DIVISION 44

MECHANICAL EQUIPMENT

44.01 GENERAL: This division covers the furnishing of all labor, materials and equipment to install the mechanical equipment for the pumping station in accordance with the Contract Documents.

A. The pump and motor combination shall be designed to meet the conditions identified on the plans when operated continuously or intermittently in sewage services.

B. The pump must be able to pass a minimum 3-inch spherical solid and be designed to prevent clogging by stringy or fibrous material.

44.02 MOTORS:

A. Motor Efficiency: Where "High Efficiency" motors are specified, motors shall be General Electric "Energy Saver", Louis Allis "Spartan" or equal. Where "Normal Efficiency" motors are specified, or where no indication is given, motors shall be industry standard "Normal Efficiency" motors.

B. Ratings and Design: Motors shall conform to NEMA Standard and all applicable requirements of ANSI and IEEE Standards and the National Electrical Code.

1. General: Motors shall be of adequate ratings to accelerate and drive their connected equipment under normal operating conditions without exceeding their nameplate ratings, excluding the service factor. Unless otherwise specified, motors 1/2 HP and larger shall have a service factor of 1.15 and Class F insulation. Motor ratings shall be continuous and based on 40 degrees C ambient temperature.

a. Unless otherwise specified, all motors rated ½ HP or more shall be 3-phase, 60 hertz induction type squirrel cage motors, designed for operation at 230 or 460 volts as required. Motors rated less than ½ HP shall be single-phase, 60 hertz, 115/230 volt induction motors, unless otherwise noted.

b. Motor operating speeds shall be as specified in other sections or as required for the equipment driven.

c. Nameplates shall be furnished for all motors with markings in accordance with NEMA MG1. Terminal boxes shall be of sufficient size to accommodate conduits, connectors and insulation over connectors. Terminal boxes for weather-protected and totally enclosed motors shall be rubber gasketed. Motors used with belt drives shall have sliding bases to provide for belt take-up.

d. Terminal boxes for horizontal motors shall be located on the left-hand side, when viewing the motor from the drive shaft end, and shall be designed so that c6nduit entrance can be made from above, below or either side of the terminal box.

2. Three-Phase Motors: Unless otherwise specified or except as required by the dynamic characteristics of the load, all 3-phase squirrel-cage motors shall be designed to withstand full-voltage starting, and shall have torque and locked-rotor current characteristics as specified for NEMA Design B motors.

3. Single-Phase Motors: All single-phase fractional horsepower motors shall comply with NEMA Standards for Definite Purpose Motors. In general, capacitance type induction motors shall be used unless otherwise approved by the Engineer. Shaded pole motors larger than 1/4 HP will not be allowed. Thermal overload protectors and any auxiliary components necessary to provide the required starting characteristics (including capacitors, resistors and automatic switching devices) shall be furnished and mounted integrally, unless motor starters with overload protection are provided.

4. Mechanical Construction:

a. Unless otherwise specified, electric motors shall be of the following types of construction according to the degree of mechanical protection:

1) Where located outdoors, or elsewhere if specified, motors shall be totally enclosed fan-cooled or weather-protected Type I.

2) Where located indoors, motors shall be weather-protected Type I or open drip-proof.

b. Motors rated less than 100 HP shall have grease-lubricated anti-fraction ball bearings with conveniently located grease fittings.

c. Where of vertical shaft construction, motors shall have adequate thrust bearings to carry all motor loads and any other operating equipment loads. Where of horizontal shaft construction and coupled to fluid pumps, motors shall have adequate thrust bearings or shall have the coupling end-play and rotor float coordinated to prevent damage to rotor bearings.

d. Running fit adjustment shall be provided by mans of a lockable nut at top of the shaft.

e. Rotors shall be statically and dynamically balanced and shall have secondary bars of heavy copper silver-brazed to one-piece end rings or shall have rotor windings of one-piece cast aluminum. Where applicable, rotors shall be constructed with integral fans.

f. Non-reversing ratches shall be provided where specified.

g. Unless otherwise noted, motors for outdoor service shall be provided with 120-volt, 60-hertz space heaters to keep the windings dry during inoperative periods.

5. Two-Speed Motors: One-half (1/2) HP and larger shall have two windings. Two-speed motors less than 1/2 HP may have single windings. Motor speed shall be as specified.

