

Special Specification 7229

SH 207 Pump Station Upgrades



1. DESCRIPTION

Work includes upgrade of the existing electrical and mechanical system for the existing SH 207 Pump Stations. Contractor will install manual transfer switches and controls to upgrade the existing electrical distribution system. Mechanical improvements include upgrading pump to submersible system. The facility must be complete, functional, and fully automatic consisting of the following:

- Electrical Systems
- Submersible Pump
- Water Level Control System
- Transfer switch for use of portable Standby Engine-Generator Set
- Wireless Remote Monitoring and Notification System
- Security lighting system
- Portable trailer mounted backup generator

2. MATERIALS

2.1. Submit the following items to the Engineer for approval before using them on this project. Submit shop drawings electronically in accordance with Item 5, "Control of Materials" in the General Notes.

2.1.1. Electrical. Provide certified manufacturer's outline dimensioned drawings, brochures, and descriptive bulletins of the equipment to be used. Include scaled layouts of the switchgear. Submit shop prints for the fabricated items.

2.1.2. Pumps. Submit general arrangement drawings, performance curves for pumps, complete electrical characteristics of motors and installation details, and details on accessories (hatch, cable holders, base elbows, etc.)

2.1.3. Wireless Remote Monitoring and Notification System. Provide manufacturer's brochures and installation diagrams.

2.1.4. Safety lights. Provide manufacturer's brochures and installation drawings.

2.2. Approval. Upon approval of the above items, construct the facility or any portion of it pertaining to the approved items.

If an approved item requires dimensional changes or alterations of the project plans, prepare at no expense to the Department, the necessary drawings and submit electronically to the Engineer for approval. Upon approval, proceed with that portion of the pumping station affected by the change.

No changes are permitted in the list of equipment or shop drawings once approved, unless authorized in writing by the Engineer. Approved equipment and drawings constitute final plans for construction of the facility. Approval, in no way relieves the Contractor or equipment suppliers of any responsibilities described elsewhere in these specifications.

2.3. Operation Manuals. Upon determination of the equipment to be used in this station and before final acceptance of this project, furnish the Engineer 3 books each containing the following:

- 2.3.1. The portions of data required for approval of Section 2.A. Items "1" through "10" and "as built" drawings. Include complete operation manual, lubrication instructions, service, maintenance instructions, and parts lists.
- 2.3.2. The complete sequence and full description of operating instructions, noting all precautions.
- 2.3.3. The parts list for each item of mechanical and electrical equipment.
- 2.3.4. Bound copies of warranties and guarantees with dates of expiration, also names and addresses of persons providing warranties and guarantees.
- 2.4. Diagram. Furnish 22 in. x 34 in. diagrams, laminated with clear plastic, showing in detail each circuit of the control devices with each wire individually numbered. Upon approval by the Engineer, frame the laminated diagrams and protect with clear plastic sheet and place them on a wall near the Motor Control Center located in the generator building.

3. EQUIPMENT

- 3.1. Provide electronic control components conforming to the following:
 - 3.1.1 Wire and Cable.
 - A. Design. Provide cable designated as XHHW, single conductor, copper and UL 83 and UL 1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90 C in dry locations and 75 C in wet locations while installed above ground in conduit or in control panels. Provide conductors which are Class D, concentric stranded, annealed uncoated copper with physical and electrical properties complying with ASTM B 3 and ASTM B 8 and Part 2 of ICEA S-68. The minimum size of wire and cable for power must be No. 12 AWG and No. 14 AWG for control wiring. Type MTW stranded is also acceptable for control wiring.
 - B. Insulation. Each conductor must be PVC insulated and nylon jacketed to meet the requirements of Part 3 of ICEA S-68-516, NEMA WC 8, UL 44, and IEEE 383.
 - C. Wire Marking
 - 1. Wire marking must be in accordance with National Electrical Code (NEC) Article 310 and must be printed on the wire insulation at 2-ft. intervals.
 - 2. The printing method used must be permanent and the color will sharply contrast with the jacket color.

