

SECTION 151620
SUBMERSIBLE PUMPS FOR WASTEWATER (S-114)

1. DESCRIPTION

This specification shall govern all work necessary for furnishing, installing, and placing into operation the submersible pumps with accessories required to complete the project.

2. GENERAL

Pumps shall be designed and constructed to pump raw unscreened sanitary sewage and capable of passing 3" diameter spheres. Design of mounting system shall facilitate removal and inspection of pumps. There shall be no need for personnel to enter wet well for inspection and maintenance of pumps. Lifting chain, guide rails and mounting system shall be provided and installed for each pump. Pumps shall be designed, built and installed in accordance with best available technology and practice, and shall operate satisfactorily when installed.

3. WARRANTY

The pump manufacturer shall furnish the City with a written guarantee to warrant pumps and components against failure due to defective materials and workmanship for a period of 5 years after full operation and acceptance by the City. The warranty shall include 100% coverage of manufacturer's shop labor and parts for the first year, then 50% coverage through the 5th year. Pumps repaired under warranty shall be returned to the City's Wastewater Department with freight prepaid.

4. QUALIFICATIONS OF BIDDER

4.1 Manufacturer & Supplier: The submersible pumps and accessories, with the possible exception of the discharge connection assembly which shall be Flygt or compatible, for each lift station shall be furnished by a single manufacturer/supplier who is fully experienced, reputable and qualified in the manufacture of the pumps to be furnished.

4.2 Prebid Submittals: General The Contractor shall obtain tentative approval of the submersible pumps prior to bidding the project. Tentative approval does not relieve the Contractor of the responsibility of providing and installing pumps that will comply with all sections of these specifications and that will function properly. To obtain tentative approval for bidding, the Contractor shall submit the following pre-bid submittals at least 3 weeks prior to the bid opening. Failure to obtain tentative approval shall be considered grounds for rejection of bid.

Suitability Certification

The Contractor shall submit a certification stating that the manufacturer's authorized representative for the pumps has studied the Contract Documents (plans and specs), evaluated conditions affecting these pumps, and certifies that they should be suitable for the application and should require no more than normal maintenance if not damaged or abused. The certification shall state that the proposed pumps are suitable for the application and will function as intended and will comply with all requirements of this specification, with the exception of those listed in the certification. The certification shall be

signed by the Contractor and the Manufacturer's authorized representative. If the equipment is approved for use on the project and is found at any time to have unlisted exceptions, the Engineer shall have the right to reject the equipment or require the Contractor to bring the equipment into compliance at no cost to the City.

Pump Data

The Contractor shall furnish certified pump curves showing the results of test pumping units of identical design, size, and horsepower as those to be furnished. Catalog curves are not acceptable. Graphs shall include:

1. Pump Curve - Q in GPM, H in FEET
2. Power Input Curve - KILOWATT
3. Efficiency Curve (including motor) wire to water
4. N.P.S.H. Curve
5. Model, Impeller size, serial number
6. Motor rated HP, Voltage
7. Date and place of test
8. Customer for whom test was conducted
9. Data in English units (gallons, feet, etc.)

5. MATERIALS

5.1 Pump Construction:

General

Major parts, including lifting cover, stator casting, volute, and impeller, shall be ASTM 48, Class 30 gray cast iron. All nuts, bolts, washers, and fastenings shall be of 316 stainless steel. Ferrous metal surfaces coming into contact with wastewater shall be protected with a coating of rubber-asphalt paint.

Power Cable

The motor power cable shall consist of well insulated cable with a double jacketed system, Hypolon outside, synthetic rubber inside, exceeding industry standards for oil, gas, and sewage resistance and shall be permanently marked with the indicated code. Sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable. Each pump shall be installed with a sufficiently long power cable to suit the installation as shown on the drawings without splicing.

Power Cable Entry

The cable entry seal shall insure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet flanked by a stainless steel washer, all having close tolerance fit against the cable and compressed by the entire body containing a strain relief function, separate from the function of sealing. A separate junction chamber shall provide for connection of the cable to the stator power leads. The junction chamber shall be separated from the motor stator housing by a terminal board which is bolted to a machined surface using an o-ring seal. Stator leads shall also be sealed to prevent moisture from entering the motor interior.