6. Painting: Unless otherwise noted, all motors shall have shop applied finish consisting of a rust inhibitive prime coat and a finish coat. of paint.

7. Manufacture and Performance: As far as practicable, all motors furnished with identical equipment shall be of one manufacturer. Suitable motor outline drawings together with motor performance data, including guaranteed values of full load and locked rotor currents, shall be submitted to the Engineer for review. For motors rated 50 HP and larger, values of efficiency and power factor at 100 percent. 75 percent and 50 percent of full load shall also be submitted.

a. Motors shall operate without excessive noise or vibration and shall show no signs of phase unbalance.

b. Bearing Lubrication: Bearings shall be grease lubricated with provisions for the addition and relief of grease.

44.03 FLOODED SUCTION PUMPS:

A. General: This specification covers vertical single-stage, single-suction, split casing centrifugal pumps designed specifically for municipal, institutional, commercial and industrial sewage applications. Pump shall have intermediate shafting.

B. Pump Construction:

Casing shall be close-grained cast iron conforming to ASTM A48, of sufficient strength, weight and metal thickness (Class 30 minimum) to insure long life, accurate alignment and reliable operation. Volute shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller and provide smooth unobstructed flow. A large clean-out opening with removable cover, having its interior surface matching the volute contour, shall be located on the casing at the impeller center line, to allow access to the interior of volute. Casing shall be split perpendicular to the shaft, with removable suction cover and stuffing box cover. Machine fits for these parts shall be accurately aligned and identical so that casing may be installed for either clockwise or counter-clockwise direction of rotation. Casing shall be so arranged that the impeller may be removed without disturbing either suction or discharge piping.

C. Casing Connections: Suction and discharge flanges shall conform to ANSI 816.1 Class 125 flat face flanges. All flange bolt holes shall be slotted for ease of assembly and disassembly. Each suction and discharge flange shall be drilled and. tapped for gauge connections. A ¼" IPS tap' shall be supplied in the suction nozzle, and a ½" IPS tap in the discharge nozzle. The tap in the discharge nozzle shall serve as a vent when gauge is not used.

D. Discharge Position: Pump discharge nozzle shall be capable of rotation to any one of eight discharge positions for each direction of rotation. Discharge shall be located to suite the configuration shown on the plans.

E. Impeller shall be of the single-suction enclosed type with vanes, capable of passing a 3" solid sphere. Impeller shall be particularly designed with smooth water passages to prevent clogging. Impeller shall be statically and hydraulically balanced. Impeller shall be keyed and secured to the shaft by a stainless steel capscrew and washer, and shall be readily removable without the use of special tools. Pump shall have provisions for

adjustment of axle clearance. This adjustment shall be made through the use of shims placed between the frame and outboard bearing housing.

F. Stuffing Box Cover and Stuffing Box:

1. Stuffing Box Cover: Stuffing box shall be made of a close-grained cast iron, conforming to ASTM A48 Class 30, with integral stuffing box.

2. Stuffing Box: Stuffing box shall consist of at least five (5) rings of white asbestos or cotton plated packing, a stainless steel seal cage, and a split-type bronze gland to permit easy removal and access to packing. Sealing liquid connection to stuffing box shall be tapped in a convenient location. Ample space shall be provided for repacking the stuffing box. Arrangement shall provide for use of mechanical seals instead of packing.

G. Shaft: Pump shaft shall be high-strength carbon steel, SAE 1045 minimum, accurately machined and of sufficient size to transmit full driver output. It shall be protected from the pumped liquid by a shaft sleeve in the stuffing box area. The shaft shall be sealed by a synthetic rubber "O" ring between the sleeve and the impeller hub and a suitable gasket between the impeller hub and adjoining shaft shoulder.

H. Shaft Sleeve: Renewable shaft sleeve, which extends through the stuffing box and under the gland, shall be provided. Shaft sleeves shall be of corrosion-resistant material, approximately 500 Brinnell hardness. Shaft sleeve shall be secured to the shaft by a socket-head set screw, located under the gland for easy access.

