Standard Specifications for Well Equipping

NOT FOR CONSTRUCTION

San Miguel, California

December 2024

San Miguel Community Services District

STANDARD SPECIFICATIONS

WELL EQUIPPING

Contents

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PART 1 WELL EQUIPPING

1.01 OVERVIEW

A. GENERAL

1. This specification includes the construction and installation requirements for drinking water production well equipping. Work Included: Submersible well pumps, motors, piping, valves, controls, site requirements and related materials and equipment specified herein.
2. Quality Assurance
    a. Referenced Standards: Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps.
    b. Pumping equipment shall be the product of a manufacturer having at least 5 years' experience in the manufacturing and installation of such equipment.
    c. All pumping equipment furnished under this section shall be of a design and manufacture that has been used in similar applications.
    d. Certified Shop Test.
        i. Perform at factory before shipment.
        ii. Operate pump to check for alignment, faulty equipment, piping leaks, seals, proper wiring and overall operation.
    e. Warranty
        i. The Pump Manufacturer shall warrant to the Owner the pumps and specified well station components against defects in material and workmanship for a period of 2 years from date of project acceptance. This warranty shall cover the cost of labor and materials, excluding removal and reinstallation costs, required to correct any warrantable defect.
    f. Perform Work according to San Miguel Community Services District Standards.
3. Submittals
    a. Pump Equipment.
        i. Submit the following information for the pump:
            1) Pump curve showing total dynamic head, flow rate, brake horsepower, shutoff head, net positive suction head, variable speed, and efficiency.
            2) Motor data, including the manufacturer; the minimum guaranteed efficiency and power factor at full load, 3/4 load, and 1/2 load; locked rotor current in amps; full load current in amps; the motor speed in rpm; and mounting details.
            3) Submit manufacturer's certified performance curves for review at least two weeks prior to shipping the units from the factory.
            4) Certified Shop Test Reports.
        ii. Submit manufacturer's sample form for reporting performance shop test results at least 30 days before the tests. The test should contain the data presented in the sample form in ANSI/HI 14.6.
        iii. Submit certified copies of shop test report at least 10 days before shipping equipment.

iv. Reports shall include:

1) Test log.

2) Description of test piping, equipment and setup.

3) Test procedure.

4) Certified performance curve.

5) Plot curve to be easily read at scales consistent with performance requirements.

v. Shop Drawings:

1) Product technical data showing compliance with specifications.

2) Submit drawings showing fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering performance and materials of construction, power drive assembly, parts, devices, and other accessories.

3) Submit dimensional drawings, showing materials of construction by ASTM reference and grade. Show linings and coatings.

4) Construction details and materials of pump. Outline dimensions and weights.

5) Certified performance curves.

vi. Operation and Maintenance Manuals, including detailed instructions on installation requirements, including storage and handling procedures.

vii. NSF 61 certification of pump and motor.

4. Warranty

a. Manufacturer shall guarantee equipment against defects in material and workmanship for a period of two years from date of project acceptance.

1.02 WELL PUMPING UNIT

A. GENERAL

1. Section includes submersible well pump(s), motor(s), power cable, and related materials and equipment specified herein.

2. Submersible Well Pump shall be designed and constructed to satisfactorily meet the site specific conditions and requirements. Engineer of Record shall provide the following information for the well site:

a. Well Name

b. Design Flow

c. Total Dynamic Head at Design Point

d. Minimum Pump Efficiency at Design Point

e. Motor Power Rating

f. Maximum Pump Operating Speed

g. Nominal Discharge Diameter

h. Well Casing Internal Diameter

i. Motor Starter

j. Motor Voltage/Phase/Frequency

3. The submersible pump and motor shall be rated for continuous duty and shall be capable of pumping the specified flow range without surging, cavitation, or vibration.

4. The pump shall not overload the motor for any point on the maximum speed pump performance characteristic curve throughout the entire pump operating range. The service factor for the motor shall not be applied when sizing the motor.

5. To ensure vibration-free operation, all rotative components of the pumping unit shall be statically and dynamically balanced. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at all operating speeds is avoided. In any case, the amplitude of vibration as measured at any point on the pumping unit shall not exceed the limits set forth in the latest edition of the Hydraulic Institute Standards.

6. All parts of the pump shall be designed to withstand the stresses that will be imposed upon them during their handling, shipping, installation, and operation.

7. The completed unit, when installed and operating, shall be free of cavitation, vibration, noise, and oil or water leaks over the range of operation.

8. The pump and motor shall be able to operate for short durations at zero flow conditions and operate continuously at runout with no harm to the pump or to the motor.

B. EQUIPMENT AND MATERIALS

1. Submersible Well Pump

   a. The pump covered by these specifications shall be a submersible well pump to be used in a domestic water well application. Pump and motors to be NSF 61 certified.

   b. Pump bowl material shall be Type 316 stainless steel with Type 316 stainless steel impellers, unless otherwise hereinafter specified. ASTM, AISI, etc., numbers, types, and grades specified are typical of material composition and quality. All bolts, nuts and washers for pump assembly shall be Type 316 stainless steel. Each bowl assembly shall consist of the discharge bowl, impeller, impeller shafting, and bearings.

   c. Impeller Material: Type 316 stainless steel. Impellers shall be polished stainless steel and dynamically balanced singularly. Pump impellers shall be of the enclosed type and cast in one piece. Machine to fit the contour of the bowl, hand file in the waterways, and equip with replaceable wearing rings. Attach the impellers to the shaft in such a manner that they cannot become loose under operating condition or reverse rotation.

   d. Pump Shaft Material: Type 316 stainless steel hard faced at all bearing journals.

