

Special Specification 7219

Sanitary Sewer Lift Station



1. DESCRIPTION

Installation. Furnish labor, materials, and equipment necessary to provide a triplex, end-suction, self-priming sanitary sewer lift station and all-weather building. Lift Station must meet the TCEQ requirements specified in TCEQ Section 217

Removal. Remove existing lift station as identified on the Plans or directed by the Engineer.

2. MATERIALS

2.1 Pumps and Equipment. Furnish materials meeting the following specifications or standards.

Self-Priming Pumps. Provide end-suction, self-priming pump meeting pump manufacturer's recommendations for proper operation of the pumping system. All lift station components and controls must work properly and harmoniously with each other to provide a properly functioning lift station and not void the pump manufacturer's warranty.

Triplex Wastewater Pumps: Provide horizontal, end-suction, self-priming, vertical discharge, centrifugal type pumps suitable for continuous operation. Provide three (3) pump units, and all related equipment, Model 6STX as manufactured by Cornell Pump, similar of Gorman Rupp, or equal. Provide pumps meeting the following requirements.

2.1.1. Materials of Construction.

Casing	Ductile Iron ASTM A536 or Cast Iron ASTM A-48 Class 30
Impeller	Ductile Iron ASTM A536, non-clog 2 vane
Shaft	17-4 Stainless Steel
Bearings	Permanently Lubricated; Radial Single Ball and Double Ball Thrust
Wear Plate	Replaceable, Carbon Steel
Seals	Tandem Silicon Carbide or Tandem Tungsten - Carbide.

2.1.2. Performance Requirements. Refer to the Standards of the Hydraulic Institute for pumping heads and other terms and assume a water temperature of 68°F for design and rating purposes. Provide pumping units designed for the following operating conditions and as shown on pump curves on Drawings:

Duty Points	Single Operation
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Shut-off Head, feet	99
Design Operating Capacity, gpm	750
Design Total Head, feet	72
Design Nominal Speed, rpm	1800
Design Minimum Pump Efficiency	53%
Runout Minimum Capacity, gpm	1000
Runout Minimum Total Head, feet	65
Pump Operation	Constant Speed
Motor HP (ea)	40
Motor Power	480v-3 ph.
Motor Enclosure	TEFC

- 2.1.3. Casing. Provide casing with all water passages smooth and free of blowholes and imperfections for good flow characteristics.
- 2.1.4. Impeller. Provide a dynamically balanced, multi-vane, non-clog design impeller. Provide an impeller capable of handling 3" solids, fibrous material, heavy sludge and other materials found in the wastewater. Provide an impeller keyed and properly retained to the shaft.
- 2.1.5. Pump hafting. Provide a pump motor shaft that is separate from the motor shaft. Pump and motor shafts will be joined with a flexible shaft coupling. Shafting and coupling will be protected by OSHA guard.
- 2.1.6. Bearings. Design bearings nearest the impeller for combination thrust and radial load. Allow the upper bearing to freely move linearly with thermal expansion of the shaft to carry only radial loads. Provide bearings sealed, shielded and permanently lubricated.
- 2.1.7. Seals. Provide double mechanical pump shaft seals installed in tandem. Provide a double seal with the mating surfaces capped to a flatness tolerance of one light band. Provide a constructed seal housing, with assembled parts, that is readily removable from the shaft as a unit. Lubricate seals using an oil lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate.
- 2.1.8. Temperature Protection. Furnish temperature switches in motor windings for use in conjunction with and supplemental to external motor overload protection. Controls are to shut off pump should any winding detect high temperatures as well as trigger an alarm. Pump must reset automatically after motor returns to normal operating temperature. However, the control panel will latch this condition, requiring a manual reset. This is to prevent repetitive overheating of the motor

- 2.1.9. Electric Motors. Provide squirrel-cage induction, shell type design, housed in an air-filled, watertight chamber, NEMA MG-1 Design B type, rated for power conditions listed above. The motor must have built-in thermal overload protection.
- 2.1.10. Unit Base: The unit base must be comprised of structural steel with a perimeter flange and reinforcements. Perimeter flange and reinforcements will be designed to prevent flexing or warping under operating conditions. Perimeter flange must be drilled for hardware used to secure unit base to concrete pad as shown on the Drawings. Unit base must contain provisions for lifting the complete pump unit during shipping and installation.
- 2.1.11. Pump Air Release Valve. Each pump will be equipped with one automatic air release valve, designed to permit the escape of air to the atmosphere during initial priming or unattended re-priming cycles. Upon completion of the priming or re-priming cycle, the valve must close to prevent recirculation. Valves must provide visible indication of valve closure, and must operate solely on discharge pressure. Valves which require connection to the suction line will not be acceptable. All valve parts exposed to sewage will be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms will be fabric-reinforced neoprene. The valve must have a clean out port, 3 in. or larger in diameter, must be provided for ease of inspection, clean out, and service. Valves must be field adjustable for varying discharge heads.
- 2.1.12. Balance. Provide equipment having rotating parts accurately machined and in rotational balance. Excessive vibration will be sufficient cause for rejection of the equipment. Provide equipment with a unit mass and mass distribution to avoid resonance at normal operating speeds.
- 2.1.13. Shop Painting. Shop clean with sandblasting and paint with a suitable coating system all iron and steel parts which will be in contact with water after installation.
- 2.1.14. Shop Tests. Test each pump at the factory for capacity, power requirement, and efficiency at minimum head for continuous operation, rated head, shutoff head, and at as many other points as necessary for accurate performance curve plotting. Conduct all tests in conformity with the requirements and recommendations of the Hydraulic Institute.
- 2.2 Lift Station Controls and Equipment.
- 2.2.1. Motor Starters. Rate starters in accordance with latest published NEMA standards for size and horsepower rating. Provide starters in a NEMA 1 enclosure unless otherwise indicated. Equip across-the-line starters with double break silver alloy contacts. Supply molded construction coils. All coils provided must be capable of being replaced from the front without removing the starter from the panel. Use solid-state overload relays for three-phase magnetic starters.
- 2.2.2. Pump Control Panel. Use 120 VAC input voltage. Monitor and control the wet well level using a submersible level transducer. Backup pump control will be through 4 float switches with intrinsically safe relays.

Provide form "C" output contacts for high-level alarm. Provide normally open contacts for pump control. Use amber LEDs to indicate alarm outputs "ON". Use green LEDs to indicate pump control output "OFF". Use red LEDs to indicate pump "ON". Provide output contacts rated 10 amps at 240 VAC or 30 VDC. Provide selector switches to select pump sequence operation.

Use a 0-3 min. adjustable time delay relay to delay the starting of each pump. Factory set the first pump start time delay to 5 seconds.

Provide Siemens LC150 Pump Controller, or equal. Controller will operate pumps based on input from the level transducer. Controller to include all necessary accessories such as power supplies, modules, etc. Controller interface to be mounted to enclosure door. Backup float control must not go through the controller. Float control must be hardwired into the pump control circuit located in the MCC.

Provide oil-tight, 30.5 mm, selector switches mounted in the front of the panel. Mount push-to-test, 30.5 mm, indicating lights in the front of the panel, to indicate statuses and alarms. Switches and pushbuttons to be Allen Bradley, or equal.

Provide UPS to provide control panel with 30 min. of backup power. UPS to be APC, or equal

All field devices interfacing with the control cabinet will be terminated on terminal blocks. Terminal blocks are to be screw type Phoenix Contact, or equal. Provide 20% spare terminals.

Provide pumps that cycle between the common stop level and the start lead level under normal conditions (submersible transducer). The lag pump must start at a predefined level and run until the common stop level is reached. Any pump that has failed will not be called to start and the controller must start the next available pump.

If a certain amount of time has elapsed after a pump has started and the pump's discharge check valve remains closed, the pump must be stopped and labeled as 'failed'. The controller will then start the next pump in the sequence.

Backup pump controls are as follows and will be activated upon a float status. Pumps will cycle between the common stop float and the start lead float under normal conditions. The lag pump must start at the start lag float and run until the common stop float is reached. The emergency pump must start at the high level float and run until the common stop float is reached. When the high level float is reached, an alarm beacon light will flash and horn will sound.

Provide an alarm beacon light and horn reset pushbutton to reset the light and horn upon correction of the level problem. Silence the alarm reset pushbutton in the control panel, but keep the alarm light illuminated if the problem is not corrected.

Generator running and fail statuses as well as the Automatic Transfer Switch (ATS) phase monitor statuses will be wired to the pump control panel for inclusion into the Alarms Circuit.

Alarms Circuit consists of field inputs and relays. Alarms from field devices, pumps, generator, etc will be forwarded to the alarm beacon/horn as well as the Auto Dialer.

- 2.2.3. Nameplates. Attach black phenolic plates with engraved white letters to the front of panels, starters, enclosed breakers, and disconnects with stainless steel screws.
- 2.2.4. Float Switches. Provide direct acting, mercury free float switches to indicate liquid level for the pump station. Float switch body must be Teflon coated over a stainless steel housing. Switches are to have a support wire in a heavy neoprene jacket. Floats are to be mounted via a metal support mast. Provide Siemens 9G-EF, or equal.
- 2.2.5. Elapsed Time Meters. Provide meters of the non-reset type suitable for panel mounting. Use 120VAC operating voltage. Provide presentation with a six-digit counter in hours and tenths of hours.
- 2.2.6. Submersible Level Transducer. Provide a level transducer suitable for installation in a Class 1, Division 1 area. Transducer must output a 4-20mA signal to the pump control panel in order to operate pumps. Transducer must be Endress Hauser Waterpilot FMX21-FE221HGJ21A+POPS
- 2.2.7. Gas Monitoring System. Provide a gas monitor sample pump and alarm indication panel for the station. System is to take 120VAC power input. Sample pump must draw in air and relay any alarm status to the gas monitor alarm indicator. Indicator must be mounted as shown on the Plans and show either a "safe" or an "alarm" condition. Sample pump is to be MSA Ultima X, or equal.
- 2.2.8. Alarm Light and Horn. Provide red LED strobe alarm light Provide alarm horn rated for outdoor use. Alarm light and horn to be powered via the pump control panel.
- 2.2.9. Phase Monitor. Provide phase monitor to be installed on the load side of the ATS. Furnish ATC Diversified Electronics Model PBD-480-ALE, or equal.
- 2.3 Concrete. Use Class "A" concrete conforming to Item 421, "Hydraulic Cement Concrete" and Item 420, "Concrete Substructures".
- 2.4 Wet Well. Construct concrete wet well meeting the requirements for sanitary sewer manholes in Special Specification Item 7086, "Sanitary Sewers".
- 2.4.1. Protective Coating. Provide wet well containing a protective interior coating with the following: Coat the interior surface of all pump station wet wells with a protective coating using coal tar epoxy before installation; do not apply an exterior coating to the wet well; use the following materials applied in accordance with manufacturer's recommendations listed on their current data sheets.

