

- D. Actual tested horsepower of each pump, with final impeller trim, shall not exceed motor nameplate horsepower at any point on the pump curve.
- E. The pumps shall be used to pump secondary effluent. The secondary effluent may contain minor concentrations of mildly abrasive small diameter solids and may have chlorine in concentrations up to 5 mg/l.

2.03 EQUIPMENT

- A. Provide vertical turbine pumps including bowl assembly, column, line shaft and guides, discharge head and electric motor. Comply with construction features of ANSI/AWWA E101 except where indicated differently in this Specification. Materials of construction shall be as listed in Table 1 of E101 except where indicated differently in this Specification.
- B. Seismic: Entire pump and installation including motor, discharge head, anchors, column, drive shaft, pump bowls and impellers and fasteners shall comply with the seismic requirements in Section 01190.

C. Pump Construction:

1. Bowl assembly:
 - a. Provide pump bowls of ductile or cast iron. Provide fired porcelain lining of bowls for sizes 20 inches and smaller. Above 20 inches provide fusion epoxy lining. Provide "O" ring seals.
 - b. The impeller shaft shall be Type 416 stainless steel and shall be supported by ASTM B505-844 bronze and/or neoprene bearings. Bearings shall properly fit housing without knurling the housings or bearings.
 - c. The impellers shall be of the enclosed type and shall be of stainless steel, ASTM A743, grade CF-8M, and of heavy construction, accurately fitted, statically and dynamically balanced to Hydraulic Institute Standards. Provide wear rings on impellers and bowls made of Type 316 stainless steel with a Brinell hardness difference between the impeller wear ring and the bowl wear size of at least 50 BHN to prevent galling.
2. Discharge column assembly:
 - a. The total length of the discharge column shall be as required to meet the installation dimensions shown on the Drawings. Column pipes shall have a minimum 0.250 wall thickness steel pipe and shall have interchangeable sections not over 10 feet long. Connect column pipes with flanged couplings.
 - b. Open lineshaft pumps shall be product lubricated and shall have lineshafter made of Type 416 stainless steel.
 - c. The line shaft bearings shall be bronze and/or neoprene.
3. Discharge head:
 - a. Fabricated steel for mounting the motor and with flanged end discharge outlet located as shown on the Drawings. Provide direction of rotation arrow.
 - b. For open lineshaft pumps provide a packed stuffing box for use with a hollow shaft motor. All seal components shall be suitable for a pH of 5.0. Top shaft shall be of the same material as the lineshaft

Vertical Turbine Pumps

11215 - 4 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bld Set
1368004*00
© 2014 Kennedy/Jenks Consultants

D. Motors:

1. Provide hollow shaft vertical motors for outdoor service, suitable for operation at 480 volts, and conforming to requirements of Section 11002. Nameplate motor horsepower shall not be exceeded at any flow up through the maximum operating point in the Pump Schedule. Motors shall be suitable for operation with an adjustable frequency drive (AFD) over the specified operating range of the pump. Motors shall be equipped with an anti-reverse ratchet.
2. Provide a space heater for each motor per Section 11002. Space heaters shall be rated 120 Vac.

2.04 ACCESSORIES

- A. Provide discharge pressure gauge for each pump with features and accessories in accordance with Section 15050.
- B. Provide Type 316 stainless steel suction strainers with area at least four times the inlet eye.

2.05 FINISHES

- A. Provide pumps, motors, and bases with the manufacturer's standard factory-applied paint finish except as noted.
- B. The columns, suction inlets, inside of discharge heads and outside of bowls shall be lined and coated with factory-applied System 3A specified in Section 09960. Provide appropriate returns to prevent lifting of the coatings by dynamic pressure. Protect the lining and coating against transportation damage.
- C. Correct damage to the lining or coating to the satisfaction of the Engineer if in his opinion it is repairable. Return equipment that has damaged coating and/or damaged lining, beyond repair, to the manufacturer for recoating.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the pump unit(s) in strict conformance with manufacturer's installation instructions. Check pump and motor alignment according to the Standards of the Hydraulic Institute after complete unit has been installed at the site.

3.02 FIELD PAINTING

- A. Apply a final color coat of paint to the pump motor and discharge head in accordance with Section 09960.

3.03 FIELD TESTING

- A. Field test each pump. For further requirements on performance tests, refer to Section 11001.

McKinleyville Community Services District 11215- 5 Vertical Turbine Pumps
Wastewater Management Facility Improvements
Bld Set
1368004*00
© 2014 Kennedy/Jenks Consultants

3.04 FIELD SERVICE

- A. The equipment manufacturer shall supply a competent field service engineer to thoroughly check and inspect the equipment after installation, place the equipment in operation, make necessary adjustments, calibrate instruments, and conduct field tests.

END OF SECTION

SECTION 11217
SUBMERSIBLE TURBINE-TYPE PUMPS

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish complete, tested and operating, the equipment as shown on the Drawings, and as specified herein.
- B. Work Included in this Section:
1. Submersible turbine type pump assembly with electric submersible motor, power cable, inlet strainer, suction casing, pump bowls, discharge column, discharge head, flow inducing collars, and pump appurtenances as shown on the Drawings and specified herein.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

- A. ASTM International (ASTM):
1. ASTM A48 Gray Iron Castings
 2. ASTM A276 Stainless Steel Bars and Shapes
 3. ASTM A320 Alloy Steel Bolting Materials for Low Temperature Service Ductile Iron Castings
 4. ASTM A582 Free-Machining Stainless Steel Bars
 5. ASTM B584 Copper Alloy Sand Castings for General Applications

Vertical Turbine Pumps

11215 - 6

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004'00

© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004'00

11217 - 1

Submersible Turbine-Type Pumps

© 2014 Kennedy/Jenks Consultants

1.03 PERFORMANCE REQUIREMENTS

A. The required pump characteristics shall be as follows:

Tag Numbers	P-8321 and P-8322
Pump Name	Utility Water Pump 1 and 2
Design Operating Point	85 gpm @ 190 feet TDH
Maximum Head Operating Point	40 gpm @ 210 feet TDH
Minimum Head Operating Point	105 gpm @ 180 feet TDH
Drive	Adjustable frequency
Maximum Speed	3500 rpm
Maximum Motor Horsepower	7.5 hp
Minimum Pump Efficiency	66 percent
@ Design Operating Point	220 feet
Shut Off Head, 0 GPM @	3500/3/480
Motor Data (speed/phase/volts)	

1.04 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
3. Product data fully describing all items proposed for use to demonstrate that the equipment conforms to the Specifications.
4. Motor data as specified in Section 11002.
5. Pump layouts and dimensions.
6. Pump performance curves.

Submersible Turbine-Type Pumps 11217 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

7. Materials of construction.
 8. Certification with related drawings that equipment anchors are designed per requirements of Sections 01190 and 11001.
- B. Performance Testing: Certified non-witnessed factory performance tests in accordance with Hydraulics Institute Standards are required for each pump. Obtain favorable review from the Engineer prior to shipment of the pumps.
- C. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and parts lists.
- D. Affidavits: Furnish affidavits from the manufacturer stating that the equipment has been properly installed, adjusted and tested and is ready for full time operation.

1.05 QUALITY CONTROL

- A. All equipment furnished under this Section shall: (1) be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years; and (2) be demonstrated to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers specifically named herein.
- B. All pumps furnished under this Specification Section shall be of a single pump manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Submersible turbine pumps shall be Grundfos, Goulds, or equal, modified to provide the specified features and to meet the specified operating conditions.

2.02 MATERIALS

- A. Materials of construction shall be as follows:

Component	Material
1. Suction inlet, bowl assembly and discharge adapter	ASTM A276 or A582, Stainless Steel
2. Bowl wear rings	ASTM B584, Bronze, or ASTM A48, Cast Iron
3. Pump shaft	ASTM A276 or A582, Type 416 Stainless Steel
4. Impeller	Cast stainless steel (all stages)
5. Impeller lock collets	ASTM A276, Stainless Steel
6. Pump bearings	ASTM B584, Bronze
7. Pump discharge column	ASTM, Stainless Steel

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

<u>Component</u>	<u>Material</u>
8. Motor adapter	ASTM, Stainless Steel
9. Motor coupling	ASTM A582, Stainless Steel, Type 416
10. Discharge elbow	ASTM, Fabricated Stainless Steel
11. Strainer	ASTM A320, Stainless Steel, Type 304
12. Bolts, studs, and nuts	ASTM A320, Stainless Steel, Type 304
13. Flow inducing collar	ASTM A320, Stainless Steel, Type 304

2.03 EQUIPMENT FEATURES

- A. Motor Adapter: The bottom of the pump shall be fitted with a one piece casting motor adapter designed to serve as the suction inlet, lower bearing housing and motor adapter piece. The coupling housing portion shall be designed to prevent the entrance of abrasive material into the top end of the motor. The coupling connecting the motor to the pump bowl assembly shall be of sufficient size and strength to withstand maximum torque generated by the motor.
- B. Strainer: The suction inlet shall be provided with a strainer having a net inlet opening area of not less than four times the impeller inlet area. The strainer or mesh openings shall be sized to prevent passage of particles larger than the solids handling capability of the impeller.
- C. Suction Inlet: The suction case shall be designed to provide conservative entrance velocities and evenly distribute the flow to the impeller. The inner surface of the case shall be smooth and free from projections or cavities. The pump shaft lower bearing shall be housed in a streamlined casing, centered and held in place by means of rigid cast vanes.
- D. Pump Bowl:
1. The pump bowl shall be flanged for registered fit. Flow passages through the bowl shall be porcelain enamel-lined. The first-stage bowl shall be designed to facilitate a low NPSH impeller arrangement and first stage impellers shall be cast stainless steel. All pump bowls shall be designed to handle the shutoff head of the pump. Bowls shall not be designed to different pressure depending on stage.
 2. Bowl assembly shall be equipped with wear rings. One bowl wear ring shall be installed for each bowl in the bowl assembly. Bowl wear rings shall be installed on the suction side of the bowl seat.
- E. Impeller:
1. The impeller shall be constructed free from projections, cavities, or abrupt transitions. The impeller surfaces shall be either polished or porcelain-lined.
 2. Impellers shall be of the enclosed type, with the shroud designed to rotate against wearing rings installed in the bowl assembly. Impellers shall be secured to the pump shaft using tapered collets or keyways.

Submersible Turbine-Type Pumps 11217 - 4 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- F. Shafts: Shafts shall be sized to prevent excessive elongation and transmit the required torque without distortion in both the forward and reverse direction. Shafts shall have a first critical speed not less than 20 percent above maximum operating speed. The pumping units shall utilize a single pump shaft extending from the suction case through a discharge case or upper bowl case containing an upper pump shaft bearing.
- G. Bearings: Suction case, bowl, and lower tube bearings shall be close tolerance, sleeve type. Bearings shall be lubricated by the process fluid or grease lubricated. The top case of the bowl assembly shall contain an extra-long sleeve bearing with a sand cap. Intermediate bearings shall be furnished at each bowl assembly. The bearings shall have a minimum B-10 life expectancy of 100,000 hours for continuous service.
- H. Motor:
1. The motor shall be of the submersible electric motor type, capable of continuous operation at nameplate rating under water at a maximum temperature of 95 degrees F and suitable for across the line starting. Motor shall be provided with heat sensors compatible with specified motor overload protection system.
 2. Motor shall be a nominal 3,450-rpm unit. The maximum horsepower rating of the motor shall be as specified in Section 11217-1.03A, and the motor shall have a minimum Service Factor of 1.15. The motor nameplate full load rating shall not be exceeded at any point on the pump performance curve.
 3. The motor's full load efficiency rating shall not be less than the amount specified in Section 11217-1.03A with a minimum power factor of 87 percent. The full load efficiency shall include 100 percent of the thrust bearing's rated loading. For purposes of flow, the maximum motor diameter at the stator case shall not exceed 10 inches.
 4. The motor shall be water filled "wet winding type". It shall be filled with a 50/50 solution of water and food grade propylene-glycol. Motor shall be designed to be properly cooled by passage of water past the motor.
 5. Motor materials of construction shall be stainless steel, or stainless steel fitted. All wetted fasteners and washers shall be of Type 316 stainless steel. Mating threaded components shall be of non-galling alloys.
 6. The motor shall be totally enclosed, utilizing an elastomer expansion diaphragm for the equalization of internal and external pressure.
 7. The motor shall be equipped with a double rubber type shaft seal to seal the motor at the point that the shaft extends through the casing.
 8. Replaceable carbon composite material sleeve type radial bearings shall be provided at each end of the motor.
 9. Thrust bearings shall have capacity to carry the weight of all rotating parts plus the hydraulic thrust at shutoff head. This shall be an integral part of the driver. The pivotal shoes shall be stainless steel and the thrust driver (or thrust bearing) shall be of stainless steel material. Antifriction bearings shall be designed such that the L10 calculated life shall be no less than 8,800 hours. Thrust bearings shall also be able to support down thrust conditions for a minimum of five minutes with the discharge valve closed.

McKinleyville Community Services District 11217- 5 Submersible Turbine-Type Pumps
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

10. The motor leads shall be sealed at the motor top bracket.
 11. The multiconductor cable shall be stranded copper conductors, and meet ASTM Class B. Insulation shall be ethylene propylene rubber (EPR) type suitable for continuous immersion in water. Cable shall be non-hygroscopic with an overall neoprene jacket and classified for RHW service. The cable shall have sufficient area to meet ICEA requirements for operation in air. Cable shall be mechanically shielded where it passes the pump bowls. Sufficient cable length of cable shall include adequate length to account for sagging of the cable, or wrapping around the column pipe. The cable shall be supported on the column pipe with stainless steel straps every 8 feet.
 12. Motors shall be rated for use with adjustable frequency drives.
- I. Pump Controller:
1. Provide an integrated pump controller package that is designed to operate the two utility water pumps to maintain a discharge pressure within a predefined range. The pump controller shall receive an analog signal (4-20 mA) from a Contractor-supplied pressure transmitter on the discharge manifold as shown on the Drawings.
 2. Controller shall be mounted in a NEMA 4X stainless steel enclosure suitable for wall mounting.
 3. Provide a full voltage non reversing starter with overload and short-circuit protection for each pump. Circuit breakers shall be in accordance with Section 16155. Each circuit breaker shall be equipped with a door disconnect operating handle, with provision for up to two padlocks.
 4. Provide a Hand-Off-Auto selector switch and Start-Stop pushbuttons for each pump, in accordance with Section 16955.
 5. Sequence of Operation:
 - a) When pump is in Hand mode, pump will operate by the use of Start and Stop pushbuttons mounted on the controller.
 - b) When the pump is in Auto mode, the controller shall operate the pump(s) to maintain the discharge pressure at the predefined pressure setpoint.
 - c) Pumps shall alternate automatically. If pump demand is continuous, the pumps shall be alternated every 24 hours.
 6. Provide the following Form C contacts, rated 10A at 120 Vac, for connection to a PLC:
 - a) Pump 1 Running.
 - b) Pump 1 in Auto.
 - c) Pump 1 Fault (Overload).
 - d) Pump 2 Running.
 - e) Pump 2 in Auto.
 - f) Pump 2 Fault (Overload).
 - g) System Pressure Low.
 - h) System Pressure High.
- J. Anchors: Provide anchors and anchor design per requirements of Sections 01190 and 11001.

Submersible Turbine-Type Pumps 11217 - 6 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

2.04 COLUMN CHECK VALVE

- A. The pump column shall be equipped with a column check valve, located immediately above the pump assembly. Check valves shall be stainless steel body, slow bleed back, double door type. Check valves shall be nominal size as column pipe, threaded to match the column pipe. Valves will meet all strength requirements for the column pipe.

2.05 FLOW INDUCING COLLARS

- A. Flow inducing collars shall be provided to ensure a cooling flow past the motor pump column. The pump manufacturer shall design and supply the flow inducing collars. Collars and attachments shall be Type 316 stainless steel.

2.06 DATA PLATES

- A. Mount a data plate on each pump unit. Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data. Attach a special data plate to the pump frame that contains identification of frame and bearing numbers.

2.07 PAINTING

- A. Do not paint stainless steel components.
- B. Provide pumps, motors and bases with the manufacturer's standard factory applied paint finish. The columns, suction inlets, inlet bells, and pump bowls shall be lined and coated with factory applied 8-mil coat of paint as specified below.
 1. Manufacturer: Tnemec P66 Epoxoline; Koppers High Guard Epoxy; or equal. Epoxy coating shall be food grade and suitable for use with potable water. Factory test the coating and lining for thickness and holidays.
 2. Protect the lining and coating against transportation damage. The lining and coating shall be subject to retesting and inspection at the job site, and deficiencies will be corrected by the Contractor in the field to the satisfaction of the Engineer.

2.08 SPECIAL TOOLS

- A. Furnish a full set of manufacturer's special tools that are necessary for the replacement of parts and the adjustment of the equipment.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment in strict conformance with manufacturer's installation instructions. Check pump and motor alignment according to the Standards of the Hydraulics Institute after pump and motor have been installed.

McKinleyville Community Services District 11217- 7 Submersible Turbine-Type Pumps
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

3.02 FIELD SERVICE

- A. The manufacturer shall provide a competent field service engineer to thoroughly check and inspect the pumps after installation, place the pumps in operation and make necessary adjustments, and instruct plant personnel in proper operating and maintenance procedures.

3.03 FIELD PAINTING

- A. Pumps, motors and appurtenances shall receive touchup service in the field as required in accordance with Section 09960.

3.04 FIELD TESTING

- A. Perform field testing, observed by the Engineer, to demonstrate that the installed pump equipment provides the hydraulic performance determined by factory tests and that the equipment runs smoothly and is free from excessive noise and vibrations. Hydraulic Institute vibration limits shall govern.

3.05 PRESSURE GAUGES

- A. All pump installations shall be provided with pressure taps and gauge cocks on the discharge side of the pump. Where such taps are not provided on the pump body itself, they shall be provided on the piping immediately downstream of the pump.

END OF SECTION

SECTION 11225

AERATION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Design, manufacture, installation and startup of an extended aeration system for two secondary treatment basins.
- B. Aeration system equipment shall include aeration blowers, aeration system motor-actuated blow-off valves and silencer, in-basin aeration components including lateral piping, diffuser assemblies, motor actuated control valves, aeration control system, and restraint components.

1.02 DEFINITIONS

- A. Diffuser Unit: Manufactured unit including diffuser support frame and flexible membrane, which releases air to the water.
- B. Diffuser Assembly: Manufactured assembly including multiple diffuser units.
- C. Air Lateral Piping: Air distribution piping from header stub and diffuser assembly.
- D. Header Stub: Air distribution piping between the header piping and lateral piping. Header stub shall extend to just outside of the basin berm as shown on the Drawings and terminate with a vertical face, full diameter, flanged connection.
- E. Isolation/Balancing Valve: Motor actuated butterfly valve located between the header and lateral piping. Valve provides control of air release to the lateral for system balancing as well as isolation capability for maintenance operations.
- F. Air Header Piping: Air distribution piping from the Blower Building to the header stubs.
- G. Blower Manifold Piping: Air distribution piping between the blower discharge and air header piping.
- H. Standard Cubic Feet per Minute (scfm): Air at 68 degrees F, 14.7 psia and 36 percent relative humidity.
- I. Maximum Pressure: Pressure in blower manifold piping at the specified airflow rate.
- J. Oxygen Transfer Efficiency: Percent of oxygen in the air stream that is dissolved to the wastewater under specified conditions of temperature, barometric pressure, airflow rate, and dissolved oxygen concentration.

Submersible Turbine-Type Pumps 11217 - 8 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District 11225 - 1 Aeration System
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

K. Standard Oxygen Transfer Efficiency: Percent of oxygen in the air stream that is dissolved to clean water under conditions of 68 degrees F, 14.7 psia, and zero dissolved oxygen.

L. Air Distribution Uniformity: Variation in air distribution between diffuser assemblies.

1.03 SYSTEM DESCRIPTION

A. General: The aeration system shall consist of the aeration blowers, floating aeration chains, motorized valves on aeration chains, and control system. All the components listed must be supplied and guaranteed by the same manufacturer.

B. Design Requirements: The aeration system shall be designed to diffuse air throughout the system in accordance with the Specifications. Each diffuser assembly shall be designed to provide uniform air release over the specified airflow range.

C. Performance Requirements: The aeration system shall be provided for two earthen and lined secondary treatment basins. Each basin has a configuration as shown on the Drawings. Each basin has a minimum volume of 1.6 million gallons. Each basin will have a water depth of 13.4 to 13.5 feet and a floor dimension of 66 feet by 138 feet. The earthen berm side slope shall be 2 feet horizontal to 1 foot vertical. Under normal operation two basins will be in service. One blower shall serve each basin and one shall be standby. The following plant flows and loads will be split between two basins:

<u>Flows:</u>	
Average Annual Flow (AAF)	1.53 MGD
Maximum Month Flow (MMF)	2.13 MGD
Peak Day Flow (PDF)	3.08 MGD
Peak Instantaneous Flow (PIF)	3.77 MGD

Loads (Based on AAF):

<u>Biochemical Oxygen Demand (CBOD)</u>	
Average Annual	3,191 lbs/day
Maximum Month	4,569 lbs/day
Peak Day	6,188 lbs/day

Total Suspended Solids (TSS)

Average Annual	2,857 lbs/day
Maximum Month	5,664 lbs/day
Peak Day	7,580 lbs/day

Total Kjeldahl Nitrogen (TKN)

Average Annual	587 lbs/day (46 mg/l)
Maximum Month	625 lbs/day (49 mg/l)
Peak Day	664 lbs/day (52 mg/l)

Ammonia-Nitrogen

Average Annual	455 lbs/day
Maximum Month	662 lbs/day
Peak Day	667 lbs/day

Aeration System

11225 - 2

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

© 2014 Kennedy/Jenks Consultants

Alkalinity:

Minimum Day	190 mg/l
Minimum Month	230 mg/l
Average Annual	273 mg/l
Maximum Month	310 mg/l
Maximum Day	340 mg/l

Alkalinity to TKN Ratio:

Minimum Month	4.7
Average Annual	5.9

The following plant effluent quality shall be achieved:

	<u>Monthly Average</u>
CBOD	10 mg/l
TSS	15 mg/l
Total Nitrogen	8 mg/l
Ammonia-Nitrogen	less than 1 mg/l
pH	6.5 – 8.5

The aeration system shall provide sufficient air such that these limits can be met.

D. System Performance per Basin (equipment will be supplied for 2 basins total):

- At a minimum, the aeration-mixing system shall be designed to meet the following minimum requirements:

- SOR = 420 pounds oxygen per hour per basin
- SCFM = 2,111 scfm design per basin max without denite credit, 1,660 scfm design per basin max with denite credit.
- Discharge Pressure = 6.91 psig max (top of drop pipe)
- Design Diffuser Submergence = 12.5 feet maximum

E. Performance Guarantee and Performance Bond: The supplier shall provide a written performance guarantee guaranteeing the above effluent quality for 12 months following startup. A complete guarantee statement shall be submitted with the supplier's proposal. This guarantee will be backed by a 1- year performance bond for 100 percent of the value of the suppliers bid. Evidence of the willingness and ability to provide this performance bond must be included with the supplier's proposal. A proposal from the supplier without the performance guarantee statement or certification of intent to provide a performance bond will be considered non-responsive.

1.04 SUBMITTALS

- The following information shall be submitted in accordance with Section 01300:
 - A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by

Aeration System

11225 - 3

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

© 2014 Kennedy/Jenks Consultants

the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

- B. General: A detailed engineering submittal package shall be provided in sufficient detail and scope to confirm compliance with the requirements of this section. Submittals shall be complete and show accurate details and dimensions for all required components. Partial submittals will not be accepted.

- C. Shop Drawings: Detailed layout drawings for aeration system components. Layout drawings shall include:
 1. Layout and configuration of aeration system.
 2. Detail drawings of diffuser assemblies showing components, method of construction, and attachment mechanism to air lateral piping.
 3. Detail drawings of lateral piping showing inlet, outlet, and terminal end connections.
 4. Detail drawings of header stub components.
 5. Detail drawings of lateral restraint components.

- D. Product Data: Provide the following product data:
 1. Detailed listing of materials and materials of construction.
 2. Product literature.
 3. Motor data.
 4. Weights and materials of construction.
 5. Seismic design anchorage description, anchorage certification and related sketch.
 6. Elementary and connection wiring diagrams clearly showing external connections to other equipment.
 7. Detailed narrative description explaining how the equipment is operated and controlled.

- E. System Design and Performance Data:
 1. Aeration System
 - a. Certified Oxygen Transfer Performance Curve:
 - 1) Certified curve shall be oxygen transfer efficiency in percent versus air flux rate defined as scfm per foot of diffuser length in tap water at

Aeration System

11225 - 4
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

© 2014 Kennedy/Jenks Consultants

14.7 PSIA, 20 degrees C and zero dissolved oxygen at the specified submergence.

- 2) The certified curve shall be based on aeration test results from a full-scale test facility. Minimum acceptable tank size is 200 square feet with a maximum length to width ratio of 2.0.
- 3) Certified curve results shall be prepared and sealed by a Professional Engineer.
- b. Include complete air headloss calculations for the aeration equipment from the top of the dropleg to the farthest diffuser bubble release point.
- c. Design calculations showing uniform air distribution (+10 percent maximum variation) through lateral piping and diffuser element orifice system.
- d. Design calculations for lateral and cable loads shall be provided assuming a cross wind at 60 mph and a perpendicular surface water velocity equal to 1 fps.
- e. Guarantee: All equipment and workmanship furnished under this contract shall be guaranteed to be free of defects in materials and workmanship for a period of 12 months from the date of system startup or 18 months from the date of shipment, whichever occurs first. Any such defects, which occur within the stipulated warranty period, shall be repaired, replaced, or made good at no cost to the Owner.

F. Operation and Maintenance Manuals:

1. Operations and maintenance manuals for all proposed equipment shall be provided.
2. Information on the aeration system shall include but not be limited to:
 - a. Air flow balancing.
 - b. Diffuser assembly maintenance and membrane replacement.
 - c. Lateral restraint system.
 - d. Troubleshooting guide.

- G. Biological Process Startup Plan. Working with the Contractor, the Aeration System Supplier shall develop and submit a plan for the startup of the biological treatment system. The plan shall include at a minimum the mixed liquor seed source(s), seed schedule, raw sewage feed schedule, and analytical parameters to be monitored during startup.

1.05 QUALITY CONTROL

- A. Qualifications: Equipment furnished under this Section shall be supplied by a single manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years. Demonstrate to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers named herein.
- B. Experience: Suppliers must be able to demonstrate sufficient experience with the quoted equipment. The minimum experience requirement is for five plants in operation in the United States of similar size for a minimum of 3 years. Plant name, design information, and contact information for each plant must be provided as part of the suppliers' submittal package. Suppliers that do not meet this experience requirement will not be accepted.

11225 - 5

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

Aeration System

© 2014 Kennedy/Jenks Consultants

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Immediately upon delivery to job site, place materials in area protected from weather. Use non-marring slings for loading, unloading and handling units to prevent rope or cable damage to surfaces and protective wrappings.

1.07 WARRANTY

- A. The extended aeration equipment manufacturer shall provide a written process guarantee, guaranteeing the effluent quality. The guarantee shall cover all equipment components that affect effluent quality, including aeration system.
- B. All equipment shall have a 1-year manufacturer's warranty from date of startup.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Aeration equipment shall be manufactured by AWT Technologies Bioworks Group or by Parkson Corporation; or equal. The diffusers may be Oxiworks as manufactured by AWT Technologies Bioworks Group or BioFusers as manufactured by Parkson Corporation, or equal.

2.02 MATERIALS

- A. Welded Stainless Steel Components:
1. Sheets and plates of Type 316 stainless steel with 2D finish prior to passivation conforming to AISI 304L and ASTM A240.
 2. Limit carbon content to 0.03 percent maximum.
- B. Non-welded Stainless Steel Components:
1. Sheets and plates of Type 316 stainless steel conforming to AISI 304 and ASTM A240.
- C. Fasteners and Anchorage Components:
1. 18-8 series stainless steel.
- D. PVC Pipe and Fittings (Schedule 40 and 80):
1. Base material shall be ASTM D1784.
 2. Pipe shall be manufactured in accordance with ASTM D1785 and ASTM D2665.
- E. PE Pipe and Fittings:
1. Base material shall be PE 3408, ASTM D3350, PE 345444C.
 2. Pipe shall be manufactured in accordance with ASTM F714.

Aeration System

11225 - 6

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

2.03 AERATION EQUIPMENT

- A. Flexible Membrane, Fine Pore Diffusers:
1. Diffusers units shall be as specified.
 2. Design parameters:

- a. Maximum air flow rate per square foot of active diffuser membrane surface area of 2.6 scfm/ft².
- b. Minimum diffuser active surface area of 812 square feet. Active surface area shall be defined as the net perforated area of the media or membrane and shall reflect only that portion of the membrane which can be demonstrated to produce uniform air discharge under the full operating range proposed for the diffuser.
- c. Maximum number of floating laterals shall be 11 per basin.

B. Aeration System:

1. Floating Lateral Aeration System: The floating lateral aeration system suspending the fine bubble diffusers near the bottom of the basin shall be as manufactured AWT Technologies Bioworks Group or by Parkson Corp; or equal. It is the intent of this specification that the manufacturer shall provide a complete aeration system including all equipment and hardware required for the in-basin components.
 - a. The floating lateral aeration system shall be designed so that there are no anchors or points of attachment to the basin bottom. The aeration system must be completely suspended above the basin bottom and not be supported or resting on the bottom. The aeration system must be easily accessible for service and maintenance without basin dewatering or a complete aeration system shutdown.
 - b. The aeration system must allow for turnaround flexibility in the operation of the aeration system while maintaining a completely mixed system. The minimum mixing air requirement for each basin is 855 scfm based on the mixing criteria of 4 scfm per 1,000 cubic feet of basin volume.
 - c. A certified full-scale mixing test verifying the equipment's ability to completely mix an activated sludge basin using 4 scfm/1000 cubic feet basin volume is required and shall be submitted for approval. Equipment will not be approved from suppliers that do not provide this certified mixing test.
 - d. Each floating lateral will be fed air from one side and connect to the air main through individual motor actuated butterfly valves. The motor actuated butterfly valves will provide individual control or isolation of the airflow to each floating lateral. An adjustable tension line consisting of stainless steel cable will connect near the last aeration assembly at each end of the floating lateral and also to a hook anchored at the side of the basin as shown on the Drawings.
2. Aeration Header Assembly:
 - a. The aeration header shall be constructed of a single continuous polyethylene piping. All header piping will be manufactured by continuous extrusion process of high density, high molecular weight resin defined by ASTM D3350. Each header will be field assembled using butt fusion welds.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

Aeration System

11225 - 7

- b. Aeration lateral piping shall be SDR 17 for 4 inch diameter with a minimal wall thickness of 0.265 inches. End caps and adaptors for hose feed end shall be SDR 11 minimum.
3. Air Feed Hose & Connections:
 - a. The connecting hose between each aeration lateral and the butterfly valve shall be EPDM rubber and suitable for high temperature service. The hose shall be the same diameter as the aeration lateral. It will be attached to the butterfly valve by a stainless steel adapter and to the lateral by a machined polyethylene adapter.
 - b. The polyethylene adapter shall have a minimum wall thickness equal to SDR 11. Metallic adapters to the polyethylene lateral will not be accepted.
 - c. The connecting hose shall be held in place by no less than two band-type clamps at each end. Clamps shall be constant torque-type for the connection to the stainless steel adapter and standard band clamps at the polyethylene lateral. All clamp components will be Type 316 stainless steel. Working clamp rating shall not be less than 40 inch pounds. Rigid pipe connections will not be accepted.
4. Suspended Oxygen Transfer and Mixing Unit:
 - a. The suspended air diffuser assembly will consist of a fully functioning unit capable of housing five diffuser tubes total. Each installed tube will be secured by means of a threaded connection. The design offered must allow for a minimum of 25 percent additional membrane surface area above the design requirement to be added to each diffuser assembly to provide expansion capability for the future.
 - b. All diffuser tubes will be constructed with a complete, internal flow-through design in order to minimize buoyancy and reduce counterweight/ballast requirements. A maximum ballast weight of 30 pounds shall be allowed to insure ease of maintenance over the life of the unit. Systems with ballast above this weight must be supplied with an automatic system for lifting the diffusers out of the basin. Ballasts must be designed to allow locating the diffuser centerline within 12 inches of the basin bottom while maintaining not less than 8 inches of clearance for variations in the basin bottom and liner.
 - c. Ballast assemblies shall have a corrosion proof design suitable for service in domestic wastewater applications. Ballast may be a urethane coated carbon steel, stainless steel construction or carbon steel contained within a rigid corrosion-proof enclosure.
5. Diffuser Frame: The diffuser frame shall be rigid PVC or formed from an extruded polypropylene compound. If PVC is used it must include glass fiber, or some other additive to prevent warpage of the diffuser frames.
6. Diffuser Sheath: The diffuser sheath shall be composed of EPDM or a urethane special soft thermo plastic material. The diffuser sheath shall be held in place by stainless steel clamps.
7. Connection of Diffuser Assembly Air Supply to Aeration Lateral: The diffuser assembly will be connected to the aeration lateral by EPDM hose. The hose shall be reinforced with at least two spiral plies and have a minimum 125 psig working pressure. The point of connection to the PE pipe will be formed by an insert type nozzle fitting with same diameter as the EPDM hose. Fittings shall be factory fusion welded to the aeration piping or a field installed mechanical fitting made airtight using BUNA-N gaskets.

Aeration System

11225 - 8 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

8. Motorized Butterfly Valves:
 - a. Motorized butterfly valves shall be provided on the aeration laterals at each aeration basin and for the two aeration system blow-off valves as shown.
 - b. The butterfly valves shall comply with the requirements of Section 15050 for aeration air service.
 - c. The valves shall have electric motorized actuators mounted directly to the valves and shall have a manual hand wheel override. The actuator shall have internal travel limit switches, adjustable mechanical travel stops, external position indicator and an anti-condensation heater. The actuator shall be 480 Vac and three phase. The actuators shall comply with the requirements of Section 15050.
9. Aeration System Blow-Off Valve Silencer:
 - a. The aeration system blow-off valve discharge shall be supplied with a properly sized blow-off silencer.

2.04 AERATION BLOWERS

- A. General: Three aeration blowers shall be furnished as specified in Section 11374.

2.05 SYSTEM CONTROL PANEL

- A. General: The Aeration System manufacturer shall provide PLC based electrical control panels as required to safely and efficiently operate aeration blowers, aeration system blow-off valves, aeration chain valves, and other Manufacturer supplied equipment as specified on the plans and specifications. Panels shall comply with the requirements of this Section, Division 16, Division 17, and with the Drawings.
- B. Placement: Provisions shall be provided by the Contractor to isolate control panels from extreme heat, rain, water, ice, humidity, sun or other properties of weather.
- C. Cabinet Requirements: The control enclosures shall be UL/CSA approved, sufficiently sized to house all components required. The enclosures shall be Type 316 stainless steel NEMA 12.
- D. Starters: All motor starters provided shall be IEC type with Solid State overloads. For motors less than 100 hp, IEC starters shall be one size larger than required. Siemens or equal shall be used.
- E. Protective Devices: The panel(s) shall be protected using circuit breaker and/or motor circuit protectors as permissible in the NEC and UL. Single phase wiring less than 250Vac/Vdc shall be protected using fuses. A three-phase power monitor shall monitor the incoming power to the panel(s). The unit shall disconnect the control voltage in the event of loss of voltage on one or more phases.
- F. Terminal Blocks: Terminal blocks shall be of a spring loaded, pressure plate design. Blocks shall not use screws as tension devices.

McKinleyville Community Services District 11225 - 9 Aeration System
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

- G. Pushbuttons, Switches, Indicator Lights: Where needed, these devices shall be by Allen-Bradley 800 series or equal. Devices shall be based on the panel rating (NEMA 12 or 4X). Color and configuration of the devices shall be as reflected on the Drawings. All indicator lights shall be transformer type.
- H. Relays: General purpose "ice cube" type control relays shall be of DPDT or 3PDT. Contacts shall be 10 Amp or greater. Relays shall be socket mountable. Relays shall be IDEC or equal.
- I. Control Power Transformer: The control power transformer shall be sized as needed.
- J. PLC System: PLC system shall consist of Allen-Bradley CompactLogix System utilizing any or all I/O devices needed to most efficiently satisfy system requirements.
- K. Operator Interface: Operator interface shall have sufficient capabilities to control all system devices. Operator interface shall have a multi-level menu system that requires no PLC programming knowledge. Operator interface shall also be compatible with Allen-Bradley CompactLogix PLC. Allen-Bradley PanelView Plus 10 inches shall be used.
- L. Instruments: The aeration system supplier shall supply the following instruments:
1. One dissolved oxygen analyzer/transmitter with one dissolved oxygen probe shall be supplied for each aeration basin. The dissolved oxygen probe and analyzer shall meet the requirements of Section 17110.
 2. One pH analyzer/transmitter with one pH probe shall be supplied for each aeration basin. The pH probe and analyzer shall meet the requirements of Section 17110.
- 2.06 ANCHORS
- A. Anchor design per requirements of Sections 01190 and 11001.
- 2.07 PAINTING
- A. Apply standard factory finish before shipping.
- 2.08 SPECIAL TOOLS
- A. Furnish special tools which are necessary for the replacement of parts and the adjustment of the equipment.
- 2.09 SPARE PARTS
- A. The Contractor shall furnish the following spare parts and store as directed:
1. One diffuser aeration-mixing assembly completely factory assembled.
 2. Ten membranes and stainless steel membrane clamps.
 3. Two sets of replacement membranes and parts for DO probes.
 4. Two sets of replacement membranes and parts for pH probes.

Aeration System 11225 - 10 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment in strict conformance with the manufacturer's installation instructions.

3.02 TESTING

A. Low Pressure Air Test of Air Header:

1. The purpose of this test is to determine the tightness of the air header under pressure. The low pressure air test determines the rate at which air under pressure escapes from an isolated section of pipe.
2. The Contractor shall conduct the test as follows:
 - a. Before test: The air test shall be conducted after compaction of backfill has been made. Pipe to be tested shall be cleaned by passing a full gauge squeegee through the entire length of pipe.
 - b. Pipe isolation: The section of pipe to be tested should have all open ends plugged or capped. Plugs and caps should be carefully braced to prevent slippage or blowout during the test. One of the plugs must be provided with a means of connecting the air hose.
 - c. Connect equipment: The Contractor shall furnish the equipment necessary to conduct the air pressure test. The equipment shall consist of valves and pressure gauges used to control rates of airflow into the test section of pipe and also to monitor and control air pressure within the test section. Connect one end of the air hose to the air control equipment and the other end to the plug used for air inlet. Also connect an air hose between a compressor and the control equipment.
 - d. Rate of air loss: After all leaks have been corrected and the air pressure maintained between 3.5 psig and 4.0 psig for at least 2 minutes, disconnect air supply and allow pressure to decrease to 3.5 psig. When the pressure inside the test section of pipe reaches 3.5 psig, the stopwatch is started to determine the time for the pressure inside the test section of pipe to reach 2.5 psig. This time shall be recorded by the Contractor. The time, T, in seconds required for the internal air pressure to drop from 3.5 psig to 2.5 psig shall not be less than the following:

$$T = 0.0850(DK/.003)$$

where T is the time in seconds;

D is the pipe diameter in inches;

K is equal to 0.000419 DL

3. Blower Tests: Refer to Section 11374.
4. Upon completion of installation of the system, the Contractor shall be responsible for performing an acceptance test to verify the satisfactory operation of the system and the design performance requirements of the specification.

McKinleyville Community Services District 11225 - 11 Aeration System
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

3.03 STARTUP

- A. After installation is completed, the Contractor shall perform the following field tests in the presence of the Engineer and the Owner:
1. Fill the basins to the normal operating water level.
 2. Operate the aeration system at the design air rate and observe air release and air distribution patterns.
 3. Adjust any piping or diffusers that show leaks or disproportionate amount of airflow.
 4. All water, air, power and labor associated with testing and adjustment of diffuser assemblies are to be supplied by Contractor.

3.04 FIELD SERVICE

- A. The manufacturer shall supply a competent field service engineer to assist the Contractor with installation, thoroughly check and inspect the extended aeration and clarifier treatment units after installation, place the equipment in operation and instruct plant personnel in proper operating and maintenance procedures. A minimum of two site visits with a length of 3 person-days each shall be provided.
- B. Provide a minimum of 2 person-days to train Owner's personnel in proper operating and maintenance of the equipment after successful installation and testing.

END OF SECTION

SECTION 11240 CALCIUM HYDROXIDE METERING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide complete and tested calcium hydroxide metering system including peristaltic hose pumps, accessories, and spare parts as shown on the Drawings and specified herein.

1.02 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or mark to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
 3. Product data fully describing all items proposed for use to demonstrate that the equipment conforms to the specifications.
 4. Motor data as specified in Section 11002.
 5. Pump layouts and dimensions.
 6. Pump performance curves.
 7. Materials of construction including chemical compatibility data.
 8. Installation list specified.
- B. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

Aeration System

11225 - 12
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

Calcium Hydroxide Metering System

11240 - 1

- C. Affidavits: Furnish affidavits from the manufacturer stating that each system has been properly installed, adjusted, and tested and is ready for full-time operation.
- D. Material Safety Data Sheets (MSDS) for each chemical to be used during testing of each chemical feed system.

1.03 QUALITY CONTROL

- A. All products furnished under this section shall be from manufacturers who have been regularly engaged in the manufacture of the pumps specified for at least 5 years. Contractor shall demonstrate to the satisfaction of the Engineer that the quality is equal to equipment made by the manufacturers specifically named herein.
- B. All pumps are to be manufactured and supplied by a single manufacturer.
- C. Manufacturer shall have not less than ten successful operating pump systems, of the same model specified, in the United States pumping similar chemicals for not less than 2 years. Provide installation list.
- D. All components and equipment shall be suitable for bulk (as delivered) chemicals specified as follows in percentage by weight of solution (approximate):

Chemical	Concentration	Specific Gravity
Calcium Hydroxide	45 percent	1.3

E. Comply with the Following Regulatory Standards:

- Uniform Fire Code, especially Article 80, Hazardous Materials with local amendments, if any.
- California Building Code, current edition.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pumps shall be as manufactured by Watson-Marlow; ThermoFischer Scientific; or equal, modified to meet specified requirements.

2.02 CHEMICAL FEED PUMPS

- A. General: Provide horizontal seal-less peristaltic type tube pumps complete with all accessories as specified herein for variable speed pumping of specified chemicals. Pumps shall be self-priming, valveless/glandless with no dynamic seals in contact with the pumped fluid. Pump shall be capable of running dry without damage to pump or hose. Pump shall be able to pull 95 percent of full vacuum.

B. Pump Schedule:

Pump Service	P-4121 and P-4122
Concentration	Calcium Hydroxide 45 percent
Operating Range, gph	0.2 to 6
Operating Pressure	30 psi continuous, 45 psi intermittent
Maximum Speed, rpm	200
Metering Accuracy	+/- 0.1 percent
Tube Bore, mm	6.4
Tube Wall Thickness, mm	2.4

C. Tubing:

- Pumphead shall accept tubing sizes 1.6 mm, 3.2 mm, 4.8 mm, 6.4 mm, 8.0 mm, and 9.6 mm with 2.4 mm wall thickness and materials including, Marprene, Bioprene, Norprene, Silicone, Sta-Pure & Chem-Sure. Pumps that require tools for adjustment or changing pumpheads to accept different tubing materials or sizes are not acceptable.
- Pump tubing material shall be as recommended by the pump manufacturer for chemical compatibility and tubing longevity.

D. Pumphead:

- Pumphead shall consist of a fixed track, a hinged guard door, spring-loaded tube clamp mechanisms, and spring-loaded roller rotor assembly. Pump tubing shall be in contact with the inside diameter of the track through an angle of 180 degrees and be held in place on the suction and discharge by a spring loaded self-adjusting clamp mechanism. At all times, a minimum of one roller shall be fully engaged with the tubing providing complete compression and preventing back flow or siphoning. Tube occlusion and spring tension shall be factory set to accommodate 2.4 mm wall thickness tubing and shall not require adjustment for accommodating tubing of 1.6 mm to 9.6 mm ID.
- Rotor design shall allow manual rotation during tube loading.
- Pumpheads requiring disassembly or special tools for tube changing are not acceptable.

E. Drive:

- Rating: Continuous 24 hour operation, 40 degrees C ambient.
- Supply Power: 120V, 60 Hz, single phase. Supply 9-foot length power cord with standard 120V three-prong plug.
- Max drive power consumption: 135 VA.
- Enclosure: Factory coated NEMA 4X enclosure. Coating shall be resistant to pumped materials.
- Pumps shall provide the following minimum functionality.
 - Backlit graphical LCD to display pump speed, running status, flow rate, and programming instructions.
 - Keypad for start, stop, speed increment, speed decrement, forward/reverse direction, rapid prime, and programming.

- c. Menu driven on screen programming of manual or auto control, flow and remote signal calibration, and general programming.
- d. Programmable "Auto Restart" to resume pump status in the event of power outage interruption.
- e. Programmable "Keypad Lock" to allow operator lockout of all keys except emergency start/stop.
- f. Programmable "Maximum Speed" to allow operator to set the maximum speed of the pump.
- g. Pump Input:
 - 1) Speed Control: Analog 4-20 mA with input signal trimmable and speed scaleable over any part of the drive speed range.
 - 2) Start/Stop Control: Dry contact. Configurable command allowing open to equal run or open to equal stopped. Configurable to allow a keypad start/stop override in Manual mode.
 - 3) Forward/Reverse Control: Dry contact.
 - 4) Auto/Manual Mode Control: Dry contact.
 - 5) Leak Detection Run/Stop Control: Dry contact.
- h. Pump Outputs:
 - 1) Four relay contacts rated for 120 Vac with maximum load of 30W, normally open or normally closed software configurable to indicate the following:
 - a) Running/Stopped Status
 - b) Forward/Reverse Status
 - c) Alarm Status
 - d) Auto/Manual Status
 - 2) Speed output: Analog 4-20 mA.
- 6. Drive motor: Brushless DC motor with integral gearbox and tachometer feedback.
 - a. Speed Control Range of 2200:1 from 0.1 to 220 rpm +/- 0.1 rpm throughout the range.
 - b. Closed loop microprocessor controlled drive with pulse width modulation at speeds above 35 rpm and synchronous mode with magnetic field rotation control below 35 rpm
 - c. Circuitry complete with temperature and load compensation and protection.
- F. Leak Detection System: Provide factory mounted float type leak detector directly in pump head, which shall shut the pump down in the event of a leak. Leak detection system shall be equipped with a reset pushbutton, fault indicator LED, and output relay for remote alarm.