   e. Bowl and Suction Bell: Type 316 stainless steel with wear ring. Hydrostatic test bowl at 1-1/2 times pump design head per Hydraulic Institute Standards.

      i. Bowls shall be sufficiently rigid to prevent adverse changes in bearing alignment and to maintain the running clearance of seal rings. Bowls shall be flanged with male and female rabbets for joining to the suction case and discharge column. Waterways and the diffusion vanes shall be smooth and free from nodules, bumps, and depressions.

      ii. Bowls shall be provided with a renewable wear ring adjacent to the impeller.

   f. Impeller and Bowl Wear Rings: Replaceable CF3M stainless steel rings with clearances to prevent galling between bowl and impeller wear rings.

   g. Bowl Bearings: Hard-faced bearings to provide erosion protection.

   h. Cap Seal: Pump shall have a discharge case cap to seal off end of pump shaft from any cascading abrasives entrained in the pumped liquid when power is turned off.

i. Strainer: The pump shall have a 300 series stainless steel strainer that will not restrict the flow of water with an open area more than four times the area of the impeller eye.

j. Acceptable Pump Manufacturers:

i. Goulds

ii. Franklin

iii. Floway

iv. Flowserve

v. Simflo

vi. Or Approved Equal.

k. Stainless steel nameplate mounted on casing to include:

i. Manufacturer.

ii. Model number.

iii. Serial number.

iv. Rated head, FT.

v. Rated flow, gpm.

vi. Pump speed.

2. Motor

a. General: The motor shall be filled with FDA-approved, high-strength, dielectric mineral oil and have automatic pressure balancing between reservoir and top bearing. Pump and motors to be NSF 61 certified.

b. Operating Parameters: Motor shall be rated by the manufacturer for variable frequency drive or single speed operation and the motor locked rotor current shall be equal or less than Code E.

c. Oil and Sand Protection: The motor shall be so designed that water and sand cannot be mixed with the oil and circulated nor the oil be released from the motor into the well water.

d. Thrust Bearing: Motor thrust bearing shall be sized for continuous up-thrust and down-thrust conditions utilizing a double sided Kingsbury thrust bearing.

3. Power Cable

a. The electrical cable shall be designed specifically for submersible motor service and shall be round.

b. The cable shall be sized to conform to National Electric Code for 125% of motor full load amps at a conductor temperature rating of 75 degrees C submerged, and a voltage drop at the motor not to exceed 3%.

c. The cable shall consist of 3 stranded copper conductors with cross-linked polyethylene insulation.

d. The cable shall also include an integral ground lead of appropriate size.

e. The power cable shall have an overall Nitrile/PNC blend jacket and shall be manufactured by Brand-Rex or equal.

f. The cable shall be supported on the column pipe by means of series 300 stainless steel cable clamps and bands.

g. The cable shall terminate in a waterproof junction box above the surface plate.

h. The cable shall be furnished by the motor manufacturer. The motor end of the cable shall be factory spliced to a flat cable assembly that is protected by stainless steel inner and outer guards as the cable passes by the bowl assembly.

i. The cable shall connect to the motor with a plug-in watertight molded rubber connector with brass gland follower and gasket.

4. Discharge Head:

a. Discharge head materials shall be carbon steel. Long radius 90-degree elbow with minimum class 150 flanged outlet. A segment of column pipe shall be provided on and rigidly attached to the underside of the discharge head with a taper threaded (NPT) connection for the column piping (or shall match column piping thread standard). The column pipe segment shall be of the same size and rating as the discharge elbow.

b. Discharge Head Mounting Flange: A mounting flange shall be rigid enough to support the entire weight of the suspended parts (pump/motor, column piping and downhole control valve) when filled with water. Flange shall be carbon steel class 150. The sole plate shall include a watertight cable sealing transition through the sole plate and threaded penetrations as determined by the Engineer of Record and approved by the District.

c. The pump manufacturer or installer shall provide the sole plate. Sole plate shall match the existing well casing material. Sole plate shall be a minimum 1” thick and drilled to match the pump discharge head’s base flange bolt pattern of the discharge head.

d. Manufacture shall provide an entry for the main power cable (1.5 inches or as determined by pump manufacturer).

e. Lifting lug(s) capable of lifting the entire pump, motor and column assembly.

f. Number and size of openings for current and future appurtenances as recommended by the Engineer of Record and approved by the District.

g. Watertight Seal: There shall be an appropriate gasket installed between the pump base plate and the pump sole plate assembly to insure and provide a watertight seal.

C. EXECUTION

1. Pumps and Motors

a. Care during storage and procedures for installation, lubrication, and startup of the pumps and motors shall be in strict conformance with the manufacturer's instructions.

b. A complete set of manufacturer's instructions covering storage, installation, operation, lubrication, and maintenance shall be available at the jobsite no later than the date other pumps are received.

c. Install per manufacturer’s instructions.

d. CONTRACTOR to provide all new fittings, piping, conduit, wiring to make a complete installation.

e. CONTRACTOR shall arrange to have the supplier of the pump equipment furnish the services of competent factory-trained personnel:

i. Supplier personnel to supervise the pump installation and the initial eight (8) hours of pump operation.

ii. An appropriate allowance for this supervision shall be included by the pump supplier in the price of his equipment.

iii. After installation, the CONTRACTOR shall submit a fully completed Manufacturer's Installation Certification form signed by an authorized representative of the manufacturer.

f. Following completion of the installation and satisfactory start-up of the equipment, the CONTRACTOR shall, in the presence of the pump manufacturer's representative and the OWNER, operate the pump unit to check rotation and verify head/capacity.