The single conductor color coding will be as follows:

| <u>System Voltage</u> | <u>A</u> | <u>B</u> | <u>C</u> | <u>Neutral</u> |
|-----------------------|----------------|----------------|----------------|----------------|
| 120/208 Volt 3Ph/4w | Black | Red..... | Blue | White |
| 120/240 Volt 3Ph/4w | Black | Orange | Blue | White |
| 277/480 Volt 3Ph/4w | Brown | Purple..... | Yellow | Grey |
| Motor Control | | 1 | Black | |
| | | 2 | Red | |
| | | 3 | Blue | |
| Ground | | Green | | |

- D. All wiring must be megger tested before it is terminated. All megger testing results must be neatly recorded in a typed format for each power, instrumentation and control conductor. All results must be submitted for review before energizing the system. Conductors believed to have damaged insulation will be replaced at no expense to the Owner.

3.1.2 Conduit.

For underground conduit, use PVC Sch 80 heavy wall with 90°C wire rating, UL- listed. Provide a minimum 2 in. clearance between conduits, and minimum 24 in. cover or as noted on the plans. Use galvanized rigid steel (GRS) conduit for exposed conduit. All conduit must be supported on type 304 stainless steel Unistrut that is anchored with Type 304 stainless steel hardware. All conduit clamps must be Type 304 stainless steel.

3.1.3 Lighting Panel.

- A. Lighting panel must be fabricated with a copper bus and housed in a NEMA 3R enclosure for wall mounting. The number of required circuits must be as indicated on the drawings. The thermal magnetic breakers must be of the bolt-in type. Branch circuit breaker interrupting capacity must be minimum 10,000 AIC for 208V and 25,000 AIC for 480 volts. Provide breakers with the number of poles and trip ratings as shown on the Drawings or as required by the associated equipment. Provide ground fault interrupters as noted. Mount the enclosure on Type 304 stainless steel Unistrut that is attached with Type 304 stainless steel hardware.

3.1.4 Selector Switches, Pushbutton Control Station, and Pilot Devices.

Ensure these are 30.5 mm, heavy-duty, oil tight, and with nameplates.

3.1.5 Controls.

Mount controls in an independent control panel as indicated on the plans and the control wiring schematics. Permanently label each lamp, relay, switch, and any other device with nameplates as to their designation and function. Provide industrial type control relays with a minimum contact rating of 10 amps at 250 volts AC, Square D Type X, GE class CR122B, or approved equal.

Furnish and install a RACO Cellularm LTE Cellular Telephone Communication System unit with an integral RACO Verbatim auto-dialer installed inside the Cellularm enclosure. The Verbatim Auto-Dialer must be equipped for no less than sixteen discrete inputs. The Cellularm unit must be compatible with the cellular network provider in the Panhandle, Texas area. Presently the Cellularm unit is compatible with AT&T Cellular. Soon compatibility with Verizon's Cellular System will be available. TxDOT representatives should determine which system to install and make functional

3.1.6 Light Switches.

Mount the switches 4.5 ft. from finished floor and label them.

3.1.7 Receptacles.

Receptacles will be housed in cast enclosures with weatherproof covers.

3.1.8 Grounding System.

As shown on plans.

3.1.9 Main Disconnect.

Provide main breakers that are solid state with insulated cases, 100 percent service entrance rated, with a UL interrupting rating of 100,000 amps rms symmetrical. Provide the main breakers with the following adjustable trip functions: long time, short time, and instantaneous pickup. Coordinate and set tie breaker variables with the switchgear manufacturer. Coordinate the main and pump breakers for overcurrent tripping. Coordinate the main protective equipment with the governing utility company's transformer protective equipment. Ensure a short circuit study is performed by the manufacturer in accordance with the requirements of NFPA 70E and provided to the Engineer in report format as a submittal. The report must include the breaker time current curves, caloric arc-flash energies, separation distances, etc. All equipment must be labeled per the requirements of NFPA 70E.

3.1.10 Manual Transfer Switch (MTS).

Provide an MTS that is three-phase, 208 V, 60 Hz, three-phase with a solid neutral. The MTS must be provided with a one-year manufacturer warranty. Ensure the current rating, configuration and construction of the MTS is as shown on the plans. Provide the Department a copy of the manufacturer's warranty and any information concerning parts and service support. Product submittal will include capacities, weight, operating characteristics, specification compliance submittal, detailed wiring diagrams and point by point schematic, one-line diagram and options/features list, and detailed configuration. Ensure each manual transfer switch is mechanically held on both the emergency and the normal side and is rated for continuous duty in an unventilated enclosure. Provide double throw switches with the main contacts rigidly and mechanically interlocked to ensure only two possible positions: normal or emergency. Provide a manual operator to enable one hand manual operation.

