

**CITY OF LAKEVILLE  
STANDARD SPECIFICATIONS  
FOR ALL LIFT STATION IMPROVEMENTS  
TO BE MAINTAINED BY THE CITY**

**SECTION 6**

## **UNDERGROUND CONSTRUCTION INDEX**

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## CITY OF LAKEVILLE STANDARD SPECIFICATIONS FOR UNDERGROUND CONSTRUCTION

- 1.00 **GENERAL:** To provide for standardization of all sanitary lift stations in the City, the City of Lakeville, Minnesota, has adopted the following general standards for the rehabilitation of existing sanitary lift stations and the design and construction of future sanitary lift stations within the City of Lakeville.

The standardization of lift stations within the City will simplify operation and maintenance of the stations and will reduce the spare parts inventory that will be necessary to keep on hand.

In order to provide uniformity and standardization, the City of Lakeville will obtain the following items for inclusion in the construction of new, and rehabilitation of existing, lift stations:

- Pumps
- Pump Discharge Elbows
- CAS (Control and Status) Monitoring Unit (Pump Safe Modules)
- Pump Control Panel including SCADA Equipment

- 2.00 **LIFT STATION TYPES:** The City has defined different levels of sophistication that may be required for any one lift station installation. Depending on the size of the lift station, a separate valve manhole may or may not be required and permanent standby power may or may not be required. The City of Lakeville shall determine the level of sophistication required for existing and proposed lift stations within the city.

Lift stations with pumps and discharge piping large enough to pass a three inch solid shall be provided with non-clog submersible pumps (non-grinder). Lift stations with pumps and discharge piping that cannot pass a three inch solid shall be provided with grinder pumps.

- 3.00 **LIFT STATION DESIGN AND CONSTRUCTION:**

- 3.01 **General:** Each lift station will be provided with two or three pumps at the City's discretion, a pump control panel, submersible level transducer, a backup controller, back-up floats, and SCADA equipment within the control panel. The control panel shall be located next to the lift station a minimum of 4' from the wet well and protected by bollards.

New, non-grinder lift stations with discharge piping larger than three inches in diameter shall be required to have a separate valve manhole. Existing non-grinder lift stations currently without separate valve manholes will be upgraded with separate valve manholes where site and flow conditions permit. The minimum wet well and valve manhole size for non-grinder lift stations will be 72" in diameter.

Small grinder lift stations will not require a separate valve manhole structure. The minimum wet well size for grinder lift stations will be 60" in diameter.

Permanent standby power may or may not be required at the lift station site. Standby power requirements will be based upon the service area of the lift station and emergency response times as well as the availability of the City's existing portable standby power. Standby power requirements shall be at the sole discretion of the City of Lakeville for each lift station.

A vent pipe shall be provided for each lift station either cast integral with the slab or located off to the side of the station depending upon specific site conditions. Vent pipe location will be at the City's sole discretion.

A concrete slab shall be provided for the lift station control panel and around the lift station. A concrete driveway shall be provided as the site permits. Control panel access shall be protected by bollards. Additional landscaping measures may be necessary, final site improvements shall be at the discretion of the City.

Drawings have been provided in Appendix A to detail the general lift station requirements. Sheet No. 1 and 2 are for larger non-grinder pump lift stations. Sheet No. 3 is for smaller grinder pump lift stations. Sheet No. 4 provides standard details for both the non-grinder and grinder lift stations. Sheet No. 5 indicates the standard control panel layout. Sheet No. 6 shows the bill of materials for a typical lift station panel.

### 3.02 Wet Well and Valve Manhole:

A...Materials of Construction: Main structure shall be reinforced precast concrete manhole and/or reinforced concrete. All wet well hardware and fasteners shall be in stainless steel.

B...Buoyancy: Without justification using site specific soils and groundwater information, the wet well, wet well base slab, and wet well cover shall be designed to overcome the buoyant forces on the lift station assuming a ground water elevation at the surface, no soil interaction with the structures, and a minimum safety factor of 1.10 based on the dead loads on the concrete structure, excluding all equipment, hatches, piping, etc.

C... Structure Reinforcement: The concrete structure, including base slab and wet well shall be designed and constructed to overcome the pressure associated with minimum and maximum ground water elevations and a structural safety factor which meets current industry standards. The top slab shall be designed to handle AASHTO HS20 vehicle loads regardless of location. (It is the City's intent to not construct lift stations or valve manholes within roadways.)