i. The operation shall be free of vibration, noise, or cavitation.

ii. The pump unit's vibration levels shall be measured and recorded in opposing 90 degree planes for the full potential range of the pump unit's variable speed operation.

iii. Vibration amplitudes as measured at any point within the potential operating range of the pumping unit shall not exceed the limits set forth in the latest edition of the Hydraulic Institute Standards (HIS).

iv. All performance criteria for the pump unit shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump discharge head, and pump discharge rate. Each power lead to the motor shall be checked for current balance and reported in writing to the OWNER.

v. In the event any of the pumping equipment fails to meet the above test requirements, it shall be modified or replaced and retested in accordance with the requirements of these specifications.

g. CONTRACTOR to provide services of equipment manufacturer's field service representative(s) to:

i. Inspect pump equipment and motors.

ii. Supervise pre-start adjustments and installation checks.

iii. Conduct initial startup of equipment and perform operational checks as required to fully demonstrate pump function, and leak and temperature monitoring and protection.

iv. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by OWNER.

v. Instruct OWNER personnel for 4 hours at jobsite on operation and maintenance.

2. Standard Pump Factory Test:

a. Each completed and assembled pump/motor unit shall undergo the following factory tests at the manufacturer's plant prior to shipment. The pump bowl assembly shall be subjected to a complete factory test as specified herein. Certified test reports, in triplicate, shall be submitted to the OWNER. All tests shall be performed in accordance with the latest Hydraulic Institute Standards.

b. The pump bowl assembly shall be factory tested using a calibrated lab motor to determine the following characteristics at the maximum speed at which the pump is to be operated:

i. Head-Capacity Curve

ii. Brake Horsepower Curve

iii. Efficiency Curve

iv. Motor phase current balance at motor terminals

v. Balance

vi. Vibration

c. The pump shall have certified test curves prepared and submitted as specified.

d. Motor shall be subjected to factory tests in accordance with the requirements of the applicable sections of the IEEE, ANSI, and NEMA test standards.

1.03 PIPE AND FITTINGS

A. GENERAL

1. All products in contact with potable water shall be certified to NSF-61 standards, and lead-free per California AB-1953.

2. Section includes:

a. Above grade piping

b. Below grade piping

c. Sleeve Couplings

d. Hardware

B. EQUIPMENT AND MATERIALS

1. Above Grade Piping

a. Acceptable Materials: Ductile Iron Pipe

i. Material: AWWA C151.

ii. Pipe Class: AWWA C150 and C151, Ductile iron pipe shall be a minimum Special Thickness Class 53.

iii. Lining: Double thickness per AWWA C104.

iv. Coating: Shipped bare, field coat two coats of self-priming epoxy and one coat of polyurethane per section 2.06 herein.

v. Ductile iron pipe shall not be threaded, welded, or flanged in the field. Flanges of ductile iron shall always be furnished on ductile iron pipe.

vi. Ductile Iron Pipe shall be manufactured by McWane Ductile, US Pipe or approved equal.

b. Fittings: Ductile Iron

i. Material: Ductile Iron, AWWA C110. Compact fittings AWWA C153.

ii. Flanged Joints: AWWA C115. ASME B16.1, Class 125, flat faced.

iii. Grooved Joints: AWWA C606. Grooved end couplings shall be Gustin-Bacon 500 Series, Victaulic Style 31, or equal with flush seal type gasket designed for ductile iron pipe. Unless otherwise specified, grooved end couplings shall be rigid joint for exposed service and flexible joint for buried service.

iv. Lining: Double thickness per AWWA C104.

v. Coating: Shipped bare, field coat two coats of self-priming epoxy and one coat of polyurethane per section 2.06 herein.

vi. Joints in above ground piping or piping located in vaults and structures shall be flanged, unless otherwise determined by the Engineer of Record and approved by the District.

c. Coating System for Exposed Metal

i. Service Conditions: use on interior metal structures, piping, valves, and fittings. For ductile iron pipe and fittings must be surface prepared in accordance with NAPF 500-03-04.

ii. Prime Coat: One coat of 4-6 mils dry-film thickness. Coating shall be Tnemec L69 Epoxoline or approved equal.

iii. Intermediate Coat: One coat of 4-8 mils dry-film thickness. Coating shall be Tnemec L69 Epoxoline or approved equal.

iv. Finish Coat: One coat of 2-5 mils dry-film thickness. Coating shall be Tnemec 1095 Endura-Shield or approved equal.

2. Below Grade Piping

a. Acceptable Materials:

i. Polyvinyl Chloride (PVC) Pipe AWWA C900

ii. Ductile Iron Pipe AWWA C151

iii. High-Density Polyethylene (HDPE) Pipe AWWA C906

iv. Steel Pipe AWWA C200

b. Polyvinyl Chloride (PVC) Pipe

i. Material: AWWA C900. Pressure rating shall be as specified by the Engineer of Record and approved by the District.

ii. Fittings: Ductile Iron, AWWA C110. Compact fittings AWWA C153. Fittings shall be wrapped in polyethylene encasement in accordance with AWWA C105.

iii. Lining: Double thickness per AWWA C104.

iv. Coating: Bituminous Coating: Comply with AWWA C110.

v. Mechanical and Push-on Joints: AWWA C111, restrained.

vi. Manufacturers:

1) JM Eagle’s Eagle Loc 900

2) Diamond Lok-21

3) Or Approved Equal.

c. Ductile Iron Pipe:

i. 3-inch through 12-inch: AWWA C151

ii. Lining of all ductile iron force main piping, valves, and fittings shall be U.S. Pipe Protecto 401 Ceramic Epoxy lining or approved equal. Ductile iron pipe lining shall be shop-applied in accordance with manufacturer’s recommendations.

