

## SECTION 5C - VERTICAL TURBINE SUPPLY WELL PUMPS

### 5C-01 GENERAL

#### 5C-01.01 WORK INCLUDED

- A. The work covered in this Section shall consist of providing all labor, equipment, and materials necessary for furnishing and installing [number] potable water supply well pumps and motors in existing [ ]-inch wells as shown on the Drawings. The existing well casings have internal diameters of [ ]-inch. The pumps shall be open line shaft type vertical turbine pumps with bowl assemblies, column pipe, shaft and impellers, vertical motor, suction strainers, electrical connections, and all other materials necessary to provide installation in accordance with these Specifications and as shown on the drawings.

#### 5C-01.02 QUALITY ASSURANCE

- A. Material Service Requirements: The pumps, motors and all related equipment shall be suitably constructed of materials to withstand the operating conditions which shall be experienced during the pump's performance and outside environment.
- B. Balancing: Pump units shall be statically and dynamically balanced. The vibration allowance in the units shall not exceed the upper limits as established by the Hydraulic Institute Standards.
- C. Tests: Each pump with its own drive motor shall be fully tested on water at the pump manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, required NPSH, available suction lift, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve. Certified copies of test reports shall be submitted. The Standards of the Hydraulic Institute shall govern the procedures and calculations for these tests. During these tests the pumps with drive motors shall be checked for balance.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

**5C-01.03 SUBMITTALS**

- A. Shop Drawings - Submit the following to the Engineer for approval before fabrication and purchase in accordance with Section 1.0 of these specifications:
1. Manufacturer's literature, illustrations and applicable data for the pumps.
  2. The shop drawings shall include details of pump assembly; installation layout and procedures; piping and electrical connections and requirements; types of materials used in pump construction; details on all pump accessories, such as couplings, line shaft, discharge head, etc.; dimensions of major components; weights, structural and operating features, space required, clearances, type of finish or shop coat, and other pertinent data.
  3. A list of manufacturer's recommended spare parts to be supplied, with the manufacturer's current price for each item. List bearings by the bearing manufacturer's numbers only.
  4. The following data shall be provided on the drive motor: materials of construction, dimensions, rpm at full load, frequency, voltage, full load current, code and design letter, efficiency, horsepower, number of phases, time rating, temperature rise, service factor and bearing life rating. The submittal shall include motor manufacturer's recommended lubrication requirements.
- B. Performance Curves: The Contractor shall submit the following to the Engineer for approval, prior to shipment from the factory.
1. Submit manufacturer's certified performance curves for each pump and motor combination furnished illustrating pump characteristics of head, discharge flow, efficiency, impeller size, motor speed, and horsepower for the full range of head conditions specified.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

2. Curves shall be submitted on 8 1/2-inch by 11 inch sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum pump runout head and gallonage allowed by the manufacturer.
  3. Points of operation which cause bearing stress or shaft deflection in excess of the manufacturer's tolerances for continuous operation shall be indicated on the submitted curves.
- C. Submit the following for each proposed vertical turbine pump:
1. Pump Manufacturer's Name \_\_\_\_\_
  2. Pump Model No. \_\_\_\_\_
  3. Rated Capacity \_\_\_\_\_gpm
  4. Total Dynamic Head at Rated Capacity \_\_\_\_\_feet
  5. Nominal Speed \_\_\_\_\_RPM
  6. Number of Stages \_\_\_\_\_
  7. Length of Pumping Unit \_\_\_\_\_feet
  8. Outside Diameter of Bowl \_\_\_\_\_inches
  9. Size of Column Pipe \_\_\_\_\_inches
  10. Length of Column Pipe \_\_\_\_\_feet
  11. Size of Suction Connection \_\_\_\_\_inches
  12. Size of Discharge Connection \_\_\_\_\_inches
  13. Length from Centerline of Suction/Discharge Connection to Underside of Discharge Head \_\_\_\_\_inches