3.2. Storm Water Pumps.

Provide pumps of the electric submersible type complete with a double pipe guide rail mounting system. Use motors meeting NEMA standards. Equip each pump with a moisture sensor and a stator temperature sensor. Ensure the moisture sensor turns on blue light in the motor starter section that must be manually reset but does not inhibit pump operation. Provide a stator high temperature sensor that disables the pump until it is manually reset.

3.2.1 Provide pumps that are complete with the accessories required for operation as described in this specification. Supply storm water pumps that are the product of one manufacturer and are identical. Use pump power cables and pump status monitoring cables that are designated for submersible pump applications and meet the NEC code for wire sizes. Install the pumps using experienced pump installation personnel or those under the direct supervision of a qualified representative of the pump manufacturer. Do not use the new pumps for construction dewatering.

3.2.2 The pump supplier must maintain parts and service facility in Houston or Dallas and cover a minimum of 75% of parts service within 24 hr. or 90% within 48 hr. supply

3.2.3 Pump Performance. Provide a squirrel cage, high-performance induction motor for the storm water pumps with a maximum of 20 HP and operating on 208V, 3-Phase, 60 Hz service. Ensure the motor has a NEMA design "B" rating or better with moisture-resistant Class "F" insulation rated for 180°C and a locked rotor starting current rating of code "H" maximum. Ensure motor bearings are of the anti-friction, permanently lubricated type with a B-10 life of 40,000 hr. Use a special submersible service type of motor cable with a chloroprene rubber jacket sized per NFPA 70, National Electrical Code. Provide for the cable to enter the motor through a separate entry compartment, with an external mechanical clamp and a separate internal compartment sealed from above and below to prevent migration of moisture and gas through the conductors. The conductors for these functions are separate from the motor power cable. Verify the cable lengths. Size each stormwater pump to deliver 850 gpm at a total dynamic head (TDH) of 30 ft. and to operate at maximum efficiency without cavitation or vibration between a maximum TDH of 30 ft. and a minimum of 26.5 ft. The pump motor minimum power factor is 0.85 at any load and must never exceed unity. The power may be corrected by using power factor correction capacitors connected on the line side of the motor starter as far upstream as possible.

3.2.4 Pump Construction. Construct the pump as follows:

- Provide a casing made of fine grain cast iron with smooth surface; ASTM A 48 Class 35B minimum.
- Provide casing seals designed for continuous submergence at a depth of 60 ft.
- Provide a wear ring that provides a seal between the impeller and the volute.
- Use a shaft seal that is a tandem mechanical rotating type, running in an oil bath that hydrodynamically lubricates the lapped seal faces at a constant rate. Use seal wear rings with the characteristics of tungsten carbide
- Provide seals capable of sealing pressure equal to 65 ft. of head
- Furnish a pump capable of being run dry without damage. Provide a drop-in type pump, that when removed from the surface, leaves the pump discharge piping in place.
- Ensure the pump manufacturer submits for approval, certified test results stating that the pumps will operate as required. Impeller to be the multi-vane type and made of cast iron, type A48, Class 35B.

3.2.5 Pump Retrieval System. Incorporate the Pump Retrieval System into the pump design. Furnish a pump capable of being removed using a single, Type 304 stainless steel wire rope and lifted easily, securely, and safely in one continuous motion. Provide properly sized stainless-steel thimble eyes and shackles. Provide a wire rope assembly with a minimum safety factor of 3:1 based on the breaking strength of the wire rope and the weight of the pump. Submit the lifting technique for approval. Use stainless steel hardware.

3.2.6 Stormwater Pump Discharge Line. Provide the following components:

- Discharge Pipe. Use 150 lb. ductile iron pipe or steel pipe per ASTM A 53 Type E, Grade A or B, API 5L, hot dip galvanized. Size as shown on plans
- Weld Flanges. Supply 125 lb., flat face, slip-on registered machined steel in conformance with AWWA C207, Class B. Use full face flange gaskets made of neoprene rubber.
- Gaskets. Provide 125 lb., full face, neoprene rubber gaskets.
- Bolts. Use ASTM A 193-B7 hex head bolts with ASTM A194-2H nuts, hot dip galvanized

3.3. Portable Trailer Mounted Backup Generator.

The new engine generator unit to be furnished within an outdoor, weatherproof and acoustically sound attenuated enclosure that is mounted on a two-wheel trailer that is fully designed and certified for highway use. The trailer must be equipped with all required stop and clearance lighting to assure compliance with all applicable codes, regulations and laws. The unit output will be 120/208-volt, 3-phase. Fast starting and quick load pickup capabilities are mandatory characteristics of this equipment. The generator must be capable of powering a 50A, 120-volt, single-phase load from the light panel and subsequently start a 20HP, 3-phase, 208-volt submersible pump with no more than a 25 percent voltage drop. Certified sizing calculations must be provided as a submittal to substantiate the unit rating.