TNEMEC Protective Coatings:

Tneme-Tar	46-413
2 Coats Minimum Thickness	10 mills each DFT

Carboline Protective Coatings:

Bitumastic	300-M
2 Coats Minimum Thickness	10 mills each DFT

- 2.5 Ductile Iron Pipe. Provide ductile iron pipe other than flanged or grooved pipe meeting ANSI/AWWA C151/ A21.51 with thickness Class 51 unless otherwise noted.
- Provide flanged pipe meeting ANSI/AWWA C115/A21.15 with the pipe barrel meeting all requirements of ANSI/AWWA C151/A21.51. Provide thickness class 53 pipe.
- 2.5.1. Pipe Joints. Provide flanged pipe faced and drilled to 125 lb. unless where otherwise noted meeting ANSI/AWWA C115/A21.15. Provide nuts, bolts, and washers zinc plated in dry pit applications and 316 stainless steel in wet well and buried applications.
- Provide mechanical joints conforming to ANSI/AWWA C153/A21.53.
- Provide push on joints conforming to ANSI/AWWA C111/A21.11.
- 2.5.2. Fittings. Provide fittings for ductile iron pipe conforming to ANSI/AWWA C153/A21.53.
- 2.5.3. Protective Coatings. Provide a bituminous coating to the exterior of all underground ductile iron piping and fittings.
- Provide a shop coat primer suitable for topcoat painting on dry pit and exposed ductile iron piping, fittings, and appurtenances.
- 2.6 Force Mains. Provide force main pipe conforming to Special Specification Item 7017, "Sanitary Sewers".
- 2.7 Pipe Couplings
- 2.7.1. Flexible Couplings: Complies with AWWA C219. ASTM A536 ductile iron construction with ASTM D2000 SBR gaskets. Couplings will be Romac Style 501, similar of Smith-Blair, Dresser, or equal.
- 2.7.2. Expansion Joints: Must be flanged, single filled arch constructed of neoprene with woven polyester reinforcing. Must be suitable for 150 psig operating pressure. Flanges must be ASME 16.1 class 125. Must have integral stainless steel control cables to eliminate over expansion. Expansion joints must be manufactured by Proco, Metraflex, General Rubber, Mercer or equal.
- 2.8 Check Valves. Provide cushioned swing check valves using cast iron or ductile iron body valve, Class 125, AWWA C508, with bronze or stainless steel seat ring, bolted cap, horizontal swing, with outside lever and weight with air cushion assembly, cast iron or ductile iron disc. Check valves will be APCO CVS-EDV, M&H Style 206, or equal. Provide valve interior having a fusion bonded epoxy coating. Prime coat the exterior using a base primer compatible with field coatings specified. Valves will be factory fitted with limit switches to indicate position. Position status is to be wired to the pump control panel. Switch will be DPDT with two sets of contacts, one normally open and one normally closed.

- 2.9 Plug Valves. Provide AWWA C517 eccentric type plug valves with rectangular port and 100% port area. Valve will have a plug that is neoprene coated with nickel seat. Flanged valves must meet ASME B16.1 class 125 requirements. Provide handwheel, chainwheel and extension stem actuation accessories as indicated on Drawings. Provide valve interior having a fusion bonded epoxy coating. Prime coat the exterior using a base primer compatible with field coatings specified. Plug valves will be Dezurik Model PEF, similar of Valmatic or equal.
- 2.10 Air Release Valve. Valve must be automatic float operated type designed to release accumulated air from a piping system while the system is in operation and under pressure. Valves must have full size NPT inlets and outlets equal to the nominal valve size. The body must have a 2" NPT cleanout and 1" NPT drain connections on the sides. Cover must be bolted to the valve body and sealed with a flat gasket. A threaded adjustable orifice button must provide drop tight shut off to the full valve pressure rating. Valve body and cover must be constructed of ASTM A126 Class B cast iron. Orifice, float and linkage mechanism must be type 316 stainless steel. Orifice button must be Buna-N. Valve interior and exterior will be coated with fusion bonded epoxy. Valve will be provided with backwash accessory package including valves, hoses, and quick disconnect couplings. Air release valves will be Series 48A by Valmatic, or equal.
- 2.11 Chain Hoist. Hoist and trolley will be low headroom type. Trolley will be compact swivel, articulated truck. Hoist must be manual chain, geared type with Weston type load brake. Hoist and trolley must be steel. Gear train must be heat treated, alloy steel with planetary gearing. Chain and hook must be steel. Hook will have closure latch. Chain hoist will be Coffing Model YLHA, similar of Chester Hoist, or equal.
- 2.12 Pipe Painting. Paint all wet well and pump room piping, fittings, valves, and appurtenances with field applied top coatings meeting Section M, "Painting" of this specification. Sewage piping must be painted gray with yellow stenciled lettering that says "SEWAGE". Plumbing water piping must have identification marking bands. Flexible Couplings: Complies with AWWA C219. ASTM A536 ductile iron construction with ASTM D2000 SBR gaskets. Couplings will be Romac Style 501, similar of Smith-Blair, Dresser, or equal.
- 2.13 Expansion Joints: Must be flanged, single filled arch constructed of neoprene with woven polyester reinforcing. Must be suitable for 150 psig operating pressure. Flanges must be ASME 16.1 class 125. Must have integral stainless steel control cables to eliminate over expansion. Expansion joints must be manufactured by Proco, Metraflex, General Rubber, Mercer or equal.
- 2.13 Plumbing
- 2.13.1. Materials must comply with NSF 61.
- 2.13.2 Backflow Preventer: Reduced pressure principle conforming to ASSE 1013. Bronze construction with ball valves and air gap. Unit must be Watts series LF909, similar of Conbraco Industries, or equal.
- 2.13.3. Hose Bibb: Bronze construction with ½" inlet and hose threaded outlet with vacuum breaker.

- 2.13.4. Wall Hydrant: Self draining wall hydrant with vacuum breaker and loose operating key. Hydrants must be Josam series 71350, similar of Zurn, or equal.
- 2.13.5. Ball valves: CVPC schedule 80, true union, pressure rating 250 psi at 73 degrees. Nibco, Hayward, or equal.
- 2.13.6. Pipe and Fittings: CPVC schedule 80 ASTM D1784 and F441. Solvent cement joints. Threaded joints at equipment or fixtures.
- 2.14. Electrical. Provide materials incorporated in this Project meeting the following specifications or standards. This list is a guide and all items listed may not be used on this Project or it may not cover all required items, but it should set the standard for the quality of materials desired.
- Have materials and devices of the types for which there are Underwriters' Laboratories standard requirements, listing and labels with listing of Underwriters' Laboratories and labeled or conforming to their requirements.
- 2.14.1. Rigid Galvanized Conduit. Provide rigid galvanized conduit, elbows, nipples and couplings conforming to Federal Specification WW-C-581-E, ANSI Standard C80.1 and UL Standard #6.
- 2.14.2. PVC Non-Metallic Underground Duct, Direct Burial. Provide PVC type DB duct for use in underground, direct burial, applications conforming to the NEMA Specification TC-6 and TC-9, U.L. 651 Standard for rigid nonmetallic conduit, ASTM F-512 and ANSI C-130.2. Provide ducts and fittings made from virgin, polyvinyl chloride, C-250 compound.
- 2.14.3. PVC Coated Rigid Galvanized Conduit. Provide rigid galvanized conduit, elbows, nipples and couplings conforming to Federal Specification WW-C-581-E with a PVC exterior coating with a nominal thickness of 40 mils (.040"). Provide conduit conforming to the current NEMA Standard RN-1 with a label affixed indicating compliance with UL Standard #6.
- 2.14.4. **Liquid tight Flexible Conduit. Provide liquid tight flexible metal conduit conforming to Federal Specification WW-C-566-B.**
- 2.14.5. Junction Boxes. Provide cadmium or zinc-coated junction boxes, extensions or covers conforming to Federal Specification W-J-800b. Pull/Junction boxes: provide pull boxes with hot-dipped galvanized ferroalloy cast body and cover with neoprene gaskets and stainless steel cover screws. Furnish junction boxes with drilled and tapped conduit openings conforming to NEMA 4X (Stainless steel).
- Junction boxes within pump room must be NEMA 12 rated. Junction boxes that are within three feet of sewage pumps must be NEMA 4X rated. External junction boxes used for pump power and controls located near the wet well must be rated NEMA 7. Refer to plans for delineation of zones that require NEMA 7 ratings.
- 2.14.6. Fittings. Provide fittings for rigid steel conduit meeting the requirements of Federal Specification WW-C-581-D or WW-C-563. Provide fittings for electrical cable and liquid tight flexible metal conduit conforming to Federal Specification WW-C-566-B.

- 2.14.7. Wire. Provide thermoplastic or rubber, Type THWN, RHH, RHW or THHN wire conforming to Federal Specification JC 1292 or JC 30. Provide stranded wire. Instrument wires are to be minimum 18AWG, rated for 300V, and contain a drain wire.
- 2.14.8. Ground Rods. Install 3/4" x 10-foot ground rods as required by NEC. Provide ground conductor with a minimum No. 4 AWG bare cable connected to each ground rod with an exothermic weld. Provide grounding meeting the requirements of the National Electrical Code.
- 2.14.9. Fuses. Provide type RK5 fuses for motors and type RK1 fuses for service entrance.
- 2.14.10. Panel board. Provide 1, 2 or 3-pole Circuit breakers with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers. Provide UL listed circuit breakers rated for voltages and currents as noted on the plans. Provide bus structure insulated with all current carrying parts of the bus structure plated. Enclose panel board bus assembly in a steel cabinet. Meet the rigidity and gauge of steel as specified in UL Standard 50 for cabinets. Fabricate the box from galvanized steel or equivalent rust resistant steel. Provide a door and have a door latch with catch and pull on each front. Provide on the inside of the door a typed circuit directory frame and card with a clear plastic covering. Provide a short circuit current rating equal to or greater than the integrated equipment rating shown on the panel board schedule. Enclosure for panel board must be NEMA 12 rated.
- 2.14.11. Service Entrance Switch. Provide safety type service switch with voltage as shown on the Plans, fusible, service entrance rated, and NEMA heavy duty. Provide a handle and mechanism as an integral part of the box, not the covers, with positive padlocking provisions in the "off" position.
- 2.14.12. Motor Control Center. Motor control center must house overcurrent protection and starters for each of the sewage pumps with separate sections for each pump. Motor control center will also house the overcurrent protection for low voltage transformer. Overcurrent protection must be provided via circuit breakers. Refer to plans for voltage, amperage, and NEMA ratings.
- 2.14.13. Rubber and Friction Tape. Provide rubber and friction tape conforming to Federal Specifications HH-I-553 and HH-I-510a, respectively. Vinyl plastic tape 7 mil minimum thickness, will be acceptable in lieu of rubber and friction tape combined. Install tape half-lapped with the thickness of the completed wrap sufficient to provide insulation resistance equal to that of the conductor insulation.
- 2.14.14. Double-Throw Safety Switch. Provide switches with switch blades that are visible when the switch is OFF and the cover is open. Provide front removable lugs that are UL Listed for aluminum or copper 75o C conductors (200 - 600 Ampere). Provide current carrying parts that are plated to resist corrosion. Provide quick-make, quick-break switch operating mechanism. Provide provisions for padlocking the switch in the OFF position with at least three padlocks. Provide Type 1 devices with a quick make, quick break dual cover interlock mechanism to prevent opening of the switch cover when the switch is ON and to prevent turning the switch ON when the cover is open. Supply an interlock mechanism that is capable

of being bypassed by use of a special key supplied with the device. Provide switch covers that are top hinged, attached with removable screws and securable in the open position (Type 3R). Finish the switch enclosure with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated galvanized steel (Type 3R). Supply enclosure with a metal nameplate which includes ON-OFF-ON markings. Provide switches with tangential knockouts to facilitate ease of conduit entry. Provide switches in Type 3R enclosures through 200 Ampere with provisions for interchangeable bolt-on hubs in the top end wall. Provide UL Listed short circuit current rating of the double throw switches meeting 50,000 rms symmetrical amperes when protected by Class R fuses.

