory-charged with dehydrated air for field charging.
2. Fan Section:
   a. Variable or three-speed ECM fan with automatic airflow adjustment; external static pressure selectable during commissioning.
   b. Thermally protected, direct-drive motor with statically and dynamically balanced fan blades.
   c. Minimum-adjustable external static pressure 0.32 in-wc; provide for mounting of field-installed ducts.
3. Local Unit Controls:
   a. Temperature Control: Return air control using thermistor tied to computerized Proportional-Integral-Derivative (PID) control of superheat.
   b. Temperature Zones:
      1) Single Indoor Unit: Set served space(s) as the local temperature zone.
      2) Multiple Indoor Units: For large zones, group and coordinate related indoor units with served spaces as the local temperature zone with each indoor unit as sub-zone.
4. Return Air Filter:
5. Condensate:
   a. Built-in condensate drain pan with PVC drain connection for drainage.
   b. Units With Built-In Condensate Pumps: Provide condensate safety shutoff and alarm.
   c. Units Without Built-In Condensate Pump: Provide built-in condensate float switch and wiring connections.
6. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

B. Ceiling-Suspended, Indoor Units:

1. DX coil, tubed drain pan, and built-in controls with thermostat remotely coordinated by outdoor air unit to maintain local air temperature setpoint.
2. Variable or three-speed ECM fan with automatic airflow adjustment; external static pressure selectable during commissioning.
3. Return Air Filter: Manufacturer's standard.
4. Provide exposed unit casing with removable front grille; foamed polystyrene and polyethylene sound insulation, and mounting brackets; mildew-proof polystyrene drain pan.
5. Airflow Control: Auto-swing louver that closes automatically when unit stops; five steps of discharge angle, set using remote controller; upon restart, discharge angle defaults to same angle as previous operation.
6. Sound Pressure Range: Measured at low speed at 3.3 feet below and away from unit.
7. General
    a. Unit shall be manufactured by LG.
    b. Unit shall be designed to be installed for indoor application.
    c. Unit shall be designed to mount recessed in the ceiling and has a surface mounted panel on the bottom of the unit.
    d. The unit shall be available in a 2’ x 2’ chassis.
8. Casing/Panel
    a. Unit case shall be manufactured using galvanized steel plate.
    b. The unit panel and grille shall be made of a white Acrylonitrile Butadiene Styrene (ABS) polymeric resin.
    c. The panel shall have a tapered trim edge, and a hinged, spring clip (screw-less) return air filter-grille door.
    d. Unit shall be provided with metal ears designed to support the unit weight on four corners.
    e. Ears shall have pre-punched holes designed to accept field supplied all thread rod hangers.
    f. Unit shall be supplied with snap off access panels to facilitate leveling of unit without removing the panel.
9. Cabinet Assembly
    a. Unit shall have four supply air outlets and one return air inlet.
    b. The supply air outlet shall be through four directional slot diffusers each equipped with dual independent oscillating motorized guide vanes designed to change the airflow direction.
    c. The panel vanes shall have a discharge range of motion of 10° - 85° in an up/down direction with capabilities of locking the vanes.
    d. The unit shall have a guide vane algorithm designed to sequentially change the predominant discharge airflow direction in a counterclockwise pattern.
    e. Dual guide vanes shall provide airflow in all directions.
    f. Unit shall be equipped with factory installed temperature thermistors for:
        1) Return air
        2) Refrigerant entering coil
        3) Refrigerant leaving coil
    g. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
    h. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
    i. The unit shall have factory designated branch duct knockouts on the unit case.
    j. The unit shall have provision of fresh air ventilation through a knock-out on the cabinet.
    k. The branch duct knockouts shall have the ability to duct up to 1/2 the unit airflow capacity.
    l. The branch duct cannot be ducted to another room.

10. Unit shall have the following functions as standard:
    a. Self-diagnostic function
    b. Auto addressing
    c. Auto restart function
    d. Auto changeover function (Heat Recovery system only)
    e. Auto operation function
    f. Child lock function
    g. Forced operation
    h. Dual thermistor control
    i. Sleep mode
    j. Dual set point control
    k. Multiple aux heater applications
    l. Filter life timer
    m. External on/off input
    n. Wi-Fi compatible
    o. Multiple fan operation settings
    p. Multiple airflow control modes
    q. Leak detection logic
11. Fan Assembly
    a. The unit shall have a single, direct-drive turbo fan made of high strength ABS HT-700 polymeric resin.
    b. The fan impeller shall be statically and dynamically balanced.
    c. The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
    d. The fan motor shall include thermal, overcurrent and low RPM protection.
    e. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
    f. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of four pre-programed fan speeds in the heating mode and fan only mode and five speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed.
    g. A field setting shall be provided to vary air throw pattern to compensate for high ceiling installations.
    h. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, Super high, Power Cool, and Auto.
    i. In heating mode, the indoor fan shall have the following settings: Low, Med, High, Super high and Auto.
    j. Unit shall have factory installed dual motorized louvers to provide flow of air in up and down direction for uniform airflow.
12. Filter Assembly
    a. The return air inlet shall have a factory supplied removable, washable filter.
    b. The filter access shall be from the bottom of the unit without the need for tools.
13. Coil Assembly
    a. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
    b. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
    c. Unit shall have a 5mm dia., three row coil, with 18 columns and 22 fins per inch.
    d. Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).
    e. Unit shall include an installed and wired condensate drain lift pump capable of providing minimum 27.5 inch lift from bottom surface of the unit.
    f. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan.

g. Unit shall have provision of 45° flare refrigerant pipe connections.
h. The coil shall be factory pressure tested at a minimum of 550 psig.
i. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

14. Microprocessor Control
    a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
    b. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted and shielded communication cable.
    c. The unit controls shall operate the indoor unit using one of the five operating modes:
        1) Auto changeover (Heat Recovery System only)
        2) Heating
        3) Cooling
        4) Dry
        5) Fan only
    d. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
    e. The unit shall be able to operate with the fan turned off during system cooling thermal off.
    f. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
    g. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.
    h. Unit shall have a field settable method to choose auto fan speed change operation based on mode of operation, on/off fan operation based on mode of operation, or continuous minimum set fan speed operation.
15. Electrical
    a. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz).
    b. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.
16. Controls
    a. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS-485 daisy chain.
17. Optional Accessories
    a. Unit shall have the following optional accessories available:
    b. Premium panel with air purification kit
    c. Floor temperature sensor
    d. Human detection sensor
    e. Ventilation flange and kit
18. Seismic Installations
    a. Provide with submittal: 1) OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. 2) Equipment installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.
19. Warranty
    a. Please refer to the respective outdoor unit for applicable warranty.

C. Air Handling, Indoor Units:
    1. DX coil, tubed drain pan, and built-in controls with thermostat remotely coordinated by outdoor air unit to maintain local air temperature setpoint.

2. Variable or three-speed ECM fan with automatic airflow adjustment; external static pressure selectable during commissioning.
3. Return Air Filter: Manufacturer's standard, provide pressure differential gauge with adjustable signal flag outside the unit for local monitoring.
4. Factory-painted heavy gauge steel casing insulated with sound absorbing foil faced insulation.
5. Secondary condensate drain pan; field installed.
6. External insulation; field installed.
7. General
    a. Unit shall be manufactured by LG.
    b. Unit shall be designed to be installed for indoor application.
    c. Unit shall be designed to mount fully concealed above the finished ceiling.
    d. Unit shall have opening to supply air from front horizontal and a dedicated rear horizontal return.
    e. The supply air shall be flanged for field installed ductwork that shall not exceed the external static pressure limitation of the unit.
8. Casing/Panel
    a. Unit case shall be manufactured using galvanized steel plate.
    b. The cold surfaces of the unit shall be covered internally with a coated polystyrene insulating material.
    c. The cold surfaces of the unit shall be covered externally with sheet insulation made of Ethylene Propylene Diene Monomer (M-Class) (EPDM)
    d. The external insulation shall be plenum rated and conform to ASTM Standard D-1418.
    e. Unit shall be provided with hanger brackets designed to support the unit weight on four corners.
    f. Hanger brackets shall have pre-punched holes designed to accept field supplied, all thread rod hangers.
9. Cabinet Assembly
    a. Unit shall have horizontal supply air discharge outlets and a return air inlet
    b. Unit shall be equipped with factory installed temperature thermistors for:
    c. Return air
    d. Refrigerant entering coil
    e. Refrigerant leaving coil
    f. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
    g. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
10. Unit shall have the following functions as standard:
    a. Self-diagnostic function
    b. Auto addressing
    c. Auto restart function
    d. Auto changeover function (Heat Recovery system only)
    e. Auto operation function
    f. Child lock function
    g. Forced operation
    h. Dual thermistor control
    i. Sleep mode
    j. External static pressure (ESP) control
    k. Dual set point control
    l. Multiple aux heater applications
    m. Filter life timer
    n. External on/off input

o. Wi-Fi compatible
p. Auto fan operation
q. Leak detection logic

11. Fan Assembly
    a. The unit shall have two direct drive Sirocco fans made of high strength ABS GP-2200 polymeric resin.
    b. The fan impeller shall be statically and dynamically balanced.
    c. The fans shall be mounted on a common shaft.
    d. The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
    e. The fan motor shall include thermal, overcurrent and low RPM protection.
    f. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
    g. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of three pre-programed fan speeds, each setting is also adjustable by field setting to compensate for a limited amount of additional resistance to airflow by adjusting the RPM of the fan motor.
    h. In cooling mode, the indoor fan shall have the following settings; Low, Med, High, and Auto.
    i. In heating mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
    j. Each of the settings can be field adjusted from the factory setting (RPM/ESP).
    k. Unit shall be designed for high speed air volume against an external static pressure of up to 0.98” water gauge, model dependent.
12. Filter Assembly
    a. The return air inlet shall have a factory supplied removable, washable filter. MERV 13 filter rack is available as an option, model dependent.
    b. The filter access shall be from the rear of the unit.
13. Coil Assembly
    a. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
    b. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
    c. Unit shall have a minimum two to three row coil, 19-21 fins per inch.
    d. Unit shall have a factory supplied condensate drain pan below the coil constructed of HIPS (high impact polystyrene resin).
    e. Unit shall include an installed and wired condensate drain lift pump capable of providing minimum 27.5 inch lift from bottom surface of the unit. The unit drain pan is supplied with a secondary drain port/plug allowing the pan to be gravity drained and serviced.
    f. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan, model dependent.
    g. Unit shall have provision of 45° flare refrigerant pipe connections.
    h. The coil shall be factory pressure tested at a minimum of 550 psig.
    i. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.
14. Microprocessor Control
    a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system with or without the use of a wall mounted controller. The unit shall have a factory mounted return air thermistor for use as a space temperature control device. All operating parameters except scheduling shall be stored in non-volatile memory resident on the microprocessor. The microprocessor shall provide the following functions, self-diagnostics, auto re-start after a power failure and a test run mode.

b. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted, and shielded communication cable.
c. The unit controls shall operate the indoor unit using one of the five operating modes:
    1) Auto changeover (Heat Recovery System only)
    2) Heating
    3) Cooling
d. Dry
    1) Fan only
e. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
f. The unit shall be able to operate with the fan turned off during system cooling thermal off.
g. The unit shall be able to operate with a continuous fan setting.
h. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
i. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.

15. Electrical
    a. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz).
    b. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.
16. Controls
    a. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS-485 daisy chain.
17. Seismic Installations
    a. Provide with submittal: 1) OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. 2) Equipment installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.
18. Warranty
    a. Please refer to the respective outdoor unit for applicable warranty.

D. Outdoor Air Handler, Indoor Units:
1. DX coil, tubed drain pan, and built-in controls with thermostat remotely coordinated by outdoor air unit to maintain local air temperature setpoint.
2. Ducted horizontal discharge and side or back-end fresh-air intake; galvanized steel cabinet.
3. Variable or three-speed ECM fan with automatic airflow adjustment; external static pressure selectable during commissioning.
4. Return Air Filter: Manufacturer's standard, provide pressure differential gauge with adjustable signal flag outside the unit for local monitoring.
5. Sound Pressure: Measured at low speed at 5 feet below unit.
6. Provide external static pressure switch adjustable for high efficiency filter operation.
7. Condensate Pump: Built-in, with lift of 9 inches, minimum.
8. Switchbox accessible from side or bottom.
9. General
    a. Unit shall be provided by the following manufacturer: LG
    b. Unit shall be factory assembled, wired, piped and run tested.
    c. Unit shall be designed to be installed for indoor application.
    d. Unit shall be designed to mount fully concealed above the finished ceiling.

e. Unit shall have opening to supply air from front horizontal and a dedicated rear horizontal outdoor air intake.
f. The supply air shall be flanged for field installed ductwork that shall not exceed the external static pressure limitation of the unit.
g. Unit shall have double wall cabinet
h. Unit shall have hinged access doors with lockable handles
i. Unit shall be capable to be installed with heat pump VRF system.

10. Casing/Panel
    a. Unit construction shall be fabricated of double wall G90 galvanized steel on both sides with rigid polyurethane foam insulation. Double wall construction with thermal breaks prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
    b. Insulation shall have minimum thermal resistance R-value of 6.25, shall have a density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929-11.
    c. The unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include seals to reduce air leakage.
    d. Access to filters, main coil, reheat coil, supply fan, electrical and controls components shall be through hinged service access doors.
    e. Access doors shall be flush mounted to cabinet. Coil access door and supply fan access door shall include lockable handles.
    f. Unit shall include sloped 304 stainless steel drain pan. Drain pan connection shall be on right side.
11. Cabinet Assembly
    a. Unit shall have supply air discharge outlets horizontal and an outdoor air inlet horizontal.
    b. Unit shall be equipped with factory installed sensors for
    c. Outdoor air temperature sensor, shipped loose for field mounting in outdoor air intake ductwork
    d. Outdoor air humidity sensor, shipped loose for field mounting in outdoor air intake ductwork
    e. Discharge air temperature sensor, shipped loose for field mounting in discharge air ductwork
    f. Electric preheat coil leaving air temperature sensor
    g. Main coil leaving air temperature sensor
    h. Main coil refrigerant entering coil temperature sensor
    i. Main coil refrigerant leaving coil temperature sensor
    j. Reheat coil refrigerant entering coil temperature sensor
    k. Reheat coil refrigerant leaving coil temperature sensor
    l. Unit shall have a factory assembled; piped and wired electronic expansion valves (EEV's) for refrigerant control of main and reheat coils.
    m. Unit shall have a built-in control panel to communicate with the outdoor unit.
12. Fan Assembly
    a. The unit shall have one direct driven backward curved plenum fan.
    b. The fan and motor assembly shall be dynamically balanced
    c. The fan motor shall be ECM (electronically commutated motor) that can be field adjusted thru main controller
    d. The fan/motor assembly shall be isolated with neoprene gasket
    e. Unit shall be designed for high speed air volume against an external static pressure of up to
    f. 1.65" wg (water gage) at 2000 CFM

g. 2.50” wg at 1600 CFM
h. 2.95” wg at 1200 CFM

13. Filter Assembly
    a. The outdoor air inlet filter shall be 2” thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 8.
    b. The filter access shall be from the right side of unit.
    c. Main and reheat Coil Assembly
    d. Main coil shall be designed for use with R410a refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
    e. Main coil shall be 6 row high capacity and 10 fins per inch.
    f. Reheat coil shall be 2 row and 10 fins per inch.
    g. Coils shall be leak tested.
    h. Coils shall have factory installed EEV (Electronic expansion valves) for each coil.
    i. Coils shall have right hand external piping connections. Liquid and suction connections shall be sweat connection. Coil connections shall be labeled, extend beyond the unit casing, and be factory sealed on both the interior and exterior of the unit casing.
    j. Electric preheat coil
    k. Unit shall include an electric preheater consisting of electric heating coils, fuses and a high temperature limit switch.
    l. Electric preheater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier).
14. Controls
    a. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
    b. The DOAS unit shall be able to communicate with the outdoor unit using a field supplied minimum of 18 AWG, 4 core, stranded and shielded communication cable.
    c. The unit controls shall operate the indoor unit using one of the five operating modes:
    d. Cooling
        1) Heating
        2) Dehumidification
        3) Ventilation
        4) Defrost
    e. The unit controller shall be accessible via
    f. Direct connection to computer
    g. Web accessible IP address
    h. Direct integration to BACnet control system
    i. Direct integration to LonWorks control system
    j. The unit controller shall have a graphic of the unit components and allow adjustments of
        1) Fan speed
        2) Discharge air set point temperature
        3) Cooling enable outdoor temperature set point
        4) Heating enable outdoor temperature set point
        5) Scheduling for On/Off
    k. Dehumidification mode shall be initiated when outdoor humidity level rises above 60%. Main coil will cool incoming outdoor air down to 55ºF and reheat coil will raise temperature up to discharge air set point temperature.
15. Electrical
    a. The unit electrical power shall be 208-230/3/60 (V/Ph/Hz)
    b. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

16. Limited Warranty
    a. Please refer to the respective outdoor unit for applicable warranty.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.

B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.

C. Notify Architect if conditions for installation are unsatisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install refrigerant piping in accordance with equipment manufacturer's instructions.

C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).

D. Coordinate with installers of systems and equipment connecting to this system.

E. Connect indoor units to condensate piping.

3.03 SYSTEM STARTUP

A. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.

B. Adjust equipment for proper operation within manufacturer's published tolerances.

3.04 CLEANING

A. Clean exposed components of dirt, finger marks, and other disfigurements.

3.05 COMMISSIONING

A. See Section 01 91 13 - General Commissioning Requirements for additional requirements.

B. Execute mechanical system commissioning as indicated on Section 23 08 00.

C. Replace components not functioning properly.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

END OF SECTION 23 81 29

SECTION 25 08 00
COMMISSIONING OF INTEGRATED AUTOMATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Integrated automation commissioning requirements.

1.02 DEFINITIONS

A. BoD: Basis of design.

B. CD: Construction documents.

C. CFR: Current facility requirements.

D. Cx: Commissioning.

E. CxA: Commissioning agent or authority.

F. CxP: Commissioning plan.

G. Cx Process: Quality-focused documented OPR compliance verification.

H. Cx Team: Commissioning group consisting of CxA, Owner, Architect, Design-Builder, and Contractor as applicable.

I. FG: Facility guide or construction standard.

J. FPT: Functional performance test within Cx Process.

K. IAQ: Indoor Air Quality.

L. M&V: Measurement and verification within FPT.

M. OPR: Owner project requirements for BoD. May include CFR and FG.

N. O&M: Operation and maintenance.

O. PFC: Prefunctional checks or installation (verification) checks within Cx Process.

P. PPE: Personal protection equipment or safety gear.

Q. QA: Quality assurance or manufacturer installation instructions.

R. QC: Quality control or manufacturer reviewed installation.

S. TAB: Testing, adjusting and balancing of mechanical systems.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 202 - The Commissioning Process Requirements for New Buildings and New Systems; 2024.

PART 3 EXECUTION

2.01 COMMISSIONING

A. Test and Measurement Equipment.
   1. Bring per Cx Team resource:
   2. Accuracy: Each test and measurement equipment is to be of sufficient quality and accuracy to verify system specified performance with minimum tolerance levels.
   3. Calibration:
   4. Data Logging: Use integrated automation (BAS) and portable data loggers for M&V of CxA requested points (objects) over a time period of two weeks. Then download and provide a copy using CSV file format. As a minimum include timestamped:

B. Prefunctional Checklists:
   1. Pre-functional Cx Process:
      a. Assign two field technicians familiar with the installation to execute CxA generated installation and start-up checklists.
      b. Return timestamped, signed-off forms no later than two days after execution.

2. Nonconformity: The CxA reserves the right to stop the process if more than three discrepancies are found. Contractor to finish incomplete work, correct deficiencies, and address potential schedule delays.

C. Functional Performance Test:
   1. Functional Performance Cx Process:
      a. Assign two field technicians familiar with the installation to execute CxA witnessed sequence tests and performance verifications.
      b. Integrated Automation Verification:
      c. Setpoint Verification: Ensure point (object) setpoint, setback, maximum, and minimum settings were applied per contract documents for the following items.
         1) Flow and pressure, with values within five percent of TAB report figures.
         2) Temperature, humidity, CO2, and other monitored setpoints.
      d. Sequences of Operation (FPT's): Execute in compliance with ASHRAE Std 202.
   2. Nonconformity: The CxA reserves the right to stop the process if more than three discrepancies are found. Contractor to finish incomplete work, correct deficiencies, and address potential schedule delays.

