VERTICAL TURBINE PUMPS

PART 1 - GENERAL

1. SCOPE

1.1 This section covers the furnishing of vertical turbine pumping unit(s) as required and to the expectations of the ENGINEER with regards to the manufacture of the equipment.

1.2 The Vertical Turbine pump(s) specified in this section shall be furnished by and be the product of one manufacturer. All components of the pumping unit must be supplied by and warranted by the pump OEM (original equipment manufacturer) including bowls, impellers, column, shafting, discharge heads, couplings, seals, suction barrels (if applicable) and motors. Well drillers, distributors, or other fabrication shops will not be allowed to furnish equipment built or modified in their local fabrication shop. Equipment furnished under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by ENGINEER.

1.3 Except as modified or supplemented herein, all vertical turbine pumps shall conform to the most recent edition of ANSI/AWWA E103 and Hydraulic Institute Standards.

2. SUBMITTALS

2.1 Complete fabrication and assembly drawings together with detailed specifications and data covering materials, parts, devices and accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittals section. The data and specifications for each pumping unit shall not be limited to the following:

- Name of manufacturer.
- Type and model.
- Nominal design rotative speed.
- Number of stages.
- Type of bowl bearings.
- Type of lineshaft bearings.
- Size of shafting.
- Size of pump column.
- Size of discharge outlet.
- Data on shop painting.
- Overall dimensions.
- Total Weight.
- Complete performance curves showing capacity versus head, calculated NPSH required, efficiency, and BHP plotted scales consistent with performance requirements.

2.2 Adequate operation and maintenance information shall be supplied. Operation and maintenance manuals shall include the following:

- Equipment function, normal operating characteristics, and limiting conditions.
- Assembly, installation, alignment, adjustment, and checking instructions.

- Operating instructions for startup, routine, and normal operation, regulation and control, shutdown, and emergency conditions.
- Lubrication and maintenance instructions.
- Guide to troubleshooting.
- Outline, cross-section, and assembly drawings; engineering data; and wiring diagrams for motors if applicable.
- Test data and performance curves, where applicable.

3. QUALITY ASSURANCE

3.1. The pump manufacturer shall be certified to the ISO 9001 standard for design and manufacture of vertical turbine pumps.

4. WARRANTY

4.1 The manufacturer shall warranty their pumps to be free of defects in material and workmanship for a period of one (1) year after the product is first put into operation or 18 months after date of shipment, whichever occurs first.

5. DELIVERY,STORAGE,AND HANDLING

5.1 The pumps shall be adequately supported during transit to ensure the pumping unit is not subjected to undue stresses per pump manufacturers IOM.

5.2 Spare parts shall be furnished as specified. Spare parts shall be suitably packaged with labels indicating the contents of each package. Spare parts shall be delivered to OWNER as directed.

5.3 Final documentation shall be delivered electronically.

PART 2 - PRODUCTS

6. MANFACTURERS

6.1 SIMFLO, LLC

6.2 Or Pre-Approved Equal

Note: This specification was developed using design criteria from SIMFLO, LLC. Other manufacturers will be considered as long as they meet the performance and quality requirements specified within. Any "or equal" substitution must be submitted to the design engineer two weeks before the bid date for pre-approval. If approved, the manufacturer will be listed by addendum.

7. PERFORMANCE AND DESIGN REQUIREMENTS

7.1 Pumping units shall be designed for the performance and design requirements as required, at maximum speed unless otherwise noted.

7.2 If the pumps are to be run utilizing a variable frequency drive, the pump curve shall be continuously rising and shall be free from dips and valleys from the design point to the shutoff head.

7.3 For design and rating purposes, the water to be pumped shall be assumed to have a temperature of 70°F.

7.4 Pump performance shall be stable and free from cavitation, vibration, and noise within the operating head range and shall conform to the requirements and recommendations of the latest Hydraulic Institute Standards.