I. Bearing Frame and Bearings:

1. Bearing Frame: Pumping bearing frame shall be one piece rigid cast iron construction. Frame shall be provided with a cast iron bearing housing at the outboard end, and a cast iron end cover at the inboard end. Both ends of the frame shall be provided with lip type grease seals and labyrinth-type deflectors to prevent the entrance of contaminants. Frame shall be provided with a ¾" IPS tapped hole, located as low as possible to drain the leakage from the packing gland. (Bearing frame shall be designed so that complete rotating element can be removed from the casing without disconnecting piping.) A weep line of PVC shall be run from the drain hole to the Dry Well Floor Sump.

2. Bearings: Bearings shall be designed for 20,000 hours minimum life at conditions of operation. Radial inboard bearing shall be ball

or roller type suitable for all loads encountered in the service conditions. Axial thrust outboard bearings shall be deep groove, single row ball or angular contact double row ball type suitable for thrust loads in two directions.

3. Bearing Lubrication: Bearings shall be grease lubricated with provisions for the addition and relief of grease.

J. Pump Support and Coupling:

1. Pedestal Base: Pump shall be supported by a cast iron pedestal base with openings large enough to permit access to the suction elbow and clean-out hand hole. Base shall be designed to support the assembled weight of the pump and shafting. Base shall safely withstand all stresses imposed thereon by vibration, shock and all possible direct and eccentric loads. Base shall have adequate horizontal dimensions foundation contact area, anchorage facilities and shall be of sufficient height that the suction elbow will not touch the floor our foundation upon which the pump is mounted.

2. Suction Elbow: Each pump shall be provided with a clean-out type cast iron (reducing) suction elbow which is bolted directly to the pump suction flange. The clean-out hand hole shall be provided with a removable cover of the largest possible size. The inner surfaces of each hand hole cover shall generally conform to the curvature and radius of the suction elbow. A ¼" tapped hole for gauge connection shall be provided in the elbow near the suction flange. A 2" tapped hole shall also be provided in accordance with the manufacturer's specification in the side of the elbow for use in applying water pressure to unclog the pump in case of stoppage.

3. Unit with Intermediate Shafting: Intermediate line shafting of the flexible type shall be provided between the motor and pump. Line shafting shall be of the size recommended by the shafting manufacturer to provide continuous 24-hour duty at any speed within the range of the pump. The number of shafting sections shall also be based on shafting manufacturer's recommendations. The complete intermediate shafting assembly shall be of sufficient diameter and quality to transmit the full driver horsepower. Shafting shall be connected to the pump and motor through self-aligning couplings of the vertical type. Couplings shall be universal joint spacer type to permit removal of the pump rotating element without dismantling other sections of shafting, any intermediate bearing, and without removing driver, or suction and discharge piping. One slip spline, to allow for endwise movement, and the necessary steady bearings shall also be provided for each

shaft and shall be installed at the lower end. The driving motor shall be provided with a cast iron base of adequate height to permit access to the coupling between the motor and pump shafts from the motor floor. The motor mounting surface shall be designed for standard NEMA "P" flange motor.

K. Rotation: Pumps shall be arranged to rotate (clockwise) when looking at the pump for the drive end.

L. Miscellaneous:

1. Data Plates: All data plates shall be of stainless steel suitably attached to the pump. Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data. A special data plate shall be attached to the pump frame which shall contain identification of frame and bearing numbers.

2. Hardware: All machine bolts, nuts and capscrews shall be of the hex head type. Hardware (or parts) requiring special tools or wrenches shall not be used.

44.04 SEWAGE PUMPS AND MOTORS (SUCTION LIFT PUMPS):

A. Definitions:

1. Priming occurs on initial start-up with the pump casing completely filled with water.

2. Repriming occurs after the pump has been placed in service and for some uncontrollable reason a portion of liquid is lost from the pump casing with resultant loss of suction leg, and the pump must reprime automatically. It is mandatory that the pump manufacturer furnish reliable information concerning the pump's ability to prime/reprime at a given priming lift versus the speed of the pump.

3. Priming Lift/Repriming Lift: The vertical distance in feet measured from the centerline of pump suction to the pump on level in the wet well.

4. Cutwater Tip: That portion of the volute scroll housed within the pump casing which comes in closest proximity to the impeller tip.

B. Self-Priming Pumps: The pumps shall be of the horizontal, self-priming type, specifically designed for the handling of raw, unscreened domestic sewage.

