

**SECTION IV**  
**SEWAGE LIFT STATIONS**

# SEWAGE LIFT STATIONS

## TABLE OF CONTENTS

	<u>Page</u>
1. Objective .....	1
2. Design Calculations .....	1
3. Location .....	2
4. Lift Station .....	3
5. Wet Well .....	6
6. Controls .....	7
7. Electrical Service/Controls & Telemetry System .....	8
8. Standby Power System .....	13
9. Force Main .....	17
10. Testing Force Main .....	17
11. Lift Station Test Program .....	19

#### **IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS**

##### **1. OBJECTIVE:**

Section IV is intended to present information and provide an outline of the minimum general standards to be accomplished in planning a sewage lift station installation within the Silver Lake Water & Sewer District service area.

The Developer shall submit to the District for review and approval, complete sewage lift station plans and design which provide for the lift station, electrical service, SCADA controls, and auxiliary generator/transfer switch together with all accessories for a complete, automatically operating installation.

Design material and drawings shall provide all civil, mechanical and electrical details and align with all applicable codes and regulations, and good engineering practice.

##### **2. DESIGN CALCULATIONS:**

The Developer shall perform a study and make the determination to assure that the lift station installation is sized to serve the overall sewage flows generated within the potential service area. The flow study shall include the Developer's plat boundary area as well as adjacent and future service areas. The service areas shall be the areas within that which could be served by the installation of the lift station(s).

The station's design flow capacity shall be based on an average daily per capita flow with related peaking factors and inflow/infiltration allowances.

Documentation of present and future service area flow rates for lift station size and capacity determination shall be provided to the District.

The effects of the minimum flow conditions shall be estimated to be sure that retention of the sewage in the wet well will not create a nuisance and that pumping equipment will not operate too infrequently. The wet well shall be sized to limit pump cycles to a maximum of four cycles per hour per pump, with two pumps alternating at pump design capacity.

Lift station capacity shall meet the maximum rate of flow expected. At least two (2) pumping units shall be provided at each lift station installation. The pump shall have sufficient capacity and capability to efficiently handle the peak design flow with one (1) pump out of service and to ensure a minimum velocity of 3 feet per second velocity in the force main.

The force main shall be sized for a minimum velocity of 3 feet per second and a maximum of 8 feet per second. The minimum diameter of the force main shall be 6 inches.

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

The capacity of the receiving sewer shall exceed the flow expected.

Three (3) copies of the Design Report shall be submitted to the District for review. As a minimum, the report shall include.

1. Project description
2. Projected flows
3. Connection point with downstream capacity
4. Wet well sizing
5. Run time calculation and cycle time
6. Pump station head calculation
7. Pump selection
8. Force main size, length and material
9. Electrical load study
10. Generator sizing
11. Odor potential calculations
12. Wet well buoyancy calculations
13. Force main surge calculations

The Design Report shall be approved by the District prior to starting the design of the lift station.

#### **3. LOCATION:**

The Developer shall furnish a site layout for the lift station installation.

The lift station shall be located as far as practicable from present or proposed built-up residential areas, and an asphalt concrete access road shall be provided. Sites for sewage lift stations shall be of sufficient size for future expansion or addition, if applicable.

The easement for the lift station site shall be submitted to the District for review prior to construction of the lift station. Lift station sites not located within the plat boundary shall be deeded to the Silver Lake Water & Sewer District.

The Developer shall coordinate electrical power required to the site with the electrical utility.

As a minimum, the site shall provide for the following:

1. Lift station
2. Auxiliary power, including automatic transfer switch
3. Electrical
4. Telemetry

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

5. 1-inch water service with reduced pressure backflow preventor and hose bib installed in an above ground hot box enclosure on concrete. Furnish 50 feet of 3/4-inch heavy-duty rubber hose.
6. Odor control, as applicable for location and capacity.
7. Cuts and fills to provide level site for maintenance.
8. Asphalt concrete pavement for access and maintenance areas.
9. Safety system mount. See Detail V-LS7.
10. Single entry to wet well from recessed entry manhole (rock catcher). See Detail V-LS8.
11. 6 foot high black powder coated frame and posts together with black vinyl chain link fence with vertical vinyl slats in-laid for screening and three strands of barbed wire on top of the fence, enclosing the site with 3-foot-wide access main gate and separate vehicle access gate 12-foot wide minimum opening. Fence to be located in the asphalt, 6 inches from the edge. A gate button will be used for the center gate post.