SECTION 31 02 20 - EARTHWORK

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work includes all clearing, excavation, borrow, filling, backfilling, and grading indicated on the Drawings and necessary for the proper completion of the project, including pipes, structures (excluding buildings), and pavement. The contractor shall adhere to recommendations provided in the geotechnical report prepared by Southern Earth Sciences, T24-350. The contractor shall adhere to the more stringent specification provided in this specification or the recommendations provided in the geotechnical report.

1.2 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. All work shall be performed in accordance with Florida Department of Transportation standards, specifications and indexes and in accordance with other state and local requirements.

B. Current editions or revisions of the following specifications and standards will apply unless specifically noted otherwise herein or on the Drawings.

1. American Society for Testing and Materials (ASTM) Standard

ASTM C 33-85	Concrete Aggregate
ASTM D 698-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 Kg) Rammer and 12 in. (304.8 mm) Drop. Standard Proctor.
ASTM D 1556-82	Test Methods for Density of Soil in Place by the Sand-Cone Method.
ASTM D 1557-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (45 Kg) Rammer 2 and 18 in. (457 mm) Drop. Modified Proctor.
ASTM D 2487-83	Classification of Soil for Engineering Purposes
ASTM D 2922-76	Density of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth)
ASTM D 3017-78	Moisture Content of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth)

2. American Association of State Highway and Transportation Officials (AASHTO) Standards

AASHTO T-99	Standard Proctor
AASHTO T-180	Modified Proctor

1.3 SUBMITTALS

A. Contractor shall have reports submitted to the Engineer as required in the testing portion of this Section.

1.4 RELATED WORK

- Concrete Curbs, Curbs and Gutters and Sidewalks
- Stabilized Subbase
- Limerock Base Course
- Asphaltic Concrete Paving
- Storm drainage Culverts and Structures
- Concrete Work General
- Pre-Cast Storm Drainage Structures

1.5 SITE CONDITIONS

A. Character of Excavation Material: Prior to submitting his bid, the Contractor shall satisfy himself as to the character and amount of different soil materials, groundwater and the subsurface conditions to be encountered in the work to be performed. Information and data, when furnished, are for the Contractor's general information. However, it is expressly understood that any interpretation or conclusion drawn there from is totally the responsibility of the Contractor.

B. Subsurface Investigation: If subsurface information is included as an appendix of these specifications it is the results of soil borings and soil classification and testing made at the exact locations only. While the soil borings and information are representative of subsurface conditions at their respective exact locations, local variations in soils and groundwater will be encountered.

C. Existing Underground Facilities: Underground structures and utilities shown on the drawings are located according to the best available records. However, it shall be the Contractor's responsibility to acquaint himself with all information, and to accurately locate and uncover all underground structures and utilities along the line of work in order to avoid conflicts with existing facilities. Underground utilities shall be located by the Contractor far enough in advance of the trench or site excavation and pipe laying operations to assure ample opportunity to make the necessary adjustments to avoid conflicts. The Owner shall not be held accountable for inaccuracies or omissions in the locations or grade of facilities of this type.

D. Conflicts: Where actual conflicts are unavoidable, work shall be performed so as to cause as little interference as possible with the service rendered by the facility disturbed. The Owner may require the Contractor to work in off hours (i.e. 1:00am or Holidays) to minimize disturbance. Facilities or structures damaged in the prosecution of the work shall be repaired immediately in conformance with the best standard practices or according to the direction of the owner of such facility, to the extent required, including replacement, at no cost to the Owner.

PART 2 - MATERIALS AND EQUIPMENT

2.1 BACKFILL

A. The following shall define the terms used in the plans and specifications. Backfill material specifications apply to fill material associated with the sitework and that is five feet beyond the footprint of the buildings. The contractor will need to review the structural fill requirements identified in the geotechnical report prepared by Southern Earth Sciences.

1. Topsoil - shall be the upper most layer of soil usually dark in color and approximately 6 inches thick, rich in organic matter.

2. Gravel Bedding - Gravel bedding shall consist of well-graded crushed stone or crushed gravel meeting the requirements of ASTM Designation C-33, Graduation 67 (3/4-inches to No. 4). Air cooled blast furnace slag, alone or in combination with crushed stone and/or crushed gravel, conforming to ASTM C-33 requirements may also be used.

3. Select Backfill - shall be a select granular material free from organic matter and of such size and gradation that desired compaction can be readily attained. Select backfill is defined as those complying with AASHTO soil classification Groups A-1, A-3 and A-2-4 having a maximum size not to exceed 3 inches with at least 95% passing the 1 1/2 inch sieve and not more than 10% passing the No. 200 sieve with a coefficient of uniformity of six or greater. The liquid limit shall be less than 15. In most situations the existing backfill will not meet these requirements, therefore, select backfill is material which must be transported to the site from an approved borrow pit.

4. Suitable or Common Backfill - shall be a satisfactory soil material free from organic matter, muck, marl and rock exceeding 3 inches in diameter. At least 95% shall pass the 1 1/2 inch sieve. Common backfill shall comply with AASHTO soil classification Groups of A-2-4, A-2-5, A-2-6, A-2-7 and A-4 providing that the liquid limit shall be less than 35. Suitable backfill is usually considered on site material that meets these requirements.

5. Existing or Unsatisfactory Backfill - shall be material obtained from the Contractor's excavations to be used in areas not requiring specific compaction densities. This material shall not be used for pipe bedding nor under streets, street shoulders, or structures common unsuitable material shall comply with AASHTO soil classification Groups of A-5, A-6, A-7 and A-8. Under no conditions are destroyed pavement materials, curbs, broken concrete, etc., to be included in the backfill.

6. Concrete Encasement - shall be of portland cement type with a compressive strength at 28 days of 2500 psi.

7. Clean Sand - shall be a quartz material with less than 5 percent of the soil particles finer than the No. 200 mesh sieve, a uniformity coefficient greater than 1.5 and an effective grain size of 0.20 to 0.55 millimeters in diameter. Clean sand is required for filter material requiring good permeability.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Safety

1. In the Contractor's use of streets and highway for the work to be done under these Specifications he shall conform to all City, State, and local laws and regulations. The Contractor shall provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways for protection of the work and safety of the public rights-of-ways shall be provided with lights which shall be kept burning at all times between sunset and sunrise.

2. The Contractor shall be responsible for all damages resulting from any neglect or failure to meet these requirements. Where conditions require the presence of a watchman to fulfill the requirements stated herein, same shall be furnished without extra cost to the Owner.

   a. Access to Fire hydrants shall be maintained at all times. Do not block or barricade with spoil, materials or equipment for any period of time.

B. Maintenance of Service

1. The Contractor shall arrange his work to cause minimum disturbance of normal pedestrian and vehicular traffic and will be held responsible for providing suitable means of access to all public and private properties during all stages of the construction. Should the construction work require repairs, changes or modifications of other utilities, it shall be the responsibility of the Contractor to provide for the maintenance of continuous water, electric, telephone, and gas as well as sewage and other utility services to all present customers of such utilities, unless approval in writing is secured from the utility company for interruption of such service. A minimum of one lane of traffic shall be maintained at all times. Contractor shall keep all disturbed roads graded smooth and passable. If the road becomes impassable, the Contractor shall stabilize with dry, select backfill. The Owner may require the Contractor to work in off hours (i.e. 1:00am or Holidays) in order to minimize disturbance.

C. Limits of Construction

1. In locations where the work is to be installed in streets or road rights-of-way the activities of the Contractor shall be confined to these public properties. Where the use of private property is deemed necessary by the Contractor to facilitate construction work arrangement for such use with the property owner shall be the responsibility of the Contractor. The Contractor shall save the Owner harmless from all claims by adjacent property owners for trespassing or damage due to the activities of the Contractor in the prosecution of the work.

D. Existing Utilities

1. The Contract Documents contain data relative to existing public and private utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.

2. All existing improvements such as pavements, conduit, poles, pipes, overhead wires and other structures, shall be carefully supported and fully protected from injury. The Contractor shall be responsible for damages to these existing utilities and shall, in case they are damaged, restore them to their original condition at no cost to the Owner.

3. Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of work. This can be accomplished by making the appropriate contact with the utility companies listed on Sheet 2 of the Construction Drawings.

E. Property Protection

1. Trees, fences, poles, and all other property shall be protected unless their removal is authorized; and any property damaged shall be satisfactorily restored by the Contractor at the Contractor's expense to a condition equal to or better than that existing prior to beginning the work.

3.2 CLEARING AND GRUBBING

A. On all areas within limits of clearing and grubbing indicated on the Drawings or specified where earthwork is to be done, all timber, brush, stumps, roots, rubbish, and unsuitable material shall be removed to a depth of not less than one foot below the ground surface. Sound trees and shrubs which do not interfere with the construction and are elsewhere indicated or directed not to be removed, shall be protected properly from damage. The surface shall be plowed to a depth of not less than six (6) inches and all stumps, roots and other perishable matter thus exposed shall be removed to a depth of not less than one foot. Any deposits of muck, peat, bark or trash occurring within the limits of clearing and grubbing or where directed by the Engineer shall be removed to their full depth and backfilled with suitable backfill as specified herein. Material removed during clearing and grubbing shall be hauled to in accordance with local laws and regulations. Landfill fees shall be paid by the Contractor.

All shrubbery, ornamental trees and other such plantings including those within construction area shall be fully protected. If it becomes necessary to remove any grass, shrubbery or planting to accomplish the work, it shall be satisfactorily replaced before the work will be accepted. All areas disturbed during construction shall be restored to a condition equal to or better than that existing prior to beginning the work.

B. Trees and shrubs selected for preservation shall have their root systems protected from construction traffic, surface storage of materials, and any type of land disturbance within the drip line of the tree or shrub. The drip line of a tree or shrub is the outer outline of the tree crown where it intercepts the ground. Barricade all trees or tree groups which are selected for preservation if the possibility of root damage, surface soil disturbance within the drip line, soil compaction, or impact with construction equipment is prevalent. Barricading shall consist of continuous wood fencing constructed to the outline of the tree crown and shall be sturdy, highly visible and shall be maintained during the construction.

3.3 EROSION AND FLOODING CONTROL

A. During construction operations, the Contractor shall install and maintain temporary erosion and flooding control features to the extent necessary to prevent pollution of streams and lakes, detrimental effects on public or private property adjacent to the construction or damage to work on the Project. Additional erosion control devices may be requested by the Engineer to protect the property described above. This shall be done immediately when directed by Engineer at no additional cost to the Owner.

B. The Contractor shall attempt to limit the surface areas of erodible earth exposed by clearing and grubbing, excavation or filling operations.

C. Temporary features may include, but not be limited to silt fences, temporary grassing, sodding, mulching, sandbagging, slope drains, sediment basins, sediment checks, artificial coverings or berms. All City, County, State and Federal ordinances will be complied with.

D. The contractor shall comply with The Florida Development Manual -- A Guide to Sound Land and Water Management, Department of Environmental Regulation -- Stormwater Management Practices.

3.4 DUST CONTROL

A. If, in the opinion of the Owner or the Engineer, it is necessary to control dust during construction period, the Contractor shall furnish and spread water or calcium chloride at points where dust is a nuisance, or as directed by the Engineer, at no additional cost to the Owner.

3.5 PAVEMENT AND SIDEWALK REMOVAL AND REPLACEMENT

A. Pavement and sidewalk shall be removed and replaced as follows unless shown otherwise on the Drawings.

B. Pavement, which is to be removed for open-cut trenching, shall be cut vertically with a power-driven friction saw prior to removal. The surface shall be scored to sufficient depth to provide uniform, straight break lines. All removal of pavement shall conform to local, County, State or Federal requirements where applicable. Under no condition shall pavement be cut with a trenching machine, power shovel or backhoe. Width of cut of pavement or sidewalk shall be two feet wider than top of trench, one foot on each side of trench. In the event that trench excavation becomes wider than initial cut, pavement or sidewalk shall be recut to at least one foot back from all edges of actual excavation by the Contractor at his own expense.

1. All cut lines shall be parallel to or at right angles to the longitudinal axis of the pipeline.

C. Pavement, driveway or sidewalk material shall be separated from other excavated materials and shall not be placed in backfill but shall be satisfactorily disposed of by the Contractor. Base materials may be salvaged and stockpiled for reuse, but such reuse of base materials shall be subject to the review of the Engineer.

D. All pavement and sidewalk removed shall be replaced with base and surface materials which conform as closely as possible in thickness and quality to materials removed. All painted street markings and other traffic control devices shall be restored to former conditions. Use Safety Coatings Co. Roadrunner Traffic marking paint, or approved equal, and Ferro Co. glass spheres or approved equal. Pavement with traffic control devices and sidewalks shall be replaced as soon as practicable after compaction of backfill. Replacement pavement shall be tapered at curb.

E. Workmanship and materials shall be in accordance with best standard practice for work of this type, and shall conform to the requirements of Section 330-12, Hot Mix Asphalt General Construction Requirements. .

F. All necessary barricades, detours, lights and other protective measures shall be provided for protection of both pedestrians and vehicular traffic and shall conform to Florida DOT specifications where no local agency has specifications.

3.6 STATE HIGHWAY AND RAILROAD RIGHTS-OF-WAY

A. Pipe crossings and installations along all railroads and State highways shall be in accordance with the applicable portions of American Railroad Engineers Association (AREA) Specifications for "Pipeline Crossing under Railroad Tracks for Non-Flammable Substances" or Florida DOT "Utility Accommodation Guide" and with details shown on the drawings. Verify the existence of a formal permit to work on the right-of-way at each specific location prior to any work at that site and notify the owner of the right-of-way as required by that permit. Furnish the Engineer and the Owner with a copy of any separate certificate of insurance that is required by the owner of the right-of-way.

3.7 CURB AND GUTTER REMOVAL REPLACEMENT

A. Curb or curb and gutter removal, where required in construction of this work, shall be held to a minimum. Curb and gutter material to be removed shall be carefully separated from trench excavation material and shall be satisfactorily disposed of by the Contractor.

B. The Contractor shall replace all curb or curb and gutter which has been removed. Curb or curb and gutter shall be replaced as soon as possible after backfill is placed and compacted and shall be a duplicate in all respects to original construction. Workmanship shall be in accordance with the controlling agency (City, County, State).

3.8 RESTORATION OF ROADWAY CROSSINGS AND DRIVEWAY CROSSINGS

A. Clay, marl, shell or similar roadways and driveways that are crossed or traversed by trenches shall be restored to existing conditions prior to excavation. The Contractor may reclaim existing material, or he may furnish and compact new material. There will be no additional compensation for this type of restoration unless specifically called for in the Special Provisions or on the Bid Proposal.

B. Final and complete restoration of crossings in existing public roadways shall be completed not more than 24 hours subsequent to the final lift of the backfill.

3.9 EXCAVATION

A. General

1. Excavation shall be performed in accordance with all State, County and local regulations. Blasting will not be permitted except by written approval of the Engineer for each specific location where it is to be performed. Excavation shall conform to the dimensions indicated or specified for the pipeline or structure and topography and subgrade conditions encountered.

2. The Contractor shall notify the Engineer in due time to permit him to inspect completed excavations, and no pipes or concrete shall be placed in excavations or upon subgrades until they have been approved by the Engineer.

3. In areas where excavation may endanger existing structures, roads or utilities, Contractor will provide suitable support to these existing facilities so as to insure that damage will not occur. Contractor shall submit proposed method of support of these facilities to the Engineer for approval. The Contractor shall obtain written approval from the facility concerned before proceeding with any construction which might undermine or endanger existing facilities.

B. Control of Water

1. Furnish, install and operate all necessary machinery, appliances and equipment to keep excavations free from water during construction. Dewater and dispose of water so as not to cause injury to public or private property or to cause a nuisance or a menace to the public. The Contractor shall at all times have on-hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies and shall have available at all times competent workmen for operation of pumping equipment. Dewatering systems shall not be shut down between shifts, on holidays or weekends, or during work stoppages without written approval from the Engineer.

2. Control of ground water shall be such that softening of the bottom of excavations or formation of "quick" conditions or "boils" shall be prevented. Dewatering systems shall be designed and operated so as to prevent removal of natural soils.

3. Static water level shall be drawn and maintained one-foot below bottom of excavation so as to maintain undisturbed state or natural soils and allow placement of backfill to required density. Dewatering system shall be installed and operated so that ground water level outside excavation is not reduced to extent that would damage or endanger adjacent structures or property.

4. Release of ground water to its natural static level shall be performed in a manner so as to maintain undisturbed state of natural foundation soils, prevent disturbance of compacted fill or backfill and prevent flotation or movement of all structures and pipelines.

5. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

C. Shoring, Sheeting and Bracing

1. Excavations shall be shored and sheeted in accordance with requirements of the Department of Labor Occupational Safety and Health Administration (OSHA) with members of sizes and arrangement sufficient to prevent injury to persons, damage to structures, injurious caving, or erosion. They shall be designed, furnished, placed, maintained and removed by the Contractor.

Sheeting and shoring design shall be submitted to the Engineers as a shop drawing prior to installation and shall bear the seal of a structured engineer registered in the State of the job site.

2. Design, planning, installation and removal of all sheeting, shoring, sheet piling and bracing shall be accomplished in a manner so as to maintain required trench or excavated section with an undisturbed state of soils at and below excavation bottom.

3. Sheet piling and timbers used in trench excavations shall be withdrawn in such a manner so as to prevent subsequent settlement or misalignment of pipe or additional backfill loadings which might overload pipe. Where, in the opinion of the Engineer, removal of sheeting and shoring will or may cause damage to the work or to adjacent buildings, utilities or property, the Engineer may direct Contractor to leave all or a portion of sheeting and shoring in place. Sheeting and shoring shall also be provided as necessary to keep excavations within the available right-of-way.

4. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

D. Excavation for Pipe System

1. Common Excavation

a. Machine excavation shall be carried to a depth above final pipeline grade that will allow final grading using hand tools, as indicated on the Plans. Care shall be taken to not excavate below required depth. If excavations is carried below required depth, overcut depth shall be backfilled with select backfill material or gravel bedding material furnished at Contractor's expense and compacted to provide pipe support at least equal to that of original material.

b. Contractor may, at his option, elect to overcut trench and backfill with select backfill or bedding material. If Contractor so elects, depth of overcut shall be such that a minimum of two inches of compacted backfill material will result under lowest projection of pipe bell. No additional payment will be made for this overcut or for furnishing and placing of the required backfill material.

c. The Contractor shall exercise sound construction practices in excavating trench and maintaining it so no damage will occur to any foundation structure, pole line, pipeline or other facility because of slough of slopes or from any other cause. If, as a result of excavation, there is a disturbance of ground that endangers other property, the Contractor shall immediately take remedial action at his own expense. No act of the Owner or his representatives shall in any way affect liability of the Contractor for damages, expenses or costs that may result from trench excavation.

d. Trees, stumps and roots within limits of trench excavation shall be removed to a depth of at least 12 inches below bottom of trench.

2. Trench Requirements

a. Width of trench banks from bottom to 12 inches above top of pipe shall not exceed 18 inches nor be less than 12 inches on each side of the pipe with the exception of pre-assembled pressure pipe in non-paved areas for which the minimum trench width shall be pipe diameter plus 1 inch on each side of the pipe.

b. Trenches for gravity sewers shall be of such depth that the invert of pipe will be at elevations shown on the plans, or as may be determined by the Engineer. Trenches shall provide a minimum cover of 36 inches for water mains and 48 inches for sewage force mains over barrel of pipe, except as otherwise shown. Greater depth may be required to accommodate appurtenances or avoid obstruction.

c. Excavation for appurtenances shall be made to a size that will allow at least 12 inches between their outer surfaces and embankment or shoring.

d. The trench shall be dry when the bottom is prepared. A continuous trough shall be excavated by hand to receive the bottom 120 degrees of the pipe barrel. In addition, bell holes shall be excavated so that only the barrel of the pipe receives bearing pressure from, and is uniformly supported by, the bottom of trench. Preparation of trench bottom and placement of pipe shall be such that final position of pipe is true to line and grade and uniformly supported throughout barrel of each pipe length. When pipe is placed in select backfill over rock or other overdepth, additional backfill of same material shall be tamped on each side of barrel to height of spring line, thus forming a trough of firm, compacted bedding.

3. Pipe Interferes and Encasements

a. In no case shall there be less than 4 inches between any two pipelines or between pipelines and structures. Pipe deflections shall be performed in accordance with the plans and as contained herein. Wherever there is more than 4 inches but less than 18 inches clearance between sewers, sewer house laterals, force mains and water mains or water services, then a concrete encasement shall be provided for a distance of 10 feet on each side of the obstruction pipe. Wherever there is more than 4 inches but less than 1.0 foot clearance between any two pipe lines, other than water or sewer, or between pipe lines and structures, then a concrete encasement shall be provided for a distance of 3 feet on each side of the obstruction pipe.

b. The Engineer shall have full authority to direct the placement of the various pipes and structures in order to facilitate construction, expedite completion and to avoid conflicts.