iii. Unless otherwise specified, buried ductile iron pipe shall be coated with a bituminous coating in accordance with AWWA C151 and encased in polyethylene wrapping in accordance with AWWA C105.

iv. Rubber gasket joints for ductile iron pipe and fittings shall be styrene butadiene rubber, ethylene propylene rubber, or chloroprene, in accordance with AWWA C111.

v. Pressure Rating: As specified by the Engineer of Record and approved by the District.

vi. Fittings: Ductile Iron, AWWA C110. Compact fittings AWWA C153.

vii. Mechanical and Push-on Restrained Joints: AWWA C111, restrained.

d. High Density Polyethylene (HDPE) Pipe

i. HDPE materials, pipe and fittings shall be manufactured, inspected, sampled and tested in accordance with the requirements of AWWA C906.

DR rating and pressure rating shall be as specified by the Engineer of Record and approved by the District.

ii. Manufacturers:

(a) JM Eagle's HDPE Water Pipe

(b) ISCO Industries

(c) WL Plastics

(d) Performance Pipe, a Division of Chevron Phillips Chemical Co

(e) Or Approved Equal.

e. Schedule Steel Pipe

i. Material: ASTM A53 Grade B, Schedule 40, seamless or electro-resistance welded (ERW) longitudinally welded (not spiral wound) or per AWWA C200.

ii. Lining: Cement mortar lined per AWWA C205.

iii. Coating: Cement mortar coated per AWWA C205.

iv. Fittings: ASTM A234, ANSI B16.9, standard weight, smooth-flow (no miter). Fittings shall be flanged, welded, or grooved as determined by the Engineer of Record and approved by the District. Fittings shall be lined and coated per AWWA c205.

v. Flanges: ASTM A105, ANSI B16.1/B16.5, slip-on or weld neck, flat face. Class shall be as specified by the Engineer of Record and approved by the District.

3. Sleeve Couplings

a. General

i. Pressure: Couplings shall be designed for a working pressure not less than the design pressure of the pipe on which they are to be installed.

ii. Material: Couplings shall be made of ductile iron or steel. Ductile Iron components shall be a minimum grade of 65-45-12 ductile iron meeting the requirements of ASTM A536 of the latest revision. Steel components shall be carbon steel per ASTM A513 or A53 for 3" – 4" or ASTM A283C for 6" – 48".

iii. Hardware: Bolts nuts, and rods shall be rated at a minimum per Section 2.02F herein.

iv. Gaskets: Made from virgin Ethylene Propylene Diene Monomer Rubber (EPDM) compounded for water and sewer service in accordance with ASTM D2000, NSF 61 Certified.

v. Coating and Lining: All sleeve couplings shall be NSF61 certified. Coupling shall be coated and lined with an NSF 61 certified fusion bonded or liquid epoxy. Thickness of coating and lining shall be minimum 6 mils exterior and 15 mils interior.

b. Restrained Couplings

i. Joint restraint shall prevent axial separation of two plain ends of same or dissimilar materials, such as ductile iron, steel, PVC and/or HDPE pipe. Restrain mechanism shall incorporate a plurality of individual actuating of the restraint devices.

ii. Restrained Joint Coupling shall be manufactured by Ebba Iron 3800 Mega-Coupling Model, Smith-Blair Pipe Lock Joint Restraint Coupling (470 Series), or equal be carbon steel per ASTM A513 or A53 for 3" – 4" or ASTM A283C for 6" – 48".

c. Transition Couplings

i. Transition couplings shall utilize compressible gaskets and meet the applicable requirements of AWWA C219. Transition couplings shall be manufactured by Romac, Smith-Blair, or approved equal.

ii. Couplings connecting asbestos cement pipe to ductile iron or PVC pipe shall be Romac Model XR501, Smith Blair Model Quantum/Omni Coupling, or approved equal.

iii. Couplings connecting steel pipe to PVC pipe shall be manufactured by Romac Model 511, Smith Blair Model Quantum/Omni Coupling, or approved equal.

iv. Transition couplings shall be installed with suitable thrust block restraints where applicable or as determined by the Engineer of Record and approved by the District.

4. Hardware

a. Nuts and Bolts: Nuts and Bolts shall conform to the chemical and mechanical requirements of ASTM A307 Grade B, heavy hex, zinc plated. Bolt threads shall be lubricated with an approved anti-seize compound.

b. Steel Rods, Bolt, Lugs, and Brackets: ASTM A36 or ASTM A307, Grade A Carbon Steel.

c. Flange Gaskets: Flat Face flanges shall be provided with full-faced gaskets. Gaskets shall be non-asbestos, 1/8” thick, and be NSF 61 certified for potable water use. Non-asbestos gaskets shall be manufactured from Garlock, Tripac, or approved equal.

C. EXECUTION

1. Trenching

a. Excavate subsoil required for utilities.

b. Excavate width of trenches in accordance with County of San Luis Obispo Public Improvement Standards.

c. Provide uniform and continuous bearing and support for bedding material and pipe.

d. Do not interfere with 45 degree bearing splay of foundations.

e. When Project conditions require it, provide sheeting and shoring to protect excavation as required by this section.

f. When subsurface materials at bottom of trench are loose or soft, notify Engineer, and request instructions.

g. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

h. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

i. Remove excess subsoil not intended for reuse from site.

j. Stockpile excavated material in area designated on site.