#### 4. LIFT STATION:

##### GENERAL

The sewage lift station shall be Smith & Loveless, custom series buried, dry-well-type or wet-well mounted as approved by the District. Construction shall be in compliance with OSHA, UL, ASTM, NEC, WAC, and other applicable codes and regulations. The station shall be designed, constructed and anchored to comply with current IBC standards.

The lift station shall have, as a minimum, two sewage pumps. The pumps shall have sufficient capacity and capability to efficiently handle the peak design flow with one pump and to ensure a minimum velocity of 3 feet per second in the force main. Design calculations and pump curves indicating the same shall be provided with the submittal information.

The rotor (motor) assembly shall be dynamically balanced. Add the impeller to the rotor assembly and dynamically rebalance the assembly, all to NEMA specifications for the operating RPM condition and submit documentation to the District. Pump and motor assembly shall meet the vibration tolerances established by the Hydraulic Institute, and shall be certified by the factory prior to shipment. Field vibration testing will be conducted to confirm conformance with vibration standards after installation. Failure to meet vibration standards in the field can be cause for station rejection.

The sewage lift station supplier shall check the station during installation to determine if the installation is correct. Written confirmation of each visit and recommendations shall be provided to the District.

The sewage lift station supplier shall provide a minimum of 4 hours of training for District personnel at the station site during start-up.

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

The sewage lift station supplier shall provide four (4) complete copies of maintenance and operation material to the District.

##### **CUSTOM SERIES BURIED STATION (WET WELL/DRY WELL)**

The station shall be a Smith & Loveless Custom Series station complying with the latest edition of Smith & Loveless standard specifications and with the District Standards.

The station shall be a minimum of 8-feet in diameter and the pump motor assembly and piping shall be District standard dark green in color.

The above-ground entrance hatch shall be 44-inches minimum inside diameter with a steel cover, lockable to District standards. In all areas, lighting and ventilation shall be provided to meet the requirements for a confined space entry.

The station shall be provided with a minimum of four magnesium anodes. The test box for cathodic protection shall be mounted on the electrical rack. See Detail V-LS3.

Each motor starter shall have its own independent phase loss relay wired directly to the starter's "enable" circuit and to the RTU for alarming.

As a minimum, the station shall include the following:

1. Vertical close-coupled, motor driven, non-clog pumps.
2. Resilient seat gate valves.
3. Internal piping.
4. Central control panel with circuit breakers and intrinsically safe circuits.
5. Motor starters.
6. Shelf mounted air compressor (2) 9L25 bubbler system for automatic pumping level controls.
7. Lighting.
8. Sump pump with dedicated simplex, gray, 20A, non-GFCI receptacle in cast aluminum weatherproof box with full in-service cover.
9. Ventilating blower.
10. Blower timer.
11. Dehumidifier.
12. All internal wiring.
13. Protection against corrosion.
14. Station flooding alarm.
15. Operator in trouble emergency button.
16. Extended warranty – 24 months from start-up or 30 months from time of shipment which ever is first.
17. Document certifying the lift station is in compliance with the NEC.

