

CITY of NORTH LIBERTY

SUBMERSIBLE SEWAGE PUMP STATION STANDARDS

PART 1 – GENERAL

Date: June 2014

1.01 SUMMARY:

- A. Engineer shall design and specify sewage pump station in accordance with these standards and shall be reviewed and approved by the City of North Liberty.
- B. Contractor shall furnish all labor, materials, equipment and incidentals required to provide a completed, fully operational submersible pump lift station per engineer drawings. The total system shall be complete with all required equipment factory installed or distributor assembled. Items included in the section are wet well, valve vault, pumps, motors, base elbows, guide rails, lifting chains, access doors, covers, trash basket, ladder, valves, fittings, piping and accessories.
- C. This section includes materials, installation, and testing of submersible sewage pumps designed to operate in a wet well under submerged condition. It is the intention of this specification to disallow non-standard, "one of a kind", experimental, or unproven combinations of equipment.

1.02 REGULATORY REQUIREMENTS AND STANDARDS:

- A. Definitions and terms shall be as defined in the ASME Performance Test Code PTC 8.2 for centrifugal pumps.

1.03 PROJECT CONDITIONS:

- A. Project conditions indicated on engineering drawings are based on field observation and existing record documents.
- B. Contractor shall verify all measurements and circuiting arrangements.

1.04 SUBMITTALS:

- A. Contractor shall submit all equipment manufacturers and model numbers for approval by the City and the Owner's engineer.
- B. Shop Drawings
 - 1. Contractor shall submit shop drawings for all mechanical equipment, hatches, hoists, valves and related accessory items in accordance with Section 01300 - Submittal. Submit dimensional drawings with anchor bolt layout and anchor bolt dimensions. Show impeller diameter, eye area, sphere size, and number of vanes.
 - 2. Contractor shall submit typical installation guides and drawings, and supports and dimensions needed for correlation with other materials and equipment.
 - 3. Submit manufacturer's catalog data. Show pump type and model number. Show materials of construction by ASTM reference and grade. Show outline dimensions and weights of pumps, bases and motors. Show pump curves from manufacturer's catalog data on which the specified operating points are marked. Show efficiency and brake horsepower for the selected pump curve. Show NPSH required. Show maximum operating speed. Provide certified performance curves. The performance curve submitted for approval shall state in

addition to head and capacity performance, the pump efficiency, solid handling capacity, and reflect motor service factor.

C. Operation and Maintenance Manuals

1. Submit preliminary copies of operation and maintenance manuals for Engineer's and Owner's review prior to final acceptance and delivery of equipment.
2. Include the following information assembled in a bound manual and electronic copy.
 - a. Data for each piece of equipment including function, normal operating characteristics, performance curves and limiting conditions.
 - b. Assembly, installation, alignment, adjustment, and checking instructions.
 - c. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and trouble shooting guide for emergency conditions.
 - d. Lubrication and maintenance schedules.
 - e. Complete parts list and predicted life of parts that are subject to wear.

D. Factory Pump Test

1. Furnish written and electronic reports from pump manufacturer prior to shipment from the factory showing that the following tests have been performed in accordance with the specifications on all pumps:
 - a. A check of the voltage and frequency as shown on the nameplate.
 - b. A motor and cable insulation test for moisture content or insulation defects.
 - c. Completely submerge the pump and run to determine that the unit meets three pre-determined performance points.
 - d. Run a vibration test at maximum RPM with maximum velocity values not to exceed 1.0 mils peak-to-peak.

1.05 FIELD TESTS and SERVICES:

- A. Provide field tests and services in accordance with Part 3 of these specifications.

1.06 SPARE PARTS:

- A. Provide one spare set of pump seals and one set of all fuses.

1.07 WARRANTY:

- A. The pump equipment manufacturer/supplier shall warrant pumps, motors, piping, valves and other equipment and materials supplied under this section to the Owner against defects in workmanship and material for a period of twenty four (24) months from the date of start-up under normal use, operation and service.
- B. The warranty shall be in printed form, shall specifically assure the expedient repair or replacement of defective equipment under warranty, shall indemnify the Owner from any and all costs or losses resulting from or contributed to such defective equipment, and shall be subject to review and acceptance by the Owner's attorney.