2.14.15. Devices.

Provide devices equal to the following:

	<u>Leviton</u>	<u>GE</u>	<u>P&S</u>	<u>A.C. Rating</u>
GFCI Receptacles	6899	GF 5342	2091-S	20A, 125V
Toggle Switch	1121-2	GE 1121-1	20AC1	20A, 120V

2.14.16. Lighting Fixtures. Furnish lighting fixtures as indicated on the Plans. Interior lights must be IP65 rated for protection from water and dust. Provide site lighting fixtures that meet the "Dark Sky" requirements with IES full- cutoff dusk-to-dawn lighting fixture with photoelectric cell.

2.14.17. Surge Arrester. Provide UL listed and CSA certified secondary surge arrester. Provide arrester meeting ANSI/IEEE C62.11-1987.

2.14.18. Cable Grips. Provide stainless steel grips suitable for the size of cable being supported.

2.14.19. Conduit Seals. Provide UL listed, suitable for Class I, Div. 1 & 2, Groups A, B, C & D seals. Provide material made of copper free aluminum.

2.14.20 Diesel Fuel Diesel Emergency Generator. Furnish and install diesel fueled standby generator and fuel tank as specified per one-line diagram on sheet E-3. The proposed Standby Generator System must be classified as Level 2 Emergency Power Supply System, type 60 (60 seconds), Class 24 (24 hr.) per NFPA 110 (Emergency and Standby Power Systems). The generator will be provided with the following features and requirements:

2.14.20.1. Rating: Provide a STANDBY rating, as shown on sheet E-3. Generator to be rated at 480Y/277V, 0.8 power factor.

2.14.20.2. Governor: Electronic isochronous type.

2.14.20.3. Enclosure: Weatherproof, sound attenuating outdoor type. Access panels to be provided with key type locks, all keyed the same. Radiator exhaust exits upward, generator cooling and combustion air intake is horizontal, facing the gate end of the generator screen wall. An integral weather protecting housing is provided with level 2 sound attenuating enclosure. Maximum sound level 72 dBA at 7 meters.

- 2.14.20.4. Exhaust: Critical-type exhaust silencer mounted inside of housing, stainless steel flexible exhaust connector, stainless steel tail pipe and rain cap to extend through the generator housing and be appropriately flanged and weatherproofed.
- 2.14.20.5. Radiator: Unit mounted type with up-scoop for noise attenuation
- 2.14.20.6. Vibration Isolation: Minimum 6" deflection vibration isolation.
- 2.14.20.7. Radio Emissions: Provide radio frequency suppression to commercial standards.
- 2.14.20.8. Output Breaker: Provide a single output circuit breaker, 80% rated, mounted to the frame of the generator.
- 2.14.20.9. Jacket Heater: Provide a jacket heater (coolant heater) with a thermostat.
- 2.14.20.10. Battery: Battery to be rated for 32 degrees F minimum ambient. Provide a battery heater kit rated for 0 degree F minimum ambient. Provide battery rack and cables. Battery charger to be equalize/float-type.
- 2.14.20.11 Misc. Additional Features:
 - 2.14.20.11.1. Lifting Eye.
 - 2.14.20.11.2. Load connection kit.
 - 2.14.20.11.3. Fan and belt guard.
 - 2.14.20.11.4. Oil drain extension to skid.
 - 2.14.20.11.5. Flexible fuel lines from sub-base tank to engine as well as re-circulating fuel lines back to the sub-base tank.
 - 2.14.20.11.6. Remote start/stop switch.
 - 2.14.20.11.7. Operating instructions and O&M Manual.
- 2.14.20.12 Control and Alarms: Generator will be provided with microprocessor controller console. Console unit to be mounted on vibration isolators and must include panel lights. Controller to include the following controls and indicators:
 - 2.14.20.12.1. Run-Stop-Remote/Auto Switch
 - 2.14.20.12.2. Remote Start-Stop terminal
 - 2.14.20.12.3. Oil Pressure Gauge
 - 2.14.20.12.4. Coolant Temperature Gauge
 - 2.14.20.12.5. Charge Rate Ammeter
 - 2.14.20.12.6. Solid State engine monitor with lamp Test Switch, Cycle Cranking, Common Alarm Contact.

- 2.14.20.12.7. The Detector 12 (12 light control) provides automatic engine control and monitoring suitable for NFPA 110, Level 2 installations. Generator mounted Indicator (annunciator) panel with 12 Lights indicating each of the following conditions:
- 2.14.20.12.7.1. Pre-Low Oil pressure Alarm.
 - 2.14.20.12.7.2. Overcrank Shutdown
 - 2.14.20.12.7.3. Pre-High Coolant Temperature
 - 2.14.20.12.7.4. Overspeed Shutdown
 - 2.14.20.12.7.5. Low Oil Pressure Shutdown
 - 2.14.20.12.7.6. Generator Running
 - 2.14.20.12.7.7. High coolant Temp Shutdown
 - 2.14.20.12.7.8. Low Fuel
 - 2.14.20.12.7.9. Low Coolant Temperature
 - 2.14.20.12.7.10. Switch Not in Auto
 - 2.14.20.12.7.11. Two Customer Selected Faults
 - 2.14.20.12.7.12. AC Output Controls, provided with the following controls and indicating the following information:
 - 2.14.20.12.7.12.1. AC Voltmeter (dual range, indicated all voltages)
 - 2.14.20.12.7.12.2. Voltmeter switch, Phase selector with an Off position
 - 2.14.20.12.7.12.3. AC Ammeter (dual range, indicates current each phase)
 - 2.14.20.12.7.12.4. Ammeter Phase
 - 2.14.20.12.7.12.5. Selector with an Off position
 - 2.14.20.12.7.12.6. Voltage Adjusting Rheostat
 - 2.14.20.12.7.12.7. Frequency Meter
 - 2.14.20.12.7.12.8. Run Time Meter
 - 2.14.20.12.7.12.9. Exciter Circuit Breaker, Manual Reset
 - 2.14.20.12.7.12.10. Fine Speed Control Potentiometer
- 2.15 Load Connection Kit. Provide an additional set of lugs on the output side of the Generator Breaker to allow connection for a temporary load bank, for load bank testing of generator.
- 2.16 Additional Features: Cyclic cranking per NFP-110, High-Engine-Temp, safety shutdown and lamp (red), Run-Off/reset-(engine start), Remote Start/Stop Button.

- 2.17 Warranty: The complete electrical power system (generator set, controls, and associated switches, switchgear and accessories), as provided by the single-source manufacturer, must be warranted by said manufacturer against defects in materials and workmanship for a period of one year from the date of system start-up. Said coverage must include parts, labor, travel expenses and labor to remove/re-install said equipment. A 5 yr. warranty will be offered as and add-alternate over the base bid.
- 2.18 Grounding: Generator is not a separately derived system. Neutral and Ground should not be bonded at the generator windings. There must be a permanent neutral connection from the generator to the normal service equipment. Provide a sign at the generator as required by NEC 700.7(B).
- 2.19 Delivery, Factory Startup, Documentation and Training and Job-Site Testing:
- 2.19.1. Provide factory standard test reports for the generator shipped to the job-site. Provide 5 copies of factory installation, operation and parts manual. Photocopies are not acceptable.
- 2.19.2. Offloading and Installation of generator at the job-site by the Generator Vendor.
- 2.19.3. Factory representative at job site for start-up and training of Owner's/facility personnel, minimum 2 days (20 hr.).
- 2.19.4. An installation check, start-up, load bank test, and building full load test must be performed by the manufacturer's local representative. Provide a 4-hour 100% load bank test before building full load (transfer and accept load) test. Provide building full load tests in the presence of owner and/or their authorized representatives and facility personnel.
- 2.19.5. Provide all required and necessary fluid and oil (coolant, lubricant, etc...). Provide fuel for testing and training. Provide a full tank of fuel after completion of testing and training.
- 2.19.6. Approved manufacturers: Cummins, Caterpillar, Taylor Power Systems, Stewart & Stevenson, Kohler, Waukesha-Pearce, Baldor or equal.
- 20.20 Automatic Transfer Switch. See construction drawings for rating and layout of both the manual and automatic transfer switch. Provide a phase monitor relay on the load side of the automatic transfer switch for protection of motor circuits from voltage unbalance, phase loss, phase reversal, and incorrect sequencing.
- 2.21 Lightning Protection System. A contractor with a minimum of three years' experience and certified by the Lightning Protection Institute must design the lightning protection system that will protect the entire building and external wet well. Design must comply with LPI 175, NFPA 780. Components used and installation must comply with UL 96 and UL 96A and furnish Master Label. The manufacturer of the components must be a company specializing in lightning protection equipment with a minimum of three years documented experience and member of the Lightning Protection Institute. The Installer must be an authorized installer of manufacturer with minimum of three years documented experience and certified by Lightning Protection Institute. The Inspection Agency must be a company or individual specializing in

lightning protection inspections with minimum three years documented experience and member of the Lightning Protection Institute.

- 2.21.1. Submittals:
 - 2.21.1.1. Shop Drawings: Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.
 - 2.21.1.2. Product Data: Submit catalog sheets showing dimensions and materials of each component, and include indication of listing in accordance with UL 96.
 - 2.21.1.3. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.
 - 2.21.1.4. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
 - 2.21.1.5. Certificate of Compliance: Submit certificate from authority having jurisdiction indicating approval of lightning protection systems.
- 2.22. Field Measurements: Verify field measurements before fabrication.
- 2.23. Coordination: Coordinate work with roofing and exterior and interior finish installations.
- 2.24. Components:
 - 2.24.1. Approved Manufacturers:
 - 2.24.1.1. Advanced Lightning Technology – Dallas.
 - 2.24.1.2. Thompson Lightning Protection – Minnesota
 - 2.24.1.3. Harger Lightning Protection – Illinois
 - 2.24.1.4. East Coast Lightning Equipment – Connecticut
 - 2.24.2. Product Listing: UL 96.
 - 2.24.3. Air Terminals:
 - 2.24.3.1. Material: Copper.
 - 2.24.3.2. Configuration: Tubular.
 - 2.24.3.3. Use adhesive base for single-ply roof installations.
 - 2.24.3.4. Air terminal for Chimney: Lead-coated coppers.
 - 2.24.3.5. Decorations: Ball.
 - 2.24.3.6. Grounding Rods: Solid Copper.
 - 2.24.3.7. Ground Plate: Copper.