D...Hatch: A heavy duty aluminum access hatch shall be cast into the top slab of the lift station and valve manhole. The hatch assembly shall include a recessed padlock locking device, flush stainless steel drop handle which does not protrude above the cover, and an automatic hold open arm or release handle. Hatches shall be equipped with a compression spring assist so that the cover will require no more than 30 pounds of force to open using the lift handle. Hatches shall have a removable "T" handle operated slam lock system with a slam lock plug. A thick coated bitumastic coal-tar epoxy shall be applied to the exterior of the hatch frame that will be in contact with the concrete. The hatches shall be sized to allow removal of the pumps and valves.

The hatch or hatches shall provide a clear opening for easy removal of pump(s) and all equipment, valves, and piping to be located in the wet well or valve manhole. A minimum of 2 inches of clearance will be provided between the sides of the pumps and the hatch and a minimum of 6

inches clearance will be provided between the front of the pump (side of pump away from guide rails) and the hatch, assuming the pumps are brought straight up through the hatch following the guide rails which are set to meet manufacturer's standards. Hatches in non-traffic areas shall withstand 300 lbs./sq ft loads, at a minimum. Hatches in traffic areas shall withstand AASHTO HS20 loads, at a minimum. (The City of Lakeville shall make a case-by-case determination of minimum needs. It is the City's intent to not construct lift stations or valve manholes within roadways.) A "master" lock shall be provided for each hasp on the access hatches keyed to City of Lakeville specifications.

Each hatch shall be provided with safety grating.

E...Wet Well Size and Dimensions: The wet well dimensions and size shall follow the recommendations of the most recent standards of the Hydraulics Institute. The minimum sizes for grinder and non-grinder lift stations are indicated above.

Wet well sizing shall maintain pump cycling at or below 10 starts per hour.

The lower portion of the wet well shall be sloped to reduce solids residence times within the station to reduce the potential for odors.

The high water alarm elevation shall be at least 6 inches below the invert of the deepest influent pipe.

The low water alarm shall be above the pump manufacturer's minimum operating water level, and above the top of the submersible pump and motor unit.

Pump and wet well settings, including high water and low water alarms and pump on and off settings, shall be separated by at least 1 foot of elevations.

Oversize wet well to accommodate increase in flows should increases be likely. Avoid odor production using sloped fillets and adjustable on/off elevation settings.

Single pump installations are not acceptable.

Provide a separate valve manhole for a 3 inch diameter and larger discharge piping.

Wet well dimensions shall promote the use of standard pump sizes wherever possible. Consult the City for a list of standard pump sizes.

F...Valve Manhole Size and Dimensions: Provide a minimum of 9 inches of clear space between the valve manhole structure and flanged or otherwise bolted fittings for ease of construction and repair.

Provide adequate space for maintenance personnel to enter the valve vault to repair or replace piping, valves, etc. The minimum valve manhole size shall be 72" diameter.

The valve manhole shall have a drain to the wet well with an isolation gate valve. The drain piping shall extend to below the low water level in the wet well.

See Standard City Detail Plate for additional requirements.

### 3.03 Discharge Pumping for Non-Grinder Lift Stations:

A...Location: All buried piping shall have a minimum of 7.5 feet of cover. Discharge piping shall be spaced in accordance with pump manufacturer's recommendations.

B...Sizing: Discharge piping velocities shall be above 2.5 feet per second and below 10 feet per second.

Acceptable discharge piping velocities may be lowered based on life cycle costs calculated by the City.

C...Ductile Iron Piping and Fitting Materials: Unless otherwise stated, ductile iron pipe and fitting shall conform to the requirements of ANSI/AWWA C151/A21.51 for 150 pound working pressure with flange or mechanical joints. Flange joints shall conform to ANSI/AWWA C115/A21.15, drilled in accordance with ANSI B16.1 Class 125. The weight, class, or nominal thickness shall be shown on each pipe. All buried ductile iron pipe within 20 feet of lift station and valve manhole structure shall be a minimum of Class 52.

Mechanical joint fittings shall conform to AWWA C110/ANSI A21.10 rated at 250 psi, or AWWA C153/ANSI A21.53 rated at 350 psi. Rubber gaskets shall conform to AWWA C111.

All ductile iron pipe and fittings shall be lined with cement mortar in accordance with ANSI/AWWA C104/A21.4 unless otherwise noted.

D...Special Fittings: Flanged coupling adaptors shall be Dresser Style 227, Smith Blair 912, or equal.

E...Check Valves: Maintenance-free, swing check valves four (4) inches and larger shall meet the material requirements of AWWA C508.

