

SECTION 15050 – GENERAL PIPES AND FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is Division-15 Basic Mechanical Materials and Methods section, and is part of each Division-15 section making reference to pipes and pipe fittings specified herein.

1.02 SUMMARY:

- A. This section is generic in that it describes material and installation required by several other sections of this specification.
- B. Types of pipes and pipe fittings specified in this section include the following:
 - 1. Steel Piping
 - 2. Copper Piping
 - 3. Cast-Iron Pressure Piping
 - 4. Cast-Iron Soil Piping
 - 5. Grooved Joint Piping
 - 6. Miscellaneous Piping Materials/Products.
- C. Pipes and pipe fittings furnished as part of factory-fabricated equipment and are specified as part of equipment assembly in other Division-15 sections.

1.03 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications:
 - 1. Firm with at least three years history of successful experience on projects of similar nature.
 - 2. Licensed as a firm in the contractor state of origin and in the State of Utah.
 - 3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the contractor.
 - 4. All workmen employed on the project shall carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.
- C. Welding Certification:
 - 1. Each welder shall have passed a qualification test within the past six months.
 - 2. The test shall be in accordance with the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications", ASME Section VIII, and ANSI 313.
 - 3. The test report shall certify that the welder is qualified to weld the material to be used at the job site.

4. The contractor shall submit three copies of each welder's qualification test report to the Project Manager for approval prior to commencing the work. No welder shall be used on the project until so certified.

1.04 **SUBMITTALS:**

- A. **Product Data:** Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.
- B. **Welding Certifications:** Submit reports as required for piping work.
- C. **Brazing Certifications:** Submit reports as required for piping work.
- D. **Maintenance Data:** Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division 1.

1.05 **REFERENCES:**

- A. **Codes and Standards:**
 1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.
 2. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

1.06 **DELIVERY, STORAGE, AND HANDLING:**

- A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 **GENERAL:**

- A. **Piping Materials:** Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.
- B. **Pipe/Tube Fittings:** Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated,

comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.02 STEEL PIPES AND PIPE FITTINGS:

- A. Black Steel Pipe: Seamless or ERW, ASTM A 53.
- B. Galvanized Steel Pipe: ASTM A 53.
- C. Galvanized Seamless Steel Pipe: ASTM A 53.
- D. Electric-Resistance-Welded Steel Pipe: ASTM A 135.
- E. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.
- F. Cast-Iron Flanged Fittings: ANSI B16.1, including bolting.
- G. Cast-Iron Threaded Fittings: ANSI B16.4.
- H. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.
- I. Unions: ANSI B16.39; 300 lb. ground joint malleable iron, hexagonal, selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
- J. Dielectric Unions: 175 psig WSP at 250°F. Equal to Walter Villet Company V-line insulating coupling.
- K. Threaded Pipe Plugs: ANSI B16.14.
- L. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
 - 1. Material Group: Group 1.1.
 - 2. End Connections: Buttwelding.
 - 3. Facings: Raised-face.
 - 4. Steel Pipe Flanges For Waterworks Service: AWWA C207.
- M. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.
- N. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.
- O. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).

2.03 COPPER TUBE AND FITTINGS:

- A. Copper Tube: ASTM B 88; Type K, L (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated.
- B. DWV Copper Tube: ASTM B 306.

- C. ACR Copper Tube: ASTM B 280.
- D. Cast-Copper Solder-Joint Fittings: ANSI B16.18.
- E. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
- F. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.
- G. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.
- H. Cast-Copper Flared Tube Fittings: ANSI B16.26.
- I. Bronze Pipe Flanges/Fittings: ANSI B16.24.
- J. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.04 CAST-IRON SOIL PIPES AND PIPE FITTINGS:

- A. Hubless Cast-Iron Soil Pipe: FS WW-P-401.
- B. Cast-Iron Hub-and-Spigot Soil Pipe: ASTM A 74.
- C. Hubless Cast-Iron Soil Pipe Fittings: Neoprene gasket complying with ASTM C 564 and stainless steel clamp holding band.
- D. Cast-Iron Hub-and-Spigot Soil Pipe Fittings: Match soil pipe units; complying with same standards (ASTM A 74).
- E. Compression Gaskets: ASTM C 564.
- F. Lead/Oakum Joint Materials: Provide products complying with governing regulations for use in service indicated.

2.05 ACID RESISTANT CAST IRON:

- A. Bell and spigot type, high silicon iron alloy "Duriron", with chemical resistant packing and caulked lead joints.
- B. POLYPROPYLENE PIPE: Orion Blueline, flame retardant, Schedule 40, with Schedule 40 fittings, heat fusion welded joints. Alternate manufacturers, GSR, Enfield. Meet material standards of ASTM-D4101, joint standards of ASTM-D2657.

2.06 GROOVED PIPING PRODUCTS: (Only where acceptable and as shown on plans.)

- A. General: As Installer's option, mechanical grooved pipe couplings and fittings may be used for piping systems having operating conditions not exceeding 230°F (110°C), excluding steam piping and any other service not recommended by manufacturer, in lieu of welded, flanged, or threaded methods, and may also be used as unions, seismic joints, flexible connections, expansion joints, expansion compensators, or vibration reducers.
- B. Coupling Housings Description: Grooved mechanical type, which engages grooved or shouldered pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secure together during assembly with nuts and bolts.

Permit degree of contraction and expansion as specified in manufacturer's latest published literature. (Victaulic style 77) For rigid joints (Victaulic "Zero Flex" style 07).

1. Coupling Housings: Malleable iron conforming to ASTM A 47.
 2. Coupling Housings: Ductile iron conforming to ASTM A 536.
 3. Standard: Enamel coated, options hot dip galvanized.
- C. Gaskets: Mechanical grooved coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D 2000.
1. Water Services: EDPM Grade E, with green color code identification.
 2. Air services: Viton
 3. Other Services: As recommended by Manufacturer.
- D. Bolts and Nuts: Heat-treated carbon steel, ASTM A 183, minimum tensile 110,000 psi.
1. Exposed Locations: Tamper resistant nuts.
- E. Branch Stub-Ins: Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts.
- F. Fittings: Grooved or shouldered end design to accept grooved mechanical couplings.
1. Malleable Iron: ASTM A 47.
 2. Ductile Iron: ASTM A 536.
 3. Fabricated Steel: ASTM A 53, Type F for 3/4" to 1-1/2"; Type E or S, Grade B for 2" to 20".
 4. Steel: ASTM A 234.
- G. Flanges: Conform to Class 125 cast iron and Class 150 steel bolt hole alignment.
1. Malleable Iron: ASTM A 47.
 2. Ductile Iron: ASTM A 536.
- H. Specialties:
1. Inline strainers.
 2. Suction diffusers.
- I. Grooves: Conform to the following:
1. Standard Steel: Square cut.
 2. Lightweight Steel: Roll grooved.

3. Ductile Iron: Radius cut grooved, AWWA C606.
- J. Manufacturer: Subject to compliance with requirements, provide grooved piping products of one of the following:
1. ITT Grinnell Corp.
 2. Stockham Valves & Fittings, Inc.
 3. Victaulic Co. of America.
 4. Gustin-Bacon
 5. Grippin.

2.07 MANUFACTURERS:

- A. Manufacturer uniformity: conform with the requirements specified in Basic Mechanical Requirements, under "Product Options."
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering piping materials and specialties which may be incorporated in the work include, but are not limited to, the following:
1. Pipe Escutcheons:
 - a. Chicago Specialty Mfg. Co.
 - b. Sanitary-Dash Mfg. Co.
 - c. Grinnell
 2. Dielectric Waterway Fittings:
 - a. Epco Sales, Inc.
 - b. Victaulic Company of America
 3. Dielectric Unions:
 - a. Eclipse, Inc.
 - b. Perfection Corp.
 - c. Watts Regulator Co.
 4. Strainers:
 - a. Armstrong Machine Works.
 - b. Hoffman Specialty ITT; Fluid Handling Div.
 - c. Spirax Sarco.
 - d. Victaulic Co. of America. (low pressure applications only)
 - e. Watts Regulator Co.
 5. Expansion Joints:
 - a. Flexonics Div.; UOP, Inc.
 - b. Hyspan Precision Products, Inc.
 - c. Keflex, Inc.
 - d. Metraflex Co.
 - e. Vibration Mountings and Controls, Inc.

- 6. Flexible Connectors:
 - a. Flexonics Div.; UOP, Inc.
 - b. Hyspan Precision Products, Inc.
 - c. Keflex, Inc.
 - d. Metraflex Co.
 - e. Vibration Mountings and Controls, Inc.

2.08 PIPING SPECIALTIES:

- A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.
- B. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.
- C. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.
- D. Dielectric Waterway Fittings: electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.
- E. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch.
 - 1. Provide strainers with 125 psi working pressure rating for low pressure applications, and 250 psi pressure rating for high pressure application.
 - 2. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
 - 3. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 - 4. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 - 5. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EPDM gasket.

2.09 EXPANSION JOINTS:

- A. Rubber Expansion Joints: Construct of duck and butyl rubber with full-faced integral flanges, internally reinforced with steel retaining rings. Provide steel retaining rings over entire surface of flanges, drilled to match flange bolt holes, and provide external control rods.
- B. Expansion Joints for Grooved Piping: Provide expansion joints constructed of cut grooved short pipe nipples and couplings, designed by manufacturer to suit intended service. Select couplings and gasket materials to match balance of piping system.

2.10 FLEXIBLE CONNECTORS:

- A. Braided Flexible Pump Connector: Stainless steel annular corrugated metal surrounded with a woven braid of high tensile stainless steel flange connection. Minimum 125 psi pressure rating, similar to Keflex KSSPC.
- B. Flexible Connector: Stainless steel annular, close pitch hose with stainless steel braid. Flanged or threaded connection, Minimum 125 psi pressure rating, similar to Keflex KFCS.

2.11 SLEEVES:

- A. Sheet-Metal Sleeves: 10 gauge, galvanized sheet metal, round tube closed with welded longitudinal joint.
- B. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.

2.52 MECHANICAL SLEEVE SEALS:

- A. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.13 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

- A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

- B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements. Use no lead bearing solders in domestic water applications.

Tin-Antimony Solder: ASTM B 32, Grade 95TA.

Silver-Lead Solder: ASTM B 32, Grade 96TS.

- C. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.

Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

- D. Gaskets For Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.

- E. Piping Connectors For Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

MANUFACTURER: Subject to compliance with requirements, provide piping connectors of the following:

1. Fernco, Inc.
2. Mission.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently- leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible union, flanges, etc., for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Do not cold spring. Store filler weld materials in accordance with codes.

Comply with ANSI B31 Code for Pressure Piping.

- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Provide high point vents, low point drains with valves and extension to drain for all piping.
- C. All piping in press room, mechanical rooms, fan rooms, etc., shall be exposed. Do not conceal or imbed piping in walls, floors or other structures.
- D. Make changes in direction or size with manufactured fittings. Anchor and support piping for free expansion and movement without damage to piping, equipment or to building.
- E. Piping shall be arranged to maintain head room and keep passageways clear.
- F. Provide unions at connections to equipment and elsewhere as required to facilitate maintenance.
- G. Run full pipe size through shutoff valves, gas cocks, balancing valves, etc. Change pipe size within three pipe size diameters of final connection to equipment, coils, etc.
- H. All piping shall be erected to insure proper draining. Air piping shall pitch down in the direction of flow a minimum of 1" per 40 feet. Domestic water and utility water shall slope down a minimum of 1" per 40 feet towards the drain (low point). Refrigerant suction line shall slope a minimum of 1" per 10 feet towards compressor. Soil, waste, vent, and roof drain lines shall slope in accordance with requirements of Uniform Plumbing Code.
- I. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.
- J. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal.
- K. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.

- L. Use fittings for all changes in direction and all branch connections.
- M. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.
- N. Install unions adjacent to each valve, and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.
- O. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.
- P. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air).
- Q. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water). Insulating fittings are not required between bronze valves and steel pipe or between copper coil headers and steel pipe.
- R. Electrical Equipment Spaces: Do not run piping in or through, electrical room, transformer vaults and other electrical or electronic equipment spaces and enclosures or above electrical gear unless authorized and directed. Install drip pan under piping that must be run through electrical spaces.

3.02 EXPANSION AND CONTRACTION:

- A. Make all necessary provisions for expansion and contraction of piping.
- B. Use grooved joint couplings, expansion compensator, offsets or loops as required to prevent undue strain.
- C. At piping connection to heat exchangers provide expansion (joint) as shown on drawings.

3.03 FLEXIBLE CONNECTORS:

- A. At pumps, engines and at all rotating or vibrating pieces of equipment, provide and install flexible connectors to accommodate alignment and vibration.
- B. At pumps provide and install a series of three grooved joint couplings or braided flexible pump connectors.
- C. At engines provide and install flexible connector.
- D. Install owner furnished flex connectors for digester gas and natural gas.

3.04 PROTECTIVE COATINGS:

- A. All underground steel pipes shall be wrapped with Scotchwrap No. 50 tape to give not less than two complete layers on the underground piping system, or piping shall have "X-tru Coat", factory applied plastic protective covering, or pipe shall be coated and wrapped with coal tar enamel and Kraft paper, all with coated and taped joints.

3.05 PIPING SYSTEM JOINTS:

- A. General: Provide joints of type indicated in each piping system.

- B. **Threaded:** Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- C. **Brazed:** Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
- D. **Soldered:** Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- E. **Welded:**
1. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.
 2. Weld pipe joints in accordance with recognized industry practice and as follows:
 3. Weld pipe joints only when ambient temperature is above 0°F (-18°C) where possible, with minimum pipe preheat to 50°F.
 4. Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
 5. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
 6. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
 7. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
 8. At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.
 9. At Installer's option, install forged branch-connection fittings wherever branch pipe of size smaller than main pipe is indicated; or install regular "T" fitting.
- F. **Flanged Joints:** Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
- G. **Lead Joints:** Tightly pack joint with joint packing material. Do not permit packing to enter bore of finished joint. Clean joint after packing. Fill remaining joint space with one pouring of lead to indicated minimum depth measured from face of bell. After lead has cooled, calk joint tightly by use of hammer and caulking iron.
- H. **Hubless Cast-Iron Joints:** Comply with coupling manufacturer's installation instructions.
- I. **Plastic Pipe/Tube Joints:** Comply with manufacturer's instructions and recommendations, and with applicable industry standards:
1. Heat Joining of Thermoplastic Pipe: ASTM D 2657.

2. Making Solvent-Cemented Joints: ASTM D 2235, and ASTM F 402.

J. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.06 CLEANING, FLUSHING, INSPECTING:

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

1. Inspect pressure piping in accordance with procedures of ASME B31.

B. Disinfect water mains and water service piping in accordance with AWWA C601.

END OF SECTION 15050

SECTION 15100 –VALVES

PART 1 - PRODUCTS

1.01 GENERAL

- A. Scope: Furnish and install all valves complete and in accordance to the requirements of the Contract Documents.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve.
- B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data and spare parts list for each type of valve. Include this data, product data, shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service.
- B. Valve Types: Provide valves of same type by same manufacturer.
- C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- D. Codes and Standards:
 - 1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
 - 2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".

PART 2 - PRODUCTS

2.01 ECCENTRIC PLUG VALVES

- A. All plug valves shall be of the tight-closing, resilient faced plug type and shall be of bi-directional eccentric seating such that the opening movement of the closing member results in the closing member rising off the body seat contact.
- B. Valve bodies shall be constructed of cast iron ASTM A-48 Class 40. Flanges shall be faced and drilled in accordance with ANSI B16.1
- C. Plug valves shall be furnished with permanently lubricated, sleeve type metallic bearings. Grit excluder seals shall be provided in the upper and lower journals to isolate the bearings.

- D. Plug valve shaft seals shall be the self-adjusting type, replaceable without removing the valve bonnet
- E. Manual gear actuators shall be totally enclosed worm and gear type permanently lubricated. Above ground and buried valves 6" and larger shall be provided with gear actuators.
- F. All buried valve installations shall be fitted with stainless steel 304 nuts and bolts.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering eccentric plug valves which may be incorporated into the work are:
 - 1. Milken
 - 2. Pratt
 - 3. Dezurik
 - 4. Or equal.
- H. Electric Valve Actuators: Actuators shall be noted on the plans. Actuators shall be electric On-Off type with a corrosion resistant NEMA 4, 4X die cast aluminum housing and cover, powder polyurethane coated, stainless steel fasteners, 8,600 in-lbs torque capability (or as required depending on valve size, type, and stem length) self-locking EPI-Cyclical gear train; no brake required, standard manual override with handwheel; manual override can be operated with any lever, clutch or brake upon power outage, visual position indicator, and a 120 VAC power supply. The actuator shall come fully tested and ready for installation. Mounting kits shall be provided. Actuator shall be Limitorque, Rotorque, Auma, or equal.

2.02 BALL VALVES:

- A. Features
 - 1. PVC
 - 2. True union
 - 3. Teflon seat
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering ball valves which may be incorporated in the work are:
 - 1. Hayward
 - 2. Goerge Fischer Sloane
 - 3. Dura Plastic Products, Inc.
 - 4. Or equal.

2.03 GATE VALVES

- A. The gate valves shall be of the resilient seated wedge design, fusion bonded epoxy coated per AWWA C550, cast iron body design. They shall comply with the AWWA gate valve standard C-509 as latest revised.

- B. Valves shall be rated for zero leakage a 200 psi water working pressure and have a 400 psi hydrostatic test for structural soundness for valves of 4" to 12".
- C. Gate valves shall be furnished with type of end connection specified in the plans and as follows: 125# ANSI flange drilling, mechanical joint per AWWA C-111. push-on ends suitable for stab joints with ductile iron, cast iron and C900 plastic pipe, asbestos cement ends, PVC, or combination thereof.
- D. Valve bodies shall be constructed of cast iron ASTM A-48 Class 40. Flanges shall be faced and drilled in accordance with ANSI B16.1. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed
- E. Stems shall be manganese bronze having a minimum tensile strength of 60,000psi, a minimum yield of 20,000 psi
- F. Bolts shall be electro-zinc plated with hex heads and hex nuts accordance with ASTM A-307 and A-536 respectively. In buried applications bolts and nuts shall be stainless steel 304.
- G. Resilient seated gate valves shall be of the non-rising stem (NRS) type. NRS stem thrust collars shall be cast integral with the stem and machined to size. A stainless steel thrust bearing shall be incorporated to optimize operating torques.
- H. Valves shall be furnished with O-ring stem seals using two O-rings located above and one below the thrust collar. O-rings shall be set in grooves in the stem, the O-ring groove shall not be less than the root diameter of the stem threads.
- I. Valve shall be capable of installation in any position with rated sealing in both directions. Rubber seats of specially compounded SBR material shall be utilized and be capable of sealing under normal conditions. The valve body shall have integral guides engaging integral lugs in the gate in a tongue and groove manner, supporting the gate throughout the entire open/close travel.
- J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering gate valves which may be incorporated in the work are:
 - 1. M&H Company
 - 2. Or equal

2.04 SWING CHECK VALVES

- A. The rubber flapper swing check valve shall have a heavily constructed cast iron body and cover in accordance with ASTM A126 Grade B. The body shall be long pattern design (not wafer) with integrally cast-on end flanges. The flapper shall be Buna-N, or other elastomer, having an O-ring seating edge and be internally reinforced with steel.
- B. Flapper to be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position. Flapper shall be easily removed without the need to remove the valve from line. Check Valves to have full pipe size flow area. Seating surface to be on a 45 degree requiring the flapper to travel only 35 degrees from closed to full open position for minimum headloss. Valve has non-slam closure characteristics.

- C. Buna-N flapper which creates an elastic spring effect to assist the flapper to close against a slight head to prevent or minimize slamming.
- D. Valve designed for 175 psi differential pressure for water, sewage, oil or gas (higher pressure available). The valve shall be suitable for buried service, in which case, stainless cover bolts must be furnished.
- E. When necessary to prime or backflush a clogged pump, an external backflow device can be furnished—sizes 3" and larger.
- F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering swing check valves which may be incorporated in the work are:
 - 1. APCO
 - 2. Or equal.