C. Construction: Because of the type of material being pumped, debris occasionally may become lodged between the suction check valve and its seat resulting in the loss of the suction leg and the siphoning of liquid from the pump to the level of the cutwater tip in the pump casing when the pump shuts down. This condition shall be considered normal, provided that there is a properly installed air release line to atmosphere to insure repriming when the pump is restarted. Each pump shall be designed to retain adequate liquid in the pump casing to insure unattended automatic repriming at its rated speed and each pump shall be tested at the vertical reprime lift as specified hereinafter.

The pump must be equipped with a removable cover plate, allowing access to pump interior to permit the clearing of stoppages and to provide easy access for service and repairs without disturbing the pump volute or the suction or discharge piping.

The pump shall also be fitted with a replaceable wear plate. Replacement of the wear plate, impeller, and the seal shall be accomplished through the removable cover plate. The entire rotating assembly, which includes bearing, shaft, seal and impeller, shall be removable as a unit without disturbing the pump volute or piping.

D. Impeller: The impeller shall be a two-vaned, semi-open, non-clog, ductile iron with integral pump out vanes on the back shroud and capable of passing a 3" diameter sphere. It shall thread onto the pump shaft and be secured with a lockscrew. Means shall be provided for external adjustment of the clearance between the impeller and wear plate.

E. Shaft and Bearings: The shaft bearings shall be of ample size and proper design to withstand all radial and thrust loads incurred during normal pump operation. Bearings shall be oil lubricated, with the bearing pedestal cooled by the liquid being pumped. The pump shaft shall be protected by a shaft sleeve through the mechanical seal cavity.

F. Seal: The pump shaft shall be sealed against leakage by a mechanical seal. Both the stationary seal member and mated rotating member shall be of identical metallic alloy construction, with a Mohs hardness rating of 8.8 and capable of withstanding temperatures up to 1200 degrees F. Each of the mated surfaces must be ground and polished to produce a flatness tolerance not to exceed 5.8 millionths of an inch. The stationary seal seat must be double-floating and self-aligning to insure that seal faces remain in full contact at all times, and especially during shock loads which cause deflection, vibration, and axial or radial movement of the pump shaft.

The mechanical seal shall be lubricated with oil from a separate oil filled reservoir of the pump pedestal, the oil being both lubricating and cooling media. The seal must be removable and replaceable through the cover plate opening.

The mechanical seal must be warranted for a minimum of four (4) years from date of shipment. Should the seal fail within the first year, the manufacturer shall be obligated, upon notification, to furnish to the Owner a new seal, no charge, FOB factory. The cost of replacement seals thereafter will be on a pro rata basis as follows:

Failure Within	Percentage of New Seal Price
2 years	25%
3 years	50%
4 years	75%

G. Suction Check Valve: Each pump shall incorporate a molded one-piece suction check valve that can be removed or installed through the removable cover plate opening, without disturbing the suction piping. Valve shall not incorporate a pressure relief blowout feature.

The pump casing and volute and all areas exposed to sewage, shall be constructed of cast iron, no lesser grade that Class 30, and contain no openings of a lesser diameter than the sphere size specified. Screens or any internal devices that create a maintenance nuisance or interfere with priming and performance of the pump will not be permitted. Certified dimensional drawings indicating size and locations of the priming recirculation port or ports shall be submitted to the Engineer for his approval. Certification shall be by the pump manufacturer.

The pumps shall be fitted with a pump drain assembly consisting of a nipple, gate valve and quick connect fitting (1" minimum) and flexible hose of adequate length to discharge at the station sump to facilitate draining the pumps for maintenance purposes.

H. Drivers: Power shall be transmitted from motors to pumps by means of vertical V-belt drive assemblies. The driver assemblies must be selected to establish proper pump speed to meet the specified operating conditions.

Each drive assembly shall have a minimum of two V-belts. In no case will a single-belt drive be acceptable. Each V-belt drive assembly shall be selected on the basis that adequate power will be transmitted from driver to pump.