2.03 METERING SYSTEM ACCESSORIES

- A. General: Materials of construction shall be satisfactory for continuous exposure to the hereinbefore-listed chemicals.
- B. Pump Wall Mounting Shelf: Provide a 1/2 -inch PVC or FRP wall mounted shelf for each pump as shown on the Contract Drawings. Shelf shall be designed to hold the weight of an operating pump and any unsupported connecting piping without any deflection. Each shelf shall be provided with Type 316 stainless steel hardware to attach the shelf to the wall and to secure the pump in place.

Calcium Hydroxide Metering System 11240 - 4 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

C. Piping Specialties:

- 1. Pressure Relief Valve: A pressure relief valve shall be provided with each pump as a package for complete coordination and compatibility. Material type shall be selected for suitability with pumped chemical. Valves to be field adjustable with initial setting per pump manufacturer's recommendations.
- 2. Calibration Chamber: The calibration chamber shall be clear PVC graduated cylinder with 1,000-milliliter capacity and 10 milliliter divisions. Provide anti-splash caps for each calibration cylinder.
- 3. Piping Connectors: Provide connectors to transition from tubing to rigid PVC piping for the suction and discharge of each pump. Material of connectors shall be compatible with pumped fluid.
- 4. Provide rotameters where shown. Tube and all wetted materials shall be suitable for the pumped fluid. Meters shall have a minimum rangeability of 10:1. Connections shall be per requirements of piping system.
- 5. Provide pressure gauge and switches where shown on the Drawings. Gauges and switches shall meet the requirements of this Section and Section 17150. All wetted materials shall be suitable for the pumped fluid. Connections shall be per requirements of piping system.
- 6. Optical moisture switch. Provide each pumped system with an optical moisture switch to sense discharge from the pressure relief valves. Switch to activate a remote alarm. Moisture switch shall be connected to the piping system as shown. Switch shall be constructed of PFA, Type 316 stainless steel and Polysulfone or Polysulfone as required for chemical compatibility with pumped liquid. Switch shall provide an NPN open collector output signal. Switch shall be capable of mounting in the horizontal or vertical position and shall include LED switch status. Switch shall be Series OLS by W.E. Anderson or equal.
- D. Calcium Hydroxide Tote Mixer: A calcium hydroxide tote mixer (MIX-4111) shall be provided. The mixer shall be tote cap-mounted using a bolted style (four bolt) bulkhead fitting. The mixer shall have a folding propeller which is capable of fitting through a 2-inch opening. The propeller, shaft, bulkhead fitting, and all hardware shall be Type 316 stainless steel. The mixer shall operate at a maximum speed of 350 rpm. Mixer sizing and cap connections shall be coordinated with the calcium hydroxide supplier for tote dimensional information and calcium hydroxide viscosity. Mixer motor shall be a maximum 1 hp, 120 volt, 1 phase. The mixer shall have an on-off switch mounted on its housing. Plug-in power cable shall be provided with sufficient length to plug into a local outlet. Mixer, motor and power cable and plug shall be located outdoors and shall have weather-tight seals and be made of UV resistant materials. All motor and mixer materials which are not Type 316 stainless steel shall be coated in the factory with a standard factory coating. Mixer shall be Neptune Mixer Company Style RGT, or equal.
- E. Calcium Hydroxide Tote Secondary Containment Pallets:
 - 1. Provide five chemical tote spill containment pallets as shown on the Drawings.
 - 2. Pallets shall have a dimension of 28 inch H by 62 inch W by 62 inch L. Sump shall have a 360 gallon capacity and shall have a forklift entry system.
 - 3. Pallets shall have a drain with isolation valve.

McKinleyville Community Services District 11240 - 5 Calcium Hydroxide Metering System
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

4. Pallets shall be 100 percent polyethylene and shall have a top grating to be compatible with all IBCs, including metal. Pallets shall be UV resistant.
5. Pallets shall have a load capacity of 8,000 lbs.
6. Pallets shall be Snyder; UltraTech; or equal.

2.04 SPARE PARTS

- A. Provide the following spare parts:
 1. 50 feet of tubing, each pump.
 2. One pump head for every two pumps of the same size.
 3. Special tools if required for maintenance.

PART 3 - EXECUTION

3.01 FIELD INSTALLATION

- A. The chemical feed equipment shall be installed in strict conformance with the manufacturer's installation instructions and favorably reviewed shop drawings.

3.02 FIELD SERVICE

- A. The pump manufacturer shall supply a competent field service engineer to thoroughly check and inspect the pumps after installation, place the pumps in operation, make necessary adjustments, calibrate instruments, and conduct field tests. The services required shall also include on-the-job training of operators including safety procedures, operating instructions, and preventive maintenance procedures. Furnish a minimum of 8 hours of field services. Additional visits to the site, as often as necessary, will be provided to achieve satisfactory installation and operation in the opinion of the Owner.

3.03 FIELD TESTING

- A. The manufacturer shall thoroughly test all equipment in the factory before shipping. After field services described in Section 3.02 are performed, the Contractor shall field test all equipment specified in this section. Pumps shall be tested in the manual mode of operation using water, and run continuously for an 8-hour period. Testing of control systems required for automatic operation of the pumps shall be performed separately.
- B. Each chemical system shall be tested against a closed discharge solution line to test pressure relief valve operation. This shall be performed for each metering pump and shall be witnessed by the Owner. Only after satisfactory testing with water and complete draining and removal of water from the chemical system, and thorough drying, which may require blowing dry air through the pipelines, may the final test with chemical be allowed to proceed. After draining the test water, hand wipe, dry, and blow dry air through chemical feed pipelines to leave the chemical pipelines clean, dry, and ready for conveyance of the chemical; then test each chemical feed system in all operational and alarm modes to show conformance with

these Specifications. Provide sufficient chemicals (approximately 250 gallons) for the tests. The chemicals used shall be favorably reviewed by the Engineer prior to the test. Each chemical metering pump shall be calibrated and tested throughout its pumping range. The MSDS for each chemical shall be on hand during the testing of the chemical feed system.

- C. The Contractor shall be responsible for the disposal of the test material(s).

END OF SECTION

SECTION 11303
SUBMERSIBLE WASTEWATER PUMPS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provide complete, tested, and operating submersible wastewater pumps as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
 3. Product data fully describing all items proposed for use to demonstrate that the equipment conforms to the specifications.
 4. Motor data as specified in Section 11002.
 5. Shop drawings including pump dimensions, pump discharge connection, guide rail system, control panel, clearance requirements, equipment weight and materials of construction.

THIS PAGE INTENTIONALLY BLANK

6. Pump performance curves with specified operating conditions shown and indicate minimum continuous stable flow (MCSF). Indicate impeller trim. Variable speed curves shall be provided for pumps specified for variable speed applications. Variable speed performance curves shall cover the range from full speed to manufacturer's recommended minimum speed. Indicate minimum continuous stable flow (MCSF) for all speeds.
 7. Guide rail and other accessory data.
 8. Electrical wiring diagrams showing component designation and rating.
 9. Signed and sealed anchor design calculations and drawings per requirements of Section 01190.
- B. Manuals: The Contractor shall furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.
 - C. Affidavits: The Contractor shall furnish affidavits from the manufacturer stating that the pumps have been properly installed and tested, and each is ready for full time operation.
 - D. Performance Testing: Certified non-witnessed factory performance tests in accordance with Hydraulics Institute Standards are required for each pump. Obtain favorable review from the Engineer prior to shipment of the pumps.

1.03 QUALITY CONTROL

- A. All equipment furnished under this Section shall: (1) be of a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years; and (2) be demonstrated to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers specifically named herein.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pumps shall be as manufactured by ABS; Flygt; or equal, modified to meet specified requirements.

2.02 SUBMERSIBLE WASTEWATER PUMPS

- A. General: Pumps shall be heavy-duty, submersible, non-clog, centrifugal, quick disconnect sump pumps. The pumps shall be capable of operating in the range of capacity specified on a continuous basis with no detrimental effects to the pump or motor. The pumps shall be designed for continuous operation in submerged, partially submerged, or totally dry conditions without damage to the pump and motor.

Submersible Wastewater Pumps 11303 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- B. Pump Schedule: The pump operating characteristics shall be as follows.
1. Variable speed pumps:

Equipment No.	P-4511 (RAS Pump 1)	P-4512 (RAS Pump 2)	P-4513 (RAS Pump 3)	P-4514 (RAS Pump 4)
Full Speed Operation				
Guaranteed condition				
Flow rate, gpm		550		
Total head, feet		22.5		
Minimum head condition				
Flow rate, gpm		670		
Total head, feet		19		
NPSHR, feet		13		
Reduced Speed Operation				
Minimum flow condition				
Flow rate, gpm		275		
Total head, feet		12		
Pump speed		Reduced		
Startup/shutdown condition				
Flow rate, gpm		0		
Total head, feet		10		
Pump speed		Minimum		
Maximum pump speed, rpm		1,800		
Maximum motor power, hp		5		
Motor voltage and phase		480/3		
Efficiency, percent ^(a)		68		
Piping connection size, minimum, inches		6		
Minimum sphere passing size, inches		3		

Notes:

- (a) Minimum allowable efficiency at the guaranteed operating condition.

McKinleyville Community Services District 11303 - 3 Submersible Wastewater Pumps
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

2. Constant speed pumps:

Equipment No.	P-4414 (Scum Pump) Shelf Spare ^(a)	P-8311 (TDS/N Pump 1) P-8312 (TDS/N Pump 2)
Guaranteed condition		
Flow rate, gpm	123	225
Total head, feet	47	26
Average head condition		
Flow rate, gpm	166	400
Total head, feet	39	17
Minimum head condition		
Flow rate, gpm	210	575
Total head, feet	27.5	9
NPSHR, feet	18	13
Maximum pump speed, rpm	3,600	1,800
Maximum motor power, hp	5	5
Motor voltage and phase	480/3	480/3
Efficiency, percent ^(b)	45	63
Piping connection size, minimum, inches	3	4
Minimum sphere passing size, inches	2.5	3

Notes:

- (a) Uninstalled spare pump. Provide complete pump minus pump base plate.
(b) Minimum allowable efficiency at the average head condition.

C. Pump Construction:

1. General:
 - a. The pumps shall be designed to permit sump-top removal of pumping units from the wet well for inspection or service without disconnecting or disturbing the discharge piping. The pump connection shall be metal to metal or with secondary O-ring seal. The design shall permit the pumps when lowered into place to be automatically connected to the discharge piping by positively locking the volute in position to prevent any axial or lateral movement. There shall be no need for personnel to enter the wet well when pump inspection or service is required.
 - b. Pump assembly, including motor, pump and cable accessories must be rated for Class 1, Division 1 hazardous environment, explosion proof, group C & D.
 - c. Lifting assemblies and discharge mating flanges shall be spark proofed, Factory Mutual or UL Standards.
2. Pump Castings: Castings shall be of cast iron or semi-steel of uniform quality and free from blowholes, porosity, hard spots, shrinkage defects, cracks and other injurious defects. The casings shall be designed to permit replacement of wearing parts. Joints shall be properly sealed with O-rings and shall not leak under a test pressure equal to 50 percent greater than the pump discharge pressure or the total dynamic head, whichever is greater. Passageways shall permit smooth flow and shall be free from sharp turns and projections.

3. Impellers: Impellers shall be of cast iron, cast steel, or an alloy suitable for the service required. The impellers shall be smooth and free flowing and shall have sufficient clearance to permit objects in the sewage that enter the pump to pass into the discharge pipe. Each impeller shall be accurately fitted and keyed, splined, or threaded on the shaft, and locked in such a manner that lateral movement will be prevented and reverse rotation will not cause loosening.
4. Balance: All rotating parts of the equipment shall be in such balance, mechanically and hydraulically, as to operate throughout the required range without excessive end thrust, vibration or noise.
5. Shafts: Shafts shall be steel, shall be of sufficient size and strength to perform the work required, and shall be adequately provided with alignment bearings.
6. Bearings: Bearings subject to submersion shall have a minimum L-10 life of 50,000 hours.
7. Mechanical Seals: Each pump shall be equipped with tungsten carbide seals.
8. Electrical Motors: Submersible, 60 Hertz. Each motor shall include a moisture detection and motor winding thermostat systems. Relay for the moisture detection and motor winding thermostat systems shall be provided by the submersible pump manufacturer. See Section 11002 for detailed motor specifications.
9. Cooling System: Pumps shall be equipped with a cooling system to prevent motor starters from overheating. The cooling system shall require no external connections to cooling and shall allow for continuous operation with the motor submerged, partially submerged, or totally dry without damage to pump or motor.
10. Miscellaneous Metals: Bolts, nuts, washers, and all other types of supports necessary for the installation of the pumps and drive units shall be furnished and shall be of Type 304 stainless steel.
11. Shop Painting: Pump, motor, and accessories shall be factory applied and finish painted in accordance with the manufacturer's standard.
- D. Inlet Nozzle: Where shown, pump manufacturer shall provide an inlet nozzle and flare fitting to extend the pump inlet connection. Pump casing shall be drilled and tapped as needed to accept nozzle. Nozzle and flare fitting shall be sized as shown and shall match pipe material used for the pump discharge piping. See Section 15050.

2.03 ACCESSORIES

- A. Piping, Fittings, and Appurtenances: Each pump shall be furnished with quick-disconnect discharge elbow, two Schedule 40 pipe rails, upper guide rail bracket, intermediate guide rail bracket, rail-guided lifting assembly, and stainless steel chain of sufficient strength to raise and lower pump. All guide rail components and fasteners shall be Type 316 stainless steel. Provide intermediate guide rail support brackets as recommended by the pump manufacturer.
 1. Each pump shall be provided with 3 feet of lifting chain connected to the pump. Lifting cable shall be connected to the end of the lifting chain. The lifting cable shall be of sufficient length to extract the pump from the installation. Both the lifting chain and lifting cable shall be Type 316 stainless steel. Ends of the lifting chain and one end of the lifting cable shall be provided with shackles for

- connecting. The other end of the lifting cable shall have a loop for hooking on the cable holder. The loop shall fit through the large eye of the Grip-Eye.
2. Provide a Type 316 stainless steel cable holder.
 3. Furnish each submersible pump with a stainless steel Grip-Eye for use with a mechanical lifting device. Grip eye shall be appropriately sized for weight of pump to be lifted and size of lifting chain.
- B. Access Frame and Cover: Provide aluminum access hatches and accessories for pump installations as shown on the Drawings in accordance with Section 08307.
- C. Pressure Gauges: Provide discharge pressure gauges for each pump with features and accessories in accordance with Section 15050. Gauge range is indicated in the Pump Schedule.
- D. Miscellaneous Materials:
1. Bolts, nuts, anchors, washers, and all other types of supports necessary for the installation of the pumps, drive units, and all other accessories within the wet well shall be furnished and shall be of Type 316 stainless steel.
 2. Elastomers: Nitrile (Buna-N).
 3. Miscellaneous metal items permanently installed within the wet well: Type 316 stainless steel. Type 304 stainless steel or galvanized steel is not acceptable.
 4. Protective coatings: Discharge piping and other items within the wet well requiring protective coatings per Section 09960 shall be coated in accordance with the requirements for "submerged service."
- E. Anchors: Anchors to meet requirements of Sections 01190 and 11001.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions.

3.02 FIELD SERVICE

- A. The manufacturer of the pumps shall supply a competent field service engineer to thoroughly check and inspect the pumps after installation, place the pumps in operation and make necessary adjustments, and instruct owner's personnel in proper operating and maintenance procedures before and after installation. A minimum of 8 hours of onsite training shall be provided.

3.03 FIELD PAINTING

- A. Pumps and appurtenances shall be touched up as required, per Section 09960.

3.04 FIELD TESTING

- A. After installation, pumps shall be operated and tested in accordance with Sections 01650 and 11001. Pumps shall demonstrate compliance with the Specifications and shall operate to the satisfaction of the Engineer under actual operating conditions.

END OF SECTION

SECTION 11320

PACKAGED SEWAGE EJECTORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Provide complete, tested and operating packaged duplex sewage ejector pump systems complete with pumps, rail systems, and stainless-steel control panels with combination motor starter and control devices, as shown on the Drawings and as specified herein.
- B. Related Sections:
1. Section 02080: Precast Concrete Sectional Manholes for additional information on design criteria.
 2. Section 08307: Access Hatches for additional information on design criteria.
 3. Section 15050: Piping, Valves and Accessories for additional information on pipe system design.
 4. Section 17140: Level Measurement for additional information on control devices.

1.02 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

11320 - 1 Packaged Sewage Ejectors

THIS PAGE INTENTIONALLY BLANK

3. Manufacturer's catalog and/or other data-confirming conformance to specified design, material and equipment requirements. Drawing of wetwell, pump rails, and cover showing location of cover in relation to final grade and location of wetwell bottom. Also include location and size of pipe penetrations.
 4. Predicted performance data and/or curves as applicable developed for the specific application, confirming conformance to specified design and operating requirements and characteristics.
 5. Electrical and control diagrams.
 6. Installation requirements, showing clearance required for maintenance purposes.
 7. Motor data as specified in Section 11002.
 8. Certification with related drawings that equipment anchors have been designed per requirements of Sections 01190 and 11001.
- B. Manuals: Furnish manufacturer's installation, operation and maintenance manuals, bulletins, and spare parts lists.

1.03 QUALITY CONTROL

- A. Equipment furnished under this Section shall be supplied by a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The sewage ejector shall be Little Giant; Zoeller Pump Company; or equal, modified as necessary to provide the specified features and to meet specified operating conditions.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Design requirements shall be as follows:

Equipment No.	P-8331, P-8332
Guaranteed condition	
Flow rate, gpm	96
Total head, feet	21
Minimum head condition	
Flow rate, gpm	140
NPSHR, feet	14
Maximum pump speed, rpm	1,725
Maximum motor power, hp	1
Motor voltage and phase	460/3
Piping connection size, minimum, inches	3
Minimum sphere passing size, inches	2

- B. Pump Construction:
1. The pump motor housing and pump casing shall be epoxy coated cast iron.
 2. The pump inlet shall be open and clear without screening.
 3. All fasteners exposed to the pumped liquid shall be Type 304 or Type 316 stainless steel.
 4. All power chords shall be water resistant UL approved, with double insulation, and properly sized for the load.
 5. The pump shall handle liquids and solid waste material up to 2 inches in diameter.
- C. Motor and Shaft: The stator, rotor, and bearings shall be mounted in sealed submersible type housing.
- D. Bearings and Shaft: An upper radial and lower thrust bearing shall be required. These shall be heavy-duty single row ball bearings permanently and continuously lubricated and cooled by oil in the motor housing. The motor shaft shall be stainless steel and sealed from the pumped liquid with a mechanical seal.
- E. Impeller: The impeller shall be two vane, with pump out vanes on the back side. These vanes wash out grit and stringy material that could damage the shaft and mechanical seal.
- F. Rail System and Access Frame and Cover: The guide rail shall be constructed of 304 stainless steel and the base shall be Little Giant bronze, or equal. Provide stainless steel lifting cable and "quick connect flange". Pump manufacturer shall coordinate requirements for guide rails and pump lifting assembly with those of the access frame and cover shown and as specified in Section 08307.
- G. Piping and Valves: As indicated on the Drawings and Section 15050 of the Specifications.
- H. Controls:
1. The pumps shall be provided as part of a duplex sewage ejector pump system with a UL-508 duplex alarm/disconnect control panel and a four float level control system. Power for the pumps shall be supplied to the control panel via a single 480V, 3-phase, 3-wire connection with ground. Control panel shall contain the necessary transformers, relays, etc. for operation of the pumps. Control panel shall be housed in a NEMA 4X wall-mount enclosure including the following features:
 - a. Individual pump motor circuit breakers
 - b. Pump hand-off-auto (HOA) switches
 - c. Pump run lights
 - d. Pump fault lights
 - e. High level indicator light
 - f. Automatic pump alternator
 - g. Dry contacts for the following outputs:
 - 1) Pump run status (each pump)
 - 2) Pump Fault (common for both pumps)
 - 3) High level alarm.

2. Float system: Provide a four float level control system in the wetwell manhole for automatic operation of the duplex pump system. Level control shall be as follows:
 - a. Pump off
 - b. Lead pump on
 - c. Lag pump on
 - d. High level alarm
3. See the Drawings for additional requirements.
- I. Anchors: Provide anchors and anchor design per requirements of Sections 01190 and 11001.

2.03 FINISHES

- A. Painting: Apply manufacturer's standard factory paint finish.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Sewage ejector shall be installed as shown on the Drawings and as recommended by the manufacturer. Provide piping and valves as indicated on the Drawings and Section 15050 of the Specifications.

3.02 FIELD PAINTING

- A. Apply a final coat of water reducible alkyd air-dried enamel after assembly in accordance with Section 09960. The paint shall be applied in one coat with a minimum thickness of 3 to 4 mills.

3.03 FIELD TESTING

- A. Field test all equipment. Visually inspect the power chord for imperfections, cuts, and nicks. Check the pump for ground continuity. Motor chamber shall be hi-potted to test for moisture or insulation defects. Pressurize the motor and volute housing and run a 10-second air leak decay test. For further requirements on performance tests, refer to Section 11001.

END OF SECTION

Packaged Sewage Ejectors 11320 - 4 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

SECTION 11372

AIR COMPRESSORS AND RECEIVERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 1. Air Compressors
 2. Air Receivers
 3. Filters
 4. Regulating Valves

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

- A. American Society of Mechanical Engineers (ASME)
- B. National Board of Boiler and Pressure Vessel Inspectors (National Board)
- C. National Electrical Manufacturers Association (NEMA)
- D. Underwriters' Laboratories (UL)

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer

McKinleyville Community Services District 11372 - 1 Air Compressors and Receivers
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
 3. Product data to demonstrate that the equipment conforms to the Specifications.
 4. Motor data.
 5. Seismic anchorage certification and related sketch.
 6. Equipment layouts and dimensions.
- B. Performance Testing: Submit certified non-witnessed factory performance test results for air compressors 50 hp and above. Receive favorable review of test results prior to shipping the equipment.
- C. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.
- D. Affidavits: Submit affidavit from the manufacturer stating that the equipment has been properly installed, adjusted, and tested and is ready for full-time operation.

1.04 QUALITY CONTROL

- A. All equipment furnished under this Section shall be of a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years. Demonstrate to the satisfaction of the Engineer that the quality is equal to the equipment made by those manufacturers named herein.

PART 2 - PRODUCTS

2.01 EQUIPMENT

- A. Air Compressors:
1. General:
 - a. Compressors and motors shall be cast iron construction and factory assembled on steel bases or receivers. Provide OSHA compliant guards on belt drives and couplings. Equip units with dual control and automatic unloaders for loadless starts. Units shall be air-cooled unless noted otherwise. Units shall be rated for continuous duty.
 - b. Supply each compressor assembly complete with the following accessories:
 - 1) Visual crankcase oil sight gauges
 - 2) Pressure relief valves

Air Compressors and Receivers 11372 - 2
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004 00
© 2014 Kennedy/Jenks Consultants

- 3) Pressure gauges
 - 4) Pressure switches for automatic start-stop operation
 - 5) Low oil level shutdown switch
 - 6) Air-cooled after-cooler and moisture separator
 - 7) Spring vibration mounts (seismic restrained type)
 - 8) Magnetic oil plug
 - 9) Intake filters
2. Reciprocating 5 to 20 hp: Units shall be two-stage with intercooler unless noted otherwise. Units shall be splash lubricated with removable cylinders, one-piece connecting rods, and an overhung crankshaft. Maximum operating pressure shall be at least 175 psig. Ingersoll Rand T30; Atlas Copco KT/LE/LT Series; or equal.
- B. Air Receivers: Air receiver size, capacity, and rated pressure shall be as listed in the Air Receiver Schedule. Receiver shall be ASME Code labeled and National Board registered. Accessories shall include:
1. Support legs for vertical or horizontal mounting as shown on the Drawings, designed to resist overturning from seismic forces.
 2. Tank NPT connections as shown on the Drawings, including inspection plugs, and for any devices required by the compressor.
 3. "No air loss" electric drain valves. Ingersoll Rand ENL; Atlas Copco EWD; or equal.
 4. ASME NPT connection type safety valve located on the top of the tank and rated for full flow of the compressor.
 5. NPT connection type liquid filled pressure gauge. See paragraph 2.01.G for additional pressure gauge requirements.
- C. Compressor Controls:
1. Provide a wall-mounted, NEMA 4, enclosed, compressor control panel with UL label. Panel shall include motor starters and any other provisions to allow the compressor to operate from a single electrical point of connection.
 2. Provide contacts input and output signals as shown on the Drawings.
- D. Filters: Provide all filters with automatic mechanical drains. Size filters for 150% of the rated compressor output or the branch that is served by the filter, as shown on the Drawings. Filters shall be rated for 150 psi continuous service. Each filter shall include an integral differential pressure indicator. Provide three replacement filter elements with each filter. Ingersoll-Rand GP Series, Atlas Copco PD, or equal.
1. Coalescing: .01 micron filter element, 3-psi pressure drop
 2. Particulate: .5 micron filter element, 5-psi pressure drop.
- E. Regulating Valves: Regulators shall be sized for 150% of either the rated compressor output or the branch served by the regulator. Trim shall be stainless steel. Regulators shall be rated for 300 psi continuous service, with pressure regulation range as shown on the Drawings.
1. Pressure Regulator: Non-rising adjustment knob, zinc body with nitrile diaphragm. Fisher 95 Series; Jordan Mark 608 Series; or equal.
 2. Backpressure Valve: Fisher Type 63EG, Jordan Mark 508 Series, or equal.
- F. Pressure Gauges: Provide a pressure gauge for each air receiver, and downstream of each pressure regulator. Provide additional gauges as shown on the Drawings. Range shall be 0 to 200 psi unless noted otherwise. Gauges shall be as specified in Section 15050.

McKinleyville Community Services District 11372 - 3 Air Compressors and Receivers
Wastewater Management Facility Improvements
Bid Set
1368004 00
© 2014 Kennedy/Jenks Consultants

2.02 FINISHES

- A. Painting: Apply manufacturer's standard factory paint finish. Shop paint receivers in accordance with Section 09960.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions.

3.02 APPLICATION

- A. Apply a final color coat of paint in the field to the compressors/receivers assemblies in accordance with Section 09960.

3.03 FIELD QUALITY CONTROL

- A. The manufacturer shall supply a competent field service engineer to thoroughly check and inspect the equipment after installation, place the equipment in operation, make necessary adjustments, calibrate instruments, and conduct field tests. The services required shall also include on-the-job training of operators including safety procedures, operating instructions, and preventive maintenance procedures. Furnish a minimum of 4 man-hours of field services.

- B. Field test in accordance with Section 11001 and requirements therein. Furnish equipment and apparatus necessary for tests. Tests shall be witnessed by the Engineer.

C. Test compressors to demonstrate:

1. Automatic "on-off" control operation at the specified pressure settings.
2. Automatic unloading system operation.
3. Automatic cooling system operation.
4. Automatic operation of the relief valve.
5. Automatic operation of the moisture trap.

- D. Test air dryer for dew point temperature and trap operation.

3.04 SCHEDULES

Air Compressor/Receiver Schedule

Unit No.	Type	(Min.) Free Air CFM ⁽¹⁾	(Max.) HP	Voltage/Phase	Pressure, psig	Receiver Size, gallons	Horizontal or Vertical Receiver	1 st Mt. and Model No.	2 nd Mt. and Model No.
CP-1301/PVL-1302	Reciprocating	14.7	5	208/1	175	60	Horizontal	Ingersoll Rand	Atlas Copco

⁽¹⁾ or equal

⁽¹⁾ Free air depends on altitude, barometer, and temperature.

END OF SECTION

Air Compressors and Receivers

11372 - 4

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

© 2014 Kennedy/Jenks Consultants

SECTION 11374

HIGH SPEED TURBO BLOWERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Furnishing, installing and placing into successful operation high speed turbo blowers for aeration complete with accessories. Each packaged blower shall be provided with an inlet air filter/silencer, outlet flexible joint, discharge check valve, blow-off valve and blow-off silencer, motor cooling air outlet silencer (if required), sound enclosure, adjustable frequency drive (AFD), local control panel, programmable logic controller, air bearings and other appurtenances as described in this specification section needed for a complete system. The same supplier shall furnish the turbo blowers and accessories.

1. Each single-stage radial centrifugal turbo blower is to be designed to provide absolutely oil-free air to the aeration system.
2. The turbo blower and control cabinet shall be mounted on a common base plate.
3. An Occupational Safety and Health Administration (OSHA) National Recognized Testing Laboratory (NRTL) rated AFD shall vary the turbo blower speed to provide continuous flow control and power optimization according to the changes in the process (air flow and differential pressure) and ambient conditions (ambient temperature and relative humidity) automatically without operator interface when the controls are in the remote mode.
4. The speed of the blowers shall be varied using either the local HMI or the secondary aeration system control panel to assure the turbo blower(s) are operating at maximum efficiency.
5. Accessories shall be as shown on the contract drawings and described in this Specification.

1.02 PERFORMANCE REQUIREMENTS

- A. Aeration blowers shall meet the following design conditions:

1. Number of Blowers 3
2. Tag Numbers BLO-4311, BLO-4312 and BLO-4313
3. Plant Elevation Above Sea Level 68 feet
4. Atmospheric pressure 14.65 psia
5. Design Inlet Air Temperature 100 degrees F
6. Design Relative Humidity 85 percent
7. Design Discharge Volume, each 1,700 scfm
8. Minimum Discharge Volume, each 680 scfm
9. Design Discharge Pressure 7.5 psig
10. Discharge Connection Size (ANSI 150 lb) 10 inches
11. Maximum Motor Nameplate Horsepower, each 100 hp
12. Power Voltage and Phase 480/3
13. Maximum Noise at 3 Feet 82 dBA
14. Allowable Vibration Level < 4 mm/sec

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

© 2014 Kennedy/Jenks Consultants

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
- B. Shop Drawings: Submit Shop Drawings for favorable review of the blowers, motors, silencers, flexible connectors, check valves, controls and accessories. Shop drawings showing blowers, motors, including controls, and accessories shall be submitted at one time for review. Submit seismic design anchorage description. Submit motor data as required by Section 11002.
- C. Factory Test Results: Submit certified performance test results prior to shipment.
- D. Manuals: Furnish manufacturer's installation, lubrication and maintenance manuals, bulletins and spare parts lists.
- E. Affidavits: Furnish an affidavit from the manufacturer stating that the blowers have been properly installed and tested and are ready for full time operation.
- F. Shop Drawings: Submit signed and sealed structural calculations and detailed drawings for the attachments and anchorage to the structure of the equipment and appurtenances in this Section. Calculations shall conform to the requirements of Section 01190.
- G. Submit Level 2 certification from the manufacturer that the equipment is capable of resisting seismic loads. Loading shall be as described in Section 01190.

High Speed Turbo Blowers 11374 - 2 McKInleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

1.04 QUALITY CONTROL

- A. All equipment furnished under this Section shall be supplied by a manufacturer who has at a minimum 5 years in the production and manufacture of blower equipment. Demonstrate to the satisfaction of the Engineer that the quality is equal to the specified models of equipment made by manufacturers named herein.
- B. Perform a factory mechanical test to assure mechanical integrity. If the test indicates that adjustments are necessary to insure conformance to the specified performance characteristics, such adjustments shall be made prior to shipment. Successful performance, as indicated by a certified report of this test, shall be considered as the basis for acceptance by the Engineer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The blowers shall be APG-Neuros; Aerzen; or equal.

2.02 MATERIALS

- A. Major blower components shall be manufactured from the following materials:
1. Casings and Inlet Inducer: High-strength aluminum alloy.
 2. Impellers: High-strength forged aluminum alloy or stainless steel. (17-4 PH)
 3. Rotor Shafts: Alloy steel with copper cladding.
 4. Turbo Blower and Motor Frame: Welded steel.
 5. Inlet and Outlet Accessories: Stainless steel.
 6. Sound Enclosure: Type 316 stainless steel.

2.03 EQUIPMENT

- A. General:
1. Blowers shall be of the bump foil air bearing type and shall not require oils or lubricants for adequate operation. Leaf or Layered style bearings are unacceptable.
 2. Blowers shall be capable of variable speed operation with a minimum turndown of 50 percent from its maximum capacity and shall use an integral adjustable frequency drive. Each blower shall be capable of operating continuously and satisfactorily at any point between the minimum and maximum flows without any surge, vibration, hunting, or excessive heating of bearings or motor.
 3. Blowers shall be designed to operate at optimum specific speed in order to maximize adiabatic efficiency and reduce motor speed. Maximum efficiency is achieved at 95 percent of full load.
 4. Complete blower packages shall be OSHA NRTL listed, with no exception. OSHA NRTL listing nameplate to be on package exterior. OSHA NRTL listing must be for the complete package.

McKinleyville Community Services District 11374 - 3 High Speed Turbo Blowers
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

5. Blowers shall be factory tested per a modified American Society of Mechanical Engineers Power Test Code for Displacement Compressors, Vacuum Pumps and Blowers (ASME PTC-10) performance test to verify flow and wire power at design conditions as well as blower maximum conditions. The acceptance criteria are 4 percent tolerances on flow regardless of the size of the machine.
6. No special foundations nor anchoring shall be required for installation.
7. All elastomeric materials for couplings, valves, etc., shall be rated for a minimum 250°F temperature.
8. System components shall be designed for continuous operation in an environment with conditions as follows:
 - a. Temperature 0 to 100 degrees F
 - b. Relative Humidity 30 to 100 percent
 - c. Ambient Pressure 14.65 psia
- B. The system supplier shall furnish completely packaged high speed turbo blowers, including electric motors, silencers, filters, blow-off valves, check valves, pressure relief valves and all necessary appurtenances. Blowers shall be sized to provide one unit as an installed spare and located as shown on the plans.
- C. Turbo blowers shall be of single-stage centrifugal design utilizing oil-free non contacting air bearing technology with the following design characteristics:
 1. Turbo blowers shall be designed for heavy, continuous, industrial service, be capable of providing a minimum of six starts per hour, a total of 20,000 normal starts and stops, and have a minimum design life of 20 years before any major rebuild will be needed.
 2. Operate within specified vibration levels without overloading the drive motor.
 3. Operate without sign of distress when operating at specified operating point and at off design conditions.
 4. Have a pressure-volume curve, which extends from the design system pressure to the upper system surge pressure with a continuously rising pressure characteristic.
 5. The maximum input motor horsepower should not exceed specified nameplate horsepower when operating at design flows at 40 degrees F.
 6. The turbo blower must deliver oil-free and non pulsation air at all times to the aeration process.
- D. Wire to air power must include all motor, thermal, mechanical and electrical losses of the turbo blower as well as losses of all auxiliary equipment such as all lubrication systems, cooling systems etc. Each blower shall be designed to maintain a minimum rise to surge margin of 2.5 psig away from surge at a point in its design capacity range.
- E. Blower impellers shall be of the backswept three dimensional high efficiency configuration designed using Computational Fluid Dynamics (CFD) milled from forged aluminum alloy Type 7075, or machined from a cast stainless steel profile (17-4 PH stainless steel), with first lateral critical speed at least 120 percent of the maximum allowable operating speed. The impeller shall be mounted directly to the motor shaft and shall be statically and dynamically balanced. The use of dual impellers is not permitted.

High Speed Turbo Blowers 11374 - 4 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- F. Each blower shall be supplied with a Type 316 stainless steel sound enclosure covering the entire blower package. The sound enclosure shall be designed for easy inspection and maintenance of all blower package components. Quick release panels shall provide easy and quick access for routine maintenance of the blower and the package components. The blower package enclosure shall protect against falling water, condensation, and dust.
- G. Blowers shall not allow heat caused by motor to be exhausted into the blower room. Motor cooling air exhaust shall be hard piped to the exterior of the building. Blower and integral AFD shall not require any external cooling devices such as cooling fans or external glycol cooling. AFD cooling air may be exhausted into the building at a maximum air flow of 211 cfm and with a maximum heat load of 145 btu/minute.
- H. Each blower shall be supplied with integrated instrumentation allowing for direct measurement of vibration or manufacturer's equivalent method to protect from vibration and the temperatures of the motor. Each blower shall be supplied with built-in vibration isolating mounts. The blower manufacturer shall be responsible for attenuating noise and vibration in the blower package such that no special installation base shall be required nor shall vibration above specified limits stated above from the blower package be transmitted to the floor or intake and discharge base or the piping.
- I. Blowers shall be placed on a concrete equipment pad as shown on the Drawings and shall be anchored to the pad using 316 stainless steel anchor bolts or threaded rods. Manufacturer shall provide the specification for anchor bolt or threaded rod for the Contractor's information. Contractor shall furnish and install the manufacturer specified anchor bolts.
- J. Minimum flow of each turbo blower must be no greater than 40 percent of the maximum flow rate over the entire temperature range.
- K. Rotor critical speed must be a minimum of 20 percent above the operating design speed.
- L. Maximum unfiltered peak-to-peak radial or axial displacement of the rotor shaft shall not exceed 1.25 mils at all operating speeds when measured at on the motor or the turbo blower base.
- M. Free field (R=infinity) sound pressure level without accessories shall not exceed 82 dbA at any point 3 feet from the turbo blower assembly when operating at specified air flow rates and differential pressure.
- N. Local control panel: A mode control switch to select the turbo blower operating mode (remote, local, stop, and local start) shall be included as part of the LCP motor control cabinet.
 1. Access to the control cabinet internal components shall be through the control cabinet doors of the turbo blower. The control cabinet and doors shall be a minimum 12-gauge steel with hinged doors equipped with triangle key locks for quick access. The doors shall be gasketed to seal the cabinet interior from the outside atmosphere providing an enclosure with a minimum NEMA 12 rating.

McKinleyville Community Services District 11374 - 5 High Speed Turbo Blowers
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

2. The cabinet shall be painted using a phosphate treatment system with a zinc chromate iron oxide primer with a baked rust-inhibiting enamel topcoat.
3. The equipment mounted within the control cabinet enclosure shall be mounted on the enclosure back panel and neatly organized.

2.04 APPURTENANCES

- A. All appurtenances listed in this specification section are to be supplied by the turbo blower manufacturer as part of the turbo blower system to ensure system compatibility. Each specified accessory should be furnished and factory assembled within each blower package.
- B. Each blower package shall include a 10-inch EPDM or a Type 304 bellow stainless steel flexible connector to be installed on the discharge aeration piping prior to the main air header. The flexible connectors shall be sized for a standard pipe diameter and shall prevent the transmission of noise and vibrations and allow for slight misalignments on the pipe-work between the blower package and the piping. The flexible connector shall be suitable for the maximum operating temperature and pressure ratings of the equipment in the air stream.
- C. Each blower shall be supplied with one 10-inch-size water-style, dual plate check valve that shall be installed on the discharge line. Check valve will be carbon steel body, aluminum bronze disc, stainless steel 316 spring and viton seat. Check valve shall meet API 594 standard, ANSI 150 lb.
- D. Each blower shall be equipped with an integrated blow-off valve actuated by blower pressure.
- E. The blow-off valve discharge shall be supplied with a properly sized blow-off silencer.
- F. Each blower shall be provided with an integrated combination intake/inlet filter/silencer system. Intake, filter and silencer performance losses shall be included by the blower vendor in the blower performance calculation. The intake/inlet filter/silencer system shall be integrated into the overall blower and enclosure design and shall fit within the enclosure.
- G. The filter media must have an efficiency of 90 percent by weight per ASHRAE 52-76 with synthetic dust equivalent to separation > 95 percent @ 10 microns. Filter element shall be removable without disconnecting the inlet duct and shall be cleanable by maintenance personnel as a preventative maintenance procedure.
- H. Each blower shall be equipped with the following integrated instrumentation.
 1. Inlet differential pressure sensors for filter monitoring
 2. Discharge differential pressure sensor
 3. Inlet and discharge temperature sensors
 4. Motor temperature sensor
 5. Vibration sensor or manufacturer's method of detecting vibration

High Speed Turbo Blowers

11374 - 6

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bld Set
1368004*00
© 2014 Kennedy/Jenks Consultants

- I. Motor Cooling Air Silencers (if required): Motor cooling air silencers shall be provided as recommended by the supplier.

2.05 MOTORS

- A. Each blower shall be supplied with a high speed Permanent Magnet Synchronous Motor (PMSM) driven by an adjustable frequency drive operating on 460/480 volts, 3 phase, 60 hertz input power. Induction or brushless DC motors shall not be acceptable.
- B. The maximum allowable motor horsepower shall be as specified.
- C. The motor shall have a 1.15 service factor. The motor shall be able to start under the starting conditions required. Blower manufacturer shall be responsible for coordinating the starting torque requirement of the blower and the motor. Certified tests shall be submitted to the Engineer prior to shipment of the equipment.
- D. Each blower motor shall be of the PMSM type that has no physical connection between stator and shaft, therefore eliminating brushes, slip rings or break resistors. The PMSM must be combined with a Sine Wave Filter (Sinus Filter) or manufacturer's method to prevent electrical noise and input line reactor.
- E. Additional requirements for the blower motors are:
 1. Enclosure: TE (Totally Enclosed).
 2. Stator temperature monitoring: internal thermocouple embedded in motor windings
 3. Maximum ambient temperature: 122°F (50°C).
 4. Minimum ambient temperature: -35°F (-35°C).
 5. Duty: Continuous.
 6. Bearings: Bump-foil type air bearings.
 7. Grounding: There shall be a grounding lug attached to the blower scroll.

2.06 ADJUSTABLE FREQUENCY DRIVE

- A. Each blower shall be equipped with a high efficiency OSHA NRTL listed AFD with 97 percent efficiency at full rated motor speed and power. AFD manufacturer shall be manufacturer's standard. Each AFD manufacturer shall have an operation in the USA for manufacturing, support, and provision of replacement parts.
- B. Each AFD shall be supplied with a passive harmonic filter that reduces the THD (Total Harmonic Distortion) in compliance with IEEE 519 rating. The harmonic filters shall be supplied by Artech; Mirus International; Transcoil Inc.; or approved equal. Harmonic filter shall be mounted inside the electrical room or inside the blower enclosure.
- C. Each AFD shall have a sinusoidal filter on its output consisting of an L (inductor) and C (capacitor) filter or a method for limiting DC bus voltage on the output side of the inverter.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bld Set
1368004*00
© 2014 Kennedy/Jenks Consultants

11374 - 7

High Speed Turbo Blowers

- D. Each AFD shall have an integrated user interface that includes field bus connection and free available support software. Provide control of AFD via touch screen control panel and PLC/CPU.

2.07 CONTROL AND INSTRUMENTATION

A. General:

1. All components in the control panel shall be completely factory wired and shall include all necessary controls for both the manual and automatic operation as indicated on the Drawings and Specifications.
2. The incoming power provided to the panel shall be 480 volt, 3 phase. A suitable thermal-magnetic main circuit breaker sized no less than 125 percent greater than the connected load shall be provided along with all transformers, relays, etc. necessary to make the panel fully functional. Surge protective devices (SPD) shall be provided to protect the electrical and control components from excessive voltage and current: type 2 SPD to protect the 480V loads (AFD) and SPD to protect the 120V loads (PLC controller box). The SPD locations shall be strategically selected to have surge immunity and the MCOV shall be not less than 115 percent of nominal voltage.
3. Wiring shall comply with UL/CSA and the Canadian National Electrical Code.
4. All electrical connections to external devices and equipment shall be provided by the Contractor.
5. Equipment and controls furnished by other manufacturers shall be provided in accordance with their instructions, where applicable.
6. The system shall have an Allen Bradley CompactLogix PLC-based or CPU Microcontroller control system for the operation, adjustment and monitoring of the system equipment and appurtenances.

B. Miscellaneous Electrical Devices:

1. A 115 Vac or 220 Vac to 24 Vdc power supply shall be provided to power the programmable controller inputs and other 24 Vdc powered devices. The power supply shall be properly sized for the LCP total load.
2. Provide noise filter to provide clean, noise-free power to programmable controllers.

C. Operator Interface: Provide the following indicators on the operator interface:

1. Blower Status (RUN/STOPPED)
2. Operator Mode Selection
3. System Pressure Display
4. Blower Local/Remote Control
5. Blower Speed Indication Status
6. Blower Run Times (hours)
7. Blower Amp Draw (amps) or Blower Power Draw (kW)
8. System Pressure
9. System Flow

D. Operator Interface Device:

1. The device shall include the following displays:
 - a. History: displays history of sequential alarms with date and time of occurrence.

High Speed Turbo Blowers

11374 - 8
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bld Set

1368004*00
© 2014 Kennedy/Jenks Consultants

- b. Status: One-touch access to display current system operating status. When the system is running, the display shall show the set point pressure, actual pressure, flow and speed (0-100 percent).
 - c. Alarm Information: Last alarms recorded in memory are displayed with related detailed information on the alarm including time of occurrence, date, and blower's main operating parameters at the time of alarm and how to correct the alarm condition. Each log shall include individual blower run status, AFD mode, flow, and alarm type.
 - d. Alarm List: One-touch access to an alarm list of all possible alarms and their current status.
 - e. Daily Log/Total: Displays the individual equipment run times and run times since last reset.
 - f. Scroll Key: Used to scroll up and down through data.
2. Provide Setup Menu system for adjusting all alarm set points, dead band, delays, etc. Display and adjust flow and pressure set points and time delays. Set equipment alternation to manual or automatic. Set the hour of the day for automatic alternation. Restore all factory defaults. Protect adjustable settings with a password.