E. Excavation for Structures

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection, or as shown on the Drawings.

2. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.

3. In areas underlain by expansive clay, undercutting or excavation of clay pockets will be required beneath footings and slab areas as may be shown on the drawings and directed by the Engineer. Post-hole diggers may be used to determine the depth to the clay materials in all the footing bottoms. Heavy clay that is encountered within a zone that is four (4) feet below the bottom of any footing or floor slab should be undercut and replaced with suitable or common backfill material. The width of undercutting in the footing should extend at least four (4) feet beyond the edge of the footing or slab to provide a non-expansive water barrier above the clay. Other clay pockets discovered during construction may also require complete removal upon the recommendation of the geotechnical engineer.

F. Unsuitable Material

1. Unsuitable materials are soils exposed at the bottom of excavations that are compressible, expansive, contain extraneous rubble, or offer uneven foundation support. Unsuitable materials/soils will include, but not be limited to, mulch, peat, expansive clays, boulders, rubble, any portion of trees or similar vegetation, wood, or unyielding material such as rock.

2. The Contractor shall notify the Engineer immediately when unsuitable material is encountered. The Engineer will investigate questionable material to determine its suitability. Should the Engineer require soils testing be performed to aid in his determination, then tests revealing suitable materials shall be paid for by the Contractor.

3. Where the Engineer determines that unsuitable material is present below the excavation which will not provide adequate support the Contractor shall remove the unsuitable material as directed by the Engineer and replace the unsuitable material with Select backfill. Prior to the excavation of any unsuitable material, written approval must be obtained from the Engineer. The approval shall state the linear feet of excavation. No payment shall be made for the removal of any unsuitable bedding material if prior approval is not obtained.

3.10 BACKFILL AND COMPACTION FOR PIPES

A. General

1. Contractor shall not perform any backfilling operation other than that necessary to hold pipe in place until the locations of connections and appurtenances have been recorded on the "as-built" drawings and the line has been inspected and released for backfilling. Backfill and compaction shall be performed as specified herein and as shown on the drawings. Backfilling of trenches shall progress as rapidly as the construction, testing and acceptance of work permits. In areas subject to traffic temporary backfill or base material is required to provide a smooth stable driving surface until final base and/or pavement can be constructed.

B. Haunching and Initial Backfill

1. After pipe has been properly laid and inspected backfill shall be carefully placed and compacted around the pipe in loose horizontal layers not exceeding 6 inches loose depth, equally on both sides of pipe and shall be spaded (walked in) and compacted with hand tampers to obtain the required density. This shall continue to a level of one foot above the top of the pipe.

C. Subsequent Backfill

1. Above the level of initial backfill, the trench shall be filled in horizontal layers and mechanically compacted to the density required up to 3 feet below the base of pavement or structures, up to 6 inches in areas to receive topsoil, seeding, or soiling and up to final grade in non-paved streets.

D. Backfill and Compaction Requirements for Pipe (unless shown differently on the plans)

1. Paved Areas

a. Initial - Select backfill in 6" lifts at 100%.

b. Subsequent - Select backfill in 8" lifts at 100%.

c. Top 3 feet below road base - Select backfill in 6" lifts at 100%.

2. Unpaved Street and Street Shoulder Areas

a. Initial - Suitable backfill in 6" lifts at 95%.

b. Subsequent - Suitable backfill in 8" lifts at 95%.

3. Off Street Areas

a. Initial - Suitable backfill in 6" lifts at 95%.

b. Subsequent - Unsuitable or existing backfill in 18" lifts compact till firm.

NOTE: Density listed are maximum dry density in accordance with ASTM D155. .

3.11 BACKFILL AND COMPACTION FOR STRUCTURES

A. For the area under the structure and within a 2 foot of the perimeter, compact the top 12 inches of subgrade and each 6-inch layer of select backfill or fill material to 95% Standard Proctor density.

3.12 GRADING

A. Grading shall be performed at such places as are indicated on the drawings, to the lines, grades, and elevations shown or as directed by the Engineer and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B. Grade all areas as indicated. Fill shall be brought to finish grades shown and shall be graded to drain water away from structures.

C. Overall area grading for which no grades are indicated within the limits of construction and outer limits of clearing and grubbing, all holes and other depressions shall be filled, all mounds and ridges cut down and the area brought to sufficiently uniform contour that the Owner's subsequent mowing operations will not be hindered by irregular terrain. This work shall be done regardless of whether the irregularities were the result of the Contractor's operations or originally existed.

Permanent ponds or other permanent water areas, as so designated by the Engineer, will not be required to be filled.

3.13 TESTING

A. General

1. Contractor shall comply and pay for the services of an independent testing laboratory in accordance with Section 01410 "Testing and Laboratory Services" to perform testing specifically indicated herein.

2. Exact location of the test shall be selected by the Engineer or his representative. If the Engineer, after being notified by the Contractor, is unable to be present during the test, the laboratory personnel shall randomly select testing locations that are representative of the work being tested. All cost of this testing and providing of certificates shall be a subsidiary obligation of the Contractor with the cost included in the item for which the testing is associated.

3. The minimum testing rate shall not prevent the Contractor nor the testing laboratory from performing additional testing to insure the construction is in accordance with the plans and specifications.

4. A minimum of two (2) copies of reports of test results of all maximum dry density and optimum moisture content determinations and all in-place density tests shall be submitted to the Engineer. Reports must be signed by a registered Professional Engineer.

5. The Contractor shall repair all test holes and borings resulting from the testing and retesting of his work at no cost to the Owner. Any areas failing to pass the tests as called for, and interpreted by the Engineer, shall immediately be brought into conformance with these Specifications at the Contractor's expense.

B. Minimum Schedule of Test Required

1. Determination of the soil classification for each type of soil material used to determine its suitability for use as defined herein and in accordance with the AASHTO or Unified Soil Classification System.

2. Determination of maximum dry density and optimum moisture content for each type of soil to be compacted to a specified density.

   At least one determination will be made for each soil used. Tests shall be performed in accordance with the appropriate ASTM or AASHTO Standards.

3. In-place (insitu) density test shall be made in accordance with ASTM and AASHTO Standards and shall be made at a frequency to assure contract requirements are met but in no case less than the following:

   a. Pipeline backfill at the rate of one test for each 150 linear feet of trenchline for each backfill lift. A backfill lift shall never be considered to be greater than one foot in thickness. In unpaved areas, testing rate by be reduced to one test for each 150 lineal feet of trenchline for each backfill lift.

   b. Structure backfill Fill beneath pavement at the rate of one test for each 5000 square feet for each backfill lift (maximum lift of 12 inches).

c. Pavement, sidewalk and curb backfill at the rate of one test for each 50 lineal feet of street for each backfill lift (maximum lift of 12 inches).

3.14 MAINTENANCE

A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

END OF SECTION 310220

SECTION 31 02 51 – STABILIZED SUBBASE

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work specified in this Section includes all labor, materials, transportation and equipment necessary to properly construct a Type B stabilized roadbed having a Limerock Bearing Ratio (LBR) of 40. The required LBR shall be obtained by stabilizing/blending the existing soils with crushed limerock, crushed concrete or graded aggregate base specified in Section 914 of the FDOT Standard Specifications.

1.2 RELATED WORK

A. The following items of related work are included and specified in other Sections of these Specifications:

1. Earthwork
2. Limerock Base
3. Curbs and Gutters
4. Asphalt Concrete Surface Course

1.3 COMPLIANCE WITH STANDARDS

A. Except as modified or supplemented herein, all work in this Section shall meet the requirements and standards listed. In case of conflict between the referenced Specifications or standards, the one having the more stringent requirements shall govern.

1. American Association of State Highway and Transportation
2. Officials - AASHTO
3. Florida Department of Transportation - FDOT

1.4 SUBMITTALS

A. Submit reports to Engineer demonstrating materials complying with requirements herein.

B. Test Results: Submit results of all tests conducted to the Engineer.

PART 2 - MATERIALS

2.1 CRUSHED SHELL

A. Crushed shell for this use shall be mollusk shell (i.e., oysters, mussels, clams, cemented coquina). Steamed shell will not be permitted. This shell shall meet the following requirements: Material having a plasticity index of more than ten or a liquid limit greater than 40 shall not be used as a stabilizer. At least 97% by weight of the total material shall pass a 3 1/2-inch sieve and at least 50% by weight of the total material shall be retained on the No. 4 sieve. Not more than 20% by weight of the total material shall pass the No. 200 sieve. The determination of the percentage passing the No. 200 sieve shall be by washing only. In the event that the shell meets the above requirements without crushing, crushing will not be required.

2.2 LOCAL MATERIALS

A. Local materials used for this stabilizing may be soils or recyclable materials such as crushed concrete, roof tiles and asphalt coated base or reclaimed pavement. However, no materials that deteriorate over time, cause excessive deformations, contain hazardous substances,

contaminates, or do not improve the bearing capacity of the stabilized material may be used. (see 914-4 for qualifying tests for these conditions.) The Contractor shall provide information or test results to the Engineer to substantiate these properties. At least 97% by weight of the total material shall pass a 3 1/2 inch sieve. Material having a plasticity index greater than ten or a liquid limit greater than 40 shall not be used as a stabilizer. No blending of materials to meet these requirements will be permitted unless authorized by the Engineer. When blending is permitted blended material shall be tested to ensure the above requirements are met before being spread on the roadway.

PART 3 - EXECUTION

3.1 APPLICATION

A. The stabilizing material shall be spread, mixed and compacted in accordance with Section 160 of the FDOT Standard Specifications.

3.2 TESTING

A. Contractor shall comply and pay for the services of an independent testing laboratory in accordance with section 01410.

1. Bearing Value Tests

a. Bearing value samples will be obtained and tested for approximately each 500 square yards of pavement area, as directed by the engineer.

2. Density Requirements

a. Minimum density requirements at any location in the stabilized subbase area will be as shown on the plans and set forth in Section 310220 - "Earthwork". Density tests will be made for approximately each 500 square yards of pavement area as directed by the engineer. The contractor shall dewater the subbase, if required, to ensure proper compaction.

END OF SECTION 310251

SECTION 31 02 52 – LIMEROCK BASE COURSE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work specified in this Section includes all labor, materials, transportation and equipment necessary to properly perform all work specified here, indicated on the drawings or reasonably implied to complete the construction of base course composed of limerock. It shall be constructed on a prepared subgrade, in accordance with these Specifications and in conformity with the lines, grades, notes and typical cross-sections shown on the Drawings and in the Plans. Included as a part of this work are the following items:

1. Limerock Base Course (single and double course)

1.2 RELATED WORK

A. The following items of related work are included and specified in other Sections of these Specifications:

1. Earthwork
2. Stabilized Subgrade
3. Curbs and Gutters
4. Asphalt Concrete Surface Course

1.3 SCHEDULE

A. The Contractor, at his option, may construct a Limerock Base Course when such an alternate is shown on the Plans. If selected for construction it shall be used throughout the project. It shall NOT be mixed with other types of base courses for construction of contiguous portions of the work.

B. Limerock Base Course construction shall not commence (nor shall limerock material be placed on the roadway) until the drainage system (including underdrains) is completed and 100 percent functional and the curbs and gutters, if any, have been properly constructed.

C. Base Course construction shall commence within 24 hours of completion of the stabilized subgrade work.

1.4 COMPLIANCE WITH STANDARDS

A. Except as modified or supplemented herein, all work in this Section shall meet the requirements and standards listed. In case of conflict between the referenced Specifications or standards, the one having the more stringent requirements shall govern.

1. American Association of State Highway and Transportation Officials – AASHTO

2. Florida Department of Transportation – FDOT

1.5 SUBMITTALS

A. Submit reports to Engineer demonstrating materials comply with requirements herein.

B. Test Results: Submit results of all tests conducted to the Engineer.

PART 2 - MATERIALS

2.1 LIMEROCK

A. The Limerock material shall meet the requirements of FDOT "Standard Specifications for Road and Bridge Construction", Section 911. At the Contractor's option limerock of either Miami or Ocala formation may be used but only limerock of one formation may be used on this contract. The material shall originate in quarries currently on the FDOT approved list for limerock base material sources. Provide certificate of conformance to the requirements of Section 911, FDOT.

2.2 PRIME COAT (REQUIRED)

A. The material used for prime coat shall be cut-back Asphalt Grade RC-70 or RC-250 meeting the requirements of Section 916-2, of the FDOT Specifications, Emulsified Asphalt Grades SS-1 or CSS-1, SS-1H or CSS-1H diluted in equal proportion with water; Asphalt Emulsified Grades AE-60, AE-90, AE-150 or AE-200 diluted at the ratio of 6 parts emulsified asphalt to 4 parts water; special MS-Emulsion diluted at the ratio of 6 parts emulsified asphalt to 4 parts water; Asphalt Emulsion Prime (AEP) meeting the requirements of Section 916-4, of the FDOT Specifications, or other types and grades of bituminous material which may be called for in the Plans or Special Provisions.

B. The Contractor may select any of the specified bituminous materials unless the Plans or Special Provisions indicate the use of a specific material. Types and Grades of bituminous material other than those specified above may be allowed if it can be shown that the alternate material will properly perform the function of prime coat material.

2.3 COVER MATERIAL FOR PRIME COAT (REQUIRED)

A. If an emulsified asphalt is used for prime coat, the Engineer may require that cover material be hot-asphalt coated (mix to contain from two to four percent asphalt-cement) if necessary to achieve a prime coat which will remain reasonably intact until the surface course is placed.
If material other than emulsified asphalt is used for the prime coat, the cover material shall be either sand (bare or hot-asphalt coated) or screenings, at the Contractor's option. The sand shall be non-plastic and free from any appreciable amount of silt, clay balls and root particles, and from any noticeable sticks, trash, vegetation or other organic matter.

2.4 TACK COAT

A. Unless a specific type or grade of material is called for in the Plans or Special Provisions, the material used for tack coat may be any of the following: Emulsified Asphalt, Grades RS-2 or CRS-2; Emulsified Asphalt, Grades SS-1 or CSS-1, SS-1H or CSS-1H (all diluted in equal proportions with water); Emulsified Asphalt, Grades AE-60, AE-90, AE-150 or AE-200, diluted at the ratio of 6 parts emulsified asphalt to 4 parts water; Emulsified Asphalt, Grade CRS-2H; Special MS-Emulsion; Asphalt Emulsion Prime (AEP) (may be diluted with water at the ratio not to exceed 6 parts emulsified asphalt to 4 parts water) meeting the requirements of Section 916-4, of the FDOT Specifications.

PART 3 - EXECUTION

3.1 LIMEROCK BASE COURSE

A. Equipment to construct the base course shall be as set forth in Section 200-3, FDOT Specifications.

B. Limerock shall be transported to the point where it is to be used (placed on the roadbed) by hauling over previously placed rock and deposited at the end of the preceding spread material.

C. The limerock shall be spread, compacted, finished, tested, primed and maintained in accordance with Sections 200-5 through 200-9 (inclusive) of the FDOT Specifications.

D. In addition to the above requirements, the following shall apply:

1. Section 200-7 shall only apply when the asphalt concrete surface course is to be paid for by the ton.

2. The Contractor shall not be compensated for areas of limerock base that are thicker than shown on the Plans or Drawings. Areas of excess thickness shall not be used to compensate for areas of deficient thickness as set forth in Section 200-9.

3. In maintaining the base the Contractor is required to place sandbag berms at each inlet so as to divert stormwater into the inlet. In all road sections with a grade greater than 2%, per the Drawings, the Contractor shall place sandbag berms at distances no greater than 200 feet between inlets.

3.2 PRIME COAT AND COVER MATERIAL (REQUIRED)

A. Equipment to construct the prime coat and spread the cover material shall be as set forth in Section 300-3, FDOT Specifications.

B. Cover material shall be transported over the portions of the roadbed previously coated with cover material.

C. The prime coat and cover material shall be constructed in accordance with Section 300-4, -5, and -6 of the FDOT Specifications.

3.3 TACK COAT

A. When a tack coat is required it shall be constructed as set forth in Section 300-7 of the FDOT Specifications.

3.4 TESTING

A. General

1. Testing Agency - The Agency shall be approved by the Engineer, and shall be the type and possess the degree of experience required. If required, furnish evidence of agency's ability to perform the test required in this Specification.

2. All testing shall be arranged and paid for by the Contractor.

3. The horizontal and vertical locations of the tests shall be reported. Station numbers shall be used with distances right or left of centerline or baseline. Testing to comply to Section 01410.

B. Frequency of Tests

1. LBR Test - One (1) for each 750 tons or portion thereof delivered to site. The LBR shall be conducted by the quarry and results sent to the Engineer.

2. In-situ Density - One (1) for each 500 square yards or part thereof finished as a unit, but in no case less than two tests or at intervals of not more than 200 feet.

3. Thickness - Thickness of the base shall be determined at all density test sites at intervals of not more than 200 feet.

4. Proof Rolling - Prior to asphaltic concrete placement, the base shall be proof-rolled with heavy pneumatic-tired rollers having unit pressures of 200 psi. All soft, loose, or yielding areas of base shall be excavated and filled with sand-asphalt hot mix (500 lb. Marshall Stability) and compacted.

5. Contractor shall provide template and conduct cross section/crown test in the presence of the engineer.

END OF SECTION 310252

SECTION 311000 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing vegetation where improvements are proposed.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, moving, and removing site utilities or abandoning site utilities in place.
7. Temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Retain one of first two paragraphs below; revise to define "topsoil" according to local practices if required. Topsoil is raw material that typically needs screening and amending before meeting planting soil mix requirements. First paragraph assumes topsoil depth is known and shown or specified; second paragraph assumes that Contractor will identify and determine depth of existing topsoil. Coordinate with "Topsoil Stripping" Article.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain on Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct pre-construction conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Engineer or Owner.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material. in Section 312000 "Earth Moving."

   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag/Wrap a 1-inch (25-mm) blue vinyl tie tape flag around each tree trunk at 54 inches (1372 mm) above the ground.

C. Protect existing site improvements to remain from damage during construction.

   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect/Engineer.

3.4 EXISTING UTILITIES

A. Contractor to gain approval from Owner before disconnecting and sealing indicated utilities that serve existing structures before site clearing.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner and Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 024116 "Structure Demolition" and Section 024119 "Selective Structure Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm) and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

PAGE LEFT BLANK INTENTIONALLY

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 QUALITY ASSURANCE

A. Qualifications: Engage a licensed professional pest control operator, for application of soil treatment solution.

B. Regulatory Requirements: Use only termiticides which bear a Federal registration number of the U.S. Environmental Protection Agency.

C. Comply with FBC Section 1816 - Termite Protection.

1.03 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

B. To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of soil toxicant manufacturer.

1.04 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.

1.05 WARRANTY

A. Provide 5 year written warranty from date of treatment, signed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

PART 2 - PRODUCTS

2.01 Materials

A. Soil Treatment Solution: Use emulsible concentrate termiticide for dilution with water, specially formulated to prevent termite infestation. Provide a working solution of one of following chemical elements and concentrations.

A. Permethrin ("Dragnet", "Torpedo"); 0.5% in water emulsion.

B. Cypermethrin (APrevail FT@); 0.5% in water emulsion.

C. Imidacloprid ("Premise 75"); 0.1% water emulsion.
D. Fipronil (Termidor 80WG); 0.125% water emulsion.

B. Other solutions may be used as recommended by Applicator if acceptable to local governing authorities and to Architect. Use only soil treatment solutions which are not injurious to planting.

PART 3 - EXECUTION

3.01 APPLICATION

A. Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Termiticide may be applied before placement of compacted fill under slabs, if recommended by manufacturer.

B. Application Rates: Apply soil treatment solution at rates recommended by soil termiticide manufacturer.

C. Treatment Areas: Treat areas required by applicable codes. In addition treat everything within one foot outside of building perimeter and as follows:
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 the entire inside perimeter of foundation walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, and piers; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3.02 Post signs in areas of application warning workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

3.03 Reapply soil termiticide treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

END OF SECTION 313116

PAGE LEFT BLANK INTENTIONALLY

SECTION 32 02 51 – CONCRETE CURBS, CURBS AND GUTTERS, AND SIDEWALKS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes all labor, materials, transportation and equipment necessary to properly perform all work specified here, indicated on the Drawings, or reasonably implied to complete the construction. Included as a part of the work of this Section, but not necessarily limited by it, are curbs, curbs and gutters and sidewalks.