2.05 BALL CHECK VALVES:

- A. Ball check valves shall be designed to be fully automatic in operation and specifically suited to serve where solids, fibers or highly viscous materials are encountered.
- B. Ball check valves will have one moving part, the ball, which moves automatically out of the path of flow, providing an unobstructed smooth flow through the valve body. Upon discontinuation of flow the ball automatically rolls back to the closed position, providing a positive seal against back pressure or backflow.
- C. Ball check valves, epoxy coated cast iron or ductile iron, are designed to be maintenance free and suited for installation in the horizontal or vertical position.
- D. The valve shall be so constructed that by unbolting and lifting off the cover, the ball may be removed and replaced without removing the valve from the line.
- E. Flomatic Model 408 or equal

2.06 AWWA BUTTERFLY VALVES:

- A. GENERAL: Butterfly valves shall be manufactured in accordance with the latest revision of AWWA C504, Class 150B and conform to NSF Standard 61. The manufacturer shall have produced AWWA butterfly valves for a minimum of five years
- B. Valve bodies shall be constructed of ASTM A126, Class B cast iron for flanged valves or ASTM A48, Class 40 for wafer style. Flanged valves shall be fully faced and drilled in accordance with ANSI Standard B16.1, Class 125.
- C. Rubber body seats shall be of one-piece construction, simultaneously molded and bonded into a recessed cavity in the valve body. Seats may not be located on the disc or be retained by segments and/or screws. For wafer style valves, the seat shall cover the entire inner surface of the valve body and extend over the outside face of the valve body to form a flange gasket.
- D. Valve bearings shall be of a self-lubricating, nonmetallic material to effectively isolate the disc-shaft assembly from the valve body. Metal-to-metal thrust bearings in the flow stream are not allowed.
- E. The disc shall be a lens-shaped design to afford minimal pressure drop and line turbulence. Materials of construction shall be:

- a. ASTM A126, Class B cast iron disc with a stainless steel type 316 edge
- b. Discs shall be retained by stainless steel pins, which extend through the full diameter of the shaft to withstand the specified line pressure up to valve rating and the torque required to operate the valve. Disc stops located in the flow stream are not allowed.
- F. Valve shafts shall be of stainless steel type 304. At the operator end of the valve shaft, a packing gland utilizing "V" type chevron packing shall be utilized. "O" ring and "U" cup packing is not allowed.
- G. All surfaces of the valve interior shall be clean, dry and free from grease before painting. The valve surfaces except for disc edge, rubber seat and finished portions shall be evenly coated with asphalt varnish in accordance with Federal Specification TT-C-494 and AWWA Standard C504. The exterior valve surfaces and actuator shall be evenly coated with a suitable primer to match field coatings.
- H. Hydrostatic and seat leakage tests shall be conducted in strict accordance with AWWA Standard C504.
- I. Ductile iron wrenches shall be provided on valves 6-inches and smaller. Weatherproof hand wheel gear operators shall be provided on 8-inch and larger valves.
- J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering butterfly valves which may be incorporated into the work are:
 - 1. Milken
 - 2. Pratt
 - 3. Or equal.

2.07 KNIFE GATE VALVES

- A. Series G Knife Gate Valves shall be bonnetless, wafer type made with a cast iron body, with several support ribs for a strong, flanged connection. All sizes shall have a fabricated stainless steel liner.
- B. Standard flange holes shall be drilled and tapped, thru bolted flanges shall be an available upon except in the chest area where the holes are drilled and tapped. Flange drilling dimensions meet MSS SP-81 and ANSI B16.5 Class 125 / 150 requirements.
- C. The Series G has raised face flanges and meets MSS SP-81 face-to-face dimensions. Valve shall have all wetted parts made of 304 or 316 Stainless Steel. Stainless Steel liner shall extend through the valve chest to the top of packing gland. Both sides of the gate shall be finish ground. The stem shall be Stainless Steel and have double lead threads. The yoke nut shall be acid-resistant bronze. The valve shall have a raised seat with a relieved area around the seat to prevent jamming.
- D. The valve gate shall be suitable for 150-psi pressure differential. The packing gland shall have 3 layers of fiber packing with a 4th elastomer seal. The valve shall be metal seated with a round port.
- E. Valve shall be installed in accordance with manufacturer's written Installation and Operation Manual and approved submittals.

- F. The Valve shall be a manually operated metal seated series G knife gate valve by Red Valve company or equal

2.08 AIR BUTTERFLY VAVES

- A. Air valves shall be butterfly valve style. Valves shall conform to ANSI standards.
- B. Valve Bodies shall be wafer style. The valves shall be rated at 150 psi bi-directional differential pressure. Body to have 2" extended neck for insulation and to be shock resistant ductile iron and shall conform to ANSI 125/150 specifications in terms of laying lengths and minimum body shell thickness.
- C. Valve Discs shall be made of 316 stainless steel.
- D. Valve Seat shall be EPDM rubber.
- E. Valve Actuators shall be NEMA 4X and designed for maximum life cycle for modulating service with the self-locking EPI-CYCLICAL gears eliminating the need for unreliable solenoid brakes. Actuator shall be CSA and CE approved and a 115VAC power supply requirement. Actuator shall accept a 4-20mA input control signal, have (2) 10AMP auxiliary limit switch outputs, manual override that is stationary when valve is in operation, visual position indicator, and ISO5211 mounting patterns. Actuators must operate a full 90 degrees within 28 seconds. Actuators shall be TRIAC EMI series or equal.
- F. Valve and actuator shall be coupled together with a 316 stainless steel bracket & coupler supplied by the actuator manufacturer.

2.09 PRESSURE RELIEF SURGE ANTICIPATOR VALVE

- A. Function
 - 1. This valve shall control high pressures and power failure surges by bypassing system pressure that exceeds the high pressure control setting and also by opening a preset amount when sensed pressure decreases below a preset minimum in anticipation of a surge.
- B. Main Valve
 - 1. The valve shall be hydraulically operated, single diaphragm-actuated, globe pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.
- C. Main Valve Body
 - 1. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. Ductile Iron is standard and other materials shall be available. No fabrication or welding shall be used in the manufacturing process.
 - 2. The valve shall contain a resilient, synthetic rubber disc with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight

seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

3. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.
4. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.
5. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 6" and smaller size valves shall be threaded into the cover and body. Valve seat in 8" and larger size valves shall be retained by flat head machine screws for ease of maintenance. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.
6. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment provided the valve is installed and used in accordance with all applicable instructions. Electrical components shall have a one-year warranty.
7. The valve manufacturer shall also provide a computerized cavitation chart which show flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity, and if there will be cavitation damage.

a. Material Specification

Valve Size: 4"
Main Valve Body and Cover: Ductile Iron
Main Valve Trim: Standard Bronze ASTM B62
End Detail: Flanged

Pressure Rating: ANSI 150
Temperature Range: 55° to 85° F
Rubber Material: Buna N

Coating: Epoxy
Desired Options: Closing Speed Control

D. Pilot Control System

1. The pressure relief pilot shall be an adjustable, spring-loaded, normally closed diaphragm control designed to permit flow when upstream pressure exceeds the control setting. The low pressure pilot shall be an adjustable, spring loaded, normally open diaphragm control designed to open when the sensed pressure falls below the control setting and close when pressures are normal. The pilot system shall contain an adjustable hydraulic limiter to limit valve travel during low pressure opening without affecting high pressure relief valve travel. The contractor shall connect the sensing/pilot supply connection to the main header with minimum 3/4" pipe or tubing.
2. A full range of spring settings shall be available in ranges from 0-450 psi.
3. Pilot Control Options:
 - Integral wye strainer.
 - Ball cock shut off.
 - Closing speed control.

E. Material Specification for Pilot Control:

Pressure Rating: ANSI 150
Trim: Stainless Steel Type 303
Rubber Material: Buna N
Tubing and Fittings: Copper / Brass
High Pressure Adjustment Range: 100psi to 350psi
Low Wave Adjustment Range: 20psi to 200psi
Operating Fluids: Water
Desired Options: Pressure Relief, Surge Anticipation, Slow Closing Action

F. ACCEPTABLE MANUFACTURERS

1. Cla-Val Model No. 52-03/652-03 Pressure Relief and Surge Ancipator Valve as manufactured by Cla-Val, Newport Beach, CA 92659-0325.
2. Or Equal

2.10 SLOW CLOSING CHECK VALVE

A. Function

1. This valve shall open to permit flow when the inlet pressure is greater than the discharge pressure. When the discharge pressure is greater the valve shall close drip tight to prevent return flow.

B. Main Valve

1. The valve shall be hydraulically operated, single diaphragm-actuated, globe pattern. The valve shall consist of three major components: the body, with seat installed; the cover, with bearings installed; and the diaphragm assembly. The diaphragm

assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

C. Main Valve Body

1. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material; Ductile Iron is standard; other materials shall be available; and no fabrication or welding shall be used in the manufacturing process. Total shipping weight shall be equal or greater in all respects to the Hytrol 100-01/100-20 body.
2. The valve shall contain a resilient, synthetic rubber disc, having a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs, circular, square, or quad type shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hour-glass shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.
3. The diaphragm assembly containing a non-magnetic 303 stainless steel stem; of sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.
4. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the full opened or full closed position.
5. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 6" and smaller size valves shall be threaded into the cover and body. Valve seat in 8" and larger size valves shall be retained by flat head machine screws for ease of maintenance. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.

6. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment, provided the valve is installed and used in accordance with all applicable instructions. Electrical components shall have a one-year warranty.
7. The valve manufacturer shall be able to supply a complete line of equipment from 2" through 24" sizes and a complete selection of complimentary equipment. The valve manufacturer shall also provide a computerized cavitation chart which show flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity, and if there will be cavitation damage.

D. Pilot Control System

1. The pilot system shall contain auxiliary controls which permit independent adjustment of the main valve opening and closing speeds. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

E. Material Specification

Valve Size: 6"
Main Valve Body and Cover: Ductile Iron
Main Valve Trim: Stainless Steel 303
End Detail: Flanged
Pressure Rating: 0-450 psi
Temperature Range: 55° - 85° F
Rubber Material: Buna N
Coating: Epoxy

F. Acceptable Manufacturers

1. This valve shall be a Cla-Val Co. Model No. 81-02/681-02 Series Check Valve as manufactured by Cla- Val Co., Newport Beach, CA 92659-0325.
2. Or Equal

2.11 AIR VACUUM AND RELIEF VALVES

- A. Sewage Combination Air Valves (single body, double orifice) are used to allow large volumes of air to escape or enter thru the larger diameter air / vacuum orifice when filling or draining a pipeline.
- B. When the pipeline is filled and under pressure the large air / vacuum orifice shall stay closed, but the smaller diameter air release orifice shall remain operative and open to allow small pockets of accumulating air to escape automatically and independently of the large orifice. The large air / vacuum orifice shall shut off when the free acting center guided plug is raised into the orifice by the lifting force of the CONCAVE bottom float. The large orifice shut-off shall be "WITHOUT SPILLING". The Float* shall be heavily constructed stainless steel (hermetically sealed) having a concave bottom impact area to provide immediate resistance to flow and instant upwards movement to shut off the large orifice "WITHOUT SPILLING". The Buna-N seat must be fastened to the valve cover without distortion for drop tight shut-off.
- C. Materials
 1. Body & Cover Cast Iron ASTM A126 GR.
 2. Concave Float* Patented Stainless Steel ASTM A240 T304
 3. Float Stem Stainless Steel ASTM A581 T303

4. Needle & Seat Buna-N
5. Plug (1", 2", 3", 4") Brass ASTM B124 (6" Size) Stainless Steel ASTM A240 T304
6. Leverage Frame Cast Iron ASTM A126 GR. B.

D. Acceptable Manufacturers

1. Apco Willamette Series 400
2. Or Equal

2.12 METHANE GAS BUTTERFLY VALVES

The valve shall be capable of drop-tight service to 250 psig and vacuum.

A. Actuation

Valve body shall have an integrally cast top plate for direct flush-mounting of manual or power actuators without use of brackets or adapters. Valves 8-inches and larger shall be provided with manual gear or power actuators.

B. Materials

- | | |
|--------------------------------------|----------------------------|
| 1. Body: | Cast Iron ASTM 126 Class B |
| 2. Seat: | EPDM Molded-In Seat |
| 3. Disc: | Stainless Steel |
| 4. Stem: | 416 Stainless Steel |
| 5. Upper Stem Bushing: | Acetal |
| 6. Inboard Stem Bearings: | Bronze |
| 7. Stem Packing: | NBR |
| 8. Torque Plug Disc-Stem Connection: | 316 Stainless Steel |

C. Acceptable Manufacturers

1. Keystone
2. Or Equal

2.13 HOT WATER BUTTERFLY VALVES

Two-piece cast iron, Series 20 Wafer bodies, Nylon 11 coated (1" – 8"). Polyester coated (10" – 20"). Flange locating holes shall meet ANSI Class 125/150. Disc/Stem of one-piece, high capacity design. Tongue-and-groove seat design with primary hub seal and a molded O-ring suitable for weld-neck and slip-on flanges. Seat totally encapsulates the body without flange gaskets.

A. Materials

- | | |
|---------------|---|
| 1. Body: | Cast Iron ASTM A126 Class B |
| 2. Seat: | Buna-N |
| 3. Disc/Stem: | 316 Stainless Steel per ASTM A351 Type CF8M |

B. Acceptable Manufacturers

1. Bray Series 20 Wafer
2. Or Equal

2.14 SWING TYPE LEVER AND WEIGHT CHECK VALVES

Valves shall meet all applicable parts of ANSI/AWWA C508 Standard. Flanged end dimensions and drilling comply with ANSI B16.1, Class 125. 2 1/2" – 12" sizes shall have a maximum working pressure of 175 psig and test pressure of 350 psig. 14" – 24" sizes shall have a maximum working pressure of 150 psig and test pressure of 300 psig.

A. Materials

1. Body: Iron body, bronze mounted (IBBM)
2. Disc Facing: Bronze

B. Acceptable Manufacturers

1. Mueller
2. Or Equal

2.15 TELESCOPING VALVES

A. The valve tube travels inside a cast iron or ductile iron riser pipe as shown in the plan drawings. The nominal riser pipe diameter determines the valve tube diameter. The telescoping valves shall have a flared top as provided by the manufacturer.

B. Tube (metal)

1. Stainless steel or steel tubes up through 24" size shall be manufactured from seamless pipe or tube. Steel tubes are to be fusion epoxy coated. Tube lengths shall be as shown or noted on the drawings and must be of sufficient length to facilitate valve travel and maintain an appropriate insert depth. Valve tubes are to be a minimum 1/8" thick and are attached to connecting stems by use of a lifting bail.

C. Seal Flange

1. A cast iron or stainless steel companion flange and neoprene slip seal gasket shall be provided by the valve manufacturer. The gasket must be a minimum 1/4" thick. The inside diameter of the gasket is to be 1/8" smaller than the outside diameter of the valve tube to provide a friction seal. The gasket is to be sandwiched between the riser pipe flange and the companion flange. The gasket and companion flange shall include a 125# standard drilling pattern to match the riser pipe.

D. Lifting Bail

1. On brass and PVC tubes the lifting bail shall be stainless steel construction and be fastened to the valve body with stainless steel attaching bolts. On stainless steel and steel tubes, the bail shall be the same material as the tube and be rigidly welded to the tube.

E. Lift and Stems (Rising)

1. Lifts shall be handwheel type, with UHMW polyethylene thrust bearings along with a stub acme threaded type 304 stainless steel stem to provide automatic self-locking, infinite valve positioning. The standard rising stem lift shall use a galvanized steel square tube with torque nut design to prevent telescoping valve tube rotation. Alternately, where conditions require, a vee keyed shaft, with torque plate, shall be used to prevent valve tube rotation. Handwheels shall be a minimum of 12" in diameter and shall include a clear plastic Butyrate stem cover with a mylar strip type position indicator, calibrated in 1/4 inch increments to illustrate valve position. The mylar strip, provided by the manufacturer, will be affixed by the contractor after installation to provide a true and accurate indication of the tube elevation by

comparing it to the top of the rising stem. Stainless steel anchor bolts shall be provided for all pedestals. Cleaning and shop prime coat of lift housing and handwheel will be (as specified elsewhere in this specification) (manufacturer's standard).

2.16 MANUFACTURE

Telescoping valve shall be Model TS-2 as manufactured by Waterman Industries, Inc. or equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. General: Except as otherwise indicated, comply with the following requirements:
1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
 2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane.
- B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.
- C. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections.
1. Pipe Size 2" and Smaller: One of the following, at Installer's option:
 - a. Threaded valves.
 - b. Flanged valves.
 2. Pipe Size 2-1/2" and Larger:
 - a. Flanged valves.
 - b. Grooved joint valves.
- D. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.
- E. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

3.02 ADJUSTING AND CLEANING:

- A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.
- B. Valve Identification: Tag each valve in accordance with Division-15 section "Mechanical Identification".

3.03 VALVE INSTALLATION:

- A. Locate all valves in locations which will allow easy operation and facilitates maintenance.
- B. Provide chain operators for any valves located more than 8 feet above finished floor. This means double acting lever handles for quarter turn valves, or chain wheels for multi-turn valves. Arrange valves and set up chain length for proper operation.

END OF SECTION 15100

SECTION 15105 – ALUMINUM LAUNDER COVERS

PART 1 - PRODUCTS

1.01 GENERAL

- A. Scope: Provide aluminum launder covers and all accessories as specified herein and on the contract drawings.
- B. Acceptable suppliers
 - 1. Nefco
 - 2. Protectolite
 - 3. RPS Engineering
 - 4. WesTech Engineering, Inc.
 - 5. or equal
- C. Design Requirements: Launder covers shall be designed to meet all current Orem City standards for loadings and seismic code.
- D. QUALITY ASSURANCE: The aluminum launder covers shall be the product of a manufacturer having a minimum of five (5) years successful experience in the design and production of water control equipment of this type. At the request of the engineer, the manufacturer shall submit evidence of performance on other projects with similar design conditions.

PART 2 - PRODUCTS

2.01 THE REQUIREMENT

- A. The cover shall be a clear-span structure supported by the specified tank structure. Individual panels alternately mate with adjacent panel, and overlap the support structure. No more than the adjacent panels shall need removal to remove any one panel. Each panel shall be one welded assembly with stiffeners welded to underside. Handles, bolts and hinges shall pose no tripping hazard. Dead load of individual removable panels shall not exceed 150 lbs. All dissimilar surfaces shall be separated by gasket or sealant. All mating and bearing surfaces shall be gasketed, forming a mostly air-tight system. The cover seal shall allow for air intake. No appreciable water ponding allowed.

2.02 MATERIALS OF CONSTRUCTION

- A. Extrusions: 6061-T6, 6063-T52, 6005A-T6
- B. Plate: 3003, 5052, 6061, 7075
- C. Sheet: 3003, 5052, 6061, 7075
- D. Composite: Clear acrylic composite
- E. Fasteners: 316 Series Stainless Steel
- F. Anchors: 316 Series Stainless Steel
- G. Hardware: 300 Series Stainless Steel
- H. Gaskets: Neoprene or approved other

- I. Sealant: Silicone, Silpruf or approved other

2.03 ACCESSORIES

- A. Doors, hatches, vents, flanged connections: 3003, 5052, 6061 Stainless

PART 3 – EXECUTION

3.01 FIELD MEASUREMENTS

- A. Contractor shall field verify all dimensions prior to fabrication of cover.

3.02 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall be responsible for unloading, storing and handling cover.

3.03 INSTALLATION

- A. Contractor shall be responsible for installing the cover per manufacturer's directions. Only competent workmen familiar with this type of erection shall be used. The cover shall be erected level and plumb, and to be true within the specified construction tolerances; no cumulative dimensional error is allowed.
- B. Prior to installation, the erector shall check all design dimensions as shown on drawings. Any discrepancies between the field dimensions and design dimensions shall be brought to the attention of the manufacturer. No installation shall proceed until site conditions are remedied to the point that the cover will be installed correctly. Any remedies are not the responsibility of the cover manufacturer.
- C. The erector shall furnish all equipment to install the cover in place. All bolted and anchored connections for the cover shall be made by means of bolting material specified and as noted on the drawings.
- D. The cover shall not be modified in any manner without first consulting with the cover manufacturer.

END OF SECTION 15105

SECTION 15110 –ALUMINUM SLIDE GATES

PART 1 - PRODUCTS

1.01 GENERAL

- A. Scope: There shall be furnished aluminum slide gates as shown on the drawings. The equipment shall include gates, frames, and gear operators.
- B. Acceptable suppliers
 - 1. Golden Harvest
 - 2. Fontaine LTD
 - 3. Whipps Inc.
 - 4. Waterman Industries, Inc
 - 5. or equal
- C. QUALITY ASSURANCE: The slide gates and operators shall be the product of a manufacturer having a minimum of five (5) years successful experience in the design and production of water control equipment of this type. At the request of the engineer, the manufacturer shall submit evidence of performance on other projects with similar design conditions. Gates shall be Series 900 as manufactured by Whipps, Incorporated, of Athol, Massachusetts or approved equal.

PART 2 - PRODUCTS

2.01 THE REQUIREMENT

- A. General Design: All slide gates will have ultra high molecular weight polymer (UHMW) seat seals having an intrinsic viscosity of greater than 14 by test. UHMW seat seals shall be provided on both upstream and downstream faces of the slide and shall be mechanically locked in the gate guides. Each UHMW seat seal will be shaped to provide two bearing surfaces and two sealing edges. The slide will be a tight fit within the UHMW to limit leakage.
- B. MATERIALS OF CONSTRUCTION: Aluminum Gates – The aluminum gates shall be ¼ inch minimum thickness extruded (ASTM B-221), cast (Alloy SR-319), or rolled aluminum (ASTM B-209) type 6061-T6. Guides for wall-mounted frames shall be extruded.
- C. FRAMES: The wall-mounted gate frames shall be of self-contained design with integral, welded yokes. Guides shall be extruded, one-piece, for the full height of the frame. Frames shall extend above the operating floor to the height shown on the plans. The yoke channels supporting the operator shall be welded to the guides to provide a one-piece rigid frame. Yoke members shall be spaced such that the operator, stem and slide can be easily removed. The gate invert frame member shall contain a replaceable neoprene seat seal. Invert seals attached to the gate slide will not be acceptable.
- D. SLIDES: Gates Slides shall consist of a flat plate, reinforced with welded stiffeners. Stiffeners shall be of type, spacing and number such that, at the design head, bending stress is limited to 1/5 the ultimate strength of the material and deflection is limited to 1/360 of the gate width. Stem connection will be by means of a threaded block, either directly welded to the slide or contained in a pocket designed to distribute operating forces to the upper region of the slide.
- E. STEMS: The operating stem shall be sized to safely withstand without buckling or permanent distortion the stresses induced by normal operating forces. The stem shall

have a minimum diameter of 1-1/2 and shall be designed to transmit in compression at least stall thrust x 1.3 times the rated output of the electric operator. Stem threads shall be machine-cut, acme type. Stems shall be stainless steel, ASTM A-276 type 304 and shall be one-piece. Clear plastic stem covers shall be provided, properly vented, with indicator strips for field-mounting by the installing contractor.