E. Alarm Systems:

1. Local indication of alarm conditions and specific alarm messages shall be provided on the operator interface screen.
2. All alarm conditions shall be displayed at the operator HMI terminal and shall provide output capability to display all alarm conditions at future SCADA system. No other similar or equal HMI will be acceptable.

F. SCADA System:

1. The following outputs shall be provided to the plant PLC and SCADA system via Ethernet/IP communication:
 - a. All alarms
 - b. All equipment status (On/Off, In Remote/Not in Remote, Off)
 - c. All parameters displayed at the operator interface (blower PLC)
 - d. Motor speed
 - e. Airflow
 - f. Discharge pressure
 - g. Blower run: output
 - h. Blower stop: output
 - i. Blower fault: output
 - j. Remote on: output, enabled when touch screen is placed in remote
2. The following inputs shall be provided from the plant PLC and SCADA system:
 - a. Remote command: 4-20 mA input for remote control of blower speed
 - b. Remote start: input
 - c. Remote stop: input
 - d. Remote emergency stop: input

G. System Function:

1. Each blower shall be equipped with an integrated PLC/CPU control system physically located inside the blower enclosure with the following:
 - a. PLC/CPU with multifunctional display capability. The PLC/CPU shall provide control, monitoring, and diagnostic capability.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bld Set

11374 - 9

High Speed Turbo Blowers

1368004*00

© 2014 Kennedy/Jenks Consultants

- b. Blower controls shall provide real time monitoring via discharge pressure vs. suction air flow graph indicating current operating point and boundaries.
- c. Each blower shall have the ability to be controlled in four different modes: constant speed, constant pressure, constant flow or dissolved oxygen.
- d. Blower controls shall include intuitive, user friendly fault menus for ease of monitoring diagnostics and troubleshooting.
- e. Each blower shall include built in automatic surge protection.
- f. Blower controls shall include built in measurement for the following parameters:
 - 1) flow
 - 2) speed
 - 3) temperature
 - 4) pressure
 - 5) sensors with associated data display and adjustment capability for each of the above.
- g. Integrated control system shall control the blow-off valve for each blower.
- h. Integrated control system shall be accessible through a touch screen control panel.
- i. All integrated controls shall be enclosed in a sub-panel.
- j. Turbo Blower PLC/CPU shall be capable for communication through Ethernet/IP communication protocol.

2.08 NAMEPLATE DATA

- A. An aluminum nameplate shall be provided on each turbo blower. The nameplate shall be mounted easily visible and contain the following information.
 1. Vendor's Name
 2. Model Type and Serial Number
 3. Year Manufactured
 4. Weight
 5. Main Power Supply
 6. Auxiliary Power Supply
 7. Enclosure

2.09 SHOP PAINTING

- A. The blower enclosure shall be painted in manufacturer's standard color. Painted cast iron and carbon steel shall be Alkyd Resin primed and final coat with a total dry film thickness of 4 mils dft. Sound enclosure shall be powder coated polyester base total dry film thickness 4 mils dft. Surface preparation shall be SSPC 10 or better.

2.10 FACTORY TESTS

- A. All equipment shall be factory tested in accordance with the following tests for compliance with the operational requirements specified herein.
- B. Tests shall be performed on the actual assembled unit being supplied for this project. Prototype model tests and calculated values based on previous model testing will not be acceptable.

High Speed Turbo Blowers 11374 - 10 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

1. Blower Test:

- a. Mechanical Test: Blower(s) shall be given a factory mechanical test to assure mechanical integrity. If the test indicates that adjustments are necessary to ensure conformance with specifications, such adjustments shall be made prior to shipment. Unless otherwise specified, a certified report of a mechanical test of each blower furnished shall be provided. The mechanical test shall consist of operating the units at or near design conditions for a minimum of 1 hour. Test data shall include duration of the test, bearing temperatures, speed, brake horsepower, pressure and temperature rise and vibration level.
- b. Performance Test: A certified report of a performance test of the blowers furnished shall be submitted to the Engineer for review. The performance test shall be performed in accordance with ASME PTC-10 and shall demonstrate the durability with the applicable performance criteria specified or manufacturer's standard to represent performance at various performance points.
2. Blower Package Testing: On completion of final assembly of the packaged blower and prior to shipment, each packaged blower shall be mechanically run for a minimum of 30 minutes to ensure the durability by demonstrating the design points of the specifications.
- C. In the event the blower equipment fails to meet the performance requirements specified, the Engineer shall have the right to require the Contractor to modify or replace the blower equipment to enable said system to meet the performance requirements specified.
- D. The second test, if required, and any subsequent tests as may be necessary to ensure compliance with these Specifications shall be performed at no additional cost to the Owner.
- E. The Contractor shall notify the Engineer and Owner at least 14 days prior to conducting the factory performance tests.
- 2.11 FACTORY ASSEMBLY AND SHIPPING
 - A. All equipment specified in this section shall be factory assembled and shipped as a complete unit. Accessories such as blow-off valve, blow-off silencer, discharge check valve, and discharge flexible joint shall be shipped loose and field installed by the Contractor. All equipment must be shipped via a flatbed open-top type trailer. Shipments in van type trailers will not be accepted and returned to the shipper for proper transportation to job site. Partial shipments are also not acceptable. Blower packages must arrive at the job site fully assembled and finish painted.
- 2.12 SPECIAL TOOLS AND SPARE PARTS
 - A. Provide special tools which are necessary for the replacement of parts and the adjustment of the equipment. Provide one set of spare parts as recommended by the equipment manufacturer.

McKinleyville Community Services District 11374 - 11 High Speed Turbo Blowers
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the turbo blower and accessories in accordance with manufacturer's recommendations found in the Installation Manual and any addendums including alignment of components, mounting level and connections.

3.02 INSPECTION

- A. Inspect the turbo blower and accessories for shipping damage and to ensure that all accessories arrived undamaged and are in conformance with the specifications.
- B. The following inspection of the installation shall be completed before the turbo blower is started.
1. Piping and accessories are properly aligned.
 2. All accessories are adequately supported per the Specification and Drawings.
 3. The turbo blower is adequately grounded per the manufacturer's installation instructions.
 4. The turbo blower anchor bolt and all accessory fasteners are properly torqued.
- C. Assure that all electrical systems are proper connected and terminals are tight.
- D. Touch up factory coating as required.

3.03 FIELD QUALITY CONTROL

- A. Inspection and Check-out:
1. Prior to operating the turbo blower, complete the inspection as outlined. Test all support systems, including but not limited to power systems, control systems, piping systems, safety systems, alarm circuits, etc.
 2. Complete electrical system shall be tested to ensure proper function.
 3. Instrumentation and Controls:
 - a. A complete functional test of the internal instrumentation and control systems shall be completed to assure they have not been damaged during shipment.
 - b. Set operational limits (start/stop, etc.) and alarm and shutdown limits as needed.
 4. Inspect piping to assure it is clean and free of any contaminants that may harm the turbo blower.

B. Equipment Performance Test:

1. Run each turbo blower from minimum to maximum specified flows at the differential pressure of the plant system to assure that no damage has occurred during shipment that may affect the performance of the turbo blower.
2. Record temperature, pressure, and flow.

High Speed Turbo Blowers

11374 - 12

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set

1368004*00

© 2014 Kennedy/Jenks Consultants

C. Operational Testing:

1. Testing of each turbo blower shall be deemed successful if it has been demonstrated that it operates as intended and meets specification requirements.
2. The turbo blower tests shall be deemed failed if an unintended shutdown occurs, the control system does not respond as it should, and vibration is in excess of the specified value. Minor on-line adjustments and tuning of instrumentation are not considered a failure.
3. If during the testing the turbo blower fails any of the tests the cause of the failure will be corrected and the testing repeated until no failures occur.

D. Manufacturer's Field Service:

1. A factory authorized representative shall inspect the turbo blower and installed accessories before the initial startup and certify that the system has been correctly installed and prepared for startup. The factory authorized representative shall insure proper operation of turbo blower protection devices. The allotted time for this work shall be 1 day per turbo compressor.
 - a. Services to be included:
 - 1) On-the-job training of operations and maintenance personnel of the Owner.
 - 2) Safety inspections and instruction.
 - 3) Preventive maintenance instructions.
 - 4) Assistance with cleaning and/or tune-up.
 - 5) Calibration check and recalibration of instruments.
 - 6) Efficiency analysis.
 - 7) Vibrations and temperature inspection.
 - 8) Current alarms with interlocks and pre-surge.
2. The factory authorized representative shall also provide training for Owner's personnel in the operation and maintenance of the turbo blower system. The allotted time for the training shall be 4 hours per blower and occur after the turbo blowers' inspection and startup have been completed.

END OF SECTION

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set

11374 - 13

High Speed Turbo Blowers

1368004*00

© 2014 Kennedy/Jenks Consultants

SECTION 11385
ROTARY LOBE PUMPS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide rotary lobe pumps as shown on the Drawings and as specified herein suitable for pumping return activated and waste activated sludge associated with a municipal wastewater treatment plant.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

- A. American Iron and Steel Institute (AISI)
- B. American National Standard Institute (ANSI)
- C. ASTM International (ASTM)
- D. Anti-Friction Bearing Manufacturers Association (AFBMA)
- E. Hydraulic Institute

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
- 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

11385 - 1 Rotary Lobe Pumps

THIS PAGE INTENTIONALLY BLANK

If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

- B. Shop Drawings and Product Data: Submit the following as a single complete initial submittal in accordance with Section 01300:

1. Product data to demonstrate that the equipment conforms to the Specifications.
2. Motor data.
3. Signed and sealed anchor design calculations and drawings per requirements of Section 01190.
4. Pump layouts and dimensions.
5. Pump performance curve.

- C. Performance Testing: Submit certified non-witnessed factory performance test results. Receive favorable review of test results prior to shipping the equipment.

- D. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

- E. Affidavits: Submit affidavit from the manufacturer stating that the equipment has been properly installed, adjusted, and tested and is ready for full time operation.

1.04 QUALITY CONTROL

- A. Equipment furnished under this Section shall be supplied by a single manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years. Demonstrate to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers named herein.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pumps shall be as manufactured by Boerger, Vogelsang; or equal, modified to provide the specified features and to meet the specified operating conditions.

2.02 GENERAL

- A. The pumps shall be of the positive displacement, rotary lobe type designed to be abrasion resistant for return activated sludge and waste activated sludge pumping applications in wastewater treatment plants. The pumps shall incorporate an abrasion resistant design with replaceable and/or reversible sacrificial wetted components all easily accessed by opening the rotorcase front cover.
- B. The equipment furnished shall be designed, constructed, and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.
- C. 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.
- D. The pumping units 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.
- 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. 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 fittings 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.
- I. The pumps shall be controlled by adjustable frequency drives (AFDs).

Rotary Lobe Pumps 11385 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District 11385 - 3 Rotary Lobe Pumps
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

2.05 EQUIPMENT

A. Pump Construction: General: Provide horizontal mounted pumping units, complete with motor and belt drive. Equip pumps with 125-pound ANSI flanges. Other mounting configurations are permissible with Engineer's approval.

B. Casing: The pump casing shall be manufactured in a single block construction (Cast iron ASTM A48 grade 40, Brinell hardness 264 Brinell). All wear surfaces shall be protected with replaceable wear plates with a hardness of 700 Brinell. The front cover protection plate shall be reversible.

C. Cover: The cover shall be reversible and either hinged or secured with four eye nuts. No securing methods shall impede or rub the interior lobes. All wearing wet-end parts shall be changeable through the front cover without disassembly of any pieces/couplings of the motor.

D. Rotors: The rotor shall be a pair of intermeshing tri or quad lobe screw rotor design. The rotors shall be coated with abrasion-resistant Buna-N material. Stacking of lobes is not acceptable. The length of the rotor shall not exceed its diameter. The rotors shall be locked into position by a recessed locking assembly.

E. Wearplates: All wearing surfaces swept by the rotors (front, back, upper, and lower faces) shall be protected with carbon steel wearplates. These wearplates shall permit the restoration of the rotorcase's worn surfaces without replacing the whole rotorcase. The radial wearplates shall be retained through a series of stainless steel socket-head cap screws located at the exterior corners of the rotorcase. The securing screws for the radial wearplates shall not protrude into the wearing surface of the wearplates thereby preventing premature grooving of the rotors. The wearplates shall feature a machined rib to slide into a groove that is machined into the rotorcase. Other wearplate securing methods which would impede or touch the rotors are not acceptable.

1. Radial wearplates: 40 Rockwell C AISI 4140 carbon steel.
2. Rear wearplates: 55/60 Rockwell C AISI 8620 carbon steel.
 - a. Wearplates shall incorporate fiber-cutting grooves to prevent the accumulation of fibers behind the rotors.

F. Shafts: The shafts shall be non-sludge-wetted. The rotor and shaft connection shall be lubricated with quench fluid of the intermediate chamber. They shall be timed in their rotation by straight cut timing gears running in a separate oil chamber, which also contains the ball and roller bearings for each shaft. Sludge wetted rotor and shaft connections are not acceptable. The shafts shall be constructed from carbon steel AISI 4140. The conveyed product shall not come into contact with the carrying shafts of the pump to ensure that the shafts do not become corroded and to ensure easy, trouble-free exchange of the rotors.

G. Seals: The pumps shall be supplied with split silicon/tungsten carbide, front loading, cartridge-type single or double mechanical seals. Each cartridge seal shall be removable as a complete unit, consisting of a seal, shaft sleeve and seal housing. Designs requiring the removal of the rotor case will not be acceptable.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

11385 - 5
Rotary Lobe Pumps

2.03 PERFORMANCE AND DESIGN REQUIREMENTS

A. Pump Schedule

Item	Equipment Number	WAS Pumps P-4611, Shelf Spare ^(a)
Maximum Speed Operating Point	100 gpm @ 47 feet TDH	
Minimum Speed Operating Point	20 gpm @ 0 feet TDH	
Net Positive Suction Head Available (NPSHA) at Maximum Flow	25 feet	
Suction/Discharge Size	4 inches	
Solids Passing	1.5 inches	
Maximum Motor Speed	1,800 rpm	
Maximum Pump Speed	260 rpm	
Motor hp ^(b)	7.5	

Notes:

(a) Uninstalled spare pump. Provide complete pump minus pump base plate.

(b) Motor horsepower provided shall permit pumping against a total head of 50 psi at maximum pump speed to overcome initial startup head to get liquid moving, periodic variability of sludge concentration, and pipe plugging. The pumped flow rate under this pressure condition may be less than the pumping rate specified for the maximum speed operating point.

2.04 PUMP CONSTRUCTION

A. All fluid-wetted parts including the mechanical seal shall be replaceable through the quick release front cover without disassembly of coupling, drive unit or the pipe system. Mechanical seals shall be lubricated by oil, and require no external water flush.

B. The pumps shall be designed to temporarily run dry and to operate in either direction. Oil-quench flush systems for protection of the mechanical seal are mandatory.

C. The pumps shall be constructed with an oil-filled intermediate chamber between the pump casing and the gearbox with the following functions:

1. Oil-quench (lubrication and cooling) of the mechanical seals.
2. Detection of seal failures.
3. Buffer zone to the sealed timing gear.

D. Oil drain of gearbox and intermediate chamber shall be easily accessible with side mounted drain screw. Oil drain under the pump is not acceptable.

E. The rotor/shaft connection shall be oil-lubricated fed by an intermediate chamber and shall not come in contact with the pumped fluid.

Rotary Lobe Pumps

11385 - 4
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

- H. Bearings: Bearings and timing gear shall be located in a common oil-filled cast iron gearbox, fitted with a built in sight glass to monitor oil level. The timing gear shall maintain non-contact between the rotors. Bearing life to be designed for L-10 bearing life rating of 100,000 hours at design conditions.
- I. Base: Pump and drive fitted on common base, made from galvanized steel to form a rigid platform for the pump and drive unit.
- J. Vibration: Pumps and motors shall operate at any point within their operating range without undue noise and vibration. Vibration at any point in the operating range shall not exceed the limits allowed by the Hydraulic Institute.
- K. Pump Connection: Provide ANSI 125-pound flanges or grooved-type end connections with minimum 1-inch drain connections. Connection type (e.g. gooseneck, 90 degree elbow, or straight) shall be as shown.

2.06 MOTORS

- A. General:
1. Furnish drive motor complying with pump performance and operating parameters in Section 11002 and as specified herein.
 2. Each unit shall consist of a pump/geared motor configuration and shall be supplied with an in-line reducer complete with electric motor, 1800 rpm, 3 phase, 60 hertz, 460 volt, TEFC, 1.15 SF, Class F Insulation. Mounting configuration shall be in conformance with manufactures' installation requirements.
 3. Nameplate motor horsepower shall not be exceeded at any flow up to the maximum operating point in the pump schedule.
 4. Motors shall be rated for use with AFDs.
 5. Motors shall not be overloading at any point on the pump curve.
 6. Provide over-temperature sensor with the motor.
 7. All motors shall be built in accordance with latest NEMA, IEEE, ANSI, and AFBMA standards where applicable.

2.07 ANCHORS

- A. Anchors to meet requirements of Sections 01190 and 11001.

2.08 ACCESSORIES

- A. Provide suction and discharge pressure gauges for each pump with features and accessories in accordance with Section 15050.

2.09 FINISHES

- A. Painting: Apply manufacturer's standard factory paint finish.

Rotary Lobe Pumps 11385 - 6 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

2.10 SPARE PARTS

- A. The following spare parts shall be provided:
1. One set of mechanical seals and o-rings for each pump model.
 2. One set of lobes for each pump model.
 3. One set of axial protection plates for each pump model.
 4. One set of radial liners.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment shall be installed in strict conformance with manufacturer's installation instructions. Pump and motor alignment shall be checked according to the Standards of the Hydraulics Institute after pump and motor have been installed at the site.

3.02 FIELD SERVICE

- A. Provide the services of a competent pump manufacturer's field service engineer to thoroughly check and inspect the pumps after installation, place the pumps in operation and make necessary adjustments, and instruct plant personnel in proper operating and maintenance procedures. A minimum of 8 hours of onsite training shall be provided.

3.03 FIELD TOUCH-UP PAINTING

- A. Where appropriate, apply a final color coat in the field to the equipment.

3.04 FIELD TESTING

- A. After installation, all pumps shall be operated and tested in accordance with Sections 01650, and 11001. Pumps shall demonstrate compliance with the Specifications and shall operate to the satisfaction of the Engineer under actual operating conditions.

END OF SECTION

McKinleyville Community Services District 11385 - 7 Rotary Lobe Pumps
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

SECTION 11880
HYDROPNEUMATIC TANKS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Provide complete, tested and operating hydropneumatic tanks as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
 3. Product data to demonstrate that the equipment conforms to the Specifications.
 4. Certification with related drawings that equipment anchors have been designed per requirements of Sections 01190 and 11001.
 5. Tank layouts and dimensions.
 6. Submit signed and sealed structural calculations and detailed drawings for the attachments and anchorage to the structure of the equipment and appurtenances in this Section. Calculations shall conform to the requirements of Section 01190.
 7. Submit Level 1 certification from the manufacturer that the equipment is capable of resisting seismic loads. Loading shall be as described in Section 01190.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

11880 - 1
Hydropneumatic Tanks

THIS PAGE INTENTIONALLY BLANK

- B. Hydropneumatic Tanks: The interior and exterior of the tanks shall be protected with a baked marine epoxy coating, factory applied after fabrication. The coating shall be applied in two coats and shall be completely free of pin holes and thin spots. The coating shall be white in color. Field coating of tank exterior shall be in accordance with Section 09960. The hydropneumatic tanks shall be provided with integral factory welded ASME fabricated steel pedestal supports for vertical mounting on the concrete equipment pads. The tanks shall be fitted with the following accessories:
1. Top and side mounted lifting rings.
 2. Air charging valve.
- C. Anchors: Provide anchors and anchor design per the requirements of Sections 01190 and 11001.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The hydropneumatic tanks and accessories shall be installed, filled, and pressurized in strict accordance with the tanks manufacturer's written instructions.

END OF SECTION

- B. Manuals: Furnish manufacturer's installation, operation and maintenance manuals, bulletins, and spare parts lists.

1.03 QUALITY CONTROL

- A. Equipment furnished under this Section shall be supplied by a single manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Hydropneumatic tanks shall be manufactured by Amtrol or equal.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Nonpotable water will be used in the hydropneumatic tanks. The pH for this water will range between 6 and 8. Design requirements shall be as follows:

1. Tag Number	PVL-8325
2. Total Tank Volume	528 gallons
3. Tank Diameter	48 inches
4. Tank Height	84 inches
5. Pressure Rating	150 psig
6. System Connection	3 inch

2.03 MATERIALS

- A. Materials shall be as follows:

Component	Material
Hydropneumatic tank	Carbon steel
Mounting brackets	Steel
Internal diaphragm	Heavy duty butyl/EPDM
Liner	Polypropylene

2.04 EQUIPMENT

- A. General:
1. Equipment delivered under this specification shall meet the requirements of Section VIII, of the ASME Boiler Code.
 2. Each ASME constructed tank shall bear an ASME inspector's stamp, complete with design working pressure, date and place of manufacture.

Hydropneumatic Tanks

11880 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

11880 - 3

Hydropneumatic Tanks

SECTION 11903

LIFE RING STATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Life ring station with a life ring, rope, and fiberglass cabinet that can be bolted onto a concrete surface.

1.02 SYSTEM DESCRIPTION

- A. Each life ring station shall be fiberglass with a stand that can be bolted to a concrete surface and have the following elements:
1. Life Ring: Coast Guard approved life ring, with a diameter of 30 inches.
 2. Rope: One waterproof rope, 90 feet long.
 3. Life Ring Cabinet Dimensions: 34 inches high, 34 inches wide, 7 inches deep.
 4. Life Ring Stand: Must raise the bottom of the Life Ring Cabinet a minimum of 15 inches above grade.

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

THIS PAGE INTENTIONALLY BLANK

3. Submit product data fully describing all items proposed for use to demonstrate that the equipment conforms to the Specifications.

B. Manuals: Furnish manufacturer's installation and maintenance manuals.

1.04 QUALITY CONTROL

- A. Qualifications: Equipment furnished under this Section shall be supplied by a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years. Demonstrate to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers named herein.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Use non-marring techniques for loading, unloading, and handling units to prevent damage to surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Life ring stations shall be manufactured by Cheyenne Manufacturing Inc. or equal, modified as necessary to provide the specified features.

2.02 EQUIPMENT

- A. The life ring cabinet shall be fiberglass colored bright yellow.
B. Provide non-locking "T-Handle" entry for the cabinet.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install life ring stations in strict conformance with the manufacturer's installation instructions. Where life ring stations cannot be mounted on handrail or fencing, provide a cabinet stand and a concrete support per the manufacturer's recommendations.

3.02 FIELD TESTING

- A. Field test all life ring stations.

END OF SECTION

Life Ring Stations

11903 - 2
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

SECTION 11920

AUTOMATIC SAMPLERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Automatic samplers for automatic sampling of water quality in wastewater treatment plants. Automatic samplers shall be pad mounted and include a weather-proof housing suitable for ambient temperatures from -20 degrees F to 120 degrees F without additional enclosure. Samplers shall have two modes of operation: flow and time.

1.02 SYSTEM DESCRIPTION

A. Design and Performance Requirements:

1. General: Equipment provided under this Section shall continuously sample process streams in a municipal wastewater treatment plant. The samplers shall be refrigerated, self-contained units, exposed to the weather. The samplers shall consist of a sampling mechanism, a refrigerator, appurtenances and controls. The fluid to be sampled is expected to contain up to 300 milligrams per liter of suspended solids, soft biological floc, industrial solvents, petroleum products, grease, and grit. The sampler shall automatically air purge the suction line before and after sampling. The duration of the purge shall be automatically adjusted for varying intake line lengths and lift. The sampler shall also provide the option of automatically rinsing the suction line with source liquid immediately before collecting the sample.

2. Operating Requirements:

Equipment:	Influent Sampler (SMP-2205)
	Effluent Sampler (SMP-6300)
Sample size	10 ml to 990 ml, adjustable
Suction line size	3/8 inch I.D., 30 foot length, minimum
Time sampling interval	1 minute to 24 hours, adjustable
Sample pump vertical lift	25 feet
Sample storage temperature	32 degrees F to 46 degrees F
Composite sample size	2.5 gallons
Voltage/Phase	120/1

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

Automatic Samplers

11920 - 1

The sampler shall be capable of collecting samples at adjustable, switch-selected volumes. In the flow mode, the sampler shall collect samples proportional to flow at regular flow increments based on a 4-20 Ma signal. Signal input shall be fully isolated and present a burden not to exceed 250Ω in accordance with ISA 50.1. The sample volume shall be directly selectable in 10 ml increments of sample liquid. The sampler shall deposit liquid in a minimum 2.5-gallon polyethylene container to be provided. The sampler shall be capable of depositing liquid in multiple discrete bottles. The sampler shall be convertible to composite by removing a modular distributor assembly and replacing the multiple bottle set with a composite container. With the assembly in place, the distributor shall automatically advance to the first bottle position. The sampler shall include a tray of 24 1-liter bottles.

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
 3. Product data fully describing all items proposed for use to demonstrate that the equipment conforms to the Specifications.
 4. Shop drawings showing equipment dimensions and materials of construction.
 5. Motor data as specified in Section 11002.
 6. Seismic anchorage certification and related sketch.
 7. System layouts and/or schematics.
 8. Elementary and connection wiring diagrams clearly showing external connections to other equipment.

Automatic Samplers

11920 - 2

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set

1368004*00
© 2014 Kennedy/Jenks Consultants

- B. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

- C. Affidavits: Submit affidavits from the manufacturer stating that the equipment has been properly installed, adjusted, and tested and is ready for full-time operation.

1.04 QUALITY CONTROL

- A. Qualifications: All equipment furnished under this Section shall be supplied by a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years. Demonstrate to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers named herein.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Immediately upon delivery to job site, place materials in area protected from weather. Use non-marring slings for loading, unloading and handling units to prevent rope or cable damage to surfaces and protective wrappings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Automatic samplers: ISCO, Hach Sigma, or equal.

2.02 EQUIPMENT FEATURES

- A. Sample Draw: The samples shall be drawn with a peristaltic pump having a capacity of at least 3500 ml/minute with 3/8-inch tubing of 2.5 ips with 3 feet of head. The sample shall pass through no valves or measuring chambers. The entire flow path shall be under pumped flow; there shall be no gravity flow used. The suction line shall be vinyl tubing provided with a streamlined, weighted strainer head of stainless steel and polyethylene. A switch shall automatically terminate the sampling when the container is full. The sample container shall have an access for cleaning. The refrigerator shall maintain a sample temperature from 32 degrees F to 46 degrees F in specified ambient temperatures.
- B. Refrigeration System: The refrigeration system shall include electronic temperature sensing devices for measuring ambient air temperature, evaporator plate temperature, and internal air temperature. Built-in control circuitry shall utilize these sensors to control operation of the compressor, built-in heaters, and the self-defrosting cycle of the evaporator plate. The built-in heaters shall prevent collected samples from freezing if the ambient air temperature drops below freezing. The unit shall use a condensing coil with forced air cooling and the air intake shall be filtered to prevent dirt and other contaminants from entering the condenser. The compressor shall be equipped with a temperature safety cutout that will disengage the compressor at high temperature.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set

11920 - 3

Automatic Samplers

1368004*00
© 2014 Kennedy/Jenks Consultants

C. Materials: The refrigerator body shall be double wall linear low density polyethylene (LLDPE). The copper refrigeration lines shall be protected with polyester tubing and phenolic resin. The condenser coil shall be powder coated with UV resistant polyurethane. The refrigerator evaporator plate shall be aluminum and powder coated with epoxy. The refrigerant used shall be a non-CFC refrigerant. The refrigerator shall include 1½ inches of rigid foamed-in-place insulation. The top insulation shall consist of 3 inches of rigid insulation. A magnetic gasket shall be used to seal the refrigerator door. The refrigerator power supply and solid state thermostat shall be contained in a sealed, NEMA 4 enclosure, as dictated by environmental requirements. All other exposed metal components used in the construction of the refrigeration system shall be either anodized or irridited aluminum or stainless steel.

D. Electrical Housing and Datalogger: All electromechanical components shall be protected in a sealed housing conforming to NEMA 4X and NEMA 6 standards for submersible, watertight, and corrosion resistant operation. The sampler shall utilize a hermetically sealed keypad for programming. The keypad shall have an alphanumeric liquid crystal display and shall be self-prompting. The sampler shall have an internal solid state datalogger which records the time and date for every sample whether collected or missed.

E. Size: Each sampler shall occupy a space no greater than 28 inches wide by 33 inches deep by 52 inches high.

2.03 FINISHES

A. Painting: Apply manufacturer's standard factory paint finish.

2.04 SPARE PARTS

A. The following spare parts shall be provided:

Item	Total Number
Tray for 24 1-liter bottles	2
1-liter bottles, polyethylene	48
2.5-gallon composite bottles, polyethylene	4
Intake tubing	50 feet
Pump tubing	Adequate for 10 replacements

2.05 SPECIAL TOOLS

A. Furnish special tools which are necessary for the replacement of parts or adjustment of equipment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in strict conformance with the manufacturer's installation instructions.

3.02 FIELD TESTING

A. Field test all equipment. For further requirements on performance tests, refer to Section 11001.

3.03 FIELD SERVICE

A. The equipment manufacturer shall supply a competent field service engineer to thoroughly check and inspect the equipment after installation, place the equipment in operation, make necessary adjustments, calibrate instruments, and conduct field tests. The services required shall also include on-the-job training of operators including safety procedures, operating instructions, and preventive maintenance procedures. Furnish a minimum of 2 hours of field services.

END OF SECTION

SECTION 12346
METAL LABORATORY CASEWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provide modular metal laboratory casework, with laboratory tops and related accessories.
- B. Related work specified elsewhere:
 - 1. Furnishings, installing and connecting of all service lines, drain lines, piping and system vacuum breakers within equipment, in service turrets or tunnels, through, under or along the backs of working surfaces, and in reagent racks above counter tops.
 - 2. Setting of all sink bowls, cup sinks, troughs, plumbing and accessory fixtures.
 - 3. Furnishing, installing and connecting of all vents, revents, steam fittings and special plumbing fixtures.
 - 4. Furnishing, installing and connecting of rigid conduit, wiring, receptacles and electrical equipment, including installation of electrical equipment furnished by laboratory equipment supplier.

1.02 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
 - 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 - 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal.

If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

- B. Submit shop drawings prepared specifically for this project. Drawings to show every item of laboratory furniture in plan and in elevation at scale: 1/2 inch equals 1 foot, or larger. Show all cutouts for electrical, mechanical and plumbing fixtures and accessories. Show all dimensions. Furnish templates for proper location of accessories furnished and installed by other trades. Show location of backing required for attachment of cabinets.

- C. Submit laboratory furniture manufacturer's details showing the following:

1. Top construction.
2. Drawer construction.
3. Corner and leg construction.
4. Cabinet construction.
5. Door construction.
6. Finish.
7. Hardware.
8. Accessories.

Call attention to any items that deviate from the project specifications.

- D. Submit manufacturer's full line of standard color chips of casework finishes.

1.03 QUALITY CONTROL

- A. Standards:

1. All metal casework shall be modular steel (in 3- or 6-inch increments) constructed in accordance with SAMA Standard Performance Requirements and the best practices of the metal casework industry.
2. Provide products of a manufacturer regularly engaged in fabricating laboratory furniture.
3. Installation shall be accomplished under the direct supervision of the manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect laboratory furniture prior, during and after installation to assure equipment's acceptability at the time of completion.
- B. Deliver materials in labeled, unbroken packages and crates as factory sealed. Store materials as recommended by the manufacturer. Take care in handling laboratory equipment to prevent damage.
- C. Building must be enclosed and heating/air conditioning system in operation prior to delivering laboratory furniture.

Metal Laboratory Casework 12346 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bld Set 1368004*00
© 2014 Kennedy/Jenks Consultants

PART 2 - PRODUCTS

2.01 CASEWORK MATERIALS

- A. Construct all units from cold rolled stretcher leveled furniture steel of the following minimum gauges:
1. Solid door interior panels, scribing strips, removable backs, filler panels, enclosures, drawer fronts, drawer bodies, and shelves: 20 gauge.
 2. Case tops, ends, bottoms, bases, backs, vertical posts, uprights, glazed door members, door exterior panels and rear corner gussets: 18 gauge.
 3. Top front rails, intermediate horizontal rails, table legs and frames, leg rails and stretchers: 16 gauge.
 4. Drawer suspensions, top back rail, door and case hinge reinforcements and front corner reinforcements: 14 gauge.
 5. Table leg corner brackets and gusset for leveling screw: 11 gauge.

2.02 CONSTRUCTION

- A. Casework construction shall be top of the line as manufactured by: Hamilton Industries, Division of American Hospital Supply Corporation, Two Rivers, Wisconsin; Kewaunee Scientific Equipment Corporation, Adrian, Michigan; or equal.
- B. Each unit shall have a completely welded shell assembly and shall be rigid and self-supporting for use interchangeably in a group of units or for single unit use.
- C. Front surfaces of all doors, drawers, and panels shall be flush with cabinet front. At intersection of vertical and horizontal case shell members, such as end panels, top rails and bottoms, all parts shall be in the same plane, without overlap, secured by spot and arc welding. Front corners shall have heavy back up gusset reinforcements.
- D. Base cabinet shall have an integral toe space 4 inches high by 3 inches deep. Provide leveling screws accessible through openings in front of toe space. Base cabinets shall have interchangeability of doors and drawers without use of special tools. Three (3) and 4-foot base cabinets with doors shall open full width without center support posts.
- E. Drawer Fronts: Double wall construction, 3/4 inches thick and sound deadened. All interior surfaces to be painted before assembly. Top front corners to be welded and ground smooth.
- F. Drawer Bodies: One-piece construction including the bottom, two sides, back and inner front. Interior bottom shall be covered on all four sides for easy cleaning. All top edges shall be hemmed for strength. Concealed parts shall be corrosion protected before assembly.
- G. Drawer Suspension: Heavy-duty with covered raceways for self-centering of drawer. Drawer run with covered raceways to be welded to drawer body.

McKinleyville Community Services District 12346 - 3 Metal Laboratory Casework
Wastewater Management Facility Improvements
Bld Set 1368004*00
© 2014 Kennedy/Jenks Consultants

H. Drawer Rollers: Rounded nylon tired, ball bearing type, which fit raceways of drawer suspension. Drawers shall be self-closing and shall have rubber bumpers for cushioned closing and cushioned stop at full open.

I. Doors: Double wall construction, $\frac{3}{4}$ inch thick. All interior surfaces shall be protected from corrosion prior to assembly. Provide sound deadening core material glue-laminated between face sheets, forming a rigid stressed skin door panel true to plane. All edge seams shall be welded and ground smooth.

J. Glazed Hinged Doors: Double wall construction same as solid panel doors. Provide $\frac{1}{4}$ -inch-thick tempered glass panels set in continuous vinyl glazing retainers.

K. Shelves: Shall have four sides formed down $\frac{3}{4}$ inch, and front and back edges return-formed $\frac{1}{2}$ -inch shelves shall be adjustable on $\frac{1}{2}$ -inch centers. Shelves over 36 inches long shall have welded on reinforcement to prevent sag center. Support posts not acceptable on cabinets 3 to 4 feet wide. Shelves shall have front rails to prevent items from falling off front of shelf in an earthquake.

2.03 HARDWARE

A. Drawer and Hinged Door Pulls: Extruded aluminum with clear anodized finish with attachment screws on 4-inch centers.

B. Hinges: Institutional type with 5 knuckles, no less than 2 $\frac{1}{2}$ inches long, with each leaf drilled for three attachment screws. Hinge to be of heavy wrought steel, brushed chrome plated, with hinge barrel only, projecting beyond face of cabinet.

C. Door Catches: Spring actuated with nylon roller and adjustable for controlled opening or closing action.

D. Locks: Heavy-duty cylinder type with 500 primary key changes in five master key groups. Provide removable core cylinders and keyways matching University standard system. Furnish two keys with each lock.

E. Label Holders: Formed steel with brushed chrome finish.

F. Shelf Clips: Die formed steel, zinc plated, designed to engage in shelf adjustment holes on nominal $\frac{1}{2}$ -inch centers. Provide four per shelf plus 5% extra chips.

G. Base Mouldings: 4 inches high, black rubber or vinyl. Inside corners to be mitered and outside corners wrapped.

2.04 FINISHES

A. All casework shall be factory finished. The following finish system is used by Hamilton Industries, and is specified here to establish the level of quality required. Equivalent systems may be submitted for review.

B. All metal shall be spray cleaned with a warm alkali solution, and pretreated with zinc phosphate spray and chrome acid rinse prior to application of final finish. The strength of each solution shall be monitored by titration to insure consistent quality. Treatment shall be performed in six stages as follows:

1. Alkali spray cleaning.
2. Water rinse.
3. Activating rinse.
4. Zinc phosphate spray.
5. Water rinse.
6. Chromic acid rinse.

C. All treated parts shall be immediately dried in heated ovens and gradually cooled before application of the finish. Treated metal parts shall be clean and properly prepared to provide optimum adhesion of finish and resistance to corrosion.

D. Finish for metal equipment shall be a high-grade laboratory furniture quality, chemical resistant baked enamel of color selected from the manufacturer's standard colors and applied electrostatically. Enamel shall be baked in a controlled high temperature continuous oven, assuring uniform curing to a smooth, hard satin finish.

E. All surfaces, exterior or interior, exposed to view, shall receive two coats of enamel and shall have a smooth satin luster.

F. Backs of cabinets and other surfaces not exposed to view shall have one coat.

G. All drawer bodies shall be finished in a color to match or harmonize with exposed parts of casework.

2.05 LABORATORY COUNTER TOPS (Casework Tops, Splashes, And Ledges)

A. Molded epoxy resin, "Modified Epoxy 20L202" by American Hamilton; "Kemresin" by Kewaunee Scientific Equipment Corporation; or equal.

1. Material shall be resistant to acids, alkalis, salts and solvents in accordance with the manufacturer's test procedure using 50 different chemicals (reagents).
2. Tops shall be 1 $\frac{1}{4}$ inches thick. All joints shall be made with highly chemical and corrosion resistant cement having the same properties as the base materials. Drip grooves shall be provided on the underside of all exposed edges of tops installed on units or assemblies containing sinks.
3. Tops shall have the following minimum physical characteristics:
 - a. Flexural strength (ASTM Method D790-66) 12,000 lbs/in².
 - b. Compressive strength (ASTM Method D695-63T): 35,000 lbs/in².
 - c. Hardness, Rockwell M (ASTM Method D785-65): 100.
 - d. Water absorption, % by weight & ASTM Method D2127 % in 24 hours: 0.02.

B. Provide cutouts for sinks and laboratory equipment furnished by other trades.

Metal Laboratory Casework

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

12346 - 4

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

Metal Laboratory Casework

12346 - 5

© 2014 Kennedy/Jenks Consultants

© 2014 Kennedy/Jenks Consultants

2.06 LABORATORY SINKS (EPOXY RESIN)

- A. Chemical and corrosion resistant epoxy resin material heat-formed into one-piece construction, having rounded corners and 1½-inch drain outlet. Same maker as work surfaces.
- B. Nominal Inside Dimensions: 16 inches by 11 inches by 7½ inches deep.
- C. Provide sink attachment materials conforming to epoxy resin worktop manufacturer's recommendations.

- D. Acceptable manufacturers and products are: Hamilton Modified Epoxy 20L202; Kewaunee Kemresin No. 1000 series; or equal.

2.07 SINK DRAIN ASSEMBLIES

- A. Durcon Model No. So-3 outlet with No. AD-1 adapter, No. DT-3 trap and BH-6 overflow; R & G Sloane Manufacturing Company Model No. 7841A outlet with No. 7218 adapter, No. 7225 P-trap and No. 7842 overflow; or equal.

2.08 SINK FAUCET ASSEMBLIES

- A. Kewaune Scientific Equipment Corporation Model B-851 (with vacuum breaker); Chicago Faucet Company Model 947; or equal.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate all work under this Section with all other trades whose work adjoins, combines, or aligns with same. Take such field measurements as may be required. Report any major discrepancy between Drawings and field dimensions, and secure directions before proceeding.
- B. Make sure that all blocking and backing are properly located before wall finishes are in place.
- C. Inspect all surfaces to receive casework and report all defects before proceeding.

3.02 INSTALLATION

- A. Set casework in place, plumb, square, level, and secure to structure in position indicated.
- B. Provide all closures and fillers required for a neat and finished installation. All such exposed items shall match casework.

Metal Laboratory Casework

12346 - 6

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

12346 - 7

Metal Laboratory Casework

- C. Provide all supports, clips, anchors, fasteners, and bracings required for a sturdy installation.

- 1. Anchor wall cabinets with a row of fasteners near the top and row near the bottom of cabinets. Space fasteners at 16 inches on centers maximum, into solid backing.
- 2. Anchor base cabinets to wall with a row of fasteners near the top of cabinets spaced 16 inches on centers into solid backing. Anchor to floor with a row of drilled expansion bolts into concrete floor, spaced 16 inches on centers maximum.
- 3. Anchor island (freestanding) base cabinets with drilled expansion anchor bolts all around the perimeter of cabinets spaced 16 inches on centers maximum.

- D. Adjust all doors, drawers, and other moving parts to operate freely without binding or sticking, adjacent items level, vertical lines plumb and aligned, clearance uniform.

- E. Field fit composition worktops, splashes, and utility curbs to job conditions after cabinets are in place. Attach to cabinets with concealed fasteners from inside of cabinets.

END OF SECTION

SECTION 13418
FIBERGLASS ENCLOSURES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section describes fiberglass enclosures specifically designed for outdoor exposure and damp conditions. Enclosure to house chemical metering pumps as shown on the Drawings and shall be complete with access door, heater, breaker panel, interior light, equipment mounting panel and electrical outlets. Interior layout shall be coordinated with requirements for installation of metering pumps and associated appurtenances.

1.02 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
 3. Product data to demonstrate that equipment conforms to the Specifications.
 4. Drawings showing enclosure dimensions and materials of construction.
- C. Manuals: Furnish manufacturer's installation, operation and maintenance manuals, and bulletins.

McKinleyville Community Services District 13418 - 1 Fiberglass Enclosures
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

- D. Affidavits: Furnish affidavit from the manufacturer stating that the enclosure has been installed to the manufacturer's requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Enclosures shall be as manufactured by Shelter Works; Tracom Fiberglass Products; or equal.

2.02 FIBERGLASS ENCLOSURES

- A. Construction: One-piece molded fiberglass construction with minimum 25 percent glass content. Construction shall be made up of an exterior and interior laminate with a foam core. Laminate shall be minimum 1/8 inch thick. The bottom of the enclosure shall be open and contain an integral base mounting flange with neoprene gaskets for mounting to a concrete pad and creating a weather tight seal. Exterior surface shall be free of irregularities and have minimum 15 mil gel coat containing UV inhibitors.
- B. Dimensions: 4' by 4' by 7'-6" (LxWxH).
- C. Components:
1. Doorway. A 26-inch-wide door with stainless steel hinges and cylindrical hardware shall be provided.
 2. Electrical. Electrical components shall meet requirements of Division 16, include the following and come completely wired in PVC conduit. Enclosure is located within an area that is classified as Class 1, Division 2 within 18 inches of grade. Therefore, all electrical devices associated with the enclosure shall be more than 18 inches above grade.
 - a. Panelboard. 120/240 3-wire for wet locations NEMA 250, Type 4 with minimum 50 amperes main circuit breaker and minimum of 12 branch circuit breakers 20 amps each. Allocate one breaker for self-regulating heat trace cable system.
 - b. Incandescent vapor proof light with switch.
 - c. Ten-inch exhaust shutter fan with thermostat and rain hood.
 - d. Ten-inch gravity inlet air shutter with rain hood and insect screen.
 - e. Two GFCI receptacles mounted on opposite sidewalls or as needed to accommodate installation of the chemical metering pumps and associated appurtenances.
 - f. Complete electrical installation shall meet the requirements of NEC.
 3. Equipment panel. Enclosure shall be provided with integral, encapsulated 42-inch by 60-inch plywood mounting panel on the back wall of the enclosure.

- D. Color: White.

- E. Anchors: Enclosure shall be mounted to a concrete equipment pad as shown on the Drawings. Anchors and anchor design shall be provided as required by Section 11001.

Fiberglass Enclosures 13418 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004'00
© 2014 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install tanks in strict accordance with the manufacturer's instructions and with favorably reviewed shop drawings.

END OF SECTION

McKinleyville Community Services District 13418 - 3
Wastewater Management Facility Improvements
Bid Set 1368004'00
© 2014 Kennedy/Jenks Consultants
Fiberglass Enclosures

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Provide a complete and operating portable davit crane as specified herein.

1.02 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
 3. Product data to demonstrate that the equipment conforms to the Specifications.
 4. Dimensional drawings.
 5. Certification with related drawings that equipment anchors have been designed per the requirements of Sections 01190 and 11001.
- C. Manuals: Furnish manufacturer's installation, operation and maintenance manuals, bulletins, and spare parts lists.