Impeller

The impeller shall be of non-clog design, capable of handling solids fibrous

material, sludge, etc. with long thoroughfare having no acute angles and shall be dynamically balanced. The impeller shall be class 30 gray cast iron, coated with a ceramic coating to provide wear resistance to particle erosion caused by sands and silts typically found in sewage. The coating shall have a minimum thickness of .05". The fit between the shaft and impeller shall be a sliding fit with one key. Fastening of the impeller to the shaft shall be by a locking assembly which is sealed from the liquid by a protective rubber cap and a bolt threaded to the shaft end.

Volute

The volute shall be single piece gray cast iron and shall have a replaceable wear ring.

Wear Rings

Stainless steel wear rings shall be fitted to the volute and the impeller.

Discharge Connection

Each pump shall be supplied with a coupling, ANSI 125 cast iron, which bolts to the discharge flange, if other than Flygt. The floor mounted discharge elbow shall be compatible with the Flygt model specified as follows:

At Laguna Shores	CP 3201
At Riviera	N/A use existing

No part of the pump shall bear directly of the sump floor and no rotating motion of the pump shall be required for sealing. Sealing at the discharge shall be effected by metal to metal contact of the pump discharge flange and the mating discharge connection either with or without a replaceable rubber seal form fitted to the machine discharge coupling to insure a positive leak proof system and for ease of removal of the pump.

Bearings

Pumps shall be equipped with three lubricated bearings, one upper and two lower. The upper shall restrain radial thrust and be of the single row roller type. The two lower shall consist of one roller for radial thrust and one angular contact for axial thrust. Bearings shall have a minimum design life of 40,000 hours.

Lower Bearing Temperature Sensor

Pumps with motors larger than 60 HP shall have a lower bearing temperature sensor to monitor the lower bearing temperature, unless the bearings are lubricated with circulating force fed oil.

Shaft

The shaft shall be of large one piece design and extend through the pump and motor. The shaft shall be constructed of stainless steel, unless the entire shaft is not exposed to the pumped liquid, in which case the shaft may be C1034 carbon steel.

Shaft Seals

Shaft seals shall have lapped tungsten carbide faces. The seal system shall

allow continuous pump operations with the exterior completely dry. The seal assemblies shall not require adjustments, shall be easily inspected, shall be easily replaceable and shall not require operating pressure differential for sealing.

Guide Brackets

A guide bracket shall be Flygt compatible and shall allow raising and lowering of the pump in the wet well without binding with the guide rails. No special adjustment shall be necessary to assure proper alignment. Guide brackets shall be cast iron or stainless steel.

Motor

The pump motor shall be integral to the pump for submersible or dry well operation. The motor shall be squirrel cage induction type with class F insulation, NEMA B design, class H slot liners with a service factor of 1.15 or above. The dual voltage copper wound stator, which will allow field changeability of voltage, shall be triple dipped in epoxy enamel or varnish to withstand a heat rise of 155E C as defined in NEMA Standard MG-1. The NEMA starting code shall be F or less. The motor shall be statically and dynamically balanced. The motor shall be designed for continuous operation at 400E C ambient air and be capable of up to 10 starts per hour.

Stator Temperature Sensor

Stator temperature sensors switch shall be embedded in the stator windings and shall be used to stop the motor when the stator temperature exceeds 155E C. The motor shall resume operation when the stator cools to 150E C.

Cooling System

Motors shall have a forced convection type of cooling system.

5.2 Accessories:

General

Pump, accessories, controls, rails, hardware, etc. shall be furnished by the pump manufacturer. The pump manufacturer shall be responsible for the coordination and compatibility of accessories. The accessories shall be warranted against defects and corrosion by the manufacturer for five years after final acceptance of the project.

Lifting Chain

A lifting chain assembly shall be provided and installed for each pump. The chain and shackle shall be of 316 stainless steel and have a minimum working load of two times the pump weight. The chain shall be secured to the pump with the shackle and to the access cover with a hook. A five foot length of excess chain shall be suspended at the hook to facilitate the lifting of the pump.

Access Covers

Access covers and frames shall be of aluminum. The door panels shall be 1/4" thick diamond plate designed to withstand a live load of 150 lbs, per square foot. The door shall be provided with stainless steel hinges with tamper-proof fasteners. All hardware shall be stainless steel. The door shall open to 90E

and automatically lock in that position with a stainless steel positive locking arm and release handle. The door shall close flush with the top of the frame.