- F. GEARED OPERATORS AND ELECTRIC ACUATOR: Gates which are equipped with electric motor operators and electric actuators will be sized and furnished by gate supplier.

2.02 THE ACTUATOR REQUIREMENT

- A. Gear housing will be made of cast aluminum with a bronze alloy worm gear and heat-treated steel spur gear.
- B. Electrical compartment covers: Cast Aluminum, O-ring sealed with nickel-plated carbon steel hardware.
- C. Motor: Squirrel cage induction 460 volt 3-phase 60 Hz, 16 minute normal duty. Dynamic Torque is minimal 20% of start torque.
- D. Manufacturer: EIM, Auma, Limitorque, Rotorque, or equal.
- E. Controls: Local controls including Open, Close, Stop, Local, Remote, and Off.
- F. Remote Signals:
 - 1. Position – % OPEN (analog out)
 - 2. Fail
 - 3. Remote signal to open and close (modulate)
- G. Operation: In the remote position, gate will receive a 4-20 mA signal to set position of gate to achieve a predetermined flow rate. Control will be by a remote PLC. In the local position, the gate controlled by the local switches.

END OF SECTION 15110

SECTION 15140 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is Division-15 Basic Mechanical Materials and Methods section, and is part of each Division-15 section making reference to supports and anchors specified herein.

1.02 SUMMARY:

- A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division-15 sections.
- B. Types of supports and anchors specified in this section include the following:
 - 1. Horizontal-Piping Hangers and Supports.
 - 2. Vertical-Piping Clamps.
 - 3. Hanger-Rod Attachments.
 - 4. Building Attachments.
 - 5. Saddles and Shields.
 - 6. Miscellaneous Materials.
 - 7. Roof Equipment Supports.
 - 8. Anchors.
 - 9. Equipment Supports.
- C. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.03 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.04 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.
- B. **Shop Drawings:** Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.
- C. **Maintenance Data:** Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.05 REFERENCES:

- A. **Codes and Standards:**

9. Code Compliance: Comply with applicable building, mechanical and plumbing codes pertaining to product materials and installation of supports and anchors.
10. UL and FM Compliance: Provide products which are UL-listed and FM approved.
11. MSS Standard Compliance:
 - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
 - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - d. Terminology used in this section is defined in MSS SP-90.

PART 2 - PRODUCTS

2.01 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

- A. General: Except as otherwise indicated, provide factory- fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
- B. Adjustable Steel Clevises Hangers: MSS Type 1. (For suspension of non-insulated or insulated stationary pipe lines; 1/2" to 30".)
- C. Steel Double Bolt Pipe Clamps: MSS Type 3. (For suspension of pipe requiring up to 4" of insulation and where flexibility of clamp is desirable; 3/4" to 24".)
- D. Steel Pipe Clamps: MSS Type 4. (For suspension of cold pipe lines or hot lines where little or no insulation is required; 1/2" to 24".)
- E. Pipe Hangers: MSS Type 5. (For suspension of piping when off-center closure allowing installation of hanger before erection of piping is desired; 1/2" to 4".)
- F. Adjustable Swivel Pipe Rings: MSS Type 6. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".)
- G. Adjustable Steel Band Hangers: MSS Type 7. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".)
- H. Adjustable Band Hangers: MSS Type 9. (For suspension of non-insulated stationary pipe lines; 1/2" to 8".)
- I. Adjustable Swivel Rings, Band Type: MSS Type 10. (For suspension of non-insulated stationary pipe lines; 3/8" to 8".)

- J. Split Pipe Rings: MSS Type 11. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".)
- K. Extension Split Pipe Clamps: MSS Type 12. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".)
- L. U-Bolts: MSS Type 24. (For support of heavy loads; 1/2" to 30".)
- M. Clips: MSS Type 26. (For support of uninsulated piping not subject to expansion or contraction.)
- N. Pipe Saddle Supports: MSS Type 36, including steel pipe base- support and cast-iron floor flange. (To support pipe from floor stanchion, using floor flange to secure stanchion to floor 4" to 36".)
- O. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange. (To Type 36 except U-bolt provided for retaining pipe.)
- P. Vee Bottom Clevis Hanger: With continuous 18 gauge galvanized steel support channel (for support for PVC and polypropylene piping) similar to B-line figure B3106V.

2.03 VERTICAL-PIPING CLAMPS:

- A. General: Except as otherwise indicated, provide factory- fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- B. Two-Bolt Riser Clamps: MSS Type 8. (For support and steadying of pipe risers; 3/4" to 20". Also supports pipe covering or insulation.)
- C. Four-Bolt Riser Clamps: MSS Type 42. (When longer ends are required for riser clamps.)

2.04 HANGER-ROD ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory- fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. Steel Turnbuckles: MSS Type 13. (For adjustment up to 6" for heavy loads.)
- C. Steel Clevises: MSS Type 14. (For use on high temperature piping installations.)
- D. Swivel Turnbuckles: MSS Type 15. (For use with split pipe rings, MSS type 11.)
- E. Malleable Iron Sockets: MSS Type 16. (For attaching hanger rod to various types of building attachments.)

2.05 BUILDING ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory- fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
- B. Concrete Inserts: MSS Type 18. (For upper attachment for suspending pipe hangers from concrete ceiling.)
- C. Top Beam C-Clamp: MSS Type 19. (Use under roof installations with bar joist construction, for attachment to top flange of structural shape.)
- D. Side Beam or Channel Clamps: MSS Type 20. (For attachment to bottom flange of beams, channels, or angles.)
- E. Center Beam Clamps: MSS Type 21. (For attachment to center of bottom flange of beams.)
- F. Welded Beam Attachments: MSS Type 22. (For attachment to bottom of beams where loads are considerable and rod sizes are large.)
- G. C-Clamps: MS Type 23. (For attachment to structural shapes.)
- H. Top Beam Clamps: MSS Type 25. (For attachment to top of beams when hanger rod is required tangent to edge of flange.)
- I. Side Beam Clamps: MSS Type 27. (For attachment to bottom of steel I-beams.)
- J. Steel Beam Clamps W/Eye Nut: MSS Type 28. (Same as Type 28 with link extensions.)
- K. Linked Steel Clamps W/EYE Nut: MSS Type 29. (Same as Type 28 with link extensions.)
- L. Malleable Beam Clamps: MSS Type 30. (For attachment to structural steel.)
- M. Steel Brackets: One of the following for indicated loading:
 - 1. Light Duty: MSS Type 31, to 570 pounds.
 - 2. Medium Duty: MSS Type 32, to 1,500 pounds.
 - 3. Heavy Duty: MSS Type 33, to 3,000 pounds.
- N. Side Beam Brackets: MSS Type 34. (For use on sides of steel or wooden beams.)
- O. Plate Lugs: MSS Type 57. (For attachment to steel beams where flexibility at the beam is desired.)
- P. Horizontal Travelers: MSS Type 58. (For supporting piping systems subject to linear horizontal movements where head room is limited.)

2.06 SADDLES AND SHIELDS:

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

- B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
- C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- D. Thermal Hanger Shields: Constructed of 360 degrees insert of high density, 100 psi, water-proofed calcium silicate, encased in 360 degrees sheet metal shield. Provide assembly of same thickness as adjoining insulation.
- E. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
 - 1. Elcen Metal Products Co.
 - 2. Pipe Shields, Inc.

2.07 **MANUFACTURERS OF HANGERS AND SUPPORTS:**

- A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - 1. Kin-Line, Inc.
 - 2. Fee & Mason Mfg. Co.; Div. Figgie International
 - 3. ITT Grinnel Corp.
 - 4. B-Line Inc.
 - 5. Ellen Metal Products

2.08 **HIGH HUMIDITY AND OUTSIDE AREAS:** Use cadmium plated or galvanized hangers, channels, angle iron, attachments, rods, nuts, bolts and other accessories in press room, truck area, and other high humidity areas and for supports located exposed outside.

2.09 **MISCELLANEOUS MATERIALS:**

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration. Use Embeco grout for non-shrink applications.
- D. Heavy Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.
- E. Pipe Guides: Provide factory-fabricated guides, of cast semi- steel or heavy fabricated steel, consisting of bolted two- section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.10 **ROOF EQUIPMENT SUPPORTS:**

- A. General: Construct roof equipment supports, unless detailed otherwise, using minimum 18-ga galvanized steel with fully mitered and welded corners, 3" cant, internal bulkhead reinforcing, integral base plates, pressure treated wood nailer, and 18-ga galvanized steel counterflashing.

- B. Configuration: Construct to sizes as indicated or dictated by equipment, compensate for slope in roof so top of support is dead level.
- C. Manufacturer: Subject to compliance with requirements, provide roof equipment supports of one of the following:
 - 1. Custom Curb, Inc.
 - 2. Pate Co.
 - 3. Thycurb Div.; Thybar Corp.

PART 3 - EXECUTION

3.01 INSPECTION:

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

3.02 PREPARATION:

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.
- B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS:

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the tops of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Install hangers, supports, clamps and attachments to rigidly support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

- C. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by isolating with foam rubber covering.
- D. Provisions For Movement:
- E. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- F. Install supports within 2 feet of non-vertical flex connectors.
- G. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- I. Insulated Piping: Hangers shall not come in contact with pipe where pipe is specified to be insulated.
- J. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- K. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold water piping, install galvanized steel protective shields. Install calcium silicate blocks (12" long minimum) at support points.
- L. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.05 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer for loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.06 EQUIPMENT SUPPORTS:

- A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 15. Size bases to extend a minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

- B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.
- C. Furnish roof equipment supports to Contractor for installation as part of work of Division 7; not work of this section.

3.07 ADJUSTING AND CLEANING:

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 15140

SECTION 15190 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is Division-15 General Mechanical Materials and Methods section, and is part of each Division-15 section making reference to identification devices specified herein.

1.02 DESCRIPTION OF WORK:

- A. Furnish mark and install identification devices for all exposed piping installed in this work.
- B. Furnish and securely attach an engraved plastic nameplate to all new pieces of equipment (Owner or Contractor furnished).
- C. Tag all valves installed in this work.

1.03 QUALITY ASSURANCE:

- A. Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 - PRODUCTS

2.01 IDENTIFICATION OF PIPING:

- A. Identification of all exposed pipe shall be accomplished by color-coding with bands and by lettering. Color bands shall be pressure-sensitive adhesive-backed vinyl cloth or plastic tape.
- B. Each pipe identification shall consist of 2 color-coded bands, a printed label identifying the name of the pipe, and a flow arrow to indicate direction of flow in the pipe. All labels shall be preprinted on pressure-sensitive adhesive-backed vinyl cloth or plastic tape. Arrows shall be die-cut of the same type of material as the labels.
- C. Preprinted identification devices shall be as manufactured by W.H. Brady Co., Seton Nameplate Corp., or equal.

2.02 VALVE TAGS:

- A. Brass Valve Tags: Provide 1-1/2" x 3" size 19-gage polished brass valve tags with stamp-engraved 1/8" high letters.
- B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.03 ENGRAVED PLASTIC-LAMINATE SIGNS:

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS:

- A. Coordination: Install identification after completion of covering and painting where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces.

3.02 PIPING SYSTEM IDENTIFICATION:

- A. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow:

<u>FLUID ABBREVIATION</u>	<u>FUNCTION AND IDENTIFICATION</u>	<u>ID COLOR</u>
IA	INSTRUMENT AIR	ALUMINUM
NG	NATURAL GAS	YELLOW
PA	PLANT AIR (COMPRESSED AIR)	ALUMINUM
PCW	POTABLE COLD WATER (DOMESTIC)	GREEN
RWL	RAIN WATER LEADER	BLUE
SD	SANITARY DRAINS & VENTS	BLUE
PHW	POTABLE HOT WATER (DOMESTIC)	GREEN
ANER BIOSLD	BIOSOLIDS - ANEROBIC	PURPLE
AERO BIOSLD	BIOSOLIDS - AEROBIC	PURPLE
UW	UTILITY WATER	ORANGE
WW	WASH WATER	ORANGE
POLY	POLYMER FEED	RED
DI	DEIONIZED WATER	GREEN
NAOCL	SODIUM HYPOCHLORITE	RED
NAOH	SODIUM HYDROXIDE	RED

- B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, crawl spaces, plenums) and exterior non-concealed locations.
 1. Near each valve and control device.
 2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 3. Near locations where pipes pass through walls or floors/ ceilings, or enter non-accessible enclosures.
 4. Near major equipment items and other points of origination and termination.
 5. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

3.03 VALVE IDENTIFICATION:

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures. List each tagged valve in valve schedule for each piping system. Valve tags shall include the following minimum information:

1. Plan Identification
2. Normal Position
3. Duty
4. Area served
5. Valve type.

B. Example of typical valve tag (where it is apparent what valve is serving):

B-14 Automatic 3-way mixing chlorine feed pump rate control
Position: 1/2 open
Duty: Control flow rate

3.04 MECHANICAL EQUIPMENT IDENTIFICATION:

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as non-potable water outlets. For non-potable water outlets use red engraved laminate with white lettering.
2. Pumps, compressors.
3. Press.
4. Air Handlers and Exhaust Fans, Furnaces, Condensing Units.
5. Polymer Feed Units.
6. Tanks and pressure vessels.
7. Open Control Equipment.

B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

D. A sample identification tag for equipment could be as follows:

Heating water pump Symbol P-1
Rating: 900 gpm, 120 ft. hd.
Maintenance: Lubricate with type C lubricant.

3.05 PANEL IDENTIFICATION:

- A. All panel devices on panel faces shall have engraved black face formica with white engraved lettering labels.
- B. All internal panel components shall have engraved black face formica with white engraved lettering labels. Fasten label beneath each device.
- C. All panel wiring and tubing shall be numerically or alphabetically coded.

3.06 ADJUSTING AND CLEANING:

- A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division.
- B. Cleaning: Clean face of identification devices.

END OF SECTION 15190

SECTION 15200 – BOILERS

PART 1: GENERAL

1.01 SUBMITTALS

- A. Shop drawings showing general equipment arrangement, installation details, dimensions, and materials.
- B. Descriptive information such as catalogs, performance data, and other product literature showing equipment meets specified design criteria.
- C. Motor and speed reduction data.
- D. Wiring diagrams and electrical schematics for control equipment.

1.02 MANUFACTURER'S SERVICE

- A. Provide a manufacturer's service representative for inspection of completed installation and provide start-up service and training for the natural gas auxiliary fuel. Service shall include at least one 8-hour day at the site.
- B. Provide a manufacturer's service representative for start-up and training with digester gas fuel. Service shall include at least one 8-hour day at the site.

1.03 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer shall be engaged primarily in design and fabrication of wastewater treatment equipment including digester gas fueled boilers and heat exchangers.
 - 2. Test the unit for both mechanical and electrical operation prior to shipment.
 - 3. Provide an inspection report for the unit stamped by an inspector holding a National Board Commission.
 - 4. Perform field tests specified in this section.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Receive deliveries, handle, store, and protect equipment as recommended by manufacturer and as specified in other sections.

1.05 CODES AND STANDARDS

- A. The codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto.
- B. Abbreviations
 - 1. AISC – American Iron & Steel Institute.
 - 2. ANSI – American National Standards Institute.
 - 3. HI – Hydraulic Institute.
 - 4. NEMA – National Electric Manufacturer's Association.
 - 5. ASME – American Society of Mechanical Engineers.

PART 2 PRODUCTS

2.01 GENERAL

- A. Furnish and install two digester boilers and accessories as necessary to complete the installation.
- B. The hot water system shall be designed to provide 180° F water to the heat exchanger as specified in below.

- C. Controls and accessories shall be provided to operate on manual or automatic mode, on digester gas or the auxiliary fuel source.
- D. Boiler shall meet ASME code requirements.

2.02 BOILER

- A. The boiler shall be of the fire-tube, low-pressure type.
- B. The fire tubes shall consist of a boiler tubing rolled into the tube sheets.
- C. The firebox shall be of firebox quality steel and shall be lined with factory-molded refractory material in the combustion area.
- D. The front and back plates shall be easily removable for inspection, and the back plate shall have a flame observation port.
- E. The boiler shall be insulated on all sides with 1" thick fiberglass and covered by 22-gauge steel plate panels.
- F. A 30 gallon expansion tank with gauge glass and overflow drain shall be included.
- G. A pressure relief valve, temperature limit control thermostat, altitude-pressure gauge, and temperature gauge shall be part of the boiler system.
- H. The boiler shall have a water side heating surface of at least 63 square feet.
- I. The boiler output heating capacity shall be a minimum of 650,000 Btu/hr.
- J. The boiler shall receive manufacturer's shop prime and finish paint coatings.

2.03 BURNER

- A. The burner shall be of the forced draft-type capable of burning digester gas and natural gas through a multiple-orifice type burner with intimate mixing of air and fuel for high combustion efficiency.
- B. A blower mounted on the burner shall provide combustion air.
- C. An air pressure switch shall prove proper blower operation before the combustion cycle can commence.
- D. Completely separate fuel control trains shall be used for each fuel – no mixture of gases shall be allowed.

2.04 BURNER CONTROLS

- A. Automatic controls shall be provided which will allow for the burning of digester gas until the manifold pressure is reduced.
- B. The burner fuel shall automatically be switched to auxiliary fuel at pressures below 6" W.C. Natural gas fuel shall be used until proper digester gas pressure is again available at which time the fuel source will automatically switch back to digester gas.
- C. A differential gas pressure switch shall be provided to close the main motorized gas valve in case of low gas pressure.
- D. The burner shall be electrically connected and control the motorized damper.

2.05 SAFETY CONTROLS

- A. Ultra-violet or infrared flame-scanning type safety controls shall be provided.
- B. The scanning device shall include a lead sulfide cell to prove the gas pilot flame before the main gas valve is opened.
- C. It shall provide a purging cycle before and after combustion, and it shall automatically ignite the gas pilot flame.
- D. In case of flame failure, the main gas valve shall close.

2.06 DIGESTER TEMPERATURE CONTROLS

- A. The controls shall be provided to keep the digester contents automatically within 1° F of preset temperature.
- B. A sensitive sludge thermostat shall be mounted in the digester tank wall through a thermowell as indicated on the drawings.

- C. The thermostat shall start the hot water pump upon low temperature in the digester and shall keep the water recirculation pump in operation until the sludge has reached the desired temperature.
- D. Selector switches shall be provided to operate the pump and control the digester temperature manually.
- E. An automatic temperature-controlled blending valve shall be provided for mixing return water with the water line to the heater. Protection against overheating shall be included.
- F. A direct-reading stem thermometer in the hot water pump discharge line shall be provided to indicate the hot water temperature.

2.07 ELECTRIC CONTROLS

- A. A NEMA 12 control panel shall be mounted on the boiler room wall or the side of the hot water boiler and contain the necessary electrical controls. A numbered terminal strip shall be provided in the panel and on the boiler.
- B. The panel shall include a disconnect switch and magnetic starters for the burner motor and hot water recirculation pumps.
- C. Program timers, alarm horn, flame safeguard unit with pre- and post-purge, necessary switches, relays, and terminals shall also be provided in the panel.
- D. Provide contacts in the panel to provide outputs indicating burner motor status, hot water recirculation pumps status, and indication of if natural gas or digester gas is burning.
- E. The panel shall be prewired, and terminals shall be provided for connection to 460 volt, 60 cycle, 3 phase, AC voltage.
- F. A control transformer for 115 volt AC shall be provided in the control panel.
- G. The Contractor shall provide wiring between the control panel, the pumps and the boiler.

2.08 HOT WATER PUMPS

- A. Provide one hot water circulation pumps included on each boiler skid.
- B. Each pump shall be rated for 150 gpm at 80' TDH.
- C. Pumps shall be provided by the boiler supplier.

PART 3 EXECUTION

3.01 SHOP TESTS

- A. The boilers shall be shop fired and tested with natural gas prior to shipment to ensure proper operation and to adjust air and fuel flow. A report of the results of this test shall be submitted to the Engineer. This report shall include the following information.
 1. Manometer readings at the main gas regulator, pilot gas regulator, burner inlet, burner, and furnace.
 2. Amperage drawn by all motors
 3. Voltage of pilot and main flame controller signal
 4. Flue gas readings including percent oxygen, percent carbon dioxide, temperature, efficiency, and smoke test results.