Check valves shall be as manufactured by Val-matic, Clow Valve, Golden Anderson, or approved equal.

F...Gate Valves: Gate valves three inches and larger shall be resilient seated gate valves conforming to AWWA C515. Allowances shall be made for material thickness associated with ductile iron valves.

### 3.04 Discharge Pumping for Grinder Lift Stations:

A...Location: All buried piping shall have a minimum of 7.5 feet of cover. Discharge piping shall be spaced in accordance with pump manufacturer's recommendations.

B...Sizing: Discharge piping velocities shall be above 2.5 feet per second and below 10 feet per second.

Acceptable discharge piping velocities may be lowered based on life cycle costs calculated by the City.

C...PVC Piping and Fitting Materials: Piping and fittings shall be manufactured from a PVC compound which meets the requirements of Type 1, Grade 1 PVC in accordance with ASTM D1784. Pipe, fittings, and valves shall be Schedule 80. Fittings shall conform to the requirements of ASTM D2467 for socket type, and ASTM D2464 for threaded type. All socket type connections shall be joined with PVC solvent cement conforming to ASTM D2564. Pipe, fittings, and valves shall be installed in compliance with manufacturer's recommendations.

D...Stainless Steel Piping and Fitting Materials: Stainless steel piping shall be Schedule 40, threaded. Fittings shall be Class 150, threaded.

E...Ball Check Valves: Valves (3 inches and smaller) shall be true union type stainless steel ball check valves.

F...Swing Check Valves: Small diameter swing check valves (2 inch diameter and less) shall be stainless steel Class 200 swing disc type. Valves shall have integral seat and screwed cap with union type fittings.

G...Metal Ball Valves: Valves two inches and smaller shall be three piece construction allowing for maintenance without removing the valve from the pipeline. Valve body and pipe ends shall be brass or stainless steel. Pipe ends shall be NPT screwed and bolted through the valve body. Valve ball and stem shall be Type 316 stainless steel. Seats shall be TFE glass reinforced. Seals shall be Buna-N or PTFE.

H...PVC Ball Valves: PVC ball valves shall be true union type. Valves shall be provided with PTFE ball seats, double Viton or E.T. stem seals, and blow-out proof stem.

I...Operator Extension: Provide a stainless steel operator extension with a lever handle for ball valves. Extensions shall extend to just below the lift station hatch.

### 3.05 Pumps and Lift Station Appurtenances:

A...Pump Type: Install KSB or equal submersible, non-clog sewage pumps and discharge elbows capable of passing a three-inch diameter solid sphere.  
IMPORTANT: Non-clog pump type only!

If properly sized pumps and piping cannot pass a three-inch diameter solid sphere, install KSB or equal submersible grinder pumps and discharge elbows.

B...Non-grinder Pump Warranty: The pump manufacturer shall warrant the total non-grinder submersible pumping package for 60 months from the date of shipment, on a pro-rated basis per Exhibit A, Sheet 6. The total pumping package includes all pump components, including bearings, power cables, etc. The major wear parts such as mechanical seals, impeller, pump housing, wear rings, and ball bearings, are pro-rated on a linear basis over a full five (5) years following the time period stipulated previously in this paragraph.

C...Grinder Pump Warranty: The pump manufacturer shall warrant the total grinder submersible pumping package for twelve (12) months from the date of shipment, or for twelve (12) months from the date of written acceptance by the City of Lakeville, based on whichever date is later.

This total pumping package warranty will be a 100% non-pro-rated warranty. The total pumping package includes all pump components, including bearings, power cables, etc.

D...Pumps and Motors: Pumps shall be centrifugal, non-clog, solids handling, and submersible, explosion-proof wastewater type pumps capable of handling raw unscreened wastewater. The entire pumping unit shall be explosion proof. The pump casing shall have a centerline discharge equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment. The pumps shall automatically connect to the discharge piping when lowered into position. Sealing of the pump to the discharge piping (discharge elbow) shall incorporate a watertight seal utilizing a profile gasket between machined surfaces. The pumps shall be equipped with stainless steel chains long enough and strong enough to raise the pump for removal and inspection. The pumps shall be easily removable by one operator with a portable hoist for inspection or service, requiring no bolts, nuts, or other fasteners to be removed for this purpose, and no need for personnel to enter the wet well. No portion of the pump shall bear directly on the sump floor.

The pump volute, motor, and seal housing shall be high quality grey cast iron, ASTM A-48, Class 35B. All external mating surfaces shall be machined and Buna N Rubber O-ring sealed. All fasteners exposed to the water shall be 304 stainless steel.