1.08 OPERATING CONDITIONS:

- To be set by engineering specifications.

PART 2 - PRODUCTS

2.01 SUBMERSIBLE WASTEWATER PUMPS:

- A. Submersible non-clog Pump. Each pump shall be a heavy duty pump rated for use in larger pump stations for daily operation.
- B. Requirements. Furnish and install (required number of) submersible non-clog wastewater pumps. Each pump shall be equipped with a submersible electric motor with 25 feet of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be supplied with a mating cast iron (engineer specified size) discharge connection and be capable meeting initial operating conditions.
- C. Acceptable manufacturers. Subject to review and approval by the Engineer and City, provide pumps manufactured by Flygt or pre-approved equal.
- D. Pump Design. The submersible pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. No portion of the pump shall bear directly on the sump floor.
- E. Pump Construction.
 - 1. The pump body, seal plates, and motor housing shall be constructed of high quality, ASTM A-48 class 30 or better, cast iron. A coat of air dry enamel shall be applied before and after assembly. All exposed hardware shall be of corrosion resistant stainless steel. The pump discharge shall be (engineer specified size) elbow and 125 lb. flat faced ANSI flange.
 - 2. The pump impeller shall be of the multi-vane design and shall be capable of handling a 3" spherical solid. The impeller shall be hydraulically and statically balanced. The impeller shall be capable of being trimmed to meet specific performance characteristics. Impeller shall not require coating.
- F. Shaft Seals
 - 1. The tandem seal system shall be a double mechanical type running in an oil-filled chamber with tungsten-carbide or silicon-carbide faces and stainless steel metal parts. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced. A moisture sensor detection system shall be integrated as standard within the oil-filled seal chamber.
 - 2. The lower seal shall be replaceable without disassembly of the seal chamber and without the use of special tools.
- G. Submersible Motors
 - 1. The three phase motors shall be built to NEMA MG-1 Design B specifications. The motor shall be housed in an air-filled watertight chamber. Protection against excessive temperature shall be provided by a heat sensor thermostat attached to the stator windings and connected in series with the contactor coil in the control box. The motor shall have an upper radial bearing and a lower thrust bearing.
 - 2. Motor service factor shall be 1.15 and capable of up to 20 starts per hour.
 - 3. Designs reducing the number of bearings or support areas or substituting sleeve bearings for ball bearings will not be considered equal. The stator design must be such that it allows for easy removal from its housing for replacement. The motor shaft shall be of stainless steel.

4. The pump and motor shall be specifically designed so that they may be operated partially dry or completely submerged in the liquid being pumped. The pump shall require cooling water jackets.
5. Heat shrink tubes shall be used to connect power cord leads with motor leads. A master heat shrink tube shall be provided and filled with epoxy to seal the outer cable jacket and the individual strands to prevent water from entering the motor housing. A secondary rubber pressure grommet shall be provided as an additional sealing point and strain relief at the point of cable entry. Cable entry designs utilizing terminal boards to connect power cord leads with motor leads shall not be acceptable.
6. Motors shall have premium duty ratings to be driven by variable speed drives.

2.02 GUIDE RAIL SYSTEM:

- A. The lift station shall include a guide rail system to allow each pump to be automatically connected to the discharge piping when lowered into place on the discharge connection. The pump shall be easily removable for inspection or service without the need for personnel to enter the wet well. Pump removal shall require no bolts, nuts, or other fasteners to be disconnected. The guide rail system shall be designed to prevent spark ignition of explosive gasses during removal and installation of the pumps.
- B. The Contractor shall provide and install two discharge base elbows designed for use with the specified pump. The base elbow shall be designed to adequately support the guide rails, discharge piping, and pumping unit under both static and dynamic loading conditions with support legs that are suitable for anchoring to the wet well floor. The face of each base elbow inlet flange shall be perpendicular to the floor of the wet well. Sealing of the pump unit to the base discharge elbow shall be accomplished by a single, linear, downward motion of the pump. The pump unit shall be guided to and wedged tightly against the inlet flange of the base elbow. The connection shall form a metal to metal seal between the pump discharge and base elbow without use of bolts, gaskets or O-rings.
- C. The Contractor shall provide and install two (2) 304SS schedule 40 guide rails for each pump. The guide rails shall be sized to mount directly to the base elbow at the floor of the wet well and to guide rail bracket at the top of the wet well below the hatch opening. Intermediate guide brackets shall be supplied for rail lengths over 15 feet.
- D. The upper guide bracket shall align and support the two guide rails at the top of the sump. It shall bolt directly to the hatch frame and incorporate an expandable rubber grommet for secure rail installation.
- E. Each pumping unit shall be provided with stainless steel chain 3-feet in length with a ¼ inch diameter stainless steel cable and stainless steel grip slide similar to the Flygt “Grip-Eye” system or approved equal. The lifting system shall be of sufficient length to extend from the pump to the top of the wet-well. The access frame shall provide a hook to attach the lift cable when not in use. The stainless steel chain and shall be sized according to the pump weight.