3.02 FOUNDATION

- A. Examine foundation or support structure where the boilers are to be located and make any modifications necessary for mounting the equipment.
- B. Anchor bolts shall be provided for the boiler equipment and shall be located as required.

3.03 INSTALLATION

- A. Install the equipment and accessories in accordance with the drawings and manufacturer's written instructions.
- B. Lubricate for all moving parts as recommended by the written instructions for the equipment provided by the manufacturer.

- C. Check all piping, wiring, bolted connections to make sure they are properly tightened.

3.04 TESTING

- A. After installation, provide a manufacturer's service representative to assist in the following.
 - 1. Inspect the installation and make recommendations for any necessary modifications.
 - 2. Place the equipment in operation using natural gas and make adjustments as necessary.
 - 3. Operate on digester gas if available. If not available perform this operation at a later date.
 - 4. Instruct the operations and maintenance personnel in the proper operation and maintenance of the equipment.
 - 5. Certify that the boilers have been installed properly and are ready for normal operation.
- B. The Contractor shall provide notification of the tests to the engineer, at least one week in advance of the test

END OF SECTION 15200

SECTION 15205 – HEAT EXCHANGERS

PART 1 – GENERAL

1.01 SUBMITTALS

- A. Shop drawings showing general equipment arrangement, installation details, dimensions, and materials.
- B. Descriptive information such as catalogs, performance data, and other product literature showing equipment meets specified design criteria.
- C. Motor and speed reduction data.
- D. Wiring diagrams and electrical schematics for control equipment.

1.02 MANUFACTURER'S SERVICE

- A. Provide a manufacturer's service representative for inspection of completed installation and provide start-up service and training for the equipment. Service shall include at least one 8-hour day at the site.
- B. Provide a manufacturer's service representative for start-up and training. Service shall include at least one 8-hour day at the site.

1.03 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer shall be engaged primarily in design and fabrication of wastewater treatment equipment including heat exchangers.
 - 2. Test the unit for both mechanical and electrical operation prior to shipment.
 - 3. Provide an inspection report for the unit stamped by an inspector holding a National Board Commission.
 - 4. Perform field tests specified in this section.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Receive deliveries, handle, store, and protect equipment as recommended by manufacturer and as specified in other sections.

1.05 CODES AND STANDARDS

- A. The codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto.
- B. Abbreviations
 - 1. AISC – American Iron & Steel Institute.
 - 2. ANSI – American National Standards Institute.
 - 3. HI – Hydraulic Institute.
 - 4. NEMA – National Electric Manufacturer's Association.
 - 5. ASME – American Society of Mechanical Engineers.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Furnish and install one thermophilic heat exchanger, one plug flow heat exchanger, one sludge-to-sludge heat exchanger, and accessories as necessary to complete the installation.
- B. The equipment shall be furnished by one manufacturer.

2.02 MANUFACTURER

- A. Heat exchangers shall be manufactured by Walker Process Equipment, or equal.

2.03 THERMOPHILIC HEAT EXCHANGER

- A. Furnish and install one thermophilic digester heat exchanger. The unit shall consist of a series of 6" ID Schedule 40 steel pipe sludge tubes concentrically placed within 8" ID Schedule 40 steel pipe water tubes. The tubes shall be joined by Neoprene-gasketed end castings so designed that any leakage occurring will be to the exterior of the heat exchanger. The tubes shall be supported by 3/4" thick steel end plates with structural steel members serving as supports and framing for the exterior steel paneling. The sludge and water tubes shall be independently removable and so arranged as to prevent contamination of the heating water by material circulated through the sludge tubes.
- B. The sludge tube end castings shall be removable to permit tube inspection without having to drain the jacket water. All sludge passageways shall be designed to pass 3 1/2-inch spheres. The inlet and outlet connections shall be of cast iron and shall have connection(s) for sludge piping and jacket water piping. In addition, these castings shall have 3/4" NPT connections for attachment of sludge and water inlet and outlet thermometers. The entire sludge-water tube bundle shall be wrapped with a minimum of 1 1/2" of blanket insulation.
- C. The heat exchanger unit shall have not less than 16 sludge tubes that will provide a total heated surface area, based on the log mean surface area of the sludge tubes, of not less than 446 sq. ft.
- D. The heat exchanger shall be designed, fabricated and tested in accordance with ASME Code for pressure piping, B31.9-1966.
- E. Provide a thermostatic limit valve placed in the water jacket circulating line to maintain a boiler water temperature of 180°F, regardless of the load on the boiler, so that a sufficient supply of heat will always be available for sludge heating and, also, to prevent condensate corrosion of the boiler. All additional manual blending and shut off valves shall be furnished as recommended by the Equipment Manufacturer or as shown on the plans. The thermostatic valve shall also limit the sludge heat exchanger jacket water from exceeding a temperature of 150°F to prevent sludge "baking" on the tubes and the resultant loss of heat transfer efficiency.
- F. The heat exchanger shall be suitable for installation as shown on the contract drawings and shall be designed to operate at the following conditions.
 - 1. Hot water flow, gpm: 150
 - 2. Hot water temperature, °F: 175
 - 3. Digester sludge flow, gpm: 232
 - 4. Sludge inlet temperature, °F: 111

- | | | |
|----|---|-----------|
| 5. | Sludge outlet temperature, °F: | 135 |
| 6. | Minimum heat transfer capacity, Btu/hr: | 2,900,000 |
- G. The heat exchanger shall be built to operate at 30 psig, and shall be hydrostatically tested at 60 psig. The separate pieces of piping shall be assembled with grooved-end couplings. Couplings shall meet ASTM A-47 and ASTM A-536 codes and shall be rated at 350 psig working pressure.
- H. The sludge tubes shall be connected by coupled 180° long radius, full passageway return bends. Sludge and water inlet and outlet connections shall be grooved for use with grooved-end pipe couplings. Water shall be transferred between jacket tubes by short tubes, connected by grooved-end couplings, preventing leakage from one fluid to the other. The water jacket tubes shall be attached to a heavy duty structural steel support frame with fixed and expandable connectors.
- I. Sludge tubes shall be removable from the water jacket tubes without removing the water tubes. Return bends shall be removable from either end of the sludge tubes by releasing not more than two bolts at each connection.
- J. Inlet and outlet connections for both sludge and water shall be flanged and shall be attached to the heat exchanger with grooved-end couplings.
- K. The heat exchanger shall be equipped with recessed thermometer wells in the sludge and water inlets and the sludge and water outlets.
- L. All tubes and piping shall be ASME A-53-B steel pipe. Steel members in contact with liquids, either continuously or intermittently, shall have a minimum thickness of 1/4".
- M. All structural steel shall conform to the requirements of ASTM A-36.
- N. Gaskets shall be UL approved Gruvlok Grade E, EPDM compound, rated for 200 psig and 230° F service.
- O. Heat exchanger enclosure panels on the sides, ends and top shall be of 14 gage painted steel casing and shall not enclose the return bends. The panels shall be provided with one inch rigid insulation.
- P. Shop fabrication and welding of structural members shall be in accordance with the latest edition of AWS D 1.1 of the American Welding Soc.
- Q. The heat exchanger shall be shop cleaned per SSPC SP-6 and primed with two coats of rust inhibitive primer at 1 to 2 mils per coat.

2.04 PLUG FLOW HEAT EXCHANGER

- A. Furnish and install one plug flow heat exchanger. The unit shall consist of a series of 4" ID Schedule 40 steel pipe sludge tubes concentrically placed within 6" ID Schedule 40 steel pipe water tubes. The tubes shall be joined by Neoprene-gasketed end castings so designed that any leakage occurring will be to the exterior of the heat exchanger. The tubes shall be supported by 3/4" thick steel end plates with structural steel members serving as supports and framing for the exterior steel paneling. The sludge and water tubes shall be independently removable and so arranged as to prevent contamination of the heating water by material circulated through the sludge tubes.
- B. The sludge tube end castings shall be removable to permit tube inspection without having to drain the jacket water. All sludge passageways shall be designed to pass 3 1/2 inch

spheres. The inlet and outlet connections shall be of cast iron and shall have connection(s) for sludge piping and jacket water piping. In addition, these castings shall have 3/4" NPT connections for attachment of sludge and water inlet and outlet thermometers. The entire sludge-water tube bundle shall be wrapped with a minimum of 1 1/2" of blanket insulation.

- C. The heat exchanger unit shall have not less than 8 sludge tubes that will provide a total heated surface area, based on the log mean surface area of the sludge tubes, of not less than 63 sq. ft.
- D. The heat exchanger shall be designed, fabricated and tested in accordance with ASME Code for pressure piping, B31.9-1966.
- E. Provide a thermostatic limit valve placed in the water jacket circulating line to maintain a boiler water temperature of 180°F, regardless of the load on the boiler, so that a sufficient supply of heat will always be available for sludge heating and, also, to prevent condensate corrosion of the boiler. All additional manual blending and shut off valves shall be furnished as recommended by the Equipment Manufacturer or as shown on the plans. The thermostatic valve shall also limit the sludge heat exchanger jacket water from exceeding a temperature of 150°F to prevent sludge "baking" on the tubes and the resultant loss of heat transfer efficiency.
- F. The heat exchangers shall be suitable for installation as shown on the contract drawings and shall be designed to operate at the following conditions.
 - 1. Hot water flow, gpm: 150
 - 2. Hot water temperature, °F: 175
 - 3. Digester sludge flow, gpm: 116
 - 4. Sludge inlet temperature, °F: 131
 - 5. Sludge outlet temperature, °F: 140.4
 - 6. Minimum heat transfer capacity, Btu/hr: 553,000
- G. The heat exchanger shall be built to operate at 30 psig, and shall be hydrostatically tested at 60 psig. The separate pieces of piping shall be assembled with grooved-end couplings. Couplings shall meet ASTM A-47 and ASTM A-536 codes and shall be rated at 350 psig working pressure.
- H. The sludge tubes shall be connected by coupled 180° long radius, full passageway return bends. Sludge and water inlet and outlet connections shall be grooved for use with grooved-end pipe couplings. Water shall be transferred between jacket tubes by short tubes, connected by grooved-end couplings, preventing leakage from one fluid to the other. The water jacket tubes shall be attached to a heavy duty structural steel support frame with fixed and expandable connectors.
- I. Sludge tubes shall be removable from the water jacket tubes without removing the water tubes. Return bends shall be removable from either end of the sludge tubes by releasing not more than two bolts at each connection.
- J. Inlet and outlet connections for both sludge and water shall be flanged and shall be attached to the heat exchanger with grooved-end couplings.
- K. The heat exchanger shall be equipped with recessed thermometer wells in the sludge and water inlets and the sludge and water outlets.
- L. All tubes and piping shall be ASME A-53-B steel pipe. Steel members in contact with liquids, either continuously or intermittently, shall have a minimum thickness of 1/4".

- M. All structural steel shall conform to the requirements of ASTM A-36.
- N. Gaskets shall be UL approved Gruvlok Grade E, EPDM compound, rated for 200 psig and 230° F service.
- O. Heat exchanger enclosure panels on the sides, ends and top shall be of 14 gage painted steel casing and shall not enclose the return bends. The panels shall be provided with one inch rigid insulation.
- P. Shop fabrication and welding of structural members shall be in accordance with the latest edition of AWS D 1.1 of the American Welding Soc.
- Q. The heat exchanger shall be shop cleaned per SSPC SP-6 and primed with two coats of rust inhibitive primer at 1 to 2 mils per coat.

2.05 SLUDGE-TO-SLUDGE HEAT EXCHANGER

- A. Furnish and install one sludge-to-sludge heat exchanger. The unit shall consist of a series of 5" ID Schedule 40 steel pipe sludge tubes concentrically placed within 8" ID Schedule 40 steel outer tubes. The raw sludge shall circulate through the inner tubes and all passageways through the inner tubes and return bends shall be large enough to pass a 3 1/2 inch diameter sphere. The digested thermophilic sludge shall circulate through the annular space that shall have a minimum of 1.2 clearance between the inner and the outer tubes. The tubes shall be joined by Neoprene-gasketed end castings so designed that any leakage occurring will be to the exterior of the heat exchanger. The tubes shall be supported by 3/4" thick steel end plates with structural steel members serving as supports and framing for the exterior steel paneling. The inner and outer tubes shall be independently removable.
- B. The sludge tube end castings shall be removable to permit tube inspection without having to drain the jacket water. All sludge passageways shall be designed to pass 3 1/2 inch spheres. The inlet and outlet connections shall be of cast iron and shall have connection(s) for sludge piping and jacket water piping. In addition, these castings shall have 3/4" NPT connections for attachment of sludge and water inlet and outlet thermometers. The entire sludge-water tube bundle shall be wrapped with a minimum of 1 1/2" of blanket insulation.
- C. The heat exchanger shall have not less than 16 sludge tubes that will provide a total heated surface area, based on the log mean surface area of the sludge tubes, of not less than 362 sq. ft.
- D. The heat exchanger shall be designed, fabricated and tested in accordance with ASME Code for pressure piping, B31.9-1966.
- E. The heat exchangers shall be suitable for installation as shown on the contract drawings and shall be designed to operate at the following conditions.

1. Raw Sludge:

i. Flow rate, gpm:	116
ii. Solids content, percent:	3 – 4
iii. Primary sludge, percent:	47
iv. WAS sludge, percent:	53
v. Winter Inlet temperature, °F:	54
vi. Summer Inlet temperature, °F:	77

vii. Winter outlet temperature, °F:	90
viii. Summer outlet temperature, °F:	104

2. Digested thermophilic sludge

i. Flow rate, gpm:	116
ii. Solids content, percent:	3 – 4
iii. Inlet temperature, °F:	140
iv. Winter outlet temperature, °F:	102
v. Summer outlet temperature, °F:	112

- F. The heat exchanger shall be built to operate at 30 psig, and shall be hydrostatically tested at 60 psig. The separate pieces of piping shall be assembled with grooved-end couplings. Couplings shall meet ASTM A-47 and ASTM A-536 codes and shall be rated at 350 psig working pressure.
- G. The sludge tubes shall be connected by coupled 180° long radius, full passageway return bends. Sludge and water inlet and outlet connections shall be grooved for use with grooved-end pipe couplings. Water shall be transferred between jacket tubes by short tubes, connected by grooved-end couplings, preventing leakage from one fluid to the other. The water jacket tubes shall be attached to a heavy duty structural steel support frame with fixed and expandable connectors.
- H. Sludge tubes shall be removable from the water jacket tubes without removing the water tubes. Return bends shall be removable from either end of the sludge tubes by releasing not more than two bolts at each connection.
- I. Inlet and outlet connections for both sludge and water shall be flanged and shall be attached to the heat exchanger with grooved-end couplings.
- J. The heat exchanger shall be equipped with recessed thermometer wells in the sludge inlets and outlets.
- K. All tubes and piping shall be ASME A-53-B steel pipe. Steel members in contact with liquids, either continuously or intermittently, shall have a minimum thickness of 1/4".
- L. All structural steel shall conform to the requirements of ASTM A-36.
- M. Gaskets shall be UL approved Gruvlok Grade E, EPDM compound, rated for 200 psig and 230° F service.
- N. Heat exchanger enclosure panels on the sides, ends and top shall be of 14 gage galvanized steel casing and shall not enclose the return bends. The panels shall be provided with one inch rigid insulation.
- O. Shop fabrication and welding of structural members shall be in accordance with the latest edition of AWS D 1.1 of the American Welding Soc.
- P. The heat exchanger shall be shop cleaned per SSPC SP-6 and primed with two coats of rust inhibitive primer at 1 to 2 mils per coat.

PART 3 – EXECUTION

3.01 SHOP TESTS

- A. The heat exchangers shall be shop assembled and hydrostatically tested at 60 psi for 60 minutes and certified by a registered professional engineer.

3.02 INSTALLATION

- A. Install the equipment and accessories in accordance with the drawings and manufacturer's written instructions.
- B. Lubricate for all moving parts as recommended by the written instructions for the equipment provided by the manufacturer.
- C. Check all piping, wiring, bolted connections to make sure they are properly tightened.

3.03 TESTING

- A. After installation, provide a manufacturer's service representative to assist in the following.
 - 1. Inspect the installation and make recommendations for any necessary modifications.
 - 2. Place the equipment in operation and make adjustments as necessary.
 - 3. Instruct the operations and maintenance personnel in the proper operation and maintenance of the equipment.
 - 4. Certify that the heat exchangers have been installed properly and are ready for normal operation.
- B. The Contractor shall provide notification of the tests to the engineer, at least one week in advance of the test.

END OF SECTION 15205

SECTION 15210 – WASTE GAS HANDLING EQUIPMENT

PART 1: GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish and install gas handling equipment for the anaerobic sludge digesters and the sewage gas piping system and all appurtenant work, complete and operable, including condensate and sediment traps, drip traps, flame arresters, flame traps, flame check, pressure relief/flame trap, pressure and vacuum relief valves, foam separator, and waste gas burner in accordance with the requirements of the Contract Documents.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Codes: All codes, as referenced herein, are specified in Section 01090 – Reference Standards.
- | | |
|--------------|------------------------|
| ANSI/NFPA 70 | National Electric Code |
|--------------|------------------------|
- B. Commercial Standards
- | | |
|------------|--|
| ANSI B16.1 | Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 123, 250, and 800 |
| ANSI B16.5 | Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys |

1.03 CONTRACTOR SUBMITTALS

- A. Prior to ordering of equipment, the CONTRACTOR shall submit shop drawings of all sludge processing equipment in accordance with Section 01300 – Contractor Submittals.

PART 2: PRODUCTS

2.01.1 CONDENSATE AND SEDIMENT TRAPS

- A. Condensate and sediment traps shall have flanged connections. Flow capacity shall be not less than 3000 SCFH at less than 0.5 in WC pressure loss. Storage capacity shall be a minimum of 6 gallons sediment and 6 gallons condensate. Construction shall be carbon steel with prime & finished external and coal tar epoxy coating on internals. Flanges shall be drilled to ANSI 150 FF dimensions. Maximum working pressure shall be 25 psig.

The sight glass shall have 1/2" NPT connections of the correct length to fit the sight glass connections on the Sediment and Condensate Trap. Sight tube shall be 5/8". Guard rods shall protect the sight tube. Assembly shall include two isolation valves to facilitate cleaning. Lower valve shall include a drain cock. Materials shall include stainless steel isolation valves, drain cock, and guard rods.

- B. Manufactures, or Equal:
1. Varec Biogas 233 series.

2.02 DRIP TRAPS

- A. The drip traps shall have one 1-inch size NPT inlet and outlet connections and shall be of the ball float operated needle valve type. A plug shall be provided to permit manual draining of the bowl. Construction shall be low copper aluminum body and cover. Internal working parts and fasteners shall be stainless steel. Maximum working pressure shall be 25 psig. The drip trap shall be at least 2 quarts.
- B. Manufactures, or Equal:
 - 1. Varec, Inc. series 245

2.03 FLAME ARRESTERS

- A. The flame arrester shall have an ANSI class 125 flange as shown on the drawings. Housing construction shall be cast aluminum. Flame arrester net free area through the bank assembly shall be not less than three times the corresponding size standard pipe. Entire bank assembly shall slide easily out of the arrester housing to facilitate inspection and cleaning. Removing or replacing the bank assembly shall not require support for alignment, jackscrew for extending the housing, and shall not place a strain on the connecting piping. Bank frame shall be extensible and shall be filled with corrugated rectangular shaped bank sheets. Alternating flat and crimped ribbon is not an acceptable substitute. Flame arrester shall be self -draining. Arrester housing construction shall be low copper cast aluminum. Bank assembly shall include a low copper aluminum frame and bank sheets with stainless steel hardware.
- B. Manufactures, or Equal:
 - 1. Groth Equipment Corp.
 - 2. Varec, Inc.

2.04 FLAME CHECK

- A. Flame check shall have ¾-inch NPT connection. House shall be of "pipe union" design to permit easy disassembly for inspection and cleaning. Element shall be replaceable and be made of compressed 316 SS woven wire. Housing shall be constructed of low copper cast aluminum. Maximum working pressure shall be 25 psig.
- B. Manufacturers or Equal:
 - a. Varec, Inc series 5200

2.05 PRESSURE RELIEF AND FLAME TRAP ASSEMBLY

- A. The pressure relief and flame trap assembly shall have an ANSI class 125 flange fitting.
- B. The pressure relief portion shall be back pressure regulator valve actuated by a spring loaded diaphragm. The spring barrel shall include a glass enclosed pointer and scale to indicate setting and it shall be arranged to permit setting adjustments without disassembling the diaphragm housing. Setting range shall be from 2" to 16" W.C. pressure. Construction shall be aluminum throughout except for stainless steel shaft and bearings, molded synthetic rubber fabric reinforced diaphragm. Flame arrester net free area through the bank assembly shall be not less than three times the corresponding size standard pipe. Entire bank assembly shall slide easily out of the arrester housing to facilitate inspection and cleaning. Removing or replacing the bank assembly shall not require support for alignment, jackscrew for extending the housing, and shall not place a

strain on the connecting piping. Bank frame shall be extensible and shall be filled with corrugated rectangular shaped bank sheets. Alternating flat and crimped ribbon is not an acceptable substitute. Flame arrester shall be self - draining. Arrester housing construction shall be low copper cast aluminum. Bank assembly shall include a low copper aluminum frame and bank sheets with stainless steel hardware.