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

18. Convenience receptacles, white, duplex, 20A, GFCI, in cast aluminum weatherproof boxes with full in-service covers.
19. Spare parts each pump:
  - Replacement pump shaft seal – one each for each pump
  - Filter element for the seal filters – one each for each pump
  - Volute gaskets – two each for each pump
20. Touch up paint kit.
21. Ductile iron piping between wet well and station.
22. Common reinforced concrete base slab for station and wet well.
23. 316 stainless steel sump pump piping from the sump pump to the wet well with check valve and unions. Piping to go up dry well entry and discharge through the connection opening in the entry tube.
24. Air bubbler line to go up dry well entry, above ground level, back down and discharge through connection openings in entry tube. Air bubbler line shall be 316 stainless steel tubing in the station and 3/4-inch diameter 316 stainless steel pipe from the entry tube to a wet well mounted tee with 3/8-inch stainless steel pipe extended down from the wet well mounted tee to 6 inches above the inlet of the suction pipes.
25. The wet well shall be a minimum of 8 feet in diameter. The wet well shall provide for the volume of the pumps to be fully submerged.
26. The wet well shall be of precast concrete construction with flat slab cover and 4 x 6 (two door) hatch for access. The flat slab concrete cover shall be provided with a 4-inch vent, which is “hooked and screened.”

#### **WET WELL MOUNTED STATION**

The station shall be Smith & Loveless wet well mounted vacuum primed station complying with the latest edition of Smith & Loveless standard specifications and with the District Standards.

Each motor starter shall have its own independent phase loss relay wired directly to the starter’s “enable” circuit and to the RTU for alarming.

As a minimum, the station shall include the following:

1. Vertical, close-coupled, motor driven, vacuum-primed, non-clog pumps.
2. Resilient seat gate valves.
3. Internal piping.
4. Central control panel with circuit breakers and intrinsically safe circuits.
5. Motor starters.
6. Shelf mounted air compressor (2) bubbler system automatic pump level controls. Shelf to be mounted at the same level or higher as the top of the station side wall.
7. Heater.
8. Ventilating blower.
9. Priming pumps and appurtenances.

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

10. All internal wiring.
11. Discharge pipe welded to the base plate and to be flanged below.
12. Bubbler piping above the base plate, plastic tubing, and below the base plate to be 3/8 inch diameter 304 SS pipe extended down to 6 inches above the inlet of the suction pipes.
13. Lid to be 2 piece design with hydraulic hood assist.
14. Paint station with dark green epoxy.
15. Shelf mounted vacuum pumps located at the same level or higher as the top of the station side wall.
16. Extended warranty – 24 months from start-up or 30 months from time of shipment whichever is first.
17. Document certifying the lift station is in compliance with the NEC.
18. Convenience receptacles, white, duplex, 20A, GFCI, in cast aluminum weatherproof boxes with full in-service covers.
19. 3/4-inch conduit connection in electric panel for connection to the telemetry sub panel.
20. Spare parts each pump:
  - Replacement pump shaft seal – one for each pump
  - Volute gaskets – two for each pump
21. Touch up paint kit.
22. AWWA C900 PVC suction pipes.
23. Flexible restrained coupling (Romac Adaptor RFCA) to connect station to suction pipes.
24. The wet well shall be a minimum of 8 feet in diameter.

#### **MOTORS**

The pump and motor shafts shall be the maximum diameter available for these units.

Pump motors shall be 3-phase, 60-cycle, 480-voltage inverter rated, TEFC. Motors 40 hp and larger shall be furnished with soft start or variable frequency drives (VFDs). VFDs shall comply with the latest ANSI, IEEE, and NEC codes. VFD load circuits from starter to motor shall be shielded power cables in RGS conduits.

The motors shall have 1.15 service factor and be non-overloading for the full range of the curve unless otherwise approved by the District.

#### **5. WET WELL:**

##### **GENERAL**

The wet well shall be precast concrete manhole sections. Joints between precast wall sections shall be confined O-ring or as otherwise approved. The poured in place slab top shall be designed with the wet well to exceed buoyant forces and

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

shall have a cast in place flush mount safety system sleeve per District Standard Detail.

The wet well shall be provided with polypropylene manhole steps as specified for manholes.

The wet well shall be checked to ensure all joints are watertight to prevent infiltration and exfiltration of the wet well.