1.2 REFERENCED SPECIFICATIONS

A. All materials and methods of construction shall conform to the requirements of the "Florida Department of Transportation, Standard Specifications for Road and Bridge Construction" therein.

B. Section 310220 - Earthwork

PART 2 - MATERIALS

2.1 CONCRETE

A. Curbs, curbs and gutters shall be Type I concrete as required in Section 921 of the FDOT Standard Specifications.

B.

2.2 REINFORCEMENT

A. Any steel reinforcement shall conform to the requirements of Section 415 of the FDOT Standard Specifications.

2.3 JOINT MATERIALS

A. Joint materials shall be in accordance with Section 932-1, FDOT Standard Specifications.

PART 3 - EXECUTION

3.1 CURBS AND CURBS AND GUTTERS

A. Curbs and curbs and gutters shall be formed, excavated for, placed, constructed jointed, finished, cured and backfilled, and the concrete tested in accordance with Section 520 of the FDOT Standard Specifications.

3.2 SIDEWALKS

A. Sidewalks shall be formed, excavated for, placed, jointed, finished and cured in accordance with Section 522 of the FDOT Standard Specifications.

3.3 MACHINE PLACEMENT

A. Curbs, curbs and gutters, and sidewalks may be placed by machines at the Contractor's option. The finished product shall be true to line, grade and cross-section as shown on the Drawings.

B. Not withstanding Sections 520 and 522 of the FDOT Standard Specifications, the following shall apply to items placed by machines.

C. Contraction joints shall be sawed. Joints shall be sawed as soon as the concrete has hardened sufficient that raveling will not occur and within 24 hours of placement. Sawing shall be with mechanically driven carborundum or diamond saws. The depth of cut shall not be less than 2 inches.

D. Construction joints shall be sawed. The time element for sawing shall be as set forth above. Construction joints occur at the beginnings and ends of runs by machine placement. Saw cuts shall be made the full height of vertical faces before the wasted material is removed.

END OF SECTION 320251

SECTION 32 02 52 – ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes all labor, materials, transportation and equipment necessary to properly perform all work specified here, indicated on the Drawings, or reasonably implied to complete the construction. Included as a part of the work of this Section, but not necessarily limited by it, are the following items:

1. Superpave Asphalt Concrete (SP) PG-76-22 (PMA) Traffic Level B with Reclaimed Asphalt Pavement Material (RAP) maximum of twenty percent (20%)

1.2 RELATED WORK

A. The following items of related work are included and specified in other Sections of these Specifications:

1. Earthwork
2. Base Course
3. Curbs and Curb and Gutters

1.3 DESCRIPTION OF PAVING

A. Pavement shall be constructed over the existing pavement or bases constructed as specified, and shall conform to grades, lines, and dimensions as indicated on the Drawings. Type of surface course to be specified on the Plans.

1.4 COMPLIANCE WITH STANDARDS

A. All work in this Section shall meet requirements and recommendations of applicable portions of standards listed. In cases of conflict between the referenced Specifications or standards, the one having the more stringent requirements shall govern.

1. American Association of State Highway and Transportation Officials – AASHTO

2. Florida Department of Transportation - FDOT

1.5 SUBMITTALS

A. Mix Design - Submit mix design for approval by the Engineer. No asphalt pavement shall be constructed until the mix design is approved.

B. Test Reports - Submit test reports indicating the results of testing specified herein to the Engineer.

1.6 JOB CONDITIONS

A. Existing Conditions - Examine surfaces to receive work specified herein, for defects that will adversely affect the execution and quality of the work, and for deviations beyond allowable tolerances. Do not start work until all unsatisfactory conditions are corrected.

B. Environmental Requirements - Temperature and weather conditions shall be within the requirements specified in Sections 334 of the FDOT Standard Specifications.

C. Protection of Work

1. Protect graded surfaces from damage by other construction work. Replace damaged materials.

2. Do not permit traffic on finish until surfaces have hardened sufficiently to prevent marring or distorting.

PART 2 - MATERIALS

A.1 ASPHALTIC CONCRETE

A. Superpave Asphaltic Concrete (SP) shall meet Section 334, FDOT Standard Specifications.

B. Notwithstanding the above, the following shall also apply:

1. Gravel, when used in any of the above mixtures, shall be crushed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. 1. Superpave Asphaltic Concrete (SP) shall meet Section 334, FDOT Standard Specifications.

3.2 TESTING

A. General

1. Testing Agency - The Agency shall be approved by the Engineer

2. The Contractor shall arrange and pay for all tests required herein.

3. Except as modified herein below, the type, number, frequency, and methods of testing and the evaluation and meaning of test results shall be as set forth in Sections 334 of the FDOT Standard Specifications as applicable to Superpave.

B. Field Testing

1. The project shall be tested at random intervals for each 2000 tons, or fraction thereof, of each type of asphaltic concrete. The following tests shall be conducted as a minimum:

a. Mix Proportions - Each day's production shall be tested for compliance with the mix design as to gradation and asphalt content.

b. Surface Requirements, Density and Thickness - Each 300 linear feet of paving lane or part thereof shall constitute a Lot and shall be tested for surface requirements, density and thickness.

END OF SECTION 320252

SECTION 32 02 61 – PAINTING TRAFFIC STRIPES AND MARKINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes furnishing all paint, materials, labor and supervision, and equipment to complete the painting and protective coatings as shown on the drawings (if provided) or contained in the Bid Proposal and specified herein. Included as a part of the work of this Section, but not necessarily limited by it, are the following items:

1. Lead-Free Thermoplastic Traffic Paint

B. Surface preparation, paint, and coating materials, and their application shall be as recommended by the coating manufacturer, specified in the FDOT Standard Specifications for Road and Bridge Construction and approved by the Engineer. The Contractor shall take all health and safety precautions necessary to prevent accidents during the storage, handling, application, and drying of any of the coatings herein described.

C. Unless otherwise indicated in the Bid Proposal or on the drawings, Contractor shall provide traffic markings as per the recommendations of the Manual on Uniform Traffic Control Devices.

1.2 DESCRIPTION OF PAINTING

A. Painted stripes shall be constructed over existing or proposed pavement as indicated on the Drawings. All painted stripes, markings, and messages shall be reflectorized lead-free thermoplastic paint in accordance with sections 711 and 971 of the FDOT Standard Specifications for Road and Bridge Construction, unless otherwise noted as Thermoplastic Paint, and all painting stripes or markers within the FDOT right of way will be Thermoplastic Paint.

1.3 COMPLIANCE WITH STANDARDS

A. All work in this Section shall meet requirements and recommendations of applicable portions of standards listed. In cases of conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.

1. American Association of State Highway and Transportation Officials -AASHTO
2. Florida Department of Transportation - FDOT

1.4 QUALITY ASSURANCE

A. Obtain painting materials from one manufacturer. Painting materials not obtainable from the prime manufacturer shall be obtained from a second source recommended by the prime manufacturer.

B. The contractor shall maintain at the job site throughout the construction period a wet film thickness gauge and a magnetic, dry film thickness gauge for the use of the Engineer or his representative.

C. All Equipment, Alignment, Tolerances, Application, Protection, Corrective Measures, and Acceptance of Work shall meet the requirements of Sections 710 and 711 of FDOT Standard Specifications for Road and Bridge Construction.

1.5 JOB CONDITIONS

A. Existing Conditions - Examine surfaces to receive work specified herein, for defects that will adversely affect the execution and quality of the work and for deviations beyond allowable tolerances. Do not start work until all unsatisfactory conditions are corrected.

B. Environmental Requirements - Temperature and weather conditions shall be within the requirements specified in Section 710-4, 711-4, and 971 of the FDOT Standard Specifications for Road and Bridge Construction.

C. Protection of Work - All newly painted stripes and pavement markings shall be protected in a manner set forth in Section 710-7 and 711-6 of the FDOT Standard Specifications for Road and Bridge Construction.

1.6 MEASUREMENT AND PAYMENT

A. Measurement and payment shall be set forth in the Bid Proposal and as provided in Sections 710-10, 710-11, 711-9 and 711-10 of the FDOT Standard Specifications for Road and Bridge Construction.

PART 2 - MATERIALS

2.1 PAINTS

A. All materials used for the work shall meet the requirements in Sections 710, 711, and 971 of the FDOT Standard Specifications for Road and Bridge Construction.

B. Standard Paint shall meet the requirements of Section 971-3 of the FDOT Standard Specifications for Road and Bridge Construction.

D. Glass spheres for Reflective Traffic Paint shall meet the requirements of Section 971-2 of the FDOT Standard Specifications for Road and Bridge Construction.

E. Thermoplastic Traffic Paints shall meet the requirements of Section 711-2 of the FDOT Standard Specifications for Road and Bridge Construction.

2.2 EQUIPMENT

A. Equipment for painting traffic stripes shall meet the requirements of section 710-3 of the FDOT Standard Specifications for Road and Bridge Construction.

B. Equipment for the application of Thermoplastic Traffic Stripes and Markings shall meet the requirements of FDOT Standard Specifications for Road and Bridge Construction.

PART 3 - EXECUTION

3.1 APPLICATION

A. The application of Paint and Spheres shall meet the requirements of Section 710-4 of the FDOT Standard Specifications for Road and Bridge Construction.

B. The application of Thermoplastic Traffic Stripes and Markings shall meet the requirements of Section 711-4 of the FDOT Standard Specifications for Road and Bridge Construction.

3.2 CORRECTIVE MEASURES

A. All deviations from the plans shall be corrected in conformance with Section 710-8 and 711-8 of the FDOT Standard Specifications for Road and Bridge Construction.

3.3 ACCEPTANCE OF THE WORK

A. When the work under sections 710 and 711 of the FDOT Standard Specifications for Road and Bridge Construction has been completed to the satisfaction of the Engineer, including any corrections or repairs ordered by the Engineer, acceptance of the work of painting will be made, independent of the remaining work under the contract, and the Contractor will be relieved of all maintenance of the painting except for damage due to his operations.

END OF SECTION 320261

SECTION 32 02 93 – SODDING, SEEDING, AND MULCHING FOR SITE STABILIZATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to prepare lawn bed and install sodding, seeding and mulching as shown on contract drawings and as specified.

B. Areas to receive Centipede sod shall be:

1. All disturbed area unless otherwise noted on construction documents
2. All Landscape areas.

C. Areas to receive seed and mulch shall be:

1. All areas disturbed by Contractor that are not required to be sodded.
2. All areas indicated on the drawings.

1.2 SUBMITTALS

A. Contractor shall submit to the Engineer a signed statement of total weight for each type of seed and fertilizer actually installed on the project with copies of purchase receipts.

PART 2 - MATERIALS

2.1 MULCH

A. The mulch used shall be normally dry mulch shall be straw or hay and shall consist of centipede.

2.2 SEED

A. Grass seed shall be centipede. Seed, which has become wet or moldy shall not be used. All seed shall meet the requirements of Section 570 and 981 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

2.3 FERTILIZER

A. Commercial fertilizer shall comply with the State fertilizer laws. The numeral designations for fertilizer indicate the minimum percentage (respectively) of (1) total nitrogen, (2) available phosphoric acid, and (3) water-soluble potash, contained in the fertilizer. The chemical designation shall be 12-8-8. Either dry or liquid fertilizer may be used.

2.4 SOD

A. Sod shall be 99.9% centipede. Sod shall meet the applicable requirements of Sections 570 and 981, of the "Florida Department of Transportation Standard Specification for Road and Bridge Construction".

2.5 WATER

A. The Water used in the grassing operations shall be free of excess and harmful chemicals, acids, alkalies, or any substance, which may be harmful to plant growth or obnoxious to traffic. Saltwater shall not be used.

PART 3 - EXECUTION

3.1 LAWN BED PREPARATION

A. Areas to be seeded shall be cleared of all rough grass, weeds, and debris, and the ground brought to an even grade as approved. The soil shall then be thoroughly tilled to a minimum 8-inch depth. The areas shall then be brought to proper grade, free of sticks, stones, or other foreign matter over 1-inch in diameter or dimension. The surface shall conform to finish grade, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.2 SEEDING AND MULCHING

A. Fertilizing, seeding or mulching operations will not be permitted when wind velocities exceed 15 miles per hour. Seed shall be planted or sown only when the soil is moist and in proper condition to induce growth.

B. Apply the lawn seed with a drop type spreader at the rate of eight (8) pounds per one thousand (1,000) square feet.

C. Apply half the seed in one direction and the remainder at right angles to the first seeding.

D. After applying the seed, rake the seed into the seed bed and roll with a lawn roller.

E. Seeded areas shall be uniformly mulched in a continuous blanket immediately following seeding and compacting operations, using at least 1 1/2 tons of hay or straw per acre. Hay with noxious seeds or plants will not be acceptable. Rotted, brittle, molded hay will not be accepted. It is intended that mulch shall allow some sunlight to penetrate and air to circulate, at the same time shading the ground, reducing erosion and conserving soil moisture. Thickness of covering shall be adequate to hold soil but sufficiently loose and open to favor development of grass. Immediately following spreading of mulch, material shall be anchored to soil by means of a seed drill, dish harrow set to cut only slightly, or other suitable equipment which will secure mulch firmly and prevent loss or bunching by wind or rain, or may be anchored with string lines placed at sufficient intervals. On slopes where machinery cannot be used mulch may be retained in place by hand spading, string lines, or non-metallic open weave fabric. Unless rain is imminent, mulched areas shall be watered immediately after placing. Upon completion, surface or mulched areas shall be free from clods of earth, bumps, or waterholding pockets and to required grades.

3.3 SODDING

A. Sodding shall be incorporated into the project at the earliest practical time in the life of the contract. No sod which has been cut for more than 72 hours shall be used unless specifically authorized by the Engineer after his careful inspection thereof. Any sod, which is not planted within 24 hours after cutting, shall be stacked in an approved manner and maintained properly moistened.

B. Sodding shall not be performed when weather and soil conditions are, in the Engineer's opinion, unsuitable for proper results.

C. The sod shall be placed on the prepared surface, with edges in close contact, and shall be firmly and smoothly embedded by light tamping with appropriate tools.

D. Where sodding is used in drainage ditches, the setting of the pieces shall be staggered such as to avoid a continuous seam along the line of flow. Along the edges of such staggered areas the offsets of individual strips shall not exceed six inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a featheredge effect.

E. On areas where the sod may slide, due to height and slope, the Engineer may direct that the sod be pegged, with pegs driven through the sod blocks into firm earth, at suitable intervals.

F. Any pieces of sod which, after placing, show an appearance of extreme dryness shall be removed from the work.

3.4 MAINTENANCE

A. Maintenance shall begin immediately following the last operation of grassing and continue until final acceptance. Maintenance shall include watering, mowing, replanting, and all other work necessary to produce a uniform stand of grass.
B. Sufficient watering shall be done by the Contractor to maintain adequate moisture for optimum development of the lawn areas. Grassed areas shall receive no less than 1.5 inches of water per week.
C. Grassing will be considered for final acceptance when the permanent grass is healthy and growing on 95 percent of the area with no bare areas wider than twelve (12) inches.

END OF SECTION 320293

SECTION 32 31 13 – CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

Provide chain link fences, top enclosure and gates as complete units by a single supply source including necessary erection accessories, fittings, and fastenings. Refer to Drawings for locations and sizes of chain link fencing and gates.

1.2 SUBMITTALS:

Submit manufacturer's technical specifications and installation instructions for fence framing, fabric, gates, and accessories.

PART 2 - PRODUCTS

2.1 Manufacturer:

Subject to compliance with requirements, provide galvanized steel fencing and fabric by one of the following:

Allied Tube and Conduit Corp.
American Chain Link Fence Company
American Tube Company
Anchor Fence, Inc.
Capitol Wire and Fence Co., Inc.
Century Tube Corp.
Cyclone Fence Div./USX Corp.

2.2 Steel Fabric:

Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 12 feet high. Wire size includes zinc coating.

A. Size: 2-inch mesh, 9 gauge (0.148-inch diameter) wire.

B. Galvanized Steel Finish: ASTM A 392, Class 1, with not less than 1.2 oz. zinc per sq. ft. of uncoated wire surface.

2.3 Framework and Accessories:

Except as indicated otherwise, conform to the Chain Link Fence Manufacturers Institute (CLFMI) Product Manual, Industrial Steel Guide for Fence Rails, Posts, Gates, and Accessories, including Table II.

A. Strength requirements for posts and rails conforming to ASTM F 669.

B. Type I Pipe: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (schedule 40) with not less than 1.8 oz. zinc per sq. ft. of surface area coated.

C. Fittings: Comply with ASTM F 626. Mill finished aluminum or galvanized iron or steel, to suit manufacturer's standards.

D. Top and Center Rails: 1-1/4-inch NPS (1.66-inch OD) Type I or II steel pipe or 1.625-inch x 1.25-inch roll-formed C sections weighing 1.35 lbs. per ft. Provide manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top and middle rails securely to each gate corner, pull and end post.

2.4 Swing Gates:

Comply with ASTM F 900. Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

A. Hinges: Non-lift-off type, offset to permit 180 deg. gate opening.

B. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

C. Hold-Open Catch: Self latching type mounted on wall to hold gate open, with padlock eye as integral part of catch. Equal to Model #1933 by Hager. (Mount @ bottom of gate).

2.5 Concrete:

Provide concrete consisting of portland cement, ASTM C 150, aggregates ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 psi using at least 4 sacks of cement per cu. yd., 1-inch maximum size aggregate, maximum 3-inch slump, and 2 to 4 percent entrained air.

PART 3 - EXECUTION

3.1 Excavation:

Drill or hand excavate holes for posts maximum 10 feet o.c., unless otherwise indicated and to diameters. If not indicated on drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times largest cross-section of post.

3.2 Installation:

Install in accordance with ASTM F 567 and written installation instructions of fencing manufacturer to provide secure, aligned installation.

A. Setting Posts: Center and align posts in holes 3 inches above bottom of excavation.

B. Top Rails: Run rail continuously through line post caps. Provide expansion couplings between each section.

C. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

D. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

E. Bottom Tension Wire: Install taut within 6 inches of bottom of fabric and attach to posts with tie wire. Fasten fabric to tension wire with 11 gage hog rings spaced maximum 24 inches o.c.

F. Tension or Stretcher Bars: Thread through or clamp to fabric 4 inches o.c., and secure to end, corner, pull, and gate posts with tension bands spaced not over 15 inches o.c.

G. Fabric: Install approximately 2 inches above finish, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires.

H. Tie Wires: Use wire to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Tie fabric to line posts 12 inches o.c. and to rails and braces 24 inches o.c.

I. Gates: Install gates plumb, level, and adjust hardware for smooth operation.

END OF SECTION 323113

SECTION 33 02 66 – WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work under this section consists of furnishing all materials, supplies, equipment and labor in accordance with the requirements set forth herein and as shown on the drawings.

1.2 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. The work under this contract shall be in strict accordance with the following codes and standards:

1. Local, county and municipal codes;
2. American Society for Testing and Materials (ASTM);
3. American National Standards Institute (ANSI);
4. National Sanitation Foundation (NSF);
5. American Water Works Association (AWWA);
6. American Association of State Highway and Transportation Officials (AASHTO);
7. Florida Department of Environmental Protection (FDEP)
8. Florida Department of Transportation Specifications (DOT);
9. Federal Specifications;
10. United States Department of Commerce Commercial Standards (CS); and
11. All local government rules and regulations.

1.3 CONTRACTOR LICENSE

A. Contractor and Subcontractor shall possess valid licenses required by state and local codes. All water main work shall be performed by a State of Florida licensed Underground Utility Contractor. All plumbing work on private property shall be performed by a licensed plumber.

1.4 SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings shall be submitted for all items included under this Section and shall include the following minimum information:

1. Full details of pipe, fittings, special joints, and assembly thereof, including manufacturer's name;
2. Joint materials and details;
3. Catalogue cuts, dimensions and full details of all castings, valves and appurtenances;
4. Certifications as specified herein; and
5. Reinforcing steel bending and setting drawings.

B. Furnish sworn certificates in duplicate that all tests and inspections required by the Specifications under which the materials were manufactured have been satisfied.

1.5 RELATED WORK

A. Testing

B. Earthwork

1.6 INSPECTION

A. All pipe and fittings to be installed under this Contract may be inspected at the site of manufacture for compliance with these Specifications by an independent laboratory selected by the Owner. The manufacturer's cooperation shall be required in these inspections. The cost of inspection by an independent laboratory will be borne by the Owner.

1.7 MANUFACTURER TESTING OF PIPE AND FITTINGS

A. Each joint of pipe 4 inches in diameter and larger shall be hydrostatically tested at the point of manufacture as required by the appropriate AWWA Standard. Owner may request that certificates of compliance be furnished with the material.