The pump impellers shall be single vane or vortex single shrouded (grinder pumps) non-clog type. The impeller shall be dynamically balanced. The impeller shall be A 48 Class 35B cast iron.

A wear ring system shall be installed to provide efficient sealing between the volute and impeller. Replaceable metal wear rings shall have a Brinell hardness of 200 or more.

The pump shafts shall be AISI Type 431 stainless steel. Pump shaft and motor shaft shall be the same unit. Couplings will not be allowed.

The pump bearings shall have a B10 bearing life of a minimum of 50,000 hours.

The pump shall be provided with an oil chamber for the shaft sealing system. The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside.

The pump shall have an electrode probe mounted in the seal chamber. The probe shall be connected via a submersible cable to the motor control center to alarm a seal failure when liquid is sensed, including a light in the control panel to notify the operator of a problem.

The pump shall have two mechanical seals mounted in tandem. Each seal shall be held in contact with its own spring. The upper tandem set of seals shall operate in an oil chamber located below the stator housing. This set shall contain silicon or tungsten-carbide rings (for non-grinder pumps) or carbon-ceramic rings (for grinder pumps). This set of seals shall function as an independent secondary barrier between the pumped liquid and the stator housing. The lower of the tandem set of seals shall function as the primary barrier between the pumped liquid and the stator housing. This set of seals shall contain one stationary and one positively driven rotating, corrosion resistant silicon or tungsten carbide ring (both for non-grinder and grinder pumps).

The motor stator, rotor, and bearings shall be mounted in a sealed submersible housing. The stator windings shall have a Class H or better insulation. Motors shall be equipped with thermal overload protection capable of resetting automatically after cool-down. The motors shall also be equipped with a seal leak detection warning system that will be connected to the motor control center to alarm a seal failure when liquid is sensed, including a light in the control panel to notify the operator of a problem.

The pump and motor shall be designed so that they may operate partially or totally submerged in water. The pump and motor shall be rated for continuous duty.

Motors shall be sized so they are not loaded above full-load rating at any point on the impeller operating curve. Operation in the motor “service factor” range is not acceptable.

Minimum motor efficiency shall be designated by the City.

Motors shall be suitable for City-determined voltages, phases, and hertz of operating power at a City-specified maximum rpm.

Protect all pumping equipment metal surfaces in contact with pumpage, other than stainless steel or brass, with a factory-applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish.

The power cable shall be sized according to NEC and ICEA standards and shall be of sufficient length to reach the control panel without any need for splices. The use of junction boxes will require special consideration and written authorization from the City of Lakeville. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without the loss of watertight integrity to a depth of 65 feet.

E...Guide Rails: Lift stations shall be equipped with dual stainless steel guide rails to guide the pump into proper alignment with the discharge elbow. The guide rails shall extend from the discharge elbow to the upper guide holder on the access door.

Guide rails shall be full length single piece construction between supports. Field welded guide rails shall not be acceptable.

Guide rail supports shall be stainless steel.

The guide rail diameter and guide rail bracing spacing shall be as recommended by the pump manufacturer. Intermediate guide rail braces shall be stainless steel.

F...Cable Holders: Four stainless steel “J” hooks shall be provided for holding pump and control cables. “J” hooks shall be fastened at hatch opening, confirm mounting locations with City during construction.

G...Pump Lifting Chains: Provide one 316 stainless steel lifting chain for each pump. Lifting chain shall be strong enough and long enough to raise pump for removal and inspection.

H...Anchor Bolts: All bolts, washers, and nuts shall be AISI Type 304 stainless steel. Anchor bolts shall be adhesive anchor bolts.

### 3.06 Force Main and Buried Piping:

A...General: All buried piping shall have a minimum of 7.5 feet of cover. Force main piping velocities shall be above 2.5 feet per second and below 10 feet per second. Acceptable discharge velocities may be lowered based upon life cycle costs calculated by the City.

Provide all crosses, tees, bends, caps, and other thrust points in the piping system with suitable means of overcoming thrust. All joints for pipe sizes greater than 10 inches in diameter shall be restrained.

Force main piping shall be PVC as specified below. Force main 3 inches or smaller shall be PVC as specified below. High points or severe changes of grade in the force main shall contain sewage air release, air/vacuum, or combination air valves. Low points shall contain cleanout wyes for cleaning in both directions. Air release and cleanouts shall be housed in precast concrete manhole structures minimum 4 foot in diameter. Precast manhole structure shall be sized adequately for servicing valves and cleanouts and the force main size.