- 2.24.3.8. Conductors: Material will be Copper or Aluminum. Configuration will be cable.
- 2.24.3.9. Connectors and Splicers: Bronze
- 2.25. Field Quality Control: Perform inspection and testing in accordance with UL 96A.
- 2.3. Auto dialer. Provide solid-state component dialer capable of dialing at least 4 phone numbers, each up to 16 digits in length. Enter phone numbers via the system's keyboard. Use standard pulse dialing or Touch Tone® DTMF dialing selected at the keyboard. The user may optionally elect to alter the following parameters from their standard normal default values via keyboard entry. Provide RACO Verbatim Model VSS8C. The built-in voice must guide and confirm the following programmable features.
 - 2.23.1. User Programmable Speech: Alarm and normal messages provided for each channel to be programmable from a standard 230 word vocabulary.
 - 2.23.2. Remote Programming: The dialer must permit user to change any user - entered programming (except speech messages) from any Touch Tone® phone. User able to cause a ninth phone number to be called on command to test system and phone line integrity.
 - 2.23.3. Alarm response delay: 0.1 to 999.9 seconds.
 - 2.23.4. Delay between alarm call-outs: 0.1 to 99.9 min.
 - 2.23.5. Alarm reset time: Programmable 0.1 to 99 hr. or "NO RESET".
 - 2.23.6. Incoming ring response (answer) delay: 1 to 20 rings.
 - 2.23.7. Number of message repetitions: Programmable 1 - 20 repetitions of the message.
 - 2.23.8. Station ID number.
 - 2.23.9. Input alarm criteria: Each channel independently configured for "Alarm On Open Circuit," "Alarm On Closed Circuit," or "No Alarm" - report on inquiry only, or in lieu of alarming, accumulate equipment running time.
 - 2.23.10. Autocall Test: When enabled, the unit places a single round of test calls, both at the time this function is enabled and also at regular subsequent intervals until this function is disabled at the keyboard. The voice identifies these calls as test calls.
 - 2.23.11. Run Time Meter: Provide channels that are keyboard programmable to accumulate and report the number of hours that its input contacts have been closed.
 - 2.23.12. User-entered programming stored intact when all power is removed for up to ten years.
 - 2.23.13. Accomplish acknowledgement of an alarm phone call by pressing a Touch Tone "9" as the alarm call is being received, or by returning a phone call to the unit after receiving an alarm call, at the user's choice. Communicate via the Automatic Telephone Dialer using a highly intelligible solid-state voice synthesizer (magnetic tape loops will not be used) with an identification of its location and the specific existing alarm condition(s).

- 2.23.14. Upon initiating an alarm phone call, the system “speaks” only those channels that are currently in “alarm status.” Inquiry phone calls can be made directly to the unit at any time from any telephone, locally or long distance, for a complete status report of all variables being monitored, including power status. Further, by pressing the Touch Tone “0,” the user may hear all user-entered programming and diagnostic counts (Cumulative Counts of Call In Count, Dial-out Count, Acknowledged Alarm Count, Power Off Alarm Count). Allow access to all this information by keyboard inquiry at the unit as well.
- 2.23.15. Provide normal power of 105-135 VAC, 15 watts maximum. Provide gel cell rechargeable battery with product which is automatically kept charged when AC power is present. Provide battery capable of keeping the product operating, and user programming intact, for a minimum of six continuous hours in the event of power failure. Shorter backup time not acceptable. Provide built-in charger with precision voltage controlled, not a “trickle charger,” to minimize recharge time and maximize battery life available.
- 2.23.16. Operate dialer on a standard rotary pulse or Touch Tone “dial-up” phone line (direct leased line not to be required) and F.C.C. approved. Provide a regular private line. Connect the telephone through an industry standard four-pin modular jack (RJ-11).
- 2.23.17. Provide gas tube and solid-state surge protection on all inputs, including power, phone, and signal lines. Incorporate these protectors integrally into the main circuit board for maximum protection. Mounting protectors external to the main circuit board is unacceptable.
- 2.23.18. Provide installer with a good electrical ground connection point near the unit to maximize the effectiveness of the surge protection. Provide a dialer with a two (2) yr. warranty covering parts and labor performed at the factory.
- 2.23.19. Provide a system to include expansion connectors to accommodate field upgrades for additional dry contact inputs, remote supervisory control, remote reprogramming, analog input, and communication with serial printers. Seal all keyboard and front panel switches to prevent contamination.
- 2.23.20. Indications from front panel LEDs to show: Normal Operation, Program Mode, Phone Call in Progress, Unacknowledged Alarm, Acknowledged Alarm, AC Power Present, AC Power Failure, and Low or Discharging or Recharging Battery.
- 2.23.21. On any Inquiry telephone call or On-Site status check, provide voice with specific warning if no dial-out phone numbers are entered, if the alarm switch is in the “disable” position, or if AC power is off or has been off since last reset.
- 2.23.22. Provide a built-in microphone to allow anyone at a remote phone to listen to local sounds and to have a two-way conversation with personnel at the dialer.
- 2.24. Equipment Schedule. Provide manufacturer’s field services, and operation and maintenance manuals for the items of equipment indicated in the following schedule

<u>Type of Equipment</u>	<u>Mfr’s Field Services</u>	<u>O&M Manual</u>	<u>Certificate of Compliance</u>
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Sanitary Sewer – Valves & Covers	X	X	X
Water Mains – Valves & Fire Hydrants	X	X	X
Pump Station Equipment & Appurtenances	X	X	X
All Electrical Equipment & Work	X	X	X

2.25. Lift Station Building

- 2.25.1. Foundation. Provide foundation system for lift station building having exterior dimensions of approximately 20-ft x 30-ft (refer to plans). Provide 12 in. thick reinforced concrete slab with #6 rods at 12-in on center each way over 6 mil polyethylene, over a compacted sand layer. Grade beams must be 12-in x 36-in reinforced concrete with six #5 rods, and ¼-in stirrups spaced at 24-in on center. Piers must be 12-in diameter spaced at 6-ft on center extending down to bearing soil as recommended in the geotechnical report.
- 2.25.2. Walls. Provide 8-in x 8-in x 16-in concrete masonry units (CMU) reinforced with ladder wall ties spaced at 48-in vertically, capped with reinforced bond beam at the top of 12-ft CMU walls.
- Final coat of CMU exterior walls will be an anti-graffiti sealer having a clear satin finish.
- 2.25.3. Doors. Provide one pair of double 6-ft x 8-ft access doors as shown on the drawings. Provide wood core doors clad in galvanized metal. Provide hollow metal frames using stainless steel hardware to avoid corrosion.
- 2.25.4. Roof Structure. Provide triangular, light gauge steel trusses welded to embedded 8-in x ¼-in x 6-in steel plate at top of masonry/concrete bond beam.
- 2.25.5. Roof Decking. Provide galvanized corrugated roof decking “paint grip” standing seam roof constructed and erected to comply with I-90 wind loads and hurricane codes adopted due to the latest data recorded during the last active hurricane season.
- Gable ends of building must be affixed with pressure relief louvers and exhaust fans with capacities capable of maintaining proper air flow through building as designed by mechanical engineer.
- Provide galvanized gutters and downspouts to collect and direct rainwater to the lift station site’s drainage system.
- 2.26. Painting. Deliver paint to the job in original unopened containers with labels intact. Store paint inside and protected against freezing. Do not add adulterant, unauthorized thinner, or other material not included in the paint formulation to the paint for any purpose.
- Use paint in successive field coats produced by the same manufacturer. Use Paint in the first field coat over shop painted or previously painted surfaces causing no wrinkling, lifting, or other damage to underlying paint.

Where painting materials are referenced to Federal or Military Specifications, the reference will define generally type and quality required but is not intended to limit acceptable materials to an exact formulation.

Provide paint system and type as listed on the table shown in Construction Methods of this special specification as manufactured by Tnemec Company Incorporated, or equal.

- 2.26.1 Product and Color Selection. Provide black color for the appropriate surface coatings on designated pipes, appurtenances, and fittings. Submit the color card for the paint color proposed, together with complete descriptive specifications.
- 2.27 Lift Station Fencing. Provide chain link fence meeting the following material specifications.
 - 2.27.1. Post Footings. Provide Portland Cement Concrete post footings.
 - 2.27.2. Wire Fabric. Provide copper bearing steel wire woven in 2" mesh heavily galvanized by the "Hot-Dip" process after weaving and able to withstand six (6) one min. dips by the Preece Test. Provide fabric six (6) feet in height with knuckled edges.
 - 2.27.3. Line Posts. Provide tubular steel line posts of the size specified on the Plans, heavily galvanized and spaced not more than ten (10) feet center to center.
 - 2.27.4. Terminal Posts. Provide tubular steel corner posts and end posts of the size specified on the Plans and heavily galvanized.
 - 2.27.5. Railings. Provide tubular steel rails of the size specified on the Plans and heavily galvanized, with sleeve couplings for expansion and contraction. Provide fences ten (10) feet or higher with an intermediate rail equidistant from top and bottom.
 - 2.27.6. Tension Wire. Install No. 9 gauge galvanized coiled steel tension wire along the top of the fence, as well as the base of the fabric if bottom rail is not called for.
 - 2.27.7. Fabric Ties. Use No. 12 gauge aluminum wire spaced not more than 14" center to center to secure the fabric to all posts. Use No. 12 gauge aluminum wire spaced not more than 24" center to center to secure the fabric to rails, braces and tension wire.
 - 2.27.8. Fittings. Provide all necessary post tops, rail ends, hinges, bracing, fabric bands, and other fittings required to install the fence complete in place. Fit tops and rail ends over the outside of the pipe.
- 2.28. Lift Station Surfacing. Furnish and place aggregate type material for the lift station as stipulated on the plans and as temporary surfacing where shown on the drawings or as directed. Provide Type A or B, Grade 3, SAC-B of aggregate meeting Item 302, "Aggregates for Surface Treatments".
- 2.29. Lift Station and Utilities Demolition and Salvage. Demolish, remove and salvage lift station and utilities in accordance with the plans and as specified herein.

3. Construction Methods

Construct in accordance to Items 1-9, "General Requirements and Covenants" unless otherwise indicated

Unless otherwise indicated. "Owner" is defined as the utility owner.

3.1 Submittals. Provide submittal data to show compliance with these specifications, plans or other specifications that will influence the proper operation of the pumps. Provide standard submittal data for approval consisting of:

3.1.1. Lift Station.

Pump Performance Curves
 Pump Outline Drawing.
 Station Drawing for Accessories.
 Electrical Motor Data.
 Pump Control Panel Drawings and Data.
 Submersible Level Transducer
 Float Switches
 Magnetic Flowmeter
 Gas Monitoring System
 Ventilation Panel Drawings and Data
 Access Frame Drawing.
 Typical Installation Guides.
 Technical Manuals.
 Parts List.
 Printed Warranty.
 Manufacturer's Equipment Storage Recommendations.
 Manufacturer's Standard Recommended Start-Up Report Form.