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

- |     |                                                                          |             |
|-----|--------------------------------------------------------------------------|-------------|
| 14. | Length From Underside of<br>Discharge Head to Bottom<br>of Bowl Assembly | _____feet   |
| 15. | Size of Line Shaft                                                       | _____inches |
| 16. | Type of Impellers                                                        | _____       |
| 17. | Discharge Head Model No.                                                 | _____       |
| 18. | Motor Manufacturer<br>and Model No.                                      | _____       |
| 19. | Motor NEMA Frame No.                                                     | _____       |
| 20. | Motor Horsepower                                                         | _____hp     |
| 21. | Motor Speed                                                              | _____RPM    |
| 22. | Motor Efficiency at<br>Rated Capacity                                    | _____%      |
| 23. | Actual Bowl Efficiency<br>at Rated Capacity<br>(Adjusted for Staging)    | _____%      |
| 24. | Line Shaft Loss<br>at Rated Capacity                                     | _____HP     |
| 25. | Brake Horsepower of Pumping<br>Unit at Rated Capacity                    | _____BHP    |
| 26. | Kilowatt Consumption Per<br>Hour at Rated Capacity                       | _____KW/hr  |
| 27. | Field Efficiency of System<br>(Wire to Water)                            | _____%      |
| 28. | Hydraulic Thrust<br>at Rated Capacity                                    | _____pounds |
| 29. | Weight of Line Shaft                                                     | _____pounds |

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

- 30. Total Thrust Load  
at Rated Capacity \_\_\_\_\_pounds
- 31. Capacity of Motor  
Thrust Bearing \_\_\_\_\_pounds
- 32. Inside Diameter of  
well casing \_\_\_\_\_inches

D. Operating and Maintenance Instructions: Submit six sets of operation and maintenance manuals. The operation and maintenance manuals shall have been prepared specifically for the model and type of pump furnished and shall not refer to other models and types of similar equipment. Disk copies of material submitted shall be provided in MS Word and ACAD 2000 version or later. The operation and maintenance manuals shall include but not be limited to the following:

- 1. Equipment function and description.
- 2. Normal and limiting operating characteristics.
- 3. Installation instructions (assembly, alignment and adjustment procedures).
- 4. Operation instructions (normal start-up and shutdown procedures, normal operating conditions and emergency situations, troubleshooting guide).
- 5. Lubrication and maintenance instructions.
- 6. Parts list with catalog numbers and predicted life of parts subject to wear.
- 7. Drawings - cross sectional view, assembly and wiring diagrams.
- 8. Performance curves.

E. Factory Performance Test Data:

- 1. After acceptance of pump shop drawings, factory performance test data will be submitted for approval on the pumping units.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

2. Tests shall be in accordance with the standards of the Hydraulic Institute including head, capacity, brake horsepower, pump efficiency and NPSH.

**5C-01.04    PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete.
- B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer. Pumps shall be prepared for shipment in accordance with API Standard 610.
- C. Finished surfaces of all exposed pump openings shall be protected by wooden blanks.
- D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- E. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.
- F. Each box or package shall be properly marked to show its net weight in addition to its contents.
- G. Pump shall be shipped and handled in such manner as to prevent damage. At the job site, pumps and motors shall be stored in clean, dry, and protected locations.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

**5C-01.05    WARRANTY AND GUARANTEES**

- A. All equipment supplied under this section shall be provided with a limited warranty for a period of five (5) years by the manufacturer and an unlimited warrantee for two (2) years. Warranty periods shall commence upon SBMWD final acceptance.
- B. The equipment shall be under warranty to be free from defects in workmanship, design, and materials. If any part of the equipment should fail during the warranty period, it shall be replaced at no expense to the SBMWD.
- C. The replacement or repair (including cost of parts and labor) of those items normally consumed in service, such as pump packing, oil, grease, and the like, shall be considered as part of routine preventive maintenance by the SBMWD.
- D. Certifications: Furnish the Engineer with a written certification signed by the manufacturer's representative, that the installed equipment:
  - 1. Has been installed per manufacturer's requirements.
  - 2. Has been lubricated per manufacturer's instructions.
  - 3. Has been accurately aligned and proper running clearances set.
  - 4. Is free from undue stress imposed by piping or mounting bolts.
  - 5. Is ready to be operated on a continuous basis, and is free from any known defects.