Guide Rails

Guide rails shall be schedule 40 type 316 stainless steel pipe of suitable diameter. The rail shall be held in position with upper, intermediate (if bar exceeds 20' in length) and lower guide bar brackets. The upper guide bracket shall be stainless steel and designed to allow simple removal and replacement of guide bar without entering the wet well. The intermediate bracket shall be of stainless steel and be installed about midway between the upper and lower bracket.

Float Cable Rack (not applicable for doppler controls)

A stainless steel cable rack shall be provided and attached to the upper frame. The rack shall support the level control float cable.

Power Cable Supports

Stainless steel power cable supports, Kellum type, shall be used for power cables to all motors. The supports shall be attached to eyebolts bolted into the concrete on the side of the access opening.

Hardware

All nuts, bolts, fasteners, fabricated metal, etc. shall be Type 316 stainless steel.

5.3 Electrical Controls:

The pump supplier and the Contractor shall provide for proper control operation and protection. The electrical control panels for the pumps shall be supplied to the Contractor by the pump supplier to assure component compatibility. See drawings for electrical equipment to be supplied.

5.4 Preconstruction Submittals

Pump Data (same as prebid submittal)

The Contractor shall furnish certified pump curves showing the results of test pumping units of identical design, size, horsepower as those to be furnished. Catalog curves are not acceptable. Graphs shall include:

1. Pump Curve - Q in GPM, H in Feet
2. Power Input Curve - KILOWATT
3. Efficiency Curve (including motor) wire to water
4. N.P.S.H. Curve
5. Model, Impeller size, serial number
6. Motor rated HP, Voltage
7. Date and place of test
8. Customer for whom test was conducted
9. Data in English units (gallons, feet, etc.)

Parts List and Specifications

A comprehensive list of all station accessories and pump components, listing

material type shall be submitted for the Engineer's review and approval.

Shop Drawings

Shop drawings of station accessories and pump components and connections shall be submitted for the Engineer's review and approval.

Supplemental Construction Details

The construction drawings depict the approximate locations of pumps and access covers. Supplemental drawings depicting the precise locations of anchor bolts, pump mounting system, access covers, guide rails, etc. will be required for the type of pump to be used. These supplemental drawings shall be prepared by the pump supplier and submitted by the Contractor to the Engineer for documentation of the project. The supplier shall be responsible for completeness and accuracy of shop drawings and any applicable revisions, as required to successfully complete the construction.

Wiring Diagrams

See construction Drawings for wiring diagrams.

6. OPERATING CONDITIONS

Pump Sequences

0 & 1 pump alternating:

```
#1      0      #2      0      #3      0      #4      0      #1      0      #2      0
----one----cycle----
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1 & 2 pumps alternating:

```
#2              #3              #4              #1              #2
#1      #2      #2      #3      #3      #4      #4      #1      #1      #2
----one----cycle----
```

2 & 3 pumps alternating:

```
#3              #4              #1              #2              #3
#2      #3      #3      #4      #4      #1      #1      #2      #2      #3
#1      #2      #3      #3      #3      #4      #4      #1      #1      #2
----one----cycle----
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Control Settings

Elev.	Rising	Descending
-5.80	Alarm On	
-6.05	P ₁ + P ₂ + P ₃ on	

-6.15	P ₁ + P ₂ on	P off
-6.40	P ₁ + on	P off
-6.75	Min. W.S.	P off
-8.25	Bottom of Sump	

Pump Operating Conditions

Pump Discharge Size: 8"

Max. Head Condition:

	1220 GPM @ 105' TDH, Minimum Total Efficiency 57%
*	1185 GPM @ 105' TDH, Minimum Total Efficiency 57%
	1173 GPM @ 105' TDH, Minimum Total Efficiency 57%

Mid. Head Condition

	1824 GPM @ 85' TDH, Minimum Total Efficiency 60%
*	1771 GPM @ 85' TDH, Minimum Total Efficiency 60%
	1753 GPM @ 85' TDH, Minimum Total Efficiency 60%

Min. Head Condition

	2226 GPM @ 69' TDH, Minimum Total Efficiency 57%
	2162 GPM @ 69' TDH, Minimum Total Efficiency 57%
	2140 GPM @ 69' TDH, Minimum Total Efficiency 57%
	Total Efficiency = combined pump and motor