The wet well floor, walls and underside of the top shall be coated to comply with the following:

##### **Surface Preparation:**

Allow a minimum of 28 days cure time for concrete. Sweep blast to provide a surface profile. Surface shall be clean, dry and free of contaminants.

##### **Exterior Surfaces:**

The exterior surface of the wet well shall be coated with 30 mils minimum of coal tar epoxy.

##### **Interior Surfaces:**

- **Filler and Surfacer:** Tnemec Series 218 Filler and Surfacer. Applied as needed. After the application of the prime coat, the bugholes and surface voids shall be filled to ensure that the finish coat is monolithic and pinhole free.
- **Finish:** Tnemec Series 435 Perma-Glaze Applied in two coats at 15 mils dry film thickness each. Color light gray.
- **Total System:** 30 mils dry film thickness.

Comply with all conditions of the manufacturer's specifications for preparation and application.

#### 6. CONTROLS:

The control panel shall include:

1. Main disconnect.
2. Panel mounted running light for each pump.
3. Panel mounted ammeter for each pump to read percentage of load.
4. Panel mounted running time meter for each pump.
5. Panel mounted Cutler Hammer HOA switches for each pump.

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

6. Mounting bracket for telemetry sub panel in station (size: 13-1/2" L x 10" W x 6-1/2" Deep).
7. Local/Remote contact for the following alarms:
  - a) Low Level
  - b) High Level
  - c) Power/Phase Failure (single & 3-phase)
  - d) Pump Failure
  - e) High Water (dry well)
  - f) Pump On
  - g) Intrusion
8. Panel mounted wet well gauge. Minimum 2.5-inch dial and read for depth of wet well in inches (Model Marsh Bellofram No. G 22 687).
9. Phase monitor to protect the pump motors from single-phase reversal and low voltage.
10. Discharge check valve limit switches (each).
11. Pump alternator, each cycle.
12. High water float pump control.

#### 7. ELECTRICAL SERVICE/CONTROLS & TELEMETRY SYSTEM:

##### GENERAL

Codes and regulations exist at the federal, state, and local level dictating minimum acceptable requirements for electrical systems. The following standards shall be used as a basis for design and review.

1. National Electric Code (NEC)
2. Occupational Safety & Health Act (OSHA)
3. State & Local Building Codes
4. National Electrical Code (NEC)
5. National Electrical Manufacturers Association (NEMA)
6. Underwriters' Laboratory (UL)
7. Insulated Power Conductor Engineering Association (IPCEA)
8. American National Standards Institute (ANSI)
9. Institute of Electrical & Electronic Engineers (IEEE)

##### ELECTRICAL SERVICE

The local electric utility will be the primary source of electrical power. The Developer shall ascertain proper coordination between the nominal secondary delivery voltage supplied by Snohomish County PUD No. 1 and the connection to the lift station equipment. The electrical service shall be 480/277V 4-wire, 3-phase, 60 hertz, with a solid neutral terminal at the disconnect or as may otherwise be required by Snohomish County PUD No. 1. This shall be confirmed with the Snohomish County PUD No. 1 and confirmed by the suppliers.

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

All installation shall be approved by Snohomish County PUD No. 1 and shall be in conformance with the NEC (current issue) UL, OSHA and County and State electrical codes.

The District shall be furnished with a certificate of final inspection by the inspecting agency.

All wire shall be stranded copper.

All conduit shall be rigid galvanized (RGS). All underground RGS conduits, elbows, and fittings shall be coated with 20 mils (minimum) of PVC coating or a half-lapped wrap of Scotchwrap No. 51. See Detail V-LS4.

All underground conduits shall be covered with a strip of yellow polyethylene tape placed 6-inches below finished grade and directly above the conduit.

All conduit shall have a minimum of 2'-0" of cover.

Instrumentation conduits, elbows and fittings shall be RGS over their entire length.

Heating strips shall be provided for outside electrical enclosures.