2.03 ACCESS FRAMES and DOORS:

- A. Hinged aluminum access doors shall be supplied for access to the pumps and wet well and to the valve vault as indicated. All hardware shall be stainless steel with a flush upper surface without protrusions. Access frame and cover shall be manufactured by Syracuse Castings, U.S.F. Fabrication Inc. or Halliday Products.

- B. Access frame and cover shall be a double or single leafed system as indicated with access dimensions shown on the plans.
- C. Frame shall have a 1/4 inch thick one-piece, mill finish extruded aluminum frame, incorporating a continuous concrete anchor. A bituminous coating shall be applied to the frame exterior where it will come in contact with concrete.
- D. Door panel shall be 1/4 inch aluminum diamond plate, reinforced to withstand a live load of 300 psf liveload. Doors shall open to 90 degrees and automatically lock with a T-316 stainless steel hold open arm with aluminum release handle. The access door shall be furnished with a flush drop handle and an automatic hold open device with a vinyl grip on the release handle.
- E. For ease of operation, the hold open arm shall incorporate an enclosed stainless steel compression spring assist.
- F. Doors shall close flush with the frame and rest on a built-in neoprene cushion/gasket. Hinges and all fastening hardware shall be T-316 stainless steel.
- G. Doors shall lock with a locking bar or post for owner supplied padlock and a T-316 stainless steel slam lock with removable key and have a non-corrosive handle.
- H. Door units shall carry a ten (10) year guarantee against defects in material and/or workmanship.
- I. All hatches will be positioned to facilitate maintenance, removal of pumps, and removal of the trash basket.

2.04 TRASH BASKET:

- A. Contractor shall supply and install a heavy duty trash basket system as manufactured by U.S.F. Fabricators Inc., Syracuse, Flygt, or Halliday Products.
- B. The stainless steel trash basket shall be of the standard bar-screen style. Basket shall have a 2-inch clear opening between 1/4-inch bars and solid sides. The basket shall have a hinged drop bottom option to facilitate cleaning.
- C. The heavy duty ladder/guiderail system shall be of 3-inch structural stainless steel channel and incorporate minimum 1-3/8 inch diameter or 15/16-inch square slip resistant rungs on 12-inch centers.
- D. For ease of operation, the basket shall have four (4) 2-1/2 inch solid stainless steel wheels with 1/2 inch stainless steel axles.
- E. Provide a lifting bail positioned over the center of the basket for direct lifting and lowering of the basket without binding. The Contractor shall provide and install 20-feet of the 3/16" stainless steel lifting cable with a minimum load limit of 750 lbs.
- F. All fasters and wall anchors shall be stainless steel.
- G. A stainless steel basket stop shall be supplied loose for field mounting to insure proper basket position.

2.05 PORTABLE CRANE/WINCH ASSEMBLY:

- A. Furnish one (1) Thern Model No. 5124 portable crane rated at 2000 lb. with 3 ton electric winch, or approved equivalent 2000 lb. capacity hoist. The crane shall be designed for full 360° rotation. For pumps larger than 25 hp, Engineer shall design/specify a larger approved crane.
- B. Provide two (2) pedestal bases permanently mounted to the wet well cover for lifting and lowering of the pumps and trash basket. The bases shall be located so that the crane assembly is capable of being centered over the trash basket or pumps.
- C. Provide one set each of 304 stainless steel cable with stainless steel oval hook and stainless steel swaged ball fitting. Cables will be proper length and diameter per pump weight. One set shall attach to the trash basket and the others shall attach to the pumps. The swaged ball fitting shall allow each cable end to be connected to the winch without disconnecting the hook from the trash basket or the pumps. Hangers shall be provided to hang the coiled free cable under the hatch opening while not connected to the winch.