Max. RPM: 1750

6.2 Riviera Lift Station: (three pumps required)

Pump Sequences

0 & 1 pump alternating:

#1	0	#2	0	#3	0	#1	0	#2	0
----one----cycle----									

#2		#3		#1		#1	
#1	#2	#2	#3	#3	#1	#1	#2
----one----cycle----							

Control Settings

Elev.	Rising	Descending
-5.80	P ₁ + P ₂ + P ₃ on + Alarm	
-6.00	P ₁ + P ₂ + on	P ₃ off
-8.25	P ₁ on	P ₂ off
-10.00	Min. W.S.	P ₂ off
-12.25	Bottom of Sump	P ₁ off

Pump Operating Conditions

Pump discharge Size: 6"
Max. Head Condition: 613 GPM @ 67' TDH, Tot. Eff. 45%
Mid. Head Condition: 989 GPM @ 51' TDH, Tot. Eff. 54%
Min. Head Condition: 1100 GPM @ 46' TDH, Tot. Eff. 53%
Total Efficiency = Wire to Water Efficiency
MAX. RPM: 1750

Discharge Connection

The three discharge connections that are currently in place are designed to accept Flygt Model CP3152 Pump Impeller 432 with 8" discharge.

7. CONSTRUCTION METHODS

7.1 Delivery and Storage of Materials:

Parts and equipment shall be properly protected so that no damage or deterioration will occur during transport and during storage. Factory assembled components shall not be dismantled, unless done so under the supervision of the authorized pump manufacturer.

7.2 Installation:

General

Installation of the pumps shall be in strict accordance with the manufacturer's instructions and recommendations.

Placement of Pumps and Accessories

The location of the discharge piping is shown on the construction drawings. The location of the pumps, access covers, and discharge connection are approximate. The precise placement and alignment of anchor bolts, discharge assembly guide rails, access cover and associated connections shall be in accordance with supplemental construction details provided by the pump manufacturer. The manufacturer shall check alignment during start up field testing. Improper alignment shall be corrected prior to continuation of testing.

7.3 Start-up Inspection

Installation Inspection

After the pumps have been completely installed and wired, the Contractor shall remove the pumps to the deck of the wet well and the pump manufacturer shall:

- a. Megger stator and power cables
- b. Check seal lubrication
- c. Verify proper rotation
- c. Check power supply voltage
- e. Measure motor no load current

Operating Check

After initial inspection, the Contractor shall lower pumps into pumping position and confirm proper alignment and connection. The service representative shall then perform an initial operation check of each pump including:

- a. Motor current with discharge valve closed
- b. Motor current with discharge valve open
- c. Power supply voltage with 1, 2, 3, ... pumps running
- d. Vibration
- c. Check level control and sequence

8. FINAL SUBMITTALS

8.1 Inspection Report: (four copies required)

The results of the Installation Inspection and Operating Check shall be submitted as a written report of findings and data determined with regard to the pumps, motors, level control, sequence, accessories, electrical, etc. The report shall be prepared and signed by a Registered Professional Engineer employed or retained by the pump manufacturer.

8.2 Manual: (included with Inspection Report)

The Operation and Maintenance Manual shall be included with the Inspection Report with one manual for each of the four copies of the report. The O&M Manual shall include a minimum of the following:

- 1. Service Location & phone
- 2. Fact Sheet (pump data)
 - Serial No.
 - Pump Curve
- 3. Maintenance instructions & schedule
- 4. A shop service manual
- 5. An assembly manual showing all parts by their catalog number for ordering

8.3 Spare Parts:

Unless it can be demonstrated that local parts and service have been available through the same financially sound firm on a continuing basis for at least 10 years, the spare parts listed below must be furnished with the pumps at no additional costs to the City.

Spare Parts: (For each type of pump)

Impeller	Service Tools
Upper mechanical seal	Wear ring
Lower mechanical seal	Cable entry assembly
Complete set of o-rings	Power Cable
and gaskets	Set of bearings

9. MAINTENANCE TRAINING WORKSHOP

The equipment manufacturer shall conduct an 8 hour training workshop under the direction of a qualified factory field service representative. The workshop shall be conducted both at the job site and at a training room provided by the Wastewater Department.

10. MEASUREMENT AND PAYMENT

Pumps and accessories shall not be measured for pay but shall be subsidiary to the appropriated bid item.