A service entrance shall be provided with a pedestal on which shall be mounted, as a minimum, the following equipment:

1. Meter and meter can (as required by the PUD)
2. Meter C.T.S. (as required by the PUD)
3. Main disconnect SUSE-rated circuit breaker in a NEMA 3R, enclosure, with padlock to District standards.
4. Service voltage shall be 480/277 volts, 3 phase, 4-wire, except as required by Snohomish County PUD #1.
5. Single phase services shall be 240/120 volt, 3 wire. Panels shall conform with NEMA 3R.
6. A 120-volt duplex in NEMA 3R enclosure with padlock to District standards on the electrical rack.
7. Ground rod and connector wire in conduit to NEC standards.
8. Mount equipment per Detail V-LS3

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

9. Provide a complete electrical plan set including the following minimum documents:
  - a) Electrical plan view showing equipment and interconnecting conduits
  - b) A cable and conduit schedule
  - c) A one-line diagram
  - d) Motor starter control schematics
  - e) Panelboard schedule
  - f) Main control panel schematics
  - g) PLC I/O tables
  - h) Associated electrical details
  
10. The District shall be provided with a complete reproducible set of as-constructed plans and details showing final location of all equipment, conduit and wire.

#### **CONTROLS**

Control and instrument system plans shall thoroughly and completely depict system design. The plans, in conjunction with the specifications, shall define the type of control system, the type of components in the system, set points and the interface between the instrumentation and control system and the lift station system. To accomplish this, the control and instrument plan(s) shall include, as a minimum, the following:

1. Control and instrumentation system legend and general notes
2. Control, instrumentation and distribution diagram
3. Plans showing location of all control, instrument, and distribution system equipment and components, both electrical and pneumatic
4. All equipment and installation details

The power, control and instrumentation systems shall be designed with both operational reliability and maintainability. Use standard products wherever possible.

Electrical equipment and devices shall be connected using separate power, control, and instrumentation conduits. Electrical gutters or fabricated raceways shall not be used.

All components within the lift station system, including both internally and face-mounted instruments and devices, shall be clearly identified with phenolic nameplates of black background with white letters reverse engraved from the backside (smooth front surface).

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

Intrinsically safe electrical circuits shall be installed in the main control panel in compliance with NEC, not in the motor starters.

All wiring between cabinet, equipment and components shall be labeled and color coded where applicable.

All pump motors shall have an independent lockable circuit breaker located within the lift station and the lift station shall have a lockable main circuit breaker located outside the lift station.

Lead and lag pump functionality shall alternate between pumps on each cycle change.

The pump controls shall be air bubbler type with two compressors alternating on timer control, and shall provide for both pumps to operate at high water conditions. The control elevations shall be indicated on the plans, i.e., on-off, first pump on, second pump on, and high water alarm. The air compressors shall not be located in electrical cabinets or enclosures.

The wet well shall be equipped with a high water redundant float to override the bubbler pump control and start the pumps and send high wet well level alarm.

A complete set of spare fuses shall be provided for all fused equipment.

#### **TELEMETRY**

The District's telemetry system utilizes Zetron 1716 RTUs for SCADA functions related to the wastewater collection systems. The RTUs report to a master unit at the District Headquarters. The master unit communicates with a personal computer running Wonderware *Intouch* software to allow Supervisory Control and Data Acquisition functions to take place.

The RTUs shall be provided in enclosures with auxiliary equipment to facilitate connection of external signals to the RTU, and to monitor voltage, intrusion, and similar status signals. Communication with the Zetron 1700 MTU shall be via leased telephone lines to the District's office.

For each new lift station, the Developer shall provide a Zetron 1716 RTU (with Modbus option, accumulator/pulse counter access and battery backup) along with an enclosure, power supply, relays, surge protection devices for power and telephone lines, and other auxiliary devices as required for proper operation of the system. Typical discrete inputs for a station include:

1. Utility Power Fail
2. Three Phase Power Fail (phase reversal, phase imbalance, phase loss, undervoltage, and overvoltage)

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

3. Generator Run
4. Generator Fail
5. ATS in Standby
6. Intrusion Alarm
7. Wet Well High Level
8. Wet Well Low Level
9. Pump No. 1 Run
10. Pump No. 2 Run
11. Pump No. 1 Fail
12. Pump No. 2 Fail  
(Note: Additional pump run and fail signals are required for each pump when the station has more than two pumps.)
13. Station Flood (Buried Station)
14. Ventilation Fail (Buried Station)
15. Operator in Trouble (Buried Station)
16. Flow Meter Totalizer
17. All exterior transfer switches will be NEMA 3 enclosure with keyed switch for access to controls.