The new emergency engine generator unit must consist of a single diesel fueled engine driven electric generating unit which is pre-wired, pre-piped, assembled and aligned on a trailer, complete, delivered, installed, and tested.

3.3.1 The engine generator set, including accessories, to be furnished by a single supplier who has been regularly engaged in the production of similar engine generator sets for a minimum of twenty (20) yr. The two (2) acceptable generator manufacturers for this project are Cummins and Caterpillar. All components to be manufacturer's factory built and factory tested components that are furnished by the single supplier to ensure one source of supply and responsibility for warranty, parts and service. A local factory authorized representative of the engine generator manufacturer within fifty (50) miles of the Project site who can provide factory trained service personnel, the required inventory of replacement parts, and technical assistance.

The responsibility for the overall performance of the engine generator set relative to the requirements of these specifications are not to be divided among individual suppliers of components of the systems but to be assumed solely by the manufacturer of the engine generator unit.

3.3.2 All controls are to be the standard of the manufacturer who is engaged in the manufacture of engines and generators and has such controls available for purchase on the open market. Control parts to be identified by part numbers of the manufacturer and have a second source listing where applicable. Control systems supplied by a sub-vendor or sub-contractor of the manufacturer and not incorporated in the documentation data of the engine or generator manufacturer are not acceptable.

The equipment described herein conforms to that of recognized manufacturers of diesel engines, electric generators and accessory equipment. All equipment furnished must conform to that specified herein regarding quality, operation, and function. Where shown, named manufacturers are included to establish a level of quality and experience, and are not to be construed as a sole source of supply unless specifically stated.

3.3.3 The emergency engine generator set will have as a minimum the standby power rating required by the previously stated operating conditions while operating under the Panhandle, Texas area environmental conditions and using the fuel specified herein.

Information on the longest period of full-load operation permissible before shutting down for maintenance is recommended must be provided

The generator set will be provided with a trailer mounted fuel tank capable of fueling the engine at 75% of rated capacity for 24 hr.

The engine generator unit must be capable of operation at any speed at no load, and at any load at full speed, without excessive vibration or dangerous stresses. The complete unit must be capable of 25% over speed without failure of any component.

Provide a battery-operated starting system for the engine. Battery set will be 12-volt DC maintenance free unit.

Provide a fully automatic battery charging system with high and low rate charging and equalizing charging by manual operation. The charger must have a minimum 10-amp, 24-volt DC output with a 115-volt, 60 Hz input and be capable of fully charging the batteries within a period not to exceed 8 hr. The engine must be equipped with an engine driven alternator capable of an output of no less than 60A.

3.3.4 The Prime mover engine requirements are as follows:

The engine must be liquid cooled for use with No. 2 low-sulfur diesel fuel. The engine must be certified by the manufacturer as capable of developing enough brake horsepower (BHP) at a maximum of 1800 rpm to drive electric alternators yielding the minimum required rating on a continuous basis during the interruption of normal power source at ambient conditions of 104oF, 29.31 in. Hg barometric pressure at sea level.

The engine and speed must be suitable for direct connection to an alternating current generator without exceeding engine manufacturer's published curves, with a speed not to exceed 1800 rpm.

Provide an engine mounted thermostatically controlled jacket water heater on the engines to keep the unit in a condition for quick starting.

The engines must be radiator cooled by an engine mounted air-cooled radiator system with enough capacity for cooling the engine when delivering the full rated horsepower at an ambient temperature of 104oF. The systems will include belt driven pusher type fan, coolant pump and thermostatic temperature control. Coolant must be 50% ethylene glycol antifreeze - water solution.

Provide remote two-wire starting, 12-volt DC, solenoid shift, electric starters in accordance with manufacturer's requirements. Two independent systems must be provided to disconnect the starting circuit upon engine starting.