- C. The element shall be the proven spiral wound, crimped ribbon design. The pressure relief regulator and the flame trap assembly shall be functionally interconnected by a thermal shut-off valve assembly which will automatically close the regulator by applying full upstream gas pressure on the top side of the diaphragm housing in the event a fusible element is released due to gas temperature reaching 260° F at the flame trap outlet. Fusible element shall be replaceable without disassembling the valve.
- D. Manufactures, or Equal:
 - 1. Groth Equipment Corp.
 - 2. Varec, Inc. series 440

2.06 PRESSURE AND VACUUM RELIEF VALVE

- A. Pressure and vacuum relief valve shall have flanged connections. Pressure relief shall be set at 4" WC. Capacity shall be not less than 4,000 SCFH digester gas of 0.8 specific gravity at 4" WC overpressure. Vacuum relief shall be set at 1" WC. Capacity shall be not less than 4000 SCFH digester gas of 0.8 specific gravity at 1" WC underpressure.
- B. Valve pressure and vacuum ports shall be oversized to keep overpressure to a minimum. Pallets and seat rings shall be replaceable and interchangeable. Pallets shall be dead weight loaded, and both center and side guided for stability. They shall incorporate replaceable "air cushion" Teflon seat inserts. HDPE protective screens shall be provided at the pressure and vacuum ports, located external of the pallets.
- C. The valve body and cover shall be low copper cast aluminum construction. Spun hood, seat rights, and pallet assemblies shall be low copper aluminum. Guideposts shall be 304 stainless steel. Flanges shall be drilled ANSI 125 FF Flanged dimensions.
- D. Manufacturers or Equal:
 - 1. Varec Inc. series 2010B

2.07 WASTE GAS BURNER

- A. The waste gas burner shall have a four inch ANSI 150 flanged fitting. Burning capacity shall be not less than 9000 SCFH gas of 0.8 specific gravity at 60° F with 0.5" WC pressure drop. Burner shall be designed for waste gas composed primarily of methane (methane 50-55% and CO₂ 40-45%) with a minimum heating value of 550 BTU/cubic foot.
- B. Burner shall be self-supporting on 150 ANSI flange for winds to 150 mph and shall meet Seismic Zone 4 requirements
- C. Burner shall be constructed with 304 stainless steel shroud and upper 24" of stack and pilot piping. Remainder of burner stack shall be mild steel. The burner shall come with 316 SS pilot nozzles, 316 SS Type K thermocouple with an inconelthermowell.

- D. Continuous flame nozzle shall be mounted integral to the burner and shall have a long profile flame. Pilot shall be inclined 30 degrees off vertical. Pilot flame shall extend through waste gas flow profile to ensure ignition of waste gas regardless of the flow rate.

Unprotected pilot shall withstand winds up to 110 mph (177km/h) without the use of downdraft protectors, vortex vanes or other flow restricting devices.

Pilot shall burn at an elevated temperature to assist in the conversion of hydrogen sulfide and subsequently, odor control.

Waste gas burner shall operate using a waste gas pilot.

Pilot gas and air shall be mixed and ignited at ground level, remote from the burner stack a minimum of 15 feet to a maximum of 35 feet away from the burner tip.

Specifically, no component of the ignition system shall be mounted to the burner stack or shroud; nor shall heat shields be substituted in an attempt to protect such devices from the heat of combustion.

- E. The automatic pilot ignition control panel shall be housed in a NEMA 4X, 316 stainless steel enclosure and shall provide automatic pilot ignition upon receiving signal from the pressure switch. Pilot controls to provide sparking for a predetermined time or until the pilot is lit and will provide an alarm contact for "Flame failure" if ignition is not realized within the adjustable time limit. "Flame Failure" alarm to operate anytime a flame is not sensed while the system is in the operate mode. A reset switch shall be provided to reset the control system. A switch shall be provided on the control panel for manual mode and will override the automatic mode. A status contact for "Pilot On" shall also be provided at the control panel. Status lights shall be provided for "T/C Monitor OK", "Pilot Gas On", "Pilot Flame On", and "Pilot Flame Failure".
- F. Control panel shall include necessary pilot controls to provide automatic "start-up", flame sensing, reignition sequence for flame failure and automatic "shut-down" on "contact-open" signal. A solenoid valve shall be provided to operate the pilot fuel on/off function.
- G. Pilot system to provide a stoichiometric air/fuel mixture by utilizing an inspiriting venturi and shall sense the pilot flame by use of a thermocouple. The maximum pilot fuel consumption shall be 45,000 BTU/hr
- H. Electrical input of the control panel to be 115 V, 1 phase, 60 Hz, 10 Amps, Grounded Neutral. Contacts for remote monitoring to be:
 - 1. Flame On – N.O. 5A @ 115 VAC and
 - 2. Flame Failure – N.C., 5A @ 115 VAC.
- I. Pressure switch to be explosion-proof and have an operating range of 4" to 20" W.C. with a 0.4" to 0.6" deadband.
- J. Ambient temperature rating shall be -20° F to +150° F.
- K. Contractor shall supply U.L. site certification.
- L. Manufactures, or Equal:

1. Varec, Inc. series 244WG

2.08 SAFETY SELECTOR VALVE

- A. Install a Safety Selector Valve (SSV) with the two Pressure and Vacuum Relief Valve and Flame Arrester Assemblies to allow performing maintenance on one unit while the other is kept in operation.
- B. The valve design shall prevent the possibility of leaving the digester unprotected at any time during the switch-over of the operating Pressure and Vacuum Relief (PVR) Valve and Flame Arrester Assembly.
- C. Valve shall have built in seat equalization. This is defined as the pressure being uniform and equalized across the SSV seat during changeover in order to facilitate the changeover process. During changeover pressure shall be applied to both sides of the seating surface. Valves in which pressure is applied to only one side of the seating surface during changeover shall not be allowed. No special tools shall be required to operate the unit. The SSV shall require no more than 80 foot-pounds of torque to equalize the seat. Units requiring more than 80 foot-pounds shall be supplied with explosion proof electric actuators.
- D. A bright red indicator manufactured in stainless steel is included to provide positive indication of active pressure and vacuum relief and flame arrester.
- E. There shall be means to accommodate a locking device shall be provided to prevent unwanted access to either of the Pressure and Vacuum Relief (PVR) Valve and Flame Arrester Assembly.
- F. The SSV shall have a pressure drop through the active device of not greater than 3% of the flow with the pressure relief valve fully open. Valve design shall have Cv values which are verified in an ASME certified flow test facility. Testing shall have been witnessed by an ASME observer and test reports shall be supplied as part of the submittal process. Cv shall, at a minimum, be as defined in the following table:

Size	Cv
2"	225
3"	612
4"	1061
6"	2713
8"	4512

- G. Packing design shall be tested to ASTM E427, Method A Halogen Leak Test, to reduce the possibility of fugitive emissions.
- H. The SSV shall come with threaded ports on both process sides. The threaded ports shall come with 1" manual hand valves constructed in stainless steel. This will allow pressure testing of each process side and subsequently allow field testing and calibration of the Pressure and Vacuum Relief Valve and Flame Arrester.
- I. The Safety Selector Valve shall be rated for a minimum pressure of 15 psig at 100 degrees F and shall be rated for a maximum temperature of 400 degrees F. The unit shall come with ANSI 150 FF Flanged Connections.

- J. Material shall be as follows: Body, Base: Aluminum; Rotor, Indicator and Seat: 316 SS; Isolation Disk, Index Shaft, Retraction Bushing: 1704 stainless steel; Body/Base Nut and Process Connection Nut: SA194-8M stainless steel; Body/Base Stud and Process Connection Stud: SA193-B8M stainless steel; Soft Goods: Teflon.

2.09 INSULATING JACKET

- A. When installed outdoors, provide the pressure and vacuum relief valve and flame arrester, safety selector valve and flame trap assemblies with an easily removable 1" thick insulation jacket.
- B. The insulating jacket shall be constructed with a silicone impregnated woven glass cloth lining with a 1" thick, 6-lb density fiber glass insulating material. Through-cover quilting pins provide firm support for the insulation. The pins shall keep the insulation from shifting inside the liner and jacket for dimensional stability and uniform heat retention. The silicone lining has inside seams and folded closing seams with two parallel rows of stitching.
- C. The special made insulating jacket shall be attached to the unit with a combination of Velcro and cinch belts. The jacket must allow access to the flame arrester bank assembly during maintenance without removing the entire jacket.

2.10 WELL TYPE MANOMETERS

- A. Provide direct reading single-tube well-type monometers, as indicated. Manometer housing shall be extruded aluminum with epoxy paint finish. Housing shall include machined end blocks and a tight fitting, polished plate glass window to protect internals. Housing shall be suitable for indoor and outdoor service and shall be fitted for wall or panel mounting. Indicating tube shall be gland packed to prevent leakage. Mount all the monometers on a Type 316 stainless steel or fiberglass panel 4-feet above finished floor. Provide a polycarbonate or Type 316 stainless steel nameplate indicating service.
- B. Indicating Fluid:
 - 1. Provide red oil, specific gravity 1.0, temperature range 30° to 100° F.
 - 2. A venting petcock shall be supplied for field installation at the inlet of the manometer to permit routine maintenance calibration. When closed, the petcock bleeds the gas from the manometer well to atmosphere, allowing the manometer zero position to be checked. Material shall be brass with 1/4" NPT connections.
 - 3. A float check valve shall be supplied for field installation at the outlet of the manometer. It shall be used to protect fluid from being blown-out by pressure increase beyond the manometer pressure range. Construction shall be stainless steel body and head with Teflon float. Connection shall be 1/4" NPT.
 - 4. Provide minimum 1/4" flame check on the vent line manifold of the manometer.
- C. Scale
 - 1. Provide English unit dual scale with graduations for a range 0-20 in-wc on one side of the glass tube and graduations for tenths on the other side.
 - 2. Provide external scale adjustment for calibration.

PART 3: EXECUTION

3.01 INSTALLATION

- A. General: All gas handling equipment shall be installed in strict accordance with the manufacturer's printed recommendations.
- B. Upon completion of the installation, each piece of equipment and each system shall be tested for satisfactory operation without leakage, excessive noise, vibration, overheating, etc. All equipment must be adjusted and checked for misalignment, clearance, supports, and adherence to safety standards.

END OF SECTION 15210

SECTION 15440 – PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

- A. This Section specifies plumbing fixtures and trim. The types of fixtures specified includes the following:
 - 1. Water closet
 - 2. Urinal
 - 3. Lavatory
 - 4. Hose Bibb
 - 5. Non-Freeze Wall Hydrant
 - 6. Cleanouts
 - 7. Utility Hose Bibb

1.03 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. Uniform Plumbing Code.
 - 2. ARI Standard 1010: "Drinking fountains and self-contained mechanical-refrigerated drinking water coolers"

1.04 SUBMITTALS:

- A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers.
- B. Shop Drawings: Submit rough-in drawings. Detail dimension, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with fixtures installed in countertops and cabinets. Furnish templates.
- C. Maintenance Data: Include data in maintenance manuals specified in Section 01730.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommend temperatures to prevent damage.
- B. Store fixtures and Trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture or trim.

1.06 SEQUENCE AND SCHEDULING:

- A. Schedule rough-in installations with the installation of other building components.

PART 2 - PRODUCTS

2.01 FIXTURES:

A. Water Closet: (Flush Valve Type)

1. Standard Use Fixture: (1.6 gal/flush, siphon jet)
 - a. Vitreous china, elongated bowl, top spud.
 - b. Approved Manufacturers:
 - (1) Kohler No. K-4302
 - (2) American Standard - "Madera 17"EL" No. 3043.102
 - (3) Eljer - "PRESERVER" No. 111-4823
 - (4) or equal
2. Flush Valve: (1.6 gal./flush)
 - a. Chrome plated, vacuum breaker, screwdriver stop, level operated.
 - b. Approved Manufacturers: (Typical for standard and handicapped use fixtures)
 - c. Sloan - "Royal" No. 110-YO-3
 - d. Delany - "Flushboy" No. 402-JVB
 - e. Zurn - "Aquaflush" No. Z-6000
3. Seat:
 - a. (White) high impact plastic, open front, check hinge.
 - b. Approved Manufacturers: (Typical on standard use and handicapped use fixtures)
 - (1) Church No. 295C
 - (2) Beneke No. 527CH
 - (3) Bemis No. 1655-C
 - (4) Olsonite No. 95

B. Urinal:

1. Standard Use Fixture: (1.0 gal/flush)
 - a. Vitreous china, top spud.
 - b. Approved manufacturers:
 - (1) Eljer – "Correcto Urinal" No. 161-1030
 - (2) American Standard – "Lynbrook 0.85" No. 6601.012
 - (3) or equal
2. Flush Valve:
 - a. Delany No. F451-1
 - b. Sloan No. 180-1
 - c. or equal

C. Lavatory:

1. Standard Use Fixture:
 - a. Stainless steel, self-rimming single compartment sink, approximately 21" x 16" x 10".
 - b. Approved Manufacturer:
 - (1) Kohler Ballard Utility Sink Stainless Steel No. 3206-3
 - (2) Kindred QS1925/12
2. Faucet and Drain:
 - a. Two handle, 4" center set, aerator with 2.5 GPM flow control chrome plated pop-

- up drain assembly.
- b. Approved Manufacturer:
 - (1) Kohler Triton No. 7401-2
 - (2) American Standard Heritage No. 2103.703

3. Supplies and Stops:

- a. Chrome plated hand wheel, chrome escutcheon
- b. Stuffing box
- c. Chrome plated supplies
- d. Washerless type
- e. Approved Manufacturers:
 - (1) Brass craft
 - (2) Eastman
 - (3) Dearborn

4. P-Trap:

- a. 1-1/2", 17 gauge, tubular brass, chrome plated and chrome escutcheons.
- b. Approved Manufacturers:
 - (1) Dearborn
 - (2) Frost
 - (3) Jameco

D. Hose Bibb:

1. Fixture:

- a. Chrome plated brass, removable key, vacuum breaker, 3/4" inlet and outlet, provide isolation valves upstream of bibb.
- b. Approved Manufacturers:
 - (1) Chicago Faucet No. 998.

E. Non-Freeze Wall Hydrant:

1. Fixture:

- a. Bronze hydrant, removable key, vacuum breaker
 - (1) Wade No. W-8620
 - (2) Zurn No. Z-1310
 - (3) Smith No. 5609
 - (4) Josam No. 71050
 - (5) Woodford No. 65

F. Cleanouts:

1. Finished Floors:

- a. Approved Manufacturers:
 - (1) Zurn No. Z-1400-2.
 - (2) J.R. Smith No. 56010.
 - (3) Wade No. W-7000.
 - (4) Josam No. 56010.

- G. Utility Hose Bibb: At locations shown on drawings provide utility water hose bibb. Hose bibb and valving shall be as shown on the drawings. At each utility water hose bibb location provide and install hose rack assembly either wall mounted or free standing. Hose rack shall be as detailed on the drawings.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Verify all dimensions by field measurements.
- B. Examine existing rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

3.02 INSTALLATION:

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.
- B. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
- C. Install stop valves in an accessible locations in the water connection to each fixture.
- D. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations.
- E. Seal fixtures to walls and floors using silicone. Match sealant color to fixture color.
- F. Encase catch basins and trench drains in concrete to a minimum depth and encasement as per manufacturer's instructions.

3.03 FIELD QUALITY CONTROL:

- A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Repair malfunctioning units, the retest.

3.04 ADJUSTING:

- A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream.
- B. Replace washers of leaking or dripping faucets and stops.
- C. Clean all aerators.

3.05 CLEANING:

- A. Clean fixtures, trim and strainers using manufacturer's recommended cleaning methods and materials.

3.06 PROTECTION:

- A. Provide protective covering for installed fixtures and trim.
- B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

END OF SECTION 15440

SECTION 15515 – RECIRCULATION PUMP

PART 1 - GENERAL

1.01 **THE REQUIREMENT**

- A. The Contractor shall provide submersible recirculation pumps and appurtenant work, complete and operable, in accordance with the Contract Documents.
- B. The Supplier shall examine the Site conditions, intended application, and operation of the pump system and recommend the pump that will satisfy the indicated requirements.

1.02 **SUBMITTALS**

- A. General: Submittals shall be furnished in accordance with Section 01300 – Constructor Submittals.
- B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of pump, indicating dimensions, weights, materials, and methods of assembly of components.
- C. Technical (O&M) Manual: The Technical Manual shall contain the required information for this pump as per Section 01300 - Contractor submittals.
- D. Maintenance Data: Submit maintenance data and spare parts list for each type of pump. Include this data, product data, shop drawings in maintenance manual in accordance with requirements of Section 01730 – Operation and Maintenance Manuals.

1.03 **QUALITY ASSURANCE**

- A. The Contractor shall have the wall pump manufacturer demonstrate the proposed pump assembly has provided previous acceptable performance using a recirculation pumps by supplying the Engineer with a list of at least 5 previous U.S. installations where its pumps are in operation under similar conditions.

PART 2 - PRODUCTS

2.01 **PUMPS**

- A. Operating Conditions: The Work of this Section shall be suitable for long-term operating under the following conditions:

Duty	Continuous
Drive	Variable
Ambient Environment	Outdoors, Submerged
Ambient Temp (F)	60-100
Ambient Relative Humidity (%)	15-80
Fluid Temp (F)	50-80
Fluid pH range	6.5-8.0
WS EL (ft)	4517.61
Bioreactor Floor EL	4,499.50
Pump Centerline EL	4,501.00

B. Performance Requirements:

Maximum flow capacity, gpm	7,845
Maximum flow pump head, TDH ft	2.2
Minimum flow pump head, TDH ft	0.5
Minimum propeller efficiency, %	50
Maximum pump speed, rpm	650
Maximum motor speed, rpm	1,800
Maximum motor size, hp	20
Voltage/Phase/Hertz	480/3/60

C. Pump Dimensions:

Minimum Propeller Diameter, in	19
Number of propeller blades	3
Pump discharge size, inches	20

2.02 **PUMPS REQUIREMENTS**

A. Construction: Submersible recirculation pump shall be close-coupled with gear reducer, driven by a submersible motor suited for continuous operation in a fully submerged condition.

Motor Casing	Stainless Steel or epoxy-coated
Gear Reducer	Stainless Steel or epoxy-coated cast iron oil housing, planetary gear type, 1.5 min. SF
Impeller	Type 316 Stainless Steel propeller
Inlet Shroud	Type 316 Stainless Steel
Bearings	Permanently lubricated ball and sleeve type, L-10 life 100,000 hrs
Shaft	Stainless Steel, series 400
Seal	Mechanical seals, 2 min, oil reservoir
Fasteners	Type 316 Stainless Steel
Mounting Method	Stainless Steel guide rail
Pump Connection	Flange and Counter Flange

B. Drive: Enclosed, submerged, inverter duty electric motor, suitable for 480 volt, 3 phase, 60 Hz AC power supply, with armored cable.

- The cable entry shall be an integral part of the stator casing. The cable entry shall be comprised of a single cylindrical elastomer grommet, clanked by washers and a ferrule designed with close tolerance fit against the cable outside diameter and the entry inside diameter. This will provide a leak proof, torque-free seal at the cable entrance. The assembly shall bear against a shoulder in the stator casing opening and shall be compressed by a gland nut threaded into it. Interaction between the gland nut and the ferrule should move the grommet along the cable axially instead of with a rotary motion. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

C. Motor:

- The mixer motor shall be squirrel cage, induction, shell type design, housed in an air filled, watertight chamber. The stator winding shall be insulated with moisture resistant Class F insulation, which will resist a temperature of 155°C (310°F). The stator shall be dipped and baked three times in Class F varnish. The motor

shall be designed for continuous duty, capable of sustaining a maximum of at least ten evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. At the design point, the motor shall not draw more than 1.3kW in clear water at nominal voltage of utility supply quality.

- D. Control: Pumps shall be controlled as shown on the drawings.
 - 1. Pump shall include moisture sensor and temperature sensor control. See drawings and specifications for other control devices.
- E. Sensor:
 - 1. Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with two thermal switches, embedded in the end coils of the stator winding. These shall be used in conjunction with, and supplemented to, external motor overload protection, and wired to the control panel.
- F. Seals:
 - 1. Each mixer shall be provided with two mechanical, lapped end face type seals, which shall run in an oil reservoir. The outer seal shall have both the stationary and rotating ring faces made of silicon carbide. The inner seal shall have a seal made of one ceramic and one carbon face. The seals shall require neither maintenance nor adjustment, but shall be easy to check and replace.
 - 2. Each mixer shall be provided with a single oil chamber for the shaft sealing system. Seal lubrication shall require an oil chamber capacity no greater than 0.1 quarts. The drain and inspection plugs, with positive anti-leak seal, shall be easily accessible from the outside.

2.03 PROTECTIVE COATING

- A. Ferrous pump components other than stainless steel shall be epoxy coated in accordance with Section 09800 – Protective Coatings.