Typical discrete outputs include:

1. Start Generator (with an interposing relay driven by the RTU in the telemetry subpanel)

Typical analog inputs include:

1. Pump No. 1 Amperes
2. Pump No. 2 Amperes
3. Wet Well Level
4. Flow Rate

Provisions shall also be made for additional I/O signals by providing terminals from each I/O point on the RTU to terminals within the telemetry panel.

The telemetry panel and all items contained therein shall be provided by Systems Interface, Inc., (425) 481-1225.

The Developer shall also be responsible for correct set-up of the RTU with respect to the existing system configuration. This includes coordinating configuration parameters such as:

1. RTU addressing
2. Master unit configuration
3. RTU configuration,
4. I/O point configuration (enable/disable format)
5. Debounce time
6. NO/NC inputs

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

7. Percent change reporting
8. High/low alarm limits
9. Accumulator sampling rates
10. Momentary/latched outputs
11. Signal adjustments (receive gain, transmit gain).
12. Rebalancing of the District's Verizon dedicated telemetry circuit.

The Developer shall coordinate with the telephone utility and the District for obtaining proper telephone service to the site. The Developer shall be responsible for obtaining, installing, and starting up the RTU for the new lift station. The Developer shall coordinate obtaining, installing and starting up the RTU with the District to ensure that the station is properly configured and functions correctly in conjunction with the existing system.

All major components, including relays, timers, and power supplies shall be identified using phenolic or vilam engraved labels.

Provide a 600 ohm impedance matching transformer for the telephone line, per Zetron's recommendations.

A line (surge) protector unit shall be provided for the telemetry equipment. The unit shall protect the equipment from transient and electrical surges on the telephone line. Protection shall include line fuses and clamps for voltages over 25 volts, gas tubes shall be provided as an integral part of the lighting protection unit.

#### **8. STANDBY POWER SYSTEM:**

##### **GENERAL**

Standby power generation equipment shall be provided at the lift station site, which will operate the lift station in the event of a commercial power outage.

The standby system shall be designed with capacity and rating to safely start and operate the entire connected lift station load, including all pumps and ancillary loads unless otherwise approved by the District. All applicable codes shall be followed, including NEC and UPC.

The generator set shall be complete in every respect and shall include, but not be limited to the following:

1. Generator, control panel & circuit breaker.
2. Engine, radiator & exhaust system.
3. Fuel tank. (Capacity for 7 days at 25 percent load.)
4. Generator set enclosure providing noise attenuation in compliance with Washington State Administrative Code, Chapter 173-60, and lockable to District Standards.

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

5. Automatic transfer switch – single electric motor style.
6. Block heater.
7. Battery & rack.
8. Battery charger.
9. Conduit, wire and piping.

The generator set and transfer switch shall be Cummins/Onan complying with the latest edition of Onan Corporation standard specifications and District Standards or a District approved equal generator set and transfer switch.

The generator set shall be spark-ignited, liquid propane; 60 Hertz, 1,800 rpm, 3-phase, 480/277 volt standby power or diesel if approved by the District. Diesel required for generator sets greater than 150 kW.

The generator set shall include the following:

##### **Engine**

1. Single phase, 1500 watt block heater (115 VAC)

##### **Generator Set**

1. Mainline circuit breaker
2. 5-year basic power warranty

##### **Accessories**

1. Batteries
2. Battery Charger, 2 amp, 12 VDC, 120 Vac Input
3. Vibration Isolators, Pad Type

##### **Control Panel**

1. Annunciator relays (12)
2. Run relay package (3)
3. Low coolant level shutdown
4. Anti-condensation space heater, 120 Vac
5. Oil temperature gauge
6. Wattmeter
7. Emergency stop switch

##### **Fuel Systems**

1. Diesel unless approved by the District. All piping shall be black iron, except for flexible vibration isolation connections at pipe ends with shut off ball valves.