2.06 DISCHARGE PIPING AND FITTINGS:

- A. The Contractor shall provide and install all discharge piping and fittings. Discharge piping and fittings shall mainly consist of (engineer specified) diameter Class 52 ductile iron pipe with bolted mechanical joint or flanged fittings as indicated on the plans. All ductile iron pipe and fittings shall contain an interior 20 mil DFT coating of coal tar epoxy.

2.07 VALVES and PLUMBING FIXTURES:

- A. Plug and check valves shall be rated to serve flows and pressures generated by the submersible pump lift station. Contractor shall submit shop drawings identifying all valve models, sizes, and installation details for review and acceptance by the Engineer.
- B. Plug valves shall be manufactured by DeZurik or equivalent. All plug valve stems should be extended to valve boxes cast in the valve vault lid. Operating nuts should be accessed immediately below the valve box cover. Provide a 4-foot long valve operating T-wrench to operate the plug valves.
- C. A swing check valve with outside lever and weight shall be installed in the horizontal position in the valve manhole for each pump. The design of the valve shall be such that it keeps solids, stringy material, grit, rags, etc., moving without the need for back flushing. The valve shall be Mueller model A-2602-6-01 flanged end, weight and lever operated with rubber disc facing, gray cast iron, ASTM A48 Class 30, or better. All seats, seat rings, pins, bushings and other parts subject to wear shall be bronze.

- A. Floor drain shall be Jay R. Smith Mfg Co or equal, Model DX 2010, Duco Cast iron body construction with nickel bronze round top strainer.

2.08 WET WELL and VALVE VAULT STRUCTURES:

- A. The Contractor shall construct the lift station wet well and valve vault structures as shown on the plans. Materials furnished shall in general accordance with Section 02700. The details shown on the construction drawings shall govern. The reinforced concrete flat top(s) may be cast in-place, using 4,000 psi minimum concrete strength, or may be precast as detailed on the drawing.

- B. All concrete and metal surfaces inside the wet well above the normal water surface level, except the pumps and pump slide rails and other stainless steel parts, shall be painted with a heavy coat of two component coal-tar epoxy-polyamide black paint (Tnemec Hi-Build Tneme-Tar or approved equivalent, 14-20 mils dry film thickness).
- C. Apply waterproofing to all hand made joints.
- D. Wet well joint wrap shall be butyl rubber-based tape. The tape material shall be EZ-Wrap Plastic as manufactured by the Press-Seal Gasket Corporation. The butyl component of the tape shall consist of 50% minimum butyl rubber, shall contain 2% or less volatile matter, and shall be 0.030" thick. The backing component shall be high-density polyethylene film. A release paper may be utilized. The tape shall be 9-inches wide.

2.09 MISCELLANEOUS METAL:

- A. All bolts, nuts, washers and all miscellaneous metal inside or near the wet well and valve structures shall be stainless steel meeting the requirements of ASTM A276, type 316 because of the highly corrosive atmosphere typically found in wastewater collection and treatment facilities.