THIS PAGE INTENTIONALLY BLANK

1.03 QUALITY CONTROL

- A. Equipment furnished under this Section shall be supplied by a single manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The davit crane shall be Thern or equal.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

- A. The davit crane shall be classified by Underwriters Laboratories Inc. as to the specified load capacity and shall meet all applicable OSHA and ANSI standards. Other design requirements shall be as follows:

1. Capacity 1,300
2. Reach at rated capacity, inches 72
3. Reach range, inches 28 to 81
4. Hook height, range, inches 33 to 83

2.03 MATERIALS

- A. Materials shall be as follows:

Component	Material
Mast and Boom	Type 316 stainless steel
Bases	Type 316 stainless steel
Winch	Type 316 stainless steel
Cable	Type 316 stainless steel

2.04 EQUIPMENT

- A. General: One complete davit crane with one equipment-rate winch shall be provided. Davit bases shall be supplied in quantity and installed in locations as shown on the drawings. The davit crane shall break down into separated pieces for transport. The heaviest separated piece (boom with handle) shall be no more than 84 pounds.

- B. Davit Crane: The davit crane shall be capable of 360 degree rotation. The crane shall be portable and designed to fit into permanent davit bases. Reach and hook height shall both be adjustable within the range specified in this section.

- C. Davit Bases: Davit bases shall be permanently mounted and installed on concrete surfaces. Bases shall be provided at locations shown on the Drawings and shall be socket mounted flush type. All bases shall be supplied with removable sleeve plugs to exclude water and debris.

Davit Cranes

14625 - 2
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

- D. Hand Winch: The hand winch shall be of the spur gear type with capacities specified in this section. Capacities shall be permanently marked on the winch. Winch shall allow for quick connection to the davit crane and shall have a brake for load control. Wire rope shall be ¼ inch diameter and 28 feet long.

- E. Anchors: Provide all needed anchors and anchor design per requirements of Sections 01190 and 11001.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The davit bases shall be installed as shown on the drawings and in accordance with the manufacturer's recommendations. The davit crane shall be installed in the davit bases and operated to remove the equipment.

END OF SECTION

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

14625 - 3

Davit Cranes

SECTION 14627

PORTABLE GANTRY CRANES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Provide a complete and operating portable gantry crane as specified herein.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

- A. State of California Department of Industrial Relations, Division of Industrial Relations (CAL/OSHA), Title 8, Division 1, Group 13.
- B. Hoist Manufacturers Institute (HMI).
- C. American National Standards Institute (ANSI).
- D. Crane Manufacturers Association of America (CMAA).

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

14627 - 1
Portable Gantry Cranes

THIS PAGE INTENTIONALLY BLANK

- the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
 3. Product data to demonstrate that the equipment conforms to the Specifications.
 4. Dimensional drawings.

- B. Manuals: Furnish manufacturer's installation, operation and maintenance manuals, bulletins, and spare parts lists.

C. Affidavits:

1. Prior to installation, furnish the results of the manufacturer's shop load test. The results of this test shall be certified by a corporate officer of the manufacturer.
2. After installation, furnish a certification by a representative of the manufacturer who is knowledgeable and experienced with the subject equipment that the hoists and trolleys have been properly installed, adjusted and tested and are ready for full time operation. This certification shall also include the items specified in Paragraph 3.02, Testing, hereinafter.

1.04 QUALITY ASSURANCE

- A. Equipment furnished under this Section shall be supplied by a single manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years.
- B. After manufacture, perform a certified shop load test on these units. Conduct the shop test of the assembled portable gantry crane, trolley and hoist with a minimum load of 125% the rated load capacity.
- C. The trolley shall fit the beam and provide smooth travel without binding for the entire length of the beam.
- D. Field test all equipment to demonstrate compliance with CAL/OSHA standards.
- E. All portable gantry crane system components specified in this section shall be furnished by one supplier.

Portable Gantry Cranes 14627 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The portable gantry crane shall be Wallace Cranes Model Tri-Adjustable Aluminum Ton, Model A4T12-A10, or equal. Hoist and trolley shall be ACCO Wright; Yale; P&H; or equal.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

- A. The portable gantry crane shall be classified by Underwriters Laboratories Inc. as to the specified load capacity and shall meet all applicable OSHA and ANSI standards. Other design requirements shall be as follows:
 1. Capacity, tons 2
 2. Span, feet 10
 3. Maximum overall height, feet 12.33
 4. I-beam depth, inches 10
 5. Maximum height to bottom of beam, feet 11.75
 6. Net weight of portable gantry crane, pounds 408
 7. Weight of heaviest piece (i-beam), pounds 89
 8. Hoist lift height, feet 9

2.03 MATERIALS

- A. Materials shall be as follows:

Component	Material
Portable Gantry Crane	Aluminum

2.04 EQUIPMENT

- A. General: One complete portable gantry crane with one chain operated hoist/trolley shall be provided. The portable gantry crane shall break down into separated pieces for transport. The heaviest separated piece (i-beam) shall be no more than 89 pounds.
- B. Portable Gantry Crane: The portable gantry crane shall be adjustable including height, span, and caster frame spread.
- C. Furnish manual chain hoists with integral geared trolleys or separate manual chain hoists and geared trolleys, complete with stops.
- D. Trolleys shall be made of steel and have cast iron wheels with two single-row, lifetime lubricated ball bearings. Provide beam stops on beam to fit the trolley furnished.

McKinleyville Community Services District 14627 - 3 Portable Gantry Cranes
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

- E. Hoists shall have fully enclosed gearing with lifetime lubricated gear trains. Housings shall not support any bearings. Provide each hoist with load limiting device, load brake, and swivel hook with spring latches. Limit maximum chain pull to 65 pounds to lift hoist's rated capacity. Provide chain bucket. Provide all additional devices required by the CAL/OSHA. Hoists shall be low headroom design.
- F. Hoist and trolley chains shall extend to within 1 foot of the hoist operating floor. Zinc plate all chains.
- G. Hoist Lift Height: The distance from the hoist operating floor to the maximum lifting elevation of the hoist hook.
- H. Paint: Provide corrosion-resistant coating in manufacturer's standard colors.

PART 3 - EXECUTION

3.01 ASSEMBLY

- A. The portable gantry crane shall be assembled in accordance with the manufacturer's recommendations and located in the Maintenance Room as shown on the Drawings.

3.02 TESTING

- A. After field assembly, test the assembled unit over its full range of travel. Perform all tests to comply with CAL/OSHA requirements and furnish certificates of compliance.

END OF SECTION

SECTION 15050 PIPING, VALVES, AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Provide all piping, including fittings, valves, supports, and accessories as shown on the Drawings, described in the Specifications and as required to completely interconnect all equipment with piping for complete and operable systems, including equipment drains.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

- A. Air-Conditioning and Refrigeration Institute (ARI)
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- C. ASTM International (ASTM)
- D. American Society of Mechanical Engineers (ASME)
- E. American National Standards Institute (ANSI)
- F. American Water Works Association (AWWA)
- G. American Welding Society (AWS)
- H. Cast Iron Soil Pipe Institute (CISPI)
- I. U.S. Department of Transportation (DOT)
- J. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
- K. National Fire Protection Association (NFPA)

Portable Gantry Cranes

14627 - 4

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

15050 - 1

Piping, Valves, and Accessories

1.03 SUBMITTALS

A. The following information shall be submitted in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

B. Shop Drawings:

1. Verify by excavation, inspection and measurement all installation conditions, including existing utilities and structures, for all pipe before preparation of Shop Drawings. Submit field measurements and photos with Shop Drawings where exposed conditions are significantly different than indicated on the Drawings. See also paragraph 3.02, Existing Utilities of Section 02301.
2. Layouts and Schematics: Submit detailed installation drawings of all piping. Schematics may be submitted for piping 4 inches and smaller. The Drawings and schematics shall include: pipe support locations and types, fittings, valves, other appurtenances. (Product Review)
3. Submit data to show that the following items conform to the Specification requirements:
 - a. Pipe, fittings, and accessories (Product Review)
 - b. Fabricated pipe supports and other pipe supports (Product Review)
 - c. Pipe couplings and flexible pipe pieces (Product Review)
 - d. Valves and Accessories (Product Review)
 - e. Thermal insulation (Product Review)
4. Pipe, fittings and joint fabrication details for welded steel pipe (T.M-2P and T.W-1P) (Product Review).
5. Submit reinforcement calculations for T.M-2P to demonstrate compliance with AWWA M11.
6. Submit procedures for welding field joints of welded steel pipe (T.M-2P and T.W-1P) and welder qualifications (Product Review).

Piping, Valves, and Accessories

15050 - 2

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set

1368004*00
© 2014 Kennedy/Jenks Consultants

7. Submit samples of gaskets and other materials where required by the detailed specifications.
8. Submit certified test reports as required herein and by the referenced standard specifications (Product Information).
9. All items that are submitted for use on water or reclaimed water pipelines, including, but not limited to, pipe and valve linings, solvent cements, welding materials, gaskets and gasket lubricants and additives in concrete or cement mortar shall (in accordance with Section 64591 of the California Water Works Standards) be NSF certified for use in water systems. Submit proof of NSF certification for each item submitted.

C. Samples:

1. Solder and flux for copper pipe.
2. Gaskets for Type PVC-5 pipe.

D. Manuals: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for the following items:

1. Valves 4 inches and larger and all actuated valves.
2. Air Valves.
3. Pneumatic/motorized actuators, including positioners and I/P converters. Include the actuator manuals for the valves requiring them.
4. Strainers, motorized or automatic washing.
5. Filters.
6. Pressure regulators.
7. Rotameters.

E. Affidavits: Furnish affidavits from the manufacturers for the following equipment:

1. Valves, motorized or hydraulic or pneumatically operated.
2. All motorized or calibrated equipment.

F. Field test reports as required in Part 3.

1.04 QUALITY CONTROL

- A. Materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years. Demonstrate to the satisfaction of the Engineer that the quality is equal to the materials and equipment made by the manufacturers specifically named herein, if an alternate manufacturer is proposed.
- B. Factory Quality Control: The Contractor shall test all products as noted herein and by the reference specifications.
- C. Field Quality Control:
 1. The Owner's Representative will inspect field welds and test the welds if it is deemed necessary.
 2. The Contractor shall:
 - a. Perform leakage tests.
 - b. Perform bacteriological analysis for pipelines to be disinfected.
 - c. Be responsible for the costs of additional inspection and retesting by the Owner resulting from noncompliance.

McKinleyville Community Services District

15050 - 3

Piping, Valves, and Accessories

Wastewater Management Facility Improvements
Bid Set

1368004*00

© 2014 Kennedy/Jenks Consultants

1.05 POTHOLING (CHECK ON LOCATIONS)

- A. Do not prepare any shop drawings for, or make final order for, or design any pipe materials for any particular section of pipeline until all utilities in that section of pipeline have been exposed, as specified in paragraph 3.02 of Section 02301 and until such time as no interferences are found between said existing utilities and the proposed pipeline alignment. If interferences are found in any particular section of pipeline, do not prepare any shop drawings for, or make final order for, or design any pipe materials for that particular section of pipeline until the pipeline alignment has been modified by the Engineer to eliminate all such interferences.

1.06 CONSTRUCTION SCHEDULING/SEQUENCING

- A. Construction under this Contract may involve expansion and/or modification of an existing piping system which must continue to provide service to all buildings during construction.
- B. Connections and utilities changes must be programmed to provide the least possible interruptions of service. Prior to any shutdown, all materials, fittings, supports, equipment and tools shall be on the site and all necessary labor scheduled prior to starting any connection work. The Contractor shall notify the Engineer in writing at least 7 days in advance of any required shutdowns so that affected customers may be notified. In general, shutdowns shall not exceed four hours in duration unless specifically authorized or indicated in the suggested construction sequence. If a shutdown of more than 4 hours is required, the Contractor shall first install temporary service connections to all affected houses and other buildings. All temporary piping shall be disinfected in accordance with Paragraph 3.06 before being put into service (water and recycled water piping systems only).
- C. All work under this Contract shall be conducted in a manner which will minimize shutdowns, open roadways, or traffic obstructions caused by the construction. Shutdowns causing damage to adjacent public and private property shall not be permitted, and any damage resulting shall be the sole responsibility of the Contractor.
- D. Planned utility service shutdowns shall be accomplished during periods of minimum use. In some cases, this will require night or weekend work, which shall be at no additional cost to the Owner. The Contractor shall program his work so that service will be restored in the minimum possible time, and shall cooperate with the Owner in reducing shutdowns of the utility system to a minimum. No utility interruption will be permitted without the prior approval of the Engineer.

1.07 PIPING SYSTEMS

- A. The various piping systems are identified by a multi-letter code on the Drawings. Unless otherwise shown on the Drawings, each system shall be constructed using the materials indicated for that system in the Piping Schedule. Piping materials are identified by type designation in the schedule unless otherwise noted, and most valves and accessories are identified by a valve and accessory system unless otherwise noted.

Piping, Valves, and Accessories

15050 - 4
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004'00

© 2014 Kennedy/Jenks Consultants

1.08 APPURTENANCES

- A. Furnish and install all necessary guides, inserts, anchors and assembly bolts, washers and nuts, hangers, supports, gaskets, couplings and flanges; all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping; devices included in or on the piping equipment; and piping accessories.

1.09 PIPE SUPPORTS

- A. General:
1. Piping 6 Inches and Larger: Pipe supports are shown on the Drawings for piping 6 inches and larger in diameter, where the piping is shown on layout drawings. Each pipe support used is designed to resist seismic loading except where the support is of the sliding type for thermal expansion. Other supports are provided to resist axial seismic loading of pipes designed for thermal expansion. Pipe supports that are considered seismic resistant are so noted on the pipe support detail sheets on the Drawings. The location and types of supports and braces are indicative and may be modified by the Contractor to suit field conditions, provided the modified support system conforms to the design criteria stated herein, and receives the favorable review of the Engineer. Where piping is shown schematically only, it shall be the Contractor's responsibility to support all such piping in accordance with the design criteria stated herein and using support details shown on the Drawings. Pipe supports have been designed assuming flanged joints on ductile iron pipe and steel pipe, unless otherwise indicated on the Drawings. If groove type mechanical couplings are used as an alternative, provide additional supports where required, particularly to resist rotation. Shop drawings of these additional supports shall be favorably reviewed by the Engineer prior to installation.
 2. Piping Less Than 6 Inches: Pipe supports are generally not shown for piping less than 6 inches in diameter. Where supports are not shown, it shall be the Contractor's responsibility to support all such piping in accordance with the design criteria stated hereinafter and the support details shown on the Drawings. Piping 2½ inches and larger and all piping for hazardous chemicals shall be supported with pipe supports designed to resist seismic loads. Hazardous chemical piping includes chlorine solution, natural gas, hypochlorite, polymer, sodium bisulfite, ferric chloride (concentrated and solution), compressed air, and sludge gas. Piping smaller than 2½ inches with non-hazardous contents may be supported with non-seismic resistant supports.
 3. Where not detailed or otherwise indicated, pipe support types and spacing shall be in accordance with the Manufacturer's Standardization Society (MSS) Standard Practice No. SP-58 and No. SP-69, except as superseded by the requirements of these Specifications. Hangers and supports used as components of a fire protection system shall comply with NFPA Standard No. 13 and be listed and labeled by UL and FM.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004'00

Piping, Valves, and Accessories

15050 - 5

© 2014 Kennedy/Jenks Consultants

- B. Pipe Support System Design:
- Design Loads: Pipe suspension shall be such as to prevent excessive stress or excessive variation in supporting force while system is in operation. Pipe supports shall support the sum of the weight of the pipe, fittings, appurtenances, and contents. In addition, the pipe shall be anchored to resist internal pressure forces tending to separate any unrestrained joint at pressures 1½ times the maximum working pressure for the applicable service.
 - Seismic Loads: Seismic loads shall conform to the requirements of Section 01190.
 - Location: All piping shall be supported in a manner that will prevent undue strain on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, at all nonrigid joints, at hose bibbs, and where otherwise shown. Where piping connects to equipment, it shall be supported by a pipe support and not by the equipment.
 - Maximum support spacing shall conform to the following table:

Pipe Size (Inches)	Pipe Material	Maximum Spacing (Feet)
1 inch and smaller	Iron or Steel Copper Plastic Tubing	6 4½ continuous continuous
1¼ inch to 2 inch	Iron or Steel Copper or Plastic	8 5
2½ inch to 4 inch	Iron or Steel Copper or Plastic	10 6
6 inch to 8 inch	Iron or Steel Plastic	12 8
10 inch and larger	Iron or Steel	15

- Piping penetrations through concrete walls and slabs are considered to resist seismic loading, provided penetrations for pipes 3 inches in diameter and larger are complete with a wall flange.
- Branch piping is not considered to provide resistance to seismic forces.
- Anchors: Anchors for connecting pipe supports to concrete shall be in accordance with Section 05090.
- Thermal Expansion Allowance:
 - Provide one rigid pipe support for each straight run of pipe and between each pair of flexible couplings, flexible connectors, or expansion loops for pipes listed below. Provide other supports at the required spacing that allow sliding or rolling, as noted, along the pipe axis:
 - PVC pipe larger than 1-inch in diameter (sliding inside PVC sleeve).
 - Building heating hot water (rolling).
 - Domestic hot water (rolling).
 - Liquid Oxygen.
 - Aeration Air, Airwash Air, Compressed Air.
 - Provide vertical support only, that is, no lateral support, within 4 feet of an angle or tee for pipes listed above.

Piping, Valves, and Accessories 15050 - 6 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bld Set 1368004*00
© 2014 Kennedy/Jenks Consultants

PART 2 - PRODUCTS

2.01 GENERAL

- Pipe and valve sizes are nominal inside diameter unless otherwise noted.
- Construct vents of materials specified for the pipe system for which they serve.
- All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.
- Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified hereinafter.
- Cutoff Flanges: Provide at all pipe or sleeve penetrations where cast into wall for pipes 4 inches and greater in nominal diameter, and at all penetrations of 3-inch and smaller nominal diameter pipe in wet or potentially wet locations as indicated on the Drawings. Cutoff flange outside diameter shall be at least a standard connection flange's outside diameter except that for pipe 30-inch-diameter and larger, nominal size, cutoff flange outside diameter may be 6 inches greater than outside pipe diameter. Cutoff flange shall be at least ¼-inch thick and shall be continuously welded (or cast) onto the pipe. Conform to pipe penetration details in paragraph 3.01A and as shown on the Drawings.

2.02 GENERAL MATERIAL REQUIREMENTS

- Gaskets: Except where specified otherwise, gaskets shall be SBR rubber or NBR (Nitril or Buna-N). Use Hypalon or Viton for sodium hypochlorite, and chlorine solution service.
- Bolts and Tie Rods: Unless specified otherwise herein, flange bolts and nuts, coupling bolts and nuts, tie rods and other hardware shall be as follows:
 - Exposed: Type 316 stainless steel, minimum tensile strength: 60,000 psi.
 - Submerged: Type 316 stainless steel, minimum tensile strength: 60,000 psi.
 - Concrete Encased: Steel.
 - Buried: Type 304 stainless steel, minimum tensile strength: 60,000 psi.
 - Apply an anti-gauling compound to the threads of stainless steel bolts.
- Flexible Sealant: Flexible sealant for pipe joints, where shown on the Drawings, shall be a two-component polysulfide, non-sag; Sikaflex 2C, Dualthane, or equal.
- Fusion Epoxy Coating: AWWA C213; except application shall be by fluid bed only unless the greatest dimension of the article to be coated exceeds ten feet, in which case electrostatic spray or flocking application may be used.

2.03 PIPING MATERIALS

- Pipe and Fitting Designation: Piping materials are identified by a "Type" designation in these Specifications. The "Type" designation identifies not only the pipe itself but the associated fittings and appurtenances and the installation and test procedures described for that "Type." The designation of a particular type shall indicate a complete installation including fittings, joints, cleaning and testing. The pipe and fitting materials for each type designation shall be as specified herein and summarized in the Pipe Type Schedule.

McKinleyville Community Services District 15050 - 7 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bld Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- B. Piping Schedule: Piping systems and their corresponding piping and valve systems are listed on the Drawings.
- C. Pipe Type Schedule: Pipe material, joints and fittings shall be as summarized below. A detailed specification of each pipe type follows. (The detailed specification supersedes the schedule in case of any conflicts.)

Pipe Type	Pipe Description	Field Joints	Fittings
BS40	Black Steel, Schedule 40	Weld	Steel
CISP	Cast Iron Soil Pipe	B&S or Mech. Coupling	CI
CUP	Copper	Solder or Flare	Wrought Copper or Bronze
DIPB	Ductile Iron Bell & Spigot Pipe	B&S	DI
DIPF	Ductile Iron Flanged Pipe	Flange or Mech. Groove Coupling	DI
GSP	Galvanized Steel Pipe, Schedule 40	Thread	Galvanized Malleable Iron or Cast Iron
PVC-1	PVC, Schedule 80	Threaded or Solvent Weld	PVC, Schedule 80
PVC-5	PVC, Sewer	B&S	PVC
SSP	Stainless Steel Pipe	Flanged or Weld	Stainless Steel
WSP	Welded Steel Pipe	Weld (flanged or coupling where shown)	WS

- D. **BS40 Type X-1 Pipe:**
- Pipe: Schedule 40 black steel, ASTM A53, Grade B, butt weld or seamless.
 - Joints: Butt welded or socket welded, except where otherwise shown on the Drawings and where screwed or flanged accessories or valves are required.
 - Fittings: Forged steel, butt weld type, same Schedule as pipe conforming to ASTM A234, or 2,000 psi forged steel socket weld fittings conforming to ASTM A105.
 - Flanges: Where required to connect to flanged equipment or valves, shall be slip-on or weld-neck type conforming to ASTM A105 or ASTM A181. Flange drilling and facing shall match that of the flanged valves or equipment to which the pipe connects.
 - Branches two sizes or smaller than pipe main may be made with factory fabricated steel welding saddles manufactured by Bonney, Ladish, or equal.
- E. **CISP Type N-3 Pipe:**
- Pipe and Fittings: Bell and spigot service weight cast iron soil pipe or no-hub cast-iron soil pipe. (No-hub pipe may be used only in concealed locations.)
 - Bell and Spigot: ASTM A74.
 - No-Hub: Cast Iron Soil Pipe Institute Standard No. 301.
 - Bell and Spigot Gaskets: Sewage and oil resistant, ASTM C564.
 - No-Hub Couplings: Cast Iron Soil Pipe Institute Standard No. 301.
- F. **CUP Type T-1 Pipe:**
- Pipe: Copper, ASTM B88.
 - Buried: Type K (soft drawn).
 - Exposed: Type L (hard drawn).

Piping, Valves, and Accessories 15050 - 8 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- Joints:
 - Buried: Soldered or flared.
 - Exposed: Soldered.
- Solder: ASTM B32, Alloy Grade Sn 94, Sn 95 or Sn 96. Solder and flux shall contain less than 0.2 percent lead.
- Fittings:
 - Soldered: Wrought copper, ASTM B73 for materials and ANSI B16.22 for dimensions; or cast bronze, ASTM B62 for materials and ANSI B16.18 for dimensions.
 - Flared: AWWA C800 and ANSI B16.26

G. **DIPB Type N-1 Pipe:**

- Pipe: Ductile iron bell and spigot pipe, AWWA C151.
 - Minimum Pressure Class: 350
- Joints: Push-on or mechanical, AWWA C111 as modified, except where flanged joints are shown on the Drawings or where making connections to valves.
 - Gaskets:
 - Unless otherwise specified, gaskets shall be SBR OR NBR (Nitril or Buna-N).
 - Aeration service: Viton.
 - Restrained joints: For all connections provide restrained joints for pipe and fittings capable of deflection after restraint is installed. Joints shall not separate under an internal pressure of 250 psi. For push-on joints use TR FLEX or Field Lok by United States Pipe & Foundry Company; equivalent product by American Cast Iron Pipe Company; or equal. For mechanical joints use Megalug restraints by EBAA Iron, or equal.
 - Buried Tee-Head Bolts and Nuts for Mechanical Joints: Ductile iron or cor-ten or Type 304 stainless steel.
 - Buried bolts and nuts for flanged joints shall be Type 304 stainless steel.
 - Provide insulating flanges with two cathodic test stations for buried ductile iron to steel connections.
- Fittings: Ductile iron with push-on joints, or mechanical joints, AWWA C110 and AWWA C153.
 - Special Fittings: Special fittings not available in ductile iron or cast iron pipe may be fabricated of welded steel pipe (Type WSP M-2 Pipe) with a design pressure of 350 psi. Line and coat with fusion epoxy. Design and wall thickness shall be submitted to the Engineer for review.
- Lining: Standard thickness cement mortar lining for pipe and fittings, AWWA C104, except where noted otherwise in the Drawings or in the Pipe Schedule. Cement mortar linings shall be seal coated. Alternatively, fittings may be fusion epoxy lined and coated per AWWA C116.
 - Aeration air service: No lining.
 - Ceramic Epoxy lining for pipe and fittings where required in the Drawings or Piping Schedule:
 - Pipe and fittings shall be previously unlined. Solvent clean and completely abrasive blast all areas to receive lining.

McKinleyville Community Services District 15050 - 9 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- 2) The ceramic epoxy material shall be an amine cured novolac epoxy containing at least 20 percent by volume of ceramic Quartz. Ceramic epoxy lining shall meet the following test requirements:
 - a) Permeability rating of 0.00 when tested per Method A of ASTM E 96, Procedure A with 30-day test duration.
 - b) Salt spray (scribed panel) results equal to 0.0 undercutting after two years per ASTM B-117.
 - c) Cathodic disbondment 1.5 volts at 77°F equal to no more than 0.5 mm under cutting after 30 days per ASTM G-95.
 - d) Immersion testing using ASTM D-714:
 - (1) 20 percent sulfuric acid – no effect after two years.
 - (2) 140°F 25 percent sodium hydroxide – no effect after two years.
 - (3) 160°F distilled water – no effect after two years.
 - (4) 120°F tap water (scribed panel) 0.0 undercutting – after two years.
 - e) Abrasion resistance of no more than 3 mils loss after one million cycles per European Standard EN 598, Section 7.8.
- 3) Lining shall be factory applied to the interior of pipe and fittings to a dry film thickness of 40 mils. Gasket areas and spigot ends shall be coated with 6 to 10 mils of ceramic epoxy joint compound, which shall also be used for field touchup of any damaged surfaces.
- 4) Thickness test linings per SSPC-PA-2 using a magnetic film thickness gauge. Test interiors for pinholes with nondestructive 2,500-volt test. Correct all defects before shipment.
- c. Glass lining for pipe and fittings, where required in the Drawings or Piping Schedule:
 - 1) The glass lining shall be applied to chemically clean casting in such manner that intergranular hydrogen entrapment is eliminated. Bisque coating shall be matured at temperatures exceeding 1,400°F. Furnace atmosphere will be normal or inert with reduced moisture environment.
 - 2) The lining shall have a compressive strength of 30,000 psi and hardness of 6 MOHS scale, or equivalent performance after 5,000 wear cycles in standard Taber Abrasive Test.
 - 3) The glass lining, including interface, shall average a minimum of 0.008-inch in thickness as measured by Elco Magnetic thickness gauge. No reading shall vary more than 50 percent under or 150 percent over this figure. Glass coating shall be resistant to corrosion of solutions at 125°F between pH 3 and pH 10. Standard T Section Thermal Shock Test as specified by U. S. Bureau of Standards, over a range of 500°F, shall produce no visible deterioration of linings. Lining shall not be affected by a 10 percent N solution of sulfuric acid evaporated on the glass surface at ambient temperature.
 - 4) Pinholes shall be kept to a minimum, representing less than 0.1 percent of the total glassed surface. Lining shall be smooth and glasslike. Joint edges shall be smooth and unchipped.

Piping, Valves, and Accessories

15050 - 10

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

© 2014 Kennedy/Jenks Consultants

- 5) Pipe shall be bored or machined to remove any voids, protrusions or surface irregularities to obtain a smooth, continuous surface for glass lining. Pipe shall be of suitable wall thickness to assure that boring or machining will not impair the specified wall thickness.
5. Coating: Buried pipe shall receive asphalt coating per AWWA C151. Exposed or submerged pipe requiring protective coating per Section 09960 shall be shipped bare or shall be factory primed compatible with selected field paint system.
6. Protection for buried pipe:
 - a. Polyethylene encasement, black, AWWA C105. Single-wrap pipe, double-wrap flanged fittings, mechanical joints, or other appurtenances with significantly different outside diameters from the pipe. Tape to seal seams and overlaps at least 4 mils thick and at least 2 inches wide.
 - b. Aeration service: Buried piping and fittings used for aeration service shall be encased with 2 layers of 4-mil AWWA C105 high density cross laminated polyethylene.
7. Pipe Taps:
 - a. Direct threaded taps are not acceptable. Pipe branch line connections shall be made using service saddles, by using reducing flanges on tees, or by tapping blind flanges on tees.
 - b. Service Saddles:
 - 1) Materials: Ductile iron saddle with electro-galvanized straps and hardware for above ground and bronze or 304 stainless steel for buried, and nitrile or neoprene gaskets.
 - 2) Type: For ductile iron pipe 4 inches and less, single strap saddles may be used. For pipe greater than 4-inch, double-strap saddles can be used.
 - 3) Manufacturers: Smith-Blair Model 311 or 313; equivalent by Mueller; or equal.
8. Field Closure Connections for Restrained Joints: Pipe cut in the field where necessary and when favorably reviewed by the Engineer shall be connected by one of the following methods.
 - a. Series 3800 Mega-Coupling by EBAA Iron, Inc.; or equal.
 - b. Mechanical joint sleeve with two Series 1100 Metalug restraints by EBAA Iron, Inc.; or equal.

H. DIPF Type N-2 Pipe:

1. Pipe: Flanged or grooved end ductile iron.
 - a. Flanged Pipe: AWWA C115 including Appendix A, minimum thickness Class 53.
 - b. Grooved End Pipe: AWWA C151 with grooves in accordance with AWWA C606, Table 3, for rigid joints. Provide minimum thickness classes in accordance with AWWA C606.
2. Joints: Where flanges are shown on the Drawings, provide mechanical rigid grooved couplings up to 24-inch or flanges, at the Contractor's option, except where grooved couplings are required in the Drawings. (See paragraph 1.07A.1 for special requirements for pipe supports with grooved couplings.) Provide flanges where required to connect to valves, equipment or certain pipe supports.

15050 - 11

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

Piping, Valves, and Accessories

© 2014 Kennedy/Jenks Consultants

3. Flanges: Ductile iron, plain faced, AWWA C115. Submit certification that flanges comply with AWWA C115. Provide insulating flanges with two cathodic test stations for buried ductile iron to steel connections.
4. Mechanical Grooved Couplings: AWWA C606, minimum pressure rating of 150 psi.
5. Fittings:
 - a. Flanged: Ductile iron, AWWA C110 or AWWA C153.
 - b. Grooved End: Ductile iron, AWWA C110 for materials, dimensions and pressure ratings. Grooves shall be in accordance with AWWA C606, Table 3, for rigid joints.
 - c. Special Fittings: Special fittings not available in ductile iron may be fabricated of fusion epoxy lined and coated welded steel pipe with a design pressure of 450 psi. Submit design and wall thickness to the Engineer for review.
 - d. Buried bolts and nuts for flanged and grooved end joints shall be Type 304 stainless steel.
6. Lining: Standard thickness cement mortar lining for pipe and fittings, AWWA C104, except where noted otherwise in the Drawings or in the Piping Schedule. Cement mortar lining shall be seal coated.
 - a. Ceramic Epoxy Lining for pipe and fittings where required in the Drawings or Piping Schedule: See ductile iron push-on joint pipe.
 - b. Glass lining for pipe and fittings where required in the Drawings or Piping Schedule: See ductile iron push-on joint pipe.
 - c. Fusion epoxy lining and coating, where required in the Drawings or Piping Schedule, shall be applied in accordance with paragraph 2.02D.
7. Coating: Buried pipe shall receive asphalt coating per AWWA C115. Exposed or submerged pipe requiring protective coating per Section 09960 shall be shipped bare or shall be factory primed compatible with selected field paint system.
8. Gaskets:
 - a. Flanged: Full face, 1/8-inch-thick SBR rubber or NBR (Nitril or Buna-N), AWWA C115, Appendix A.
 - b. Mechanical Grooved Coupling: SBR rubber or NBR (Nitril or Buna-N), AWWA C606.
9. Flange Bolts: AWWA C115, Appendix A unless stainless steel is required in paragraph 2.02.
10. Pipe Taps:
 - a. Direct threaded taps are not acceptable. Pipe branch line connections shall be made using service saddles, by using reducing flanges on tees, or by tapping blind flanges on tees.
 - b. Service Saddles:
 - 1) Materials: Ductile iron saddle with electro-galvanized straps and hardware for above ground and bronze or 304 stainless steel for buried, and nitril or neoprene gaskets.
 - 2) Type: For ductile iron pipe 4 inches and less, single strap saddles may be used. For pipe greater than 4-inch, double strap saddles shall be used.
 - 3) Manufacturers: Smith-Blair Model 311 or 313; equivalent by Mueller; or equal.

Piping, Valves, and Accessories 15050 - 12 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

11. Field Closure Connections for Restrained Joints: Pipe cut in the field where necessary and when favorably reviewed by the Engineer shall be connected by one of the following methods:
 - a. Series 3800 Mega-Coupling by EBAA Iron, Inc.; or equal.
 - b. Mechanical Joint Sleeve with two Series 1100 Megalug Restraints by EBAA Iron, Inc.; or equal.

I. GSP Type Y-1 Pipe:

1. Pipe: Galvanized steel, ASTM A53, Schedule 40.
2. Fittings:
 - a. Pressure Pipe Service: Galvanized malleable iron, screwed, ASTM A197 for materials, ANSI B16.3 Class 150 for dimensions (rated 300 psig WOG at 150°F).
 - b. Drain Pipe Service: Galvanized cast iron drainage pattern, ANSI B16.12.
3. Threads: ANSI B2.1.
4. Unions: Galvanized malleable iron, ASTM A197 for materials and ANSI B16.39 for dimensions, with brass seats.
5. Thread Compound: Permatex No. 2; Crane equivalent; or equal, or Teflon tape.

J. PVC-1 Type V-1 Pipe:

1. Pipe: Schedule 80 polyvinyl chloride (PVC), gray, normal impact, Type 12454 B, ASTM D1784 and ASTM D1785. Pipe shall bear the National Sanitation Foundation (NSF) label.
2. Joints: Solvent weld, except flanged or threaded permitted where required at equipment connections and where required on the Drawings. Use Military Specification T 27730A tape for threaded joints.
3. Fittings: Solvent weld, socket type, of same material as the pipe, Schedule 80, ASTM D2467.
4. Cement: Solvent weld, ASTM D2564, as recommended by the pipe manufacturer for the schedule and size to be joined.
5. Pipe Cleaner: As recommended by the pipe manufacturer for the schedule and size to be joined.
6. Double containment of piping is required for all buried chlorine solution (CLS) piping.

- a. Size: Provide Schedule 80 PVC containment pipes as follows:

Carrier Pipe	Containment Pipe
½ inch	2 inch
1 inch	3 inch

- b. Joints: Solvent weld except flanged where required. Use two-piece hinged couplings as specified below where necessary. Do not make-up joints until successful completion of leak tests of primary carrier pipe.
- c. Fittings: Yellow or clear PVC two-piece, hinged, and pregasketed (EPDM) containment fittings. Termination couplings shall be hubless type of PVC rubber with 316 stainless steel clamps. Carrier pipe shall be installed concentrically to the containment using three- or four-legged positioning clips. Fittings shall be Flo-Safe as supplied by Harrington Industrial Plastics, Contain-It by R&G Sloane; or equal.

McKinleyville Community Services District 15050 - 13 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- d. Provide underground leak detection station with sensor and pump out port as shown on the Drawings. Leak sensor shall be wired to the leak detection system control panel. Leak detection system shall meet the requirements of this Section and those contained in Division 17. System shall include sensor, PTFE sensor cable, control box and Type 304 stainless steel control box stand. System shall operate using 120-volt single phase electrical service. Leak detection controls shall be mounted in a NEMA 4X enclosure with power ON/OFF switch, power light, leak detection light, alarm silence push button, control relay for remote alarm, and alarm horn. Pilot devices shall be NEMA 4X rated. Leak detection sensor shall be a RF capacitance sensor made of PTFE and shall be suitable for operation with chemicals to be detected and temperatures from 0 degrees F to 150 degrees F.
- K. **PVC-5 Type V-5 Pipe:**
1. Pipe and Fittings: Polyvinyl chloride sewer pipe:
 - a. 4-inch through 15-inch nominal size: ASTM D3034, SDR 26.
 - b. 18-inch through 48-inch nominal size: ASTM F679.
 2. Joints: Elastomeric gasket joints, ASTM D3212.
 3. Gaskets: SBR rubber or NBR (Nitril or Buna-N).
 4. Factory Testing:
 - a. Pipe Tests: Test at least three specimens for each size to be provided for the following conditions in accordance with ASTM D3034.
 - 1) Pipe Diameters
 - 2) Pipe Flattening
 - 3) Impact Resistance
 - 4) Pipe Stiffness
 - b. Joint Tests: Assemble two sections of pipe for each size in accordance with the manufacturer's recommendations. Test in accordance with ASTM D3212.
 - c. Gasket Tests for NBR Gaskets: Test three gaskets of each size for all properties noted in Section 7 of ASTM F477.
- L. **SSP Type W-1 Pipe:**
1. Pipe: Stainless steel, ASTM A312 or A778 TP 304L, Schedule 10S except Schedule 40S for screwed joints and pipe 6 inches and smaller.
 - a. Joints: Butt welded or socket welded or mechanical grooved couplings, except where screwed or flanged joints are required adjacent to valves or equipment. Cut or rolled groove connections, AWWA C606.
 3. Fittings: Wrought stainless steel, ASTM A774, TP304L, ANSI B16.9 for dimensions.
 4. Flanges: Welding neck or slip-on, raised face, ASTM A182, TP304 ANSI B16.5 for dimensions. Class 150, drilling to match adjacent accessories or valves.
 5. Gaskets: Full face gasket per ANSI B16.21
 6. a. Unless otherwise specified non-asbestos Teflon-bonded EPDM.
 7. b. Process Air Service: Viton
 8. Safety Shields: TFE coated fiberglass, OSHA orange border with see-through shield for inspection of leaks. Ramco Vue-Gard; or equal.

Piping, Valves, and Accessories 15050 - 14 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

M. **WSP Type M-2 Pipe:**

1. Pipe: Cement mortar lined steel cylinder pipe, AWWA C200 except as modified herein. Pipe shall be cement mortar coated where buried, and if required elsewhere by the Drawings or Specifications. Steel shall be ASTM A36.
 - a. Dimensions: Nominal inside diameter shall be the minimum net inside clear lined diameter, except that net inside clear lined diameter may be up to ½ inch less than the nominal diameter for nominal diameter 12 inch or less.
 - b. Steel Cylinder Thickness: The pipe manufacturer shall design steel cylinder for pipe and fittings for the cover shown on the Drawings, in accordance with AWWA M-11. The minimum cylinder thickness for pipe with welded joints shall be 12 gauge. Design criteria areas follow:
 - 1) Superimposed external load: AASHTO H20
 - 2) Internal pressure including surge allowance: 250 psi
 - 3) Internal negative pressure: 15 psi
 - 4) Maximum allowable stress: 50% of minimum yield point or 16,500 psi, whichever is less.
 - 5) Maximum deflection permitted: 2%
 - 6) For tapered sections, minimum cylinder and mortar lining thicknesses shall conform to the requirements for the larger pipe diameter.
 - c. Minimum steel cylinder thickness and lining thickness for in-plant piping:

Nominal Size (Inches)	Steel Cylinder Minimum Wall Thickness (Inches)	Minimum Lining Thickness (Inches)
6 to 8	0.135	3/8
10 to 16	0.188	1/2
18 to 48	0.250	3/4
54 to 60	0.312	3/4
2. Joints: Use welded joints, except flanged or connected with couplings where shown on the Drawings.
 - a. Welded joints shall be butt strap, split butt strap, or lap joint. Butt straps and lap joint details shall be submitted to the Engineer for favorable review. The joint shall be designed to withstand all loads associated with installation and operating conditions. Rolled lap joints are not acceptable. The radius of the bell bends shall be greater than 15 times the cylinder wall thickness. Joint configuration and welding shall conform to the requirements of AWWA M11 and AWWA C206 except Section 6-2 testing, which are modified herein. The size of fillet welds shall be equal to the thickness of the smaller plate being joined. Butt welds shall be full penetration.
 - b. For pipe less than 24-inch-diameter, the proceeding described in AWWA C205, paragraph 4.7.2.2.2 utilizing a burlap-covered ball shall be used for applying cement mortar lining to the insides of the joints.
 - c. Cement mortar lining shall be patched after joint testing and may be hand applied. Conform to AWWA C205, Appendix A.
 - d. Provide special closure lap joints at approximately 500-foot intervals in accordance with AWWA C206.

McKinleyville Community Services District 15050 - 15 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

3. Fittings: Fittings shall be made of hydrostatically tested cylinders of the same material and minimum thickness as the pipe, except that elbows shall have greater thickness if necessary to compensate for stress concentrations. They shall be as detailed on the Drawings or, if not detailed on the Drawings, shall be designed by the pipe manufacturer by the method stated in the AWWA Pipe Manual M11 as modified herein, subject to the favorable review of the Engineer. Unless otherwise noted or detailed on the Drawings, fitting dimensions shall conform to AWWA C208. Adding pipe to the fittings does not change the requirement that the fittings conform to AWWA C208 dimensionally, nor does it reclassify the pipe portion as part of the fitting.
 - a. Provide reinforcement for fittings (outlets, tees and wyes, etc.) in the form of collars, wrappers or crutch plates, in accordance with the current revision of AWWA M11, Table 13-2. Coat buried fitting reinforcement with cement mortar.
 - b. Crutch plates shall be designed in accordance with AWWA M11, using a minimum plate thickness of 1 inch.
 - c. Elbow dimensions (unless otherwise noted or detailed on the Drawings):
 - 1) Minimum number of pieces for mitered elbows:
 - a) 68° to 90°: five pieces.
 - b) 46° to 67°: four pieces
 - c) 23° to 45°: three pieces
 - d) Up to 22½°: two pieces
 - 2) Radius, R, to pipe centerline:
 - a) 1.25 pipe diameters for in-plant piping
 - b) 2.5 pipe diameters for transmission lines
 - 3) Wrought steel elbows complying with ANSI B16.9 and ASTM A234 may be substituted for mitered elbows as long as they meet, as a minimum, the radius, wall thickness and internal diameter requirements of this specification.
 - d. Nozzles 3 inches and less shall be Schedule 40 weld fittings. Wheeling Pipe-O-Lets; Allied Branchlets; or equal. They may be unreinforced.
 - e. Flares: Flare diameter shall be equal to the flange O.D. for the same size pipe. Fabricate flares from two sections of truncated cones, one angled 22 ½ degrees from pipe axis, the other 45 degrees. Grind all interior welds and edges perfectly smooth before lining.
4. Lining: Cement mortar, ¾-inch thick AWWA C205 except as modified herein. Cement shall be Type II. On pipe 27-inch diameter and larger, the lining shall be reinforced using a plain 2 by 4-inch, 13 by 13 gauge welded wire mesh welded to the inside of the pipe, fitting, or steel plate special. If the cement mortar lining is applied by the centrifugal process, the reinforcement may be omitted. Wire reinforcement shall conform to ASTM A185. Paint interior edges and other unlined surfaces in accordance with System 3 in Section 09960.
5. Coating:
 - a. Cement mortar coating: ¾ inch thick over the reinforcement, AWWA C205. Cement shall be Type II containing 15 percent to 20 percent pozzolan. Reinforcement shall be in accordance with AWWA C205.

Piping, Valves, and Accessories 15050 - 16 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- b. Non-cement mortar coating: Pipe without cement mortar coating shall be painted in accordance with Section 09960. Shop prime with products compatible with final coats. Hold back coatings of concrete encased portions of pipes from a point 2 inches within face of concrete encasement.
- c. On buried piping where the cement mortar coating is held back for flexible couplings or other similar connections, edges shall be ground smooth and the exposed pipe shall be painted with System 3 in Section 09960, Protective Coatings, and shall overlap the cement lining and mortar coating. Stripe coat edges between finish coats.
6. Flanges and Bolts:
 - a. Steel ring flanges conforming to AWWA C207, Class B, D with bolt holes drilled in conformance with ANSI B16.1, 125-pound class except as needed to match equipment or other pipeline items. Bolts shall be sized in accordance with ANSI B16.1. Welding shall conform to AWWA C207. The inside diameter of all flanges shall be no more than 3/16-inch greater than the outside diameter of the steel cylinder. Flanges shall be welded to the cylinder without warping and with flange face perpendicular to the longitudinal axis of the cylinder.
 - b. Where ductile pipe joins with steel cylinder pipe, the steel flange is to be modified to be compatible, in pressure rating and configuration, with the ductile iron pipe. Provide insulating flanges with two cathodic test stations for buried ductile iron to steel connections.
 - c. Exposed metal on the flanges shall be coated in accordance with Section 09960. In addition, buried flanges, couplings and other mechanical connections shall be double-wrapped with polyethylene encasement, AWWA C105 and extended to overlap the cement mortar coating with edges of the encasement taped with PVC tape.
7. Gaskets: SBR rubber OR Sewage and grease-resistant NBR (Nitril or Buna-N), 1/8-inch thick.
8. Interior Bracing: Each section of pipe 24 inch and larger shall have adequate interior bracing to prevent the pipe from being deformed during handling, transportation, storage, and installation. Bracing shall not be removed until construction operations are complete.
9. Factory Testing: Perform hydrostatic pressure tests of pipe and tests of specials in accordance with Section 5.2 of AWWA C200. Test methods are subject to the favorable review of the Engineer.
10. Marking: Cylinders and completed pipe and fittings shall be marked in accordance with AWWA C200-97, Section 6.1. The manufacturer shall maintain records that identify the cylinder used for all completed pipe and fittings. All test results and other documentation required to be furnished to the Engineer shall identify the cylinders and completed pipe and fittings by use of this marking system.
11. Interior Moisture Control: Maintain interior moisture and provide plastic sheet end caps during storage and transportation.
12. Protective Coating: Exposed steel at joints, flanges, and other locations shall be painted with 10 mils dry film thickness of high build epoxy. Tremec Series 104 or equal.