Force main piping material, air release valve, cleanout locations, and structure sizing shall be at the discretion of and subject to approval by the City.

B...PVC Pipe: The PVC pipe and fittings furnished shall be of the type as specified below for each particular use or type of installation.

Force Main Piping (less than 4-inches in diameter): Pipe, fittings, and valves shall be manufactured from a PVC compound which meets the requirements of Type I, Grade I PVC in accordance with ASTM D1784. Compound from which pipe is produced shall have a design stress rating of 2,000 psi at 23 ° C, listed by PPI.

Pipe, fittings, and valves shall be Schedule 80. Pipe, fittings, and valves shall be installed in compliance with manufacturer's recommendations and in accordance with ASTM D2274.

PVC Force Main Piping (4 – 12 inches in diameter): PVC pressure pipe in sizes 4 – 12 inches in diameter shall conform to all applicable requirements of ANSI/AWWA C900 or C909.

The pipe shall meet cast iron pipe equivalent outside diameters and shall be minimum Class 150 (DR18) or Class 200 (DR14) pipe as indicated on the drawings, and shall meet the requirements of Table 2 of AWWA C900 or C909 as applicable.

The manufacturer of each shipment of pipe may be required to supply a statement certifying that each lot or load of pipe has been subjected to the appropriate testing for PVC pipe meeting the requirements of AWWA C900 or C909, as applicable.

Fittings shall be mechanical joint ductile iron fitting meeting the requirements of AWWA C110/ANSI A21.10 or AWWA C153/ANSI 21.53 rated at 350 psi. Gaskets shall conform to the requirements of AWWA C111 and the cement lining shall conform to the requirements of AWWA C104. Fittings shall be wrapped in polyethylene encasement material as specified later in this section.

All joints shall be integral, bell and spigot gasketed joints, or plain end with rubber ring couplings. When the spigot end is to be inserted into a mechanical joint fitting, the beveled end of the pipe shall be removed prior to insertion. Gaskets and lubricant shall be made from materials that are compatible with the plastic material and with each other when used together. Gaskets shall meet the requirements of ASTM F477.

Joint restraint systems shall be suitable for PVC pipe. For push on joints EBBA Iron, Inc. Series 1500 Bell Restraint Harness, or equal shall be used. At mechanical joint fittings EBAA Iron, Inc. Megalug Series 2000PV Retainer Gland shall be used. Joint restraint systems shall be rated for at a minimum the design pressure of the pipe with a 2-to-1 safety factor.

Provide a tracer wire with all non-metallic force main piping. Tracer wire shall be a No. 10 AWG insulated copper wire laid along the top of the pipe and held in place with tape or ties. The tape or ties shall not be spaced more than 10 feet apart. A splice kit shall be provided with split bolt for 1kV and 5kV and suitable for direct bury and submersible applications at each splice location. Provide a 3/8 inch diameter, 60 inch length steel ground rod uniformly coated with metallurgically bonded electrolytic copper. Tracer wire for force mains shall be terminated within the inlet valve manhole and discharge manhole structures. Tracer wire shall be appropriately mounted to the manhole structure, and brought up near the top for easy connection for testing.

Pipe, fittings, and valves shall be installed in compliance with manufacturer's recommendations and in accordance with ASTM D2274.

PVC Force Main Piping (14 inches in diameter and greater): PVC pressure pipe in sizes 14 inches in diameter and greater shall conform to all applicable requirements of ANSI/AWWA C905.

The pipe shall meet cast iron pipe equivalent outside diameters and shall be minimum PR 165 (DR25), PR 200 (DR21), or PR 235 (DR18) pipe as indicated on the drawing, and shall meet the requirements of Table 2 of AWWA C905 as applicable.

The manufacturer of each shipment of pipe may be required to supply a statement certifying that each lot or load of pipe has been subjected to the appropriate testing for PVC pipe meeting the requirements of AWWA C905, as applicable.

Fittings shall be mechanical joint ductile iron fittings meeting the requirements of AWWA C110/ANSI A21.10 or AWWA C153/ANSI 21.53 rated at 350 psi. Gaskets shall conform to the requirements of AWWA C111 and the cement lining shall conform to the requirements of AWWA C111 and the cement lining shall conform to the requirements of AWWA C104. Fittings shall be wrapped in polyethylene encasement material as specified later in this section.