The pump manufacturer shall submit to the Engineer power transmission calculations, which clearly express the following:

a. Ratio of pump speed as related to motor speed;

b. Pitch diameter of driver and driven sheaves;

c. Number belts per drive assembly;

d. Theoretical horsepower transmission per V-belt;

e. Center distance between driver and driven shafts;

f. Center distance and combined arc-length correction factor applied to theoretical horse power transmission per V-belt; and

g. Service factor, i.e. power transmitted per drive assembly as related brake horsepower requirements of the pump.

Drive systems with a safety factor less than two (2) shall not be considered sufficient for the service intended.

A fabricated steel belt guard constructed to conform to OSHA standards, shall be furnished with each drive assembly to assure maximum protection for maintenance personnel. Pump drive(s) shall be enclosed on all sides in a guard constructed of any one, or combination of materials consisting of expanded, perforated or solid sheet metal. Assemblies shall be manufactured to permit complete removal from the pump unit without interference of any unit components. Maximum perforated or expanded openings shall not exceed ½ inch. All metal should be free from burrs and sharp edges. Structural joints shall be continuously welded. Panels may be riveted to frames with not more than five-inch spacing. Tack welds shall not exceed a four-inch spacing. Guards shall be securely fastened to the unit base and rigidly braced every three feet or fractional part of their height to some fixed part on the unit. The guard shall be painted n accordance with Division 41 of these Specifications.

I. Experience and Workmanship: The pumps shall be the product of a manufacturer with experience in the design and manufacturer of self-priming centrifugal pumps handling sewage.

44.05 SUBMERSIBLE:

A. General: Each pump shall be the sealed submersible type, Model Numbers as shown on the plans. Pumps shall be capable of handling raw, unscreened sewage with two-part, non-clog, cast iron impellers. Pumps

shall have two mechanical seals with oil chamber between the seals. Rotating seal faces shall be carbon and stationary seal faces to be ceramic.

B. Pump Construction:

1. All metal parts of seal including spring shall be 303 Stainless Steel. All pump fasteners shall be 303 Stainless Steel.

2. Configuration: Pump motors shall be of the sealed submersible type. Pump motor-shaft shall be of 303 Stainless Steel. Pump shall be a standard production pump with attached rail guides and discharge elbow. Rail guides shall be fastened to pump so that all lifting loads will come on the guide supports and not on the pump or motor housing. A lifting cable or chain (Stainless Steel) and hook shall be supplied for each pump. The hook shall be attached to the access door.

3. Motors: Motors shall be explosion proof, UL or FM approved, within a sealed submersible-type housing, three-phase, 60 hertz; of voltage, RPM and HP as shown on the plans; vertical, solid shaft, normal thrust, drip-proof, ball bearing type. Motors shall be amply rated for the head and capacity specified, on continuous duty, without exceeding their service factor when pumping at the minimum head possible in the installation.

4. Motor Protection: Motors shall be supplied with heat sensing units attached to motor winding. The heat-sensing unit shall trip starter if motor overheats.

   The motors shall also be fitted with seal failure sensors.

5. The discharge of each pump shall be fitted with a diaphragm-type hydraulically operated sealing flange. When pump is in operation, pressure shall force diaphragm against discharge elbow flange providing a leak-proof seal. When pump is idle, pressure shall be removed from diaphragm so that pump can be removed from sup with no mechanical contact of sealing flanges. Complete weight of pump to rest on bottom support plate, no weight to be supported on guide rails or discharge elbow. Sealing diaphragm to be removable and to be mounted on pump discharge flange. Diaphragm material to be Buna N rubber.

6. Mounting Plate: A separate mounting plate shall be furnished for each pump. These plates shall include adjustable guide rail supports and discharge elbow with flange to align with pump

hydraulic sealing flange. Discharge elbow flange shall conform to ANSI al6.1, Class 125. Pipe size to be as shown on the plan.

7. Coatings: Plates and fittings shall be coated with tar base Epoxy paint. Sealing face of discharge elbow shall be coated with sprayed on metal (pure zinc) for smoothness and corrosion resistance.

8. Impeller: Impeller shall be of the single-suction enclosed type with vanes, capable of passing a 3" diameter sphere. Impeller shall be particularly designed with smooth water passages. Impeller shall be statically and hydraulically balanced. Impeller shall be keyed and secured to the shaft by a stainless steel capscrew and washer, and shall be readily removable without the use of special tools. Pump shall have provisions for adjustment of axial clearance. This adjustment shall be made through the use of shims or by external adjusting screws.