McKinleyville Community Services District 15050 - 17 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

2.04 PIPE COUPLINGS AND FLEXIBLE PIPE PIECES

- A. General:** For typical pipe joints refer to pipe material specifications. Other joint devices shall be furnished where called for on the Drawings and as specified below.
- B. Flexible Couplings and Flange Coupling Adaptors:**
1. Sleeve: Cast iron or fabricated steel.
 2. Followers: Cast iron, ductile iron, or steel.
 3. Sleeve Bolts: ASTM A225, Type 3; malleable iron; or equivalent, except for buried and submerged, which shall be Type 304 stainless steel and Type 316 stainless steel, respectively.
 4. Coating: High-build epoxy line and coat sleeve and followers.
 5. Pressure Rating: The test pressure of the applicable service or 50 psi, whichever is greater.
 6. Performance: Longitudinal movement and angular deflection capabilities shall meet AWWA C219.
 7. Flanged Coupling Adaptor Flanges: Match mating flanges. If required by connecting valve or other device, provide flanges with inside diameter equal to nominal pipe diameter.
 8. Buried Flexible Coupling Sleeve: Long barrel; Smith-Blair 442, Dresser Style 40; or equal.
 9. Manufacturers:
 - a. Flexible Couplings:
 - 1) Connecting Pipe with Identical Outside Diameters: Smith-Blair 411 or 441; Dresser Style 38 or 138; or equal.
 - 2) Connecting Pipe with Slightly Different Outside Diameters: Smith-Blair 413 or R441; Dresser Style 62; or equal.
 - b. Flange Coupling Adaptors: Smith-Blair 912 or 913; Dresser Style 128-W; or equal.
 10. Gaskets: SBR rubber or oil and grease resistant (Nitril or Buna-N).
 11. Joint Restraint: Provide joint harnesses (tie rod lug or attachment plate assemblies) designed for the test pressure or 50 psi, whichever is greater, across all flexible couplings and flange coupling adaptors, except where specifically indicated otherwise on the Drawings. For steel pipe the joint harness shall conform to the requirements of Chapter 13 of AWWA M-11, Table 13-4 - Tie Bolt Schedule for Harnesses Joints. Anchor studs may be used on flange coupling adaptors for pipe up to 12 inches in diameter.
 12. Protection for Buried Couplings, Dismantling Joints and Adaptors:
 - a. Double-wrap with polyethylene encasement, AWWA C105 and tape the edges of the encasement with PVC tape.
- C. Dismantling Joint:**
1. General: The Dismantling Joint shall be a self-contained flanged restrained joint fitting, including both flanged components and sufficient harness bars to withstand the imposed thrust complying with AWWA C219 where applicable. The Dismantling Joint shall be furnished as a complete assembly consisting of spigot piece, flange adaptor, tie bars and gasket. The gasket seal and compression stud and nut arrangement shall be separate and independent of the tie bar restraint system.
 2. Performance: No less than 5 inches of longitudinal adjustment and installed with 4 inches of inward adjustment and 1 inch of expansion.
- Piping, Valves, and Accessories 15050 - 18 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
- © 2014 Kennedy/Jenks Consultants

- Pressure Rating: 150 psi.
3. Spigot Piece and Flange Adapter: Steel.
 4. Exterior Fasteners: All exterior fasteners including the bars shall be Type 316 stainless steel. The bar diameter shall be equal to the corresponding bolt diameter of the mating flange.
 5. Flanges: AWWA C207 Class D.
 6. Coating: Coated inside and out with a fusion bonded epoxy coating applied to a DFT thickness of 5 to 10 mils. The epoxy shall comply with the requirements of AWWA C550 and AWWA C213. Stainless steel fasteners and tie bars shall not be painted.
 7. Gaskets:
 - a. Flanged gaskets shall be full faced gaskets SBR, 1/8-inch thick.
 - b. Wedge gaskets shall be EPDM Grade 199, Buna-S or Buna-N.
 8. Manufacturer: The dismantling joint shall be Style 131 as manufactured by Dresser Industries/SVE or equivalent by Romac; or equal.
- D. Mechanical Groove Couplings:**
1. Application: Mechanical couplings (segmental clamp joints) shall be used wherever shown on the Drawings. They may be substituted for flanged joints on steel pipe if favorably reviewed by the Engineer and may be substituted for flanges on ductile iron pipe to the extent permitted under the ductile iron pipe specification.
 2. Type: AWWA C606, pressure rated at least 300 psi.
 3. Joints: Cut groove, except shoulder joints may be used for steel pipe where the wall thickness of the pipe is less than that allowed by Table 4 (AWWA C606). Only Type B, Type C, and Type D special ends are acceptable for shoulder joints.
 4. Grooves:
 - a. Ductile Iron Pipe where Mechanical Groove Couplings are shown on the Drawings: Flexible joint, Table 2 (AWWA C606).
 - b. Ductile Iron Pipe where Flanges are shown on the Drawings: Rigid joint, Table 3 (AWWA C606).
 - c. Steel Pipe: Table 4 (AWWA C606).
 5. Gaskets: EPDM. Use Nitrile for oil service.
- E. Flexible Connectors:**
1. Up to 12-inch-Diameter:
 - a. Type: Built-up, single arch (unless otherwise shown on Drawings) rubber expansion joints with full rubber flanges and retainer rings. Provide filled arch-type or wide flowing arches on raw sewage, sludge, and grit service.
 - b. Materials: Neoprene cover over nitrile tube, reinforced with nylon or polyester body and galvanized steel retainer rings. Pressure Rating: 190 psi.
 - c. Manufacturers:
 - 1) Standard: Proco Series 230; Holz Type 200; Garlock Style 200HP; or equal.
 - 2) Concentric Reducers: Proco RC Series; Holz 200TC
 - 3) Eccentric Reducers: Proco RE Series; Holz 200TE
 - 4) For connections to plastic piping systems provide connectors with additional flexibility as recommended by the manufacturer. Proco Series 261R; Holz Type 320EZ; or equal.
- McKinleyville Community Services District 15050 - 19 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
- © 2014 Kennedy/Jenks Consultants

2. Larger than 12-inch-Diameter:
- Type: Built-up, single arch (unless otherwise shown on Drawings) filled arches with full rubber flanges and retaining rings.
 - Materials: Neoprene cover over nitrile tube, reinforced with nylon or polyester body and galvanized steel retainer rings. Protect cover with Hypalon paint where exposed outdoors.
 - Pressure Rating: 80 psi.
 - Manufacturers:
 - Standard: Proco Series 230; Holz Type 200, Garlock Style 200HP, or equal.
 - Concentric Reducers: Proco RC Series; Holz 200TC
 - Eccentric Reducers: Proco RE Series; Holz 200 TE
 - For connections to plastic piping systems provide connectors with additional flexibility as recommended by the manufacturer. Proco Series 261R; Holz Type 320EZ; or equal.
3. High Pressure Applications:
- Type: Fixed-flange, bellows type with integral flow liner and limit rod lugs.
 - Materials:
 - Flanges: Carbon steel conforming to ASTM A36
 - Belows: Laminated ASTM A240 Type 304 stainless steel.
 - Flow Liner: ASTM A240 Type 304 stainless steel.
 - Limit Rods: ASTM A307 bolts, A563 nuts.
 - Pressure Rating: 300 psi minimum.
 - Connections: 300 lb. drilled in conformance with ANSI B16.5.
 - Manufacturer: Hyspan Model 5501R; Microflex; or equal.
4. Restraint: Provide galvanized steel control rod-compression sleeve assemblies for all flexible spools, except where pipelines cross structural expansion joints or where specifically omitted by note in the Drawings.
- Number and size of control rods shall be as required for the test pressure of the pipe system or 50 psi, whichever is greater.
5. Provide full-size intermediate metal pipe flanges where rubber spool connects with wafer style valves, lug style valves or other pipeline items that do not have full-face metal flanges.

F. Flexible Metal Hose:

- Braid enclosed corrugated metal hose with factory attached ends with male pipe threads in sizes to 1½ inch and with flanges for sizes 2 inch and larger. Units shall have minimum live length as recommended by the manufacturer for maximum misalignment of ½ inch unless larger misalignment requirement is shown on the Drawings.

2. Minimum Pressure Ratings:

Service	Minimum Working Pressure (psi)
Compressed Air	300
Fuel Oil	200
Water	150
Engine Exhaust	25 at 1,500 feet.

- Material: AISI Type 316 ELC stainless steel.
- Manufacturers: Flexonics Series 401; Anaconda Type LW and BW; or equal.

Piping, Valves, and Accessories 15050 - 20 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

2.05 CONNECTION DEVICES FOR SEWERS

- Transition Couplings: Transition couplings shall be elastomeric plastic or synthetic rubber-resistant to sewage and grease, chemical and normal sewer gases. Couplings shall be designed to slip over the outside of the pipes being connected with a snug fit. Couplings shall be held in place and sealed with a stainless steel band clamp around each end. Couplings shall be specifically manufactured for making the transition between various types of pipe with different outside diameters. Couplings shall meet the requirements of the Uniform Plumbing Code. Fernco; Indiana Seal; or equal.
- Transition Donuts: Transition donuts shall be elastomeric plastic resistant to sewage and grease, chemicals and normal sewer gases. They shall be designed to be inserted into the bells of sewer pipe to adapt the bell to accept the spigot of a smaller size pipe. They shall have reversed fins on the inside and outside to grip the bell and spigot. Transition donuts cast or grouted into concrete pipe or manhole sections shall have an outside diameter at least 2 inches greater than the inside diameter. Fernco; Indiana Seal; or equal.
- Manhole Adaptors: Manhole adaptors shall be SBR rubber manhole waterstops for use with PVC sewer pipe, Fernco, or equal.
- Flexible Manhole Connectors: ASTM C923.
- House sewer service lateral connections between existing pipe and cast iron soil pipe replacement pipe shall be made with rubber couplings and elastomeric bushings sealed with stainless steel banks; Calder couplings as manufactured by Joints, Inc.; Fernco; or equal.
- Other Devices: Other equivalent connection devices will be considered provided that they are made of elastomers resistant to sewage and grease, chemicals and normal sewer gases. Metallic parts shall be stainless steel.

2.06 VALVES AND ACCESSORIES

- Valve and Accessory System Designation: Most valves and accessories to be furnished and installed are identified by a valve and accessory system designated by a letter symbol in the Piping Schedule.
- General Requirements for Valves:
 - All valves of each type shall be the product of one manufacturer.
 - All exposed valves shall be furnished with operators, handwheels, levers, or other suitable type wrench including handles as specified herein or as shown on the Drawings. Valves 4-inch and larger located more than 7 feet above the floor level shall be furnished with chain operators. Chains shall be galvanized and shall extend to within 3 feet of the floor. Provide hook so that chain may be stored clear of walkways. All buried valves shall be provided with 2-inch-square operating nut and valve boxes.
 - All threaded stem valves shall open by turning the valve stem counter-clockwise.
 - All exposed valves and valve operators shall have a non-bleeding shop coat, unless otherwise specified. Buried valves and operators shall be painted with System 8 as specified in Section 09960.

McKinleyville Community Services District 15050 - 21 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

5. Pneumatic Valve Actuators: Conform to AWWA C504 and AWWA C540 as modified herein. Cylinder bodies, heads, and ends fabricated from plastic, fiberglass, or other non-metallic materials will not be acceptable.
6. Open-Close Electric Motor Valve Actuators: Comply with AWWA C540.
 - a. Valve opening/closing time shall be 40 seconds.
 - b. Provide integral electric controls for open-close service including reversing starter, limit switches, torque switch, indicating lights and local-off-remote switch. Comply with AWWA C540. The motor shall be reversible, squirrel cage induction rated for 480 volts, 3-phase, 60 Hz with Class "F" insulating system. The motor shall be totally enclosed and nonventilated with all leads terminating within the limit switch compartment. The motor shall be of sufficient size to open or close the valve at 200 percent of maximum required breakaway torque. The motor shall operate at ± 10 percent of rated voltage and shall be sufficient for one complete cycle without exceeding its temperature rating.
 - c. Provide auxiliary contacts for remote monitoring of "open," "close," and "ready" indication. Ready indication shall be indicated when the valve selector is in the "remote" position.
 - d. Manufacturer: Auma; Limitorque; Rotork; EIM; or equal.
7. Modulating Electric Motor Valve Actuators:
 - a. Motor operated valve control shall include motorized actuator with motor, solid state modulating controller, electro-mechanical starter, operator unit gearing, limit switch gearing, limit switches, torque switches, declutch lever and auxiliary handwheel as a self-contained unit in a NEMA 4 enclosure. Valve opening/closing time shall be 60 seconds. Valve actuator shall be rated for at least 100 starts per hour.
 - b. The motor shall be reversible, squirrel cage induction rated for 460 volts, 3-phase, 60 Hz with Class "F" insulating system. The motor shall be totally enclosed and nonventilated with all leads terminating within the limit switch compartment. The motor shall be of sufficient size to open or close the valve at 200 percent of maximum required torque. The motor shall operate at ± 10 percent of rated voltage and shall be sufficient for one complete cycle without exceeding its temperature rating.
 - c. The drive unit shall be a multiple reduction unit with power gearing consisting of spur, helical and worm gearing. The spur/helical gears shall be made of treated steel. The worm shaft shall be of hardened alloy steel with the threads ground after heat treating. The worm gear shall be of alloy bronze accurately cut with a hobbing machine. All power gearing shall be grease lubricated and accurately machine cut. Ball or roller bearings shall be used throughout. Non-metallic or cast gearing shall not be allowed.
 - d. Limit switches and gearing shall be an integral part of the valve control. The limit switch gearing shall be of the intermittent type, totally enclosed in its own gear case, grease lubricated to prevent dirt and foreign matter from entering the gear train and shall be made of stainless steel. Limit switches shall be of the adjustable type capable of being adjusted to trip at any point between fully opened valve and fully closed valve positions.

Piping, Valves, and Accessories

15050 - 22

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004'00

© 2014 Kennedy/Jenks Consultants

- e. Each valve control shall be provided with minimum limit switches as shown on the Drawings. Geared limit switches must be geared to the driving mechanism and in step at all times whether in motor or manual operation.
 - f. Operator shall include a "hand," "remote" selector switch and "open," "close" pushbuttons and indicating lights indicating status as well as a mechanical attachment to indicate valve position.
 - g. The actuator shall contain an integral modulating controller capable of receiving a 4-20 mA input (command) signal corresponding to a valve position. The modulating controller shall include an integral control power transformer. The actuator shall automatically adjust the position of the valve when the error in the comparison to feedback is greater than the preset or field adjusted deadband of the modulating controller.
 - h. The modulating controller shall compare the command signal with a position feedback potentiometer and position the actuator to the appropriate position. The modulating controller shall have the following features:
 - 1) Input signal: 4-20 mA that shall cause a movement of actuator for an adjustable range throughout the fully open to fully closed position. For example, the range should be adjusted from 20 percent to 80 percent of full open.
 - 2) Zero and span adjustment.
 - 3) At a loss of signal, the actuator shall maintain last position except where designated otherwise in the plans and specifications.
 - 4) Two-wire position transmitter calibrated 4-20 mA 0-100 percent travel.
 - 5) Auxiliary contacts for remote monitoring of "open," "close," and "ready" indication. Ready indication shall be indicated when the valve selector is in the "remote" position.
 - i. The solid state starter shall be reversing type not susceptible to power line surges and spikes and shall be tested in accordance with IEEE 887.
 - j. The solid state starter shall be rated for continuous modulating service. A permanently attached handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operation but must be responsive to manual operation at all times except when being electrically operated. The motor shall not rotate during hand operation, nor shall a fused motor prevent manual operation. When in manual operation position, the unit will remain in this position until motor is energized at which time the valve operation will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. This movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever that will disengage the motor and motor gearing mechanically but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running.
 - k. Manufacturer: Limitorque; Auma; Rotork; EIM; or equal.
- C. General Requirements for Accessories: Pressure Gauges: Provide shutoff valves for all pressure gauges. Conform to additional requirements in this Section below.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004'00

15050 - 23

Piping, Valves, and Accessories

© 2014 Kennedy/Jenks Consultants

- D. Valve and Accessory Systems: See Piping Schedule on the Drawings.
1. **Valve and Accessory System A:** Applicable Service Condition: Clean Water.
- a. Gate Valves through Size 2 inch:
 1) Rating: 200 psi WOG.
 2) Type: Rising stem, screw in bonnet, solid wedge disc, handwheel operated.
 3) Connections: Threaded.
 4) Materials: All bronze, UNS 83600, ASTM B62, B505 or B584.
 5) Manufacturers: Jenkins Figure 810J; Crane No. 428; or equal.
- b. Gate Valves 2½ inch through 12 inch:
 1) Rating: 200 psi WOG.
 2) Type: Rising stem, O.S. and Y, solid wedge, handwheel operated.
 3) Connections: Flanged, 200 psi WOG.
 4) Materials: Cast iron, UNS 83600, bronze trimmed.
 5) Manufacturers:
 a) Jenkins Figure 651A; Crane No. 465 1/2; or equal.
 b) For system pressure above 200 psi, provide Jenkins Figure 20J; Crane 7-1/2 E; or equal.
- c. Resilient Seated Gate Valves, 3 inch through 16 inch.
 General: Comply with AWWA C509 or C515 except where otherwise specified herein. Valve shall be epoxy lined and coated.
 1) Rating: 200 psi.
 2) Type: Rising stem, OS&Y, handwheel operated except for buried service use non-rising stem with operating nut.
 3) Connections: Flanged.
 4) Manufacturers: U.S. pipe Metrosel; Clow; or equal.
 5) Gate Valves through size 3 inch:
 1) Rating: 300 psi WOG.
 2) Type: Union bonnet, handwheel operated, straight or angle pattern.
 3) Connections: Threaded.
 4) Materials: All bronze, ASTM B62 Alloy 83600 and ASTM B16 except disc shall be Teflon.
 5) Manufacturer: Jenkins 106A; Crane 7TF; or equal.
- e. Ball Valves through size 4 inch in metal piping:
 1) Rating: 400 psi WOG.
 2) Type: Lever.
 3) Connections: Threaded.
 4) Materials: Bronze body ASTM B584 Alloy 83600 or 84400, chrome-plated ball, Teflon seats.
 5) Manufacturers: Apollo 70-100; Watts B-6000; or equal.
- f. Swing Check Valves through size 2 inch:
 1) Rating: 300 psi WOG.
 2) Type: Swing, composition disc.
 3) Connections: Threaded.
 4) Materials: All bronze, ASTM B62 body, ASTM B61 and B584 Alloy 87600 other bronze parts, except disc shall be Teflon.
 5) Manufacturers: Jenkins 352; Crane 141; or equal.

Piping, Valves, and Accessories 15050 - 24 McKinleyville Community Services District
 Wastewater Management Facility Improvements
 Bid Set 1368004*00
 © 2014 Kennedy/Jenks Consultants

9. Swing Check Valves 2 inch through 12 inch:
 Rating: 175 psi
 1) Type: Swing, metal seats, outside spring and lever, AWWA C508.
 2) Connections: Flanged, 125-pound ANSI.
 3) Materials: Cast iron, bronze trim.
 4) Manufacturers: M & H Style 259; equivalent by Clow; or equal.
- h. Twin Element Check Valves:
 General: Lug type or water type, designed to fit between ANSI flanges. Provide where shown on the Drawings.
 Design: Valve shall have two movable elements, called doors, which provide a tight shutoff when there is no flow in the pipe. The twin doors shall be spring loaded by means of a heavy-duty stainless steel torsional spring. The doors shall open when there is flow in the pipe. As the flow is reduced, the doors shall slowly close and shut tight when the flow is reduced to zero velocity. The entire assembly shall be designed to close without slamming.
 Materials:
 3) a) Seat: Buna N rubber, mounted on the body.
 b) Body: Cast steel, ASTM A216 WCB or ductile iron, ASTM A536.
 c) Doors: Cast steel, ASTM A216 WCB; or aluminum bronze, ASTM B148 C95200.
 d) Spring, Hinge Shaft, and Stop Shaft: Type 316 stainless steel.
- i. Manufacturers: Duo-Chek, by TRW Mission Manufacturing Company; Double Door Check Valve, by APCO; or equal.
 Globe Style Silent Check Valves 3 inch and larger:
 1) Rating: 200 psi through 12 inch; 150 psi above 12 inch size.
 2) Headloss: Not more than 2.5 ft. at 8 ft./sec. velocity.
 3) Type: Center guided plug with spring operated shut-off.
 4) Connections: Flanged, 125-pound ANSI. If connecting flanges are not full-face metal flanges, provide intermediate flanges where required to retain valve seat.
- 5) Materials: Cast iron, bronze trim, stainless steel spring.
 6) Manufacturers: APCO Series 600; Valmatic 1800 Series; or equal.
- j. Pressure Gauge Assembly:
 1) Complete assembly shall include isolation valve, pulsation dampeners or snubbers. Provide a support plate to the nearest flange.
 2) Pressure gauges shall have a dial size not less than 4½ inches, phenolic or polypropylene case, stainless steel movement, phosphor bronze or stainless steel bourdon tube, 0.5% accuracy (ASME B40.100 Grade 2A), friction mounted adjustable pointer, black figures on white dial, glass or acrylic window. Label face of dial to identify unit of measurement. If vibration is present: gauge case shall be liquid filled with glycerin or silicone. If vibration is not present: gauges will be a field fillable design. Process connection size shall be as shown on Drawings (1/2 NPT recommended). Complete gauge shall be Ashcroft 1279; Tertrice Series 450; WIKA Type 222.34; or equal.

McKinleyville Community Services District 15050 - 25 Piping, Valves, and Accessories
 Wastewater Management Facility Improvements
 Bid Set 1368004*00
 © 2014 Kennedy/Jenks Consultants

- 3) Isolation valves shall be Type 316 stainless steel needle valves (unless ball valves are shown on the Drawings); Ashcroft 7004L; Terice 735 or 740; WIKA Type 910.11.200; or equal.
- 4) Porous pressure snubbers shall be stainless steel for the specific service involved. Porosity of media shall be suitable for the fill fluid and range of operating pressures. Pressure snubbers shall be Ashcroft 25-1112S or 50-1112S; Terice No. 872; WIKA Type 910.12.100 or equal.
- k. Strainers:
- 1) Rating: 125 psi.
 - 2) Type: Y-type basket strainers, 20 mesh.
 - 3) Connections: Threaded or flanged.
 - 4) Materials: Iron body, stainless steel screen.
 - 5) Manufacturers: Bailey 100A; Hoffman Series 400, 450; or equal.
 - 6) Installation: Each to be complete with ball valve on blowoff and piping to drain.
- l. Solenoid Valves: Valves shall be for 150-psi water pressure, 120-volt ac service, with a watertight enclosure. Valve body shall be brass, seats Buna-N, with stainless steel plug. Valves shall be normally closed except where noted otherwise. Provide manual override control. Valves shall be ASCO Bulletin 8211; Skinner L or R Series; or equal.
- m. Pressure Reducing Valves:
- 1) For Water:
 - a) Self-Contained: Watts No. USB for low flows or 223B for flows to 170 gpm; Cashco Model D for low flows or Model 8310 HP, DS for flows to 170 gpm.
 - b) Provide strainers with stainless steel screens for each pressure reducing valve unless otherwise noted.
 - c) Sizes, capacities and pressures shall be as noted on the Drawings.
 - 2) For Air: Valves shall have an adjustable range from 3 to 125 psi with integral gauges. Valves shall be as manufactured by Wilkerson Model 2001 or 2015; Parker Hamlin 2000; 4000, or 6000 Series; or equal. See Drawings for sizes, capacities, and pressure reduction.
- n. Globe Style Pilot Controlled Valves (FCV-8354):
- 1) Rating: 175 psi.
 - 2) Type: Hydraulic pilot controlled, globe style for maintaining a maximum upstream pressure by bypassing flow through the valve. Initial pressure relief setting shall be 90 psig. Relief pressure shall be field adjustable. Connections: Flanged, 125-pound ANSI.
 - 3) Materials: Iron body with fusion epoxy lining, stainless steel and/or bronze trim, Buna-N elastomers.
 - 4) Manufacturers: Cla-Val; OCV; Watts; Singer; or equal.
- o. Rotameters: Provide Type 316 stainless steel housing or frame and a calibrated borosilicate glass metering tube with float. The float shall be of a material and shape suitable for the process fluid. The tube shall be readily field removable for cleaning. All other wetted parts shall be Type 316 stainless steel, except O-rings shall be Teflon unless otherwise recommended by the manufacturer for the process fluid

Piping, Valves, and Accessories 15050 - 26 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

specified. End fittings shall be chosen to suit the process fluid and the installation requirements in the field. The metering scale shall be a nominal 250 mm in length with GPM graduations. Meters shall have a minimum rangeability of 10:1. Accuracy shall be ± 2 percent of full scale for flow rates in the upper 90 percent of the maximum flow range specified. Rotameters shall be manufactured by Brooks Instrument; SK Instrument; Wallace & Tieman; Fischer & Porter; or equal.

p. Butterfly Valves:

- 1) Standard: AWWA C504, except as modified herein.
- 2) Type:
 - a) 3 inch through 12 inch: Wafer body, except short body flanged or mechanical joint where shown on the Drawings, or where buried.
 - b) 14 inch through 72 inch: Short body flanged or mechanical joint where shown on the Drawings.
 - c) Geared operator, resilient seated, 90° seating.
- 3) Pressure Class:
 - a) 3 inch through 12 inch: 150 psi.
 - b) 14 inch through 72 inch: 150 psi, unless shown otherwise on the Drawings.
 - c) Valves shall be leak-tight at rated pressure in either direction.
- 4) Materials:
 - a) Body: Cast Iron; ASTM A126, Class B, or ASTM A48, Class 40.
 - b) Disk: Cast or ductile iron with Ni-Chrome or Type 316 stainless steel edge.
 - c) Valve Shaft: Type 304 or Type 316 stainless steel.
 - d) Seats: Buna-N.
- 5) Construction:
 - a) Seats: Applied to body. Cartridge type seats with retaining rings are not acceptable.
 - b) Disk to Shaft Connection: Stainless steel taper pins or torque plug.
 - c) Valve Diameter Limitation: Internal diameter of valve at the throat shall be no less than the nominal diameter of the valve less 1½ inches.
 - d) Bearings shall be self-lubricating and corrosion-resistant.
- 6) Finish:
 - a) Exposed Exterior: Shop prime compatible with field applied finish coats. Refer to Section 09960.
 - b) Buried Exterior: Shop coat with high-solids epoxy, 12 mils minimum.
 - c) Interior: Shop line with two-component, high solids epoxy, AWWA C550.
- 7) Testing: Test in accordance with AWWA C504, except that leakage test shall be in both directions. Submit certified test results for tests specified in Section 5.2 for valves 24 inches and larger.

McKinleyville Community Services District 15050 - 27 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- 8) Actuators:
- Type: Manual, except where specified otherwise, or shown otherwise on the Drawings. Provide valve position indicators on all actuators.
 - Manual Actuators: Traveling nut, self-locking, or worm gear above 48 inches.
 - Buried: Designed for buried service, watertight up to 10 psi. Provide 2-inch-square standard AWWA operating nut, with extension stem to reach the ground surface as shown on the Drawings, and with a ground level position indicator.
 - Provide three valve operator tee handles to the Owner.
 - Pneumatic: See paragraph 2.05B.5
 - Motor: See paragraph 2.05B.6-7.
- 9) Manufacturer:

Size Range (Inches)	Type	First Name	Second Name or Equal
3 inch to 12 inch	Wafer	Pratt, MKII	-
3 inch to 20 inch	Flanged	Pratt, 2FII	DeZurik, BAW
24 inch to 72 inch	Flanged	Pratt, XR-70	DeZurik, BAW
Buried 6 inch to 48 inch	Flanged	Pratt Groundhog	DeZurik, BAW

- q. Temperature Control Valves (Three-Way Valve): Provide self-actuated, temperature regulating three-way valve.
- Temperature Measurement Range:
 - Nominal Range: 30 degrees Fahrenheit to 115 degrees Fahrenheit.
 - Working Range: 85 degrees Fahrenheit to 110 degrees Fahrenheit.
 - Connections: Flanged.
 - Materials:
 - Body: Bronze.
 - Valve Stem: Stainless steel.
 - Poppet Spring: Stainless steel.
 - Capillary: 304 stainless steel with stainless steel braid.
 - Sensing Bulb: 316 stainless steel.
 - Separable Well: Stainless steel.
 - Thermometer: Dial type.
 - Manufacturers: Dwyer 38R, Terlice 91400; or equal.
 - Temperature Gauges:
 - Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.
 - Gauge Temperature Range:
 - Hot Water: 30°F to 240°F with 2°F scale divisions.
 - Dial Type Thermometers: Bi-metal type, 5-inch white dial with black markings, stainless steel case, ring and stem; window of shatterproof glass, adjustable angle stem of length suitable for piping system.

Piping, Valves, and Accessories 15050 - 28 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- Thermometer Wells: Same manufacturer as thermometers, brass or stainless steel, pressure rated to match piping system design pressure, extended type where pipe is insulated.
Sensor insertion depth shall be less than 3 inches.
- Air Valves:

Standard: AWWA C512, except as modified herein.

 - Air Release Valves (ARVs):
 - Function: Releases accumulated air under pressure at pipeline high points.
 - Materials: Cast or ductile iron body, stainless steel float.
 - Pressure Rating: 150 psi.
 - Manufacturers: APCO Series 200; equivalent by Valmatic; or equal.
 - Air and Vacuum Valves (AVVs):
 - Function: Exhausts large volumes of air during pipeline filling and allows air back in when pipeline pressure drops below atmospheric pressure.
 - Provide slow closing Surge Check below air valve consisting of a globe style, sliding disc spring return valve.
 - Materials: Cast or ductile iron body, stainless steel float.
 - Pressure Rating: 150 psi.
 - Manufacturers: APCO Series 140 or 150; equivalent by Valmatic; or equal.
- Combination Air Valves (CAVs):
 - Function: Exhausts large volumes of air during pipeline filling, releases accumulated air under pressure and allows air back in when pipeline pressure drops below atmospheric pressure.
 - Provide slow closing Surge Check below air valve consisting of a globe style, sliding disc spring return valve.
 - Materials: Cast or ductile iron body, stainless steel float.
 - Pressure Rating: 150 psi.
 - Manufacturers: APCO Series 140C or 150C; equivalent by Valmatic; or equal.
- Valve and Accessory System B:
 - Applicable Service Conditions: Sludge, drainage, sewage and wastewater at working pressures to 100 psig.
 - Plug valves 2-inch and larger:
 - Rating: 175 psi through 12 inch; 150 psi 14 inch through 36 inch; 125 psi 42 inch and larger.
 - Type: Resilient faced eccentric plug, lever operated 4 inch and smaller, worm geared handwheel operated 6 inch and larger, or pneumatically actuated as shown on the Drawings. Valves shall provide drip-tight shutoff in both directions.
 - Connections: Flanged, 125-pound ANSI, except screwed connections may be used for 2-inch valves.

McKinleyville Community Services District 15050 - 29 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- 4) Materials: Cast iron body, welded nickel seat, NBR or Buna-N coated plug, NBR or Buna-N packing or U-cup stem seal. Valves shall have interior and exterior metal surfaces other than the plug and valve seat coated with two coats of high-solids epoxy with total dry film thickness 12 mils minimum.
- 5) Manufacturers: DeZurik PEC, Milliken, Clow Eccentric Plug Valve, or equal.
- 6) Installation: Unless otherwise necessary for proper installation or permitted by Engineer, all eccentric plug valves shall be installed with shaft horizontal and with plug in upper half of body. Valves in sewage lines shall be installed with seat on upstream end.
- c. Check Valves: General: Unless specifically called out otherwise by the Drawings or Specifications, provide swing- type check valves. Swing check valves shall be as specified above for System A.
- d. Ball Check Valves:
 - 1) Rating: 125-pound class.
 - 2) Type: Ball.
 - 3) Connection: Flanged, 125-pound ANSI.
 - 4) Materials: Cast iron body with nitrile or phenolic ball.
 - 5) Manufacturers: Flygt HDL, Flomatic Type 50, or equal.
- e. Pinch Valves:
 - 1) Pressure: Rating 75 psi.
 - 2) Type: Enclosed body.
 - 3) Connections: 125 psi flanged.
 - 4) Materials: Cast-iron body, nylon reinforced neoprene sleeve.
 - 5) Operator: Handwheel.
 - 6) Manufacturers: Red Valve Company, Series 75; Flexible Valve Corporation, Series 6200; or equal.
- f. Knife Gate Valves: Wafer type suitable for long term use with raw sewage with minimum working pressure ratings as follows: 2 inch to 36 inch = 90 psi; 42 inch to 54 inch = 50 psi. DeZurik Figure KGL; equivalent model by Fabrilvalve; or equal.
 - 1) Materials:
 - a) Wetted Parts: AISI Type 304 stainless steel. Body may be Class 25 gray iron.
 - b) Valve Stem: AISI Type 304 stainless steel.
 - 2) Wafer Flanges: ANSI B16.1 Class 150 drilled. Flange holes may either be tapped or be drilled through the valve body. Bolts and nuts to be ASTM A276 stainless steel.
 - 3) Protective Coating: All non-stainless steel surfaces shall be coated with a minimum thickness of 16 mils epoxy.
 - 4) Seat/Seal Material: Chloroprene, sewage and grease resistant.
 - 5) Packing: PTFE impregnated synthetic fiber.
 - 6) Operator: Each valve to be factory equipped with a hand wheel operator.
 - 7) Testing: Each valve shall be factory tested.
- g. Temperature Gauges:
 - 1) Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

Piping, Valves, and Accessories 15050 - 30 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- 2) Gauge Temperature Range:
 - a) Sludge: 30°F to 240°F with 2°F scale divisions.
- 3) Dial Type Thermometers: Bi-metal type, 5-inch white dial with black markings, stainless steel case, ring and stem; window of shatterproof glass, adjustable angle stem of length suitable for piping system.
- 4) Thermometer Wells: Same manufacturer as thermometers, brass or stainless steel, pressure rated to match piping system design pressure, extended type where pipe is insulated.
- 5) Sensor insertion depth shall be less than 3 inches.
- h. Pressure Gauges:
 - 1) Unless indicated otherwise, use wafer style, Red Valve™ Series 40 or Ashcroft Type 80 or 81, pressure sensor ring with 2.5-inch diameter steel cased pressure gauge with pressure range equal to approximately twice the pressure rating of the pumping system.
 - 2) When indicated on the drawings or for Valve System C applications, use Type 2 pressure gauge consisting of the following materials: Complete installation, unless otherwise shown, shall include ¾-inch plug valve isolation at the main, a diaphragm seal made specifically for solids handling service, a snubber if over 5 psi operating pressure and gauge. Provide a support plate to the nearest flange.
 - 3) Plug Valve: Shall be DeZurik PEC; Val-Matic 5800 or equal. Connections shall be threaded.
 - 4) Diaphragm Seal: Shall be for slurry service with flushing connection. Body shall be stainless or carbon steel. Diaphragm shall be oversized and be removable of Type 316 stainless steel. Complete unit shall be Terice Series 600, Ashcroft Model 100; or equal.
 - 5) Gauges and Snubbers: Shall be as specified for System A.
 - 6) Installation: All protectors and gauge bourdon tubes shall be evacuated of air, silicone filled at the factory and factory calibrated.
- i. Air Valves:
 - 1) Standard: AWWA C512, except as modified herein.
 - 2) Sewage Air Release Valves (SARVs):
 - a) Function: Releases accumulated air under pressure at pipeline high point. Keeps sewage from air openings by incorporating deep body.
 - b) Materials: Cast or ductile iron body, stainless steel float.
 - c) Pressure rating: 150 psi.
 - d) Manufacturer: APCO Series 400; equivalent by Valmatic; or equal.
 - 3) Sewage Air and Vacuum Valves (SAVVs):
 - a) Function: Exhausts large volumes of air during pipeline filling and allows air back in when pipeline pressure drops below atmospheric pressure. Keeps sewage from air openings by incorporating deep body.

McKinleyville Community Services District 15050 - 31 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- b) Materials: Cast or ductile iron body, stainless steel float.
- c) Pressure rating: 150 psi.
- d) Manufacturer: APCO Series 400; equivalent by Valmatic; or equal.
- 4) Sewage Combination Air Valves (SCAVs):
 - a) Function: Exhausts large volumes of air during pipeline filling and allows air back in when pipeline pressure drops below atmospheric pressure. Keeps sewage from air openings by incorporating deep body.
 - b) Materials: Cast or ductile iron body, stainless steel float.
 - c) Pressure rating: 150 psi.
 - d) Manufacturer: APCO Series 400; equivalent by Valmatic; or equal
3. **Valve and Accessory System C:** Applicable Service Condition: Sample water, chlorine solution, calcium hydroxide, sulfur dioxide solution.
 - a. Ball Valves Through 4-inch Size:
 - 1) Rating: 150 psi at 75°F.
 - 2) Type: Double union.
 - 3) Connections: Socket.
 - 4) Materials: PVC body, Teflon seats and EPDM O-ring seals, except Viton O-ring seals with chlorine solution.
 - 5) Manufacturers: R&G Sloane, Asahi/America Pro Block, or equal.
 - b. Check Valves Double Union Type:
 - 1) Rating: 150 psi at 75°F.
 - 2) Type: Ball for horizontal or vertical service.
 - 3) Connections: Union ends for socket weld.
 - 4) Materials: PVC body, Viton O-ring seals and seats except provide EPDM for caustic service.
 - 5) Manufacturers: Chemtrol True Union BC, Plastiline No. 8611, or equal.
 - c. Diaphragm Valves:
 - 1) Rating: 150 psi.
 - 2) Type: Weir type diaphragm.
 - 3) Connections: Flanged or true union.
 - 4) Materials: PVC bodies with EPDM/TFE bonded diaphragms.
 - 5) Manufacturers: Asahi/America Type 72, Gemü, or equal.
 - 6) Actuators:
 - a) Type: Manual, except where specified otherwise, or shown otherwise on Drawings. Provide local, visual, valve position indicators on all actuators. Provide manual override on all motor actuators.
 - b) Motor Actuators: Provide motor, limit switches and gearing within a NEMA 4 enclosure. Motor shall be reversible for use with 115V single-phase power. Unit shall accept remote open and close dry contacts and shall include position indicating limit switches for remote indication of open and closed positions.

Piping, Valves, and Accessories 15050 - 32 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- d. Strainers:
 - 1) Rating: 150 psi.
 - 2) Type: Wye-type basket strainers. Strainer screen size as recommended by feed pump supplier.
 - 3) Connections: Threaded.
 - 4) Materials: PVC.
 - 5) Manufacturers: Chemtrol, GF, or equal.
 - 6) Installation: Each to be installed with ball valve blowoff and piping to drain.
- e. Pressure gauges shall be as specified for System B. Provide protector body and diaphragm and isolation valve materials appropriate for the chemical solutions to which they will be exposed.
- f. Plug valves shall be as specified for System B.
- g. Rotameters: Glass tube type as specified for System A except that end fittings shall be Type 316 stainless steel, float shall be Hastelloy C, and retainers shall be Kynar plastic.
4. **Valve and Accessory System D:**
 - a. Applicable Service Conditions: Clean water at pressures to 150 psi and temperatures to 150°F utilizing copper piping.
 - b. Gate Valves through 2½ inch:
 - 1) Rating: 200 psi water.
 - 2) Type: Rising stem, solid wedge.
 - 3) Connections: Solder ends for copper pipe.
 - 4) Materials: All bronze.
 - 5) Manufacturers: Jenkins Figure 991AJ; Crane No. 11700S; or equal.
 - c. Globe Valves through 2½ inch:
 - 1) Rating: 200 psi water.
 - 2) Type: Renewable disc, globe or angle.
 - 3) Connections: Solder ends for copper pipe.
 - 4) Materials: All bronze.
 - 5) Manufacturers: Jenkins Figure 995AJ; Crane No. 1702S; or equal.
 - d. Check Valves through 2½ inch:
 - 1) Rating: 200 psi water.
 - 2) Type: Regrinding swing check.
 - 3) Connections: Solder ends for copper pipe.
 - 4) Materials: Bronze with bronze or brass disc.
 - 5) Manufacturers: Jenkins Figure 997AJ; Crane No. 1707S; or equal.
 - e. Pressure Relief Valves:
 - 1) Rating: 150 psi for valves 2-inch and smaller.
 - 2) Type: Adjustable spring loaded.
 - 3) Connections: Threaded.
 - 4) Materials: Bronze body.
 - 5) Manufacturers: Consolidated 2478; Farris 1400S; or equal.
 - f. Ball Valves shall be as specified under Valve System A.
 - g. Strainers shall be as specified under Valve and Accessory System A.
 - h. Hydronic Hot and Chilled Water System Accessories shall be as specified under Valve and Accessory System K.

McKinleyville Community Services District 15050 - 33 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

5. **Valve and Accessory System E:**
 Applicable Service Conditions: Compressed air to 200 psig.
 Check Valves ½ inch to 2 inch:
 1) Rating: 300 psi.
 2) Type: Lift check with dash pot or spring control.
 3) Material: Bronze body and stainless steel disc.
 4) Manufacturer: Jenkins Figure 54, Crane No. 366E, or equal.
 Moisture Trap and Drainer:
 1) Rating: 200 psi.
 2) Type: Snap action float.
 3) Material: Metallic body; stainless steel or rubber float.
 4) Manufacturer: Armstrong, No. 71A, Wilkerson 5100-4, or equal.
 Pressure Relief Valves: Set valve at 125 psig. Valves shall have O-ring seats, Kunkle 6030; Farris 2856; or equal.
 Ball Valves:
 1) Rating: Class 300.
 2) Materials: Carbon steel body and ball, Teflon seats.
 3) Manufacturer: Neles-Jamesbury, Type 5300; or equal.
 Flexible Connectors: American BOA Type BCT; or equal.
 Pressure Regulator: Norgen 11-004, stainless steel internals; Wilkerson; or equal.
 Air Dryer: Heat Reactivated, Desiccant, 200 psig. Provide moisture indicator, muffled purge; Zeks; Kemp; or equal.
 6. **Valve and Accessory System F:**
 Applicable Service Condition: Aeration air, instrument air.
 Temperature rating: Unless otherwise specified, valves shall be suitable for working temperature range of 45°F to 250° F.
 Expansion Joint:
 1) Type: Bellows.
 2) Connection: Flanged.
 3) Axial movement: As shown.
 4) Materials:
 a) Bellows: Molded PTFE T-62.
 b) Flanges: Ductile iron.
 c) Reinforcing Rings: Stainless steel.
 5) Manufacturers: Proco or equal.
 Ball Valve (sizes 2 inches and smaller):
 1) Type: Lever.
 2) Connections: Threaded.
 3) Materials: Bronze body ASTM B584 Alloy 83600 or 84400, chrome-plated ball, PTFE seats.
 4) Manufacturers: Apollo 70-100; Watts B-6000; or equal.
 Check Valve:
 1) Sizes 2 inches and smaller:
 a) Type: Lift check.
 b) Connections: Threaded.
 c) Materials: Bronze body ASTM B62, PTFE disc.
 d) Manufacturers: Crane Horizontal Lift Check 27TF; Lunkenheimer Series 1616; or equal.

Piping, Valves, and Accessories 15050 - 34 McKinleyville Community Services District
 Wastewater Management Facility Improvements
 Bid Set 1368004*00
 © 2014 Kennedy/Jenks Consultants

- 2) Sizes 2½ inches and larger:
 a) Type: Low-pressure, double-plate, spring-closed designed specifically for low pressure air service.
 b) Pressure class: 150.
 c) Connections: Wafer or lug-wafer.
 d) Materials: Cast-iron body ASTM A126 Class B or ASTM A278 Class 40, aluminum bronze ASTM B148 or stainless steel ASTM A351 Type 316, EPDM seats.
 e) Manufacturers: APCO Series 9000 DDCV; Tyco Gulf Valve Model MB; or equal.
 f. **Pressure Reducing/Regulating Valves:**
 1) General: Pressure reducing/regulating valves shall be self-contained with field adjustable downstream pressure setting.
 2) Type:
 a) Pressure loaded diaphragm.
 b) 2 inch and less: Threaded (NPT).
 3) Connection Pressure Rating: 400 psi.
 4) Materials:
 a) Body: Cast Iron; ASTM A126, Class B.
 b) Cover dome: Cast iron; ASTM A126, Class B.
 c) Trim: Type 17-4 PH stainless steel.
 d) Diaphragm, seats and seals: Selected for compatibility with operating temperatures listed.
 5) Finish: Shop prime compatible with field applied finish coats. Refer to Section 09960.
 6) Manufacturers: Kaye MacDonald or equal.
 g. **Butterfly Valves:**
 1) General: Butterfly valves for aeration air and air scour service shall conform to the following requirements.
 2) Type:
 a) 3 inch through 20 inch: Wafer body, except short body lug wafer where shown as flanged on the Drawings.
 b) Modulating or cyclic duty: Valves shall be double offset disc design.
 c) Valves shall be bubble-tight at rated pressure in either direction.
 3) Pressure Rating: ANSI/ASME B16.5 Class 125/150, unless shown otherwise on the Drawings.
 4) Materials:
 a) Body: Type 316 stainless steel
 b) Disk: Type 316 stainless steel.
 c) Valve Shaft: Type 316 or Type 416 stainless steel.
 d) Seats: EPDM or reinforced PTFE suitable for temperatures up to 350°F.
 5) Construction:
 a) Seats: Reinforced resilient type and field replaceable. If cast iron or carbon steel bodies provided, seats shall act as a body liner to prevent piped fluid from contacting the body casting.