All joints shall be integral, bell and spigot gasketed joints, or plain end with rubber ring couplings. When the spigot end is to be inserted into a mechanical joint fitting, the beveled end of the pipe shall be removed prior to insertion.

Gaskets and lubricants shall be made from materials that are compatible with the plastic material and with each other when used together. Gaskets shall meet the requirements of ASTM F477.

Joint restraint systems shall be suitable for PVC pipe. For push on joints EBBA Iron, Inc. Megalug Series 2800 Bell Restraint Harness, or equal shall be used. At mechanical joint fittings EBAA Iron, Inc. Megalug Series 2200 Retainer Gland shall be used. Joint restraint systems shall be rated for at a minimum the design pressure of the pipe with a 2-to-1 safety factor.

Provide a tracer wire with all non-metallic force main and water main piping. Tracer wire shall be a No. 10 AWG insulated copper wire laid along the top of the pipe and held in place with tape or ties. The tape or ties shall not be spaced more than 10 feet apart. A splice kit shall be provided with split bolt for 1kV and 5kV and suitable for direct bury and submersible applications at each splice location. Provide a 3/8 inch diameter, 60 inch length steel ground rod uniformly coated with metallurgically bonded electrolytic copper. Tracer wire for force mains shall be terminated within the inlet valve manhole and discharge manhole structures and/or air release or cleanout structures. Tracer wire for force mains shall be terminated within the inlet valve manhole and discharge manhole structures and/or air release or cleanout structures. Tracer wire shall be appropriately mounted to the manhole structure, and brought up near the top for easy connection for testing.

Pipe, fittings, and valves shall be installed in compliance with manufacturer's recommendations and in accordance with ASTM D2274.

C...Gate Valves: Gate valves 2 inches to 48 inches in diameter shall be resilient seated wedge type gate valves rated for 250 psi working pressure with all ferrous components ductile iron in accordance with ASTM A536. Gate valves 3 inches to 36 inches in diameter shall be in full compliance with the requirements of AWWA C515. Manufacturer shall furnish an affidavit stating that the valve and all materials conform to the applicable AWWA requirements and all tests specified under the respective standard have been performed and have been met. Valves shall be NSF 61 certified.

Provide stem extensions for all actuators. Extension length will vary with the depth of the bury for each valve. Provide all necessary appurtenances for complete operation of valve.

Valve boxes shall be three piece cast iron with a round base, Mueller-H-10357, or equal. The top of the valve boxes shall be 5 ¼ inches in diameter. Valve box height shall be suitable for the burial depth of the valve and shall have sufficient length to permit at least 6 inches of the adjustment above and below grade when the valve is laid to the specified depth. Adjustment shall be screw type. Covers shall have the word "Sewer" cast on top.

D...Air Release, Air/Vacuum, and Combination Air Valves: Valves shall be as manufactured by A.R.I., or equal. Air/vacuum valves shall be model K-020, or equal. Air release valves shall be model S-020, or equal. Combination air valves shall be model D-020 or D-025 or equal. Valves shall be sized in accordance with manufacturer's recommendations for pipe size, location, and flow conditions.

Air valves shall be specifically designed to operate with liquids carrying solid particles such as sewage and provides separation of the liquid from the sealing mechanism. The air gap separation is sustained under pressure up to 150 psi minimum by a conical body shape and under vibrations by a spring loaded joint. Valves shall include a quick connect coupling for back flushing of components and a drainage outlet for easy removal of excess liquids.

### 3.07 Pump Control:

A...Level control shall be accomplished using a submersible pressure/level transducer and Allen Bradley MicroLogic 1400 PLC. In addition, float back-up controller and float switches shall be provided as a back-up system to the submersible transducer and programmable Logic controller. The float switch back-up circuitry shall be independent of the primary level control circuitry for redundancy. Provide two float switches with the following functions:

- High Level Alarm / Start Pumps
- Stop Pumps

B...Float switches shall be non-mercury type. Provide intrinsically-safe barrier relays on each float switch circuit.

C...The control panel shall follow the bill of material and panel layout per the Appendix sheets.

### 3.08 Motor Starters / Variable Frequency Drives:

A...Starter shall be NEMA-style, NEMA-rated for the application. Starters shall have replaceable contacts and solid-state type adjustable overloads that provide NEMA Class 10 protection for submersible pump motors.

B...Approved starter manufacturers:

- Siemens
- Square D Company
- Cutler Hammer

C...Where phase conversion equipment is needed to convert single-phase utility power to three-phase power for pump motors, provide variable frequency drives (VFDs) that are rated for single-phase input voltage by the drive manufacturer. When VFD's are used, the control panel shall be located in an area that is not exposed to direct sunlight.