B. All ductile and cast iron fittings to be furnished under this Contract shall be inspected and tested at the foundry as required by the AWWA Standard C-110, Section 10-10.

C. Provide letters of certification of all tests.

1.8 DEFINITIONS

A. DI: Ductile Iron
B. PE: Polyethylene plastic.
C. PP: Polypropylene plastic.
D. PVC: Polyvinyl chloride plastic.
E. NPS: Nominal Pipe Size
F. HDPE: High Density Polyethylene Pipe

1.9 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and other specialties to include in emergency, operation, and maintenance manuals.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

A. Unless otherwise specified or shown on the drawings, materials and equipment shall be the standard product of a manufacturer and shall comply with the Contract Documents and applicable standards for such materials or equipment.

B. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to the requirements of AWWA C-150 unless other wise noted on the plans. The pipe shall be Class 51 thickness. Glands for mechanical joints shall be ductile iron or cast iron. Pipe shall be as manufactured by American Case Iron Pipe Co., Clow, or equal.

B. Fittings shall conform to the requirements of AWWA C-110. Fittings shall be mechanical joint and shall have a 350 psi minimum working pressure. Fittings shall be as manufactured by U.S. Pipe Co., American Cast Iron Pipe Co., Clow or equal.

C. Flanged fittings shall conform to ANSI B16.1, screwed-on flanges, faced and drilled to ANSI Class 125-pound template. They shall provide 1/16-inch full face gaskets of red sheet rubber.

D. Joints shall conform to the requirements of AWWA C-111.

E. Coatings and Linings of the internal surfaces of all ductile iron pipe and fittings for water mains shall be coated with a cement lining and seal coat in accordance with AWWA C104. The outside surface shall be coated with a bituminous coating approximately one mil thick.

F. All pipe shall be given a factory hydrostatic test of not less than 600 pounds per square inch.

G. All ductile iron pipes (NPS3) shall be designed in accordance with the latest version of ANSI/AWWA C150/A21.50 for a rated water working pressure class of 350 PSI.

Ductile iron pipe for above ground installation shall be furnished with flange type joints, unless otherwise shown on the drawings. Flanges shall be ductile iron and conform to ANSI/AWWA C115/A21.15. Flange gaskets shall be full-face type gaskets molded from high-quality styrene-butadiene rubber (SBR) and shall be pre-drilled to match flange bolt pattern. The flange and gasket shall be rated for a working pressure of 350 psi, unless otherwise specified.

For potable water line the interior surface of all ductile iron pipe and fittings with a cement mortar lining and bituminous seal coat in accordance with ANSI/AWWA C104/A21.4. For buried applications, coat the exterior surface of all fittings with a1.0 mil thick asphaltic coating in accordance with ANSI A21.51. For exposed or above ground applications, coat the exterior surface with an epoxy primer to a thickness of 5 mils and apply a topcoat of epoxy to a minimum thickness of 15 mils. Approved primer and topcoat products include Tnemec Series N140 Pota-Pox Plus (primer) and Tnemec Series 435 Perma-Glaze (topcoat), or approved equals. The topcoat only may be field applied by an experienced applicator and allowed to cure before installation.

All interior linings and exterior coatings (including primers) shall be applied by a certified applicator at the foundry or certified application facility. All surfaces shall be prepared in accordance with the manufacturers' recommendations for the intended environment and the product(s) to be applied.

2.3 POLYVINYL CHLORIDE PIPE (PVC) AND FITTINGS

A. PVC pipe for potable water in sizes 4 inch through 12-inch shall conform to AWWA Standard C900-89, "PVC Pressure Pipe for Water". Laying lengths shall be 20 feet ± 1 inch for all sizes.

B. Pipe shall have an integral bell end or extruded coupling with gasket seal which is in compliance with the requirements of ASTM D3139, "Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals".

1. PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
2. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    a. Gaskets: AWWA C111, rubber.
4. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Pipe shall be Class 150 (DR 18) with cast iron outside dimensions. Each piece of pipe shall be hydrostatically tested to 600 psi. Marking shall include nominal size and O.D. Base (e.g. 6 inch C.I.), material code designation number (PVC 1120), dimension ratio number (DR 18), AWWA pressure Class 150, AWWA designation AWWA C900, as manufacturer's name and production code. All PVC pipe shall be Underwriters Laboratory (UL) and Factory Mutual approved.

D. PVC pipe in sizes under 4 inches shall be 200 psi (SDR 21) in IPS dimensions manufactured from 1120 PVC resin. Pipe shall have integral wall bells or extruded couplings with gasket seals. Pipe shall be marked with manufacturer's name, size, material code (PVC 1120), pressure rating (200 psi), DR number (DR21).

E. All taps on PVC pipe will be made through saddles or tapping sleeve and valve.

F. Fittings for pipe smaller than 4 inches in diameter shall be PVC. Fittings for pipe 4 inches and larger shall be Ductile Iron conforming with the requirements of ANSI/AWWA C153/21.53-84.

2.4 PE PIPE AND FITTINGS

A. PE, ASTM Pipe: ASTM D 2239, DR No. 11; with PE compound number required to give pressure rating not less than 200 psig (1103 kPa).

1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.
2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

B. PE, AWWA Pipe: AWWA C906, DR No. 11; with PE compound number required to give pressure rating not less than 200 psig (1103 kPa).

1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 200 psig (1103 kPa).

2.5 WATER SERVICE PIPING

A. Type “K” copper tubing with bronze compression fittings shall be used for ¾ inch through 2-inch services. Copper tubing size outside dimension ratio – 9 (SDR-9). No substitutes will be allowed. No flared or solder joints shall be allowed.

OR

B. High Density Polyethylene (HDPE) tubing for water supply shall conform to AWWA C901. For HDPE tubing ¾” to 2” in diameter, dimensions shall conform to ASTM D2737 with copper tubing OD Base.

HDPE tubing pressure rating shall be Pressure Class 200 psi with a minimum working pressure of 150 psig, and comply with ASTM D 1598, D1599, D1693, D3350 and AWWA 901.

HDPE tubing material shall conform to ASTM D3350, Standard Code PE 3408, and shall have minimum cell classification of PE 35434C.

OR

C. PVC pipe in sizes under 4 inches shall be 200 psi (SDR 21) in IPS dimensions manufactured from 1120 PVC resin. Pipe shall have integral wall bells or extruded couplings with gasket seals.

Pipe shall be marked with manufacturer's name, size, material code (PVC 1120), pressure rating (200 psi), DR number (DR21).

2.6 DETECTABLE BURIED WARNING TAPE AND COPPER LOCATION WIRE

A. Detectable buried pipe warning tape shall be 2 inches minimum width, long lasting plastic with metalized foil core specifically designed for non-metallic pipes and shall be placed over all underground water lines and fittings. Metalized core shall be detectable to depths of up to 6 feet by use of commercially available pipe location equipment. Tape shall be furnished in manufacturer's standard color and roll length and shall be imprinted continuously with the following words unless otherwise approved: CAUTION BURIED WATER MAIN BELOW. Detectable buried warning tape shall be equal to or better than Terra Tape "D", as manufactured by Griffolyn Company Inc., 10020 Mykawa Road, Post Office Box 33248, Texas, 77033

B. In addition to the installation of the detectable buried warning tape over all PVC water lines, the Contractor shall install an 10 gauge insulated copper wire directly on top of all PVC water lines and taped every ten feet for location purposes. The wire shall be continuous and all connections taped. Three feet of excess wire shall be left in all valve boxes. Each fire hydrant shall have one wrap of the wire around the barrel located at final grade and connected to the wire on the water main. No additional payment will be made for this wire and tape installation and will be included in the unit price per linear foot for PVC water pipe.

2.7 VALVES AND GATES

A. General

1. Unless otherwise indicated, valves three (3) inches and smaller shall be all brass or bronze, and valves larger than three (3) inches shall be iron body, bronze mounted. Unless otherwise indicated, gate, globe, angle, and check valves three (3) inches and smaller shall be provided with threaded connections; those larger than three (3) inches shall be provided with connections as indicated. Connections shall conform to the herein above specified piping connections.

2. All valves shall be ample strength to withstand and operate satisfactorily under the working pressures and shall be subject to the test pressure specified herein. All valves shall be rated for a minimum cold water working pressure of 150 psi and a minimum test pressure of 300 psi, except as otherwise specified herein.

3. Tests shall be made in the shop with a hydrostatic water pressure, cost of tests to be merged in the cost of the valves, and any valves which leak or which show any defects shall be rejected.

B. Valves 4" and Larger (Resilient Wedge Gate, Check, etc.)

1. All gate valves in size four inch through 12 inch shall be of the resilient wedge gate type. Valves shall be manufactured to meet all applicable requirements of AWWA Standards for Resilient Seated Gate Valve C509-80. All valves of this type shall be bubble tight at 200 psi water pressure.

2. Valves shall have non-rising stems open by turning counter clockwise (left) and with two inch square operating nut with arrow cast in metal to indicate direction of opening.

3. The inside of the valve body and bonnet shall be lined with an epoxy coating. The lining shall be a two-part thermosetting epoxy resign applied by the manufacturer and equal to Endurall 3300.

4. Each valve shall have the manufacturer's name, pressure rating and year manufactured cast on the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to twice the specified working pressure.

5. All valves shall be the mechanical joint type as manufactured by Mueller, Clow, American, Dresser or equal.

6. Each valve shall be equipped with a valve box. For this project a total of two (2) tee handle socket valve wrenches shall be furnished by the Contractor to the Owner. The cost of value wrenches and boxes shall be included in the price of the valve.

7. All internal coatings shall be ANSI Standard 60 certified.

8. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
    1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, ductile iron, non-rising stem, resilient seated gate valves with valve box.

    2. Use the following for valves in vaults and above ground:
        a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, non-rising or rising stem.
        b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, ductile iron, OS&Y rising stem, resilient seated or UL/FMG, cast iron, OS&Y rising stem.
        c. Check Valves: AWWA C508, swing type with rudder flapper.

C. Gate Valves, Under 4 inches (Bronze)

1. Gate valves three (3) inches in size and smaller shall be 125 lb. bronze, rising stem, double wedge disc, union or screwed bonnet type. Valves shall be of a design to permit repacking under pressure. Unless otherwise indicated valves shall be equipped with handwheels. Each valve shall be equipped with a valve box.

2.8 VALVE BOXES

A. All valves installed underground shall be provided with adjustable cast iron valve boxes to fit the depth of earth cover over the valve. Boxes shall be three piece adjustable screw type with a minimum inside diameter of 5". Boxes shall be furnished with case iron covers marked "Water" and so constructed as to be tight and non-rattling. Boxes shall be so designed as not to bear on the valve or pipeline or transmit any surface loads thereto.

2.9 FIRE HYDRANTS

A. All fire hydrants shall fully comply with AWWA C-502 and be a mechanical-joint, dry barrel-traffic type as manufactured by Mueller Centurian No. 423 or equal. The size shall be six (6) inches in diameter by three (3) feet in length with a 1-1/2 inch Pentagon operating nut and equipped with two 2-1/2 inch hoses and one 4-1/2 inch pumper connections. The hydrant shall be painted fire engine red with caps equipped with chains.

2.10 HOSE BIBS

A. Hose bibs shall be Crane No. 58 or equal of size shown on the Drawings.

2.11 PIPING INSTALLATION

A. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

B. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

D. Install PE pipe according to ASTM D 2774 and ASTM F 645.

E. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

F. Bury piping with depth of cover over top at least 30 inches (750 mm) in non-paved areas with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following, or per section 3.2 of these specs, whichever is greater:

1. Under Driveways: With at least 30 inches (910 mm) cover over top.
2. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm) additional cover.

G. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

H. Bed pipe in soil that is at least 95% compacted and does not contain sharp rocks or objects. Backfill with native soil, remove sharp rocks and objects in the soil surrounding the pipe. Compact soil for every 1 foot of fill.

I. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping as indicated in the Restrained Joints section, thrust blocks, anchors, tie-rods and clamps, and other supports.

K. Joint Construction - Make pipe joints according to the following:

1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
5. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
6. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
7. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.

2.12 SERVICE SADDLES

A. For 3/4 inch and 1 inch taps on PVC pipe, a service saddle with a single 2 inch wide stainless steel band or strap shall be furnished. The saddle shall be of cast or ductile iron and shall be epoxy, nylon, or PE coated (10 mils minimum). Approved styles are Ford FC101, Romac 101N and Rockwell 315, or Cascade Model CNS1. No substitutes.

B. For 1 1/2 inch and 2 inch taps on PVC pipe, a more stable saddle is required. Saddles for these taps shall have either two each stainless steel 2 inch straps or a single stainless strap a minimum of 3 1/4 inches wide. The saddle body shall be cast or ductile iron and shall be coated with epoxy or nylon. Approved styles are Ford FC202, Romac 202N and Rockwell 317, Cascade Model CNS2.

C. As an equal alternate, service saddles may be Continental "Fasttap" model #5263-31-2506-00.

2.13 REPAIR OR JOINING CLAMPS

A. If repair or joining clamps are required, Contractor shall notify Engineer for approval indicating make and model and intend use. Clamps shall be of non-corrosive material (i.e., stainless steel, cast iron, bronze) as manufactured by Rockwell or equal.

2.14 TAPPING SADDLES, SLEEVES AND CROSSES

A. Tapping Saddles

1. Tapping saddles shall be fabricated of ductile iron or steel and suitable for either wet or dry installation as manufactured by American Cast Iron Pipe Company, U.C. M. Corporation, or approved equal. The sealing gasket shall be the o-ring type suitable for the applicable service. The outlet flange shall be ANSI B16.1, 125 lb. standard.

2. The straps and bolts shall be corrosion resistant alloy steel.

B. Tapping Sleeves and Crosses

1. Tapping sleeves and crosses shall be of mechanical joint type with outlet flange per ANSE B16.1, 125 lb. standard as manufactured by Mueller No. 615 or 715, or approved equal.

C. Cut-In Sleeves

1. Cut-In sleeves shall be mechanical joint type class 150 ductile iron as manufactured by Mueller.

2.15 METER BOXES

A. Meter boxes shall be concrete, plastic, or cast iron unless otherwise indicated on the plans or in the Bid Proposal. The inside dimensions shall be approximately 11" x 24", rectangular in shape with a hinged cast iron lid for reading the meter. The box shall be large enough to house the back flow preventor, meter, curb stop, and hand valve.

2.16 DOMESTIC WATER METER

A. General

1. The domestic meter shall be a positive displacement, 5/8 inch by 3/4 inch size unless otherwise indicated on drawings. It shall meet AWWA standards for displacement type cold water meters. The water meter shall be a Rockwell SR or approved equal.

B. Meter Construction

1. Main Case
   a. The meter shall have a bronze main case. The bronze case must be able to withstand internal pressure and external stress without distortion, cracking or breaking to cause leaking or to interfere with the proper operation of the meter. The meter shall have a strainer to prevent foreign material from entering the measuring chamber.

2. Register
   a. The register shall be hermetically sealed and magnetically driven. The registration reading shall be U.S. gallons with a 10 gallon sweephand and shall have a capacity of 1,000,000 gallons.

3. Accuracy and Operating Range
   a. Normal operating flow range of the meter shall be 1 to 20 gallons per minute and accuracy at the normal flow range shall be 100 $\pm$ 1.5 percent of actual flow. Low flow registration shall be 95 percent at 1/4 gallons per minute. Maximum pressure loss at 20 gallons per minute shall not exceed 11 psi. Maximum operating pressure shall be 140 psi.

C. Workmanship and Materials

1. The supplier and manufacturer shall warrant the meter including register for a period of twenty-five (25) years. The supplier shall replace or repair, without charge, those parts in which a defect has developed within the specified warranty period upon return of such parts.

2. The meter installation shall be warranted for a period of twelve (12) months.

2.17 GLOBE SERVICE VALVES (HAND VALVE)

A. Globe service valves (hand valves) shall be installed inside meter box. Valves shall be 3/4" size with 3/4" iron pipe threads end configuration. Globe service valves shall be Ford G11-333 or approved equal.

2.18 ANGLE BALL METER VALVES

A. Angle ball meter valves shall be 5/8" size with inlet pack joint for 3/4" plastic tubing. Angle ball meter valves shall be Ford BA43-232W or approved equal.

2.19 RESIDENTIAL BACKFLOW PREVENTER

A. Residential backflow preventers shall be Mueller RPZ Model H-14242 or approved equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Safety

1. In the Contractor's use of streets and highway for the work to be done under these Specifications he shall conform to all City, State, and local laws and regulations. The Contractor shall provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways for protection of the work and safety of the public rights-of-ways shall be provided with lights which shall be kept burning at all times between sunset and sunrise. The Contractor shall be responsible for all damages resulting from any neglect or failure to meet these requirements. Where conditions require the presence of a watchman to fulfill the requirements stated herein, same shall be furnished without extra cost to the Owner.

B. Maintenance of Service

1. The Contractor shall arrange his work to cause minimum disturbance of normal pedestrian and vehicular traffic and will be held responsible for providing suitable means of access to all public and private properties during all stages of the construction. Should the construction work require repairs, changes or modifications of other utilities, it shall be the responsibility of the Contractor to provide for the maintenance of continuous water, electric, telephone, and gas as well as sewage and other utility services to all present customers of such utilities, unless approval in writing is secured from the utility company for interruption of such service.

C. Limits of Construction

1. In locations where the work is to be installed in streets or road right-of-way the activities of the Contractor shall be confined to these public properties. Where the use of private property is deemed necessary by the Contractor to facilitate construction work arrangement for such use with the property Owner shall be the responsibility of the Contractor. The Contractor shall save the Owner harmless from all claims by adjacent property owners for trespassing or damage due to the activities of the Contractor in the prosecution of the work.

D. Existing Utilities

1. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.

2. All existing improvements such as pavements, conduit, poles, pipes and other structures, shall be carefully supported and fully protected from injury. The Contractor shall be responsible for damages to these existing utilities and shall, in case they are damaged,

restore them to their original condition at no cost to the owner.

3. Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of work. This can be accomplished by making the appropriate contact with the following utility companies listed on page 2 of the plans.

3.2 PIPE INSTALLATION

A. Connections to Existing Mains

1. It is the Contractor's responsibility to make exploratory excavations and/or use other methods available to locate valves, fittings and piping prior to construction of any underground piping system and to adjust the new piping layout to agree with existing piping layout prior to construction and at no additional cost to the Owner. All adjustments shall be subject to approval by the Engineer prior to installation.

2. Prior to any connection to existing mains, all new water mains and service lines must have passed all pressure and disinfection test as required herein and written permission must be obtained from the Engineer authorizing the connection. The Engineer's authorization shall only be given after a clearance or partial clearance is issued by the Florida Department of Environmental Regulation.

3. Contractor shall have all fittings and equipment and adequate labor on-hand so as to make as quick as possible connection to minimize interruption of water service. Engineer shall specify time of day and day of week for connection to minimize effects of interruption. Contractor shall notify Engineer and utility owner 48 hours prior to connection. Engineer may require Contractor to use restraint rods, retainer glands or other methods in place of thrust blocks to avoid time required for concrete to harden.

B. Separation

1. Water and sewer lines shall maintain a horizontal separation of 10 feet or a vertical separation of 18 inches. When this is not possible, concrete encasement of pipe for a distance of ten feet each side of the sewer main shall be used. In lieu of the concrete encasement, ductile iron pipe may be used. A minimum vertical separation of 6 inches shall be maintained with all other utilities.

C. Excavation, Backfill and Compaction

1. Excavation, backfill and compaction shall meet the requirements of Section 02200, Earthwork and as shown on the drawings.

D. Field Layout

1. Only approximate location of lines are indicated on drawings. Field adjustment of location will be required. Consult Engineer for proper adjustments.

E. Depth of Cover

1. Where elevations are not indicated, lay water main lines with a minimum of 36 inches of cover unless shallower depths are specifically indicated on the drawings. Greater depths will be permitted where required to miss obstructions or for proper installation of valves, hydrants, or specials. Pipe shall not be deflected more than manufacturer's recommendation.

2. Service lines shall have a minimum cover of 18 inches.

F. Well Pointing

1. Water shall not be allowed in the trench at any time. An adequate supply of well points, headers or pumps, all in first class operating conditions, may be used to remove the water. The use of gravel and pumps shall also be an acceptable means of removing the water. The trench shall be excavated no more than the available pumping facilities are capable of handling. This discharge from pumps shall be routed to natural drainage channels or emptied into drains or storm sewers.

G. Ductile Iron Pipe (D.I.P.)

1. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 and the Handbook of Ductile Iron Pipe, 6th Edition.