2. Paints and Coatings:

a. Coating System C-1: Exposed Metal

i. Type: High-performance epoxy coat having minimum volume solids of 100%, with primer and intermediate coats as recommended by manufacturer.

ii. Service Conditions: For use with all metal structures or pipes which are not buried including within the valve vault at the Lift Station.

iii. Surface Preparation: SSPC SP-10.

iv. Prime Coat: Polyamidoamine epoxy recommended by the manufacturer for overcoating with a high-performance epoxy finish coat. Apply to a thickness of 3 mils. Products: Tnemec Series N69 Hi Build Epoxoline II, Amercoat 370, Sherwin-Williams Copoxy Shop Primer, or equal.

v. Intermediate Coat: Modified Aliphatic Amine epoxy if recommended by the manufacturer for overcoating with high-performance epoxy finish coat. Products: Tnemec Series 434 Perma-Shield H2S, or equal.

vi. Finish Coat: Modified Polyamine or two component polycyclamine, 100% solid, no to low VOCs epoxy recommended by the manufacturer for overcoating a high-performance epoxy coating. Apply to a thickness of at least 2 mils. Products: Tnemec Series 435 Perma-Glaze, International Enviroline 222, Amercoat 351, Sherwin-Williams Dura- Plate® 5800, or equal.

3. Installation

a. Buried Pressurized Piping

i. PVC Pipe:

1) Install buried PVC pipe according to AWWA C605.

2) Handle and assemble pipe according to manufacturer's instructions.

3) Contractor to obtain the desired horizontal and vertical alignment by use of fittings or bending the pipe per the manufacturers' recommendations for maximum deflection. Do not bend the pipe with machinery. Protect the joint from offset while bending the pipe. If bending the pipe within the manufacturers' recommendation is inadequate to meet the required alignment Contractor shall use fittings or high deflection couplings, as applicable.

4) Deflected joints shall not exceed 80% of manufacturers' allowable deflection

5) Install pipe to indicated elevations to within tolerance of 5/8 inches.

6) Install pipe with no high points, unless as otherwise determined by the Engineer of Record and approved by the District. If unforeseen field conditions arise that necessitate high points, install air release valves as directed by Engineer.

7) Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.

8) Prevent foreign material from entering pipe during placement.

9) Install pipe to allow for expansion and contraction without stressing pipe or joints.

10) Close pipe openings with watertight plugs during Work stoppages.

11) Install plastic ribbon tape continuous buried 12 inches above pipe line.

12) Install detectable warning tape 12 inches below finish grade, or between aggregate base course and subgrade in paved areas.

ii. Polyethylene Encasement

1) All buried Ductile Iron fittings, and all buried valves shall be encased with loose polyethylene film, unless otherwise stated on the plans.

2) Install according to AWWA C105.

3) Terminate encasement 3 to 6 inches aboveground where pipe is exposed.

4) Polyethylene encasement shall be colored green for sanitary sewer force mains.

b. Above-Grade Piping

i. General

1) Installation shall be according to ASME B31.3.

2) Run piping straight along alignment, with minimum number of joints.

3) Fittings:

4) Clean gasket seats thoroughly and wipe gaskets clean prior to installation.

5) Install fittings according to manufacturer instructions.

6) Bolts:

7) Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight.

8) Use torque wrench to tighten bolts to manufacturer instructions.

9) Install fabricated fittings with flexible pipe couplings.

10) Provide required upstream and downstream clearances from devices as determined by the Engineer of Record and approved by the District.

11) Install piping with sufficient slopes for venting or draining liquids and condensate to low points.

12) Provide supports for exposed piping.

13) Provide expansion joints and pipe guides to compensate for pipe expansion due to temperature differences.

14) Dielectric Fittings: Provide between dissimilar metals such that galvanic cells causing corrosion are not developed.

15) Field Cuts: According to manufacturer instructions.

16) Finish primed surfaces as specified in this specification.

4. Field Testing

a. Pressurized Piping

i. This pertains to all piping which will be pressurized during typical operations.

ii. Hydrostatic pressure test pressurized piping as follows:

1) Test Pressure: As specified by the Engineer of Record and approved by the District

2) Conduct hydrostatic test for at least two hours.

3) Test all piping, which include the force main and points of connection.

4) Slowly fill section to be tested with water; expel air from piping at high points. Install corporation stops at high points. Close air vents and corporation stops after air is expelled. Allow the pipeline to set for a minimum of 24 hours.

5) Refill the pipe, if necessary, and raise pressure to specified test pressure.

6) Observe joints, fittings, and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.

7) Correct visible deficiencies and continue testing at same test pressure for an additional one hour to determine leakage rate. Maintain pressure within plus or minus 5 psi of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.

8) The water necessary to maintain this pressure shall be measured by the amount of water withdrawn from a fixed vessel, such as a barrel.

9) Leakage shall not exceed the rate of 30 gallons per inch of diameter per 24 hours per mile of pipe.

10) When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

D. DESIGN AND PERFORMANCE CRITERIA

1. Pressurized Piping

a. Maintain a pipe velocity between 3 to 4 feet per second.

1.04 VALVES

A. GENERAL

1. All valve interiors/exterior shall be fusion bonded epoxy coated (8 to 12 mils) with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550 (latest). Completed coating shall be free from all defects and shall be inspected by use of low voltage holiday detecting and non-destructive thickness gauges.

2. Where the manufacturer demonstrates in writing that it would be impossible to use the powder epoxy method without causing damage to the valve components, the use of a liquid epoxy will be permitted upon approval by the Owner.