2.10 GENERATOR and AUTOMATIC TRANSFER SWITCH:

- A. Complete turnkey installation of a permanent generator and transfer switch at lift station in the City of North Liberty. This generator will provide emergency power to (engineer specified) HP 480 VAC soft start or VFD submersible pump motors and supporting equipment. A 6 hour initial full load bank test will be part of the start-up procedure. Start-up training will be provided to city staff on generator and transfer switch.
- B. A two year 100% coverage parts and labor warranty on the entire project will be in writing and will start from the date of final acceptance from the city.
- C. GENERATOR:
 - Highest Tier emission level rating available
 - Generator size per engineer's specifications
 - Oversize alternator for motor starting KVA
 - Sound attenuated weather proof enclosure containing 1 ½" acoustic foam with aluminum exhaust louver in front of radiator.
 - Jacket water heater: 1500w, 120v
 - Radiator cooling system with 50% ethylene glycol installed
 - Low coolant level shutdown and solenoid shutoff
 - 12 V starting battery, rack and cables
 - 6A automatic battery charger
 - Electronic governor
 - State-of-the-art digital control system with a control panel capable of communication with a personal computer, via a network or modem configuration including the following: over crank, low coolant temperature warning, high coolant warning, low oil pressure shutdown, low oil pressure warning, over speed, low fuel (level or pressure), low coolant level, ESP supplying load, low and high voltage, air damper indication, master switch not in auto, battery charger fault, lamp test, contacts for local and remote common alarms, audible alarm silence switch, and runtime meter.
 - UL double walled sub base 24 hour fuel tank with alarms. Fully enhanced digital control NFPA level compatible.
 - Wire fuel levels to control panel for a fuel level gauge

- Run relay and failure relay
- Local emergency stop button
- Alternator strip heater 200W 120V
- Air cleaner restriction indicator
- Control panel to include: pre-alarm senders, panel lights
- Phase selector switch, voltage adjustable rheostat, ac voltmeter and ammeter
- Frequency meter, DC ammeter, water temperature gauge, oil pressure gauge
- Rain cap on the exhaust pipe
- Full tank of blended fuel (current market price at time of bid), City will pay difference if higher after generator is installed
- Concrete pad 8" thick with ½" rebar. Concrete pad extended two feet wider at all points from the generator. 8 six inch steel bollards located per owner's direction around the generator and transfer switch. See section 3.06 Bollard specification sheet for construction.
- Install extra 120 volt GFI outlet with weather proof box inside generator enclosure
- UL main circuit breaker with shunt trip
- Extra set of all fuses and keys
- Complete O/M manual and an electronic copy of all computer programs.

D. TRANSFER SWITCH:

1. Installation of an ASCO 300 series or equivalent, 100 amps, three pole, 480 volt NEMA 4X stainless steel automatic transfer switch with strip heater and digital programmable exerciser or comparable equivalent.
2. A three KVA (or proper size low voltage, pump control panel transformer may be sized for all low voltage) control transformer for block heater, trickle charger and alternator strip heater.
3. 30 Amp, 600V, 3R fused waterproof disconnect, or proper size for this job.
4. 3-pole solid neutral, open transition
5. All required stainless steel Square D pole breaker enclosures
6. Time delay engine start, time delay normal to emergency
7. Time delay emergency to normal, time delay engine cool down
8. Installation of all various sizes of Rigid/PVC conduit, copper wiring and all miscellaneous work for a complete turnkey installation.
9. Complete O/M manual
10. Extra set of all fuses and keys
11. Provide Final As-Built electrical drawings in both hard copy and electronic format
12. Lockable covers for all exposed control panels.

2.11 OXYGEN GENERATOR:

- A. Model # to be approved by City of North Liberty specifications.
- B. Complete turnkey installation including all electrical, water connections, RPZ, wetwell and sewer connections per engineering specifications.
- C. Provide Final As-Built electrical drawings in both hard copy and electronic format.
- D. A two year 100% coverage parts and labor warranty will be in writing and will start from date of final acceptance from the City of North Liberty.

2.12 BUILDING STRUCTURE:

- A. An insulated building (properly sized per engineering drawings) meeting all City building codes and design standards approved by the City of North Liberty Building Department will be constructed on site to house all control panels including pump controls, oxygen generator skid and automatic transfer switch for generator. Main power disconnect, station alarm light and generator receptacle will be mounted on the exterior.
- B. The building will be temperature controlled with heat, ventilation and air conditioning.
- C. Door opening will be 36” with knob lockset and deadbolt keyed to wastewater department keys.
- D. Electrical will have GFI 120vac outlets on the interior and exterior, interior lighting and exterior service light.

2.13 PIGGING PIPE and VALVING:

- A. Installation of forcemain pigging piping design, launch piping, size and valve layout design shall be designed by the Engineer as approved by the City of North Liberty.