The fuel system for the unit must consist of the following elements:

- Provide engine driven self-priming fuel pumps suitable for unassisted supply of fuel to the engine from the fuel tank.
- Provide full flow replaceable element fuel filters.
- Provide flexible fuel connection lines between fuel supply piping and engine.
- Provide a heavy duty, replaceable element, dry type air cleaner.
- Provide an engine speed solid state electronic governor system to automatically control the alternator frequency within 1 percent of rated frequency from no load to full load output.
- Provide over-speed trip device(s) acting independently of the governor to shut down the engine when speed exceeds the rated rpm by more than 15 percent.
- Provide each unit with a positive displacement engine driven full pressure lubrication oil pump, full flow replaceable oil filter, dipstick oil level indicator and oil pressure gauge.

- The following primary sensing elements/alarms/ shutdowns and protective features must be provided on the engine:
 - a. Coolant temperature gauge.
 - b. Lubricating oil pressure gauge.
 - c. Low coolant level alarm/shutdown.

3.3.5 The generator requirements are as follows:

The alternator will be direct coupled to the engine driver and be of the permanent magnet type complete with a low noise centrifugal blower for proper cooling and a temperature compensated solid state voltage regulator.

The voltage regulators must be solid-state design and must function by controlling the exciter magnetic field between stator and motor to provide no load to full load regulation of rated voltage within +/- 2 percent during steady-state conditions. The generator set and regulator must sustain at least 90 percent of no-load voltage for ten (10) seconds with 250 percent of rated load at near zero power factor connected to its terminals. The voltage regulator must be of the asynchronous pulse width modulated design or equal that is insensitive to severe load induced wave shape distortion from SCR or thyristor circuits such as those used in battery charging (UPS) and motor speed control equipment loads. All other performance criteria must be equal to the specified equipment. A rheostat will provide a minimum of +/- 5 percent voltage adjustment from rated value.

Insulation on both stator and rotor must be Class H with a maximum allowable temperature rise of 80°C above a 40°C ambient at rated capacity.

The alternator must be direct connected to the engine driver through a semi-flexible coupling to ensure permanent alignment. The alternator mountings must include jacking screws, jacking pads and mounting holes.

The alternator will have a shaft mounted fan for forced air through the generator with the exhaust at the drive end.

4 CONSTRUCTION

- 4.2.1 Concrete. Provide concrete in accordance with Item 421, "Hydraulic Cement Concrete." For concrete in slabs, use Class A with Grade 3 aggregate. For concrete used as grout in walls, bond beams and lintels, use Class A with Grade 6 aggregate.

Use non-shrinkable grout, where specified, that conforms to ASTM C827, and has a specified compressive strength at 28 days of 5000 psi.

Ensure the detailing of concrete reinforcement bars and accessories conforms to the recommendations of the ACI Detailing Manual (ACI 315).

Mix, transport, and place concrete in accordance with ACI 301 and Items 420, "Concrete Structures," and 421, "Hydraulic Cement Concrete."

Provide concrete cover protection for reinforcement bars as follows (see ACI 318-83 Section 7.7 for conditions not noted):

| | |
|----------------------|-----------|
| Footings: | 3 in. |
| Grade Beams: | |
| Top | 1-1/2 in. |
| Sides (Board Formed) | 2 in. |
| (Earth Formed) | 3 in. |
| Bottom | 3 in. |
| Slabs on Grade (Top) | 3/4 in. |
| Pilaster and Plinths | 2 in. |

Provide standard bar chairs and spacers as required to maintain the concrete cover protection specified.

Use concrete reinforcement bars conforming to ASTM A615, Grade 60, with supplementary requirements (S1). No. 3 bars may conform to ASTM A615 Grade 40, with supplementary requirements (S1) unless noted otherwise. The "N" designation is acceptable instead of the "S" designation requirement; however, meet the other requirements of supplement S1. Do not tack weld, heat, or cut reinforcement bars unless indicated on the contract documents or approved by the Engineer.

Lap reinforcement designated as "continuous" 36 bar diameters at splices unless noted otherwise. Locate reinforcement bar splices in grade beams at the centerline of supports for bottom bars and at midspan for top bars. Provide standard ACI hooks for top and bottom bars at discontinuous ends of grade beams.

Provide 1-No. 4 reinforcement bar x 4.0 ft. at re-entrant corners and around rectangular holes in slabs unless noted otherwise. Place the bars diagonal to the corner with 1 in. clearance from the top and the side of the slab at the corner.