3. The following valves are provided under this section:

a. Pump Control Valve

b. Check Valve

c. Gate Valve

d. Air and Vacuum Valve

B. EQUIPMENT AND MATERIALS

1. Pump Control Valve

a. The pump-to-waste (PTW) valve shall be a pump control valve.

b. Valve shall be globe type and function as a blowoff valve when well first starts up and a pressure sustaining valve to maintain a preset pressure upstream to provide back pressure for the pump.

c. The pump control valve shall be equipped with one (1) solenoid valve that is energized to close control valve after the preset blowoff period. The pump control valve is normally open and closed by energizing the solenoid via start pump signal from site SCADA. The valve close solenoid shall be activated by a delay timer to allow the valve to close after the well's PTW period has expired. Upon loss of power, the pump control valve shall fail open.

d. Valve shall be ANSI B16.42 flanged. The working pressure shall be as specified by the Engineer of Record and approved by the District.

e. The valve shall be capable of a flow range which is specified by the Engineer of Record and approved by the District. The valve shall be equipped with stainless steel anti-cavitation trim, which shall protect the valve from damage due to a pressure differential across the valve.

f. Acceptable Manufacturers:

i. Cla-Val

ii. Or Approved Equal.

g. Accessories

i. Limit Switch: An adjustable limit switch assembly shall be mounted on the main valve, connected to the main valve stem. It shall be actuated by opening or closing of the valve and easily adjusted to operate at any point of the valve's travel. The limit switch will be used to complete the pump off cycle. The actuating point of the limit switch shall be adjustable. Limit switch shall be Cla-Val or approved equal.

2. Check Valve

a. Check valve shall be a silent globe check valve. The valve design shall incorporate a center guided, spring loaded disc and having a short linear stroke that generates a flow area equal to the nominal valve size.

i. Body: Ductile Iron ASTM A536 Grade 65-45-12

ii. Disc and Seat: Lead-Free Bronze ASTM B584 Alloy C87600 or Aluminum Bronze ASTM B148 Alloy C95500. Optional trim material includes ASTM A351 Grade CF8M stainless steel.

iii. Compression Spring: ASTM A313 Type 316 stainless steel with ground ends

iv. Ends: Flanged ANSI B16.1

b. Manufacturers

i. APCO Series 6000 Convertible Swing Check Valve.

ii. Val Matic Valves.

iii. Flomatic Valves.

iv. Or Approved Equal.

3. Gate Valves

a. Above grade resilient wedge gate valves (RWGV) within well building shall be furnished with handwheels. Above grade RWGVs outside of well building or below grade shall be furnished with 2" operator nut. RWGVs shall open counterclockwise unless otherwise indicated.

b. Resilient Wedge Gate Valves: AWWA C509 or AWWA C515

i. Body: Ductile Iron

ii. Resilient Seats

iii. Stem: Non-rising (NRS) Bronze Stem.

iv. Ends: Flanged, mechanical joint or bell end connections as shown on the plans.

c. Manufacturers:

i. Mueller Co. Series: A-2361, A-2362

ii. Clow Valve Company: Model 2638

iii. Or approved equal.

4. Air and Vacuum Valves

    a. Air valves shall be combination air or combination air and vacuum valve (air, vacuum, and automatic release). They shall permit automatic escape of large quantities of air from pipeline when it is being filled, permit air to enter pipeline when it is being emptied, and allow accumulating air to escape while pipeline is in operation and under pressure.

    b. Air and Vacuum Valves: AWWA C512

        i. Body and Cover: Cast Iron ASTM A126 Class B or Ductile Iron ASTM A536 Grade 65-45-12

        ii. Trim: Type 316 Stainless Steel

        iii. Coatings: NSF61 certified liquid epoxy (internal and external)

    c. Air valves shall be subjected to factory hydrostatic test at pressure equal to 150% rated working pressure with no harmful deflections or other defects.

    d. Air valves shall be installed with a downward-facing bug screen.

    e. Manufacturers:

        1) Val-matic Model: 201C Combination Air Valves

        2) ARI USA Model: D-040-C

        3) Or approved equal.

C. EXECUTION

1. Install Valves and Appurtenances in accordance with manufacturer’s written instructions.

2. CONTRACTOR shall coordinate with the valve manufacturer to ensure that all electrical connections and pressure supply lines necessary for proper valve operation and monitoring are installed prior to startup and testing.

3. CONTRACTOR shall provide the services of a Manufacturer's representative to visit project Site for startup and initial setting valves. Manufacturer’s representative shall provide a certification of proper installation documenting the correct installation of the valve.

1.05 CONTROLS AND INSTRUMENTATION

A. GENERAL

1. The following instruments are provided under this section:

    a. Flowmeter

    b. Hydrostatic Level Transducer

    c. Pressure Transmitter

    d. Pressure Switch

    e. Pressure Gauge

B. EQUIPMENT AND MATERIALS

1. Flow Meter

    a. Well main line and pump to waste lines shall both be metered.

    b. Flowmeter shall utilize either magnetic or propeller technology to accurately measure instantaneous flow and totalized flow. Flowmeter measurements shall be read in gallons in lieu of cubic feet.

    c. If well discharge header is 4-inches or smaller then magnetic or ultrasonic.

    d. If well discharge header is larger than 4-inches then magnetic or propeller.

e. Instantaneous flow shall be sent to SCADA via a 4-20 ma signal.

f. Manufacturers:

i. Master Meter Ultrasonic

ii. Seametrics

iii. McCrometer

iv. Or Approved Equal.