7.5 The pumping application required for this project demands equipment that will operate reliably for many years. Unscheduled downtime is unacceptable to the client, and it is the objective of this specification to deliver the highest quality equipment that is fit for purpose.

7.6 The complete pumping unit shall conform to the vibration requirements set forth in Hydraulic Institute Standards. (SIMFLO is not responsible for field vibration testing or compliance.) (Field balancing may be required)

8. SERVICE CONDITIONS

Service	XXX
Tag Numbers	XXX
Quantity	X
Design Flow (GPM)	XXX
Design TDH (ft)	XX
Minimum Bowl Efficiency at Design Point (%)	XXX
Maximum Speed at Design Point (RPM)	XXXX
Secondary Point A Flow (GPM)*	XXXX
Secondary Point A TDH (ft)*	XXX
Minimum Bowl Eff at Secondary Point A (%)*	XX
Secondary Point B Flow (GPM)*	XXXX
Secondary Point B TDH (ft)*	XXX
Minimum Bowl Eff at Secondary Point B (%)*	XX
Minimum Shutoff TDH (ft)	XXX
Minimum Flow (when using VFD) (GPM)	XXX (XXX RPM)
Minimum TDH (when using VFD) (ft)	XXX (XXX RPM)
Minimum Bowl Efficiency at Minimum Point (%)	XX
Maximum Motor HP	XXX
Pump Operation	Constant/Variable Speed
Minimum Column Diameter (in)	XX
Minimum Discharge Diameter (in)	XX

*Secondary design point to be within HI 3B Tolerance

9. PUMP CONSTRUCTION

9.1 NSF61 CERTIFICATION **(OPTIONAL)**

9.1.1 The complete pump assembly shall be certified to NSF/ANSI standard 61. This certification shall cover all wetted components of the pump, including but not limited to the bowl assembly, column assembly, discharge head assembly and suction barrel (when applicable). Manufacturers without NSF61 certification will not be considered. The pump manufacturer's NSF listings can be found on the NSF website. The pump discharge head shall be fitted with a separate nameplate displaying the NSF61 logo. No exceptions.

9.2 BOWL ASSEMBLY

9.2.1 The pump bowl assembly shall be SIMFLO Pump model XXXX or pre-approved equal. The pump bowls shall be constructed of the material as listed under the subsection "materials of construction". The bowls shall be accurately machined and flanged with machined rabbit-fit connections. The water passages of pump bowls size 6" through 14" shall have vitreous porcelain enamel lining and 16" and larger shall have ScotchKote™ Fusion Bonded Epoxy 134 both to reduce friction losses. The waterways and diffusion vanes shall be smooth and free from nodules, bumps and dips and shall be free of blow holes, sand holes and other detrimental defects. The bowl assembly shall be fitted with a suction which includs integral cast ribs supporting the suction bearing and sand collar to protect the suction bearing from abrasives. The suction bearing shall be permanently packed with food grade grease, and shall have a length not less than two times the shaft diameter. The bowl bearings are to be lubricated by the product being pumped and located above and below each impeller. All bearings shall be sleeve type of the material listed in the subsection "materials of construction." When applicable, the bowl bolting material shall be as listed in the subsection "materials of construction." For enclosed lineshaft applications, a tube adapter shall attach to the discharge case and be fitted with a tube bearing to provide a means of connection for the shaft enclosing tube assembly. The discharge case shall be fitted with a throttle bearing to restrict pumped fluid from entering the shaft enclosing tube assembly and drain ports located between the throttle bearing and tube adapter connection.