- 4.2.2 Masonry Notes. Use masonry units (CMU) that are hollow concrete units conforming to the requirements of ASTM 90 Standard Specifications for Load Bearing Concrete Masonry Units." The minimum allowable compressive strength for masonry units is 1500 psi at 28 days. Do not install masonry units before they attain the required 28-day strength.

Provide reinforcement conforming to the standards specified in the concrete notes.

Use mortar for the CMU block that is color matched to the block and has natural sand aggregate conforming to ASTM C144, Type II Portland cement conforming to ASTM C150, Type S hydrated lime conforming to ASTM C207, and potable water. Use Type M or Type S mortar proportioned according to ASTM C270, Tables 1 and 2. The minimum allowable compressive strength for the mortar is 1800 psi at 28 days.

Provide continuous reinforcing bars in bond beams as indicated on the drawings.

Lap the reinforcement placed in bond beams a minimum of 36 bar diameters at splices. Provide corner bars of equivalent size lapped 36 bar diameters at corners and intersections of walls.

Field cut the vertical masonry reinforcement for 4.0 ft. lifts and lap splice a minimum of 30 bar diameters. Grout masonry cores containing vertical reinforcement solid with Class A concrete, Grade 6 aggregate. Perform grouting by the "low-lift" method in conformance with UBC Section 2404(f)1. Provide one No. 5 vertical bar at each end, corner, and intersection of walls.

At masonry lintels bearing on masonry walls, provide a minimum of 16 in. of bearing over two grouted cores each side of the opening. Reinforce each core with one No.5 vertical. Extend the reinforcement the entire height of the wall. To accomplish this, bar splices lapped a minimum of 24 in. are acceptable.

- 4.2.3 Paint. Paint the doors, fixtures, supports, joists, ceiling, trim, and any other accessories as directed, in accordance with specification Item 446, "Cleaning and Painting Steel," except give metal a 3.0 mil dry film thickness (dft) prime coat of red oxide industrial primer with a 2 coat, 2.0 mil dft each finish coat of industrial alkyd enamel in a color to match the louvers.

- 4.2.4 Concrete Finish. Paint the Controls Building interior walls with Sherwin-Williams, Glidden, Benjamin Moore, or approved equal. Provide a concrete finish as follows:

Surface Prep: As per the manufacturer's recommendations.

Primer: Concrete sealer per the manufacturer's recommendations.

Finish: 2 coats dry fallout eggshell white per the manufacturer's recommendations (10.0 mil dft min.).

Apply to the building exterior 2 coats of a sealer such as Prim-A-Bel 200 Clear for waterproofing.