##### **Alternator**

1. Anti-condensation heater, 120 Vac

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

##### **Control Features**

1. Run-stop-remote switch
2. Remote starting, 12-volt, 2 wire
3. Coolant temperature gauge
4. Field circuit breaker
5. DC voltmeter
6. Running time meter
7. Lamp test switch
8. Oil pressure gauge
9. Fault reset switch
10. Cycle cranking
11. 12-light engine monitor with individual 1/2 amp relay signals and a common alarm contact for each of the following conditions:
  - Run (Green Light)
  - Pre-Warning For Low Oil Pressure (Yellow Light)
  - Pre-Warning For High Coolant Temp (Yellow Light)
  - Low Oil Pressure Shutdown (Red Light)
  - High Coolant Temperature Shutdown (Red Light)
  - Overcrank Shutdown ( Red Light)
  - Overspeed Shutdown (Red Light)
  - Switch Off (Flashing Red Light- Indicates Generator Set Not In Automatic Start Mode)
  - Low Coolant Temperature (Yellow Light)
  - Low Fuel (Yellow Light)
  - Two Customer Selected Faults (Red Light)

##### **AC Meter Package**

Order with NFPA 110 monitor to meet code requirements.

1. AC voltmeter (dual range)
2. AC ammeter (dual range)
3. Voltmeter/ammeter phase selector switch with an off position
4. Dual scale frequency meter/tachometer
5. AC Rheostat (panel mounted) for + 5% voltage adjust

The transfer switch shall include the following:

1. Sized for full station and auxiliary equipment load plus 25%.

##### **Pole Configuration**

1. Poles - 3 (Solid Neutral)

##### **Frequency**

1. 60 Hertz

##### **Application**

1. Appl - Utility to Genset

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

##### **System Options**

1. Three phase, 3-wire or 4-wire

##### **Enclosure**

1. Generator will be installed in a 12-gauge galvanized welded steel, insulated, sound attenuated, NEMA 3R weather-protective, walk-in drop over acoustical enclosure. The enclosure will meet the requirements of ASTM A-653 and the current IBC. The sound pressure level will average not more than 45 dBA at 110 feet in a free-field condition, or 53 dBA at 23 feet, or will meet more stringent sound requirements as specified by the District.

##### **Listing**

1. Listing - UL 1008

##### **Programmed Transition**

1. Program Transition, 1-60 sec.

##### **Applications Modules**

1. Monitor - Phase Sequence/Balance

Suitable guards shall be provided on all electrical parts to minimize the personal shock hazard.

Generator shall be broken-in sufficiently to permit application of full load immediately upon installation.

Generator supplier shall provide all tools for the generator set as recommended and required by the manufacturer.

Generator installation shall be checked by the supplier after installation to determine that the installation is correct. Written confirmation shall be provided to the District. Generator supplier shall perform a full load test for 2 hours after installation is complete. Provide resistive load bank for this test.

Generator supplier shall provide a minimum of 4 hours of training for District personnel at the station site during start-up.

Generator manufacturer shall provide 4 copies of the maintenance and operation manual. These manuals shall be complete and shall include all information necessary to allow District personnel to maintain the generator.

Generator mounting pad shall be reinforced concrete to carry the weight of the unit and shall extend a minimum of 3 inches beyond generator housing. All formed edges to be 1/2 round or 3/4 inch chamfer.

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

Diesel tanks shall be Convault AST, or approved equal, equipped with external fuel shutoff valve.