9.2.2 **(Optional)** *The bowls shall have Nitrile or Viton "O" rings fitted to custom machined grooves to ensure minimal leakage between flanged joints.*

(Optional) *Fit all bowls and/or impellers with renewable wear ring(s). The wear rings shall be constructed of material as outlined in the subsection "materials of construction".*

9.2.3 The impellers shall be cast in one piece of the enclosed type and constructed of the material listed in the subsection "materials of construction". The impellers shall be statically or dynamically balanced depending on impeller diameter. The impeller shall be securely fastened to the shaft with taper split bushings (collets) of the material listed in the subsection "materials of construction" for bowl-shafts 2-3/16" nominal diameter and smaller or with keyed connections

for bowl-shafts larger than 2-3/16" nominal diameter. The bowl-shafting shall conform to the material listed in the subsection "materials of construction" The bowl-shaft shall be of sufficient diameter to transmit the pump horsepower with a safety factor consistent with AWWA pump-shaft standards. Impellers shall be adjusted vertically by external means and shall have sufficient axial clearance for reliable service in accordance with the specified operating conditions.

9.2.4 **(OPTIONAL pumps under 40' in length)** *The suction bell shall be fitted with a heavy gauge wire woven basket type anti vortex strainer, of the material listed in the subsection "materials of construction." The strainer shall have a net inlet equal to at least four times the suction pipe area. The maximum opening shall not be more than 75% of the minimum opening of the water passage through the bowl and impeller. The strainer shall be secured to the suction bell by means of through bolted stainless steel cap screws.*

9.2.5 **(OPTIONAL pumps over 40' in length)** *The suction bowl shall be fitted with a cone strainer, of the material listed in the subsection "materials of construction." The strainer shall have a net inlet equal to at least four times the suction pipe area. The maximum opening shall not be more than 75% of the minimum opening of the water passage through the bowl and impeller. The strainer shall be secured to the suction bell by means of taper thread.*

9.3 COLUMN ASSEMBLY (Open Lineshaft)

9.3.1 **(pick one below)**

Threaded Column (4" through 12")

Column pipe shall be per subsection "Materials of construction". For pumps less than 40' in length, intermediate sections are to be no greater than 5' in length. For pumps greater than 40' in length, intermediate sections are to be no greater than 10' in length. The top and bottom sections shall not exceed 5' in length. The ends of each section shall be faced parallel and machined with 8 straight threads per inch permitting the ends to butt and insuring alignment. The column pipe shall be connected by straight butt style threaded couplings. The weight of the column pipe shall be no less than that stated in ANSI/AWWA Specification E103, Section 5.1 "Standard Specifications for Discharge Column Pipe". The column size shall be such that friction loss will not exceed 5' per 100', based on the design capacity of the pump or as listed under the subsection "service conditions."

Flanged Column

The column pipe shall include flanged with a female register to ensure proper alignment and be machined for drop-in bearing retainers. Any column larger than 12" will require weld in style bearing retainers. The column pipe shall be constructed of material per subsection "Materials of construction". The weight of the column pipe shall be no less than that stated in ANSI/AWWA Specification E103, Section 5.1 "Standard Specifications for Discharge Column Pipe". The column diameter will be sized such that friction loss will not exceed 5' per 100',

based on the rated capacity of the pump. For pumps less than 40' in length, intermediate sections are to be no greater than 5' in length. For pumps greater than 40' in length, intermediate sections are to be no greater than 10' in length. The top and bottom sections shall not exceed 5' in length. Flange bolting shall be provided in the materials as listed in the subsection "materials of construction." **(Optional)** *Bearing retainers shall be integrally welded to column pipe.*

9.3.2 The column line-shaft shall be turned and ground and manufactured of the material listed in the subsection "materials of construction." They shall be furnished in interchangeable sections not over 5 feet in length. The line-shaft shall be of sufficient diameter to transmit the pump horsepower, with safety factor, consistent with ANSI/AWWA- E101 Specifications, Section 5.5 and shall be such that elongation due to hydraulic thrust will not exceed the axial clearance of the impellers in the pump bowls. Maximum shaft run out shall not exceed 0.005" TIR. The line-shaft bearings shall be sleeve type provided of the material listed in the subsection "materials of construction" and are to be lubricated by the product being pumped. Line-shaft diameter and bearing spacing shall be such that the shaft first critical frequency shall include an operational tolerance of 20% above or below the operating frequency.