- 4.2.5 Fire Extinguisher. Provide halon or approved equal, Type (1211) A:B:C rated fire extinguishers that are DOT approved and wall-mounted.
- 3.4. Electrical System. Perform electrical work in accordance with the applicable codes, standards, and ordinances. Employ a master electrician, licensed in the State of Texas to directly supervise the Contractor forces.
- Provide all work required for complete electrical and ancillary system as indicated on the drawings and in these specifications. This may include, but is not necessarily limited to; panelboards, transformers, cabinets, Automatic Transfer Switch (ATS) and Manual Transfer Switch (MTS) installation, circuit breakers, fuses, disconnect switches, surge suppression, interior and exterior lighting, lamps, relay panels, contactors, controls, wiring devices, wire and cable, grounding and bonding, lightning protection, equipment wiring system, conduit, raceways, boxes, supporting devices, identification, fire stopping, testing, excavating, concrete equipment bases, concrete duct encasements, conduit sleeves and supports, anchors, vibration and sound isolation, access panels, record drawings, installation permits, inspections by governing authorities, electrical work of certain temporary facilities and services, cutting and patching work, utility connection coordination, startup of electrical systems and equipment, training of Owner's operating personnel, operating and maintenance manuals, final cleaning of electrical and similar work.
- 4.2.6 Provide electrical submittals that are certified correct by the master electrician. Ensure persons performing electrical work have an appropriate electrical license. Provide documentation that proves the Contractor has a minimum of 5 yr. experience and is qualified in this type and scope of work. Provide the necessary equipment, materials, and labor to provide a complete electrical system as shown in the plans and described in the specifications. Install electrical service as shown in the plans and as required by the electrical utility company. Provide any temporary electrical equipment, materials, and service necessary for constructing the pumping station, including any for dewatering. Provide electricians to make necessary connections of the portable load banks to the load lugs of the generator or generator main breaker so that the required generator set testing can be performed. Electrical submittals are not opportunities for gaining acceptance of substitutions. Any variance from the contract documents must be identified. Any variances from the contract documents in the submittals which are not identified by the Contractor and subsequently not identified by the Engineer's review must be corrected by the Contractor at no cost to the Owner. Substitution request would only be considered if product is equal or better than what listed.
- 4.2.7 Contractor will provide shop drawings and coordination drawings showing work in generator and pump rooms with horizontal and vertical dimensions to avoid interference with structural framing, and other services. The coordination drawings must be to a scale of 1/4" = 1'-0" or larger for all generator and pump rooms. Coordination drawings should include but not be limited to size and location, major electrical equipment and accessories, switchgear and clearances, light fixtures, communications equipment, access panels, transformers, MTS, panelboards, control panels, code clearances for equipment, manufacturers required maintenance clearance for equipment, concrete equipment pads, exterior wall penetrations, foundation penetrations, and fire rated wall penetrations. Show clearance dimensions of critical locations, and show dimensions of spaces required for operation and maintenance of equipment. Show conduit layouts and wire/cable connections and other electrical service connections and show interfaces with other work, including structural support. Indicate by note, portions of electrical work shown on shop drawings which deviates from indication of work in contract documents, and explain reasons for deviations. Show how such deviations coordinate with interfacing deviations on shop drawings for other portions of work, currently or previously submitted. Show wiring diagrams, erection, setting, weights, capacities, speeds, outputs, consumption, efficiencies, voltages, amperages, hertz, phases, noise levels, etc.
- 4.2.8 Manufacturer's Data: Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which variations are to be provided. Delete or mark-out all portions or pre-printed data which are not applicable. Where operating ranges are shown, mark data to show portions of range required for project application. Expansion or elaboration of standard data to describe non-standard product must be processed as shop drawing data to describe non-standard product. For each product include manufacturer's production specifications, installation or fabrication instructions, point to point wiring diagrams and connections, nearest source of supply (including telephone number), sizes, weights, speeds, operating characteristics, ratings, conduit and wire/cable connection sizes and locations, statements of compliance with required standard and governing regulations (include manufacturer's signed statements if not covered in printed data), performance data (where applicable) and similar information needed to confirm compliance with requirements.

Manufacturer's Certification: Each manufacturer is required to review the system design as related to the proper operation of his equipment, including electrical requirements, automatic controls, mechanical systems and equipment locations and related items. With shop drawings submit a letter from the manufacturer stating that his equipment will operate satisfactorily under the design conditions. The manufacturer's representative will review the final installation at the site and submit a second letter stating that the equipment operates satisfactorily as installed. Furnish certification for the systems listed in each section of electrical Division.

- 4.2.9 Test Reports: The contractor for various sub-systems must submit proposed testing procedure for their system, subject to review and approval and owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems has been demonstrated and verified and reports have been provided, reviewed and accepted. The project will not be declared substantially complete until "As-Built" drawings have been submitted, reviewed, and accepted by owner and various systems have been commissioned and accepted.
- 4.2.10 Warranties: A minimum of one-year warranty period is required for all materials and equipment. Warranty period starts upon first beneficial use or acceptance by owner, whichever comes first. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; names, addresses and telephone numbers and procedures for filing a claim and obtaining warranty services.
- 4.2.11 O&M Manuals: For each product, equipment, or system, submit the following:
- 4.2.11.1 Furnish a general description of the equipment or system listing the major components, intended service and other general data.
- 4.2.11.2 Furnish technical data including nameplate data, design parameters, ratings, capacity, performance data, operating curves, characteristics, and the like. Clearly distinguish between information which does and does not apply.
- 4.2.11.3 List warnings and cautions to be observed during both installation and operations.
- 4.2.11.4 Fully detailed wiring diagrams, point by point connections, installation and operation instructions including special tools required, alignment instructions, start-up, and shut-down sequences.
- 4.2.11.5 Furnish maintenance, service and repair instructions including maintenance and service schedules, materials, and methods for performing routine and annual service.
- 4.2.11.6 Furnish a troubleshooting guide and check list indicating common failures, test methods and procedures for determining component fault or failure.
- 4.2.11.7 Furnish a spare parts list indicating part and order number with name, address, and telephone number of supplier. Include current prices of replacement parts and supplies.
- 4.2.11.8 Furnish diagrams including controls, wiring, installation or operation of the equipment or system.
- 4.2.11.9 Furnish copies of all approved submittals, warranties, and guarantees.
- 4.2.11.10 Furnish copies of all test reports
- 4.2.12 Utilities: Contractor will examine the site and must verify, to his own satisfaction, the location and elevation of all utilities, and will adequately inform himself as to their relation to the work before entering into a contract. Existing utility lines shown within the scope of this project to be abandoned or removed will be performed as directed by the Owner, and/or utility companies. Existing utility lines not shown on the drawings but encountered during construction must be protected, relocated or capped as directed by the Owner, and/or utility companies. All precautions must be exercised to prevent damage to existing lines not shown, but should work become necessary, it must be authorized before execution except in an emergency situation. Before beginning excavations of any nature whatsoever, the contractor must make an attempt to locate all underground utilities of every nature occurring within the bounds of the area to be excavated. The contractor will then proceed with caution in his excavation work so that no utility will be damaged with a resultant loss of service. Should any damage result to any utility through the contractor's negligence or failure to