#### 9. FORCE MAIN:

The force main shall be a minimum 6-inch diameter ductile iron Class 52 polyethylene or epoxy lined or high-density polyethylene (HDPE) if approved by the District and provided with a continual positive slope. There shall be no intermediate high point between the lift station and the force main discharge point, unless properly protected with sewage air and vacuum release assembly. Minimum cover over the force main shall be 4'-0". All pipes (gravity and pressure) entering and leaving the wet pit or dry pit shall have flexible couplings within 18-inches of the structure. Install force main location boxes as required, shown on Detail V-S4.

Discharge of the force main to the gravity sewers shall be made at a manhole with the force main penetration core drilled and the force main aligned to discharge towards the downstream pipe. The invert of the force main shall be 0.1-foot above the invert of the downstream pipe. Channel the manhole as required.

A bypass pump connection equipped with a Cam Lock fitting and cap shall be located near the wet well in a location specified by the District. See Detail V-LS2.

A surge valve shall be installed on the force main to discharge into a manhole or the wet well if high head conditions will occur as determined by the District.

#### 10. TESTING FORCE MAIN:

##### Cleaning

All force mains shall be cleaned prior to connection of force main to pumping facilities. Contractor to provide cleaning plan for District review and approval.

##### Test Specifications

All force mains shall be tested prior to acceptance of work. All pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping, and measuring equipment necessary for performing the test shall be furnished, installed and operated by the Developer. Feed for the pump shall be from a barrel or other container within the actual amount of "makeup" water, so that it can be measured periodically during the test period.

The pipeline shall be backfilled sufficiently to prevent movement of the pipe under pressure. All thrust blocks shall be in place and time allowed for the concrete to cure before testing. Where permanent blocking is not required, the Developer shall furnish and install temporary blocking.

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

The pipeline shall be subjected to a pressure and leakage test of a minimum of 200 pounds per square inch for a period of not less than 1 hour. The test pressure shall be applied at the low end of the section tested.

Prior to calling for the District to witness the pressure test, the Developer shall first perform a satisfactory pressure test. The allowable leakage rate per thousand feet of each size pipeline is as follows:

Pipe Size	Allowable Leakage
	Gal. per Hour per 1,000 Ft. @ 200 psi
6"	0.64
8"	0.85
10"	1.06
12"	1.28

Defective materials or workmanship, discovered as a result of the tests, shall be replaced by the Developer at the Developer's expense. Whenever it is necessary to replace defective material or correct the workmanship, the tests shall be re-run at the Developer's expense until a satisfactory test is obtained.

#### **Preliminary Tests**

Developer shall conduct preliminary tests and assure himself that the section to be tested is in an acceptable condition before requesting the District to witness the test.

#### **Thrust Blocks & Anchor Blocks**

Fittings shall be "blocked" with poured-in-place concrete, with a firm minimum bearing against an undisturbed earth wall. Timber blocking will not be permitted. Thrust blocks shall be poured as soon as possible after setting the fittings in place to allow the concrete to "set" before applying the pressure test. The concrete thrust blocks shall be in place before beginning the pressure test. Anchor blocks shall be allowed to set sufficiently to develop the necessary bond strength between the reinforcing rods and the concrete anchor before beginning the pressure test. A visqueen barrier shall be provided to protect glands, bolts and other miscellaneous materials required for this type of connection from the concrete. Fittings that must be blocked against an undisturbed earth wall shall be restrained with restrained joint pipe and fittings.

#### **11. LIFT STATION TEST PROGRAM:**

The Developer shall perform, as a minimum, the following tests and provide the District written documentation of the date performed and results obtained. Pump

#### IV. SEWAGE LIFT STATIONS - GENERAL STANDARDS - Continued

tests shall meet or exceed specified capacity. The District shall be informed of the testing schedule 48 hours prior to the test and shall be present during testing.

1. Pump capacity by drawdown test
2. Bubbler/control panel operation
3. Generator load test
4. Automatic transfer reconciled to auxiliary power and back to utility power
5. Telemetry control to terminal strip
6. Telemetry control to SCADA system
7. Pump vibration analysis

Fill water for testing shall be obtained in accordance with District cross-connection practices.