McKinleyville Community Services District 15050 - 35 Piping, Valves, and Accessories
 Wastewater Management Facility Improvements
 Bid Set 1368004*00
 © 2014 Kennedy/Jenks Consultants

- b) Disk to Shaft Connection: Type 316 stainless steel pins or torque plug.
- E. Miscellaneous Valves and Accessories:
1. Hose Bibbs:
 - a. Indoor: Nilco Model 55; Arrowhead Brass Model 353; or equal.
 - b. Outdoor (Non-freezing type): J.R. Smith 5913; Zurn Z-1385; or equal.
 - c. Hose Racks: Suitable for 50 feet of ¾-inch hose.
 2. Link-Type Seals: Link-type seals shall be interlocking synthetic rubber links connected by stainless steel bolts and nuts to form a continuous belt. Tightening of the bolts shall expand the rubber to form a watertight seal of the annular space between a pipe and the hole or sleeve in the wall.
 3. Pipe Service Saddles for PVC Pipe: Service saddles shall be provided where shown on the Drawings. Service saddles shall be the broad band strap type and be suitable for use in service up to 150 psi working pressure and 150°F. Body shall be stainless steel with ¾-inch NPT tap, except where other size is required on the Drawings.
 4. Groundwater Pressure Relief Valves: 4-inch-diameter, cast iron, with removable cover, lead-to-lead seat, internal self-contained lock, and removable grate. Neenah Foundry R-5000-C; Clow F-1492; or equal.
 5. Flexible Rubber Hose:
 - a. General: At each hose rack, provide 50 feet of 1-inch-diameter flexible rubber hose. Also provide hose at other locations where shown on the Drawings. Provide each hose with nozzle, and male and female threaded connectors. Specifically design all hose to resist deterioration due to weather, sunlight, and outdoor exposure, and to hot water or chlorine solution where applicable.
 - b. Nozzles: Provide compatible nozzles on each hose associated with a hose bibb and hose rack. Nozzles shall be brass or bronze. Nozzles for hoses associated with the UW System shall have a 5/16-inch-diameter opening.
 6. Floor Boxes (Bushing Type): Cast iron, installed with top set at finish grade. Floor boxes shall be suitable for 150 lb./ft² live load. Clow Figure F-5695; equivalent product by Mueller; or equal.
 7. Valve Boxes for Buried Valves: Adjustable, cast-iron, screw-type, installed with top set at finished grade. All valve boxes and covers shall be suitable for H20 AASHTO wheel load. Clow Figure F-2454 with Figure F-2476 extension; equivalent products by Mueller; or equal.
 8. Concrete Vaults and Valve Boxes: Precast reinforced concrete, of the size and orientation shown on the Drawings. Unless otherwise shown or noted, all vaults, boxes and their covers shall be designed for H20 AASHTO wheel loads. Steel lids shall be galvanized. Provide Christy, Brooks, or equal.
 9. Valve Tags: Plastic, fiberglass, or plastic material, 2-inch square with grommeted hole. The tags shall be attached to valves with a brass jack chain. For buried installations use a nylon strap. Lettering shall be stamped or cut into the tag at least 3/16-inch high.
 10. Pipe Escutcheons:
 - a. Manufactured wall, ceiling, and floor plates; cast brass, polished chrome plated, with set-screw, deep pattern type where required to conceal protruding fittings and sleeves.

Piping, Valves, and Accessories 15050 - 36 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- b. Inside Diameter: Closely fit around pipe, tube and insulation of insulated piping.
- c. Outside Diameter: Completely cover opening.
- d. One-piece design for piping to plumbing fixtures and to equipment in finished spaces.
- e. Split concealed hinge type for piping not serving plumbing fixtures or equipment in finished spaces.

2.07 THERMAL INSULATION FOR PLUMBING AND PIPING

- A. General:
1. Delivery: Deliver insulation materials to the job in original packages with manufacturer's "R" values clearly shown. Provide certification of compliance.
 2. Warning: The Contractor is warned that working with fiberglass or rock wool materials may constitute a serious health hazard. The Contractor shall take all necessary precautions to ensure the safety of the workers.
 3. Shields: Insulation protection shields are required per paragraph 2.07C.
 4. The following table summarizes the insulation system by use and service:

System	Location	Service ⁽¹⁾	Insulation System	Insulation Thickness (Inches)
Aeration Air (A)	Blower Room	E	B	2 inch
Potable Water (PW)	All exposed	E	A	1.5 inch
Hot Water (HW)	All exposed	E	A	1.5 inch

Note:

(1) E = Exposed including concealed space.

- B. Insulation System A:
1. Material: Insulation shall be a pre-molded fiberglass with a maximum "K" factor of 0.25 at 70°F and having a factory-applied jacket. Fittings shall be insulated with insulating cement or mitered section of pre-molded fiberglass. Fittings shall be covered with a Zeston, Thermazip, or equal jacket. Pipe insulation shall be Schuller "Micro-Lok 850-AP" with foil scrim kraft jacket, with laps and butt straps secured with Benjamin Foster or Arobol adhesive; Owens Corning Fiberglas Type 25 ASJ/SSL; or equal.
 3. Insulation exposed to the weather shall have, in addition, an aluminum waterproof jacket alloy 3003 (0.024-inch); Childers, Alcorjac, or equal.
- C. Insulation System B:
1. Material: Insulation shall be a pre-molded block insulation composed of hydrous calcium silicate, Thermo-12 Gold by Industrial Insulation Group, or equal. Fittings shall be insulated with mitered sections of pre-molded insulation.
 2. Insulation shall have an aluminum waterproof jacket alloy 3003 (0.024-inch); Childers; Alcorjac; or equal.
 3. Valves, expansion joints, and blind flanges shall be covered with soft jacket style insulation system. Insulation shall be fiberglass mat Alpha Temp-Mat or equal covered by fiberglass fabric coated with dry silicon rubber. Alpha-Martex Style 1700-S or equal.

McKinleyville Community Services District 15050 - 37 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

2.08 PIPE SUPPORTS

- A. **Manufacture and Design:** Pipe supports shall to the maximum extent possible be standard factory fabricated units conforming to the typical supports and braces shown in the Drawings and as specified below. Where required support cannot be provided by standard factory fabricated units, and is not detailed on the Drawings, the Contractor shall provide special pipe supports. Supports shall be manufactured or special fabrications or combination as shown on the Drawings or specified. Special fabrications shall be in conformance with Section 05500. Provide $\frac{3}{4}$ -inch chamfer on corners of all support elements and file or grind smooth. Supports designated to allow axial pipe movement shall have smooth and even contact surfaces.
- B. **Materials:** All support systems shall be galvanized steel except that those that are submerged or that are located within a tank, channel, or other structure designed to hold water, below the top of surrounding walkway elevation or tank wall top, or otherwise called out on the Drawings, shall be Type 316 stainless steel. Trays for continuous support of plastic pipe or tubing shall be made of 20-gauge galvanized steel.
- C. **Insulation Protection Shields:** Provide insulation protection shields at all pipe supports for insulated piping.
- D. Provide plastic caps with rounded corners on all exposed ends of channels.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

- A. **General Handling and Placing:**
- Exercise great care to prevent injury to or scoring of the pipe lining and coating, as applicable, during handling, transportation or storage. Handle fusion epoxy coated pipe and ceramic epoxy lined pipe in accordance with AWWA C213. Do not store pipe on rough ground and do not roll the pipe on the coating. Any damaged pipe sections, specials, or fittings shall be repaired or replaced at the expense of the Contractor as satisfactory to the Engineer.
 - Carefully inspect each pipe, fitting, valve and accessory before installation to insure there is no defective workmanship or obstructions. Inspect the interior and exterior protective coatings and patch all damaged areas in the field or replace to the satisfaction of the Engineer.
 - Place or erect all piping to accurate line and grade and backfill, support, hang, or brace against movement as specified or shown on the Drawings, or as required for proper installation. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining. Use reducing fittings where any change in pipe size occurs. Do not use bushings unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.
 - Cast all metallic pipes and sleeves 6-inch and larger into new concrete walls without breakout. Pipes 5 inches and smaller may be cast in place or installed in a smooth core drilled hole using a link type seal at the Contractor's option. Maintain at least $\frac{1}{2}$ -inch clearance between reinforcing steel and metal pipe in penetrations.

Piping, Valves, and Accessories

15050 - 38

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set

1368004*00
© 2014 Kennedy/Jenks Consultants

- Cover polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC) and polyethylene (PE) pipe stored outside for more than two months with canvas or other opaque material. Provide for air circulation under the covering.
- Certain installation requirements are contained in Section 15400 and Section 15800.

B. General Buried Piping Installation:

- Trenching, bedding, and backfill for buried piping shall be as shown on the Drawings and as specified in Section 02301.
- Where pipe grade elevations are shown on the Drawings, install the pipe with straight grades between the indicated elevations.
- Where no pipe grade elevations are shown on the Drawings, install buried piping with at least 3 feet of cover to finished grade. Where piping crosses under buried electrical ducts, provide at least 4 feet 6 inches of cover. Provide 12 inches minimum separation between the buried pipes and ducts.
- Provide each pipe with a firm, uniform bearing for its full length in the trench except at field joints. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work.
- Protect buried piping against thrust by use of restrained pipe joints. All exposed free pipe ends shall be securely braced. Cap or plug pipe ends that are left for future connections as shown on the Drawings and in a manner favorably reviewed by the Engineer.
- Where piping leaves a structure or concrete encasement, provide two joints capable of angular deflection. For pipes 12 inches and smaller, the first joint shall be within 1 foot of the structure. Distance between joints shall be 2 feet or one pipe diameter, whichever is greatest. Joints for pipes larger than 12 inches shall be provided as shown on the Drawings. Conform to details on the Drawings where such details are shown.
- Snake buried PVC pressure pipe from side to side in the trench in long sweeps.
- Concrete Encasements: All piping and conduits except plumbing lines installed under slabs or footings on earth or crushed rock shall be encased in concrete not less than 6-inch thickness on all sides and extending up to the bottom of the slab or footing, unless otherwise specifically noted on the Drawings. Encasement shall extend to within 6 inches of the first pipe joint beyond the slab or footing. Provide concrete encasement whether or not the encasement is shown on the Drawings. Provide encasement under slabs on earth or crushed rock even if the structure is supported on piles, caissons, or footings. Provide continuous concrete cradles where shown.
- Do not pull bell and spigot, gasketed joints more than 75 percent of the maximum deflection permitted by the pipe manufacturer.
- Double Containment for Buried Chemical Tubing: Enclose buried chemical tubing within Type PVC-1 Pipe. Terminate at watertight junction boxes.
- Coat bolts on buried flanges or other buried appurtenances in accordance with Coating System 8 in Section 09960. Wrap the appurtenance with polyethylene encasement and tape the encasement tightly closed to the pipe.

C. General Exposed Piping Installation:

- Unless shown otherwise, install piping parallel to building lines, plumb and level.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set

15050 - 39

Piping, Valves, and Accessories

1368004*00

© 2014 Kennedy/Jenks Consultants

2. Install piping without springing or forcing the pipe in a manner that would set up stresses in the pipe, valves, or connected equipment.
 3. Set all pipe flanges level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.
 4. Flexibility and Expansion: Provide flexible couplings, flexible hose, or flexible spools for all piping connections to motor driven equipment and where otherwise shown. The Contractor may install additional flexible couplings at favorably reviewed locations to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection. Anchor piping subject to expansion or contraction in a manner permitting strains to be evenly distributed. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeves.
 5. Install unions or flexible connections where shown on the Drawings, and at all non-motor-driven equipment to facilitate removal of the equipment.
 6. Provide valves wherever equipment drain connections are furnished and carry the discharge pipe to the nearest floor drain, drain trench or sump. Where no receptacle for drain exists, install drain piping to 1 inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.
 7. Where piping conveying liquids passes over motor control centers, electrical panels and other electrical devices, install a protective drainage tray below the piping.
- D. Water Main Installation:
1. The Contractor is advised that precautions taken to keep the pipeline clean during construction will facilitate achieving the disinfection requirements of this project with a minimum of effort and expense. Compliance with these suggested minimum procedures will not relieve the Contractor of the disinfection requirements.
 2. Prior to installation, thoroughly clean the interior of each length of pipe and each fitting or valve and inspect to ensure that no foreign material remains. Cover both ends with plastic and do not uncover them until just prior to completing the joint.
 3. Whenever pipe laying is discontinued for short periods, or whenever work is stopped at the end of the day, close the open ends of the pipe with water-tight plugs or bulkheads.
 4. Provide adequate trench pumping to ensure against groundwater contacting the inside of the pipeline at any time. Do not lower any pipe or fitting into a trench where groundwater is present and may enter the pipe. When necessary, pump the water from trenches and keep the trench dry until the joist have been completed and the open ends of the pipe have been closed with a water-tight plug. Do not remove the plug until the trench has again been pumped dry.
 5. Keep new pipe sections clean and dry.
 6. When making the connection between a new pipeline and an existing pipeline, or when repairing a damaged pipe, take the following extra precautions:

- a. Clean the exterior of the existing pipeline of all dirt and debris, and spray or swab with a standard 5.25 percent or stronger chlorine solution (as specified) in the immediate vicinity of the work. Clean equipment and materials, including new pipe and fittings, to be used in making these connections of all dirt and debris and disinfect them. Allow at least 30 minutes contact time before the chlorine solution is diluted or rinsed off. Provide sufficient trench pumps to prevent flooding of the trench.
- b. When an old line is opened either by accident or by design, the excavation may be wet or badly contaminated from groundwater. Apply liberal quantities of standard chlorine solution tablets to the open trench areas to lessen the danger from such pollution. Tablets are recommended because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation. Scatter liberally around and locate the tablets so that flow entering the work site will contact the disinfecting agent. Trenching application should be done very carefully to avoid contact by skin and clothing with chlorine solution. Minimally, safety dictates wearing safety goggles and rain gear.
- c. When excavating a leaking or broken pipeline, "valve-off" the system gradually to less than water-tightness. This is to prevent causing areas of zero pressure which would allow entry of foreign material. A flow should be maintained which is slightly less than trench pump capability. Once the break is exposed and cleaned to disallow site contamination, the valving can then be made water-tight.

E. Pipe Welding:

1. General: Unless specified otherwise, shop and field welding of pipe shall conform to ANSI B31.1 as amended by this paragraph.
2. All field and shop welding shall be done by the electric arc process unless otherwise specified. All field welding shall be done in passes not thicker than 1/4 inch. Size and type of electrodes, and current and voltages used, shall be subject to the favorable review of the Engineer. Give particular attention to the alignment of edges to be joined, so that complete fusion and penetration will be effected throughout the bottom of the weld. Welds shall contain no valleys or undercuts in the center or edges of the weld. Thoroughly clean each pass, except the final one, of dirt, slag, and flux before the succeeding bead is applied.
3. Clean completed field welds of pipe joints of dirt, slag and flux, and then visually inspect. Completely chip out all defects in welds discovered during field inspection in a manner that will permit proper and complete repair by welding subject to the favorable review of the Engineer. Under no circumstances will caulking of defective welds be permitted.
4. All welding shall be done by experienced, skilled operators familiar with the methods and materials to be used. Hand welding will be done only by welders qualified under the standard qualification procedure of Section IX of the ASME Boiler and Pressure Vessel Code. Field welds shall follow as closely as possible to the laying operation. All field welds shall be complete before lining or coating of the joints in steel pipe is begun. Where pipe is fusion epoxy lined and/or coated, follow AWWA C-213 procedures for field welded joints.

5. A single, continuous, watertight, full fillet weld shall be the minimum required at all field joints. Double welded joints are required on all piping specifically noted to be double welded.
 6. See also installation specifics for welding of pipe.
- F. Installation Specifics:**
1. **BS40 Type X-1 Pipe:**
 - a. Install and weld in accordance with ANSI B31.1.
 - b. Threaded joints shall have connections metal-to-metal tight. Remove all burrs from the ends of the pipe and clean threads of all oil and chips. Coat male threads with a joint lubricant.
 - c. All BS40, Type X-1 Pipe shall be provided with a polyethylene tape coating.
 2. **CISP Type N-3 Pipe:**
 - a. Bell and Spigot: Fold and insert one-piece rubber gasket into properly cleaned hub. Apply lubricant to gasket and to spigot. Lubricant shall be a type recommended by the pipe and gasket manufacturers. Push or draw spigot into gasketed hub with a pulling tool devised especially for this purpose. Install rubber couplings with stainless steel bands for connections between existing house sewer service lateral and cast iron sewer pipe. Install elastomeric bushings as required to compensate for differences in outside diameters.
 - b. No Hub: Install in accordance with Cast Iron Soil Pipe Institute Pamphlet No. 100.
 3. **CUP Type T-1 Pipe:**
 - a. Bends shall be made in a manner that does not crimp or flatten pipe.
 - b. Dielectric unions shall be installed at connections with ferrous piping.
 - c. Pipe shall have joints squarely cut clean, soldered joints shall be properly fluxed and heated before solder is placed in the joint. Joints must be driven up tight before solder is added. Compression and flared joints shall be made up in accordance with the fitting manufacturer's installation instructions. Brazing shall be in accordance with ANSI B31.1.
 - d. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
 - e. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, ¾-inch ball valve, and short ¾-inch threaded nipple and cap.
 - f. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using steel sleeves and mechanical sleeve seals.
 - g. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity.
 - h. Install branch connections to mains using tee fittings in main with take-off out the bottom of the main, except for up-feed risers, which shall have take off out the top of the main line.

- i. Install strainers on the supply side of each control valve, pressure reducing valve, pressure regulating valve, solenoid valve, inline pump, and elsewhere as indicated. Install nipple and ball valve in blowdown connection of strainers 2 inches and larger.
4. **DIPB Type N-1 Pipe:**
 - a. Install buried pipe in accordance with AWWA C600. Handle glass and ceramic epoxy lined pipe only from the outside of the pipe.
 - b. Support and brace encased pipe to support the pipe and to prevent movement during testing and placement of the concrete encasement. The braces and supports shall be erected of materials and by methods that will prevent any future contact of the pipe with the environment surrounding the encasement.
 - c. Wrap buried pipe with 8 mil polyethylene film in accordance with AWWA C105. Continuously seal seams and overlaps with tape. Seal circumferential overlaps with two turns of tape, half lapped. Gather excess polyethylene on top of pipe so as not to block backfill material from getting under bottom of pipe. Use caution so as not to rip or cut the polyethylene film. Seal any rips or cuts in the film with tape.
 - d. Install restrained joints in accordance with manufacturer's instructions. Pull the slack out of restrained joints after they are made up.
 - e. Wherever a water pipeline crosses over or under a sewer main or house service lateral or a reclaimed water pipeline, center a standard length pipe, 18 foot minimum, on said sewer main or lateral or reclaimed water pipeline so as to have the pipeline joints as far as possible away from sewer. This may require field cutting of some pipe pieces.
 5. **DIPF Type N-2 Pipe:**
 - a. Flanged Joints: Flanged joints shall be made up tight with care being taken to avoid undue strain in the flanges, fittings, and other accessories. Bolt holes shall be aligned for each flanged joint. Bolts shall be full size for bolt holes; use of undersize bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Adjoining flange faces shall not be out of parallel to such a degree that the flanged joint cannot be made watertight without overstraining the flange. Any flanged pipe or fitting whose dimensions do not allow the making of a proper flanged joint as specified herein shall be replaced by one of the proper dimensions. Clean flanges prior to making joints. Buried flanged pipe connections shall be made with the smallest practical "bell" hole. After the joint is completed take special care to completely fill the "bell" hole under and around the pipe with compacted backfill.
 - b. Mechanical Grooved Couplings: Install in accordance with the manufacturer's instructions.
 6. **GSP Type Y-1 Pipe:** Threaded joints shall have connections made metal to metal tight. Remove all burrs from ends of pipe, and clean threads of all oil and chips. Coat male threads with joint lubricant. Properly tape wrap joints of plastic coated pipe.

7. **PVC-1 and PVC-5 Pipe:**
- Place PVC pipe within the installation areas at least 24 hours prior to installation to permit temperature equalization.
 - Cut pipe ends squarely, ream and deburr inside and out.
 - Solvent Weld Joints: Clean pipe ends and sockets and join in strict conformance with the pipe manufacturer's instructions. Make joints in accordance with ASTM D2855. Handle solvent cements and primers in accordance with ASTM F402.
 - Containment fittings for chemical and chemical solution lines shall be installed and tested in accordance with manufacturers' instructions. Install containment pipe with position clips at 3-foot centers and at fittings during installation of carrier pipe. Do not make joints until after successful leak tests of carrier pipes.
 - PVC-1 Type V-1 Pipe:** Threaded connections shall use a short nipple, threaded at one end, socket at the other. Provide thread sealant in accordance with the pipe manufacturer's recommendations. Take care not to overtighten the connection.
 - PVC-1 Type V-1 Pipe:** No work shall be performed until the pipe manufacturer provides onsite installation training and certifies the installers are trained per ASTM D2855. The Owner's inspector shall be present for the training session.
8. **SSP Type W-1 Pipe:**
- Install and weld in accordance with CGA G-4.4 and ANSI B31.1. Back purge all welds with cover gas. Seal weld all slip-on flanges.
 - Provide anti-seize compound on threaded connections.
 - Temporarily plug or cap all points of connection to exclude moisture, dust or other contaminants or impurities prior to being connected.
9. **WSP Type M-2 Pipe:**
- Installation of pipe shall be in accordance with AWWA C600.
 - The maximum trench width at the top of the pipe shall be the pipe outside diameter plus 3 feet.
 - Field welding of joints shall be in accordance with AWWA C206. Acceptance of field welds will be based on visual inspection and non-destructive testing by the Engineer while the welds are being made and after they are completed. Hand or power wire brush each weld thoroughly after completion to facilitate the inspection. Correct defects not complying with AWS Code D1.1 Sections 3.6 and 8.15. Determine the cause of defects and take corrective measures to prevent a recurrence.
 - Following satisfactory testing of the weld, the interior of all joints shall be cement mortar lined. Pipe 24 inches and less shall be finished using the ball and burlap procedure described in AWWA C-205, paragraph 4.7.2.2.2. The exterior of the joints of buried pipe shall be cement mortar coated in accordance with Appendix A of AWWA C205. Prior to coating the exterior, tack weld one layer of wire mesh to the pipe.
 - Steel edges not encased in concrete or cement mortar shall receive a protective coating of 16 mils of high solids epoxy.
- 3.02 **COUPLING INSTALLATION**
- Flexible Couplings and Flange Coupling Adaptors: Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Wipe gaskets clean before they are installed. If necessary, flexible couplings and flanged coupling adaptor gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Tighten bolts progressively, drawing up bolt on opposite sides a little at a time until all bolts have a uniform tightness. Workers tightening bolts shall be equipped with torque-limiting wrenches or other favorably reviewed type. Anchor studs on restrained flanged coupling adaptors shall be installed so as to lock into holes drilled through the pipe wall in accordance with manufacturer's recommendation.
 - Tie Rods: Except where double-nutting is required, install the nuts snug. Tighten the nuts gradually and equally at opposite sides of the pipe until snug to prevent misalignment and to ensure that all rods carry equal loads. If double-nutting is required, double-nut each end of each tie rod. The space between the pairs of nuts shall be ½ inch greater than the distance between the lugs. Provide double-nutting at buried locations and where otherwise required on the Drawings.
 - Flexible Rubber Spools:
 - Install in accordance with manufacturer's instructions. Unless otherwise shown on the Drawings, install flat with one-half the maximum expansion.
 - Connect rubber spools only to full-face metal flanges.
 - Install control rod-compression sleeve assemblies with control rod nuts snug, to relieve stress on adjacent pipe, except at buried locations. Comply with manufacturer's instructions.
 - Paint buried galvanized steel retainer rings, bolts and other appurtenances in accordance with System 8 in Section 09960.
- 3.03 **INSTALLATION OF VALVES AND ACCESSORIES**
- Wrap buried valve bodies as specified for flexible couplings and flanged coupling adaptors.
 - Use reducing fittings where any change in pipe size occurs between valves or accessories and the attached pipeline. Bushings shall not be used, unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.
 - Install valves and accessories such that all parts are easily accessible for maintenance and operation. Provide valve boxes for buried valves.
 - Where valve handwheels are shown on the Drawings, valve orientation shall be as shown. Where valve handwheels are not shown, orient valves to permit easy access to the handwheels or handles and to avoid interferences.
 - Install pressure gauges and thermometers in a position to permit reading them from a point approximately 5 feet above floor level, except that pump pressure gauges shall be installed close to the pump elevation.
 - Rigidly support pressure switches and connect them to piping and equipment using a suitable flexible linkage that will not permit transmission of vibrations from the piping or equipment to the pressure switches.

- G. Provide a union adjacent to each screwed end valve and accessory with additional unions as necessary to facilitate removal.
- H. Provide a shutoff valve below each pressure gauge, protective device or air valve unless otherwise specified.
- I. Connections between ferrous and non-ferrous piping, valves, accessories or pipe supports shall be made using a dielectric coupling, union, or flange.
- J. Where valves or other pipeline items require metal full-face connecting flanges, provide intermediate flanges if the connecting flange is not adequate.
- K. All insulated piping passing through walls or slabs shall be sleeved and insulation shall run continuously through the sleeves and shall allow for 1/8-inch annular clearance between outside of insulation and sleeve wall.
- L. Provide a suitable chrome plated escutcheon on pipes passing through walls, floors, ceilings and partitions in finished areas.
- M. Install link-type seals in cast-in-place metal sleeves or in smooth core drilled holes. Grout both sides flush with non-shrink grout unless otherwise shown on the Drawings.
- N. Install butterfly valves in accordance with AWWA C504, Appendix A, Sections A.2 through A.5, inclusive.
- O. Install thermometer wells in piping tees in vertical position. Fill with oil. Where wells are in lines 2 inches and smaller, increase line size so that velocity at well section is not increased.
- P. Provide test plugs on all closed water systems and condenser water systems located in inlet and outlet of coils, heat exchangers, cooling towers, and where indicated on Drawings. Locate test plugs where they will be easily accessible, have adequate clearance for insertion and removal of gage needles and thermometer stems, and position to allow unobstructed viewing of gages and thermometers.
- 3.04 INSTALLATION OF INSULATION
- A. General: Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions. Seal joints and seams to maintain vapor barrier. Seal penetrations for hangers, supports, and anchors. Keep insulation material dry during application. Apply vapor barrier on seams, joints, over staples, and at end butt to fittings.
- B. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.
- C. Interior Walls and Partitions Penetration: Apply insulation continuously through walls and partitions, except fire-rated walls. Apply aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches from both surfaces of wall on partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer.

Piping, Valves, and Accessories 15050 - 46 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- D. Whenever possible, slip insulation on pipe before making connections. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.
- E. Cover exterior insulation, except for metal-jacketed insulation with PVC fitting covers and seal circumferential joints with butt strips. Paint all exterior PVC covering.

3.05 INSTALLATION OF PIPE SUPPORTS

- A. General:
1. Install and adjust supports for each pipeline such that the pipeline is true to the indicated line and grade.
 2. Locate anchors and braces for any single support on a continuous structure; that is, not on two sides of a structural expansion joint.
 3. Tighten clamps to develop full friction along the pipeline except where loose fitting clamps are called for.
- B. Electrolytic Protection: Pipe supports serving copper pipe or tubing shall be dielectrically insulated from the pipe by dielectric sleeves or plastic pipe wrap at the point of contact.

3.06 PIPE AND VALVE IDENTIFICATION

- A. General: Identify all exposed piping in this project by painting, banding, system name labels, and direction arrows. The color and banding shall be as selected by the Engineer. Identify all buried and exposed valves with tags as specified below.
- B. Exposed Pipe Identification: Before painting, banding and labeling, pipes shall be identified by the Contractor with temporary wired-on cardboard tags showing the proposed marking for review by the Engineer.
- C. Piping: Paint all exposed pipes with the appropriate paint system as specified in Section 09960 and provide pipe markers per the schedule specified in Section 10400.
- D. Valves: Provide each buried valve with a valve tag identifying the pipeline contents, and either its valve number, or the area or item served by the valve for valves without a valve number. Contents shall be as designated in the Piping Schedule.
- E. Provide access panel markers for valves and control devices concealed behind access panels and above suspended ceilings. Locate markers on access doors and on ceiling T-bars.
1. Markers for Ceiling T-bar Installation: Blue, pressure-sensitive, self-adhesive, at least 3 mils thick, 3/8 inch diameter.
 2. Markers for Access Doors: 1/16 inch thick, engraved plastic-laminate, with abbreviated terms and numbers corresponding to the concealed item. Provide 1/8-inch center attachment hole.

3.07 FIELD QUALITY CONTROL

- A. The Owner will:
1. Inspect field welds and test the welds if it is deemed necessary.
 2. Perform bacteriological analysis for pipeline to be disinfected.

McKinleyville Community Services District 15050 - 47 Piping, Valves, and Accessories
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- B. Factory Quality Control: The Contractor shall test all products as required herein and by the reference specifications.
- C. The Contractor shall
1. Perform leakage tests.
 2. Be responsible for the costs of additional inspection and retesting by the Owner resulting from non-compliance.

3.08 CLEANING

- A. Prior to testing, thoroughly clean the inside of each completed piping system of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, flushing with water or blowing with compressed air or oil-free nitrogen gas, as appropriate for the size and type of pipe. Flushing shall achieve a velocity of at least 3 feet per second. The Contractor shall install temporary strainers, temporarily disconnect equipment or take other appropriate measures to protect equipment while cleaning piping. Cleaning shall be completed after any pipeline repairs.
- B. Special attention and skill is required to properly clean piping, valves and accessories for chlorine solutions.
1. Chlorine Solution Piping: After erection, the chlorine solution piping shall be flushed with clear water until there is no evidence of dust, dirt or debris.

3.09 FIELD TESTING

- A. General: Perform leakage tests on all pipe installed in this project. Furnish all equipment, material, personnel and supplies to perform the tests and make all taps and other necessary temporary connections. The test pressure, allowable leakage and test medium shall be as specified and as shown in the Piping Schedule on the Drawings. Test pressure shall be measured at the highest point on the line, except that pressure at lowest point shall not exceed pipe manufacturer's rated test pressure, unless specifically noted otherwise. Leakage tests shall be performed on all piping at a time agreed upon and in the presence of the Engineer. All visible leaks shall be repaired, regardless of the test results. The Contractor may purchase water for construction, cleaning, testing, and disinfection of the pipelines from the District. At any connection to the District water system, the Contractor shall provide an air-gap or reduced pressure backflow valve system to prevent backflow into the water source.
- B. Buried Piping: The leakage test for buried piping shall be made after all pipes are installed and backfilled. However, the Contractor may conduct preliminary tests prior to backfill. If the Contractor elects to conduct preliminary tests, provide any necessary temporary thrust restraint.
- C. Exposed Piping: All supports, anchors and blocks shall be installed prior to the leakage test. No temporary supports or blocking shall be installed for final test.
- D. Encased Piping: The leakage test for encased piping shall be made after all pipe is installed and encased, and before any structures are constructed above it. However, the Contractor may conduct preliminary tests prior to encasement. If the Contractor elects to conduct preliminary tests, provide any necessary temporary thrust restraint.

- E. Accessories: It shall be the responsibility of the Contractor to block off or remove equipment, valves, gauges, etc., which are not designed to withstand the full test pressure.
- F. Testing Apparatus: Provide pipe taps, nozzles and connections as necessary in piping to permit testing including valves to isolate the new system, addition of test media, and draining lines and disposal of water, as is necessary. These openings shall be plugged in a manner favorably reviewed by the Engineer after use. Provide all required temporary bulkheads.

- G. Pneumatic Testing: Piping tested by air or another gas shall show no reduction of pressure during the test period after corrections have been made for changes in temperature in conformance with the following relationship:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

Where T_1 and T_2 are the absolute temperatures of the gas in the pipe and P_1 and P_2 are the absolute pressures. The subscript "1" denotes the starting conditions and the subscript "2" denotes the final conditions.

- H. Precautions for Pneumatic Testing: Where air or another gas is called for as the test medium, the Contractor shall take special precautions to protect personnel. During the initial pressurization of a pipeline to the specified test pressure, personnel shall be protected by suitable barricades or shall remove themselves to locations where portions of the concrete structure itself are between them and the pipeline under test.
- I. Correction of Defects: If leakage exceeds the allowable, the installation shall be repaired or replaced and leakage tests shall be repeated as necessary until conformance to the leakage test requirements specified herein have been fulfilled. All visible leaks shall be repaired even if the pipeline passes the allowable leakage test.

- J. Drying: Gas lines tested with water shall be drained and blown dry with air or oil-free nitrogen gas.

- K. Reports: The Contractor shall keep records of each piping test, including:

1. Description and identification of piping tested.
2. Test pressure.
3. Date of test.
4. Witnessing by Contractor and Engineer.
5. Test evaluation.
6. Remarks, to include such items as:
 - a. Leaks (type, location).
 - b. Repairs made on leaks.
7. Test reports shall be submitted to the Engineer.

- L. Venting: Where not shown on the Drawings, the Contractor may install valved "tees" at high points on piping to permit venting of air. Valves shall be capped after testing is completed.

- M. Testing Specifics: Piping shall be tested as indicated in the Piping Schedule on the Drawings. All other piping systems shall be tested as required for the pipe type used. Unless specified otherwise, test each system for four hours.
1. Allowable leakage is generally none; for PVC or ductile-iron gasketed bell and spigot joints, use the following formula (EQUATION A):

$$L = \frac{N D P^{1/2}}{7400}$$

Where:

L = allowable leakage, gallons per hour

N = number of joints being tested

P = pressure, psi

D = nominal pipe diameter, inches

3.10 DISINFECTION OF POTABLE WATER SYSTEMS

- A. Disinfect all water mains and interconnected piping after testing and before being placed into service to ensure their bacteriological safety. Disinfection shall be accomplished under the supervision of the Contractor by a person skilled and experienced in the operation of water systems. Following disinfection and flushing, the Owner will take water samples for bacteriological analysis of the water. If the specified bacteriological requirements are not satisfied, the disinfection procedure must be repeated until the requirements are met.
- B. Large Pipelines 4 Inches and Larger:
 1. Standard: AWWA C651 as amended herein.
 2. Forms of Chlorine: Sodium hypochlorite or calcium hypochlorite.
 3. Method: Continuous-Feed.
 4. Injection: Provide the system with a one-inch minimum service cock or valve or other means to inject chlorine solution.
- C. Small Pipelines Less than 4 Inches:
 1. Preparation: Provide the system with a 1-inch-minimum service cock or valve or other means to inject chlorine solution at a point within 2 or 3 feet of its junction with the supply source. When system is complete thoroughly flush it by fully opening every outlet until clear water flows from all of them.
 2. Disinfecting Agent: Sodium hypochlorite or calcium hypochlorite in sufficient quantities to produce chlorine concentration of at least 50 parts per million in the system.
 3. Disinfecting Procedure:
 - a. Connect a hand-operated pump, or other means of injecting the disinfecting agent, to 1-inch minimum service cock or valve or other injection device. Pump must provide a pressure greater than that of supply of system.
 - b. With system completely full of water and supply valve open, proceed to adjust every outlet of system so that a trickle of water flows from each.
 - c. Inject disinfectant slowly and continuously at an even rate, not in slugs, until a test at each outlet shows a free chlorine residual concentration of at least 50 parts per million.

- d. Close all outlets and valves, including valve connecting to supply line and 1-inch minimum service cock on solution injection connection. Maintain condition for 24 hours. After 24 hours, test for residual chlorine at each outlet. The free residual chlorine concentration indicated should be not less than 10 ppm. If the indicated free chlorine concentration is less than 10 ppm, the disinfection procedure must be repeated until an approved result is obtained.
 - e. When the above procedure has been completed to the satisfaction of the Engineer, flush out entire system with fresh water until tests at all outlets show a residual of not more than 0.5 ppm.
- D. Chlorine Residual Testing: AWWA C651, Appendix A, DPD Drop Dilution Method, except where otherwise specified. Testing shall be performed by the Contractor.
 - E. Bacteriological Analyses of Water: After the completion of disinfecting procedure, including the final flushing as described herein before, the Engineer will obtain water samples from this system for bacteriological analyses for testing by the Owner. Requirements for satisfactory disinfection of water supply are that bacteriological analyses (Heterotrophic plate count) indicate that water samples are negative for coliformmerogenes organisms, and that total plate count is less than 100 bacteria per cubic centimeter. If bacteriological analyses do not satisfy above requirements, then disinfection procedure must be repeated until these requirements are met.
 - F. Disposal of Disinfection Solution: Dechlorinate and dispose of chlorinated water in accordance with applicable regulations.

END OF SECTION

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Plumbing fixtures and trim.
2. Building Service Piping, including:
 - a. Hot and cold (domestic) water systems
 - b. Sanitary waste, drain, and vent systems, within structures and extending to 5 feet outside of structures.
 - c. Roof drainage, floor drainage, and equipment drainage
3. Thermal Insulation.
4. Testing.

B. Related Sections:

1. Section 07900: Joint Sealants
2. Section 11001: General Mechanical Requirements
3. Section 15050: Piping, Valves and Accessories

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

A. American National Standards Institute (ANSI) Publication:

1. Z21.10.1
Storage Water Heaters
2. A117.1
Specifications for Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped
3. Z358.1
Emergency Eye Wash and Shower Equipment

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

15400 - 1

Plumbing

THIS PAGE INTENTIONALLY BLANK

<p>B. Underwriters Laboratories Inc. Standards: 1. U.L. 174 Standards for Safety</p> <p>C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): 1. Seismic Restraint Manual, Guidelines for Mechanical Systems.</p> <p>D. All state and local building codes including: 1. California Plumbing Code 2. California Green Building Standards Code (CalGREEN) 3. California Energy Code</p>	<p>B. Permits and inspections shall be in accordance with General Conditions.</p> <p>C. The Drawings shall be taken in a sense as diagrammatic. Size of pipes and general method of running them are shown, but it is not intended to show every offset and fitting nor every structural difficulty that may be encountered.</p> <p>D. ADA compliance means that the plumbing item is accessible and usable by persons with disabilities.</p>
<p>1.03 SUBMITTALS</p> <p>A. The following information shall be submitted in accordance with Section 01300: 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.</p> <p>2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.</p>	<p>1.05 SEISMIC PROTECTION</p> <p>A. Provide equipment and piping with seismic protection as specified and as recommended by "Seismic Restraint Manual, Guidelines for Mechanical Systems" latest edition by SMACNA. Provide more rigid restraint if required by Section 15050.</p>
<p>1.04 QUALITY CONTROL</p> <p>A. Codes: Comply with the rules and regulations of authorities having jurisdiction over the work specified herein, including the applicable Plumbing Code with amendments.</p>	<p>PART 2 - PRODUCTS</p> <p>2.01 GENERAL</p> <p>A. Provide equipment and materials conforming to the standards and manufacturers' serial numbers shown, or equal.</p> <p>B. All fixtures shall be in compliance with the California Plumbing Code. All products in contact with potable water shall have NSF 61 approval. Products containing brass shall also conform to NSF 372.</p>
<p>B. Submit manufacturer's information with materials, dimensions, and data to show that the products conform to the specification requirements. All products in this Section shall be included in a single initial submittal.</p> <p>C. Submit operation and maintenance manuals where available from manufacturers</p>	<p>2.02 PLUMBING FIXTURES AND ACCESSORIES</p> <p>A. Water Closets: White vitreous china, 1.28 gallons per flush, elongated bowl, syphon jet, open-front seat, and meet or exceed ANSI A112.19.2. Locate controls for flush valves on the wide side of the water closet area. Top of 2-inch maximum height seat on ADA water closets shall be between 17 and 19 inches above finished floor. Provide shutoff stop on supply. 1. WC: Water closet shall be floor-mounted, flush valve operated American Standard 'Madera' 3461.001; Kohler 'Highline' K4405; or equal. Provide supporting carrier. Flush valve shall be 1.28 gallons per flush Sloan Royal No. 111-1.28; or equal.</p> <p>B. Countertop Lavatory (LAV): 1. White vitreous china, complete with faucet-drain assemblies, traps, and angle stops. Angle stops and supplies shall be Chicago Faucet Co.; T&S Brass; or equal. Lavatory "P" traps, hot water piping and valves shall be insulated with replaceable contour molded fire-resistive foam similar to "Lav-Guard" by Trubro; "Skaigard" by TCI Products; or equal. Lavatories shall meet ADA Specifications. 2. D-shaped bowl, front overflow, self-rimming, 8-inch faucet spacing. American Standard Rondalyn 0490.011; Kohler 'Brookline' K-2202-1; or equal.</p>
<p>Plumbing</p>	<p>McKinleyville Community Services District Wastewater Management Facility Improvements Bid Set 1368004*00 © 2014 Kennedy/Jenks Consultants</p>
<p>15400 - 2</p>	<p>15400 - 3</p>
<p>Plumbing</p>	<p>Plumbing</p>

3. Provide single handle faucet with flexible connections, pop-up drain, polished chrome finish, wrist blade handles, and 0.35-gpm flow restrictor conforming to CalGREEN standard. Chicago Faucet 402-E39VPABCP.

C. Utility Sink:

1. Sink: 18-gauge, Type 304 stainless steel, self-rimming with a back ledge. Provide sound deadening coating. Sink shall have inside bowl dimensions of 16-inch x 22-inch x 7½-inch deep: Just Stylist DL2025A; Elkay; or equal. Locate drain opening at rear of sink with stainless steel flat grid strainer. Provide P-trap with threaded cleanout.
2. Faucet: Deck-mount faucet on 4-inch centers with 4-inch wrist blade handles; 0.5-gpm flow restrictor conforming to CalGREEN standard. Chicago Faucet 802-VE2805-317ABCP, or equal.

D. Shower (SHWR):

1. Shower Stalls: Architectural finishes shall be applied to wall construction. See Divisions 7 and 9 of these Specifications.
2. Shower System:
 - a. Provide three-function shower system as described herein. Moen 8342EP15; Speakman; or equal.
 - b. Faucet: Wall-mount, ADA-compliant handle operating on 270-degree rotation, pressure-balanced, 1.5 gpm anti-scaled mixing valve with concealed check stops.
 - c. Transfer Valve: Wall-mount, ADA compliant handle, operating on 270-degree rotation.
 - d. Hand-held Shower: Showerhead shall be affixed to 60-inch hose and slide bar assembly. Sub-assembly shall include provisions for mounting on stall wall for hands-free use and include vacuum breaker for cross-connection control. Slide bar shall be mounted in accordance with CBC requirements for accessibility from seat.
 - e. Fixed Shower: Showerhead shall be mounted at end of fixed, angled shower arm. Sub-assembly shall include wall flange and in-line vacuum breaker.
3. Accessories:
 - a. Grab bars (for accessible stall only): Stainless steel, fixed to opposite and adjacent walls of stall from fold-down seat. Set at 33- to 36-inch height above floor.
 - b. Soap dish: Stainless steel, recessed into fiberglass stall.
 - c. Shower drain: Finish-grid shower drain with 2-inch drain outlet.
 - d. Shower rod and curtain.

E. Water Heaters (WH):

1. Electric storage type, insulated, glass lined, enclosed controls, UL approved. Heating elements shall operate on 480-volt, 3-phase power. Approved by California Energy Commission.
2. 20-gallon nominal capacity, one 4500-watt heating element, 20-gph recovery at 90 F temperature rise. A.O. Smith Model DEL-20, or equal.
3. Provide a seismic restraint for all water heaters.

Plumbing

15400 - 4 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

4. Expansion Tank: Provide in-line thermal expansion tank at water heater installations, sized for storage tank and supply pressure Amtrol Therm-X-Trol series; Watts PLT series; or equal.

F Backflow Preventer: All backflow preventers shall be approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California. Provide straight configuration with shutoff valves and test cocks, unless shown otherwise on the Drawings.

1. Pressure rating: 175 psi
2. Temperature rating: 32 to 140 F
3. Connections, threaded
4. Type: Reduced pressure assembly, Febco LF860; Watts Series LF-009; Wilkins 975XL; or equal.

G. Emergency Shower and Eyewash Units:

1. Eyewash and Shower Combination Unit, Corrosion Resistant: Unit shall conform to ANSI Z358.1 and include drench shower with ABS plastic showerhead with pull rod actuation, eyewash with aerated sprays and dust covers with stainless steel receptor using push handle or foot-treadle actuation, galvanized supply pipe with corrosion-resistant epoxy coating, warning striping and signage. Guardian G1950; Speakman SE-603; or equal. Provide accessory system including flow switch, with output contacts, and local emergency alarm and light where noted in the Schedule.
2. Emergency Eye/Face Wash, Deck-mount, (right-hand) Swivel Actuation: Unit shall conform to ANSI Z358.1 and include eye/face wash unit with deck-mounted water supply and valve actuated on 90-degree (swivel) rotation of eye/face wash arm over separately supplied sink or basin. Valve shall close when eye/face wash arm is rotated away from sink/basin. Guardian G1774; Speakman SE-570; or equal.

2.03 PIPING, FITTINGS, VALVES, AND ACCESSORIES

A. Water System Piping (PW, HW, CW):

1. Pipe and fittings: See Section 15050, Type T-1 pipe.
2. Valves: See Section 15050, Valve System E.
3. Accessories:
 - a. Trap Primers: Precision Plumbing Products Trap Primer Valves model Oregon 1", P-1", P-2"; or equal of alternate manufacturer. Unit shall be listed by IAPMO and approved under ASSE Standard 1018.
 - b. Water Hammer Arrestor: Wade "Shokstop"; Zurn No. Z-1700; or equal.

B. Sanitary Drain, Waste, and Vent Piping (D, W, V, VTR):

1. Pipe and fittings: See Section 15050, Type N-3 pipe.
2. Accessories:
 - a. Floor drains and traps: Cast iron drains having inside caulk or push-on compression type neoprene gasket joints.
 - 1) FD-1 (For Finished Floors): Zurn Z-415-6B; Wade W-1104-AX6; or equal.
 - 2) FD-2 (Square Open Top Drain): Zurn Z-566; Wade W9130-LF or equal.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

15400 - 5

Plumbing

- 3) FD-3 (Funnel Drain): Zurn Z520, with 6-inch Z326 funnel; Wade W-1340 with EF-6 funnel; or equal.
- 4) TD-2 (Custom Trench Drain): Drain shall consist of a grated cover over a depression in a concrete floor. Refer to the structural drawings for specific requirements.
- b. Floor Cleanouts (FCO): Zurn Z-1400; Wade W-6000; or equal. Provide scoriated top.
- c. Wall cleanouts (WCO): Provide cleanout plug at run of sanitary tee installation.