D...Approved VFD manufacturers:

- Mitsubishi
- Allen-Bradley "Power Flex"
- A-C Tech "SCF Series"

### 3.09 Permanent Standby Power – (When Required):

A...Engine-generator set shall be a diesel-powered unit with four-cycle industrial diesel engine, double-wall base fuel tank, weatherproof housing, silencer, battery, battery charger, alternator, control panel, silencer, and related equipment.

B...Size the engine-generator set for continuous duty at peak flow conditions. Provide fuel storage for 24 hours, minimum operation at continuous peak station flow. Engine generator shall be sized to allow starting and operating both pumps at a duplex lift station and all three pumps at a triplex lift station.

C...Locate the unit on the project site, and provide adequate sound abatement so that the installation complies with Minnesota Pollution Control Agency (MPCA) noise rules.

D...Provide automatic transfer switch in the pump control panel, so that the unit will automatically start and transfer upon loss of utility power, or upon abnormal supply voltage conditions.  
Acceptable manufacturers:

- Automatic Switch Company (ASCO)
- General Electric/Zenith

E...Provide generator with an “Emergency Stop” push button located inside the lockable housing. Do not provide a shutdown switch on the outside of the housing.

F...Acceptable permanent standby power generator manufacturers:

- Caterpillar
- Cummins / Onan

### 3.10 Portable Standby Power – (If No Permanent Standby Power):

A...Provide Crouse-Hinds connector to match available connectors on the City’s existing portable generator sets. Select connector ampacity to match the station service entrance amperage rating.

B...For stations where an existing connector exists, salvage and install the existing connector on the new pump control panel if the connector is of the required type.

C...Provide main and standby circuit breakers with the circuit breaker manufacturer’s “walking-beam interlock” to allow only one breaker to be closed at a time.

### 3.11 Control Panel:

A...Control panel enclosure shall be a NEMA Type 3R, constructed of Type 304 or Type 316 stainless steel of not less than 12 gauge thickness. The enclosure shall be low-profile, 2-door design, with stainless steel hinges, stainless steel 3-point latch, and stainless steel vault handle with padlock provisions. Control panel enclosure shall be free standing type with stainless steel supporting legs and skirting secured with stainless steel tamperproof hardware.

B...Size the enclosure to accept all electrical equipment without overcrowding, and in accordance with the UL 508 and UL698A requirements. The minimum panel size shall be 60” wide by 48” high with an 18” skirted area below panel.

C...The completed panel shall bear UL labels in accordance with Minnesota Board of Electricity requirements, UL 508 and applicable portions of UL698A and UL913.

D...Provide front-panel components as required by the equipment and as indicated on Sheet No. 5 located in Appendix A. The attached Sheet No. 5 shows the general control panel layout requirements.

E...All control devices including, but not limited to, selector switches, push button switches, and indicating lights, shall be of heavy duty, oil tight type, and push-to-test. The contacts shall meet NEMA rating designation A600.

3.12 Outside Communication:

A...Outside communication shall be through the City's SCADA system.

B...Provide 8" wide by 8" high by 10" deep unobstructed space within the pump control panel for installation of the Johnson/Data radio equipment by the equipment installer.

The City maintains a SCADA system at the Water Treatment Facility that monitors Alarms listed below:

- 1...Wet Well Level Sensor Fail
- 2...Wet Well High level
- 3...Wet Well Low Level
- 4...Backup High Level
- 5...Power Failure / Phase Failure
- 6...Pump No. 1 Motor Hot
- 7...Pump No. 1 Seal Failure
- 8...Pump No. 2 Motor Hot
- 9...Pump No. 2 Seal Failure
- 10...Pump No. 3 Motor Hot (if applicable)
- 11...Pump No. 3 Seal Failure (if applicable)
- 12...Cycle Too Long
- 13...Pump No. 1 Running
- 14...Pump No. 2 Running
- 15...Pump No. 3 Running (if applicable)
- 16...Control Panel Low Temperature Alarm
- 17...Control Panel High Temperature Alarm
- 18...Engine-Generator Running (if applicable)
- 19...Engine-Generator Alarm (if applicable).

3.13 Spare Parts:

A...A spare parts package shall be provided for each lift station. The spare parts package shall contain the following items:

- One set each, upper and lower seals.
- Spare fuses and lamps, consisting of a minimum of 10% spare each type used, or quantity (6) of each type used, which is greater.