H. Polyvinyl Chloride Pipe (PVC)

1. PVC pipe and fittings shall be installed in accordance with the Handbook of PVC Pipe, 2nd Edition.

I. Pipe Laying

1. The bottom of the trench shall not be excavated below the specified grade. If undercutting occurs, the bottom of the trench shall be brought up to the original grade with approved material, thoroughly compacted as directed by the Engineer.

2. After placing a length of pipe in the trench, the spigot end shall be centered in the bell, the pipe forced home, brought to correct alignment, and covered with an approved backfill material.

3. When pipe laying is not in progress, the open ends of pipe shall be closed by a water tight plug or other approved means. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

4. The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe.

5. Lines shall be laid reasonably straight and any change in grade following the contour of the ground shall be made in long sweeping curves and no abrupt changes in direction or grade will be allowed except as indicated on the Drawings.

3.3 INSTALLATION OF COPPER LOCATION WIRE AND DETECTABLE WARNING TAPE

A. Install continuous underground detectable warning tape and locating wire during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping.

B. Install a continuous 10 gauge insulated copper locating wire directly on top of all PVC water lines and tape every 10 feet to secure to pipe. The wire shall be continuous and all connections and splices taped and/or secured with wire nuts. Allow at least 3 feet of excess wire above grade at all valve boxes and fire hydrants. The excess wire shall be coiled inside the valve box and/or wrapped around the base of hydrants.

C. Continuous underground detectable buried warning tape shall be installed by the Contractor over all PVC and plastic water mains or underground piping, or as indicated on the Drawings and specified here, except the detectable tape is not required over service lines. Following trenching and laying of the water main line, the trench shall be backfilled and compacted as specified elsewhere to a depth of 16 inches ± 2 inches measured from ground level. Tape shall then be placed into the trench with the wording side visible and centered directly above the pipe below. Installation of the tape shall be in accordance with the manufacturer's recommendations, except as otherwise specified or approved. Tape shall run continuously. Where splicing is required, tape shall be over-lapped a minimum of 12 inches.

D. Following placement of the tape, the trench shall be backfilled with due caution to prevent displacement or damage to the tape. After the tape has been installed and the trench backfilled, the Contractor shall perform a detection test using a commercially available pipe detector furnished by the Contractor. Any undetectable tape shall be replaced by the Contractor to the satisfaction of the Engineer at no additional expense to the Owner.

E. Permanently attach equipment nameplate or marker indicating plastic water-service piping.

3.4 VALVES AND FITTINGS

A. All valves and fittings shall be set and joined to the pipe in the proper location as specified in the Drawings. A valve box shall be provided for every valve. This valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the final grade or as may be specified in the Drawings.

1. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

2. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

3. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

4. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

5. MSS Valves: Install as component of connected piping system.

6. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

7. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.5 THRUST BLOCKS (LOCATION AND USE IS BY APPROVAL)

A. Longitudinal thrust along pressurized pipe lines at bends, tees, reducers, and caps or plugs shall be counteracted by enough weight of concrete to counterbalance the vertical and horizontal thrust forces. Where undisturbed trench walls are not available for thrust blocking, the Contractor shall furnish and install suitable pipe harnesses or ties designed and manufactured for this purpose. Harnesses and/or ties shall be approved by the Engineer.

B. Thrust blocks shall be sized for 150 psi hydrostatic pressure, with dimensions as indicated on the Water Detail Sheet. Restrained joints shall be used where directed by the drawings and may be used at other locations with prior approval by the Engineer. Joints shall be protected by felt roofing paper prior to placing concrete thrust block.

C. Concrete for thrust blocking shall be no leaner than one part cement, 1 1/2 parts sand, and 5 1/2 parts aggregate having a compressive strength of 2000 psi. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.

D. In lieu of thrust blocking, with the approval of the Engineer, pipe harnesses and/or ties or restrained push-on or restrained mechanical joints may be used.

3.6 RESTRAINED JOINTS

A. Restraining Gaskets and Mechanical Thrust Restraints Products

When restrained joints are required for below ground installations, furnish and install restrained joint pipe and/or mechanical joint restraints in accordance with the Standard Construction Details, or as specified by the Engineer of Record. The type of thrust restraint required shall depend on the material and joint type of the pipe requiring restraint. Thrust restraint maximum working pressure shall equal that of the piping. Approved thrust restraints for various pipe materials and joint types are provided in Table below.

Table Approved Thrust Restraints for Pressure Pipe and Fittings

Pipe Material	Joint Type	Approved Restraints
DI	Push-On (12-inch and smaller)	American Fast-Grip® Gasket McWane Sure-Stop 350® U.S. Pipe Field-Lok® 350
DI	Push-On (14-inch and larger)	American Flex Ring / Field Flex Ring U.S. Pipe TR Flex®
DI	Mechanical (All sizes)	EBAA Iron Megalug® Series 1100 EBAA Iron Megalug® 15MJ00TD (Tru-Dual®) Sigma One-Lok™ D-Series SLDE (Domestic) Tyler Union TUFGrip™ Series 1000 (TLD/DI) U.S. Pipe MJ Field Lok® (DI) Star Pipe Stargrip Series 3000
PVC	Push-On	Diamond Plastics - Diamond Lok-21® Gasket EBAA Iron Series 1900 JM Eagle - Eagle Loc 900™ Gasket Tyler Union TUFGrip™ Series 3000 (PP/PVC) Star Pipe Restrainers Series 1100**G2**
PVC	Mechanical	EBAA Iron Megalug® 2000PV EBAA Iron Megalug® 19MJG00 Sigma One-Lok™ D-Series SLCE (Domestic) Tyler Union TUFGrip™ Series 2000 (TLP/PVC) Star Pipe Stargrip Series 4000
HDPE	Fusion Welded	No Restraints Required
HDPE	Mechanical	HDPE MJ Adapter w/ SS Stiffener

NOTES:
1. Concrete thrust blocks shall not be allowed unless approved in writing by the owner.
2. Except for PVC Push-On joint restraints, split split-design mechanical thrust restraints shall only be considered for adding restraint to existing DI and PVC pipes.
3. Bolts and nuts for mechanically restrained joints shall be hot dipped galvanized, low alloy, high-strength steel. All-thread rods and associated washers and nuts for restrained joints shall be Type 304 Stainless Steel.

B. Restraining Gaskets and Mechanical Thrust Restraints Execution

Restraining gaskets and/or mechanical thrust restraints shall be used to provide resistance to thrust forces generated in pressurized pipelines at all valves, bends, tees, reducers, and caps or plugs. The length of restrained pipe on each side of the valve and/or fitting shall be sufficient to provide adequate resisting force to prevent separation of the pipe joints and fittings.

The minimum number of restrained joints required for resisting thrust forces shall be determined by the pipe size, material, type of valve or fitting, operating conditions, pipe trench, and soil type. Minimum restrained lengths for many typical applications are provided in the tables below, which have been calculated for various pipe material and fittings based on the following minimum design parameters:

Soil Designation: Good Sand (Unified Soil Classification: Type SM)
Safety Factor: 1.5
Trench Type: Type 3
Depth of Bury: 3 Feet
Test Pressure: 150 PSI

Any variations from the minimum restrained lengths provided in the Standard Construction Details and the design parameters above shall be requested in writing by an active Florida Licensed Professional Engineer, in good standing with Florida Board of Professional Engineers. Such requests shall include suggested changes to design parameters, supporting documentation, and new restrained length calculations, signed and sealed by the Professional Engineer.

Where concrete thrust blocks are required in addition to, or in lieu of, restraining gaskets and/or mechanical restraints, thrust blocks shall have a load bearing area sufficient to resist the thrust forces at all valves and pipe fitting. Thrust forces shall be calculated using the same design criteria as for restrained lengths above. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Joints shall be protected by felt roofing paper or plastic sheeting prior to placing concrete thrust block.

C. Contractor shall submit type and method of restrained joints to Engineer for approval prior to use.

D. Thrust Restraint Tables

3.7 SERVICE TAPS

A. All tapping shall follow manufacturer's recommended procedures. Taps will be located at 10:00 or 2:00 on the circumference of the pipe. Direct taps will be allowed only on ductile iron pipe. All other materials will be tapped with a saddle. Teflon tape for sealing and lubricating will be used on the threads of all corporation stops. Torque on corporation stops will not exceed manufacturer's recommendations. Allowance for any possible movement in the main will be made by making a half loop in the service piping at the tap and compacting backfill to 100 percent standard proctor under this loop.

3.8 SERVICE LATERALS

A. Water Service laterals shall be continuous with no joints from the water main to the water meter unless specifically allowed by the Engineer. However, in no case will joints be allowed under roadways.

B. Laterals may be installed by the open trench method except for paved areas. Under paved areas service laterals shall be installed by the dry-uncased boring method unless otherwise specifically indicated on the plans.

C. The dry-uncased boring method or "push-pull" method shall be used to eliminate the need for open cutting of streets or sidewalks. The Contractor shall use equipment specifically designed for this purpose such as the Mighty Mole or the Trojan Workhorse Pusher. The push rod shall be of the size compatible with the service lateral. The rod shall be pushed under the paved area and then the pipe attached and pulled back through. The pits for the operation shall be no closer than 3 feet to the edge of payment. In no case shall a wet boring method be allowed.

3.9 PRESSURE AND LEAKAGE TESTS OF WATER DISTRIBUTION PIPING

A. Piping Tests: PVC water mains shall be installed, pressure and leak tested in accordance with AWWA Standard C605 and Ductile Iron water mains in accordance with AWWA C600. Conduct piping tests before joints are covered and after restraints have been installed, or approved concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

C. Contractor shall furnish all gauges, meters, pressure pumps, equipment, fittings, and labor needed to test the line. The cost of these items shall be included in price of pipe. Contractor shall notify Engineer 48 hours prior to start of test. All pipe installed shall be tested and written acceptance issued by the Engineer prior to connection of new line to existing water system. The pressure test shall include service lines to the curb stop if applicable.

D. The Contractor may test the system with joints exposed or backfilling complete at his option. The contractor shall obtain and pay for all water used. Care shall be used to prevent backflow of test water into potable water source. Potable water source shall be disconnected prior to pressurizing test line. Water used during test shall be taken from a container, not directly from the existing water system.

E. The pressure required for the field hydrostatic pressure test shall be 150 psi. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure. Corporation cocks at least 3/4 inches in diameter, pipe risers and angle globe valves shall be provided at each pipe dead-end and high points in order to bleed air from the line. Duration of pressure test shall be at least two hours. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines which fail to meet tests

shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe lines shall be tested in such section as may be directed by the Engineer by shutting valves or installing temporary plugs as required. The line shall be filled with water, all air removed, and the test pressure shall be maintained in the pipe for the entire test period by means of a gasoline or electric driven test pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.

F. No pipe installation will be accepted until or unless the leakage (evaluated on a pressure basis of 150 psi) is less than 2.2 gallons per 24 hours per thousand feet per inch nominal diameter. The following tabulates the allowable leakage.

Allowable Leakage Per 1000 ft of Pipeline (In Gallons)

Duration of Test	Nominal Pipe Diameter							
	2"	3"	4"	5"	6"	8"	10"	12"
1 hour	0.18	0.28	0.37	0.46	0.55	0.74	0.92	1.10
2 hour	0.38	0.56	0.74	0.92	1.10	1.48	1.84	2.20

G. Where any section of a main is provided with concrete reaction backing the hydrostatic pressure test shall not be made until at least five (5) days have elapsed after the concrete reaction backing was installed. If high early-strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least three (3) days have elapsed.

H. Prepare reports of testing activities.

3.10 FLUSHING OF COMPLETED PIPELINES

A. Following the hydrostatic test and backfilling, each section of completed pipeline shall be as thoroughly flushed as possible. A minimum flow shall be used for flushing that will insure a velocity in the pipe of 2.5 feet per second. Water required for testing and flushing shall be furnished by the Contractor. The water shall be from a potable water source satisfactory to the Owner.

3.11 DISINFECTING POTABLE WATER PIPELINES

A. Following flushing, the Contractor shall disinfect all water distribution mains and service lines in accordance with AWWA Specification C651-86 and with the State of Florida Health Standards. Water shall be fed slowly into the system applying sufficient chlorine to produce a dosage in excess of 50 ppm at the farthest point in the system from the point of application. The chlorine solution then shall be retained in the line for a minimum period of 24 hours. At the end of this time if a minimum chlorine residual of 5 ppm is not obtained, the procedure shall be repeated. During the disinfection process all valves shall be operated. After disinfection, the water shall be flushed from the system at its extremities until excessive chlorine residuals are eliminated. The water shall also be flushed through the service lines. The lines shall then be refilled with potable water. Bacteriological sampling and analysis of the replacement water shall be taken by the

Contractor as directed by the Engineer or County Health Department and submitted to the nearest approved bacteriological laboratory. Disinfection shall not be considered satisfactory until laboratory reports are satisfactory to the Division of Health and clearance granted by F.D.E.P. Each sample point shall have two consecutive passing tests taken no less than 24 hours apart.

B. For water main sections less than 200 feet in length, a minimum of 2 bacteriological sample points shall be tested, one from each end of the pipe section. For water main sections greater than 200 feet in length, a minimum of 3 bacteriological sample points shall be tested, one at each end and one near the midpoint of the section of pipe. But in no case shall less than one bacteriological sample point be tested for each 300 lineal feet of pipe.

C. Water required for disinfection, testing and flushing shall be furnished by the Contractor. The water shall be from a potable water source satisfactory to the Owner. All cost associated with disinfecting including the cost of the water shall be included in the unit cost of the pipe and no separate payment will be made for this item.

D. Contractor shall not make any connection to existing water system nor place any water line in operation until all pressure and bacteriological test have been successfully completed and written authorization issued by the Engineer with clearance granted by F.D.E.P.

E. NOTE: H.T.H. should be applied at a rate of 0.7 pounds per 1000 gallons. Calcium hypochlorite tables (H.T.H.) containing 70 percent available chlorine may be used when water mains are 12 inches and smaller and lengths up to 2,500 feet. The water main shall be disinfected with a concentration of 50 PPM chlorine. The H.T.H. tablets shall be glued with a #1 Permatex. They shall be placed one foot from the end of the top innerside of the pipe. The following table was computed with 20 feet joints of pipe.

4" pipe use 1 H.T.H. tablet or 0.5 lb. per 1000 feet of pipe
6" pipe use 2 H.T.H. tablets or 1.0 lb. per 1000 feet of pipe
8" pipe use 3 H.T.H. tablets or 1.8 lb. per 1000 feet of pipe
10" pipe use 5 H.T.H. tablets or 3 lb. per 1000 feet of pipe
12" pipe use 7 H.T.H. tablets or 4.1 lb. per 1000 feet of pipe

F. Tablets shall be placed in each section of pipe, fire hydrants, and hydrant branches.

3.12 RESTORATION OF DAMAGED SURFACES, STRUCTURES AND PROPERTY

A. Where pavement, trees, shrubbery, fences or other property and surface structures not designated as pay items, have been damaged, removed or disturbed by the Contractor whether deliberately or not, such property and surface structures shall be replaced or repaired at the expense of the Contractor to a condition equal to that before work began within a timeframe approved by the Engineer.

END OF SECTION 330266

SECTION 33 02 73 – SANITARY SEWERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work includes furnishing all labor, materials, equipment and incidentals necessary for the complete installation of all gravity sewer lines, manholes, fittings and appurtenances as shown on the drawings and as specified herein.

1.2 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

A. The work under this contract shall be in strict accordance with the following codes and standards:

1. Local, county and municipal codes;
2. American Society for Testing Materials (ASTM);
3. American National Standards Institute;
4. Southern Building Code - Standard Plumbing Code; and
5. Florida Department of Environmental Regulation. (FDER)

1.3 CONTRACTOR LICENSE

A. Contractor and Subcontractor shall possess valid licenses required by state and local codes. All sewer main work shall be performed by a State of Florida licensed Underground Utility Contractor. All plumbing work on private property shall be performed by a plumber licensed in the local community or county of the job site.

1.4 SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings shall be submitted for items included under this Section and shall include the following minimum information:

1. Full details of pipe, fittings, special joints, and assembly thereof, including manufacturer's name;
2. Joint materials and details;
3. Catalogue cuts, dimensions, full details and loading capacity of manhole frames and coverings;
4. Certifications as specified herein; and
5. Reinforcing steel bending and setting drawings.

B. At the Engineer's option, furnish sworn certificates that all tests and inspections required by the Specifications under which the materials were manufactured have been satisfied.

1.5 RELATED WORK

- Earthwork

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

A. Unless otherwise specified or shown on the drawings, materials and equipment shall be the standard product of a manufacturer and shall comply with the Contract Documents and applicable standards for such materials or equipment.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to ANSI A21.51. Ductile iron shall have a minimum tensile strength of 60,000 psi with a minimum yield strength of 42,000 psi. Thickness of pipe to be supplied shall be one class greater than that required under Table 50.12 AWWA C150 (ANSI 21.50) and not less than Class 51 unless specifically called out on the Drawings.

B. Pipe shall be supplied in lengths not in excess of a nominal 20 feet. Pipe shall be rubber-ring type push-on joints.

C. All ductile iron pipe fittings shall be cast iron or ductile iron. Fittings shall meet the requirements of ANSI Specifications as applicable. Rubber gasket joints shall conform to ANSI A21.11 for push-on joints.

D. Ductile iron pipe shall be coated inside with a polyethylene liner and on the outside with a bituminous coating to a dry film thickness of at least 1.0 mils in accordance with ANSI A21.51. The polyethylene liner materials shall be virgin polyethylene complying with ASTM Designation D1248 compounded with sufficient additives to resist ultraviolet rays during aboveground storage of the pipe. The polyethylene shall be fused to the interior of the pipe by heat forming a tightly bonded lining a minimum of 20 mils thick extending from the spigot end to the barrel socket. A two-part epoxy liner may be used in lieu of the polyethylene liner with the Engineer's prior approval.

2.3 POLYVINYL CHLORIDE PIPE

A. Gravity sewer lines and laterals shall be polyvinyl chloride pipe and shall conform to ASTM Designation D-3034. Pipe shall be SDR-26.

B. Joints shall be of the bell and spigot type with rubber sealing ring in accordance with ASTM D-3212. The bell shall consist of an integral wall section with a solid cross section rubber ring factory-assembled.

C. Fittings installed in polyvinyl chloride pipe lines shall conform to the same specifications as the pipe line in which they are installed.

D. In addition to the requirements of ASTM specifications, the pipe shall not be out-of-round or crooked in alignment as determined by the Engineer. Any length of pipe in sizes 6-inch through 12-inch diameter whose inside diameters measured at right angles to each other vary more than 1/8-inch may be rejected.

E. Material shall meet or exceed the requirements of ASTM Designation 1784, Type 1, Grade 1 (12454-B). All PVC materials shall be stored in accordance with the manufacturer's specifications (not in direct sunlight). PVC pipe and fittings which show signs of ultraviolet degradation will be considered substandard and unfit for use.

F. All wyes, fittings, laterals and manhole couplings shall be manufactured by the pipe manufacturer. No saddles will be allowed for new pipe or as determined by the Engineer. Adapters shall be suitable for pipe supplied. All joints shall be rubber gasket. Asbestos cement manhole couplings will not be allowed.

2.4 PRECAST CONCRETE MANHOLES

A. Precast concrete manhole base, barrel, and eccentric top sections shall conform to Specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C-478, except as otherwise specified below.

B. The minimum wall thickness for the various size barrel sections shall be 5 inches.

C. Barrel sections shall have tongue and groove joints, with "Ram-Nek" as manufactured by the K.T. Snyder Company, Houston, Texas, or approved equal; or O-ring gaskets set in preformed indentations conforming to ASTM C-443 standard specifications, or Federal specification SS-S-0210 (GSA-FSS).

D. Concrete shall conform to ASTM C-94, Type II cement, with a compressive strength of 4,000 psi. Mortar shall be composed of one part cement to two parts sand.

E. The date of manufacture and the name of the manufacturer or trademark shall be clearly marked on the outside of each precast section when the form is removed and on the inside after painting. Sections shall be cured by an approved method for at least 2 days prior to painting and shall not be shipped until at least 2 days after having been painted. Sections shall not be shipped until at least 7 days after removal from the forms.

F. Top sections shall be eccentric cones, except where cover over the top of the pipe is less than 4 feet and these manholes shall have vertical walls with a flat precast concrete slab top. Precast concrete slabs over top section, where required, shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading. The tops of bases shall be suitably shaped to mate with the precast barrel section.