2.04 THERMAL INSULATION FOR PLUMBING AND PIPING

- A. See Section 15050.

2.05 PIPE SUPPORTS

- A. See Section 15050.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons secured to pipe with set-screw where pipes or tubing pass through exposed walls or ceilings.
- B. Provide all fixtures with traps and vents unless otherwise indicated on the Drawings.
- C. Unless indicated otherwise, all soil, waste and drain piping shall be sloped not less than $\frac{1}{4}$ inch per foot downward in the direction of flow.
- D. Provide unions or flanges where equipment is installed in piping. Also provide dielectric unions or couplings at points of connection of ferrous to non-ferrous metal piping.
- E. Provide a shutoff stop valve in the branch of every water, or air pipe service upstream of every fixture or outlet. Unless noted otherwise in the Products section, provide access door to stops in accordance with Section 08305.
- F. Provide identification nameplates for each item of mechanical equipment. Refer to Section 10400.
- G. Furnish and install all supports, bracing and blocking required for the proper installation of the plumbing work specified herein.
- H. Water hammer arrestors shall be installed to protect each plumbing fixture or battery of fixtures as indicated on the Drawings.

- I. Place or erect all piping to accurate line and grade and backfill, support, hang, or brace against movement as specified or shown on the Drawings, or as required for proper installation. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining.
- J. Use reducing fittings where any change in pipe size occurs. Do not use bushings unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.
- K. Trenching, bedding, and backfill for buried piping shall be as shown on the Drawings and as specified in Section 02200.
- L. Where no pipe grade elevations are shown on the Drawings, install buried piping with at least 3 feet of cover to finished grade. Where piping crosses under buried electrical ducts, provide at least 4 feet 6 inches of cover. Provide 12 inches minimum separation between the buried pipes and ducts.
- M. Provide each pipe with a firm, uniform bearing for its full length in the trench except at field joints. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work.
- N. Where piping leaves a structure or concrete encasement, provide a joint capable of angular deflection within 12 inches of the structure for pipes 12 inch and smaller or as shown on the Drawings for larger pipe sizes. Conform to details on the Drawings.
- O. Provide valves wherever equipment drain connections are furnished and carry the discharge pipe to the nearest floor drain, drain trench or sump. Where no receptacle for drain exists, install drain piping to 1 inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.
- P. Where piping conveying liquids passes over motor control centers, electrical panels and other electrical devices, install a protective drainage tray below the piping.
- Q. Installation Specifics:
 1. Copper pipe:
 - a. Bends shall be made in a manner that does not crimp or flatten pipe.
 - b. Dielectric unions shall be installed at connections with ferrous piping.
 - c. Pipe shall have joints squarely cut clean, soldered joints shall be properly fluxed and heated before solder is placed in the joint. Joints must be driven up tight before solder is added. Compression and flared joints shall be made up in accordance with the fitting manufacturer's installation instructions. Brazing shall be in accordance with ANSI B31.1.
 2. Cast Iron Soil Pipe (CISP):
 - a. Bell and Spigot: Fold and insert one-piece rubber gasket into properly cleaned hub. Apply lubricant to gasket and to spigot. Lubricant shall be a type recommended by the pipe and gasket manufacturers. Push or draw spigot into gasketed hub with a pulling tool devised especially for this purpose.

Plumbing
15400 - 6
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

Plumbing

15400 - 7

- b. No Hub: Install in accordance with Cast Iron Soil Pipe Institute Pamphlet No. 100.
- c. Comply with UPC and IAPMO IS6-89 and UPC 1991 interpretation of UPC Par. 316 (b) (2).

3.02 CLEANING

- A. Prior to testing, thoroughly clean the inside of each completed piping system of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, flushing with water, or blowing with compressed air or oil-free nitrogen gas, as appropriate for the size and type of pipe. Flushing shall achieve a velocity of at least 3 feet per second. The Contractor shall install temporary strainers, temporarily disconnect equipment, or take other appropriate measures to protect equipment while cleaning piping.

3.03 TEST AND INSPECTION

- A. Test the systems and arrange for inspection by the proper authorities.
- B. Water piping shall be hydraulically tested at not less than working pressure psig and demonstrated to be leak-free for a 1-hour test period.
- C. Waste, drain, and vent piping shall be tested in conformance with the latest edition of the California Plumbing Code with local amendments. Storm drain (rainwater) piping shall be tested similar to waste, drain, and vent piping.
- D. Natural gas piping shall be tested in conformance with the latest edition of the California Plumbing Code with local amendments.

3.04 DISINFECTION OF WATER SYSTEM PIPING

- A. See Section 15050.

3.05 PIPE AND VALVE IDENTIFICATION

- A. General: Identify all exposed piping in this project by painting, banding, system name labels, and direction arrows. The color and banding shall be as selected by the Engineer. Identify all buried valves with tags as specified below.
- B. Exposed Pipe Identification: Before painting, banding and labeling, pipes shall be identified by the Contractor with temporary wired-on cardboard tags showing the proposed marking for review by the Owner.
- C. Piping: Paint all exposed pipes with the appropriate paint system as specified in Section 09960 and provide pipe markers per the schedule specified in Section 10400.
- D. Valves: Provide each valve with a valve tag identifying the contents.

END OF SECTION

Plumbing
15400 - 8
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

SECTION 15800

HEATING AND VENTILATING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Furnish all labor, materials, equipment, services and incidentals required to provide complete, integrated, and operating, Heating and Ventilating Systems for the buildings and structures in this project. Materials and equipment to be supplied shall be new, of the best quality as specified and as shown on the Drawings.
- B. Related Sections: None.
- C. Fans, exhausters, and ventilators furnished as a part of the work of this project shall comply with applicable provisions of this Section and Schedules and Notes on Drawings.
- D. Vibration Control Products: All motorized equipment shall be provided with vibration control. Vibration control products furnished as an integral part of supplied equipment shall be specified as part of equipment assembly, herein.
- E. Work Included in This Section:
 - 1. Testing and Adjusting Equipment and Controls.
 - 2. Dampers.

1.02 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
 - 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

Heating and Ventilating Systems

15800 - 1

2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
- B. Provide shop drawings and technical literature covering all equipment and accessories being furnished under this Section. The data shall include information to demonstrate compliance with all of the requirements of these Specifications. Submittals shall include but not be limited to the following:
 1. Manufacturer's drawings detailing equipment assemblies and bases, and indicating dimensions, weights, required clearances, components, and location of field connections and equipment anchoring points.
 2. Fan curves for proposed units, with system operating conditions clearly indicated.
 3. Motor ratings and electrical characteristics, plus motor and fan accessories.
 4. Damper data, including housing, linkages, and operators.
 5. Manufacturer's product certification, where applicable.
- C. Manuals: Furnish manufacturer's installation, lubrication and maintenance manuals, bulletins and parts lists. Furnish separate list of recommended spare parts, motor and drive replacement part numbers, service depot location and telephone number.
- D. Affidavits: Furnish affidavits from the manufacturers stating that the equipment has been properly installed and tested and each is ready for full time operation.

1.03 QUALITY CONTROL

- A. Codes: Comply with all rules and regulations of authorities having jurisdiction over the work specified herein.
- B. Permits and inspection shall be in accordance with Division 1 of these Specifications.
- C. All equipment furnished under this Section shall: (1) be of a design and manufacturer who has been regularly engaged in the design and manufacture of the equipment; and (2) be demonstrated to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers specifically named herein.
- D. The Drawings shall be taken in a sense as diagrammatic. Size of ducts and pipes including general method of running them are shown, but it is not intended to show every offset and fitting nor every structural difficulty that may be encountered.

Heating and Ventilating Systems 15800 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004-00
© 2014 Kennedy/Jenks Consultants

- E. Standards and document references in text of this Section shall be the edition current at date project manual was issued.

1. AFBMA (Anti-Friction Bearing Manufacturers Association):
 - a. AFBMA Std 9 Load Ratings and Fatigue Life for Ball Bearings
 - b. AFBMA Std 11 Load Ratings and Fatigue Life for Roller Bearings
2. AMCA (Air Movement and Control Association, Inc.)
 - a. AMCA 99 Standards Handbook
 - b. AMCA 210 Laboratory Methods of Testing Fans for Rating Purposes
 - c. AMCA 300 Test Code for Sound Rating Air Moving Devices
 - d. AMCA 301 Method of Calculating Fan Sound Ratings from Laboratory Test Data
3. NEMA (National Electrical Manufacturers Association)
 - a. NEMA MG-1 Motors and Generators
- F. NEMA Compliance: Provide electric motors and components that are NEMA listed and labeled.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design Criteria: Drawings indicate sizes, profiles, connections, dimensional requirements, etc. of fans, exhausters, and ventilators, based on referenced products. Products having equivalent performance characteristics by other manufacturers may be considered, provided deviations in dimensions, profiles and efficiencies are suitable for the application and do not change the design concept or intended performance as judged by the Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site, properly store, and protect until ready for installation and use.
- B. Protect motors, shafts, and bearings from weather and construction dust.
- C. If units must be stored outside for a prolonged period, remove motors and belts and store them inside a weathertight structure.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Equipment specified under each subsection (2.02, 2.03, etc.) shall be the end product of one manufacturer.
- B. Specific information relative to the various equipment, including identification numbers, capacities, horsepower, and other information shall be as listed on the Drawings.

McKinleyville Community Services District 15800 - 3 Heating and Ventilating Systems
Wastewater Management Facility Improvements
Bid Set 1368004-00
© 2014 Kennedy/Jenks Consultants

2.02 DUCTWORK

- A. Ductwork: Unless otherwise indicated, ductwork shall be galvanized steel.
- B. Rectangular Ductwork: Unless otherwise indicated ductwork shall be galvanized steel.
1. Material: Ductwork shall be of lock forming quality, ASTM A653 and ASTM A924, coating designation G90. Zinc coating in accordance with ASTM A90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.
 - a. Carbon steel sheets: ASTM A366, cold-rolled sheets, commercial quality, oiled exposed matte finish.
 - b. Reinforcements shapes and plates: Unless indicated otherwise, galvanized steel where installed on galvanized sheet metal duct. Where installed on duct of other material, shapes and plates shall be of compatible materials.
 2. Rectangular duct fabrication:
 - a. General: Except as indicated otherwise, fabricate rectangular ducts of galvanized sheet steel in accordance with SMACNA "HVAC Duct Construction Standards," Tables 2-1 through 2-28, including associated details. Conform to requirements of referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.
 - b. Materials: Free from visual imperfections such as roller marks, seam marks, pitting, stains, and discolorations.
 - c. Size ductwork as indicated on Drawings, coordinate with structure and other installations.
 - d. Duct lengths: Appropriate to reinforcement and rigidity class required for pressure classification.
 - e. Static pressure classifications: Except where indicated otherwise, construct duct systems to following pressure classifications:
 - 1) Supply ducts: 2 inches water gauge.
 - 2) Return ducts: 2 inches water gauge, negative pressure.
 - 3) Exhaust ducts: 2 inches water gauge, negative pressure.
 - f. Interior ducts shall be suitably braced and stiffened at floor and roof penetrations, as well as over their unsupported length, to maintain duct integrity and to limit vibration and noise.
 - g. Low pressure ductwork joints:
 - 1) Transverse stiffeners and joints shall be appropriately spaced to maintain duct cross-section integrity in accordance with the pressure class specified and at the prevailing operating velocities.
 - 2) After joints are crimped, they shall be further secured by bottom punching or riveting. Longitudinal seams shall be Pittsburgh locked, and shall be cross-broken outward. Intake or exhaust side ducts shall be cross-broken inward. Discharge ducts shall be cross-broken outward. All plenums and casings shall be similarly cross-broken and further reinforced with 1-inch by 1-inch by 0.125-inch angles, running diagonally between joints, riveted to the casings.

Heating and Ventilating Systems

15800 - 4

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004-00

© 2014 Kennedy/Jenks Consultants

- 3) Girth joints shall be secured with "S" clips and drive cleats.
 - (a) Stiffen girth joints on ducts with any dimension larger than 15 inches to prevent bulging or sagging.
 - (b) "Ductmate" connector flanges are acceptable and, when used, all duct sealing tests as required by this specification shall hold with no variation.
- h. Low pressure duct construction:
 - 1) Ductwork fabrication:
 - (a) All ductwork shall be constructed, erected, and tested in accordance with the most restrictive of local regulations, procedures detailed in the ASHRAE Handbook of Fundamentals, or the applicable SMACNA standards. Provide duct material, gages, reinforcing, and sealing for operating pressure indicated.
 - (b) Size round ducts installed in place of rectangular ducts in accordance with ASHRAE Table of Equivalent Rectangular and Round Ducts. No variation of duct configuration or sizes permitted except by written permission.
 - (c) Joints shall be sealed, as required, to limit total system leakage to a maximum of 3½ percent of the specified equipment airflows.
 - i. The Contractor shall provide all ductwork, plenums, and auxiliary work and products necessary to make the HVAC systems complete and ready for operation. Ductwork shall comply with the following restrictions and conditions:
 - 1) Snap lock seams will not be permitted.
 - 2) Visible duct deflection, loss of shape, or unwarranted noise or vibration resulting from faulty or inadequate support, reinforcing, metal gauge, fabrication, or joint spacing shall not be permitted.
 - 3) Sway bracing shall be provided, with a minimum of one at right angles to each duct run.
 - 4) Joints shall not interfere with airflow in the ducts.
 - 5) Sway rods, 0.375-inch diameter, shall be installed at each transverse joint in ducts over 72-inches. The spacing between rods or the rods on the side of ducts shall not exceed 48 inches.
 - 6) Supports shall be designed and installed in accordance with CBC, Chapter 16 and Section 01190.
3. Rectangular Duct Fitting Fabrication:
 - a. Fabricate fittings (elbows, transitions, offsets, branch connections) and other duct construction in accordance with SMACNA "HVAC Duct Construction Standard," Figures 4-1 through 4-9.
 - b. Duct Increases and Reducers: Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees, convergence downstream shall not exceed 45 degrees.
 - c. All connections to main ducts shall be made with low loss fittings.
 - d. Whenever ducts extend through concrete they shall be provided with a sleeve. Concrete inserts shall be provided to support all ductwork.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004-00

15800 - 5

Heating and Ventilating Systems

© 2014 Kennedy/Jenks Consultants

C. Round Duct Fabrication:

1. General: "Basic Round Diameter" as used in this article is the diameter of the size of round duct that has a circumference equal to perimeter of a given size of flat oval duct. Except where interrupted by fittings, provide round and flat oval ducts in lengths not less than 12 feet.

a. Acceptable manufacturers: Semco; LaPine; Tangent Air; United McGill (United Sheet Metal).

2. Round ducts: Fabricate round supply ducts using seam types identified in SMACNA "HVAC Duct Construction Standards," Figure 3-1, RL-1, RL-4, or RL05. Figure RL-2 or RL-3 seam types may be used if spot-welded on 1-inch intervals. Comply with SMACNA "HVAC Duct Construction Standards," Table 3-2 for galvanized steel gauges.

D. Round Supply and Exhaust Fittings Fabrication:

1. 90 degree tees and laterals and conical tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards," Figures 3-4 and 3-5 with metal thicknesses specified for longitudinal seam straight duct.
2. Diverging flow fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.
3. Elbows: Fabricate in die-formed, gored, or pleated construction. Fabricate bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting following requirements.
 - a. Round elbows, larger than 14 inches: Gored elbows, except where space restrictions require a mitered elbow.
 - b. Round gored elbows gauges: Same as for non-elbow fittings specified above.

2.03 DIFFUSERS, REGISTERS, AND GRILLES

A. Air Registers and Grilles:

1. General: Except as indicated otherwise, provide manufacturer's standard registers and grilles where shown on Drawings of type, size, shape, and capacity indicated, constructed of materials and components indicated and as required for complete installation.
2. Performance: Furnished registers and grilles shall each have, as a minimum, performance (noise criteria ratings evidenced by listing in manufacturer's current data) as noted or scheduled on Drawings.
3. Compatibility: Border styles shall be compatible with adjacent wall and ceiling systems, specifically manufactured to fit into wall construction or ceiling module with accurate fit and adequate support. Refer to General Construction Drawings and Specifications for types of wall and ceiling systems that will contain respective type register or grille.
4. Acceptable Manufacturers: Subject to compliance with requirements, fans shall be the standard catalogued products of:
 - a. Titus.
 - b. Price Companies.
 - c. Carnes.

B. Heavy-Duty Wall-Mounted Transfer Grilles:

1. Wall-mounted return/relief/transfer grilles shall be of heavy-duty steel construction with blades of 14-gauge steel and frame of 16-gauge steel. Grille blades shall be set horizontally and on 3/8-inch to 0" deflection spacing. Grilles shall have an overlap margin to cover the wall opening. Wall-mounted grilles shall be provided with plaster frames. Plaster frames shall be of the same finish as grille.
2. Provide countersunk screw holes with oval head mounting aluminum screws. Paint screw heads to match grille finish.
3. Wall-mounted transfer grilles shall be equivalent to Titus Model 30RL, or approved equal.
4. Wall-mounted grilles shall have factory applied prime coat and be field painted, color as selected by Architect. Note: Verify finish preference on all wall-mounted grilles with Architect.

C. Duct-Mounted Supply Grilles and Registers:

1. Supply grilles and registers shall be double deflection with individually adjustable bars that allow 45° adjustment spread. Bars shall be on 3/4-inch centers, with horizontal face bars and vertical rear bars.
 2. Register Mounting:
 - a. Supply grilles installed in wall openings shall have an overlap margin to cover wall opening.
 - b. Grilles installed at ductwork shall be mounted on sheet metal register takeoffs, grille taps, or equivalent.
 3. Provide countersunk screw holes with oval head mounting aluminum screws. Paint screwheads to match grille finish.
 4. The flange face shall have a continuous sponge rubber gasket.
 5. The frame shall be 1-inch flat steel.
 6. Supply grilles and registers shall be of steel construction. Registers shall have baked enamel finish, color as selected by the Architect. Grilles shall be equivalent to Titus Model 300RL series, Titus 250 series, or approved equal.
 7. Supply registers shall be furnished with an opposed blade volume control damper and gasket seals with the air volume adjustment made through the face of the outlet. Supply register accessories shall be painted flat black.
 8. Opposed blade volume control dampers shall be equivalent to Titus Model AG-15, or approved equal.
- D. Contractor shall furnish to Owner three operating keys for each type of diffuser and register that requires them.

2.04 FANS

A. General Requirements:

1. Fans, exhausters and ventilators furnished as a part of the work of this project shall comply with applicable provisions of this Section and Schedules and Notes on Drawings.
2. Size, capacities, performance characteristics, arrangements, and accessories as scheduled or noted on Drawings.

Heating and Ventilating Systems

15800 - 6

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004'00

© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004'00

15800 - 7

Heating and Ventilating Systems

© 2014 Kennedy/Jenks Consultants

3. Performance Requirements:
 - a. Fabrication: Conform to AMCA 99.
 - b. Performance Ratings: Based on tests made in conformance with AMCA 210.
 - c. Sound Ratings: Determined by AMCA 301, tested per AMCA 300.
 - d. NEMA Compliance: Provide electric motors and components that are NEMA listed and labeled.
 - e. Performance and Sound Rating Certification: Manufacturer shall certify that their products comply with specified requirements.
4. Motors: Comply with applicable general provisions of Section 11002:
 - a. Designed for continuous operation in 40°C environment.
 - b. For temperature rise in accordance with NEMA MG-1 limits for insulation class, service factor, and motor enclosure type.
 - c. Type specified, scheduled or noted for respective units.
5. Acceptable manufacturers: Subject to compliance with requirements, fans shall be the standard catalogued products of:
 - a. Greenheck Fan Corporation
 - b. Loren Cook Company, Inc.
 - c. Or equal.
- B. In-Line Centrifugal Fans:
 1. In-line centrifugal fans shall be factory-fabricated assemblies having fan, fan motor, filter box and fan housing. Where indicated, corrosion-resistant, factory applied coatings shall be "Eisenheiss," or air-dried "Hereseite," applied in strict conformance with the paint manufacturer's instructions. Fans shall bear the AMCA seal for sound and air performance and shall be furnished with automatic gravity backdraft dampers, where indicated on the Schedule.
 2. Housing: Square design, heavy gauge galvanized steel, equipped with square duct collars, two (2) removable access panels sized and arranged to permit easy access to all interior components, and universally adjustable mounting brackets for horizontal and vertical mounting. Provide fiberglass duct liner on interior of fan and motor housings.
 3. Fan wheel: Constructed of aluminum, centrifugal backward inclined with wheel core, matched to inlet cone, statically and dynamically balanced.
 4. Filter Box: As noted on the Drawings provide a factory assembled combined filter box and fan:
 - a. Provide flanges on filter box for easy connection to ductwork.
 - b. Air pressure drop through filter box shall be as noted on Drawings.
 - c. Provide removable side panels on filter box for filter servicing without disturbing the inlet or discharge connections.
 - d. Provide 2-inch aluminum frame filter with odor control media, Purafil 'Purafilter', or equal.
 5. Direct drive fans: Provide fan wheel mounted on motor shaft.
 - a. Motor: Permanently lubricated, compatible for use with speed controls, totally enclosed, with motor cover.
 - b. Motor cover: Provide to separate motor from air stream as indicated.
 - c. Disconnect switch: Disconnect switch shall be factory wired, non-fusible, mounted in the fan's housing with thermal overload protection (overload protection is required for 120 Vac motor only) for the motor.

Heating and Ventilating Systems 15800 - 8 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

6. Isolator kits: Provide with each unit for hanging or base mounting as required, neoprene or spring type, unless specific type is indicated or required for a particular unit.
7. Accessories: Provide following with respective fans where indicated on the Schedule
 - a. Remote Fan Speed Control, solid state, capable of controlling fan speed from full speed to approximately half speed.
 - b. Provide line voltage thermostat for unit control.
- C. Sidewall Centrifugal Exhaust Fans:
 1. Sidewall exhaust fans shall be factory fabricated assemblies, as indicated on the Drawings, consisting of housing, fan, designated motor/drive, factory wired disconnect switch, aluminum bird screen, and spun aluminum hood, complete with special features and accessories as indicated in the fan schedules. Fan surfaces shall be coated with a corrosion-resistant, factory applied paint. Corrosion-resistant coatings shall be "Eisenheiss" or air-dried "Hereseite" applied in strict conformance with the paint manufacturer's instructions. Fans shall bear the AMCA seal.
 2. Exhaust fan shall be belt driven or direct drive as indicated, equipped with designated motor/drive and square one-piece, hinged aluminum curb base with venturi inlet cone.
 3. Housing: Heavy-gauge, removable, spun aluminum, dome top and outlet baffle. Motor compartment shall be completely ventilated with outside air.
 4. Fan wheel: The centrifugal wheel shall be aluminum, backward inclined, non-overloading design. The motor shall be enclosed in a weathertight compartment, separated from the exhaust air-stream and cooled by way of an air passage free of contaminated fumes.
 5. Bearings and drives for all fans:
 - a. Bearings shall be rated AFBMA 9, L-50 life at 200,000 hours heavy-duty pillow block type, self-aligning, grease-lubricated ball bearings, or AFBMA 11 L-50 life at 200,000 hours pillow block type, self-aligning, grease-lubricated roller bearings.
 - b. Shaft shall be hot-rolled steel, ground and polished, with key-way; protectively coated with lubricating oil.
 - c. Lubrication of fittings shall be extended to outside of casing.
 6. Disconnect switch: Provide mounted inside fan housing, factory wired to fan motor through an internal aluminum conduit, with thermal overload protection (overload protection is required for 120 Vac motor only) for the motor, in accordance with NEC, using UL-listed materials.
 7. Mounting Plate: Furnish by fan manufacturer with mounting holes.
 8. Electrical characteristics and components for all fans:
 - a. Electrical characteristics shall be as shown on the Drawings.
 - b. Fan motors shall be provided in accordance with Section 11002 and shall be UL-listed. Motors shall be non-overloading under all operating conditions.
 - c. Wiring terminations shall be provided by means of terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Terminal lugs shall be enclosed in terminal box sized to NFPA 70.

McKinleyville Community Services District 15800 - 9 Heating and Ventilating Systems
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

9. Accessories: Provide following with respective fans where indicated on the Schedule.
 - a. Remote Fan Speed Control, solid state, capable of controlling fan speed from full speed to approximately half speed.
 - b. Provide line voltage thermostat for unit control.
 - c. Automatic (gravity) backdraft dampers, mounted in wall opening.
- D. Combination Ceiling Exhauster, Light and Heater:
 1. Provide factory-packaged assemblies having air exhaust, lamp wattage and heating element capacities as specified for respective applications.
 2. Acceptable manufacturers: Subject to compliance with requirements:
 - a. Nutone.
 - b. Broan.
 3. Assemblies shall bear the UL label.
 4. Assemblies shall be furnished complete with triple wall switches for individual control of each component.

2.05 DUCTWORK ACCESSORIES

- A. Sealing Materials:
 1. Sealant shall be non-hardening, water resistant, fire resistant, compatible with mating material; liquid used alone or with tape, or heavy mastic, meeting the fire hazard classification rating of 25/50 when tested in accordance with ASTM E84.
 2. Duct Sealer: Miracle #D-618, United McGill "UNI-WELD," United Sheet Metal "Duct-Sealer".
 3. Flanged joint mastics: One-part, acid-curing, silicone elastomeric joint sealants; ASTM C920, Type S, Grade NS, Class 25, Use O.
- B. Ductwork Hangers and Supports:
 1. Manufacturers:
 - a. Acceptable manufacturers, subject to compliance with requirement.
 - b. B-Line Systems, Inc.; Eichen Metal Products Company; Fee & Mason Manufacturing Company; Anvil International, Inc.; Michigan Hanger Company; PHD Manufacturing, Inc.; or equal.
 2. Building attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials.
 - a. Concrete inserts for suspended hangers: Galvanized formed "U" channel concrete insert and threaded clamping nut; Michigan #C-12 CONCT and #SPRC or #NUTC; or equal.
 - b. Clamps for attachment to steel framework: Steel C-clamp, equipped with setscrew, locknut, and retaining strap; Michigan #200L +200C; or equal.
 3. Hangers and Supports:
 - a. Hangers: Galvanized steel straps or bands or round steel threaded rod, sized according to Figures 5-1 to 5-7 of SMACNA Standards, suitable trapeze arrangement appropriate for the location for large or multiple ducts, fire resistant as required for applications involving fire-rated ceilings. Hanger rod shall be fabricated from ASTM A36, steel, galvanized, continuously threaded, use double nuts and lock washers on threaded support rods.
 - b.

Heating and Ventilating Systems 15800 - 10 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

- c. Hangers installed in corrosive atmospheres: Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.
- d. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- e. Trapeze and riser supports: Hot-dipped galvanized.

C. Duct Accessories:

1. Regulatory Requirements:
 - a. Products requiring electrical connection shall be in accordance with CCR, Title 8, and shall be listed and classified by UL as suitable for the purpose specified and indicated.
 - b. Non-metallic components shall meet the fire hazard classification rating of 25/50 when tested in accordance with ASTM E84.
2. Flexible duct connections:
 - a. Flexible connection material: Fire-retardant, waterproof, airtight, abrasion-proof, ozone-resistant, neoprene coated woven glass fabric that is not affected by temperature as low as -10°F or as high as 200°F and manufactured for pressures involved. The coating shall not weigh less than 24 ounces per square yard.
 - b. Flexible duct connections shall be Ventfabrics, Inc. "Ventglas"; Duro-Dyne Corporation "Neoprene"; or equal.
 - c. Fabric shall conform to the requirements of NFPA 90A, maximum flame spread rating of 25, smoke developed rating of 50 for all materials, including connecting tape and sealant when tested in accordance with the requirements of ASTM E84. Minimum density shall be 30 ounces per square yard.
 - d. Flexible connectors shall be UL-listed.
 - e. Flexible connectors shall be provided with the necessary angle, straps, bolts, clips, or other fasteners to secure the flexible material to the equipment and ducts.
 - f. Flexible connections shall be designed to be removed and reinstalled without disassembling adjacent ductwork.
 - g. Flexible duct connectors shall be fabricated in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated on the Drawings.
3. Flexible ducts:
 - a. General: UL listed, factory pre-insulated.
 - b. Acceptable manufacturers: Clevalflex Type DBA; or equal.
 - c. Flexible duct core shall be all metal, semi-rigid construction, consisting of a single ply of perforated and corrugated aluminum, with seams interlocked, folded flat, and knurled. Flexible duct shall be wrapped with fiberglass insulation and sleeved in a fiberglass reinforced metalized polyester vapor barrier.
 - 1) Flexible duct shall be suitable for duct air velocity up to 3,000 fpm.
 - 2) Working pressure shall be 2-inch w.c.
 - 3) Burst pressure shall be 4-inch w.c.
 - 4) Insulation shall be 1½-inch thick, 0.5 lb. per cubic feet density with R-value of 4.5.

McKinleyville Community Services District 15800 - 11 Heating and Ventilating Systems
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

- d. Flexible duct fittings and couplings: Crimp on or spin in type manufactured fittings, specifically designed by flexible duct manufacturer for use with flexible ductwork; Clevalflex; or equal.
- e. Flexible duct clamps: Ventlok #670, or equal.

2.06 HEATERS

- A. Electric Infrared Radiant Heater
 1. Electric radiant heaters shall be factory fabricated unit heater assemblies designed for indoor or outdoor installation, bearing the Underwriters Laboratories label, and of capacity noted on the Drawings.
 2. Heater shall consist of sheathed alloy heating elements with lead wires, encased within an aluminum reflector housing with internal heat shield. Heater elements and housing shall be of moisture-resistant construction, and capable of withstanding hose spray exposure.
 3. Electric power supply voltage shall be 120 Vac, single phase.
 4. Unit shall be controlled by line voltage thermostat.
 5. Unit heaters shall be Qmark CRN series, Emerson-Chromalox type S-RAD, or equal.

2.07 TEMPERATURE CONTROL SYSTEMS

- A. Line Voltage Thermostat: Units shall include bimetal thermometer and single-pole, double-throw switch for circuit control. Differential temperature shall be 3°F. Front panel shall include temperature selection knob/dial with a range of 40°F to 90°F unless otherwise specified, internal sensing element and thermometer indication. Thermometer shall be Emerson "Chromalox", Honeywell; or equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examination, Coordination and Incorporation of Related Work:
 1. Examine areas and conditions, with installer present, for compliance with requirements for installation tolerances, equipment supports, ductwork, and other conditions affecting performance of fans.
 2. Do not proceed until unsatisfactory conditions have been corrected.
 3. Louvers: Where so indicated on Drawings, louvers will be furnished as a part of general construction work. Ductwork trades shall cooperate with general trades and coordinate louver features and performance.
 4. Before installing insulation, verify that respective work to be insulated is complete, has been tested and cleaned, and is ready to be insulated.
 5. Contractor shall obtain wall and ceiling construction information from General Construction Drawings and Specifications and coordinate diffusers, register and grille mounting arrangement and accessories with respect to adjacent construction.

Heating and Ventilating Systems 15800 - 12 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

B. Protection:

1. Fully protect all unfinished parts of the materials and equipment against damage from whatever cause during the progress of the work and until final completion.
2. All materials and equipment shall be covered while in storage and during construction in such manner that no finished surfaces shall be damaged or marred and all moving parts shall be kept perfectly clean and dry.
3. Ducts and other air distribution component openings shall be covered with tape, plastic, sheet metal, or other methods to reduce the amount of dust, water, and debris which may enter the system during storage and rough installation.

3.02 DUCTWORK INSTALLATION

- A. All sheet metal ductwork shall be erected in a first class and workmanlike manner and shall be in accordance with the applicable sections of California Building Code (CBC), California Mechanical Code (CMC), and California Energy Code (CEC), and in accordance with "Low Pressure Duct Standards" of the Sheet Metal and Air Conditioning Contractors National Association, Inc., and as specified above. No ductwork shall be fabricated or installed until it has been carefully coordinated with other trades. Ducts shall be located with sufficient space around equipment to allow normal operations and manufacturing activities. All transverse duct joints shall be taped airtight. Duct dimensions shown are "net" inside clear. Each air supply outlet and each air return or outside air intake shall have either an integral volume control device or shall be furnished with a volume damper.
1. Duct installation, general:
 - a. Duct system pressure class: Construct and install each duct system for the specific duct pressure classification indicated.
 - b. Install ducts with fewest possible joints.
 - c. Secure joints with sheet metal screws.
 - d. Seal all joints and seams. Apply sealer to male end connectors before insertion, and afterwards to cover entire joint and sheet metal screws.
 - e. Flanged joints: Seal with neoprene rubber gaskets.
 - f. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.
 - g. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.
 - h. Install ductwork generally in the location and manner shown and detailed on Drawings, with all fittings and connections made in accordance with applicable SMACNA Standards. Modifications or deviations required by job conditions must be approved by the Engineer prior to fabrication.
 - i. Provide and install duct accessories (dampers, turning vanes, and access doors) where called for and where shown on Drawings and where required.
 - 1) Openings in ductwork shall be provided where required to accommodate thermometers and controllers. Pitot tube openings shall be provided where required for testing of systems, complete with metal can with spring device or ensure against air leakage. Where openings are provided in insulated ductwork, insulating material shall be installed inside a metal ring.

McKinleyville Community Services District 15800 - 13 Heating and Ventilating Systems
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- 2) Ductwork and accessories shall be installed to provide a system free from buckling, warping, breathing, and vibration. Ductwork installation shall permit installation of other required services without piercing, crimping, or reducing duct sizes. Where space conditions permit, full radius turns shall be used at offsets.
- 3) To ensure airtight ducts, seams shall be sealed with liquid- or mastic-type sealants. Taped joints will not be permitted. All joints shall be in accordance with SMACNA Seal Class A.
- 4) Duct sealants shall not be installed when surface and ambient temperatures are less than those recommended by sealant manufacturers. Temperatures during and after installation of duct sealants shall be maintained as recommended by the manufacturer.
- 5) No power actuated anchors shall be used.
- 6) Duct Test Holes:
 - (a) Cut or drill temporary test holes in ducts as required. Cap with threaded metal caps.
 - (b) Permanent test holes shall be factory fabricated, airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
- j. Prior to fabrication, review duct fabrication drawings with the TAB Contractor to verify that all balancing devices are indicated for proper balancing of the system. Provide 2-inch-diameter nipples welded to the duct equipped with threaded caps where required by the TAB Contractor for balancing the system.
- k. Locate ducts, except as indicated otherwise, vertically and horizontally, parallel and perpendicular to building lines. Avoid diagonal runs. Install duct systems in shortest route that does not obstruct usable space or block access for servicing building and its equipment.
 - 1) Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
 - 2) Route ductwork to avoid passing through transformer vaults, and electrical equipment spaces, except as specifically shown.
- l. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- m. Provide 1-inch minimum clearance between structure components, furring, and outside of duct insulation and outside of uninsulated duct.
- n. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings, unless indicated otherwise. Do not encase horizontal runs in solid partitions, except as specifically shown. Install, test, and insulate (when applicable) concealed ductwork before it is furred in.
- o. Provide flexible connections between sheet metal assemblies such as ductwork and plenums, and operating machines and/or mechanisms such as fans and air handlers.
 - 1) Flexible connections of ductwork shall be held in place by 1-inch by 1/8-inch band iron bolted in place around entire perimeter of connecting ductwork.

- p. Joint sealing during fabrication and assembly:
 - 1) Thoroughly seal all air ducts and taps against air leakage and all exterior and outside air ducts against moisture leakage. Paint or trowel sealer on joints before assembly.
 - 2) Thoroughly streamline all fittings in rectangular ducts around joints by applying a filler to cover all edges extending in to the air stream.
 - (a) Set damper frames in a sealer with frame filleted into ductwork with a filler compound.
 - 3) Butted flanged joints in ductwork shall be wiped smooth with a filler compound.
 - 4) Seal terminal box joints with field applied duct sealer.
 - 5) Flanged joints: Seal with neoprene rubber gaskets.
- q. Adjusting and cleaning:
 - 1) Adjust volume control devices as required by testing and balancing procedures to achieve required airflow.
 - 2) Vacuum duct systems prior to final acceptance to remove dust and debris. Duct systems shall be cleaned with high power vacuum machines. Equipment that may be harmed by excessive dirt shall be protected with filters, or bypassed during cleaning. Adequate access into ductwork shall be provided for cleaning purposes.
- r. The inside of all ducts visible through grilles and registers shall be painted flat black.

3.03 DUCTWORK HANGERS AND SUPPORTS

- A. Preparation
 1. Coordinate locations of inserts, anchors, and clamps with supported work and with other work and related supports.
 2. Contractor shall be responsible for correcting omissions and conflicts that are due to failure to coordinate his hanger and support work.
 3. Provide ductwork and equipment supports, hangers, guides and anchors as on the Drawings, and as specified herein. When standard hangers, supports, and accessories are not adequate the Contractor shall employ a California registered Structural Engineer to prepare design calculations for all such supports, hangers, and accessories for seismic restraint needed for the ductwork and equipment installation. Calculations and shop drawings shall be signed by the above named engineer and submitted to the Engineer.
- B. Duct Supports: Duct support details and spacing shall conform to the most current edition of the SMACNA "HVAC Duct Construction Standard, Metal and Flexible," Figures 5-1 to 5-7 of SMACNA Low Pressure Duct Standards.
- C. Attachment to Structure:
 1. Follow manufacturer's load ratings and application data for products.
 2. Upper attachments to structures shall have an allowable load not exceeding 1/4 of failure (proof test) load, but are not limited to the specific methods indicated.
 3. Support duct hangers from building structural members. Do not attach hangers to roof deck or ceiling construction.

4. Inserts: Provide for suspending hangers from reinforced concrete slabs and beams, cast into slabs during pouring of concrete. Use drill-in type expansion bolts in existing concrete decks.
5. C-Clamps: Utilize for suspending hangers from structural beams and joists. Secure clamps with lockouts and retaining straps.
6. Powder actuated concrete fasteners: Utilize only for attaching strap or band hangers to structure, following manufacturer's recommendations and instructions. Do not use for attachments to lightweight aggregate concrete or for attachments to slabs less than 4 inches thick. Install only after concrete is completely cured.

D. Installation of Duct Hangers and Supports:

1. Install duct hangers and supports at proper intervals for the pressure class and conditions specified and prevailing in the system according to SMACNA Manual requirements, unless another arrangement is detailed or noted on Drawings. Supports shall be spaced to prevent visible duct deflection and loss of system integrity.
2. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.
3. Support vertical ducts at maximum intervals of 16 feet and at every floor.
4. Supports for ductwork above fire rated ceilings shall be coordinated with ceiling supports, arranged to preserve fire resistance capability of the ceiling.
5. Refer to Chapter 3, General Requirements, of the SMACNA Seismic Restraint Manual, 1991 Edition, page 3.32, for General Requirements for Bracing of Ducts. Supports shall be designed and installed in accordance with Section 01190.
6. Rectangular ductwork in concealed ceiling spaces shall be supported by metal-strap hangers, screwed to the sides and bottom of ducts. There shall be one strap each side with a minimum of two screws in the sides and one in the bottom of each strap.

3.04 DUCT ACCESSORIES

- A. General: Provide and install duct accessories where called for, where shown on the Drawings, and where required according to manufacturer's installation instructions, applicable portions of details of construction in SMACNA Standards, and applicable provisions of ductwork sections and drawings.

B. Application and Installation of Flexible Connections for Ductwork:

1. Flexible connections in ducts shall be installed in folds, and of sufficient length to accommodate the maximum deflection resulting from vibration and contraction without causing strain.
2. Minimum length in folded position shall be 6 inches. Allow for at least 1 inch of slack.
3. Provide flexible connections between sheet metal assemblies and equipment, and between different sheet metal assemblies, as called for in respective specifications and as shown on respective Drawings.
4. Installation: Governed by respective application specifications and details.

Heating and Ventilating Systems 15800 - 16 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

C. Application and Installation of Flexible Duct:

1. Provide flexible duct to connect ductwork to air devices and to connect air devices to other air devices as shown on Drawings or as required.
2. Fasten flexible duct to ductwork and devices with clamps or acceptable methods approved by Air Diffusion Council.
3. Flexible duct length shall be maximum of 60 inches long.
 - a. Flexible ductwork shall be installed to maintain a constant cross-sectional area throughout a bend. Branch ductwork shall be aligned and installed in a direction directly toward the air terminal to prevent buckling or kinking of the flexible duct.

D. Installation of Diffusers, Registers, and Grilles:

1. Coordinate diffuser register and grille installation interface with other work as necessary, including adjoining surfaces, ductwork, and duct accessories. Take special care in locating and sizing openings through finished surfaces to ensure complete coverage of rough openings by integral device flanges or auxiliary frames.
 - a. Provide plenums for slot and strip diffusers, equipped with volume damper at branch take-off to diffuser in accessible ceilings and at plenum inlet, adjustable from face, in inaccessible ceilings.
2. Install diffusers, registers and grilles as indicated on Drawings, in full accordance with applicable codes and regulations, recognized industry practices, and manufacturer's instructions. Install diffusers, registers and grilles tight against surface where installed.
 - a. Locate diffusers, registers and grilles as indicated on General Construction "Reflected Ceiling Plans". Unless indicated otherwise, locate units in center of acoustical ceiling modules.
3. Diffusers, registers, and grilles shall be installed tight on their respective mounting surfaces, plumb and true with room dimensions and accurately centered on projections, recesses, windows, ceiling grids, light fixtures, or doors. Appropriate frames shall be provided whenever necessary to adapt to the mounting surface. Locate units in center of acoustical ceiling tiles.

3.05 FAN INSTALLATION

- A. Installation shall be in strict accordance with the best practice of the several trades and with the respective manufacturer's instructions and recommendations. Installation shall include furnishing the required oil and grease for initial operation in accordance with the manufacturer's instructions.
- B. Install units level and plumb. Align, lubricate, start, and balance units in accordance with manufacturer's written instructions, with proper clearance and access for inspection and servicing.
- C. Install units with resilient mountings and flexible electrical leads.
- D. Install fan related items in a manner that will ensure vibration isolation provisions are not short-circuited.

McKinleyville Community Services District 15800 - 17 Heating and Ventilating Systems
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- E. Suspend in-line fans from structure above, unless respective unit is indicated on Drawings to be base mounted. Mount fans on vibration isolators and provide flexible duct connections.
- F. Provide ceiling access panels to access fans installed above rigid ceilings.
- G. Coordinate fan housing access panel orientation with access path.

3.06 TESTING AND ADJUSTING EQUIPMENT AND CONTROLS

- A. The equipment and controls of this Section shall be completely tested, adjusted, and placed in operating condition.
- B. Retest equipment and controls, as necessary, during the progress of the work. No work shall be covered until it is properly tested and made tight.
- C. Supply the testing apparatus and make all necessary connections for applying the tests.
- D. When about to turn the apparatus over to the Owner, put all parts of the apparatus in perfect working order and thoroughly clean out all parts of the equipment.
- E. Check damper operation and linkages. Adjust for proper damper operation.
- F. Clean exterior and interior surfaces of each unit. Vacuum clean fan wheel and surfaces exposed to the air handled by the unit.

3.07 DEMONSTRATION

- A. Demonstrate equipment operation to Owner's operating and maintenance personnel. Instruct personnel in procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and how to obtain replacement parts.
- B. Familiarize personnel with contents of Operating and Maintenance Manuals.
- C. Schedule demonstration and instruction with at least 7 days advance notice.

END OF SECTION

Heating and Ventilating Systems 15800 - 18 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

SECTION 16010 GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Work Included:
 - 1. Provide all required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, and test equipment, and satisfactorily complete all electrical work shown on the Drawings, included in these Specifications, or required for a complete and fully operating facility. In addition, provide wiring for the equipment that will be provided under other Divisions of these Specifications.
 - 2. Provide all conduits for the Instrumentation and Controls specified in Division 17. Provide all Instrumentation and Control wire that is specified in Division 16. All other necessary Instrumentation and Controls wire shall be provided under Division 17. See Section 17010.
 - 3. Auxiliary Devices: Provide conduit and wire for power, control, and instrumentation for all auxiliary devices such as solenoid valves, pressure switches, and instruments that are included as part of a manufacturer's packaged system. Contractor shall be responsible for conduit and wire to these auxiliary devices even if not specifically shown on the Drawings or specified herein.
- B. Work Specified in Other Divisions:
 - 1. Section 11002: Electric Motor Drives.
 - 2. Division 17: Providing instruments and other equipment specified in Division 17.
- C. Safety: Conduct operations in accordance with NFPA 70E, Standard for Electrical Safety Requirements for Employee Workspaces.

1.02 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
 - 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of

McKinleyville Community Services District 16010 - 1 General Electrical Requirements
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

B. Shop Drawings:

1. General: Submit in accordance with Sections 01300 and 01315.
2. Submit Product Review or Product Information shop drawings for materials and equipment as required under each Specification Section.
3. For Product Review submittals, submit a single, complete submittal package for all items specified in a particular Specification Section. Submittal packages shall be organized by equipment type. Include separators and tabs or other means of identifying each Specification paragraph (e.g., 2.01, 2.02, etc.) of the submittals or other means of identifying each section of the submittal.

- C. As-Built Shop Drawings: Revise manufacturer's shop drawings to show any construction changes. These drawings shall include all elementary, schematic, and wiring diagrams of all equipment, including heating and ventilation. Prior to Final Acceptance, deliver one complete set to the Owner for review. After such review, provide copies of all CAD produced drawings on magnetic media satisfactory to the Owner in AutoCAD DWG format.