3.14 Control Panel Supplier:

A...Several existing lift stations have been reconstructed using control panels from Quality Control & Integration, Inc. or approved equal. For consistency, ease of operations, and parts

commonality, all new lift station control panels shall match the layout, appearance and function of the existing Quality Control & Integration, Inc. panels.

B...Quality Control & Integration, Inc. contact person:

Quality Control & Integration, Inc.  
Attn: Mr. Bill Toennes  
800 6th St NW  
New Prague, MN 56071  
Phone (952) 758-9445

- 4.00 ELECTRICAL SERVICE OPTIONS: The pump station electrical requirements, available utility voltages, and standby power requirements must be identified prior to completing the lift station electrical design.

The City will contact the servicing electrical utility to determine which service voltages are available. Three-phase power is preferred to avoid the use of variable frequency drives as phase converters.

If there are utility charges to provide three-phase service, the City will obtain an estimate of the charges from the servicing utility and prepare a cost comparison between a three-phase installation and a single-phase installation.

Three-phase service voltage:

- 277/480VAC, three phase, four-wire, grounded-wye

Single phase voltage:

- 120/240VAC, single phase, three-wire, grounded center tap

For stations that require a connection for portable standby power, confirm the City's ability to provide standby power in the required capacity at the desired voltage, using the City's existing portable engine-generator sets.

Obtain information from the serving electric utility regarding available fault current at each service voltage. The entire lift station electrical system and control panel shall be designed to withstand the available fault current.

The final voltage selection shall be determined by City staff, based on a cost-benefit comparison of available operating voltages.

- 5.00 LIFT STATION WARRANTY: The Contractor shall warrant Contractor supplied lift station components and Contractor's work for twelve (12) months from final completion and written acceptance by the City of Lakeville.

## 6.00 CONSTRUCTION AND CONSTRUCTION DOCUMENTATION:

### 6.01 Submittals:

A...Shop Drawings: Shop drawings shall be submitted for approval by the Engineer. Submit the following as a minimum for review:

- Detailed specifications, dimensions, and weights of pumps, hatches, valves, piping, manholes, and other appurtenances.
- Size and model number of pump and motor
- Factory-certified pump curves for the specific pump to be delivered
- Detailed electrical data
- Control drawings and data
- Typical installation guide
- Access hatch drawings
- Technical manuals
- Parts lists
- Operation and maintenance manuals and data.
- Printed warranty for pumps and appurtenant equipment.
- Motor performance chart including curves for torque, current, power factor, input/output kilowatts, and efficiency. Include data on starting and no load characteristics.
- Certified factory performance test curves for each pump provided shall be furnished and approved prior to shipment of the unit to the site. Test curves shall cover the full range of operation from shut off to maximum capacity including head capacity curve, horsepower curve, wire to water efficiency, shut off head, and recommended operating range. Factory testing of all pump equipment shall be made in accordance with the test code of the Hydraulic Institute Standards. Pumping equipment that fails to meet the specified requirements shall be replaced with pumping equipment that does not meet the specified requirements.

### 6.02 As-Built Documentation:

A...As-builts:

- Submit a complete set of drawings, documentation, and manufacturer's operation and maintenance instructions for the project. Construction record drawings shall be updated to show "as-built" conditions.
- Submit complete electrical schematics showing control panel "as-built" information including ladder logic.
- Submit complete instrumentation and control "as-built" information including ladder logic.
- All drawings shall be submitted in reproducible hard copy format and in electronic format (Adobe .pdf)

7.00 START-UP AND TESTING: A factory trained service representative shall be present at the time when the station is to be put into service and turned over to the Owner. The service representative shall instruct the Owner in the proper operation and maintenance of the equipment. The service representative shall provide a minimum of eight (8) hours for field testing and training.

At the time of startup, the Contractor shall conduct the necessary pumping test to determine the proper operation of the system. The Contractor shall furnish all meters, equipment, and water required for these tests and the tests shall be so conducted as to check the operation of the pumping system. Necessary measurements of the electrical consumption shall be made to determine whether or not the pump is operating within the conditions recommended by the pump manufacturer. Perform a witnessed operation test of all equipment. Confirm proper operation of all station features and functions. Record phase-to-phase and phase-to-ground voltages during no-load conditions and during all pump operating conditions. In the event that the tests show the equipment does not comply with the specifications of the pump manufacturer, this shall be sufficient cause to reject the pump. All tests therein required shall be supervised by the Engineer.

No “startups” shall be scheduled for Fridays.