G. The interior and mating surfaces of the manhole shall be coated with a heavy duty coal tar epoxy coating containing not less than 72.9% by volume nonvolatile solids, approved equal to (or superior to) Koppers 300-M. This coating shall consist of a primer as specified by the manufacturer and a top coat for a total minimum thickness of 16 dry mils.

H. Top of cone shall be set between 3 inches and 18 inches below bottom of manhole cover frame. It is the intent of Specifications to provide a minimum of 3 inches to accommodate future grade changes without disturbing manholes. Riser unit sections shall be used to bring the top of the cone within the required 18 inches. The remaining distance between the top of the cone and the bottom of the cover frame shall be mortared and bricked if the distance is less than 6 inches. If the distance is between 6 and 18 inches, precast leveling rings shall be used. The leveling rings shall be a minimum of 2 inches thick and have at least one continuous #3 reinforcing bar. Leveling rings shall not be used for more than 18 inches vertical adjustment.

I. Where pipes enter or exit manholes, a "Kor-N-Seal" molded neoprene boot with stainless steel internal and external bands as manufactured by the National Pollution Control Systems, Inc., Nashua, New Hampshire, or a polyurethane joint with a short transition joint as manufactured by Mooreform Corporation, Centralia, Illinois, or an approved equal (or superior) connection shall be provided.

J. Manholes with precast invert channels formed directly into a precast concrete manhole base shall be used except at junctions with existing mains, in which case, cast-in-place manhole bases shall be used. The floor outside the channel shall be smooth and sloped downward toward the channel. The unit shall be of the Moore Base Design as manufactured by Mooreform Corporation, Centralia, Illinois, Tru-Contour as manufactured by A-LOK Products, Inc. 697 Main Street, Tully Town, Pennsylvania, or an approved equal or superior unit.

K. Manholes shall include manufacturer provided steps. Manhole steps shall be aluminum or plastic, ASTM C-478, grouted in place using Embeco 167 mortar or other approved method. Steps will be placed over the downstream side of the manhole.

L. All precast sections shall be case with non-penetrating lifting inserts. Approved: A-Lok Products Corp., Tullytown, Pennsylvania 19007.

2.5 MANHOLE FRAMES AND COVERS

A. Manhole frames and covers shall be gray or ductile cast iron, free from cracks, holes and cold shuts, and shall conform to ASTM A48-83 Class 40 for gray iron castings or ASTM A 536, Grade 60-45-12, for ductile iron castings. Frames and covers shall conform to details shown on the drawings including lettering. Bearing surfaces shall be machined to provide even bearing surfaces or shall have a non-rocking feature. Frames and covers shall be designed to withstand an HS 20-44 loading as defined in AASHTO Specifications.

2.6 MANHOLE PICK

A. Contractor shall furnish Owner with two manhole picks of the type recommended by the manhole frame and cover manufacturer to allow ease of removal of cover. Contractor shall submit cut sheet of manhole pick for Engineer's approval prior to delivery. Cost of manhole picks shall be included in the price of the manhole.

2.7 NONSHRINK GROUT

A. Grout shall be inorganic, non-shrink, nonmetallic type grout similar to Thoroseal or equal. Grout shall be placed with a tamping stick to ensure complete filling in holes and space around pipe.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Safety:

1. The Contractor use of streets and highway for the work to be done under these Specifications he shall conform to all City, State and local laws and regulations. The Contractor shall provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways for protection of the work and safety of the public. Rights-of-way shall be provided with lights which shall be kept burning at all times between sunset and sunrise. The Contractor shall be responsible for all damages resulting from any neglect or failure to meet these requirements. Where conditions require the presence of a watchman to fulfill the requirements stated herein, same shall be furnished without extra cost to the Owner.

B. Maintenance of Service:

1. The Contractor shall arrange his work to cause minimum disturbance of normal pedestrian and vehicular traffic and will be held responsible for providing suitable means of access to all public and private properties during all stages of the construction. Should the construction work require repairs, changes or modifications of other utilities, it shall be the responsibility of the Contractor to provide for the maintenance of continuous water, electric, telephone, and gas as well as sewage and other utility services to all present customers of such utilities, unless approval in writing is secured from the utility company for interruption of such service.

C. Limits of Construction:

1. In locations where the work is to be installed in streets or road rights-of-way the activities of the Contractor shall be confined to these public properties. Where the use of private property is deemed necessary by the Contractor to facilitate construction work arrangement for such use with the property Owner shall be the responsibility of the Contractor. The Contractor shall save the Owner harmless from all claims by adjacent property owners from trespassing or damage due to the activities of the Contractor in the

prosecution of the work.

D. Existing Utilities:

1. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.
2. All existing improvements such as pavements, conduit, poles, pipes and other structures, shall be carefully supported and fully protected from injury. The Contractor shall be responsible for damages to these existing utilities and shall, in case they are damaged, restore them to their original condition at no cost to the owner.
3. Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of work. This can be accomplished by making the appropriate contact with the utility companies indicated on the plans.

E. Backfill for pipes, structures, and roadways: All trenching, backfill, earthwork, and compaction testing shall be in accordance with Section 02200 Earthwork and other applicable sections.

3.2 MANHOLE INSTALLATION

A. Manholes shall be pre-cast with pre-cast invert channels except cast-in-place manhole bases may be used when connecting to existing mains.

B. Manholes constructed over existing sanitary sewers shall be installed in a manner such that wastewater flow is not interrupted. Care shall be taken in excavating for the manhole so that the existing line is not broken or disjointed in such a way that sewage leakage occurs. Only after the new line has been approved by Engineer shall the existing line be cut into in such a way that a smooth invert may be grouted forming the transition between the new pipe and the existing pipe that is to remain in service. The pipe to be abandoned shall be plugged with grout and bricks to form a watertight plug extending a minimum of 3 inches beyond the outside face of the manhole wall.

C. Manholes are to be constructed completely water tight except for the cover. Any water infiltration will cause the manhole to be unacceptable.

D. Manhole invert elevations shall not deviate more than 0.20 feet from design elevations; manhole top elevations no more than 0.5 inches in pavement areas and 2.0 inches elsewhere from design elevations. Center line of manhole ring & cover shall not deviate more than 18" from designed horizontal location. Top elevations shown on the plans are approximate. Manhole tops shall be 1 inch above the finished ground or flush with finished pavement.

E. Set precast concrete sections vertical and in true alignment. Install O-ring rubber gasket in the recess in the base of previously set section or prime and double seal joint surfaces with "Ram-Nek" pre-molded plastic joint sealer or approved equal.

F. Completely plug seal and smooth all holes in sections used for their handling and the annular space between the wall and entering pipes with nonmetallic, non-shrink grout. Finish grout smooth and flush with the adjoining interior and exterior manhole wall surfaces and make watertight.

G. Manholes located within the limits of proposed street paving are to be constructed a minimum of

1.0 feet below proposed finished street grade as shown by the Plans. After street base course is completed, the base is to be cut around the manhole and removed, the manhole cover is to be adjusted to conform to the finished street grade, and the excavated area backfilled with concrete (8:1 sand-cement mix to within 8 inches of the finished base grade and 2,800 psi concrete for the top 8 inches troweled to conform to finished base grade). Cost of adjustment is to be included in the manhole price.

H. Set manhole frames and lids to conform accurately 1.0 inch above the finished ground or flush with finish pavement as shown or as directed by the Engineer. Set frames on manholes concentric with the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flanges of the frame will be completely filled and made watertight. Place a ring of mortar around the outside of the bottom flange at least 1 inch thick and pitched.

3.3 GRAVITY SEWER LINE INSTALLATION

A. Gravity sewer lines shall be laid according to the details shown on the drawings or specified herein, and according to applicable portions of ASTM Designation D-2321, Underground Installation of Flexible Thermoplastic Sewer Pipe. Ductile iron pipe shall be installed in accordance with the requirements of Section VII of the Handbook of Ductile Iron Pipes, 4th Edition. The type of bedding to be used shall be as shown on the drawings, specified herein, or as directed in writing by the Engineer.

B. Sewer mains shall be laid by use of a laser beam directed along the interior of the pipe. The laser equipment shall be of the type specifically designed for such use. The sewer main shall at all points be within 0.1+ feet of the vertical design elevation and be within 0.2+ feet of the horizontal design location.

C. The trench bottom shall be graded to the proposed elevation of the pipe line and the bottom shaped to fit the lower quadrant of the pipe unless special bedding material is required. Holes shall be excavated at each bell so that pipe is uniformly supported along the entire length of the barrel only and not the bell. Pipe bedding shall be as described in Section "Earthwork".

D. The storage of pipe on the job site shall be done in accordance with pipe manufacturer's recommendations and with the approval of the Engineer. Pipe shall be protected during handling against impact shocks and free fall. Pipe laying shall not precede backfilling by more than 100 feet without approval from the Engineer.

E. The laying of the pipe in finished trenches shall be commenced at the lowest point, with the spigot ends pointing in the direction of flow. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash before installing in the line. Extreme care must be taken to keep the bells of the pipe free from dirt and rocks so that joint may be properly assembled without overstressing the bells. The jointing of the pipe shall be done in strict accordance with the pipe manufacturer's instructions and shall be done entirely in the trench.

F. Each time the work on the sewer is halted for more than one hour, the ends of the pipe shall be sealed to prevent foreign material from gaining entrance to the pipe.

G. Concrete encasement shall be used where indicated on the drawings. In all cases where sewer mains cross water mains with minimum clear distance between top of sewer and bottom of water main of less than 18 inches, sewer shall be ductile iron pipe or 6-inch thick concrete encased PVC ASTM D-3034 for a distance of 10 feet to either side of point of crossing. Dimensions of encasement or of cradles shall conform to those shown on the drawings. Each pipe shall be supported on brick at two points to allow minimum thickness of concrete to be placed under pipe. Concrete shall be placed carefully around and over pipe to avoid displacement or floating of pipe. Trench shall be dewatered properly before placing of concrete. Backfill shall not be placed over

a concrete cradle or arch until 24 hours after pouring unless authorized by the Engineer.

H. Joint seals in polyvinyl chloride pipe and fittings shall comply with ASTM Designation D-3212. Laying instructions of the manufacturer of the pipe and joint shall be followed explicitly. Any pipe having defective joint surfaces (bell and spigot) shall be rejected.

3.4 LATERAL INSTALLATION

A. A lateral connection shall be provided where indicated on the plans, or as identified in the Plumbing plans. Location of lateral connections are shown in the Plumbing plans.

B. Service connections shall be as shown on the drawings and adequately sealed with plugs or caps prior to beginning tightness tests. Six inches of crusher-run gravel or bedding rock shall be placed in front of the plugs or caps and over the top of the last 3-feet of pipe laid.

C. The Contractor shall maintain a record of service connection locations in conjunction with the "As-Built Plans" and, upon completion of work, shall furnish a copy of record to Engineer. The record shall include (1) location of wye branch and end of sewer connection referenced to next downstream manhole of each run, (2) offset of end of service as referenced from center line of main sewer pipe, (3) depth at end of service, and (4) distance from service end to nearest lot corner (reference lot corner shall be clearly indicated on the record). End of service pipe shall be marked with a 3'-0" minimum length of #4 rebar buried underground directly over end of service and extending to one inch above ground.

D. Service connections shall be constructed perpendicular to the sewer, unless otherwise indicated on a straight line and a constant grade of not less than 2 percent (1/4 inch per foot) and not greater than 100 percent (i.e., 45 degrees from horizontal). Riser piping is not acceptable.

E. No special fittings shall be used for a service connection constructed from a manhole. Service lines from manholes shall have crown elevation of service pipe matching that of effluent sewer. A shaped invert shall be provided from the wall of the manhole to shaped invert of main sewer.

F. When installing service connections on existing sewer mains not having wyes or tees, the Contractor shall install tapping tees or saddles. The opening in the sewer main shall be cut using a diamond tipped power driven cutter for clay pipe or a saw of the type recommended by the manufacturer of PVC pipe. Tapping tees or saddles shall be installed using an epoxy type jointing compound provided by the saddle manufacturer and stainless steel bands.

3.5 INSTALL FORCE-MAIN, PRESSURE PIPING ACCORDING TO THE FOLLOWING:

1. Install piping with restrained joints at all fittings, and at horizontal and vertical changes in direction according to the tables under 3.6 Restrained Joints in Section 33 02 66. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
2. Install piping with 36-inch minimum cover.
3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
4. Install ductile-iron special fittings according to AWWA C600.
5. Install PVC pressure piping according to AWWA M23 or to ASTM D2774 and ASTM F1668.
6. Install PVC water-service piping according to ASTM D2774 and ASTM F1668.

3.7 TESTING

A. General:

1. All sanitary sewers installed under this contract shall be tested for tightness, deflection,

and alignment. All service laterals from the main to the right-of-way line shall be included in the tightness test. Sanitary sewers will not be accepted by the Owner until the sewers have been tested and do in fact meet the criteria stated. All test shall be conducted by the Contractor in the presence of the Engineer. Contractor shall notify Engineer 48 hours prior to test. Contractor shall furnish all gauges, meters, pressure pumps, equipment fittings, and labor needed to test the line. The cost of these items shall be included in the installation price of pipe. Generally, the sewers will be tested from manhole to manhole. It is recommended the test be conducted on each section as soon as that section is complete in order to detect potential problems on future sections. All lines which fail to meet these tests shall be repaired and retested as necessary, until test requirements are met. The Engineer reserves the right to require the Contractor to test the first section between the manholes laid by each pipe crew under this contract.

B. Tightness Test (Low Pressure Air Test):

1. It is critical that the sewer system be constructed in a water tight fashion in order to eliminate infiltration and exfiltration. All sewer mains, laterals, and manholes shall be visually inspected. Any observed indications of infiltration shall require the Contractor to determine the source and make the necessary corrections. In addition, the sewer mains and laterals shall be subject to a low pressure air test to be performed in the following manner:

   a. The Contractor shall have completed to installation of the sewer main section including the associated manholes and laterals. The laterals shall have been installed to right-of-way and a temporary air tight plug installed. In order to locate leaks, backfill operations need to be complete only to one foot above the top of pipe. At the Contractor's option and risk additional backfill may be added prior to the test.

   b. The Contractor shall clean and remove all debris, silt, earth or other material from the sewer prior to testing. The sewer shall be flushed with water by the Contractor. None of this water or debris shall be allowed to enter the existing sewer.

   c. Equipment specifically designed for low pressure air testing of sewer pipe shall be used and the Contractor shall supply the Engineer with such information so as the Engineer may be reasonable assumed the equipment is property functioning and calibrated.

   d. Test plugs shall be installed in the pipe at the upstream and downstream manholes.

   e. In order to compensate for groundwater table, all gauge pressures listed herein shall be increased by adding 0.5 psi for each foot of groundwater depth above the invert of the pipe.

   f. Air shall be added slowly to the test portion of the pipe until the internal air pressure is raised to 4.0 psig. A stabilization time of 5 minutes will be used to allow entering air to equalize with the temperature of the pipe wall.

   g. At the end of the stabilization time, the internal air pressure shall be observed, and the time required for the pressure drop from 3.5 to 3.0 psig recorded. The minimum time allowed for this 0.5 psi pressure drop for 8 inch main with laterals shall be 5 minutes for manholes spaced less than 300 feet apart and 6 minutes for manholes spaced between 300 and 400 feet apart. For pipe sizes differing from this established standards shall be used.

h. Should testing on any sections of pipe line disclose an air loss greater than that permitted, the Contractor shall repair the defective area at his own expense. Following corrections, the sewer shall be tested again.

C. Tightness Test (Infiltration):

1. All sewer mains shall be subject to infiltration test. The test consists of observing and measuring the groundwater infiltration into the new sewer main. The maximum allowable infiltration rate for any section of sewer main shall be 4 gallons per 1,000 lineal feet of sewer main per hour. (This allowance takes into account service laterals and is based upon the standard 50 gallons per inch of diameter per mile per day). The Contractor shall conduct the infiltration test in the presence of the Engineer prior to the acceptance of the sewer main.

2. All manholes shall be inspected for infiltration. Visual inspection of manholes 24 hours after backfilling and compaction are complete shall indicate no leakage into the manhole when groundwater is present. When groundwater is not present, each manhole shall be sealed at each pipe penetration and filled with water to a level above the last joint. This level shall be marked and the manhole shall be re-inspected after 4 hours. Any change in water level shall be indication of infiltration and further inspection and repair of the leakage shall be completed.

D. Deflection Test (Mandrel Test):

1. After the completion of all backfilling operations on a section of sewer main, a deflection test shall be conducted to determine the out-of-roundness of the pipe. The maximum allowable deflection shall be 5%. The test shall consist of passing a 5% deflection mandrel through the entire length of the pipe without the mandrel becoming stuck nor requiring the use of excess force. For 8 inch pipe the mandrel shall have a minimum diameter of 7.2 inches. The mandrel may be floated through the pipe using clean water but must be attached to a string of sufficient strength to allow it to be retrieved if it becomes stuck. This test may be performed in conjunction with pipe flushing.

E. Alignment Test (Lamp Test):

1. After the completion of all backfilling operations on a section of sewer main an alignment test shall be conducted. After the pipe is flushed, a high beam 12 volt lamp with lamp diameter of the approximate size of the pipe diameter shall be placed at one end of the section of pipe. A hand mirror shall be used at the opposite end of the pipe to observe the light. The full diameter of the pipe/light shall be visible when viewed between the consecutive manholes. If less than 1/2 of the pipe/light diameter can be observed, the alignment is unacceptable.

3.7 CLEANING

A. At the conclusions of the work, the Contractor shall thoroughly clean all of the pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest outlet. Debris or water from the lowest outlet shall not be introduced into the Owner's sewage collection system. If, after this outlet cleaning obstructions remain, they shall be removed. After the pipe is cleaned and if the groundwater level is above the pipe, or following a heavy rain, the Engineer will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired by the Contractor.

END OF SECTION 330273

SECTION 33 02 75 – STORM DRAINAGE CULVERTS AND STRUCTURES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and install in the locations as shown on the Drawings, the drainage pipe, precast concrete manholes, headwalls, and appurtenances as specified herein.

B. All drainage culverts and structures shall be manufactured and installed in accordance with details included herein, and as shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Earth Work, Section 310220.

B. Concrete Work - General, Section 030320.

C. Precast Concrete Storm Drainage Structures, Section 330341.

1.3 QUALIFICATIONS

A. All drainage culverts and structures shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the manufacture of items to be furnished. The culverts and structures shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications and the Florida Department of Transportation Specifications.

1.4 REQUIREMENTS

A. All work in this section shall meet requirements and recommendations of applicable portions of standards listed. In cases of conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.

1. American Association of State Highway and Transportation Officials
2. Florida Department of Transportation (FDOT) Standard Specifications for Road & Bridge Construction

1.5 SUBMITTALS

A. Submit to the Engineer for approval shop drawings showing details of construction, reinforcing, joints, and pipe/wall connections.

1.6 INSPECTION

A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer, or other representative of the Owner. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though a sample section may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections which have been damaged

after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.

B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified below and these Specifications, and with the approved manufacturer's drawings.

C. Imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval.

PART 2 - MATERIAL & DESIGN

2.1 DRAINAGE CULVERTS

A. Type of Pipe to be used will be designated in the plans or in the bid proposal. If the type of pipe is not designated and only the term "culvert' or "pipe" is used then the contractor may chose from the following alternate types:

1. For side drain pipe, unless the use of a particular type (or types) is so provided for, the type to be used may, at the Contractor's option, be either concrete pipe, corrugated steel pipe, corrugated aluminum pipe, or corrugated polyethylene pipe. The particular type selected, however, shall be used throughout the project, unless otherwise allowed.
2. For gutter drain pipe, unless a specific type is shown in the plans, the type to be used may, at the Contractor's option, be corrugated polyethylene, corrugated steel or corrugated aluminum pipe.
3. For cross drain pipe, the Contractor, at his election, may use either concrete pipe, bituminous--coated corrugated steel pipe or corrugated aluminum pipe.
4. For ditch closures and similar applications, any of the alternate side drain pipe types may be used unless the use of a particular type is specified.

B. Concrete Pipe shall meet the requirements of Section 449, FDOT Standard Specifications for Road & Bridge Construction.

C. Corrugated Steel Pipe and Pipe Arch shall meet the requirements of Section 943, FDOT Standard Specifications for Road & Bridge Construction.

D. Corrugated Aluminum Pipe and Pipe Arch shall meet the requirements of Section 945, FDOT Standard Specifications for Road & Bridge Construction.

E. Cast Iron Pipe shall meet the requirements of Section 946, FDOT Standard Specifications for Road & Bridge Construction.

F. Corrugated Polyethylene Pipe shall meet the requirements of Section 948-2, FDOT Standard Specifications for Road & Bridge Construction.