2.04 ACCEPTABLE MANUFACTURERS OR EQUAL

- A. The following are acceptable:
 - 1. KSB, Inc.
 - 2. Flygt, Inc.
 - 3. Landia, Inc..

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Each pump unit and mounting accessories shall be aligned, connected, and installed in accordance with the manufacturer's recommendations. The installation shall be in accordance with the Drawings and as indicated.

3.02 TESTING

- A. Each pump shall be factory tested by the manufacturer and certified documentation supplied to the OWNER prior to shipment. The following tests shall be performed:
 - 1. An insulation test of the windings
 - 2. Balancing of the motor (rotor)

3. Pump motor shall run dry for 5 minutes at full load to verify electrical data measurements. All electrical data shall be registered as part of the documentation.
 4. A motor and cable insulation test for moisture content and insulations defects.
 5. Dry run pump test to verify mechanical integrity.
 6. Total assembly tested for vibration.
 7. Test each pump at the factory to verify performance. Test results shall document flow, head, hydraulic efficiency and horsepower draw over the entire cataloged range of operation. Test shall be conducted in accordance with Hydraulic Institute Standards to Level B tolerance.
- B. Field-Testing: See Section 01660 – Equipment Testing and Plant Start-up for the requirements for 7-day system testing.

3.03 MANUFACTURER'S SERVICES

- A. Pump manufacturer's qualified field technician shall spend three 8-hour days on site certifying that pump installation and operation meet or exceed manufacturer's criteria, assisting in start-up and training plant staff.

END OF SECTION 15515

SECTION 15535 – END SUCTION CENTRIFUGAL PUMP

PART 1 - SYSTEM DESCRIPTION

1.01 **CONDITIONS OF OPERATION**

- A. Each pump shall be capable of pumping at the hydraulic conditions shown in the pump schedule or on the drawings.

1.02 **SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data, including installation.
- B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of pump, indicating dimensions, weights, materials, and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data and spare parts list for each type of pump. Include this data, product data, shop drawings in maintenance manual in accordance with requirements of Section 01730 – Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.01 **ACCEPTABLE MANUFACTURERS**

- A. The following are acceptable:
 - 1. Aurora or equal.
- B. All products, whether named as “acceptable”: or proposed as “equal” must fully comply with these specifications. Standard product must be modified, if required, for compliance.

2.02 **FABRICATION**

- A. Each pump shall be designed for clockwise rotation viewed from driven end and include the following design features. Ductile Iron shall be Class 150 of the AWWA.
- B. Casing
 - 1. The pump casing shall be spiral volute type, back pull-out design with flanged suction and discharge connections and shall be constructed of Ductile Iron.
 - 2. The pump discharge nozzle shall be tangentially oriented.
 - 3. A pump casing drain shall be provided with a steel or brass pipe plug.
- C. Impeller
 - 1. The pump impeller shall be of enclosed design, constructed of Ductile Iron material and key driven.
 - 2. A stainless steel cap screw, washer and sleeve shall provide positive attachment of the impeller to the motor shaft.
- D. Seal Housing
 - 1. The seal housing shall be constructed of Ductile Iron material and shall hold the stationary seat of the mechanical shaft seal.
 - 2. The seal housing shall be held in place in a machined fit on the pump casing to maintain component alignment and “O-ring” sealed to insure against leakage.
- E. Mechanical Seal

1. The pump shaft seal shall be a John Crane Type 21 mechanical seal or equal constructed of the following materials.

Seal Type	Stationary Face	Rotating Face	Elastomers	Metal Components
Standard	Niresist	Carbon	BUNA-N	18-8 SS

- F. Motor:
 1. The drive motor shall be non-overloading of NEMA standard design with JM shaft extension and C-Face mounting suitable for close-coupled pump mounting.

2.03 TESTING

- A. Production performance testing will be conducted by the manufacturer on each pump unit using the actual motor. Head at shut off and a minimum of 2 operating points will be measured at operating speed to verify performance.

END OF SECTION 15535

SECTION 15550 – SUBMERSIBLE WET PIT PUMPS

PART 1 - SYSTEM DESCRIPTION

1.01 **CONDITIONS OF OPERATION**

- A. Each pump shall be capable of pumping at the hydraulic conditions shown in the pump schedule or on the drawings.
- B. Pump supplier shall provide service cables with sufficient length to allow operators to directly attach the cable to the hand crank wheel of the service crane (refer to design drawings for crane location and required cable lengths at each location) to extract the pump from the wet well for service.

1.02 **SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data, including installation.
- B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of pump, indicating dimensions, weights, materials, and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data and spare parts list for each type of pump. Include this data, product data, shop drawings in maintenance manual in accordance with requirements of Section 01730 – Operation and Maintenance Manuals.

1.03 **WARRANTY**

- A. 7 years on pump 10 years on guide system

PART 2 - PRODUCTS

2.01 **ACCEPTABLE MANUFACTURERS**

- A. The following are acceptable:
 - 1. KSB, Flygt, or equal.
- C. All products, whether named as “acceptable”: or proposed as “equal” must fully comply with these specifications. Standard product must be modified, if required, for compliance.

2.02 **MATERIALS – SUBMERSIBLE PUMPS**

- A. Pump case: Cast Iron, ASTM A48, Class 35
- B. Motor Housing: Cast Iron, ASTM A48, Class 35
- C. Impeller: Cast Iron, ASTM A48, Class 35
- D. Intermediate Housing (Backplate): Cast Iron, ASTM A48, Class 35
- E. Discharge Base Elbow: Cast Iron, ASTM A48, Class 35
- F. Pump/Motor Shaft:
 - 1. With protective sleeve: Carbon Steel, ASTM A576, Gr.1045

- 2. Without sleeve: Stainless Steel, ASTM A276 A182 Type FXM-19
- G. Shaft Sleeve: Stainless Steel, ASTM A276 A276 Type 420
- H. Wear Ring, case: Cast Iron, ASTM A48, Minimum 200 Brinell
- I. Wear Ring, Impeller: Stainless Steel, ASTM A276-400 Series, min. 300 Brinell
- J. O-Rings: Nitrile Rubber (NBR)
- K. Fasteners: Stainless Steel, ASTM A276 Type 316Ti.
- L. Lower Seal Faces: Silicon Carbide/Silicon Carbide
- M. Upper Seal Faces: Hard Metal stationary/Carbon rotating
- N. Guide Cables (or pipes): Stainless Steel, ASTM A276 Type 316
- O. Lifting Cable: Stainless Steel, ASTM A276 Type 316 (with length to go up to and connect to portable hoist).
- P. Oil-all uses (seal lubrication, motor cooling, etc.): Ecologically safe, paraffin base
- Q. Power/Control Cable Jacket: Neoprene

2.03 POWER CABLE

- A. Provide power/control cable with each pump.
- B. Provide cable suitable for submersion in a raw waste water application, sized in accordance with NEC requirements.
- C. Provide one of the following cable entry sealing systems:
 - 1. Provide cable terminal box on side of motor housing, with cable entry sealed to insure that no entry of moisture is possible into the high-voltage motor/terminal area even if the cable is damaged or severed below water level.
 - 2. Provide a compressed grommet seal on the cable's outer jacket and epoxy fill to seal the interior passage as a secondary seal against leakage through a damaged cable jacket. Provide a moisture detector in the sealed junction chamber area to signal and shut down the pump motor before shorting and motor damage can occur.

2.04 TEMPERATURE PROTECTION

- A. Furnish temperature monitoring thermistors or bimetalles in motor windings for use in conjunction with and supplemental to external motor overload protection.
- B. Arrange controls to shut down pump should any of the monitors detect high temperature and automatically reset once motor temperature returns to normal.
- C. Set temperature monitors at levels recommended by pump manufacturer.
- D. For motors rated 100 HP and larger, provide a temperature monitor for the lower bearing. Sensor to be a Resistance Type (RTD) temperature sensor with a linear relationship between temperature and resistance, with a supervision relay for each sensor to provide

dry contact closures indicating "Status OK", "Pre-Alarm:" and "Alarm Shutdown" plus a 0-10 VDC analog signal follower for temperature indication.

2.05 SEAL LEAK DETECTION

- A. Furnish a monitoring system to signal seal leakage
- B. Provide a sensor in the motor's stator cavity which allows a control panel mounted relay to indicate leakage into the motor.
- C. For motors rated 40 HP and larger, provide a stainless steel mechanical float in a separate leakage collection chamber to indicate seal leakage prior to its penetration of the lower bearing assembly.

PART 3 - FABRICATION

3.01 GENERAL

- A. Provide pumps capable of handling municipal waste water.
- B. Design pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts or other fasteners.
- C. Provide a pump which connects to a permanently mounted discharge connection by simple downward motion, without rotation, guided by at least two non-load-bearing guide pipes. Final connection shall insure zero leakage between pump and discharge connection flange.
- D. Provide a discharge connection/guide system so that no part of the pump bears directly on the floor of the wet well.
- E. Provide Type 316 stainless steel cable of sufficient length to properly and safely lift pumps from the wet well using a portable hoist mounted above the wet well.

3.02 MAJOR COMPONENTS

- A. Furnish major components (pump case, impeller, intermediate housing, motor housing) of cast material as specified in 2.2 with smooth surfaces devoid of blowholes and other irregularities.
- B. All major castings shall be produced in the pump manufacturer's own foundry under the manufacturer's direct supervision.
- C. Pump shall be coated with a two-component epoxy finish having a minimum 83% solids by volume. This coating shall be non-toxic and approve for both wastewater and water applications.

3.03 IMPELLER AND WEAR RINGS

- A. Provide Recessed non-clog type impeller, capable of passing at minimum a 2" spherical solid.
- B. Statically and dynamically balance the impeller.

3.04 SHAFT

- A. Provide common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal.

- B. Provide one of the following shaft designs:
 - 1. Machine the shaft of carbon steel (for maximum strength and motor efficiency) and isolate the shaft from the pumped media with a replaceable Type 420 stainless steel shaft sleeve under the lower mechanical seal.
 - 2. Machine the entire shaft of A182 FXM-19 stainless steel.
- D. Do not use carbon steel as shaft material without a stainless steel sleeve.

3.05 SHAFT SEAL

- A. Provide two totally independent mechanical shaft seals, installed in tandem, each with its own independent spring system acting in a common direction.
- B. Install the upper seal in an oil-filled chamber with drain and inspection plug (with positive anti-leak seal) for easy access from external to the pump.
- C. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.
- D. Provide seals which are non-proprietary in design, with replacements available from a source other than the pump manufacturer.
- E. Do not provide seals with the following characteristics: conventional double mechanical seals with single or multiple springs acting in opposed direction; cartridge-type mechanical seals; seals with face materials other than those specified; seals using the impeller hub as a mounting surface.

3.06 BEARINGS

- A. Furnish upper and lower bearings, single row (preferred) or double row as needed to provide a B10 life of, at minimum, 40,000 hours at anticipated axial and radial loadings.
- B. Provide either sealed/shielded (permanently lubricated) or open (regreaseable) bearings.
- C. If open-type (non-shielded) bearings are used, provide re-lubrication ports with positive anti-leak plugs for periodic addition of lubrication from external to the pump.

3.07 MOTOR

- A. Provide a motor which is squirrel cage, induction in design, housed in a completely watertight and air filled chamber, with a min 1.10 service factor.
- B. Insulate the motor stator with, at minimum, Class F insulation rated for 311° F.
- C. Provide motor cooling by one of the following methods:
 - 1. Provide adequately rated motor with sufficient surface area for ambient only cooling (this is the preferred method).
- D. Provide motors which are capable of operating for extended periods in a dry mode without damage to motor or seals.
- E. Provide motors which are designed, rated and warranted for continuous operation.
- F. Provide motors which are capable of 480 volts.

- G. Do not provide motors which contain in excess of two (2) gallons of oil (combined total for cooling and seals), or which contain other than ecologically safe paraffin base oil.

END OF SECTION 15550

SECTION 15575 – HORIZONTAL CHOPPER PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Vendor shall furnish ten (10) centrifugal, dry well horizontal chopper pump(s) and all appurtenances as specified. The pump shall be specifically designed to pump waste solids at heavy consistencies. Materials shall be macerated and conditioned by the pump as an integral part of the pumping action. The pump must have demonstrated the ability to chop through and pump high concentrations of solids such as plastics, heavy rags, grease and hair balls, wood, paper products and stringy materials without plugging, both in tests and field applications.

1.02 QUALITY ASSURANCE AND PERFORMANCE AFFIDAVIT

- A. The contractor shall submit manufacturer's standard warranty and a performance affidavit for equipment to be furnished in accordance with this section. The warranty for workmanship and materials shall be manufacturer's standard for 1 year from startup, not to exceed 18 months from factory shipment. In the performance affidavit, the manufacturer must certify to the Contractor and the Owner, that the Contract Documents have been examined, and that the equipment will meet in every way the performance requirements set forth in the Contract Documents for the application specified. Shop drawings will not be reviewed prior to the receipt by the Engineer of an acceptable performance affidavit. The performance affidavit must be signed by an officer of the company manufacturing the equipment, and witnessed by a notary public. The performance affidavit must include a statement that the equipment will not clog or bind on solids typically found in the application set forth.

1.03 QUALIFICATIONS

- A. To assure unity of responsibility, the pumps and motors, shall be furnished and coordinated by the pump manufacturer (MANUFACTURER). The CONTRACTOR shall assume full responsibility for the satisfactory operation of the entire pumping systems including pumps, motors, and controls as specified.
- B. The equipment covered by these Specifications shall be standard units of proven ability as manufactured by competent organizations having long experience in the production of such equipment. The pumps shall be the standard cataloged product of the MANUFACTURER. The pumps furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards, except as otherwise specified herein.
- C. All Equipment furnished under this Specification shall be new and unused and shall be the standard product of MANUFACTURERS showing a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of five (5) years.
- D. The MANUFACTURER shall be fully responsible for the design, arrangement and operation of all connected rotating components of the assembled pumping unit to ensure that neither harmful nor damaging vibrations occur within the specified operating range. Design shall include fabricated steel base plate for mounting the units.

1.04 SUBMITTALS

- A. Copies of all materials required to establish compliance with the specifications shall be submitted in accordance with the provisions of Section 01300. The submittal format shall be in the form of a booklet, suitably tabbed and divided to cover at least the areas noted below for each major equipment item. The submittal booklet shall include adequate detail and sufficient information for the ENGINEER to determine that all of the equipment proposed meets the detailed requirements of the Specifications. Incomplete or partial submittals will not be reviewed. Submittals shall include at least the following:
1. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.
 2. Descriptive literature, bulletins and/or catalogs of the equipment.
 3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity and horsepower. Curves shall be submitted on 8 ½" by 11" sheets, at as large a scale as is practical. Catalog sheets showing a family of curves will not be acceptable.
 4. A complete total bill of materials of all equipment (may be furnished with Operation and Maintenance manuals specified under paragraph 1.05).
 5. A list of the MANUFACTURER'S recommended spare parts, in addition to those specified in paragraph 1.06. with the manufacturer's current price for each item, shall be supplied. Include gaskets, packing, etc. on the list. List bearings by the bearings manufacturer's numbers only.
 6. Complete motor and control systems data.
- B. Test Reports to be Submitted:
1. A schedule of the date of shop testing and delivery of the equipment to the job site.
 2. Description of pump factory test procedures and equipment.
 3. Copies of all tests results, as specified.
- C. Complete operating and maintenance instructions shall be furnished for all equipment included under these specifications. The maintenance instructions shall include trouble shooting data and full preventative maintenance schedules and complete spare parts lists with ordering information.
- D. Submit the MANUFACTURER'S Certificate of Installation, Testing and Instruction.
- E. In the event that it is impossible to conform with certain details of the specifications due to different manufacturing techniques, describe completely all non-conforming aspects.

1.05 OPERATING INSTRUCTIONS

- A. Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operation and maintenance personnel unfamiliar with such equipment.
- B. A trained instructor, with complete knowledge of proper operation and maintenance for all major components, shall be provided for two days to instruct representatives of the OWNER and the ENGINEER on proper operation and maintenance. With the OWNER'S permission, this work may be conducted in conjunction with the inspection of the installation and test run as provided under PART 3. If there are difficulties in operation of the equipment due to the MANUFACTURER'S design or fabrication, additional service shall be provided at no cost to the OWNER.

1.06 TOOLS AND SPARE PARTS

- A. One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.
- B. Spare Parts shall be properly bound and labeled for easy identification without opening the packaging and suitably protected for long term storage.

1.07 PRODUCT HANDLING

- A. All parts shall be properly protected so that no damage deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
- B. All equipment and parts must be properly protected against any damage during a prolonged period at the site.
- C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the ENGINEER.
- D. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted thereto.
- E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- F. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.
- G. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.08 WARRANTY

- A. All equipment supplied under this section shall be warranted for a period of one (2) year from startup by the CONTRACTOR and the MANUFACTURER.
- B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to the OWNER.
- C. The MANUFACTURER'S warranty period shall run concurrently with the CONTRACTOR'S warranty period. No exception to this provision shall be allowed.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The equipment covered by these Specifications shall be standard units of proven ability as manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in

accordance with the best practice and methods, and shall operate satisfactorily when installed as shown on the Drawings.

- B. All equipment shall be designed and built for 24-hour continuous service at any and all points within the specified range of operation, without overheating, without cavitation, and without excessive vibration or strain.
- C. The pumping units required under this section shall be complete. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs and adjustment shall be provided.
- D. 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, motor, and control panel.
- E. All working parts of the pumps and motors, such as bearings, wearing rings, shaft, sleeves, etc., shall be standard dimensions built to limit gauges or formed to templates, such that parts will be interchangeable between like units and such that the OWNER may, at any time in the future, obtain replacement and repair parts for those furnished in the original machines.
- F. The nameplate ratings of the motors shall not be exceeded, nor shall the design service factor be reduced when the pump is operating at any point on its characteristic curve at maximum speed.
- G. Mechanical equipment, including drives and electric motors shall be supplied and installed in accordance with applicable OSHA regulations. Stainless steel guards shall be installed on all rotation assemblies. The noise level of motors, unless otherwise noted, shall not exceed 85 dBA measured 3 meters from the unit under free field conditions while operating on utility power.
- H. All lubrication fitting shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards.

2.02 APPROVED MANUFACTURER

- A. Pumps shall be horizontal chopper pumps as manufactured by Vaughan Co.
- B. It is the express intent of these specifications to accurately describe equipment that is a regular production item of the specified manufacturer, and that has a proven record of performance in identical (not just similar) applications in other treatment facilities. The chopper pump manufacturer shall have a minimum of twenty (20) years of documented experience in the design and production of chopper pumps of all types, and not less than five (5) years of experience in the production of the exact equipment as specified herein.
- C. Alternates shall be pre-approved no less than 30 days prior to the bid date, accompanied by a list of no less than twenty five (25) reference installations of chopper pumps in identical service applications. At least five (5) of the reference installations provided shall be of the exact model pump specified herein. References shall be pumps that have been used in continuous service for a period of no less than three (3) years. Only equipment that is in service at the time of referral shall be considered valid. Pumps that have been removed from service for any reason will not be considered as references. Telephone numbers and contact names shall be provided for any/all references upon request from the Engineer. Provision of performance bonds or other means of circumventing the

above requirements for historical references and verification of past performance in identical applications are not considered an acceptable means of verifying the manufacturer's experience.

2.03 PUMPS

A. Design Criteria:

The pumps specified in this section will pump primary sludge mixed with DAF thickened waste activated sludge (WAS) using the following design flow criteria:

Service	Solids Content (%)	Capacity (gpm)	TDH (ft)	Drive Arrangement	Motor Power	Pump Speed (rpm)	Suction Flange (in)	Discharge Flange (in)
Primary Clarifier No. 3 Sludge Pump	1-3	200	10	Direct Drive	10	1170	6	4
Primary Clarifier No. 4 Sludge Pump	1-3	200	10	Direct Drive	10	1170	6	4
Thermophilic Digester No. 3	1-3	116	35	Direct Drive	5	1170	6	4
Thermophilic Digester No. 3	1-3	116	35	Direct Drive	5	1170	6	4
Thermophilic Digester No. 3 Recycle	1-3	116	5	Direct Drive	5	1170	6	4
Thermophilic Digester No. 3 Recycle	1-3	116	5	Direct Drive	5	1170	6	4
Plug Flow Reactor	1-3	116	5	Direct Drive	5	1170	6	4
Plug Flow Reactor	1-3	116	5	Direct Drive	5	1170	6	4
Mesophilic Digester No. 2	1-3	116	1	Direct Drive	5	1170	6	4
Mesophilic Digester No. 2	1-3	116	1	Direct Drive	5	1170	6	4
Belt Press Feed	1-3	200	40	Direct Drive	10	1170	6	4
Belt Press Feed	1-3	200	40	Direct Drive	10	1170	6	4

B. Performance Requirements:

1. There shall be no significant change in vibration and noise level over the entire listed range of operating conditions of the pumping system.
2. Maximum motor speed shall not exceed 1800 rpm.
3. A motor sizing shall provide a minimum of 25% reserve hp as evidenced by specific requirements at maximum design condition on the certified performance curve.