**5C-02        PRODUCTS**

**5C-02.01    EQUIPMENT GENERAL REQUIREMENTS**

- A. All vertical turbine pumps and motors supplied for this project shall be by the same manufacturers (high service pumps and supply well pumps).

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

- B. Pump curves shall have no more than one specific flow rate corresponding to one specific head condition except for shut-off head.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

- C. Material Service Requirements: Pumps and all related equipment shall be constructed of materials suitable for the intended applications.
- D. Data Plates:
  - 1. All data plates shall be of stainless steel suitably attached to the pump with stainless steel screws. Pump data plates shall contain the manufacturer's name, serial number, pump size and type, serial number, speed, impeller diameter, design capacity and head and other pertinent data.
  - 2. Motor data plates shall contain the manufacturer's name and model number, rpm, Hp, frequency, voltage, phase, efficiency, and service factor.
- E. Hardware: All machine bolts, nuts and cap screws shall be hex head type, stainless steel. Hardware requiring special tools or wrenches shall not be used.
- F. Parts Numbering: Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Identical parts for separate units shall have the same number.
- G. Miscellaneous Parts: The equipment shall be furnished with shims, stainless steel anchor bolts, couplings, sheaves, belts, motor flanges, drive and belt guards and any other miscellaneous materials necessary to properly mount and install pump and motor.
- H. Painting: All external parts of the pump (including discharge head and bowl assembly), motor, drive unit, base, and accessories shall be primed and finish painted (one coat) at the factory prior to shipping. Both the internal

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

and external parts of the column and the internal parts of the discharge head shall be primed and finish painted (one coat) at the factory prior to shipping. Surface preparation, priming and finish coating shall be a Class 4 coating system (alkyd coating system) in accordance with Section 09900. All coatings used for shop painting shall be the products of the same manufacturer as the coating to be used for field painting to assure coating compatibility. Color of finish coating shall be medium gray.

**5C-02.02 VERTICAL TURBINE PUMP**

- A. General: The vertical turbine pump shall be an open line shaft type with a vertical drive hollow shaft motor capable of pumping from a new well at designed capacities as noted and shall conform to the applicable requirements of ANSI/AWWA Standard E101, latest revision, Vertical Turbine Pumps - Line Shaft and Submersible Types.
- B. Manufacturers: Peabody Floway Model 14FKH, Type A discharge head; Layne-Verti-Line 12DEH; or as manufactured by Fairbank Morse, Byron-Jackson, Peerless, Worthington, or approval equal.
- C. Potable Water Supply Well Pump:
  - 1. Pumps Required: [ ]
  - 2. Pump Size: [ ]-stage, [ ]-inch suction, discharge, and column
  - 3. Speed: [ ] RPM, maximum
  - 4. Impeller: [ ]-inches (nominal)
  - 5. Operating points:
    - a) Primary point - [ ] GPM at [ ] feet TDH at not less than [ ] percent pump efficiency

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

- b) Secondary point - [ ] GPM at [ ] feet TDH at not less than [ ] percent pump efficiency
- c) Shutoff - [ ] feet TDH (minimum)
- 6. Motor: [ ] hp, [ ] S.F., 460V, 3 phase, 60-Hz, [ ] percent premium efficiency
- 7. Column Depth: See Drawings.
- D. Bowl Assembly: Each pump shall be furnished with a [ ]-stage pump bowl assembly. Pump bowls shall be close grained cast iron meeting ASTM A48, Class 30, with a tensile strength of 30,000 psi, free from blow holes, sand holes, and all other faults, accurately machined and fitted to close dimensions. Pump bowl interior shall be coated with porcelain or a smooth vitreous enamel. Each pump bowl shall be fitted with a bronze bowl wear ring to restrict the leakage flow at the impeller skirt.
- E. Impeller: Pump impellers shall be heavy cast bronze meeting ASTM B-584, alloy, accurately machined and finished and shall be of the enclosed type. Impellers shall be hydraulically and dynamically balanced at normal pump speed. They shall be securely fastened to the impeller shaft with Type 316 stainless steel keys, tapered bushings, or lock nuts. They shall be adjustable vertically by means of a nut in the motor head.
- F. Impeller Shaft:
  - 1. The ANSI Type 416 stainless steel pump shaft shall be turned, ground and polished. The impeller shaft shall be supported in the bowl by a combination of water lubricated bronze ASTM B-144 and fluted neoprene bearings above and below each impeller. The size of the shaft shall be determined by the procedure described in AWWA Standard E101.
  - 2. Straightness and machining tolerance shall be as noted for line shafts.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