3.1.2. Electrical.

Circuit Breaker
 Receptacle
 Conduit
 Wire
 Surge arrester
 Service entrance switch
 Conduit seal
 Pull/junction box
 Double-throw safety switch
 Alarm light
 Alarm horn
 Interior light
 Exterior Light
 Grounding and Bonding wire and materials
 Reverse service generator receptacle
 Auto dialer
 Diesel generator

Transfer switches
 Motor control center
 Panel boards
 Fuses
 Low voltage distribution transformer
 Phase monitor
 Overcurrent protection coordination study
 Overcurrent protection short circuit study
 Overcurrent protection arc flash study

3.1.3. Pumps.

Name of manufacturer
 Type and model
 Rotating speed
 Size of suction flange
 Size of discharge flange
 Type of seal
 Net weight of pump only
 Net weight of baseplate

3.1.4. 4. Motors.

Name of manufacturer
 Type and model
 Rated size of motor (HP)
 Temperature rating
 Full load rotating speed
 Weight
 Input-Output efficiency at: i) Full load, and ii) Rated pump condition
 Full load current
 Locked rotor current
 Voltage

3.2. Lift Station Construction. Install all piping, equipment and miscellaneous items according to the manufacturer's recommendations and industry standards of practice. Construct wet well conforming to the requirements of Special Specification Item 7017, "Sanitary Sewers".

3.2.1. Excavation and Backfilling. Conform to the requirements of Item 400, "Excavation and Backfill for Substructures".

3.2.2. Piping. Field measure the length of pipe required to conform to the details shown on the Plans. Field modify to returned pipe lengths delivered which do not conform to the details shown on the plans at the Contractor's expense. Make field modifications to the pipe that will not adversely affect the integrity of the pipe as approved by the Engineer in writing before any modification.

- 3.2.3. Joints. Install push-on joints, mechanical joints, grooved joints and flanged joints according to the manufactures recommendations.

Whenever screwed-on flanges are used, extend the pipe completely through the flange. Provide pipe end and flange face finish-machined in a single operation. Provide flange faces flat and perpendicular to the pipe centerline.

When bolting flanged joints, take care to insure that there is no restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression which would cause unnecessary stress in the flanges. Do not assemble bell and spigot joints until all flanged joints affected have been tightened. Tighten bolts gradually and at a uniform rate, so that gasket compression is uniform.

Take special care when connecting to pumping or other equipment. Permanently support all such piping so that accurate matching of bolt holes and uniform contact over the entire surface of abutting pump and piping flanges are obtained before installation of any bolts in those flanges.

Do not over-tighten bolts to compensate for poor installation.

- 3.2.4. Installation. After assembly and installation on the concrete foundations, plumbed, aligned, and wedged each pump in place. Do not grout until after the initial fitting and alignment of connecting piping. Meet the requirements of pipe sections concerning flanged connections to pumps. Grout base in place with non-shrinking grout

- 3.2.5. Acceptance Testing. Perform and pass tests for all installed piping to determine the soundness and workmanship regarding alignment and pressure. Test the pump station wet well per manholes as stipulated in Special Specification Item 7017, "Sanitary Sewers".

Perform piping pressure and leakage tests for the entire pump station and related valve vaults. Furnish and install test plugs at no additional cost to the Department, including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs.

Conduct tests at 2.5 times the maximum operating pressure, not to exceed the maximum working pressure of the piping components.

Identify and repair all leaks in the system and retest the system until a successful test is achieved.

Inspect after field testing each pump using an authorized manufacturer's representative the following inspections:

- 3.2.5.1. Check impeller, motor rating and electrical connections for compliance with this specification.

- 3.2.5.2. Test motor and cable insulation for moisture content or insulation defects.

Supply a written quality assurance record confirming the above testing/inspections for each pump.

Replace pump(s) if the above requirements are not satisfied.

- 3.2.6. Start-Up. After installation of the equipment and before operation of the facility, check and calibrate all equipment using an authorized factory representative. Submit installation certifications, test reports and warranties and conduct the operator training session.
- Furnish the services of a qualified factory trained field service engineer for two (2) 8-hour working day(s) at the site to inspect the installation and instruct the owner's personnel on the operation and maintenance of the pumping units. After the pumps have been completely installed and wired, perform the following:
- Inspect megger stator and power cables.
 - Check seal lubrication.
 - Check for proper rotation.
 - Check power supply voltage.
 - Measure motor operating load and no load current.
 - Check level control operation and sequence.
 - Simulate alarms.
- During this initial inspection, have the manufacturer's service representative review recommended operation and maintenance procedures with the owner's personnel.
- After six months of operation, have the authorized factory representative make a follow-up visit to the facility to again make sure the pumps are operating properly, and conduct a second operator training or trouble-shooting session at no additional cost to the Department. Perform all work in the presence of the Owner's Operator to provide additional training. Include costs associated with the follow-up visit in the Contractor's original bid price.
- 3.3. Electrical. Approved Manufacturers:
- 3.3.1. Advanced Lightning Technology – Dallas.
- 3.3.2. General. Perform all electrical work in conformance to the 2017 National Electrical Code, local city codes and local utility company requirements as well as applicable state statutes and federal regulations. Meet the more stringent requirement if two codes pertaining to the same work applies. Notify the Engineer in writing before bids are opened of conflicts between the plans, specifications and codes. Perform work including the following:
- 3.3.2.1 Secure and pay for all permits and fees required for this work performed to complete an operating system.
- 3.3.2.2 Coordinate the installation of concealed conduit, piping, inserts, sleeves, anchors, and other concealed or embedded items, so that this work is properly completed and tested before being concealed.
- 3.3.2.3. Coordinate electrical service with the local utility.
- 3.3.3.4. Perform all work necessary to complete the work as shown on the plans and specified herein.
- Failure to visit the job site to determine local conditions will not be accepted for granting additional compensation.

Provide all offsets, fittings and accessories that may be required. Carefully investigate structural and finish conditions affecting all work and arrange such work accordingly, furnishing such fittings and accessories as may be required to meet such conditions, at no additional cost.

Tightly cover and protect fixtures and equipment against dirt, water, and chemical or mechanical injury. Thoroughly clean, adjust and operate the materials and equipment upon completion of all work.

3.3.2

Conduit and Raceway Installation. Do not use conduit ½-in. or smaller. Do not use Electrical metallic tubing (EMT). Use PVC conduit for underground conduit runs. Use PVC coated rigid steel for all underground 90° bends and where a rigid steel conduit is required for mechanical strength, but installed in a corrosive environment. Provide rigid steel conduit that is hot-dipped, galvanized steel, unless otherwise specified herein. Stamp each length of conduit with the name or trademark of the manufacturer and the Underwriters' label.

Run exposed conduit in straight lines at right angles to or parallel with walls, beams or columns substantially supported by conduit straps, suitable clamps or hangers to provide a rigid installation at a maximum of 8'-0" spacing. Do not use perforated strap hangers. Do not support or fasten conduit to other pipe or installed to prevent the ready removal of other pipe for repairs.

Provide minimal number of bends in any one conduit run between outlet and outlet, fitting and fitting or outlet and fitting containing not more than the equivalent of four quarter bends, 360° total, including those bends located immediately at the outlet or fitting. Install pull boxes where more bends are necessary. Make ¾-in. conduit bends using a conduit bender, and all larger size bends using a machine bend.

Provide watertight couplings and pipe joints in wet locations. Provide concrete- type where buried in masonry or concrete. Size conduit in accordance with N.E.C. tables unless larger sizes are indicated on the Plans. Cut all conduits with a hacksaw or an approved pipe cutting tool and thread. Ream all ends before connecting. Do not permit conductors to reach higher than rated temperatures.

Provide templates to properly align conduits where stubbed out of slabs or fill. Swab all conduit clean before pulling wire. Use PVC conduit for direct burial or concrete encased conduits shown on the Electrical Plan.

Use plugs, caps or other means on open ends of conduit to close openings during construction to prevent the entrance of foreign matter.

Avoid trapped runs whenever possible. Provide trapped runs in concrete at or below grade and trapped runs in buried conduit with a means of drainage.

Seal conduit joints against water with a heavy compound impervious to moisture or with fittings approved for the purpose.

Install conduit seal-offs where conduits pass from hazardous areas to non-hazardous areas, and as otherwise required by the NEC.

- 3.3.3. Installation of Locknuts, Bushings, Connectors and Couplings. Provide watertight hubs that are wrench tightened where conduits enter panels or cabinets to provide an effective bond.

Use malleable bushings or plastic bushings in lieu of phenolic-lined malleable bushings where insulated bushings are required by the N.E.C.

- 3.3.4. Installation of Conduit Outlet Bodies and Special Fittings. Use conduit outlet bodies where indicated or desirable. Provide cast iron, cadmium-plated, or cast aluminum fittings. Do not use dissimilar metal conduit fittings. Complete fittings with covers and gaskets. Use offsets for surface expansion of conduit.

- 3.3.5. Installation of Pull Boxes. Install Pull boxes where indicated on the Plans, where required by the N.E.C., or where dictated by wire pulling requirements. Use code grade galvanized steel with size calculated according to N.E.C. fill requirements.

Paint the backs of boxes using a heavy coat of black asphaltum paint when mounted on below-grade masonry walls or where moisture problems may occur. Use NEMA Type 1, 3, 3R, 4, 4X, 5, 7, 9, 12, or 13 enclosures where shown on the Plans or where required by N.E.C.

- 3.3.6. Installation of Outlet Boxes, Covers, Devices and Plates. Provide boxes of sizes and types to accommodate (1) structural conditions, (2) size and number of raceways and conductors or cables entering, (3) device or fixture for which required, and (4) thickness of construction. Use boxes generally four (4) in. square or octagonal except in unplastered masonry, glazed tile, or dry wall construction where sectional and assembly of sectional or "Handy Boxes" can be used.

- 3.3.7. Installation of Cabinets, Enclosures, and Devices. The enclosures must be floor, wall, or post-and-backboard mounted as indicated on the drawings. Interior enclosures must be NEMA 12 for dry locations unless otherwise specified or indicated on the drawings. Provide NEMA 4X, stainless steel, for exterior locations as identified in the contract documents. Access doors will have continuous hinges with neoprene gaskets. Cabinets will be constructed from formed 12-gauge steel. All exposed edges and welds on the enclosure will be ground smooth. All exterior mounted panels are to include a clasp for pad locks.

The interior and exterior of steel enclosures must be painted with a rust-inhibiting primer and two coats of epoxy gray paint or gray polyester powder paint over phosphotized surfaces. Stainless steel enclosures must not be painted.

The interior must be provided with a formed 12-gauge subpanel for attaching surface-mounted components and a hinged subpanel for front panel mounted hardware. All components must be attached with screws and the subpanel will be threaded. Rivets or back of panel nuts will not be allowed. Each interior must be equipped with lighting, 120-volt 15-ampere duplex GFI receptacle and circuit breakers where shown on the drawings. The interior

will be painted with two coats of white enamel paint. Refer to instrumentation drawing for enclosure size and installation details. Enclosures should be manufactured by Hoffman, or equal.