2. Hydrostatic Level Transducer

a. Hydrostatic level transducer shall measure groundwater depth in the well.

b. The continuous level transducers shall be of the hydrostatic pressure type, suitable for potable well water applications. The transmitter shall be comprised of PTFE coated elastomeric diaphragm in durable 316 stainless steel housing with polyurethane cable. The Contractor is responsible for actual cable length required as dependent on conduit routing. Cable length shall be sufficient from level transducer to the RTU Panel without splicing.

c. Provide support grip on cable to hold installed depth. Provide transducer with additional weight.

d. Transducer Probe:

i. Stainless steel housing

ii. Cable length to be minimum 150’. Splices will not be allowed. Coil excess cable in RTU Panel.

iii. Output: 4-20 mA, loop powered

e. Manufacturers:

i. Endress + Hauser

ii. Or Approved Equal.

3. Pressure Transducer

a. Pressure Transducer shall measure discharge pressure.

b. Include a pressure transducer 0-250 PSI (or as specified by Engineer of Record and approved by the District), with 4-20 mA output. Transducer shall have 1/4” or 1/2" NPT connection.

c. Manufacturers:

i. Druck

ii. Or Approved Equal.

4. Pressure Transmitter

a. Pressure Transmitter shall transmit discharge pressure for monitoring and use in control of the well.

b. Electronic indicating type pressure transmitter systems shall consist of diaphragm seal fittings, pressure transmitter with process indication, isolation valve, grounding screw, and threaded conduit connection.

c. Output: 4-20 mA

d. Manufacturers:

i. Druck

ii. Or Approved Equal.

5. Pressure Switch

a. Section includes pressure switch for protecting the pump from high and low pressure. The pressure switch system shall consist of an adjustable pressure switch, and isolation valve.

b. Pressure switch device shall be provided with the following features: continuously adjustable span, zero and damping adjustments, integral indicators scaled in engineering units, solid state circuitry, two SPDT switches and 4-20 mA output. Range provided in model numbers below. Pressure display shall be 4-digit backlit LCD.

c. Pressure switch shall be 2 single pole double throw (SPDT) rated 5 amperes at 120 volt AC. Set points adjustable 0 to 100% of full scale. External LED switch indication for each relay on front panel. Manual or automatic reset.

d. Process wetted materials shall be 316 SS. Body material shall be 316 SS. Process connections shall be 1/4" NPT. The transmitter housing shall be rated NEMA 4X. Conduit hubs shall be cast integral with the instrument housing and shall be 1/2-inch NPT. Provide with mounting bracket for back panel mounting.

e. Power Supply: Provide 120 VAC to 24 VDC power source from 24 VDC power supply in Pressure Switch Enclosure for Well Pump Discharge Pressure Switch.

f. Well Pump Discharge Pressure Switch shall be 24 VDC powered, pressure range as specified by the Engineer of Record and approved by the District PSI, Mercoid Series EDA Electronic Pressure Controller, Model #EDA-W-N1-E1-04-T1-NIST-A-EDA-BRK, with A-590 plug as required.

g. Manufacturers:

i. United Electric Controls #H54-27

ii. Mercoid Series EDA Electronic Pressure Controller

iii. Or Approved Equal.

6. Pressure Gage

a. Pressure gages shall be provided as recommended by the Engineer of Record and approved by the District. In all locations where pressure may vary from below to above atmospheric head, compound gages shall be installed.

b. Gage Construction: Gages shall be industrial grade with type 316 stainless steel movement and stainless steel or alloy case or phenol case. Unless otherwise shown or specified, gages shall have a 4-1/2-inch dial, ½-inch threaded connection, a Type 316 stainless steel snubber adapter, and a shut-off valve. Gages shall be calibrated to read in engineering units, with an accuracy of ±1 percent of reading, and shall withstand pressures equal to 150 percent of the rated working pressure or vacuum without failure or damage to the gage. All gages shall be vibration and shock resistant. Ranges shall be such that one half of range is normal operating pressure.

c. Manufacturers

i. Ashcoft

ii. Foxboro

iii. Dwyer

iv. Or Approved Equal.

7. Turbidity Meter

a. All wells shall be equipped with a turbidity meter to match existing equipment model or approved equal.

b. Turbidity meter shall be connected to SCADA system for continuous monitoring.

c. Manufacturer:

i. HACH

ii. Or Approved Equal.

8. Chlorine Analyzer

a. All wells shall be equipped with a chlorine analyzer.

b. Chlorine Analyzer shall be connected to SCADA system for continuous monitoring.

c. Manufacturer

i. HF Scientific

ii. Or Approved Equal.

1.06 CHEMICAL INJECTION SYSTEM

A. GENERAL

1. Well shall be equipped with a chemical injection system with a sodium hypochlorite injection system with metering pump for disinfection. Additional chemical injection may be required depending on the well water quality and other treatment requirements.

B. EQUIPMENT AND MATERIALS

1. Chemical injection system shall include:

a. 350 gallon double wall tank (supplied by chemical provider)

i. Peristaltic metering pump

ii. Manufacturers: Stenner or Approved Equal.

b. Chorine Analyzer to match existing District equipment or equal as approved.

c. Eye Wash/ Safety Shower Station

d. Secondary containment

1.07 MOTOR CONTROL CENTER

A. GENERAL

1. This section includes requirements for the Motor Control Center.

B. EQUIPMENT AND MATERIALS

1. Ratings:

a. Rated 480VAC, 3 phase.

2. Motor Control Center (MCC) shall be in a NEMA 12 rated free-standing enclosure.

3. MCC shall provide Three Phase Power Failure Monitoring Relay with phase loss, low voltage, phase reversal and phase unbalance functions.

4. Provide surge protector device.

5. Transformer KVA, voltage, and number of phases shall be as determined by the Engineer of Record and approved by the District. Transformers shall be NEMA TP-1 and EPA Energy Star compliant meeting all locally recognized energy efficiency requirements. Construct transformer in accordance with ANSI C89.2, NEMA ST 20, and UL Standard 506.