PART 3 – EXECUTION

3.01 INSPECTION:

- A. The Contractor shall inspect all material as it is received to determine if parts are missing or damaged. It shall be the Contractor’s responsibility to repair or replace damaged items in accordance with the manufacturer's instructions.

3.02 WET WELL and VALVE VAULT INSTALLATION:

- A. The wet well and valve vault structures shall be constructed in general accordance with Section 02700. The details shown on the construction drawings shall govern.
- B. The Contractor shall install all components of the structure and water proofing measures in conformance with the recommendations of the respective manufacturer/supplier.
- C. The wet well barrel joints shall be wrapped with butyl-rubber based tape as specified. The tape shall be overlapped at least twice it’s width. The tape shall not be stretched during application. The concrete surface shall be primed as recommended by the tape seal manufacturer.

3.03 PUMP INSTALLATION:

- A. The Contractor shall install pumps and equipment in conformance with the recommendations of the respective manufacturer/supplier and the approved shop drawings.
- B. All electrical work shall be performed by a licensed electrician in the accordance with the latest requirements of the National Electric Code.

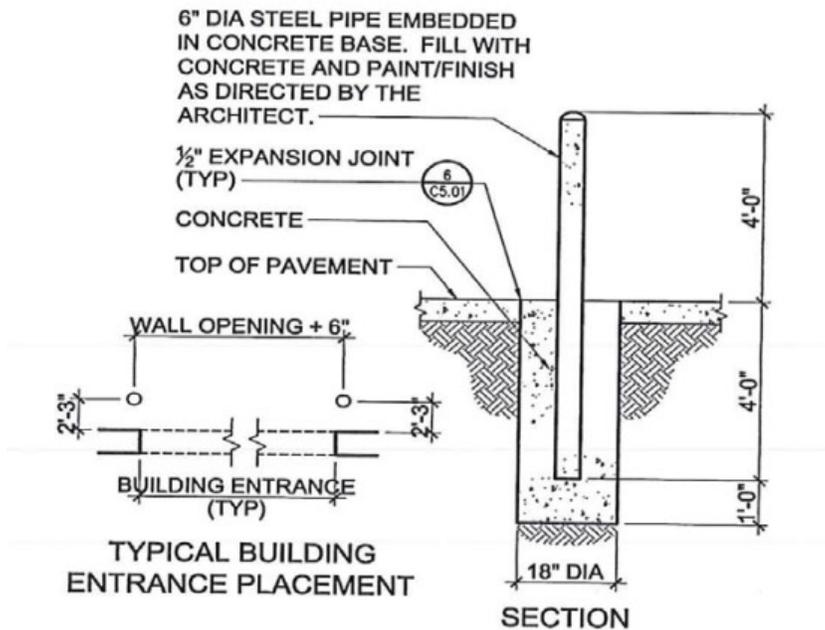
3.04 VALVE INSTALLATION:

- A. All valves shall be installed following manufacturer’s instructions and recommendations.

3.05 TESTING:

- A. All discharge and force main piping shall be tested under a pressure of 65 psi which is 50% greater than the nominal working pressure.
- B. Provide equipment manufacturer's services at the job site for the minimum man-days listed below, travel time excluded:
 - 1. One man-day to check the installation, supervise start-up, and supervise testing and adjustments of pumps.
 - 2. One man-day to instruct the Owner's personnel in the operation and maintenance of the pumps.
- C. At start up, the manufacturer's representative(s) shall test the pumps to include the following:
 - 1. The pump shall be visually inspected to confirm that it is built in accordance with the specification as to HP, voltage, phase and hertz.
 - 2. The motor seal and housing chambers shall be meggered for infinity to test for moisture content or insulation defects.
 - 3. Pump shall be allowed to run dry to check for proper rotation.
 - 4. Discharge piping shall be attached; the pump submerged in water and amp readings shall be taken in each leg to check for an imbalanced stator winding. Replace stator if necessary.
 - 5. The pump shall be removed from the water, meggered again, dried and the motor housing filled with dielectric oil.

3.06 BOLLARD DETAIL:



NOTE: BOLLARD FOOTINGS SHALL NOT BE INSTALLED BEFORE BUILDING & STOOP FOUNDATIONS ARE IN PLACE

2 BOLLARD
NOT TO SCALE