- G. Line Shafts: The line shafting shall be manufactured of Type 416 stainless steel, and shall be turned, ground and polished precision shafting of 1 1/2-inch minimum size. The shaft couplings shall be designed with a safety factor of 1 1/2 times the shaft safety factor and shall have a left-hand thread to tighten during pump operation. The line shaft shall be coupled to the motor shaft (head shaft) above the discharge head. No section of the line shaft shall be over ten (10) feet. To insure accurate alignment of the shafts, they shall be straight within 0.005-inch total indicator reading for the entire length; the butting faces shall be machined square to the axis of the shaft; the maximum permissible error in the axial alignment of the thread axis with the axis of the shaft shall be 0.002-inches in 6-inches.
- H. Column Pipe: The column pipe size shall be as noted. The column pipe shall be Schedule 40 steel pipe conforming to AWWA C200, supplied with butt threaded connections and coated internally and externally with a holiday-free, NSF approved, fusion-bonded epoxy, minimum 12 mils. The pipe shall be cut to the required length indicated to connect the bowl assembly to the discharge head outlet. The pipe shall be faced parallel and machined with threads to permit ends to butt to insure proper alignment when assembled.
- I. Discharge Head: The discharge head shall provide for aboveground mounting, be of high grade cast iron construction, in accordance with ASTM A48, Class 30, and shall provide machined surfaces for base support, motor attachment, discharge pipe flange attachment, and column pipe attachment. Discharge head shall support vertical electric motor, pump column, bowls and suction pipe. Drive shaft shall be coupled above a mechanical seal in the discharge head to facilitate easy removal and replacement of the driver. The discharge flange shall be drilled for 150 pound template (ANSI Standard B16.1) and shall have a 1/2-inch NPT connection with a plug for a pressure gauge. Lifting lugs shall be provided with the capacity to support the weight of the entire pump unit.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

- J. Base Plate: A suitable base plate of fabricated steel shall be provided and attached to the bottom of the discharge head. It shall be sized to match the dimensions of the new well casing mounting plate and be capable of supporting the entire pump, motor and appurtenances. It shall be fitted with machine bolt holes as per manufacturer's recommendations.

**5C-02.03 PUMP MOTORS**

- A. The pump manufacturer shall be responsible for supplying the motors and shall ensure proper coordination for mounting of the motors on the pumps. He shall properly select and size the drive unit for each pump inclusive of thrust bearing capacity for all conditions as start-up, runout, and shutoff.
- B. The motor bearing loading for the driver shall include the total pump line shaft down thrust. The motor bearings shall be designed to withstand any momentary total up thrust.
- C. Adjusting nut shall be provided at the top of the motor for varying the impeller clearance.
- D. The pump motor shall be a vertical, hollow shaft specially built NEMA Style "P" base, squirrel cage induction type, with low starting current and normal starting torque characteristics. The motor shall be designed for continuous operation with a 460 volt, 3 phase, 60 Hertz power supply with a maximum speed of [ ] RPM.
- E. Pump motor shall be provided with a non-reverse ratchet coupling assembly. Motor windings shall be triple dipped and baked with epoxy and finally shall be coated with a fungicidal varnish suitable for tropical environments. Rotation of the vertical shaft shall be counter clockwise when viewed from above.
- F. The motor shall be nonoverloading, without use of the service factor, at any point on the driven pump's performance curve. The motor shall be NEMA Design B, and shall be designed, constructed and

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

tested in accordance with applicable IEEE, NEMA, AFBMA and ANSI standards as manufactured by U.S. Electrical Motors, or an equal approved by the Engineer. Motors shall be given a short commercial test in accordance with IEEE standards and furnished with the following construction features:

1. Construction: All cast iron construction for frame, end brackets, conduit box and fan shroud. Motor shall be supplied with lifting lugs bolts on the top of the motor.
2. Enclosure: Totally enclosed, fan-cooled (TEFC).
3. Horsepower: [    ] HP
4. Efficiency: Premium, [    ] percent at rated capacity
5. Insulation: Class H
6. Temperature Rise: Class B based upon 40 degrees C ambient
7. Service Factor: 1.15
8. Epoxy coated rotor and stator windings.
9. Motor windings for stator and rotor and motor leads shall be manufactured using solid copper wire.
10. Shielded, regreasable, vacuum degassed steel ball bearings. Motor thrust bearings shall have ample capacity to carry the weight of all rotating parts plus the hydraulic thrust of the pump impellers with an ample safety factor. Minimum B-10 bearing life of 100,000 hours.
11. Stainless steel hardware, insect screens, and grease plugs.
12. Gasket between motor frame and conduit box.
13. Gasketed cast iron conduit box.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

14. Stainless steel nameplate fastened with stainless steel pins.
15. Accessories: Each motor shall be provided with a manually reset heat overload protection device to protect the motor from overheating during operation. The device shall immediately stop the drive motor in the event of excessive heat buildup. Motor shall be provided with a 120-volt single phase strip heater to maintain a motor temperature of at least 40 degrees C, or 10 degrees C above ambient, whichever is greater.
16. Vibration and Sound Limits: Vibration shall not exceed Hydraulic Institute Standards and sound pressure level shall not exceed 67 dbA at 5 feet under full load conditions in accordance with IEEE Standard 85.

**5C-02.04 PUMP AND MOTOR COUPLING GUARD**

- A. Provide a coupling guard on the pump base to prevent personal injury from the rotating pump and motor coupling. The guard shall be manufactured of stainless steel and painted metal and shall comply with all applicable OSHA requirements. The guard shall be bolted or screwed to the pump base with stainless steel bolts and nuts or screws and shall be easily removable for access to the pump and motor coupling.

**5C-02.05 ACCESSORIES**

- A. Sampling Tap and Pressure Gauge Tap: A stainless steel sampling tap shall be provided for the purpose of taking samples on each pump discharge line. One suitably sized pressure gauge shall be supplied as specified by the Engineer. The gauge tap and sample tap shall be connected to the discharge head.
- B. Miscellaneous Parts: The equipment shall be furnished with shims, Type 316 stainless steel anchor bolts, couplings, sheaves, motor flanges, and any other miscellaneous materials necessary to properly mount and install pumps and motors.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

- C. Lubricants: Pump and drive units shall be delivered with the equipment fully lubricated insofar as possible. If any point cannot be serviced, it shall be clearly marked to the effect that it is not lubricated and requires servicing prior to operation. An adequate supply of proper lubricant, with instructions for its application, shall be supplied with the equipment for each point not lubricated prior to shipment.
- D. Spare Parts: Furnish for each pump, the recommended spare parts, properly boxed and labeled for each pump, which are to include, as a minimum, the following:
  - 1. Two (2) sets of gaskets and O-rings.
  - 2. Two (2) mechanical seals.
  - 3. Two (2) sets of shaft sleeves, keys, and accessories.
  - 4. One (1) year supply of each type of lubricant required.

**5C-03      EXECUTION**

**5C-03.01   INSTALLATION**

- A. Installation of pumping equipment shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings. Equipment shall be installed by experience and mechanically skilled workmen with previous experience in similar installations. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- B. All necessary piping, fittings, valves, air relief valves, vents, concrete foundation, anchor bolts, grouting, etc. shall be provided to insure a complete and satisfactory installation of the

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

pumping equipment including pump, electric motor, line shafting, column pipe, electrical connections and piping connections.

- C. Install pressure gauges on the pump discharge piping as shown on the Drawings, including an isolation valve and pressure gauge at each location.
- D. Hardware: All anchor bolts, nuts and washers shall be Type 316 stainless steel. All brackets and the hardware items shall be Type 316 stainless steel.
- E. Install piping, fittings, valves and other appurtenances to the pump installation in accordance with the manufacturer's installation instructions, the requirements of referenced sections included with these specifications and as shown on the Drawings. Equipment shall be installed in a workmanlike manner so that individual equipment will function properly and freely and no individual parts shall be strained.
- F. Noise and Vibrations: All equipment containing moving parts shall be installed level and plumb, unless otherwise indicated in the Drawings or in the specifications; and shall be anchored securely in order that noise be suppressed to a minimum and that vibrations do not cause damage while in operation.