- 3.3.8. Service Entrance Switch. Install service entrance switch as specified at locations shown on the Plans.
- 3.3.9. Fuses. Provide Owner with two complete sets of fuses for every fuse holder in this project with the type fuses required.
- 3.3.10. Installation of Lighting Protection System. Install in accordance with NFPA 780, UL 96A and LPI-175. Connect conductors using exothermic welding process. Protect adjacent construction elements and finishes from damage. Conceal interior conductors within building finishes. Conceal exterior conductors where practical. Bond exterior metal bodies on building to lightning protection system, and provide intermediate level interconnection loops 60 feet on center.
- 3.3.11. Surge Arresters. Furnish and install arrester in the service entrance disconnecting means, on the pole. Install per manufacturer's recommendations.
- 3.3.12. Area Light. Mount on meter pole as detailed on Plans.
- 3.3.13. Alarm Light and Horn. Mount on building exterior as detailed on plans per manufacturer's recommendations.
- 3.3.14. Installation of Anchors, Fasteners and Miscellaneous Supports. Provide noncombustible type anchors in walls of concrete from which a load is suspended and all anchors used to fasten heavy equipment, such as the junction boxes, without lead in their construction.

Firmly fasten conduit within 3 feet of each outlet box, junction box, cabinet or fitting. Make exposed conduit fastenings with one-piece malleable conduit clamps. 2-Hole galvanized sheet metal pipe straps may be used on all concealed installations and at other location only after approval of the Engineer. Use companion bases or "backs" with conduit clamps.

Support conduit by devices of a type designed for the particular usage and install in accordance with the manufacturer's directions.

Provide job fabricated supports with a finished appearance and complement the installation.

Provide supports with materials having corrosion protection at least equal to the raceway or coat to provide such protection using "Galvanox" or equal.

Provide support spacing in accordance with the latest edition of the National Electrical Code.

Provide a support for exposed or concealed raceway as close as practical to and not exceeding one foot from an unsupported box or access fitting may be omitted when the box or access fitting is independently supported and the raceway terminal is not made with a Chase nipple or threadless box connector.

In vertical runs, carry loads produced by the weight of the raceway and the enclosed conductors entirely by the conduit supports, do not support the load using the raceway terminal.

- 3.3.15. Cutting and Patching. Patch and repair all floor, ceiling and wall surfaces damaged as a result of installation work. Include patching and repairing openings around conduits which penetrate walls, floors or ceilings. Use the same material as the damaged construction for the repair.

Perform all patching and repair at the direction of and to the satisfaction of the Engineer with a finish quality ready to receive paint.

Avoid cutting any part of new construction insofar as possible by the setting of sleeves and grounds in the rough construction. Neatly cut as necessary as approved by the Engineer.

Do not endanger any work or structural member by cutting, digging or otherwise, and do not cut or alter work of any other Contractor except with the consent of the Engineer. Do not cut holes larger than necessary to receive the work properly.

Patch and seal all openings for conduits or electrical equipment around electrical equipment and materials.

- 3.3.16. Wire and Cable Installation. Provide conductors as noted on the Plans and according to the 2017 National Electrical Code (N.E.C.). Use No. 12 AWG minimum conductor size for power, lighting circuits and control circuits. Use stranded conductors for No. 10 AWG and smaller and use stranded conductors for No. 8 AWG and larger.

Provide conductor insulation for 600 volts and less as follows: Branch circuits must be flame-retardant thermoplastic, Type letter THWN/THHN, or flame-retardant, moisture-resistant, rubber, Type RHW/RHH, except as noted otherwise on the Plans. Provide flexible, high temperature or any other special types of wire and cable as indicated on the Plans.

Color code all No. 10 AWG and smaller conductor insulation in accordance with the N.E.C. Use of low voltage multi-conductor cable allowed if properly protected.

Use approved wire lubricant of a type suitable for the wire or raceway involved. Do not pull wire until construction work in the vicinity is sufficiently complete to avoid any damage to wires and cables.

Install all wires and cables required for the work in continuous lengths, without splice from source of supply. Do not use pull boxes for making splices unless approved by the Engineer or so indicated on the plans.

- 3.2.17. Conductor Connections. Use approved pressure-type solderless connectors and lugs for all service entrance, feeder and equipment connections. Make neutral connections and taps individually, in order to prevent the possibility of an "open neutral".

Make branch circuit connections with UL approved solderless connectors. Use type that must not depend solely upon a single insulating material to secure the connection as well as to insulate it. Cover split bolt connectors with five layers of approved electrical tape.

- 3.3.18. Grounding and Bonding. Ground and bond all service entrance raceways, cabinets, equipment, feeder raceways and feeder, distribution panels, and switchboards. Ground and bond all other metallic raceways, cabinets, motors and equipment as required by the N.E.C. Ground the cases, system neutrals or appropriate system conductors as required, on all secondary systems established by transformer or any special systems.
- Provide a grounding electrode using a copper-clad ground rod 3/4-in. dia. x 10'-0" long. Set the point of connection as near as possible to the electrical service entrance to the building. Protect grounding wire. Provide, if there is greater than 25 ohms ground resistance, an electrode in the form of one or more sectional type copper-clad ground rods of 3/4-in. minimum diameter and 10'-0" in length connected in parallel to provide a minimum total ground resistance of 25 ohms including wire to rod connection when tested in dry weather.
- Do not shunt or wire around dielectric unions placed in water pipes for electrolytic purposes. Provide bonding/grounding attachments to conduits by means of phenolic or plastic-throat, malleable iron, cadmium plated ground bushings. Grounding locknuts may be used for additional bonding, but will not be acceptable in lieu of ground bushings.
- Size grounding/bonding conductors in accordance with N.E.C. requirements. Use soft annealed copper and use stranded wire when larger than No. 10, unless noted otherwise. Wire may be bare except where dangerously close to live parts. When insulated, provide a green color jacket or finish. Provide UL approved grounding lugs and fittings. When current carrying conductors are installed in PVC conduit, pull ground conductor(s) through with the current carrying conductors.
- 3.3.19. Tests and Inspection. Provide labor, material and test equipment, except as noted to the contrary herein, to test all wiring and equipment for continuity, proper polarity and proper phase relation after installation. Provide test equipment and methods meeting the Engineer's approval. Notify the Engineer at least two working days before tests. The Engineer reserves the right to witness any and all such tests. The Engineer will interpret test results and pass on the acceptability. Correct work that does not test out to the Engineer's satisfaction and retested as required without additional cost to the Department. The Engineer reserves the right to perform any test on any phase of the installation using Contractor's personnel and test equipment.
- 3.3.20. Manufacturers' Representative. Provide the services of a manufacturer's representative for all instruments as required to insure calibration and coordination of the devices with their primary elements, recording devices and controlled equipment.
- 3.4. Mechanical HVAC
- 3.4.1. Wind Load & Equipment Anchorage
- 3.4.1.1 As defined under 2012 IMC 301.15. Based on Risk Category I, the wind speed is 122 mph. Exterior HVAC equipment must be securely fastened in place. Supports must be designed and constructed to sustain vertical and horizontal loads within the stress limitations specified in ASCE 7-10 Chapter 29. Applicable vertical and lateral coefficients must be applied.

3.4.2. Basic Mechanical Requirements

- 3.4.2.1. Demolition: Remove ducts/pipe to above ceiling or below floor. Re-support any remaining duct/pipe that was supported by demolition walls. Damage to existing materials/equipment will be repaired at no additional cost. Give demolished equipment to Owner, dispose of if Owner does not want. Refrigerants become the property of the Contractor and must be removed per EPA regulations and ARI Standard 770.
- 3.4.2.2. Warranty: Guarantee labor and materials for 1-yr. Warranties begin upon Owner's acceptance of substantial completion of the installation.
- 3.4.2.3. Shop drawings: Submit complete information on all equipment, air devices, valves, duct accessories and controls. Submit complete ductwork and piping shop drawings, based on approved equipment and field observation of building conditions. Submit detailed layout of mechanical rooms and yards. Incomplete submittals will be returned to the contractor un-reviewed. No time extensions or cost increases will be allowed for delays caused by return of incomplete submittals.
- 3.4.2.4. Operations and maintenance instructions: Provide 3 copies of operation and maintenance manuals to Owner. Provide within 90 days after the date of system acceptance. These manuals will be in accordance with industry-accepted standard such as ASHRAE Guideline 1 and must include, at a minimum, the following: (a) Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance. (b) Operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions must be clearly identified. (c) Names and addresses of at least one service agency. (d) HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints will be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments. (e) A complete narrative of how each system is intended to operate, including suggested setpoints. Provide instruction on system operation to Owner's representatives.
- 3.4.2.5. Record drawings: Within 90 days after the date of system acceptance, provide record drawings in Revit Format (using the same software version the project was designed in), plus full size hard copy. Revit models may be available from Engineer for a fee. Record drawings must include as a minimum the installed location and performance data on each piece of equipment, air devices, control sensors, control panels, general configuration of duct and pipe distribution system including sizes, and the terminal air or water design flow rates.
- 3.4.2.6. Coordination: Provide Electrical Contractor with electrical requirements of approved equipment in sufficient time to order panel boards, disconnects, etc.
- 3.4.2.7. Access doors: Provide Milcor or equal as required for access to all valves, filters, controls, dampers or other devices requiring attention. Doors must match wall or ceiling rating. Architect must approve location and appearance of all access doors. Access panels for fire or smoke dampers must be openable without the use of tools.

- 3.4.2.8. Sleeves: Provide metal sleeves where pipes or control wiring penetrate walls.
- 3.4.3 Hangers and Supports for HVAC Piping & Equipment
 - 3.4.3.1 Pipe, duct and equipment hangers and supports must be per the local code.
 - 3.4.3.2 Flash and seal equipment and pipe stacks.
- 3.4.4 Vibration and Seismic Controls for HVAC Piping & Equipment
 - 3.4.4.1 Air handlers, furnaces, fans and fan coils must be suspended or supported with spring isolator unless internally isolated.
 - 3.4.3.2 Provide flexible duct connections at all air handlers, rooftop units and fans, unless internally isolated
- 3.4.5. Identification for HVAC Piping & Equipment
 - 3.4.5.1. Equipment: Permanent label (stencil, metal tag or engraved plastic) with unit tag or name and area or space served.
- 3.4.6. Testing, Adjusting and Balancing (TAB) for HVAC
 - 3.4.6.1. Balance may be by a qualified employee of the mechanical contractor. Technician must be AABC or NEBB certified.
 - 3.4.6.2 Balance in accordance with NEBB Procedural Standards –1999 Procedural Standards for Building Systems, or AABC 2002 Associated Air Balance Council Test and Balance Procedures.
 - 3.4.6.3. Adjust system to achieve air quantities shown, then adjust volumes to provide constant temperature (± 2 °F) throughout the zone. Adjust fan sheaves, when applicable and where available. Calibrate all thermostats. Mark setpoints on all dampers and valves. Return to project at 1 and 3 month intervals after completion to make balance adjustments in response to Owner's perceived comfort.
 - 3.4.6.4 Submit report (NEBB or AABC format) and include
 - 3.4.6.4.1. General data: Nameplate data on all equipment. Outside air temp; cfm each supply, exhaust and return grille and actual room temperatures and humidities vs. setpoints
 - 3.4.6.4.2. Fans: Volume and static pressure; fan rpm and amps
 - 3.4.6.5. Air systems will be balanced to meet air quantities shown at each air device; and, in a manner to first minimize throttling losses in the effected system. Then, for fans with fan system power greater than 1 HP, fan speed must be adjusted to meet design flow conditions.
 - 3.4.6.6. HVAC control systems must be tested to ensure that control elements are calibrated, adjusted, and in proper working condition. Submit test documentation.
- 3.4.7. HVAC Equipment Insulation