9. Miscellaneous:

   a. Data Plates: All data plates shall be of stainless steel suitable attached to the pump. Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data. A special data plate shall be attached to the pump frame, which shall contain identification of frame and bearing numbers.

   b. Hardware: All machine bolts, nuts and capscrews shall be of the hex head type. Hardware (or parts) requiring special tools or wrenches shall not be used.

C. Access Frame and Cover: A double door access frame assembly shall be supplied as shown on the drawings these specifications. Frame shall support guide rails. Cover shall be provided with lifting handle and safety latch to hold cover in the open position. Locking clasps shall be furnished for each cover.

D. Guide Rails: The guide rails used to direct the pump in proper alignment with the stationary discharge piping shall be of a dual rail design. The rail shall be of 2" corrosion resistant stainless steel schedule 40 pipe and positioned on the centerline of the pump to each side so that no weight of the pump bears on either of the two guide rails at any time. The guide rails shall serve truly as a guide rail.

E. Junction Boxes: A NEMA 4 waterproof junction box shall be used inside the valve vault to connect pump and control cords. This box shall be constructed so that incoming power and control wires shall be individually sealed with mechanical rubber seal so that no sealing compounds are required to make waterproof joint. Box shall be provided with terminal strip to connect incoming wires with pump and control cords. All pump and control cords to be sealed in box with mechanically held rubber seal. Box cover to be bolted on and sealed with rubber o-ring. Box and all connections shall be completely waterproofed and shall not leak under an outside pressure of 10 PSI. A control support bracket shall be attached to NEMA 4 junction box. The bracket shall be provided with cord snubbers to hold cord at any set height.

44.06 TESTING:

A. Factory Testing:

1. Each pump shall be fully tested on water at the manufacturer's plant before shipment. Pump and motor shall be tested as a unit. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve. The Standards of Hydraulic Institute shall govern the procedures and calculations for these tests. All tests shall be certified by a professional Engineer familiar with this type of testing. Copies of test results and performance curves shall be supplied to the Engineer, who shall in turn furnish copies to the City.

2. For suction lift pumps only, the reprime test shall be conducted with the pump liquid level lowered to the tip of the cutwater in the pump casing. The tests shall be certified by a professional Engineer for the pump manufacturer and the test report shall include the information below. Certified reprime test data must be submitted to the Engineer and City for approval prior to shipment, including the following:

a. Pump model and serial number

b. Impeller diameter

c. Pump speed

d. Reprime vertical lift and elapsed time

e. Type and temperature of liquid

f. Size of suction lines and length of horizontal run

B. Field Test: A field test shall be conducted by the Engineer prior to acceptance of the pumping equipment.

1. General: Upon the Engineer's verification of a proper installation, the Contractor shall notify the pump equipment supplier that the installation is complete and ready to be put into operation. The Contractor will arrange a date for the accomplishment of initial start-up and the conduct of the Field Test. Initial startup and Field Test shall be accomplished in one 8-hour day. The authorized representative of the pump manufacturer shall perform the initial startup. Upon completion of the initial startup, the Field Test will commence. Contractor shall have an electrician available on the job site during start-up and the Field Test. Contractor shall provide or arrange for provision of all equipment and instrumentation necessary to perform test.

2. Conduct of the Test: The Field Test shall be conducted by the Engineer in the presence of the Contractor, the pump manufacturer, and representative of the Department of Public Utilities. The Engineer or his representative shall conduct the test as follows:

a. Verify pump serial numbers as to matching serial numbers on pumps which factory ran certified reprime tests on.

b. Verify impeller diameter as to size specified for each pump.

c. Verify pump speed as specified.

d. Verify actual field priming lift conditions match design/specified conditions.

e. Inspect each pump casing and related piping to insure there are no stoppages.

f. Insure adequate liquid/sewage is available to reach design control levels in the wet wall.

g. Insure air release lines are open.

h. Record type and temperature of liquid to be pumped.

i. Record time of day and barometric pressure at Job site.

j. Put pumps into operation and measure suction and discharge pressure for each pump. At least three points on the pump curve shall be simulated during the test. Additional test may be required to confirm operation.