comply with the above directive, he will be liable for such damage and for all expense incurred in the expeditious repair or replacement of such damaged utilities. Repair of damaged utilities must be to a condition equal to or better than the adjacent undamaged portion of such utility and to the complete satisfaction of the Owner and/or utility companies.

- 4.2.13 Excavation: The contractor will perform all excavation of every description and of whatever substances encountered, to the depths indicated and/or required for the installation of all portions of the utilities systems. All excavated materials not required for fill or backfill must be removed. All excavation must be made by open cut. The banks of trenches must be kept as nearly vertical as practicable and where required must be properly stored and braced. Trenches must be at least 12" wider and not more than 16" wider than the outside diameter of the conduit, and must be excavated true to line so that a clear space greater than 6" and less than 8" in width is provided on each side of the conduit or duct bank. The trench bottom must be filled with course sand, fine gravel, or other suitable material. Backfill with earth under pole bases, pads or other buried structures will not be permitted, and any unauthorized excess excavation below the levels indicated for foundation of such structures must be filled with sand, gravel or concrete at the expense of the contractor. Any water accumulated in the excavations must be removed by pumping or by other approved method.
- 4.2.14 Closeout: Coordinate taking of final photographs with electrical closeout, so that maximum detail of work as finally accepted is shown. Sequence closeout procedures properly, so that work will not be endangered or damaged, and so that every required performance will be fully tested and demonstrated. Coordinate test runs of electrical systems with test runs of equipment served thereby. Check each item in each system to determine that it is set for proper operation. With Owner's Representative and Engineer present, operate each system in test run of appropriate duration to demonstrate compliance with performance requirements. During or following test runs, make final corrections or adjustments of systems to refine and improve performances where possible, including noise and vibration reductions, elimination of hazards, better response of controls, signals and alarms, and similar system performance improvements. Provide testing or inspection devices as may be reasonably requested for Engineer's observation of actual system performances. Demonstrate that controls and items requiring service or maintenance are accessible. After final performance test run of each electrical system, clean system both externally and internally. Comply with manufacturer's instructions for lubrication of both power and hand-operated equipment, and remove excess lubrication. Touch-up minor damage to factory-painted finishes and other painting specified as electrical work; refinish work where damage is extensive.
- 4.2.15 Training: In addition to specific training of Owner's operating personnel, and in addition to preparation of written operating instructions and compiled maintenance manuals specified in these specifications, provide general operating instructions for each operational system and equipment item of electrical work. Describe each basic electrical system and functioning of its control system. Explain identification system, mimic diagrams, signals, actuators, sensors, alarms, telecommunication systems, and similar audio/visual provisions. Describe interfaces with mechanical equipment, including interlocks, sequencing, start-up, shut down, emergency, safety, system failure, security and similar provisions. Outline basic maintenance procedures and major equipment turnaround requirements, including adjustments to optimize output and efficiency of electrical system. Display and conduct "thumb-through" explanation of maintenance manuals, record drawings, spare parts inventory, storage of extra materials, meter readings and similar service items.

5 MEASUREMENT

Pump station upgrades SH 207 will be measured by each.

6 PAYMENT

The work performed and materials in accordance with this item and measured as provided under the "Measurement" will be paid for at the unit price as specified.