- 3.4.7.1. Flame spread less than 25, smoke developed less than 50 as per ASTM E84, NFPA 255, UL 273.
- 3.4.8. Commissioning of HVAC
 - 3.4.8.1. All projects less than 480,000 Btu/h cooling capacity and 600,000 Btu/h combined service water-heating and space-heating capacity or with systems that serve individual dwelling and sleeping units: Test and balance contractor must observe HVAC control systems and document that all control elements are calibrated, adjusted, and in proper working condition.
- 3.4.9. HVAC DUCTS
 - 3.4.9.1. Do not fabricate duct from these drawings, confirm all dimensions and available space in field. Dimensions given on drawings are inside free area, sheet metal is larger on lined duct. Branch takeoffs to have 45 degree entry fitting with volume damper. Elbows to be radius type with minimum centerline radius 1.5 times width or mitered elbows with single thickness turning vanes.
 - 3.4.9.2. Sheet metal: Use galvanized sheet metal, conforming to current SMACNA for construction, reinforcing, support and other aspects.
 - 3.4.9.3. Pressure Class:
 - 3.4.9.3.1. Supply from single zone units: +1"
 - 3.4.9.3.2. Return: -1"
 - 3.4.9.3.3. Exhaust: -1" upstream of fan, 1" downstream
- 3.5. Painting.
 - 3.5.1. Field Priming. Shop (factory) prime surfaces of equipment, steel, and cast iron unless specified elsewhere. Field prime any such surfaces which have not been shop primed. Field prime galvanized, wood, and concrete surfaces.
 - 3.5.2. Painting Schedule. Paint using the following schedule (Table) for prime, intermediate, and finish coats for surfaces to be painted. Paint all exposed surfaces, including sides and edges.

Items to receive paint: Pump station piping, fittings, valves and appurtenances (exposed/unburied ferrous surfaces)
 - 3.5.3. Surfaces Not to Be Painted. Except as otherwise required or directed, leave exposed surfaces of aluminum, polished or finished stainless steel, nickel or chromium, and rubber and plastics surfaces unpainted.

Surface Type	System Type	Surface Preparation	COATS					
			1 st	DFT	2 nd	DFT	3 rd	DFT
Factory Primed Steel: Doors, Frames, Equipment								
Exterior Exposed	Epoxy/Urethane	Clean & Dry	Shop Prime	N/A	Series 27, Typoxy	2-3	Series 1075 Endura Shield II	2-5
Interior Exposed	Epoxy	Clean & Dry	Shop Prime	N/A	Series 27, Typoxy	2-3	Series 1075 Endura Shield II	2-5
Galvanized Steel & Nonferrous Metal								
Exterior Exposed	Epoxy/Urethane	Manufacturer's Recommendation	Series N 69	2-3	Series 1075	2-3	NA	NA
Interior Exposed	Epoxy	Manufacturer's Recommendation	Series N 69	2-3	Series N 69	2-3	NA	NA
Immersion	Epoxy	SSPC-SP1 & Abrasive Blast	Series N 69	3-5	Series N 69	4-6	NA	NA
Ductile or Cast Iron								
Exterior Exposed	Epoxy/Urethane	Manufacturer's Recommendation	Series N 69	3-5	Series N 69	4-6	Series 1075 Endura Shield II	2-3
Interior Exposed	Epoxy	Manufacturer's Recommendation	Series N 69	3-5	Series N 69	4-6	NA	NA
Immersion	Epoxy	Manufacturer's Recommendation	Series N 69	3-5	Series 46H-413	14-20	NA	NA
Ferrous Metal								
Exterior Exposed	Epoxy/Urethane	SSPC-SP6	Series 91-H ₂ O	2.5-3.5	Series N 140 - Pota-Pox Plus	4-6	Series 1075 Endura Shield II	2-3
Interior Exposed	Epoxy/Urethane	SSPC-SP6	Series 91-H ₂ O	2.5-3.5	Series N 140 - Pota-Pox Plus	3-5	Series N 140 - 15 BL Pota-Pox Plus	4-6
Immersion	Epoxy	SSPC-SP10	Series 91-H ₂ O	2.5-3.5	Series N 140 - 1255 Pota-Pox Plus	3-5	Series N 140 - 15 BL Pota-Pox Plus	4-6
Concrete								
Interior Exposed	Epoxy	SSPC-SP 13 & Brush Blast	Series 84	4-6	Series 84	4-6	NA	NA
Immersion	Epoxy	Brush Blast	Series 218	Fill Voids	Series N 140	4-6	Series N 140	4-6
PVC								
Exterior Exposed	Epoxy/Urethane	Clean & Dry	Series N 69	2-3	Series 1075 Endura Shield II	2-3		
Interior Exposed	Epoxy	Clean & Dry	Series N 69	2-3	Series N 69	2-3		

Comment [LP1]: Pota-Pox is for potable water applications like water tanks. These should be series N69 systems which work for sewage

Comment [LP2]: This is different from the concrete coatings specified in the front of the spec. need to coordinate which one we want.

- 3.5.4. Exposed Piping. Paint or repaint all exposed piping, valves and supports. Match the color of existing like piping. Paint all runs of existing piping where modifications were performed.
- 3.5.5. Mixing and Thinning. Mix and thin paint according to manufacturer's current product data sheet.
- Unless otherwise authorized, factory mix all paint to proper consistency and viscosity for hot weather application without thinning. Thinning permitted only as necessary to obtain recommended coverage at lower application temperatures. Do not reduce the wet film thickness of applied paint by the addition of paint thinner below that represented by the recommended coverage rate.
- 3.5.6. Surface Preparation. Prepare all surfaces as recommended by the paint manufacturer's current product data sheet.
- Paint surfaces that are dry and free of dirt, dust, sand, grit, mud, oil, grease, rust, loose mill scale, or other objectionable substances. Perform cleaning and painting in a manner which will prevent dust or other contaminants from getting on freshly painted surfaces. Remove oil and grease by use of solvents or detergents before mechanical cleaning is started.
- Prepare surfaces to be free of cracks, pits, projections, or other imperfections which would prevent the formation of a smooth, unbroken film.
- When applying touch-up paint, or repairing previously painted surfaces, clean and sand or wire brushed surfaces to be painted in such a manner that the edges of adjacent paint are feathered or otherwise smooth so that they will not be noticeable after painted. Remove all paint made brittle or otherwise damaged by heat of welding. Provide the type of surface preparation shown in the paint schedule.
- 3.5.7. Hardware. Cleaning of hardware and hardware items such as bolts, screws, washers, springs, and grease fittings not required before painting if there is no evidence of dirt, corrosion, or foreign material.
- 3.5.8. Application. As a minimum, apply paint according to the paint manufacturer's current product data sheet.
- Apply paint in a neat manner, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Allow each paint coat to be hard and dry through the entire paint film before applying the next coat. Apply each coat in a manner that will produce an even film of uniform and proper thickness. Do not apply paint at a rate of coverage that is greater than the maximum rate recommended by the manufacturer.
- Do not produce sags, checks, blisters, teardrops, or fat edges as a result from painting. Remove paint containing any of these defects and repaint the surface.
- 3.5.8.1 Priming. Provide edges, corners, crevices, welds, and bolts with a brush coat of primer before the specified spot or touch-up painting of metal surfaces. Fill all crevices with paint.

Repaint abraded and otherwise damaged portions of shop-applied paint. Apply a coat of the specified primer to welded seams and other uncoated surfaces, heads and nuts of field-installed bolts, and surfaces where paint has been damaged by heat. Complete this patch, spot, or touch-up painting and allow to cure before applying additional paint.

- 3.5.8.2. Weather Conditions. Do not apply paint, except under shelter, during wet, damp, or deteriorating weather, or when windblown dust, dirt, debris or insects will collect on freshly applied paint. Apply paint in strict accordance with the manufacturer's recommendation.
- 3.5.9 Repairing Damaged Paint on Equipment. Repaint painted surfaces of equipment that have become damaged before acceptance by the Engineer with the same paint used in the original application.
- 3.5.10. Protection of Surfaces. Use drop cloths, masking tape, and other suitable measures to protect all surfaces from accidental spraying, spattering, or spilling of paint. Correct and repair any damaged condition resulting from construction operations. Remove any paint deposited on surfaces that are not being painted at the time. In case bituminous paints are spilled or dropped on any material except metals, surface clean and repaint damaged paint spots or paint with two coats of masonry paint.
 - 3.5.10.1 Surface Preparation Debris Containment.
 - 3.5.10.1.1 When required by federal, state or local regulation, enclose entire tank and structure and contain surface preparation debris.
 - 3.5.10.1.2. Follow Steel Structures Painting Council, SSPC 61 Guide for Containing Debris Generated during Paint Removal Operations.
 - 3.5.10.1.3. Keep work clothing at site.
 - 3.5.10.2 Disposal of Surface Preparation Debris.
 - 3.5.10.2.1. Follow Steel Structures Painting Council, SSPC 71 Guide for the Disposal of Lead-Contaminated Surface Preparation Debris.
 - 3.5.10.2.2. Dispose surface preparation debris in compliance with applicable federal, state and local regulations.
- 3.6. Lift Station Fencing.
 - 3.6.1. Chain Link Fence. Provide posts set in concrete and spaced as shown on the Plans. Align the posts carefully and set to vertical. Trowel the tops of the concrete bases to drain water away from the posts. Install fabric in accordance with industry practice, stretched taut, and free of slack edges or warped sections.

Construct lift station fence in accordance with Item 550, "Chain Link Fence".
- 3.7 Lift Station Surfacing.

- 3.7.1. Subgrade Preparation. Before placing surfacing material, shape the roadbed to the lines, grades and cross sections to form a reasonably smooth and uniform surface without irregularities and compacted to 95% maximum density.
- 3.7.2. Hauling Material. Haul approved materials in suitable vehicles having dump beds suitable for dumping the materials along the subgrade as directed. Do not haul materials when in the judgment of the Engineer, the weather or road conditions are such that hauling operations cause excessive cutting or rutting of the road surfaces.
- 3.7.3. Placing Material. Place aggregate in uniform layers of thickness, not to exceed 6-in., as shown on the drawings. Take precautions while placing to prevent segregation of materials.
- 3.7.4. Compaction. Compact the aggregate to a uniform density of not less than 95% of the maximum density as determined by AASHTO Standard Method T-99.
- 3.7.5. Maintenance. Maintain the aggregate surfacing until accepted and replace any material displaced by any cause to the lines, grades, and section shown on the Plans.
- 3.7.6. Waybills and Delivery Tickets. Submit copies of waybills or delivery tickets during the progress of the work.
- 3.8 Lift Station Demolition and Salvage.
 - 3.8.1. Construction Requirements.
 - 3.8.1.2. Regulations. Meet applicable provisions of the Department of Labor Occupational and Health Standards (29 CFR-Part 1910), and Safety and Health Regulations for Construction (29 CFR-Part 1518); and, the requirements specified herein.
 - 3.8.1.3. Protection. Before performing any cutting or demolition work, carefully survey the existing work and examine the drawings and specifications to determine the extent of the work. Take all necessary precautions to ensure against damage to existing work or infrastructure to remain, to be reused, or to remain the property of the Owner.
 - 3.8.1.4. Wastewater Disposal. Once construction, testing and commissioning of the proposed lift station are complete, and before any cutting or demolition work of the existing lift station, the contents of the existing lift station's wet well will be removed, transported and disposed of by a contractor licensed by the State of Texas to perform such operations. This removal process must include a thorough (pressure) washing of the wet well's interior walls and floor to the extent the empty basin will no longer pose a hazard to any properly-outfitted workers that may be required to enter the space. The contents of the wet well must be delivered to a wastewater disposal facility licensed by the State of Texas to receive and process such materials.
 - 3.8.1.5. Dust Control. Control the amount of dust resulting from demolition. Prevent the spread of dust and creation of a nuisance in the surrounding area. Do not use water when it will create hazardous or objectionable conditions such as ice, flooding or pollution.