3. Priming/Repriming Test: (Suction Lift only) Each pump shall be given a priming/repriming test in the field. Each pump shall be tested three times and the elapsed time required to achieve prime/reprime recorded for each test. The average time of the three tests shall be used. This average time must be less than or equal to the' manufacturer's specified times. The test shall be conducted as follows:

a. Lower wet well level below pump on level.

b. Fill pump-casing full of water.

c. Drop suction leg.

d. Fill wet well until pump turns on automatically at specified pump on level.

e. Record time from instant starter energizes until pump comes to full prime and is pumping at full rated capacity against the specified head. Suction and discharge gauges shall be attached to the pump during the test to insure full prime is reached. A standard stopwatch shall be used to keep time.

f. After the priming test, each pump shall be given a reprime test. It shall be conducted exactly as the priming test but with one exception. Instead of using a full pump casing, the liquid level in the pump casing shall be drained to the cutwater tip.

g. The reprime test shall also be administered as above, but rather than drain the pump casing to the cutwater tip, the suction check valve shall be removed and the pump brought to prime. Once the pump is pumping at its fully rated capacity, the pump shall be cut off. The suction leg will drop and a natural siphonage shall occur from the pump casing. The time required for each pump to reprime under this condition shall be recorded. The average time of three tests shall be used.

h. Should the proposed equipment fail to meet the specified performance criteria or fail to prime/reprime within the specified time, the equipment will be rejected. The pump manufacturer shall have seven (7) days to correct any deficiencies prior to a retest. The retest shall be identical to the first test. Should equipment fail to perform as specified during the retest, the Engineer shall direct the equipment be removed from the job site and an equipment offering which will perform as specified be provided.

i. No external devices or vacuum assist units shall be used during prime/reprime tests.

4. Field Tests: All field tests shall be conducted at Contractor's expense. Three (3) copies of test results must be provided to the City.

5. Service: Manufacturer shall furnish services of a field Engineer to check installation and supervise start-up.

44.07 SUBMITTALS:

A. Required Submittal Data: All required data except the results of the factory performance tests shall be provided with initial submittal data by the pump supplier for review by the Engineer. In addition to standard information, the following data shall be provided:

1. Certified dimensional drawings of the pump recirculation port or ports.

2. Power transmission calculations.

3. Manufacturer's projected performance in regards to elapsed time required for priming and repriming while operating under specified design conditions, pump speed, and impeller diameter.

4. Certified drawings indicating location of the cutwater tip within pump casing.

B. Approval Procedure: Upon a satisfactory review of the proposed equipment suppliers initial engineering data by the Engineer, the equipment offered shall be approved conditionally and released to production. Upon completion of manufacture, all required test data shall be forwarded to the Engineer for review. Certified test data in regards to prime and reprime capabilities shall be equal to the specified performance valves at design conditions in order to be approved for shipment.

Approval for shipment shall be authorized in writing by the Engineer, but shall not be accepted by the Engineer until tested under actual field conditions, in accordance with and subject to, the provisions of above titled Field Test.

Upon receiving approval for shipment, the pump manufacturer shall provide a certified letter to the Engineer stating the name, address, and telephone number of the factory representative authorized to perform as their agent during conduct of the field fast.

C. Contractor's Liability: Should equipment selected by the contractor fail to pass a field test as described above, and consequently be ordered removed from the job site by the Engineer, it shall be at the Contractor's expense. The Contractor shall incur all costs for removal of substandard equipment, and shall be subject to any penalties or damages specified herein due to his failure to meet a project completion date.

44.08 MISCELLANEOUS EQUIPMENT:

A. Sump Pump: Furnish and install if applicable, as shown on drawings, one Sump Pump, Zoeller Model 147, Submersible, ½ HP, 115 volts or approved equal.

B. Ventilation: Furnish and install, as shown on drawings, wall mounted Vent Sets, ILG BF18, or SF21, or equal, 1140 RPM, 115 volts, 60 single-phase, HP and capacity as per plans. Fans to be actuated automatically whenever the station door is open via door frame mounted switch, providing ventilation to wet well and, if applicable, dry well.

44.09 MEASUREMENT AND PAYMENT: The mechanical equipment will not be measured, but will be included in the lump sum bid price for the pumping station.