6. Provide dead front, bolt-on type circuit breaker, safety type panelboards per NEMA PB 1. Provide with copper bus bars. Panelboard shall mount in the MCC.

7. Manufactures:

a. Tesco Controls, Inc.

b. Or Approved Equal.

1.08 STANDBY GENERATOR AND TRANSFER SWITCH

A. GENERAL

1. This section includes:

a. Standby Generator

b. Automatic Transfer Switch

c. Automatic Controls

B. EQUIPMENT AND MATERIALS

1. Standby Generator

a. All wells sites shall be equipped with a natural gas or liquid petroleum gas generator. Redundant wells, as approved by the District, shall be equipped with an automatic transfer switch and space for a portable generator.

b. Permanent generator shall include a sound attenuating metal cover.

c. Wells equipped with Liquid Petroleum Gas generators shall also have a minimum of 500 gallons of stored gas

d. All generators must comply with all state and local air quality laws and regulation that are in effect at the time of permitting.

2. Automatic Transfer Switch

a. The automatic transfer switch shall be an integral part of power service and motor control center, and shall be mounted and wired at the factory, including mounting and wiring of door-mounted accessories. The automatic transfer switch (ATS) shall be as manufactured by ASCO, Olympian, Russelectric, or equal. The ATS and accessories shall be UL listed and labeled and tested per UL Standard 1008 and comply with NEMA ICS2-447, NFPA 70, NFPA 99, and NFPA 110.

b. The ATS shall include all necessary control devices and circuitry for a complete and operable system capable of the following operations:

c. Supply normal (utility) power to the motor control center when normal power is available. Supply standby power from the standby generator set when normal power fails or is disconnected.

d. Detect sustained loss or deterioration of "normal" power (power failure), signal the standby generator set to start and run when "normal" power fails, and when "standby" power from the generator is within proper limits of voltage and frequency, transfer to supply "standby" power to the motor control center.

e. Detect sustained restoration of "normal" power within proper limits of voltage and frequency, and then retransfer to supply "normal" power to the motor control center.

f. Provide dry contacts for connection to control panel to indicate normal power "on", loss of "normal" power, and "standby" power on.

3. Automatic Transfer Switch Ratings and Components

a. The ATS controls and accessories shall be rated for continuous (24-hour) duty as installed. The switch shall be an open transition, 3-pole, double-throw, having the "normal" and "standby" positions mechanically interlocked, with microprocessor controller to provide automatic operation and shall be suitable for application to an appropriate phase, wire, frequency, voltage system. The minimum continuous current rating shall be as determined by the Engineer of Record and approved by the District. The ATS shall be rated to withstand a

short circuit current as determined by the Engineer of Record without parting of the switch contacts. The ATS shall be capable of manual operation under load.

b. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism.

c. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency. All main contacts shall be silver composition.

d. All switch and relay contacts, coils, springs, and control elements shall be serviceable or removable from the front of the switch enclosure without disconnection of drive linkages, power conductors, or control conductors.

4. Automatic Controls

a. Controls shall be solid-state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard C62.41 and C62.45.

b. Solid-state undervoltage sensors shall simultaneously monitor both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.

c. Automatic controls shall signal the standby generator set to start upon signal from the normal source sensor. Solid-state time delay start shall be adjustable and avoid nuisance start-ups. Battery voltage starting contacts shall be silver, dry type contacts factory wired to a field wiring terminal block.

d. The switch shall transfer when the emergency power source reaches the set point. Provide a solid-state time delay on transfer and operator adjustable.

e. The switch shall retransfer the load to the normal power source after a time delay retransfer and shall be operator adjustable. Retransfer time delay shall be immediately bypassed if the emergency power source fails.

f. Controls shall signal the engine-generator set to stop after a cool down time delay and shall be operator adjustable, beginning on return to the normal power source.

g. Power for transfer operation shall be from the source to which the load is being transferred.

h. Provide solid state exerciser clock to set the day, time, and duration of standby generator set exercise/test period. Provide a with/without load selector switch for the exercise period.

i. Front Panel Devices (Inside MCC NEMA 3R Wrap)

j. Provide control switches mounted on panel inside door front for:

i. Test: Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.

ii. Retransfer: Momentary position to override retransfer time delay and cause immediate return to normal source, if available.

iii. Provide LED-type switch position and source available indicator lamps on the front of the transfer switch cabinet.

k. Auxiliary Contacts

i. One normally closed dry contact, which shall open when normal power fails for "power failure" signal to RTU shall be provided. One normally open dry contact, which shall close when the ATS is connected to the emergency source for "emergency power" signal to RTU shall be provided.

1.09 PUMP TO WASTE

A. GENERAL

1. All well sites shall include a Pump Control Valve to facilitate pump to waste for well start up and shutdown.
2. Well sites should include an onsite tank to collect non-potable water from pump to waste with an overflow to a sewer system manhole, as site conditions allow.
3. Onsite tank shall have provision to pump to or gravity feed to a on site wharf head hydrant at the direction of the District.

1.10 BUILDING

A. GENERAL

1. All well sites shall include a building to house well system controls, piping, and chemicals.

B. EQUIPMENT AND MATERIALS

1. The building should be constructed of steel or concrete masonry units with a steel roof.
2. The building should include a minimum of one standard door entrance and a 10’x10’ rollup door.
3. The building shall include exhaust fans.
4. The Building shall have temperature control (heating and cooling) to provide stable temperatures year round.

END OF SECTION