2.04 PUMP CONSTRUCTION

A. Casing and Back Pull-Out Adapter Plate: The pump casing shall be of semi-concentric design, with the first half of the circumference being cylindrical beginning after the pump outlet, and the remaining circumference spiraling outward to the 150 lb. flanged centerline discharge. Back pull-out adapter plate shall allow removal of pump

components from above the casing, and allow external adjustment of impeller-to-cutter bar clearance. Casing and adapter plate shall be ductile cast iron with all water passages to be smooth, and free of blowholes and imperfections for good flow characteristics.

- B. Impeller: Shall be semi-open type with pump out vanes to reduce seal area pressure. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a set clearance between the impeller and cutter bar of .010" to .015". Impeller shall be cast steel heat treated to minimum Rockwell C 60 and dynamically balanced. The impeller shall be keyed to the shaft and shall have no axial adjustments or set screws required.
- C. Cutter Bar Plate: Shall be recessed into the pump bowl and shall contain at least 2 shear bars extending diametrically across the intake opening to within 0.010-0.015" of the rotating cutter nut tooth, for the purpose of preventing intake opening blockage and wrapping of debris at the shaft area. Chopper pumps utilizing individually mounted shear bars shall not be acceptable. Cutter bar shall be T1 plate steel heat-treated to minimum Rockwell C 60.
- D. Cutter Nut: The impeller shall be secured to the shaft using a special cutter nut, designed to cut stringy materials and prevent binding. The cutter nut shall be cast steel heat treated to minimum Rockwell C 60.
- E. Upper Cutter: Shall be threaded into the back pull-out adapter plate above the impeller, designed to cut against the pump-out vanes and the impeller hub, reducing and removing stringy materials from the mechanical seal area. Upper cutter shall be cast steel heat treated to minimum Rockwell C 60.
- F. Pump Shafting: The pump shaft and impeller shall be supported by ball bearings. Shafting shall be heat-treated steel, with a minimum diameter of 1.5 inches in order to minimize deflection during solids chopping.
- G. Bearings: Shaft thrust in both directions shall be taken up by two back-to-back mounted single-row angular contact ball bearings. Two single-row radial bearings shall also be provided. Bearings shall be rated with a minimum B10 bearing life of 100,000 hours.
- H. Bearing Housing: Shall be cast iron, and machined with piloted bearing fits for concentricity of all components. Bearing housing shall have oil bath lubrication using ISO Gr. 46 turbine oil and a side mounted site glass to provide a permanently lubricated assembly. Viton® double lip seals riding on stainless steel shaft sleeves are to provide sealing at each end of the bearing housing.
- I. Seal:
 - 1. Flushless Mechanical Seal system specifically designed to require no seal flush through the elimination of the stuffing box: The seal shall be cartridge-type with Viton O-rings and silicon carbide faces. The cartridge seal shall be pre-assembled and pre-tested so that no seal settings or adjustments are required. Any springs used to push the seal faces together must be shielded from the fluid to be pumped. The cartridge shall also include a 17-4PH, heat-treated seal sleeve and an ASTM A536 ductile iron seal gland. The mechanical seal faces shall be lubricated and cooled by a separate oil chamber.
- J. Inlet Manifold: The pump assembly shall be mounted horizontally with a 150 lb. standard inlet flange, drain, cleanout and mounting feet.

- K. Shaft Coupling: Bearing housing and motor stool design is to provide accurate, self-aligning mounting for a C-flanged electric motor. Pump and motor coupling shall be T.B. Woods Sureflex elastomeric type.
- L. Optional Belt Drive: Adjustable brackets shall be used to support an over-head mounted motor. Sheaves and belts shall be properly sized for horsepower ratings, and all guards are to be supplied with the belt drive system.
- M. Stainless Steel Nameplates: Shall be attached to the pump and drive motor giving the manufacturer's model and serial number, rated capacity, head, speed and all pertinent data.
- N. Spare Parts to be Furnished
 - 1. One (1) set of mechanical seals and o-rings for each pump.

2.05 MOTORS

- A. General:
 - 1. The motors shall be suitable for wash down and extreme outdoor duty.
 - 2. All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA standards where applicable.
 - 3. Motors shall conform to all requirements stipulated in the motor section of this specification. Motors shall be 460 V, 3-phase, TEFC with Class F insulation and have a 1.15 service factor.
 - 4. The motors supplied shall be specifically designed for inverter duty to allow for the potential of future variable frequency drives. The motors shall be compatible with the pumps provided by the MANUFACTURER.

2.06 PUMP DISCHARGE GAUGES

- A. Pump Discharge Gauges: The CONTRACTOR shall furnish and install for each pump in tapped holes in the discharge piping to accommodate discharge gauges which shall be supplied by the CONTRACTOR as shown on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

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

3.02 SHOP PAINTING

- A. Before exposure to weather and prior to shop painting all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.

- B. All exposed portions of the pumps and motors shall be coated with acrylic epoxy paint.
- C. All nameplates shall be properly protected during painting.

3.03 FIELD PAINTING

- A. Field painting is specified under Painting Section of this specification. The primer and paint used in the shop shall be products of the same MANUFACTURER as the field paint to assure compatibility.
- B. All nameplates shall be properly protected during painting.

3.04 INSPECTION AND TESTING

- A. General:
 - 1. The ENGINEER shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these specifications, prior to their shipment from the point of the manufacture.
 - 2. The ENGINEER shall be notified in writing prior to initial shipment, in ample time so that arrangements can be made for inspection by the ENGINEER.
 - 3. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.
- B. Factory Pump Tests:
 - 1. Factory testing in accordance with the standards of the Hydraulic Institute shall be required for all pumps. All pumps shall be witness tested by the pump MANUFACTURER in the presence of the ENGINEER. All witness travel and out-of-pocket expenses shall be included in the CONTRACTOR'S bid price.
 - 2. Certified pump performance curves shall be submitted, including head, capacity, and brake horsepower, for each pump supplied.
 - 3. Prior to conducting a pump test, notification of such test and a list of test equipment and test procedures shall be forwarded to the Engineer at least ten working days before the schedule test date. All electronic transducers, meter, gauges, and other test instruments shall have been calibrated in accordance with the requirements of the Hydraulic Institute Standards. Copies of calibration data shall be provided.
 - 4. All pumps shall be tested at full speed and complete staging through the specified range of flow, and head/capacity/efficiency curves plotted at maximum output speed. During each test, the pump shall be run at each head condition for sufficient time to accurately determine discharge, head, power input, and efficiency.
 - 5. If any pump tested fails to meet any specification requirement it will be modified until it meets all specification requirements. If any pump tested fails to meet the efficiency requirements at any of the listed flow or head conditions listed and all reasonable attempts to correct the inefficiency are unsuccessful, the pump(s) shall be replaced with units(s) which meet the specified requirements.
- C. Field Inspection and OWNER Instruction:
 - 1. The CONTRACTOR shall furnish the services of the MANUFACTURER'S field service technician, who has complete knowledge of proper operation and maintenance of the equipment, for a period of not less than two (2) days to inspect the installed equipment, supervise the initial test run, and to provide instruction to the plant personnel. The first visit shall be checking and inspecting the equipment after it is installed. The second visit will be to operate and supervise the initial field test.

2. At least one (1) of the two (2) days shall be allocated solely to instruction of plant personnel in operation and maintenance of the equipment. The instruction period shall be scheduled at least 10 days in advance with the OWNER and shall take place prior to start up and acceptance by OWNER. The final copies of operation and maintenance manuals specified must be delivered to the ENGINEER prior to scheduling the instruction period with the OWNER with the permission of the ENGINEER, these services may be combined with those specified by Paragraph 1.05.

D. Field Pump Tests:

1. In the presence of the ENGINEER such tests as necessary to indicate that the pumps and motors conform to the operating conditions specified shall be performed. A 30-day operating period of the pumps will be required before acceptance. If a pump performance does not meet the specified requirements, corrective measures shall be taken. All test procedures shall be in accordance with factory test procedures specified above and certified results of tests shall be submitted. Provide, calibrate and install all temporary gauges and meters, make necessary tapped holes in the pipes, and install all temporary piping and wiring required for the field acceptance tests. Written test procedures shall be submitted to the ENGINEER for approval 30 days prior to testing.
2. Noise and vibration tests shall be conducted in conformance with the Hydraulics Institute Test Codes and OSHA Standards of Occupational Noise Exposure. Maximum allowable noise level, corrected for background sound, shall not exceed 85 dBA when measured at a horizontal distance of 3 meters from the equipment being tested, at a height of 3 meters above floor level. The actual natural frequency of the installed pumping units will be verified using industry accepted procedures.
3. All pumps operating settings, alarms, controls, and shutdown devices shall be calibrated and tested during the field tests.
4. The CONTRACTOR shall furnish all power, water, facilities, labor, materials, supplies and test instruments required to conduct field test.
5. Deliver to the ENGINEER, upon completion of satisfactory testing of the equipment, reports as specified in Part 1.

E. Field Electric Control System Tests:

1. The electric control system shall be test operated for proper functioning prior to the pump mechanical test. The control system shall be checked out using simulated operating signals as per pump MANUFACTURER'S recommendations.
2. The CONTRACTOR shall check all drives for correct clearances, alignment and lubrication in accordance with MANUFACTURER'S instructions. The CONTRACTOR shall check direction of rotation of all motors and reverse connections if necessary.
3. The CONTRACTOR shall meet all the testing requirements of Division 16.

F. Field Alarm System Testing:

1. Check each alarm and detection device for proper operation.

END OF SECTION 15575

SECTION 15800 – HEATING, VENTILATION, AND AIR CONDITIONING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Refer to other Division 15-sections for ductwork and ductwork accessories required in conjunction with work of this section.

1.02 DESCRIPTION OF WORK:

- A. The following HVAC equipment will be provided and installed by the Contractor per this section and as shown in the drawings.
 - 1. Provide aluminum dampers with actuators, as shown on the drawings.
 - 2. Provide electric unit heater as noted in drawings, as shown on the drawings.
 - 3. Provide air conditioner/heat pump split unit as noted in drawings.
 - 4. Provide gas furnace and air conditioning units along with ductwork and all other accessories capable of heating and cooling, as noted on the drawings.
- B. Refer to Division-15 section 15995 "System Commissioning, Testing and Balancing" for balancing of power and gravity ventilators; not work of this section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of HVAC equipment of the types materials, and sizes required, whose products have been in satisfactory use in similar services.
- B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects with HVAC equipment work similar to that required for this project.
- C. Codes and Standards:
 - 1. Refrigeration systems shall be constructed in accordance with ASHRAE Standard ASHRAE 15 "Safety Code for Mechanical Refrigeration".
 - 2. Refrigeration systems shall meet or exceed the minimum COP/Efficiency levels as prescribed in ASHRAE 90A "Energy Conservation in New Building Design".
 - 3. Refrigeration units shall be listed by UL and have UL label affixed.

1.04 SUBMITTALS: All submittals shall be made to the Engineer in accordance with Section 01300, Contractor Submittals.

- A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model, clearly indicated weights, dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories; and installation and start-up instructions.

- B. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation equipment and control. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- C. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of HVAC equipment, indicating materials and methods of assembly of components.
- D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 01730.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle HVAC equipment and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged packaged equipment or components; replace with new.
- B. Store packaged HVAC equipment and components in clean dry place off the ground. Protect from weather, dirt, fumes, water construction debris, and physical damage.
- C. Comply with Manufacturer's rigging and installation instructions for unloading packaged HVAC equipment and moving them to final location for installation.

PART 2 – PRODUCTS

2.01 HVAC SCHEDULE:

- A. All HVAC equipment is located in the HVAC SCHEDULE in the drawings. The schedule contains the location, service, capacity/size, and models. Where no model is indicated, the Contractor shall appropriately size the equipment and submit it to the Engineer for approval.

PART 3 – EXECUTION

3.01 INSTALLATION:

- A. General: Install HVAC equipment in accordance with manufacturers installation instructions. Install units plumb and level, unless otherwise recommended by manufacturer, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support: Install AC unit on concrete pad as indicated in drawings. Coordinate installation of anchoring devices.

3.02 START-UP:

- A. Provide the services of a factory-authorized service representative to start-up air conditioning equipment in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

3.03 OPERATING AND MAINTENANCE TRAINING:

- A. Provide services of manufacturer's service representative to instruct Owner's personnel in operation and maintenance of HVAC equipment. Training shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and troubleshooting procedures plus procedures for obtaining repair parts and technical assistance.

END OF SECTION 15800

SECTION 15855 – EXHAUST AND VENT FANS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 DESCRIPTION OF WORK:

- A. Extent of power and gravity ventilator work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Providing and Installation of equipment as shown in Volume III.
- C. Refer to Division-15 section 15995 "System Commissioning, Testing and Balancing" for balancing of power and gravity ventilators; not work of this section.

1.03 SUBMITTALS

- A. Refer to Division-1 section 01300 "Contractor Submittals" for contractor submittal requirements.

PART 2 - PRODUCTS

2.01 CEILING EXHAUST FANS:

- A. General: Provide exhaust fans of type, size and capacity as scheduled with and as specified herein.
- B. Type: Ceiling mounted fans with acoustically insulated housings and a maximum sound level rating of 4.6 sones. Integral backdraft damper shall be totally chatterproof with no metal to metal contact. Fans shall have true centrifugal wheels. Entire fan, motor and wheel assembly shall be easily removable without disturbing the housing. Furnish unit with appropriate ceiling grille having a minimum 85% free open area. Motor speed shall not exceed 1050 rpm. All motors shall be suitably grounded and mounted on rubber in shear vibration isolators.

Furnish each fan with a solid state speed controller similar to Penn Leektrol.

- C. Manufacturer: Subject to compliance with requirements. Provide ceiling exhaust fans of one of the following:
 - 1. Penn Zephyr
 - 2. Tradewind
 - 3. Broan
 - 4. Jenn-Fan
 - 5. Greenheck
 - 6. Cook

2.02 VENTILATING FANS:

- A. General: Provide propeller fan of type, size and capacity as scheduled and specified herein.
- B. Panel mounted, propeller type, balanced steel blades, steel panel frame, venturi orifice, v-belt drive with variable pitch sheave, adjustable motor mounted, zerk type grease fittings, ball bearing shaft, steel angle frame. Provide discharge or inlet wire guard as required for protection. Finish housing with baked enamel finish, and finish blades and hub with epoxy. Maximum allowable fan tip speed - 6,000 fpm. Note required direction of air flow on drawings.
- C. Manufacturer: Subject to compliance with requirements, provide propeller fans of one of the following:
 - 1. Cook
 - 2. ACME
 - 3. Penn
 - 4. Greenheck
 - 5. Jenn-Fan

2.03 ROOF MOUNTED EXHAUST FANS:

- A. General: Provide exhaust fan of type, size and capacity as scheduled and as specified herein.
- B. Type: Roof curb mounted, U.L. listed, factory-fabricated, aluminum construction, backward inclined centrifugal fan wheel, direct drive design motor and fan assembly mounted on vibration isolating mounts, 120 V motorized backdraft damper furnished with fan to open when fan runs. Furnish with insulated curb.
- C. Manufacturer: Subject to compliance with requirements, provide exhaust fans of one of the following:
 - 1. Cook
 - 2. Penn
 - 3. Greenheck
 - 4. ACME
 - 5. Jenn-Fan

PART 3 - EXECUTION

3.01 INSPECTION:

- A. General: Examine areas and conditions under which exhaust and vent fans are to be installed.

3.02 INSTALLATION OF FANS:

- A. General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognized industry practices to insure that products serve the intended function.
- B. Coordinate work with work of roofing, walls and ceilings, as necessary for proper interfacing.
- C. Ductwork: Refer to Division-15 section "Ductwork." Connect ducts to fan.

- D. Roof Curbs: Install roof curbs. Flash and seal into roof.
- E. Control Dampers: Install control dampers and mount damper motors.

3.03 ADJUSTING AND CLEANING:

- A. Cleaning: Clean factory-finished surfaces.
- B. Adjust and tighten belts and sheaves.
- C. Check and adjust clearances between fan and fan housing.
- D. Provide lubrication.

END OF SECTION 15855

SECTION 15856 – ODOR CONTROL SYSTEM

PART 1: GENERAL

1.01 DESIGN REQUIREMENTS

- A. Manufacturer: AMBIO Bifiltration or equal.
- B. Photoionisation unit consisting of housing (304), dust-filter, UV, catalyst, fan, control cabinet.
- C. Type: NOX 150
- D. Air-flow rate: 100-150 m³/h or 90 cfm
- E. Size: 720 x 1,200 x 2,200 mm (H)
- F. Power demand : 0.8 kW (fan and lights)

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation.
- B. Shop Drawings: Submit manufacturer's assembly type (exploded view) shop drawings for each type of pump, indicating dimensions, weights, materials, and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data and spare parts list for each type of pump. Include this data, product data, shop drawings in maintenance manual in accordance with requirements of Section 01730 – Operation and Maintenance Manuals.

1.03 QUALITY ASSURANCE

A. Qualifications

- 1. Designer: Registered Professional engineer.
- 2. The Manufacturer shall be recognized in the design, production and operation of odor control systems in the United States.
- 3. The Supplier shall be the manufacture of the system. No third part fabricators will be accepted.
- 4. The Manufacturer shall have at least 5 years' experience in design and fabrication of FRP odor control systems similar to the type specified for this Project.
- 5. Similar Projects:
 - a. Upon request, the Manufacturer shall provide a list of five biological air treatment installations where similar equipment by the manufacturer is currently in service associated with the removal of hydrogen sulfide and /or other typical organic municipal wastewater odors.
 - b. The list shall include:
 - i. Contact names, telephone numbers, mailing address, and length of service.
 - ii. Copies of shop Drawings.
 - iii. The names of the Engineer, owner, and installation contractor.
- 6. The manufacturer's place of business shall be open for inspection.
- 7. The manufacturer must be able to provide the Owner with training and monitoring support service during the first year of operation.
- 8. Additional monitoring support to be available on a renewable annual basis, upon requested by Owner.

1.06 DELIVERY, STORAGE AND HANDLING\

- A. The manufacturer's recommendations on shipping and handling shall be

followed.

1.07 SPECIAL GUARANTEE

- A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee.
- B. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of work specified in this Specification section found defective during a period of 1 year after the date of Substantial completion.

2.02 SERVICE CONDITIONS

- A. The order control system shall be designed to remove the odorous constituents from process air stream under the following operating conditions:

Process Parameter	Value
Duty	Continuous
Elevation above Sea Level	4,800 Feet
Location	Outdoors
Inlet Air Temperature	40 to 110 degrees F
Average Inlet RH	60 % to 100 %
Type of Containment	H ₂ S and reduced sulfur Organic compounds and Other odors typically Associated with Wastewater conveyance.
H ₂ S at Inlet	Average 5.0 ppmv Maximum 20.0 ppmv
Removal required	H ₂ S: 99 % removal RS: 90% removal

3.01 MANUFACTURER'S SERVICES

- A. A manufacturer's representative for the equipment specified herein shall be present at the jobsite or classroom designated by the Owner for the minimum person-days listed for the services herein under, travel time excluded:
 - a. Two person-days for functional testing and plant startup.
- B. Services shall be at such times as requested by the Owner.

END OF SECTION 15856

SECTION 15860 – AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 DESCRIPTION OF WORK:

- A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of outlets and inlets required for project include the following:
 - 1. Contractor furnished and installed.
 - a. Louvers and Dampers per HVAC schedule.
- C. Refer to other Division-15 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- D. Refer to other Division-15 sections for balancing of air outlets and inlets; not work of this section.

1.03 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
 - 3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test method for Louvers, and Dampers and Shutters".
 - 4. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating

construction, finish, and mounting details.

3. Performance Data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

- B. Samples: 3 samples of each type of finish furnished.
- C. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 16195.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 GRILLES AND DIFFUSERS:

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
- D. All grilles and diffusers shall be adjusted to fit neatly in the room ceiling pattern. Final location shall be per architectural reflected ceiling plans.
- E. Volume Control Dampers: Provide integral dampers of the externally adjustable opposed blade type where more than one grille or register is on a common duct.
- F. Sound Level In Office Areas: The diffuser or grille generated noise shall not exceed an NC-35 sound power level curve at a point five feet away from the diffuser or grille.
- G. Fire Dampers: Install at the diffusers, registers and grilles as indicated on drawings or required by code.
- H. Manufacturers: Subject to compliance with requirements, provide grilles and diffusers of one of the following:
 1. Metal Aire

2. Krueger
3. Carnes
4. Titus
5. Tuttle and Bailey
6. Anemostat/Waterloo
7. Environmental Air Products
8. EH Price
9. or equal

I. Supply Diffusers:

- Symbol S-1 Double deflection, aluminum construction, adjustable vertical front with horizontal rear deflection vanes. Satin aluminum finish. Size as indicated on drawings. Krueger 56880-15.
- Symbol S-2 Four-way blow, steel construction. Size as indicated on drawings. White baked enamel finish. Krueger 1400.