**5C-03.02 FACTORY SERVICE REPRESENTATIVE**

- A. For each pump supplied, the Contractor shall arrange for the services of a qualified factory service representative. The period of service shall be a minimum of one day for each pump supplied and shall not be considered complete until the items listed hereafter are completed.
- B. The duties of the service representative shall be as follows: After the equipment has been installed but before it is operated by others, the representative shall inspect the completed installation for soundness (no damaged or cracked components), completeness, correctness of setting

## **SECTION 5C - VERTICAL TURBINE SUPPLY WELL PUMPS**

and alignment, that the pumps are free from stresses imposed by attached piping, and for the adequacy and correctness of packing, sealing, and lubricants. The service representative shall start-up the equipment and instruct the SBMWD's personnel in proper operation and maintenance procedures. The responsibility of the Contractor with regard to start-up shall be fulfilled when the start-up is complete, the equipment is functioning properly and has been accepted by the SBMWD.

- C. The service representative shall submit to the Engineer six (6) copies of a signed report of the result of his inspection, adjustments and start-up. The report shall include descriptions of the inspection, adjustments made, and the start-up. The report shall also include a statement that the equipment is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void. Final payment shall not be made to the Contractor until this report has been submitted to and approved by the Engineer.

### **5C-03.03 INSPECTION AND TESTING**

- A. After pump has been completely installed, the Contractor shall conduct, in the presence of the Engineer, testing of all mechanical equipment and piping as in operation to demonstrate capacity, correct alignment, smooth operation, proper adjustment, and freedom from noise, vibration, over-heating and leaking, and to ensure satisfactory compliance with the specifications. All defects shall be corrected. The Contractor shall supply all oil, grease, electric power, water and all other material necessary to complete the field tests.
- B. If the pump performance does not meet the Specifications, corrective measures shall be taken by the Contractor, or pump shall be removed and replaced with a pump which satisfies the conditions specified.

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

- C. Motor Field Testing: Motor shall be disconnected from the pump and run for four (4) hours. Following the run-in test, reconnect the motor to the pumping equipment and reinstall all coupling guards.
- D. Pump Field Testing:
1. Upon completion of all the mechanical work, the Contractor shall conduct testing as specified herein to demonstrate that the equipment performs in accordance with all specifications.
  2. The Contractor shall perform initial testing of the equipment to insure himself that the tests listed in the Demonstration Test paragraph below can be completed.
  3. The Demonstration Test shall demonstrate that all items of these Specifications have been met by the equipment, as installed, and shall include the following tests:
    - a) That the pump can deliver the specified pressure and discharge flow at rated efficiency.
    - b) That the pump controls perform satisfactorily.
  4. In the event that the equipment does not meet the Demonstration Test, the Contractor shall, at his own expense, make sure changes and adjustments in the equipment which he deems necessary and shall conduct further tests until written certification is received from the Engineer.

**5C-03.04 DISINFECTION**

- A. Pump Disinfection: Prior to installing the pump in the suction barrel, all interior and exterior parts of the pump coming in contact with the water shall be disinfected with a five percent (5%) chlorine solution (chlorine bleach). The method of

**SECTION 5C - VERTICAL  
TURBINE SUPPLY WELL PUMPS**

disinfecting the pump shall be approved by the Engineer or his representative prior to installing the pump.

- B. Well Casing and Piping Disinfection: Piping, valves, fittings, well casing, and appurtenances installed to connect the pump to water mains, and any water mains installed by the Contractor, shall be disinfected and flushed in accordance with Section 3, Construction Methods and Control.

**5C-03.05 PUMP CURVES**

- A. Submit to the Engineer six (6) of the certified performance curve for each pump, 8 1/2-inch by 11-inch in size, laminated in plastic. The pump curve shall indicate the pump number, type of service, manufacturer, model number, serial number, location in the plant and other data specific to the pump as required above for submittals.