- 3.8.1.6. Protection of Life and Property. Protect and maintain applicable public and private property. Provide all necessary barricades or protection to safeguard the public against all hazards that might arise from the construction work.
- 3.8.1.8. Procedures. Submit procedures proposed for the accomplishment of salvage and demolition work for approval.
- 3.8.1.9. Utilities. Remove all existing utilities as shown on the plans, uncovered by demolition, or as directed. Terminate in a manner and at a time satisfactory to the authorities having jurisdiction. Permit utility owner(s) access to effect the removal of their materials.
- 3.8.1.10. Inspection by Public Agencies. Provide access to work by authorized representatives of the State of Texas and the Owner wherever it is in preparation or progress.
- 3.8.1.11. Demolition. Demolish the specific structures/materials and remove the resulting debris as specified and indicated on the Plans.
- 3.8.1.12. Above Ground Structures. Raze and dispose of all concrete, masonry, roofing material, timber, flooring, wall and ceiling materials, piping, electrical, equipment and other miscellaneous construction materials as specified herein and as indicated on the Plans.
- 3.8.1.13. Below Ground Structures. Completely remove concrete walls and foundations/bases. Backfill with clean, acceptable fill materials as directed or specified herein. Remove and dispose of below ground structures and materials with all concrete, masonry, construction materials, timber, flooring, wall and ceiling materials, piping, electrical, equipment and other miscellaneous construction materials removed and disposed of as specified herein before backfilling.
- 3.8.1.14. Remove pipelines as directed on the plans or by the Engineer. Pipeline demolition will include all valves, valve boxes, fittings, fire hydrants, water meters/assemblies, service lines, manholes, valve vaults, and all other appurtenances associated with the main line utility.

Remove pump station as directed on the plans or by the Engineer with removal of all wet wells, valving, electrical equipment/infrastructure, force main, gravity lines, fencing, and all other appurtenances associated with the pump station.
- 3.8.2. Disposal and Salvage of Materials.
 - 3.8.2.1. Title of Materials. Unless reserved by others, own title to all materials and equipment to be demolished upon receipt of contract notice to proceed. The Department and Owner will not be held responsible for the condition, loss or damage to such property after notice to proceed is issued.
 - 3.8.2.2. Material for Salvage. Equipment and materials may be salvaged by the Contractor unless specifically identified as reserved items herein or on the Plans. Own all salvaged materials and equipment and removed from the site.

- 3.8.2.3 Reserved and Salvaged Items. Reserve the following existing equipment from demolition/removal operations for the City of Premont and deliver to the City as directed by a representative of the City:
 - 3.8.2.3.1. Pumps, motors and power cords
 - 3.8.2.3.1.2. Pump station float switches
 - 3.8.2.3.1.3. Water meters and fire hydrants
 - 3.8.2.3.1.4. Emergency generator
- 3.8.3. Unsalvageable Materials List. Dispose of concrete, masonry, miscellaneous metal and other materials, in an approved off-site disposal area. Provide needed excavation and transportation for proper disposal.
- 3.8.4. Environmental Protection. Comply with all Federal, state and local regulations pertaining to environmental protection during excavation, handling and disposal of materials.
- 3.8.5. Pavements and Structures. Raze, remove and dispose of existing piping, structures, and other obstructions as described on the Plans. Dispose of all concrete, reinforcing steel, and timber off the project site unless approved otherwise by the Engineer or as indicated on the Plans. If disposal is on private property, obtain written permission of the property owner on whose property the material is placed. Furnish copies of all agreements with property owners to the Engineer.
- 3.8.6. Abandonment of Pipe and Structures. Abandoned pipe in place must be purged and plugged at both ends with a minimum 12" concrete plug. At the Contractor's option, remove existing piping as an alternative to abandonment, at no additional cost to the Department.
- 3.8.7. Disposal of Trash and Debris. Remove and properly disposed of all trash and waste before the completion of demolition services. Clean up and disposal of trash and debris from the site. Dispose of demolition waste in a TCEQ permitted Construction or Demolition (C&D) landfill. Comply with all C&D landfill requirements for disposal.
- 3.8.8. Trucks. Collect and transport debris. Perform all truck hauling in compliance with all Federal, State and local regulations. Provide trucks utilized in hauling debris with a means to effectively contain the debris on the vehicle while hauling.
- 3.9. Finish Grade and Cleanup.
 - 3.9.1. Debris and Rubbish. Remove debris and rubbish from the site as soon as practicable. Do not allow to accumulate in building or on site.
 - 3.9.1.2. Debris Control. Remove and transport debris in a manner to prevent spillage on streets or adjacent areas, and as approved by the Engineer.
 - 3.9.1.3. Regulations. Comply with all local, state and federal regulations regarding hauling and disposal.

- 3.9.1.4. Grading. After the removal work is completed, grade all areas within the construction area as indicated on the Plans such that drainage will be provided at all times resulting in no ponding or detention on or adjacent to the Project site. Bring all low sections, holes or depressions to the level by filling and compacting, as required.
- 3.9.1.5. Fill. Furnish fill material approved by the Engineer. Place fill where structures have been removed to provide positive site drainage. Place fill in layers not exceeding eight (8) in. (loose measurement) and compact to 95% of standard proctor at the designated moisture content as indicated by the standard proctor test. Supplying a standard proctor test for each type of fill material used.
- 3.10. Equipment Schedule. Provide manufacturer's field services, and operation and maintenance manuals for the items of equipment indicated in the following schedule:

<u>Type of Equipment</u>	<u>Mfr's Field Services</u>	<u>O&M Manual</u>	<u>Certificate of Compliance</u>
Sanitary Sewer – Valves & Covers	X	X	X
Water Mains – Valves & Fire Hydrants	X	X	X
Pump Station Equipment & Appurtenances	X	X	X
All Electrical Equipment & Work	X	X	X

- 3.11. Testing.
- 3.11.1. Lift Station Testing. Perform all tests to determine compliance with the Contract Documents using an independent commercial testing firm acceptable to Engineer. Use a testing firm staffed with experienced technicians properly equipped and fully qualified to perform the tests in accordance with the specified standards.
- Owner provided testing services performed for the sole benefit of Owner; however, test results will be available to Contractor. Contractor testing necessary to satisfy Contractor's internal quality control procedures the sole responsibility of Contractor.
- Unless otherwise specified, provide all testing services in connection with the following items. Use the minimum acceptable party contained within the parentheses to perform the testing. Make all testing available for observation by the Engineer's and Owner's representative. Submit all testing results to one or all parties within the day following the tests. Perform all testing in strict accordance with the appropriate specification section and industry standards.
- 3.11.1.1. Wet Well Testing. Manholes/Wet Wells. (Contractor or Independent Contractor)
- 3.11.1.2. Pump Testing. Pump tests. (Contractor and Pump Manufacturer's Representative)

- 3.11.1.3. Pipe Testing. Pipeline tests including pressure and deflection. (Contractor or Independent Contractor)
- 3.11.1.4. Electrical Testing. Electrical and Equipment tests. (Contractor or Independent Contractor)
- 3.11.1.5. Controls/Alarm Testing. Control methods and auto dialer testing (Contractor or Independent Contractor)
- 3.11.1.6. Concrete Testing. Concrete materials and mix. (Independent Lab)
- 3.11.1.7. Soils Testing. Moisture-density, proctors and relative density and permeability tests on embankments, embedments, fill and backfill materials. (Independent Lab)
In-place field density tests on embankments, embedments, trenches, fills and backfill. (Independent Lab)
- 3.11.2. General. Allow the Engineer and Owner's representative to witness all testing the Contractor is conducts throughout the entirety of the testing. Provide a minimum of 24 hr. advance notice to the Engineer and Owner.

Obtain Engineer's acceptance of the testing firm(s) for each testing item before having services performed, and pay all costs for these testing services. If the proposed testing firm(s) is unacceptable to the Engineer, provide alternative proposed testing firm(s) as many times as necessary in order to retain the services of a testing firm(s) which is acceptable to the Engineer.
- 3.11.2.1 Transmittal of Test Reports. Submit written reports of tests and engineering data furnished by Contractor for Engineer's review of materials and equipment proposed to be used in the Work as specified for Shop Drawings. Submit all test results and reports to the Engineer within 2 working days of the completion of the test before payment being released to the Contractor.
- 3.12. Guarantee. Guarantee all materials, workmanship and the successful operation of all systems installed for a period of one year from the date of final acceptance of the whole work and repair or replace at his own expense any part of the work item which may show defect during that time, provided such defect is, in the opinion of the Engineer, due to imperfect material or workmanship and not careless or improper use.
- 3.13. Start-Up. After installation of all equipment and before operation of the facility, check out and calibrate all equipment by an authorized representative fully knowledgeable/licensed in each applicable discipline. Submit installation certifications, test reports and warranties and conduct operator/Owner training.
- 3.14. Measurement.
- 3.14.1. The operational building, demolition, electrical power and controls, electrical pumps, generators, wet wells, and piping satisfactorily completed in accordance with the plans and specifications to form a fully functional automatic pumping station will be measured as a complete unit by lump sum as Each (EA).

- 3.14.1.2 For the purpose of milestone measurement only, the following work categories may be paid once items in each specific category are substantially complete.
 - 3.14.1.2.1. Mobilization and Demolition – 20%
 - 3.14.1.2.2. Lift Station Concrete Work – 45%
 - 3.14.1.2.3. Lift Station Site Work and Fencing – 50%
 - 3.14.1.2.4. Lift Station Electrical Work. – 75%
 - 3.14.1.2.5. Lift Station Control Work – 85%
 - 3.14.1.2.6. Lift Station Painting, Startup and Testing – 95%. Full Payment after acceptance.
- 3.15. Payment.
 - 3.15.1 The work performed and materials furnished in accordance with this Item, and measured as provided un "Measurement" will be paid for at the unit price bid for "Sanitary Sewer Lift Station," at the location specified. This price is full compensation for furnishing and installing a fully operational automatic pumping station and for the equipment required by this Item including demolition, site improvements, building, generators, pumps, discharge pipes, sensors, controls, switchgear, electrical systems, wet well, and for other materials, labor, tools, equipment, accessories, and incidentals. Any costs associated with dewatering, electrical service, and testing are subsidiary to this Item. The work performed, materials furnished, equipment, labor, tool, and incidentals for construction of the Lift Station will not be paid for directly, but are subsidiary to this Item.