G. Gaskets shall meet the requirements of Section 942, FDOT Standard Specifications for Road & Bridge Construction.

H. Unless specifically stated in the plans, Asbestos-Cement Pipe and Bituminized-Fiber Pipe shall not be used.

2.2 DRAINAGE STRUCTURES

A. Concrete structures shall meet the requirements of Section 400, FDOT Standard Specifications for Road and Bridge Construction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All drainage culverts and structures shall be installed in accordance with FDOT Standards and Specifications for Road & Bridge Construction, specifically Sections 425 and 430.

B. Earthwork, backfill, land compaction requirements shall be in accordance with Section 310220.

END OF SECTION 330275

SECTION 33 02 93 – STORM WATER POLLUTION PREVENTION PLAN

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section covers the storm water management practices that the Contractor shall employ in accordance with the NPDES permit governing storm water discharges during construction and in accordance with erosion control practices specified in other sections.

B. The Owner has petitioned the DEP for the storm water discharges during construction at this site to be covered by the NPDES General Permit for Construction Activity. A Notice of Intent (NOI) to be covered under this permit has been filed by the Owner. The Contractor is required to file a separate NOI at least forty-eight (48) hours prior to any earth disturbing activities.

C. The Contractor shall manage the discharge of storm water from the site in accordance with the NPDES permit and this document. The Contractor shall be responsible for conducting the storm water management practices in accordance with the permit. The Contractor shall be responsible for any enforcement action taken or imposed by Federal or State agencies, including the cost of fines, construction delays, and remedial actions resulting from the Contractor's failure to comply with the permit provisions.

D. The Contractor shall monitor the suitability of the designated management practices to achieve the storm water quality provisions of the permit, and shall notify the Owner of the need to change management practices. If changes are ordered by the Owner, an adjustment in Contractor's fee shall be considered in accordance with the General Conditions. However, the Contractor's failure to monitor or report deficiencies to the Owner will result in the Contractor being liable for fines and construction delays resulting from any Federal or State agency enforcement action.

PART 2 - CONTROLS

2.0 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings and this Stormwater Pollution Prevention Plan (SWPPP).

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

2.1 EROSION AND SEDIMENT CONTROLS STABILIZATION PRACTICES

Stabilization practices for this site include:

A. Land clearing activities shall be done only in areas where earthwork will be performed and shall progress as earthwork is needed.

B. Temporary seeding of all areas for which soil-disturbing activities have temporarily ceased for a period of more than 21 days will be commenced by the 14th day.

C. Permanent seeding and planting for vegetative establishment of all unpaved areas within 7 days where construction activities have permanently ceased.

STRUCTURAL PRACTICES

Structural practices for this site include:

A. Silt fence

B. Inlet protection and outlet protection

C. Storm sewer

2.2 SEQUENCE OF MAJOR ACTIVITIES

The general contractor will be responsible for implementing the following erosion control and storm water management control structures. The general contractor may designate these tasks to certain subcontractors as he sees fit, but the ultimate responsibility for implementing these controls and ensuring their proper functioning remains with the general contractor. The order of activities will be as follows (refer to the plans for details):

CONSTRUCTION SEQUENCE

1. Post all applicable permit placards. The permit placards shall not be nailed to trees.
2. Flag or stake the proposed limits of clearing prior to demolition commencement.
3. Contractor shall meet with Leon County Environmental Inspector prior to construction commencement.
4. Construct tree barricades or fences around protected trees in the vicinity of any vehicular traffic and as shown on the plans.
5. Designate vehicular pathways within the limits of the site.
6. Designate employee parking areas, materials storage areas, and topsoil storage areas.
7. Designate refueling areas away from the water bodies or watercourses onsite.
8. Construct sedimentation control devices.
9. Follow any requirements of notification prior to construction stated in the Environmental Management Permit.
10. Clear and grub site within the limits of clearing. Stabilization and additional erosion control measures will be required in areas where immediate construction is not taking place.
11. Remove topsoil from all areas of the site where improvements are to be constructed. Stockpile onsite for redistribution on slopes and shoulders.
12. Relocate all underground utilities, install storm drainage pipes required, rough grade road and construct all swales. Protect all storm drain inlets with hay bales and filter fences (per F.D.O.T. Index 102) until a permanent vegetative cover is established.
13. Construct all remaining improvements as indicated in the plans and specifications.
14. Clean out any sediment and debris from stormwater structures, as required.
15. Seed, fertilize and mulch all disturbed areas not paved or sodded with minimum 80% coverage of a perennial type ground cover within 90 days of planting. At least 75% coverage must be provided by a seasonal coverage within 30 days of planting.

STORM WATER MANAGEMENT

Grading and storm sewer will provide storm water drainage.

When construction is complete, all unpaved areas will be stabilized with vegetation consisting of either seed and mulch or grass.

2.3 OTHER CONTROLS

WASTE DISPOSAL

All waste materials will be collected and stored in accordance with all local and state solid waste management regulations.

SANITARY WASTE

All sanitary waste will be collected from the portable units a minimum of three times per week by a licensed portable facility provider in complete compliance with local and state regulation.

OFF-SITE VEHICLE

A stabilized construction exit will be provided to help reduce tracking of sediments. The paved street adjacent to the site entrance will be inspected daily and swept as necessary to remove any excess mud, dirt, or rock tracked from the site. Dump trucks hauling material from the construction site will be covered with a tarpaulin. The job site superintendent will be responsible for seeing that these procedures are as followed.

CONCRETE WASTE FROM CONCRETE TRUCKS

Emptying of excess concrete and/or washout from concrete delivery trucks will not be allowed on the job site. If such excess concrete and/or washout residue is found on the job site it will be cleaned up immediately and not allowed to come in contact with storm water discharges.

This residue will be disposed of in accordance with Part VII of this plan and all applicable state and federal regulations. The job site superintendent will be responsible for seeing that these procedures are followed.

HAZARDOUS SUBSTANCES AND HAZARDOUS WASTE

A. All hazardous waste materials will be disposed of in the manner specified by local, state, and/or federal regulations and by the manufacturer of such products. Site personnel will be instructed in these practices by the job site superintendent, who will also be responsible for seeing that these practices are followed. Material Safety Data Sheets (MSDS's) for each substance with hazardous properties that is used on the job site will be obtained and used for the proper management of potential wastes that may result from these products. An MSDS will be posted in the immediate area where such product is stored and/or used and another copy of each MSDS will be maintained in the SWPPP file at the job site construction trailer office. Each employee who must handle a substance with hazardous properties will be instructed on the use of MSDS sheets and the specific information in the applicable MSDS for the product he/she is using, particularly regarding spill control techniques.

B. The contractor will implement the Spill Prevention Control and Countermeasures (SPCC) Plan found within this SWPPP and will train all personnel in the proper cleanup and handling of spilled materials. No spilled hazardous materials or hazardous wastes will be allowed to come in contact with storm water discharges. If such contact occurs, the storm water discharge will be contained on site until appropriate measures in compliance with state and federal regulations are taken to dispose of such contaminated storm water. It shall be the responsibility of the job site superintendent to properly train all personnel in the use of the SPCC plan.

C. Any spills of hazardous materials which are in quantities in excess of Reportable Quantities as deemed by EPA regulations shall be immediately reported to the EPA National Response Center 1-800-424.8802.

D. In order to minimize the potential for a spill of hazardous materials to come into contact with storm water the following steps will be implemented.

1. All materials with hazardous properties (such as pesticides, petroleum products, fertilizers, detergents, construction chemicals, acids, paints, paint solvents, cleaning solvents, additives for soil stabilization, concrete curing compounds and additives, etc.) will be stored in a secure location, under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on the job site.

3. A spill control and containment kit (containing, for example, absorbent such as kitty litter or sawdust, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided at the storage site.

4. All of the product in a container will be used before the container is disposed of.

5. All products will be used in strict compliance with instructions on the product label.

6. The disposal of excess or used products will be in strict compliance with instructions on the product label.

CONTAMINATED SOILS

A. Any contaminated soils (resulting from spills of materials with hazardous properties) which may result from construction activities will be contained and cleaned up immediately in accordance with the procedures given in the Spill Prevention Control and Countermeasures (SPCC) Plan and in accordance with applicable state and federal regulations.

B. The job site superintendent will be responsible for seeing that these procedures are followed.

COMPLIANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS

The contractor will obtain copies of any and all local and state regulations which are applicable to storm water management and pollution minimization at this job site and will comply fully with such regulations. The contractor will submit written evidence of such compliance if requested by the Owner or any agent of a regulatory body. The Contractor will comply with all conditions of the NPDES General Permit for Construction Activities, including the conditions related to maintaining the SWPPP and evidence of compliance with the SWPPP at the job site and allowing regulatory personnel access to the job site and to records in order to determine compliance.

The owner has petitioned the appropriate regulatory agencies for authorization and recommended measures needed in dealing with endangered species located on the proposed site.

2.4 MAINTENANCE INSPECTION PROCEDURES

Erosion and Sediment Control Maintenance and Inspection Practices

A. The following is a list of erosion and sediment controls to be used on this site during construction practice.

I. Stabilization practices for this site include:

Temporary seeding
Permanent seeding and planting

2. Structural practices for this site include:

Stabilized construction exit(s)
Silt fences
Storm water Detention Ponds
Hay bales for storm sewer inlet and outlet protection.

B. The following inspection and maintenance practices will be used to maintain erosion and sediment controls.

I. All control measures will be inspected at least once each week and following any storm event of 0.25 inches.

2. All measures will be maintained in good working order. If repairs are found to be necessary, they will be initiated within 7 days of report.

3. Built up sediment will be removed from silt fence when it has reached one-third the height of the fence.

4. Silt fences will he inspected for depth of sediment, tears, to see if the fabric is securely attached to the fence posts, and to see that the fence posts are securely in the ground.

5. Temporary and permanent seeding will be inspected for bare spots, washouts and healthy growth.

6. A maintenance inspection report will be made after each inspection. A copy of the report form to be completed by the inspector is attached.

7. The job site superintendent will be responsible for selecting the individuals who will be responsible for these inspections, maintenance and repair activities, and tilling out inspection and maintenance reports.

8. Personnel selected for the inspection and maintenance responsibilities will receive training from the job site superintendent. They will be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment controls that are used onsite in good working order.

2.5 INSPECTION AND MAINTENANCE REPORT FORMS

Inspectors shall complete the forms provided in Appendix A when performing all inspections.

2.6 SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC) PLAN

MATERIALS COVERED

The following materials or substances with known hazardous properties are expected to be present onsite during construction:

Concrete Cleaning solvents
Detergents Petroleum based products
Paints Pesticides
Paint Solvents Acids
Fertilizers Concrete additives
Soil stabilization activities

MATERIAL MANAGEMENT PRACTICES

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff

2.7 GOOD HOUSEKEEPING

The following good housekeeping practices will be followed onsite during the construction project:

A. An effort will be made to store only enough product required to do the job.

B. All materials stored onsite will be stored in a neat, orderly manner and, if possible, under a roof or other enclosure.

C. Products will be kept in their original containers with the original manufacturer's label in legible condition.

D. Substances will not be mixed with one another unless recommended by the manufacturer.

E. Whenever possible, all of a product will be used up before disposing of the container.

Manufacturer's recommendations for proper use and disposal will be followed
The job site superintendent will be responsible for ensuring proper use and disposal of materials.

2.8 HAZARDOUS PRODUCTS

These practices will be used to reduce the risks associated with hazardous materials:

A. Products will be kept in original containers with the original labels in legible condition.

B. Original labels and material safety data sheets (MSDS's) will be procured and used for each material.

C. Product containers and any surplus product must be disposed of per manufacturer's or local/state/federal government recommended methods.

D. A spill control aid containment kit (containing, for example, absorbent such as kitty lifter or sawdust, acid neutralizing powder, brooms, dust pans, mops, rages, gloves, goggles, plastic and metal trash containers, etc.) will be provided at the storage site.

2.9 PRODUCT SPECIFIC PRACTICES

The following product specific practices will be followed on the job site:

A. Petroleum Products

All onsite vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers, which are clearly labeled. Any petroleum storage tanks used on site will be installed per all appropriate local/state/federal regulations. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.

B. Fertilizers

Fertilizers will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked in the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

C. Paints, Paint Solvents, and Cleaning Solvents

All containers will be tightly sealed and stored when not in use. Excess paint and solvents will not be discharged to the storm sewer system but will be properly disposed of according to manufacturer's instructions or state and federal regulations.

D. Concrete trucks will not be allowed to wash out or discharge surplus concrete or drum wash water on the site.

2.10 SPILL PREVENTION PRACTICES

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup.

A. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

B. Materials and equipment necessary for spill cleanup will be kept in the material storage area onsite in the spill control and containment kit (containing, for example, absorbent such as kitty litter or sawdust, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.)

C. All spills will be cleaned up immediately after discovery.

D. Spills of toxic or hazardous materials will be reported to the appropriate federal, state, and/or local government agency, regardless of the size of the spill. Spills of amounts that exceed Reportable Quantities of certain substances specifically mentioned in federal regulations (40 CFR 302 list and oil) will be immediately reported to the EPA National Response Center, telephone 1-800-424-8802. Reportable quantities of some substances which may be used at the job site are as follows:

1. oil-appearance of a film or sheen on water
2. pesticides usually 1 lb.
3. acids 5000 lb.
4. solvents, flammable 100 lb

OWNER CERTIFICATION

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Signed: _____ Position: _____

Printed Name: _____ Date: _____

CONTRACTOR'S CERTIFICATION

"I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification. Further, by my signature, I understand that I am becoming a co-permittee, along with the owner(s) and other contractors and subcontractors signing such certifications, to the general NPDES storm water permit for the storm water discharges associated with industrial activity from the identified site. As a co-permittee, I understand that I, and my company, are legally required under the clean Water Act, to ensure compliance with the terms and conditions for the Storm water Pollution Prevention Plan (SWPPP) developed under the NPDES storm water permit and the terms of the NPDES storm water permit."

Signature:	Company Name:	Responsible For:

PROPOSED SCHEDULE OF WORK ACTIVITIES

Dates Activity

To be Determined and submitted by Contractor

APPENDIX A

Storm Water Pollution Prevention Plan

Inspection and Maintenance Report Form
To be Completed Every 7 Days and Within 24 Hours
of a rainfall Event of 0.25 Inches or More

Sediment Basin:

Depth of Sediment in Basin	Condition of Basin Side Slopes	Any Evidence of Overtopping of the Embankment?	Condition of Outfall from Sediment Basin

Maintenance Required for Sediment Basin:

_____

_____

_____

_____

To Be Preformed By: _____ On or Before: _____

Stabilized Construction Entrance:

Does Much Sediment get Tracked on to Road?	Is the Gravel clean or is it filled with Sediment?	Does all Traffic use the Stabilized entrance to leave the site?	Is the Culvert Beneath the entrance working?

Maintenance Required for Stabilized Construction Entrance:

_____

_____

_____

_____

To be Preformed by: _____ On or Before: _____

Stabilization Measures:

Area	Date Since last Disturbed	Stabilized? (Yes/No)	Stabilized with	Condition

Stabilization Required:

To be preformed by: _____ On or before: _____

Structural Controls Earth Dike:

Stabilized Construction Entrance To:	Stabilized Construction Entrance From:	Is dike stabilized?	Is there evidence of washout or over-topping?

Stabilization Required:

To be preformed by: _____ On or before: _____

I certify under penalty of law that this document and all attachments were prepared under my direction of supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those person directly responsible for gathering the information, the information submitted is, to the best for my knowledge and belief, true, accurated, and complete. I am aware that there are significant penalites for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: _____ Date: _____

Inspector: _____ Date: _____

Inspector's Qualifications:

Days since last rainfall: _____ Amount of last rainfall: _____

SECTION 33 03 41 – PRECAST CONCRETE STORM DRAINAGE STRUCTURES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and install in the locations as shown on the Drawings, the drainage pipe, precast concrete manholes, headwalls, and appurtenances as specified herein.

B. All drainage structures shall be manufactured and installed in accordance with details included herein, and as shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Earth Work, Section 31220.

B. Concrete Work - General, Section 030320.

1.3 QUALIFICATIONS

A. All precast structures shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of items to be furnished. The structures shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications and the Florida Department of Transportation Specifications, Section 400 and 425.

1.4 SUBMITTALS

A. Submit to the Engineer for approval shop drawings showing details of construction, reinforcing, joints, and pipe/wall connections.

1.5 INSPECTION

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

B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified below and these Specifications, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, crack, roughness, soundness, and other features. The surface shall be dense and close-textured.

C. Imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, when tested in 3-inch by 6-inch

cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS AND DESIGN

A. Precast structures shall conform to ASTM Designation C478 and meet the following additional requirements:

1. Type II cement shall be used except as otherwise approved.

2. Holes to accommodate pipe shall be precast into the section at the manufacturer's plant.

3. All sections shall be cured by an approved method and shall not be shipped or manhole rungs subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 6 days after fabrication and/or repair, whichever is longer.

4. Precast concrete top slabs shall be designed for an AASHTO H-20 wheel loading.

5. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast unit.

6. Minimum wall thickness shall be 8 inches.

7. Minimum inside diameter shall be 48 inches for manholes.

8. The precast reinforced base shall be a minimum of 8 inches thick and be cast monolithically with the bottom section of manhole walls.

9. Manhole sections shall be joined with either an O-ring type joint or a tongue and groove joint complete with flexible plastic gasket. The O-ring type joint shall be round compression ring of neoprene material set in annular spaces cast into the spigot end of a bell spigot type joint. The ring shall be uniformly compressed between the positioned sections so as to form a watertight joint. After the sections are assembled, the remaining space in the joint shall be pointed up and filled with a dense cement mortar and finished so as to make a smooth, continuous surface inside and outside the wall sections. The tongue and groove joint shall be sealed with a flexible plastic gasket as manufactured by K.T. Snyder and Sons or equal. After the manhole sections have been assembled, the gasket shall completely fill the joint.

10. If the Engineer feels the precast sections do not meet the Specifications, the Engineer shall require the sections to be tested by a certified testing laboratory.

B. Openings for pipes larger than six (6) inches in diameter are to be precast. A minimum of six (6) inches long, the inter-circumference is to remain between the extremities of hole for adjacent pipe in any single unit. A minimum of two (2) reinforcing bars shall remain in the wall between any two (2) openings.

C. The Contractor will furnish the fabricator with the angle of alignment and size of all pipes to enter manhole and the height of structure.

D. Base units shall have sufficient height to allow for minimum of six (6) inches of wall between top of highest opening for pipes and bottom of joint.

E. Pipes are to be extended into structure wall a minimum of four (4) inches, but should not extend beyond interior wall of structure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manholes shall be constructed to requirements of the State of Florida Department of Transportation as specified herein.

B. Precast concrete sections shall be set so as to be vertical and with section in true alignment with a 1/4-inch maximum tolerance to be allowed. The outside and side joint shall be filled with a comparatively dry mortar [one (1) part cement and two (2) parts sand] and finished flush with the adjoining surfaces. Allow joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If any leaks appear in the manhole, the inside joints shall be caulked with lead wool to the satisfaction of the Engineer. The Contractor shall install the precast sections in a manner that will result in a watertight joint.

C. Holes in the concrete pipe sections required for handling or other purposes shall be plugged with a non-shrinking grout or by grout in combination with concrete plugs.

D. Where holes must be cut in the precast section to accommodate pipe, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.

E. The precast concrete base shall be placed on a bed of crushed limerock, as directed by the Engineer, to provide even bearing and grade control.

F. Manhole and Head Wall Pipe Connections:

1. A tapered hole filled with non-shrink waterproof after the pipe is inserted is acceptable, providing the grout is placed carefully to completely fill all around the pipe. If this method is used, place concrete encasement around the stub.

G. Cast iron frames specified and furnished under Division 5 shall be placed, shimmed and set in Portland Cement mortar to the required grade.

H. The lines entering the manhole shall be laid to the grade shown on the Drawings.

I. Outer surfaces of precast and cast-in-place manholes shall be given two (2) coats of bituminous dampproofing at the rate of 30-60 square feet per gallon as directed by the Engineer and in accordance with the manufacturer's instructions.

J. Manhole frame and cover shall be brought to (or adjusted to) grade from the top of the structure with brick.

K. All manholes and cast-in-place structures shall be constructed watertight. If leaks appear, they shall be corrected to the satisfaction of the Engineer.

L. Manholes shall be provided with stubs and plugs if indicated on the Drawings. Pipe stubs shall be as specified in the applicable section for pipe and shall be provided via suitable caps.

END OF SECTION 330341

PAGE LEFT BLANK INTENTIONALLY