J. Return Register:

- Symbol R-1 Krueger Series 1190 for 12" x 24" panel, Krueger Series 6290 for 24" x 24" panel. Concealed hinge frame, sponge rubber gasket, white baked-on enamel, size as indicated on drawing.
- Symbol E-1 All aluminum construction with 1" square core, appropriate mounting frame, sponge rubber gaskets, satin aluminum finish, 90% minimum free area, size as shown on drawings. Krueger EGC-10.

2.02 LOUVERS:

- A. Extent of Work: At air openings in the outside wall where indicated on the drawings, install AMCA rated drainable stationary extruded aluminum 4" or 6" deep weather louvers.
- B. Material: Blades shall be on 3-1/2" centers with integral downspouts to drain the water from the louver blades.
- C. Performance: Stationary louvers shall pass 1000 fpm free area velocity with less than 0.2" static pressure drop and shall carry less than .03 ounces of water per square foot when tested in accordance with AMCA Standard 500.
- D. Louver Screens: Install 1/2" square mesh anodized aluminum wire bird screens mounted on removable extruded aluminum frames on interior face and louver.
- E. Substrate Compatibility: Contractor must coordinate louver size, flange type, and construction with structural and architectural openings to assure fit and appearance.
- F. Finish: Clear anodize aluminum.
- G. Manufacturer: Subject to compliance with requirements. Provide louvers of one of the following:
 1. Dayton
 2. American Warming and Ventilating
 3. Krueger
 4. Louvers and Dampers
 5. Ruskin Manufacturing Co.

6. or equal

PART 3 - EXECUTION

3.01 **INSPECTION:**

A. **Examine areas and conditions** under which air outlets and inlets are to be installed.

3.02 **INSTALLATION:**

A. **General:** Install air outlets and inlets in accordance with manufacturer's instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. **Coordinate with other work,** including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. **Locate ceiling air diffusers, registers, and grilles,** as indicated on general construction plans unless otherwise indicated.

END OF SECTION 15590

SECTION 15874-FIXED DIGESTER COVER

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall furnish, install, adjust, paint and test one (1) fixed steel cover for the new 75 ft. diameter digester tank. The digester cover shall be arranged as shown on the plans.

1.02 GENERAL INFORMATION AND DESCRIPTION

- A. The cover shall all be made of structural steel, conforming to the requirements of "Standard Specifications for Steel for Bridges and Buildings" ASTM A-36, and as specified in DIVISION 5 of these specifications. The minimum thickness of the steel shall be 1/4 inch.
- B. All welding, both shop and field, shall be shielded arc welding and shall conform to the latest standards AWS D1.0 "Welding in Building Construction" of the American Welding Society (AWS) for gastight welding.
- C. The Contractor's welding procedures, welders, and welding operators shall be qualified and certified in accordance with the requirements of AWS D1.0 "Welding in Building Construction" of the American Welding Society. The Contractor shall perform all field welding in conformance with information shown on the Equipment Manufacturer's drawings regarding location, type, size and length of all welds in accordance with "Standard Welding Symbols" AWS A2.0 of the American Welding Society and special conditions as shown by notes and details.

1.03 MANUFACTURERS

- A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings. The new digester cover(s) shall be EIMCO Type F as manufactured by EIMCO Water Technologies Inc., Salt Lake City, Utah or equal.
- B. The Manufacturer proposing to supply the digester covers shall have demonstrated ability to design and manufacture covers of this diameter and pressure conforming to these specifications. The Manufacturer shall provide a history of being regularly engaged in the design, manufacture, project management, execution, shipment, field inspection and startup services of arched, radial beam shell membrane design covers as defined in this specification. Manufacturers not meeting the following requirements will be rejected:
 - 1. The cover Manufacturer shall have designed and furnished not less than thirty (30) steel digester covers of 70 foot diameter or greater. The Manufacturer's bid package shall include a list indicating the number, diameter and location of the covers.
 - 2. The person responsible for the design of the proposed covers shall be a Professional Engineer registered in the state of Utah and shall be a direct employee of the Manufacturer. The Professional Engineer shall have designed a minimum of ten (10) covers furnished by the Manufacturer, while employed by the Manufacturer. The Manufacturer shall submit with the cover bid, the name of the Professional Engineer and a list of the covers designed by that person for the Manufacturer. The bid shall not be considered responsive without this list.

3. The digester cover Manufacturer shall provide a performance bond in the amount of 100% of the Manufacturer's bid price to the Contractor and Owner. The bond shall remain in effect for the period of one year after the date of the digester startup and acceptance by the Owner. The bond shall not be considered in lieu of the experience or qualifications required above.
4. The Manufacturer proposing to supply the covers on this project shall be International Organization for Standardization 9001 Quality Systems (ISO 9001) compliant.

1.04 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300 "Submittals" the Contractor shall submit to the Engineer for review, design data, support details for appurtenances, design calculations by a registered engineer in the state of Utah, and detailed shop drawings of the cover(s).
- B. The Professional Engineer that performs and stamps the calculations for the equipment covered under this section shall have designed digester covers of similar diameters and operating pressures. The Professional Engineer shall be a direct employee of the manufacturer. Provide a list of designs prepared by the engineer.
- C. Fabrication of the cover(s) shall not begin until the Engineer has accepted the design data, design calculations, and details.
- D. The equipment manufacturer's shop drawing shall clearly show complete information regarding location, type, size and length of all field welds in accordance with "Standard Welding Symbols" AWS A2.0 of the American Welding Society. Special conditions shall be fully explained by notes and/or details.

1.05 OPERATION AND MAINTENANCE MANUAL

- A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in Section 1300 "Submittals".
- B. Two copies of a preliminary or reference O & M manual from past projects shall be included in the shop drawing submittal. Without these manuals, the submittal will be considered incomplete and will be returned to the manufacturer.

1.06 SERVICES OF MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall provide the services of a qualified manufacturer's technical representative, who shall adequately supervise the installation and testing of all equipment furnished under this Contract and instruct the Contractor's personnel and the Owner's operating personnel in its maintenance and operation as outlined in the General Conditions and Section 01660 "Equipment Testing and Plant Startup". The services of the manufacturer's representative shall be provided for a period of not less than 3 days as follows:

One trip of 2 day(s) for equipment inspection and installation review.

One trip of 1 day(s) for equipment start-up and to instruct Owner's operating personnel.

- B. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor. The manufacturer's representative shall sign in and out at the office of the Resident representative on each day he is at the project.

PART 2 PRODUCTS

2.01 STEEL DIGESTER COVER (S) - GENERAL

- A. The cover(s) shall be stable under all design load conditions, including localized static and dynamic loads. All structural members shall be designed to allow the cover(s) to be self supporting when resting in an empty tank on the corbels or on the tank wall with the maximum possible applied loading as follows:

Dead Load	Normal operation dead loads and weight of insulation and cover equipment
Snow Load	35 psf (the cover manufacturer shall Account for drift effects and adjust the snow loads accordingly)
Uniform live load, psf	40
Vacuum load, inches W.C.	2
Concentrated live load, lbs.	4,500
Wind load on the total projected area above the tank wall, psf	As required per IBC-2003 and ASCE 7-02
Internal design pressure, inches W.C.	18 or escape pressure, whichever is greater
Mixer dynamic and static loads	<u>Coordinate with the mixer manufacturer</u>

- B. Maximum allowable stresses shall not exceed the limiting stresses as set forth in the AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," latest edition, for structural steel with 36,000 psi yield point. The cover shall be designed as a membrane with side skirt, thrust ring, erection members, center compression ring, and cover plates properly proportioned to match deflections and stresses. Radial beams shall be used in the cover design as erection members only and shall not be included in the structural design. Submittals using the erection beams as structural members shall not be acceptable.
- C. The structural framework shall be arranged for complete assembly by field welding all pieces in place, followed by field welding of the framework and roof plates to provide a gastight and watertight cover. There shall be no bolt holes in the plates. The cover plates shall be welded to the top of the erection beams. Any bolt heads and nuts used for erection shall be removed or shall be Type 316 stainless steel and shall be seal welded after installation.
- D. The side skirt sections shall consist of 1/4" plates with the reinforcing members adequate to support the weight under the cover. The radial joints between cover plates shall be centered on the erection beams. The cover plates shall be welded continuously to the top of the erection members and the seams between the cover plates and the erection members shall be seal welded from above and below the plates. The cover manufacturer shall provide drawings and support to the installing Contractor that will assist in minimizing the overhead weld requirements during the cover erection. Circumferential joints between cover plates may be butt or lap welded. All joints and seams required for gastight construction shall be continuously welded and coated with a protective coating as specified in DIVISION 9 FINISHES.
- E. The dome-shaped cover(s) shall have a radius of 1.5 times the tank diameter. The dome framework shall consist of arched radial erection beams held in position by a center

compression ring and peripheral thrusting ring. Erection beams used in the cover designs shall not be considered as structural members or used in the submittal structural calculations verifying the cover design pressure and load capabilities. A closed section shall be used for the thrusting rings to insure maximum torsional stiffness. Thrusting rings using open sections (angles, channels, etc.) are not acceptable due to their inherent weakness in torsion. Side skirts shall not be used to close channel or angle sections in forming the thrusting ring.

2.02 FIXED DIGESTER COVER(S)

- A. The cover(s) shall be supported on the top of the tank wall and shall be designed to resolve horizontal thrust loads into a peripheral thrusting ring. It shall be stable under all design load conditions, including localized static and dynamic loads.
- B. A cover support and anchoring assembly shall be fabricated from structural tubes welded to and extending from the thrust ring in such a manner that the moment load is transmitted to the thrust ring only and not the cover side skirt. A support and anchoring assembly shall be located at the outside end of each erection beam. Steel support and anchoring assemblies shall be designed to provide bearing surfaces of Teflon and 304 stainless steel to minimize transfer of friction loads to the tank walls during periods of steel thermal expansion and contraction.
- C. A vertical side skirt plate located at a nominal radial distance of 2" from the wall and extending below the thrust ring to a point below normal operating water level shall be provided to trap digester gas beneath the cover. A horizontal shelf plate at the bottom of the side skirt shall be provided to support a sealant in the annular space between the side skirt plate and tank wall. The annular space shall be sealed by the Contractor with caulking, seal, and fill materials. The Contractor shall submit the proposed sealing system for approval by the Engineer.

2.03 COVER APPURTENANCES

The cover(s) shall be designed to include the following appurtenances:

- A. One (1) 79" minimum diameter center compression ring with bolted and gasketed cover, (4) four lifting handles, and hot dip galvanized steel fasteners
- B. Two (2) 36" diameter manholes with cover plates, bolts, gaskets, and lifting handles. Manhole cover flanges must be horizontal for ease of entrance.

The roof manhole covers shall have a 36" inside diameter and shall include a flanged base for mounting. Cast wing nuts and a replaceable tallow flax insert shall be provided to provide a non-sparking operation and ensure a positive seal. Construction shall be low copper cast aluminum base and cover, brass wing nuts and lugs, and stainless steel hinge pins. Maximum working pressure shall be 1 psig. Roof manhole cover shall be VAREC 220 Series or equal.

- C. Two (2) 8" diameter schedule 40 sample tubes extending below liquid level. The sample tubes shall be equipped with a quick opening aluminum cover.

The quick opening aluminum covers/hatches shall have 8-inch size flanged connections. The hatches shall include inclined foot pedals to facilitate opening. Handwheels shall be provided to ensure positive seal. Handwheels shall include locking capability. Construction shall be low copper aluminum. Replaceable BUNA-N cover inserts shall be provided for non-sparking operation. Flanges shall be drilled per ANSI 150 FF flanged dimensions.

Maximum working pressure shall be 3 psig. Sampling hatches shall be VAREC 42 Series or equal.

- D. One (1) 4" diameter schedule 40 nozzle for gas line connection.
- E. One (1) 6" diameter schedule 40 blind flanged nozzle for float switches.
- F. One (1) 4" diameter schedule 40 nozzle for pressure/vacuum relief valve (PRVB) and flame arrester installation.

The pressure and vacuum relief valve with flame arrester shall have 4 inch size flanged connections.

Pressure relief shall be set at 18" WC.

Vacuum relief shall be set at 2" WC.

Relief valve and flame arrester shall be two independent items of equipment. Valve shall be field installed on the flame arrester by means of a bolted and gasketed flanged connection.

Valve pressure and vacuum ports shall be oversized to keep overpressure at a minimum. Pallets and seat rings shall be replaceable and interchangeable. Pallets shall be dead weight loaded, and both center and side guided for stability. They shall incorporate replaceable "air cushion" Teflon seat inserts. HDPE protective screens shall be provided at the pressure and vacuum ports, located external of the pallets. The valve body and cover shall be low copper cast aluminum construction. Spun hood, seat rings, and pallet assemblies shall be low copper aluminum. Guideposts shall be 304 stainless steel.

Flame arrester net free area through the bank assembly shall be not less than three times the corresponding size standard pipe. Entire bank assembly shall slide easily out of the arrester housing to facilitate inspection and cleaning. Removing or replacing the bank assembly shall not require removing the pressure and vacuum relief valve off-line, nor shall it require support for the valve and proper alignment, jackscrew for extending the housing. Bank frame shall be extensible and shall be filled with corrugated rectangular shaped bank sheets. Alternating flat and crimped ribbon sheets are not an acceptable substitute. Flame arrester shall be self-draining. Arrester housing shall be low copper cast aluminum. Bank assembly shall include a low copper aluminum frame and low copper aluminum bank sheets. Flanges shall be drilled to ANSI 125 FF Flanged dimensions. Flame arrester shall be leak proof to 10 psig. Relief valve and flame arrester combination shall be VAREC 5811B Series or equal.

- G. One (1) 58" diameter Linear Motion mixer mounting port. The size and location of the mounting port shall be in accordance with the construction drawings. The contractor shall also coordinate the location and size of the mixer mounting port with the mixer supplier/manufacturer.
- H. One (1) 8" SCH. 40 nozzle with ANSI 150# raised face flange connection for the installation of the level meter. The contractor shall coordinate the size and location of the level meter with the manufacturer.

PART 3 EXECUTION

3.01 ANCHOR/ ASSEMBLY BOLTS

- A. All flange bolts shall be made of galvanized steel. Adhesive anchors constructed of ASTM A303 stainless steel with necessary hex nuts and washers shall be provided for all parts of the cover(s) to be secured to concrete foundations.

3.02 FABRICATED ASSEMBLIES

- A. Structural steel sections and plates required to form the cover(s) shall be fabricated and shipped in sub-assemblies as large as practical with the unassembled members fabricated for assembly by welding. To prevent corrosion, no bolted structural connections will be permitted in the interior of the cover. The cover plates shall be continuously welded to the beams to form a continuously sealed dome structure.

3.03 FINISHES

- A. Steel plates, structural shapes and fabricated assemblies shall be shipped unpainted, for field painting by others. After erection, welding, testing and final inspection of erection by manufacturer's representative, the cover(s) shall be painted as directed in DIVISION 9 FINISHES of these specifications.

3.04 TESTING

- A. After field erection is complete, the Contractor shall test the cover(s) for gas tight construction by filling the tank with water and trapping air under the cover plates. All welded seams and appurtenances shall be checked for leaks by means of a soap suds solution. The air pressure underneath the dome during the test shall be not less than 14" W.C.
- B. Care shall be taken that all welds are carefully cleaned with a wire brush before the soap solution is applied. Any leaks shall be carefully chipped out to good metal and then re-welded for further testing.

END SECTION-15874

SECTION 15920 – GENERATOR DAY TANK AND FUEL LINES

PART 1 - GENERAL

1.01 SCOPE:

Provide and install a 150 gallon day tank, diesel fuel supply and return lines, piping sump, transition sump with inspection hatch, leak sensors and testing equipment, and all other fittings necessary to supply fuel to the generator. Equipment shall be new, factory tested, and delivered, including all devices and equipment specified herein, as shown on the drawings.

1.02 APPROVED MANUFACTURES:

Approval of Manufactures and Substitutes: Proposed manufactures and substitutions shall include complete submittal data, as specified herein, clearly denoting any and all deviations and/or exceptions to the equipment specified. Factory cut sheets of generators and automatic transfer switches must be attached to the Bid Schedule.

Day Tank: Tramont or approved equal
Fuel lines, sumps, and fittings, U.L. Listed 971: OPW or approved equal

1.03 SUBMITTALS:

As a minimum for all equipment specified, three each of the following are required:

1. Specification and data sheets.
2. Manufacturer's certification of prototype testing.
3. Manufacturers published warranty documents.
4. Shop drawings showing plan and elevation views with certified overall and interconnection point dimensions.
5. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
6. Manufacturer's installation instructions.
7. Operations and maintenance manual identifying schedules for exercising, routine service, and all other general maintenance of the day tank.
8. Proposal to provide maintenance on the generator.

1.04 WARRANTY:

A no deductible warranty shall be provided for all products against defects in materials and workmanship for a two-year period from the start-up date, per the manufacturer's Basic Extended Coverage Limited Warranty.

1.05 SINGLE SUPPLIER:

The supplier shall be the manufacturers authorized distributor, who shall provide freight and initial start-up date, per the manufacturer's Basic Extended Coverage Limited Warranty. Supplier shall have on call a local technician available for service calls.

PART 2 - PRODUCTS

2.01 DAY TANK AND FUEL LINES

A. The Contractor shall supply the following:

- | | |
|----------------------|--|
| 1. Day Tank: | 150 gallons |
| 2. Fuel Supply line: | ¾-inch |
| 3. Fuel Return line: | 1-inch |
| 4. Sumps | Piping & transitional with connections |

PART 3 – EXCUTION

3.01 INSTALLATION OF DAY TANK AND FUEL LINES

- A. Make all connections of fuel supply and return lines and electrical connections as required for a complete system. This includes all connections to the transfer switch.
- B. Provide fuel supply and return lines to fuel tank. Piping shall be in accordance with manufacturer instructions and requirements.

3.02 CONNECTION TO EXISTING FUEL TANK

- A. Remove all concrete above the existing fuel tank and hand-excavate to expose existing connections and openings. Tie flex fuel lines into existing tank through existing tank openings.

3.03 ON-SITE ACCEPTANCE TEST

- A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

END OF SECTION 15920

- b. Flange nuts, bolts Galvanized steel
- c. Submerged, wetted, or internal items Type 316 stainless steel

- B. Nameplates and Code Stamps: Each tank shall bear a stainless steel nameplate which contains the design and fabrication information required by the reference standard. Each nameplate shall bear the applicable code symbol.
- C. Fabricators: Tanks shall be fabricated by fabricators authorized to apply the applicable code symbols.
- D. In assembly and during welding the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the reference standards, and excessive reinforcement shall be ground down to within the requirements, and as required to install the lining systems. Upon completion of welding all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform contours and dimensions. All external corners and edges shall be ground to a 1/16-inch radius. All internal corners and edges shall be ground to a 1/8-inch radius, or a greater radius if required by the lining system.
- E. Flat bottom tanks shall have butt-welded bottoms, with a steel thickness of at least 3/8-inch.
- F. All openings 4 inches and greater in nominal diameter shall be reinforced.
- G. Tank shell joints shall have complete joint penetration and fusion, and shall be welded from both sides. Before the second side is welded the joint shall be arc-gouged to sound metal.
- H. For flat bottom tanks, the corner joint shall be tested after the inside fillet weld is complete by applying a weld-compatible penetrating oil to the outside of the joint and observing the inside fillet weld for indications of oil penetration.
- I. All shell attachments for pipe supports, tank gages, instruments and other items shall be welded to the tank shell before application of the tank lining.
- J. After fabrication but prior to application of linings each tank shall be tested in accordance with the reference standards.
- K. Unless otherwise specified, the minimum thickness for steel plates used for shells, roofs, or heads shall be 1/4-inch.
- L. Tank details shall be designed to eliminate unwelded joints that will promote corrosion, pockets that will accumulate rainwater or chemicals, and attachments to the shell which result in excessive localized stresses due to welding supports or imposed loads.
- M. Access openings shall be flanged, and, unless otherwise specified, have a nominal diameter of at least 24 inches. The cover plate and flange shall each have a net thickness, after machining, of at least 1/2-inch.
- N. All fittings shall be flanged.
- O. All tanks shall be designed to resist a horizontal force equal to at least 50 percent of the total weight of the tank plus contents and a vertical force equal to at least 25 percent of the total weight of tank plus contents.

- P. Anchor bolts shall have a nominal diameter of at least one inch, unless otherwise shown, and shall be anchored into concrete foundations using methods designed to transfer the full ultimate strength of the anchor bolt to the concrete foundation. Anchor bolts shall be attached to the tank by use of anchor bolt chairs or rings, as required, and such chairs or rings shall be designed to transfer the full ultimate strength of the bolt, or 150 percent of the calculated load, whichever is less, to the tank shell.
- Q. Unburied Surfaces: Unless otherwise specified, the unburied exterior surfaces of all tanks shall be painted as specified in Section 09800, "Protective Coatings."
- R. Manufacturers: All tanks shall be fabricated by reputable manufacturers, experienced in the design and fabrication of the specific tanks, and familiar with all applicable local regulations, codes, fire and safety orders.

PART 3 - EXECUTION

- A. Installation: The CONTRACTOR shall install welded steel tanks and appurtenances in accordance with the requirements of the manufacturer, approved shop drawings, applicable codes, and the Contract Documents.

END OF SECTION 13310