D. Manuals:

1. Furnish manual for equipment where Manuals are specified in the equipment Specifications. Electrical manual shall be consolidated and submitted as a single manual.
2. Include equipment descriptions, record shop drawings, operation and maintenance instructions, parts ordering data, and ratings for the equipment furnished for this project.

- E. Spare Parts: For each piece of equipment, submit a list of recommended spare parts. Include part numbers and the name, address, and telephone number of the supplier.

1.03

QUALITY CONTROL

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

- A. Codes: All electrical equipment and materials, including installation and testing, shall conform to the following applicable codes:
 1. National Electrical Code (NEC), 2011 edition
 2. National Electrical Safety Code (NESC), current edition
 3. Occupational Safety and Health Act (OSHA) standards
 4. Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, International Electrical Testing Association (NETA).
- B. Standards: Equipment shall conform to applicable standards of American National Standards Institute (ANSI), Electronics Industries Association (EIA), Institute of Electrical and Electronics Engineers (IEEE), and National Electrical Manufacturers Association (NEMA). The revisions of these standards in effect on the date of issuance of the Contract Documents shall apply.
- C. Underwriters Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Safety labeling and listing by other organizations, such as ETL Testing Laboratories, may be substituted for UL labeling and listing if acceptable to the authority having code enforcement jurisdiction. Provide service entrance labels for all equipment required by the NEC to have such labels.
- D. Contractor's Expense: Obtain and pay for all required bonds, insurance, licenses, permits, and inspections, and pay all taxes, fees, and utility charges that will be required for the electrical construction work.

1.04

DRAWINGS

- A. Drawings: The Electrical Drawings are diagrammatic; exact locations of electrical products shall be verified in the field with the Owner. Except where special details are used to illustrate the method of installation of a particular piece or type of equipment or material, the requirements or descriptions in this Specification shall take precedence in the event of conflict.
 1. Locations of equipment, inserts, anchors, motors, panels, pull boxes, manholes, conduits, stub-ups, fittings, lighting fixtures, power and convenience outlets, exterior lighting units, and ground wells are approximate unless dimensioned; verify locations with the Owner prior to installation.
 2. Field verify scaled dimensions on Drawings.

General Electrical Requirements

16010 - 2

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

16010 - 3

General Electrical Requirements

© 2014 Kennedy/Jenks Consultants

3. Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for the installations.
4. Should there be a need to deviate from the Electrical Drawings and Specifications, submit written details and reasons for all changes to the Owner for review.
5. Seismic Certification, Design Calculations and attachment drawings as required by Section 01190.

B. As-Built Drawings:

1. Maintain a complete and accurate record set of Drawings for the electrical construction work.
2. Record all work that is installed differently than shown on the Drawings.
3. Upon completion of the work, transfer all marked changes to a clean set of full-size Drawings with red ink. Mark the Drawings "RECORD DRAWINGS" and submit them to the Owner when the electrical work is completed.
4. Locate all underground conduits by accurate field-measured dimensions from walls and corners, etc., of surrounding structures.

1.05 FACTORY TESTS

- A. Submit reports of factory tests and adjustments performed by equipment manufacturers to the Owner prior to field testing and adjustment of the equipment. These reports shall identify the equipment and show dates, results of tests, measured values, and final adjustment settings. Provide factory tests and adjustments for equipment where factory tests are specified in the equipment Specifications.

1.06 INSPECTIONS

- A. The Owner may inspect the fabricated equipment at the factory before shipment to job site. Provide the Owner with sufficient prior notice so that an inspection can be arranged at the factory.
- B. Inspection of the equipment at the factory by the Owner will be made after the manufacturer has performed satisfactory checks, adjustments, tests, and operations.
- C. Review of the equipment at the factory shall not relieve the Contractor of responsibility for the proper installation and satisfactory startup operation of the equipment to the satisfaction of the manufacturer and the Owner.

1.07 COORDINATION

- A. Coordinate the electrical work with the other trades, code authorities, utilities, and the Owner.
- B. Where connections must be made to existing installations, properly schedule all the required work, including the power and control system shutdown periods. Schedule and carry out shutdowns so as to cause the least disruption to operation of the plant and privately owned facilities.

General Electrical Requirements 16010 - 4 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- C. When two trades join together in an area, make certain that no electrical work is omitted.

1.08 JOB CONDITIONS

- A. Operations:
 1. Keep all power shutdown periods to a minimum.
 2. Carry out shutdowns only after the schedule has been reviewed and accepted by the Owner.
- B. Construction Power:
 1. Make all arrangements for the required construction power.
 2. When required, provide all equipment, materials, and wiring in accordance with the applicable codes and regulations.
 3. Upon completion of the project, remove all temporary construction power equipment, material, and wiring from the site as the property of the Contractor.
- C. Storage: Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from weather, dust, water, or construction operations.

1.09 DAMAGED PRODUCTS

- A. Notify the Owner in writing in the event that any equipment or material is damaged.
- B. Obtain prior review by the Owner before making repairs to damaged products.

1.10 LOCATIONS

- A. General: Use equipment, materials, and wiring methods suitable for the types of locations in which they are located, as defined in Paragraph B. herein.
- B. Definitions of Types of Locations:
 1. Dry Locations: All those indoor areas which do not fall within the definitions below for Wet, Damp, Hazardous, or Corrosive Locations and which are not otherwise designated on the Drawings.
 2. Wet Locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.
 3. Damp Locations: All spaces wholly or partially underground, or having a wall or ceiling forming part of a channel or tank, unless otherwise designated on the Drawings.
 4. Corrosive Locations: Areas where chemicals are stored or processed. The Polymer System area is not considered a corrosive area.
 5. Hazardous Locations: Areas so designated in the Drawings.

McKinleyville Community Services District 16010 - 5 General Electrical Requirements
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

PART 2 - PRODUCTS

2.01 STANDARD OF QUALITY

- A. Products that are specified by manufacturer, trade name, or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are approved by the Owner prior to installation.
- B. It is the intent of these Specifications and Drawings to secure high quality in all materials and equipment in order to facilitate operation and maintenance of the facility. All equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses that may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately stayed, braced, and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.
- C. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service.

2.02 NAMEPLATES

- A. For each piece of electrical equipment, provide a manufacturer's nameplate showing manufacturer's name, location, the pertinent ratings, and the model designation.
- B. Identify each piece of equipment and related controls with a rigid laminated engraved phenolic nameplate. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel screws or, where approved by the Owner, with epoxy cement. Where no inscription is indicated on the Drawings, furnish nameplates with an appropriate inscription furnished by the Owner upon prior request by the Contractor.

- C. Each control device, including pushbuttons, control switches, and indicating lights, shall have an integral legend plate or nameplate indicating the device function. These shall be inscribed as indicated on the Drawings or as approved by the Owner. List panel name and circuit number if equipment is served from a panelboard or MCC.

2.03 FASTENERS

- A. Fasteners for securing equipment to walls, floors, and the like shall be either hot-dip galvanized after fabrication or stainless steel. Provide stainless steel fasteners in Corrosive Locations. When fastening to existing walls, floors, and the like, provide wedge anchors. Refer to Section 01190 for requirements.

General Electrical Requirements 16010 - 6 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

2.04 PAINTING

- A. Equipment: Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish that has been damaged or is otherwise unsatisfactory, to the satisfaction of the Owner.

2.05 ENCLOSURES

- A. Unless otherwise noted, provide enclosures as follows:
1. Dry Locations: NEMA Type 1.
 2. Wet Locations: NEMA Type 3R, 4, or 4X, as indicated on the Drawings.
 3. Damp Locations: NEMA Type 12.
 4. Corrosive Locations: NEMA Type 4X.
 5. Hazardous Locations: As designated on the Drawings.
 6. See additional requirements below in Metal Panels.

PART 3 - EXECUTION

3.01 REQUIREMENTS

- A. All electrical installations shall conform to the codes and standards outlined in this Section.

3.02 WORKMANSHIP

- A. Assign a qualified representative who shall supervise the electrical construction work from beginning to completion and final acceptance.
- B. Perform all labor using qualified craftsmen, who have had experience on similar projects. Provide first-class workmanship for all installations.
- C. Ensure that all equipment and materials fit properly in their installations.
- D. Perform any required work to correct improperly fit installations at no additional expense to the Owner.

3.03 EXCAVATION AND BACKFILL

- A. Provide the excavations for electrical equipment foundations and trenches for conduits as shown on the Drawings.
- B. Exercise caution during all excavation work and avoid damage to existing underground pipes. Exercise extreme caution when working near existing electrical conduits and facilities. Field verify the location of all electrical facilities before proceeding with any nearby work.
- C. Refer to Division 2, Earthwork, of these Specifications for all excavation and backfilling work.

McKinleyville Community Services District 16010 - 7 General Electrical Requirements
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

3.04 CONCRETE

- A. Where shown on the Drawings or specified, provide the required concrete installations for conduit encasement and equipment foundations.
- B. Refer to Division 3, Concrete of these Specifications for all concrete work.

3.05 CONDUCTOR IDENTIFICATION

- A. Identify all wires and cables in conformance with the requirements of Sections 16120 and 16124. This requirement applies to all equipment provided under this contract, regardless of Division, as well as to all conductors provided or worked on during this contract.

3.06 INSTALLING EQUIPMENT

- A. Provide the required inserts, bolts, and anchors, and securely attach all equipment and materials to their supports.
- B. Install all floor-mounted equipment on 3-inch-high reinforced concrete pads. The Contractor, suppliers, and fabricators shall take this requirement into consideration when designing, fabricating, and installing panels, motor control centers, and other enclosures so that height above the floor of the operating handles of electrical devices meets the requirements of these Specifications and applicable codes.
- C. All electrical components such as fans and heaters shall be provided with a disconnecting means as required by NEC Article 400 whether or not on the Drawings.

3.07 CUTTING, DRILLING, AND WELDING

- A. Provide any cutting, drilling, and welding that is required for the electrical construction work.
- B. Structural members shall not be cut or drilled, except when favorably reviewed by the Owner. Use a core drill wherever it is necessary to drill through concrete or masonry.
- C. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel.
- D. Perform patch work with the same materials as the surrounding area and finish to match, as specified in Division 3 of these Specifications.

3.08 METAL PANELS

- A. Mount all metal panels which are mounted on or abutting concrete walls in damp locations or any outside walls $\frac{1}{4}$ inch from the wall, and paint the back sides of the panels with a high-build epoxy primer. Film thickness shall be 10 mils minimum.

General Electrical Requirements 16010 - 8 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

3.09 PROTECTIVE DEVICE COORDINATION

- A. Provide the services of a recognized independent testing laboratory or coordination analysis consultant for the proper system coordination of the protective devices furnished on this project. Submit the name and the qualifications of the laboratory or consultant for review by the Engineer; qualifications must include professional registration of proposed personnel as electrical engineers.
- B. The protective device on the line side closest to the fault or abnormal conditions shall isolate the problem portion of the system and minimize damage in that portion. The rest of the system shall be maintained in normal service. The coordination shall be in conformance with the recommendations of latest IEEE Standard 242.
- C. The Contractor will be required to confirm and collect relevant data needed for a complete and accurate study.
- D. Submit the analysis that shall include impedance and short circuit calculations, list of any assumptions made in the analysis, the recommended settings of the protective devices, and the system time/current characteristic curves. The submittal shall be made so as to allow time for review and resubmittal, if necessary, before the implementation of final settings and adjustments by the testing laboratory.
- E. Mark the Main Switchboard with the maximum available fault current, in accordance with NEC Article 110.24
- F. Arc Flash Study
 1. Prepare Arc Flash Study for the Main Switchboard, MCC-8012, MCC-8011 and all panelboards per NFPA 70E. Based on the results of the study, the equipment shall be labeled appropriately.
 2. Site Visits and Data Collection: The Contractor will be required to confirm and collect relevant data needed for a complete and accurate study. The Owner will provide existing As-Built information to the Contractor for review prior to site visits and will provide electrical assistance during each visit. Contractor shall not use any assumptions unless approved by the Owner.
 3. Modeling: Develop a detailed model of the replaced electrical systems utilizing software similar to the SKM Power Tools Model Software. Through the use of the modeling software, utilize the collected information to model the replaced electrical systems and calculate the short circuit currents. Calculate the Arc Flash Energies, identify flash protected boundaries, provide personal protective equipment requirements based on the new and existing electrical system components. Identify areas where coordination may be in question. This study shall be based on the requirements of the NFPA 70E and IEEE 1584 meeting OSHA standards.
 4. Alternatives: Any items shown to have Arc Flash energies exceeding 24 cal/cm² (Class 4 or larger), or areas indicated as having device coordination issues shall receive additional attention with recommendation for solutions to lower the Arc Flash hazards or improve the coordination. These recommendations may include items such as changes to breaker settings or replacement breakers/fusing for example. Alternatives will be modeled using

McKinleyville Community Services District 16010 - 9 General Electrical Requirements
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- the modeling software illustrating the effect of the suggested changes. Provide preliminary finding to the Owner for review.
5. Reports: Provide a written final report documenting the results of this study along with modeled One-Line drawings. Provide the report in both hard copy and electronic format. Prior to the final report, submit for review a preliminary overview outlining key components and listed possible alternatives. As part of the final report, once approved, provide a PDF file containing printable copies of all required Arc Flash equipment labels.

3.10 PERFORMANCE AND FIELD TESTS

- A. Where testing pursuant to NETA requirements is required in these specifications, perform tests in accordance with applicable procedures as described in NETA Acceptance Testing Specifications.
- B. Give at least 7 working days' notice to the Owner prior to any test to permit witnessing the test.
- C. Provide all materials, equipment, labor, and technical supervision required to perform such tests and inspections. It is the intent of these tests to ensure that all electrical equipment is operational within industry and manufacturer's tolerances and is installed in accordance with the Contract Documents and manufacturer's instructions. The tests and inspections shall determine the suitability for energization.
- D. The Contractor shall have a calibration program which maintains all applicable test instrumentation within rated accuracy.
 1. The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain. Instruments shall be calibrated in accordance with the following frequency schedule:
 - a. Field instruments: 6 months maximum
 - b. Laboratory instruments: 12 months
 - c. Leased specialty equipment: 12 months
 2. Date calibration labels shall be visible on all test equipment.

- E. Where testing pursuant to NETA requirements is required in these specifications, submit a test report that includes the following:
 1. Name of project, name of person performing test, and date of test
 2. Description of equipment tested
 3. List of test equipment used and calibration date
 4. Test results
 5. Conclusions and recommendations
 6. Appendix, including appropriate test forms
 7. The test report shall be bound and its contents certified. Submit the completed report directly to the Owner no later than 30 days after completion of the test unless directed otherwise. Number of reports to be submitted for review shall be the same as the number required for shop drawing submittals.

General Electrical Requirements 16010 - 10 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

- F. Safety practices shall include, but are not limited to, the following requirements:
 1. Occupational Safety and Health Act of 1970, OSHA.
 2. Accident Prevention Manual for Industrial Operations, Seventh Edition, National Safety Council, Chapter 4.
 3. Applicable state and local safety operating procedures.

- G. All field tests shall be performed with apparatus de-energized except where otherwise specifically required by Section 8 of the latest Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems published by NETA. The Contractor shall have a designated safety representative who shall be present on the project and supervise operations with respect to safety. In all cases, work shall not proceed until the safety representative has determined that it is safe to do so. The Contractor shall have available sufficient protective barriers and warning signs to conduct the specified test safely.

- H. Where testing pursuant to NETA requirements is required in these specifications, electrical equipment and materials furnished and installed by the Contractor shall be tested in accordance with the "Inspection and Test Procedures" and "System Function Tests" (Section 8) of the latest Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems published by NETA. Tests shall not include any tests listed as optional in the aforementioned NETA Specifications unless specifically noted in respective equipment specifications for this project.

- I. Retesting will be required for all unsatisfactory tests after the equipment or system has been repaired. Retest all related equipment and systems if required by the Owner. Repair and retest equipment and systems that have been satisfactorily tested but later fail, until satisfactory performance is obtained.

- J. Putting Equipment and Cables into Service: Submittal and favorable review of the specified factory and field tests shall occur before the Contractor is permitted to place the respective equipment or cable into service.

- K. Miscellaneous Tests
 1. Insulation Resistance, Continuity, Rotation: Perform routine insulation resistance, continuity, and rotation tests for all distribution and utilization equipment including all motors 1/2 horsepower and larger. Supply a suitable and stable source of test power at each test site. Notify the Owner when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling. All testing shall be performed in the presence of the Owner. The Contractor shall be responsible for implementing all final settings and adjustments on protective devices and tap changes. Any system material or workmanship that is found defective on the basis of acceptance tests shall be reported directly to the Owner. The Contractor shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.
 2. Motor Current: Measure and record current in each phase for each new motor. Include measurement of the motor terminal voltages and motor currents when the motor is being operated at normal operating loads. For motors that are part

McKinleyville Community Services District 16010 - 11 General Electrical Requirements
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

of adjustable frequency drive systems, use true-RMS-reading instruments in making the measurements.

3. Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed, adjusted, and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions, and demonstrate satisfactory interfacing with the data acquisition and alarm systems.

3.11 EQUIPMENT PROTECTION

A. Exercise care at all times after installation of equipment, motor control centers, etc., to keep out foreign matter, dust, dirt, debris, or moisture. Use protective sheet metal covers, canvas, heat lamps, etc., as needed to ensure equipment protection.

3.12 CLEANING EQUIPMENT

A. Thoroughly clean all soiled surfaces of installed equipment and materials.

B. Clean out and vacuum all construction debris from all areas of all equipment.

C. Provide and touch-up to original condition any factory painting that has been marred or scratched during shipment or installation, using paint furnished by the equipment manufacturer.

3.13 CLEANUP

A. Upon completion of the electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Owner.

END OF SECTION

General Electrical Requirements 16010 - 12 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

SECTION 16110

CONDUIT, RACEWAYS, AND FITTINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

A. American National Standards Institute (ANSI):

1. C80.1 Specification for Zinc Coated Rigid Steel Conduit
2. C80.5 Specifications for Rigid Aluminum Conduit

B. Federal Specifications (FS):

1. FS W-C-1094 W-C-1094A Conduit and Conduit Fittings, Plastic, Rigid
2. FS WW-C-540 WW-C-540A Conduit, Metal, Rigid, (Electrical, Aluminum) Conduit, Metal, Rigid & Coupling, Elbow & Nipple, Electrical Conduit, Aluminum Flexible Metal Conduit
3. FS WW-C-566 WW-C-566C

C. National Electrical Manufacturers Association (NEMA):

1. RN 1 Polyvinyl Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
2. TC 6 PVC and ABS Plastic Utilities Duct for Underground Installation

D. Underwriters Laboratories (UL) Standards:

1. 6 Rigid Metal Electrical Conduit
2. 360 Liquid-Tight Flexible Steel Electrical Conduit

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

16110 - 1

Conduit, Raceways, and Fittings

3. 651 Electrical Rigid Nonmetallic Conduit
4. 651A Type EB and A Rigid PVC Conduit and HDPE Conduit

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

1.04 LOCATIONS

- A. Refer to Section 16010 for definitions of types of locations.

PART 2 - PRODUCTS

2.01 CONDUIT, RACEWAYS

- A. General:
 1. Rigid steel conduit (RMC) shall be used in all conduit systems, except where PVC-coated rigid metal conduit, liquid tight flexible metal conduit (LFMC) or rigid polyvinyl chloride (PVC) conduit is required as shown on the Drawings.
 2. The minimum size conduit or raceway shall be ¾ inch.
- B. Rigid Metal Conduit (RMC): RMC shall be rigid steel conduit, and shall be hot-dip galvanized after fabrication, conforming to ANSI C80.1 and UL 6. Couplings shall be threaded type.

Conduit, Raceways, and Fittings 16110 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

- C. PVC Coated Rigid Metal Conduit: PVC coated rigid steel conduit shall be hot-dip galvanized, conforming to NEMA RN 1, with factory-applied PVC coating 40 mills thick.
- D. Liquidtight Flexible Metal Conduit (LFMC): Flexible metal conduit shall be liquid-tight, shall have a moisture- and oil-proof PVC jacket extruded over a galvanized, flexible steel conduit, and shall conform to UL 360.
- E. Rigid Nonmetallic Conduit (PVC): Rigid nonmetallic conduit shall be PVC Schedule 40 (PVC-40) conduit approved for underground use and for use with 90°C wires, and shall conform to UL 651.

2.02 CONDUIT SUPPORTS

- A. Supports for individual conduits shall be galvanized malleable iron one-hole type with conduit back spacer.
- B. Supports for multiple conduits shall be hot-dip galvanized Unistrut or Superstrut channels, or approved equal. All associated hardware shall be hot-dip galvanized.

2.03 FITTINGS

- A. Fittings for use with RMC shall be hot dipped galvanized steel or galvanized cast ferrous metal; access fittings shall have gasketed cast covers and be Crouse-Hinds Condulets; Appleton Unilets; or approved equal. Provide threaded-type couplings and connectors; set-screw type and compression-type are not acceptable.
- B. Fittings for use with either rigid nonmetallic conduit or duct shall be PVC and have solvent-weld-type conduit connections.
- C. Fittings for flexible conduit shall be Appleton Type ST; O-Z Gedney Series 4Q; or approved equal.
- D. Union couplings for conduits shall be the Erickson type and shall be Appleton Type EC; O-Z Gedney 3-piece Series 4; or approved equal. Threadless couplings shall not be used.
- E. Bushings:
 1. Bushings shall be the insulated type.
 2. Bushings for rigid steel shall be hot dip galvanized insulated grounding type, O-Z Gedney Type HBLG; Appleton Type GIB; or approved equal.
- F. Conduits entering sheet metal boxes or cabinets shall be terminated with Myers hubs or approved equal.
- G. Use of "running thread" nipples is expressly forbidden.

McKinleyville Community Services District 16110 - 3 Conduit, Raceways, and Fittings
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

2.04 CONDUIT SEALANTS

- A. Moisture Barrier Types: Sealant shall be a non-toxic, non-shrink, non-hardening, putty type hand-applied material providing an effective barrier under submerged conditions.
- B. Fire Retardant Types: Fire stop material shall be a reusable, non-toxic, asbestos-free, expanding, putty type material with a 3-hour rating in accordance with UL 1479. Provide products indicated by the manufacturer to be suitable for the type and size of penetration.

PART 3 - EXECUTION

3.01 CONDUIT, RACEWAY, AND FITTING INSTALLATION

- A. From pull point to pull point, the sum of the angles of all of the bends and offsets shall not exceed 270 degrees, unless approved by the Engineer.
- B. For power, control, and signal circuits, provide conduit per Conduit Use Tables below, unless specifically indicated otherwise on the Drawings:
1. Exception: For raceways leaving a building above grade and then going below grade, provide RMC with PVC wrapped tape from a point 3 feet above grade to a point 5 feet from the building wall.
- C. At all boxes and equipment, provide insulated type metallic grounding bushings for metallic conduits. Bond together all conduits to provide continuity of the equipment grounding system. Size bonding conductor per NEC.
- D. Provide flexible conduit in lengths of not more than 36 inches unless approved by the Owner at connections to motors, valves, and any equipment subject to vibration or relative movement.
- E. Provide galvanized rigid steel factory elbows for RMC raceways greater than 2-inch trade size. Provide RMC for offsets in RMC raceways.
- F. Conduit Supports: Properly support all conduits as required by the NEC. Run all conduits exposed except where the Drawings indicate that they are to be embedded in the floor slab, walls, or ceiling, or to be installed underground.
1. Exposed Conduits:
- a. Support exposed conduits within 1 foot of any outlet and at intervals not exceeding NEC requirements; wherever possible, group conduits together and support on common supports. Support exposed conduits fastened to the surface of the concrete structure by one-hole clamps, or with channels. Use conduit spacers with one-hole clamps. Coordinate conduit locations with piping, equipment, fixtures, and with structural and architectural elements. Conduits attached to walls or columns shall be as unobtrusive as possible and shall avoid windows. Run all exposed conduits parallel to building lines.

Conduit, Raceways, and Fittings

16110 - 4

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

© 2014 Kennedy/Jenks Consultants

- b. Group together exposed conduits in horizontal runs located away from walls and support on trapeze hangers. Arrange such conduits uniformly and neatly. Trapeze hangers shall consist of channels of adequate size, suspended by means of rods or other suitable means from the ceiling or from pipe hangers. Install such runs so as not to interfere with the operation of valves or any other equipment, and keep at least 6 inches clear of any pipe, which may operate at more than 100°F. Treat cut surfaces or damaged ends with corrosion-resistant coatings such as "Devcon Z", prepared by Subox Coatings; "Galvanox Type I", prepared by Pedley-Knowles; or approved equal. Application shall follow manufacturer's recommendation.

2. Conduits Embedded in Concrete: Provide concrete cover at least equal to that of the reinforcing steel, space at 3 conduit diameters apart except where they cross at angles greater than 45 degrees, and install so as not to reduce the structural integrity of the concrete element.

- G. When expansion joints are crossed, whether conduit is embedded or exposed, provide watertight expansion fittings and bonding jumpers. In hazardous locations, provide Crouse-Hinds UNF/UNV; Appleton; or approved equal. In unclassified locations, provide Crouse-Hinds XD; Appleton; or approved equal.

- H. Spare Raceways: After completing a conduit run between manholes, handholes, or pull boxes, prove the integrity of the conduit run. Use an air compressor to blow in a pull-line, then use the pull-line to pull a mandrel through the entire conduit run. Install a new 3/16-inch nylon, 800-pound test pull-line, which has tape measure marking every foot to indicate length. Plug the ends of the conduit with conduit cap plugs.

- I. Core drill concrete or CMU walls, install conduit, and caulk around it with non-shrink grout. Install conduit seal in each conduit near the penetration.

- J. All conduit penetrations through interior walls and floors shall be sealed with fire retardant type conduit sealant.

- K. Conduit Identification: In each handhole, pull box, cabinet, motor control center, or other equipment enclosure, identify each conduit using the conduit number shown on the Drawings by means of a stamped brass or stainless steel tag affixed with stainless steel wire; where affixing a tag is not feasible, identify conduits by stenciling. Stencil all exposed conduits for identification at least once in each room.

- L. Conduit Seals: Moisture Seals: Provide in accordance with NEC paragraph 300.5(g).

- M. Flexible conduit shall have a maximum length of 36 inches, unless approved by the Engineer. Flexible conduit shall not be considered as a ground conductor. Flexible conduit shall only be installed in exposed or accessible locations.

- N. Rigid PVC conduit shall be stored on a flat surface and shielded from the sun.

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00

16110 - 5

Conduit, Raceways, and Fittings

© 2014 Kennedy/Jenks Consultants

SECTION 16120
LOW VOLTAGE WIRE AND CABLE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.
- B. Related Work Described Elsewhere: Division 17.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

- A. ASTM International (ASTM):
1. B3-74 Specification for Soft or Annealed Copper Wire
 2. B8-77 Specification for Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft
 3. B173-71 Specification for Rope Lay Stranded Copper Conductors Having Concentric Stranded Members
- B. Insulated Cable Engineers Association (ICEA):
1. S-66-524 Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable
- C. International Electrical Testing Association (NETA):
1. ATS Acceptance Testing Specifications
- D. Underwriters Laboratories, Inc. (UL):
1. 62 Flexible Cords and Fixture Wire
 2. 83 Thermoplastic-Insulated Wires and Cables

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

CONDUIT USE TABLE 1

	Inside Buildings						
	Exposed		Concealed				
	Circuit Type	Standard	Corrosive	Embedded In Concrete	Slab On Grade	In Stud Walls	Above Suspended Ceiling
Power & 120 Vac Control		RMC	NA	PVC-40	NA	NA	NA
Signal		RMC	NA	PVC-40	NA	NA	NA

CONDUIT USE TABLE 2

Circuit Type	Outside Buildings			Transition	
	Exposed	Buried In Soil	Duct Bank Encased In Concrete	Within 5 Feet of Building	of Building
Power & 120 Vac Control	RMC	PVC-40	NA	PVC Coated RMC	
Signal	RMC	PVC-40	NA	PVC Coated RMC	

END OF SECTION

Conduit, Raceways, and Fittings 16110 - 6 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

3. 510 Insulating Tape
4. 1063 Stranded Conductors for Machine Tool Wire

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
- B. Submit material or equipment data in accordance with the requirements of Section 16010.

1.04 LOCATIONS

- A. Refer to Section 16010 for definitions of types of locations.

PART 2 - PRODUCTS

2.01 CONDUCTORS

- A. General: All conductors shall be copper. Wire or cable not specifically shown on the Drawings or specified, but required, shall be of the type and size required for the application and in conformance with the applicable code. All insulated conductors shall be identified with printing colored to contrast with the insulation color.

Low Voltage Wire and Cable

16120 - 2
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

B. Power and Control Conductors, 600 Volts and Below:

1. Stranded copper wire sizes #14 AWG through #10 shall be 600 volt Type THWN, Class B stranding.
2. Stranded copper wire sizes #8 AWG and larger shall be 600 volt Type XHHW, Class B stranding.
3. Fixture wire shall be 600 volt, silicone rubber insulated, 200°C, UL Type SF-2, with stranded copper conductors.

2.02 SPLICES AND TERMINATIONS OF CONDUCTORS

A. Splices:

1. Wire and Cable Splicing Materials and Applications:
 - a. For Lighting Systems and Power Outlets: Wire nuts shall be twist-on type insulated connectors utilizing an outer insulating cover and a means for connecting and holding the conductors firmly. They shall be UL listed and suitable for connecting two to four copper conductors of #14.
 - b. All Equipment: Crimp type connectors shall be insulated type with nylon jacket, suitable for the size and material of the wires and the number of wires to be spliced and for use with stranded conductors. They shall be UL listed.
 - c. Division 16 Equipment and Power Conductors: Bolted pressure connectors shall be suitable for the size and material of the conductors to be spliced. They shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor.
 - d. All Equipment: Epoxy splice kits shall include epoxy resin, hardener, and mold, and shall be suitable for use in wet locations and hazardous locations.

B. Terminations:

1. Low Voltage Terminations:
 - a. Crimp type terminals shall be UL listed, self-insulating sleeve type with nylon jacket, with ring or rectangular type tongue, suitable for the size and material of the wire to be terminated, and for use with either solid or stranded conductors.
 - b. Terminal lugs shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor. Tongues shall have NEMA standard drilling.
 - c. Crimp with manufacturer recommended ratchet-type tool with calibrated dies. Hand crimping tools are not acceptable.
- C. Tape used for splices and terminations shall be compatible with the insulation and jacket of the cable and shall be of plastic material. Tape shall conform to UL 510 and shall be Scotch 33 Plus.

PART 3- EXECUTION

3.01 CONDUCTOR INSTALLATION

- A. Provide the following types and sizes of conductors for the uses indicated for 600 volts or less:

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

16120 - 3

Low Voltage Wire and Cable

1. Stranded Copper, Size #14 AWG and larger, individual conductors: As shown on the Drawings for the control of motors or other equipment. Size #14 shall not be used for power supplies to any equipment.
2. Stranded Copper, Sizes #12 AWG and larger: As shown on the Drawings for motors and other power circuits.
3. Stranded copper, Size #14 AWG: As shown for receptacles, lighting fixtures, and switches.
4. Fixture Wire: For connections to all fixtures in which the temperature may exceed the rating of branch circuit conductors.

B. Color Coding: Provide color coding for all circuit conductors. Insulation color shall be white or grey for neutrals and green for grounding conductors. An isolated ground conductor shall be identified with an orange tracer in the green body. Ungrounded conductor colors shall be as follows:

1. 120/208 Volt, 3 Phase: Red, black, and blue.
2. 277/480 Volt, 3 Phase: Brown, orange, and yellow.
3. 120/240 Volt, 1 Phase: Red and black.
4. Control Wiring: 120 Vac: Red
5. Control Wiring: 24 Vdc: Blue for positive, white with blue stripe for common

C. Color coding shall be in the conductor insulation for all conductors #10 AWG and smaller; for larger conductors, color shall be either in the insulation or in colored plastic tape applied at every location where the conductor is readily accessible (e.g., enclosures, pull boxes, and junction boxes).

D. Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables, or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.

E. Cable bending radius shall be per applicable code. Install feeder cables in one continuous length.

F. Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in any flexible conduit or any raceway in which all or any portion of a run consists of non-metallic duct or conduit.

G. In panels, bundle incoming wire and cables, No. 6 AWG and smaller, lace at intervals not greater than 6 inches, neatly spread into trees and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.

H. For cables crossing hinges, utilize extra flexible stranded wire, make up into groups not exceeding 12, and installed within a spiral wrap so that they will be protected from chafing and excess flexing when the hinged member is moved.

Low Voltage Wire and Cable 16120 - 4 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

3.02 CONDUCTOR SPLICES AND TERMINATIONS

A. Splices: Install all conductors without splices unless necessary for installation, as determined by the Owner. Splices, when permitted, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions. Splice or terminate wire and cable as follows:

1. Watertight Splices: Splices in concrete pull boxes, for any type of cable or wire, shall be watertight. Make splices in low voltage cables using epoxy resin splicing kits rated for application up to 600 volts.

B. Terminations: Terminate stranded #14 wire using crimp type terminals where not terminated in a box lug type terminal. Terminals must be coordinated with type of terminal board where provided.

3.03 CONDUCTOR IDENTIFICATION

A. Except for interior lighting and receptacle circuits, identify each wire or cable at each termination and in each pull box, junction box, handhole, and manhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule.

B. Conductor numbering shall be coordinated with the Interconnection Diagrams specified in Section 17010.

C. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

D. Wire markers at wire ends shall be shrinkable sleeve type. Wire numbers shall be permanently imprinted on the markers. Wire markers shall be Brady Permasleeve; Brady Bradysleeve; or approved equal.

E. Wire markers installed in each pull box, junction box, and handhole shall be Brady or approved equal.

3.04 PERFORMANCE TESTS

A. Insulation Resistance Tests: For all circuits 150 volts to ground or more and for all motor circuits over 1/2 horsepower, test cables per NETA. The insulation resistance shall be 20 megohms or more. Submit results for review. See also Section 16010.

McKinleyville Community Services District 16120 - 5 Low Voltage Wire and Cable
Wastewater Management Facility Improvements
Bid Set 1368004*00
© 2014 Kennedy/Jenks Consultants

- B. Phase Rotation: The phase rotation of all circuits shall be clockwise in sequence. The Contractor shall verify that each three-phase service, feeder, and branch circuit meets this requirement. A record shall be kept of each circuit tested and, on completion, given to the Owner for review.

END OF SECTION

SECTION 16124 SIGNAL CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.
- B. Related Work Described Elsewhere:
 - 1. Section 17010: Instrumentation and Controls, General Requirements

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

- A. ASTM International (ASTM):
 - 1. B8 Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft, Specification for
- B. Underwriters Laboratories Incorporated (UL):
 - 1. 83 Thermoplastic Insulated Wires and Cables

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
 - 1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by

Low Voltage Wire and Cable
16120 - 6
McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

Signal Cable
16124 - 1

the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

B. Submit material or equipment data in accordance with the requirements of Section 16010.

PART 2 - PRODUCTS

2.01 TWISTED SHIELDED PAIRS (TSP)

A. Cable shall conform to UL 83 and shall be type TC cable suitable for use in wet locations and for direct burial. Each TSP shall consist of two #18 AWG, 19-strand copper conductors per ASTM B8 with PVC insulation. Conductors shall be twisted with 2 inch or shorter lay, with 100 percent foil shielding and tinned copper drain wires. Each pair shall have a 47-mil-thick outer jacket. Cable shall be rated at 90°C and for operation at 600 volts. Provide Belden 9341 or approved equal.

2.02 ETHERNET CABLE

A. Provide Ethernet cables that comply with the IEEE 802.3/Ethernet specification. The cables shall be plenum rated, FEP jacket, Category 6 (TIA/EIA 568-B.2-1) cables. All cables shall be made to fit at the proper length. Provide Belden 7931A or equal.

2.03 SPECIAL CABLES

A. Use only coaxial cable recommended for specific applications such as radio antenna systems and computer networks as required by the manufacturer or system supplier. Deviation from manufacturer's recommended cable types is not acceptable.

Signal Cable 16124 - 2 McKinleyville Community Services District Wastewater Management Facility Improvements Bid Set 1368004*00 © 2014 Kennedy/Jenks Consultants

2.04 OPTICAL FIBER CABLES AND CONNECTORS

A. Cables:

1. Factory-fabricated, single-channel, low-loss, glass-type, optical fiber, multimode and singlemode, graded-index cables for trunking, LAN, and distribution applications as appropriate.
2. Construction: Single fiber with a 62.5 micron core diameter and a 125 micron cladding diameter; 250 micron outside-jacket diameter.
3. Ratings: 3.5 dB/850-nm maximum attenuation, 200 MHz/km minimum bandwidth, 0.2 nominal numerical aperture, 1.0 dB/1500 nm maximum, 500 MHz/km minimum.
4. Physical Characteristics: 7.5 kg/km, 500 N maximum installation load, 150 N maximum operational load, 30 mm minimum bending radius.
5. Operating Temperature Range: -20 to 70°C.
6. Optical fiber shall be outdoor rated loose tube, 62.5/125 micron, all dielectric, fiber contained within a single sheath. Cable shall be marked with the OFNR designation. The cable will contain a minimum of 12 fibers. The manufacturer shall be Corning; Cable Systems or equal.

B. Optical Fiber Connectors:

1. Ceramic optical fiber cable connectors capable of terminating optical fiber glass cables with diameters ranging from 125 microns.
2. ST-type connectors with quick-connect features and with insertion loss of not greater than 0.5 dB.

2.05 FIBER PATCH PANELS

- A. Fiber Patch Panels shall be Siecot WCH-02P or WCH-06P, as shown on the Drawings, or equal.
- B. Connectors shall be ST type, no exception.
- C. Mount the fiber patch panels as shown on the Drawings.

2.06 PIGTAIL SPLICE LOSS

- A. The splice loss for each pigtail assembly shall have been tested and documented with an OTDR trace during cable termination. The documentation for this testing shall be submitted as a part of the cable testing procedure. Measurements shall be made at 1300 nm. No splices having a loss greater than 1 dB shall be accepted.
- B. Documentation shall include the following information for each splice made:
 1. Test date, Tester, OTDR manufacturer, model, and serial number.
 2. Fiber ID.
 3. Location.
 4. Wavelength.
 5. Splice Loss.
 6. Witness Signature.

McKinleyville Community Services District Wastewater Management Facility Improvements Bid Set 1368004*00 © 2014 Kennedy/Jenks Consultants

16124 - 3

Signal Cable

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

- A. Signal cable shall be installed by personnel who have had a minimum of 3 years' experience in terminating and splicing twisted shielded conductors and co-axial cables.
- B. Adequate care shall be exercised by the installers to prevent cable damage or sheath distortion. Bending radius shall not exceed manufacturer's recommendations.
- C. Cables shall be continuous from initiation to termination without splices except where specifically indicated.
- D. Cable shielding shall be grounded at the Control Panel (PLC) end only of the cable. Bonding shall be to a single ground point only.
- E. Heat shrinkable sleeving shall be installed on all cables to insulate shielding at the ungrounded cable terminations.
- F. Manufacturer's cable pulling tension shall not be exceeded.

3.02 CONDUCTOR SPLICES AND TERMINATIONS

- A. Splices: Install all conductors without splices unless necessary for installation, as determined by the Owner. Splices, when permitted, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions. Splice cables as follows:
 1. Watertight Splices: Splices in concrete pull boxes, for any type of cable or wire, shall be watertight. Make splices in low voltage cables using epoxy resin splicing kits rated for application up to 600 volts.
 2. Terminal Cabinets:
 - a. When splices are permitted by the Owner, install terminal cabinet per Section 17510. Terminal system shall include insulated, crimp-type connectors and barrier-type terminal boards. Coordinate the lug and boards for correct fit. All terminations shall include marker sleeves.
 - b. Shields shall be handled as a separate conductor. Use manufacturer's compression sleeve and insulated pigtail. Keep pigtail as short as possible. Terminate pigtail with marker sleeve and tug.
 3. No splicing is acceptable for coaxial cables.
- B. Terminations:
 1. Crimp-type terminals shall be UL listed, self-insulating, nylon sleeve type with ring or rectangular tongue, suitable for size and material of the wire to be terminated, and for use with either stranded or solid wire.
 2. Crimp with manufacturer's recommended ratchet-type tool with calibrated dyes.
 3. Hand crimping tools are not acceptable.

Signal Cable

16124 - 4

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bld Set
1368004*00
© 2014 Kennedy/Jenks Consultants

3. Coaxial cable and connectors shall be terminated in accordance with the manufacturer's instructions. Use manufacturer's recommended solder. The Contractor shall prevent misapplication of solder and termination.

3.03 CONDUCTOR IDENTIFICATION

- A. Identify each wire or cable at each termination, in each pull box, and in each handhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Conductor numbering shall be coordinated with the Interconnection Diagrams specified in Section 17010.
- B. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

3.04 PERFORMANCE TESTS

- A. Insulation Resistance Tests: Perform insulation resistance tests on all circuits using twisted shielded pair cables. Make these tests before any equipment has been connected. Test the insulation with a 250 Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 20 megohms or more. Submit results for review.
- B. Optical Fiber Cable Testing Procedures:
 1. Perform visual and mechanical inspection and field test, including optional procedures, stated in NETA.
 2. Certify compliance with test parameters and manufacturer's written instructions.

END OF SECTION

Signal Cable

16124 - 5

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bld Set
1368004*00
© 2014 Kennedy/Jenks Consultants

SECTION 16130

BOXES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provisions: Applicable provisions of Section 16010 become part of this Section as if repeated herein.
- B. Work Included:
1. Installation of all necessary outlet boxes for wiring devices, lighting fixtures, and signal equipment as noted on the Drawings.
 2. Installation of junction boxes as required for the consolidation of conduit runs.
 3. Installation of pull boxes, as necessary, to aid in pulling in conductor.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

- A. ASTM International (ASTM):
1. A123 Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
- B. Federal Specifications (FS):
1. W-C-586 Conduit Outlet Boxes, Bodies, and Entrance Caps, Electrical, Cast Metal
 2. W-J-800 Junction Box, Extension, Junction Box Cover, Junction Box (Steel, Cadmium, or Zinc Coated)
- C. Underwriters Laboratories, Inc. (UL):
1. 50 Electrical Cabinets and Boxes
 2. 514 Outlet Boxes and Fittings

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

16130 - 1
Boxes

THIS PAGE INTENTIONALLY BLANK

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
- B. Submit material or equipment data in accordance with the requirements of Section 16010.

PART 2 - PRODUCTS

2.01 OUTLET, JUNCTION, AND PULL BOXES

- A. Sheet Metal Boxes: Sheet metal boxes shall conform to UL 50, with a hot-dipped galvanized finish conforming to ASTM A123. Outlet boxes and switch boxes shall be designed for mounting flush wiring devices. Boxes and box extension rings shall be provided with knockouts. Boxes shall be formed in one piece from carbon-steel sheets. Outlet boxes shall not be less than 4 inches square and 1-7/8 inches deep. Ceiling boxes shall withstand a vertical force of 200 pounds for 5 minutes. Wall boxes shall withstand a vertical downward force of 50 pounds for 5 minutes. Gangable and through-wall types are not acceptable. Boxes shall conform to FS W-J-800D and UL 514.
- B. Cast Metal Boxes: Box bodies and cover shall be cast or malleable iron with a minimum wall thickness of 1/8 inch at every point, and not less than 1/4 inch at tapped holes for rigid conduit. Bosses are not acceptable. Mounting lugs shall be

Boxes

16130 - 2 McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants

provided at the back or bottom corners of the body. Covers shall be secured to the box body with No. 6 or larger brass or bronze flathead screws. Boxes shall be provided with neoprene cover gaskets. Where only cast aluminum is available for certain types of fixture boxes, an epoxy finish shall be provided. Outlet boxes shall be of the FS types. Boxes shall conform to FS W-C-586C and UL 514.

- C. Non-metallic Boxes: Non-metallic boxes shall be hot-compressed fiberglass, one-piece, molded with reinforcing of polyester material, with minimum wall thickness of 1/8 inch.
- D. Pull Boxes and Junction Boxes: Except where otherwise shown on the Drawings, all pull boxes and junction boxes shall be stainless steel. Boxes shall be welded construction with all seams or joints closed and reinforced. Boxes other than stainless steel shall be carbon steel per UL 50, and shall be galvanized after construction. Boxes intended for outdoor use shall be cast metal with threaded hubs and neoprene gasketed covers, or shall be of the fiberglass reinforced polyester type of 1/8-inch minimum thickness. Cover retention shall be by corrosion resistant stainless steel screws.
1. All boxes and cabinets shall be securely fastened to building structural members so as to prevent movement in any direction. Boxes shall not be supported by lighting fixtures, suspended ceiling support wires, or freely hanging rods.
 - a. Covers of boxes and cabinets mounted in horizontal plane (top or bottom) shall either weigh not more than 40 pounds or shall require not more than 40 pounds of force to open or close.
 - b. Covers of boxes and cabinets mounted in vertical plane (front, back, sides) shall either weigh not more than 60 pounds or shall require not more than 60 pounds of force to open or close. All covers over 30 pounds shall be furnished with angle support at bottom to carry weight of cover for assembly.
 - c. Covers of boxes and cabinets weighing more than 30 pounds shall be provided with lifting handles or some means of grasping other than edges.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Outlet Boxes:
1. Provide fixture outlets with proper fixture connectors.
 2. Box mounting height shall be dictated by the wiring device enclosed.
 3. Blanking covers shall be installed on all unused openings.
 4. Sheet metal boxes shall be used where the conduit system is routed concealed in the walls and ceilings.
 5. Cast metal or molded non-metallic surface mounted boxes shall be used in exterior and/or in all wet locations.
 6. Bonding jumpers shall be used around all concentric or eccentric knockouts.
 7. Boxes shall be securely mounted to the building structure independent of conduits entering or exiting the boxes.

Boxes

McKinleyville Community Services District
Wastewater Management Facility Improvements
Bid Set
1368004*00
© 2014 Kennedy/Jenks Consultants