9.3.3 **(Optional)** *[The column flange joints shall have Nitrile or Viton rubber "O" rings fitted to custom machined grooves.]*

9.3.4 **(Optional)** *[Line-shafts shall be coupled with split ring and key type couplings for ease of disassembly.]*

9.3 COLUMN ASSEMBLY (Enclosed Lineshaft)

9.3.1 The outer column pipe diameters 4" thru 14" shall be per subsection "Materials of construction" in interchangeable sections not over 20' in length. The top section of column pipe shall not exceed 5' in length. The ends of each section shall be faced parallel and machined with eight (8) straight threads per inch permitting the ends to butt and insuring alignment. The column pipe shall be connected by straight butt style threaded couplings. The weight of the column pipe shall be no less than that stated in ANSI/AWWA Specification E103, Section 5.1 "Standard Specifications for Discharge Column Pipe." The column size shall be such that friction loss will not exceed 5' per 100', based on the design capacity of the pump or as listed under the subsection "service conditions."

9.3.2 The column line-shaft shall be turned and ground and manufactured of the material listed in the subsection "materials of construction." They shall be furnished in interchangeable sections not over 20 feet in length. The line-shaft shall be of sufficient diameter to transmit the pump horsepower, with safety factor, consistent with ANSI/AWWA- E101 Specifications, Section 5.5 and shall be such that elongation due to hydraulic thrust will not exceed the axial clearance of the impellers in the pump bowls. Maximum shaft run out shall not exceed 0.005" TIR.

9.3.3 The shaft enclosing tubes shall be of schedule 80 and per subsection "Materials of construction". The tube ends shall be internally threaded and machined parallel to accurately butt and align. The tube lengths shall be interchangeable and not exceed 5'. Maximum tube thread run out in 5' length shall not exceed 0.005". The top section of tube shall be designed for applying tension to the enclosing tube assembly. The enclosing tube assembly shall be of such overall assembled length to properly match the length of the column pipe and allow for proper tensioning.

9.3.5 The bearings within the shaft enclosing tubes shall be of material per subsection "Materials of construction". The bearings shall be externally threaded, installed between each enclosing tube section to securely affix the enclosing tubes, and maintain alignment of the line-shaft and prevent excessive vibration. The bearing bore shall be machined and grooved to provide proper lubrication. Bearing spacing shall not exceed 5'.

9.3.6 During assembly, a rubber tubing stabilizer (centering spider) shall slide over the enclosing tube to keep the enclosing tube and shaft centered in the column pipe. These rubber tubing stabilizers shall be placed at 30-foot intervals.

9.4 DISCHARGE HEAD

9.4.1 The discharge head shall be of material per subsection "Materials of construction". The head shall be for above ground discharge with sufficient strength and rigidity to support the attached vertical motor or driver and carry the suspended weight of the attached column and bowl assembly. All wetted pressure retaining parts shall be designed for a maximum working pressure equal to the pump shut off head. The discharge flange shall be sized to match the column diameter and have a **(150#, 300#, 600#)** ANSI **(raised, flat)** face with bolt holes straddling the vertical centerline. An NPT pressure gauge connection shall be supplied on centerline of the discharge outlet. The base of the discharge head shall be circular and fully finished machined on the bottom. The top of the discharge head shall be machined to accept a standard NEMA P base driver and have a diameter equal to or greater than the driver base diameter (BD). The motor-shaft shall be coupled to the head-shaft beneath the motor to facilitate ease of assembly and maintenance. Head shall be in all respects equal to SIMFLO type "L". All couplings and other moving or rotating parts shall be covered on all sides by a fabricated OSHA approved coupling guard. Each guard shall be designed for access to seal assembly maintenance components. All necessary supports and accessories shall be provided for each guard. The pump shall be furnished with a SS nameplate securely mounted to the discharge head.

9.4.2 **(Optional)** *A rigid flanged adjustable "spacer" type motor coupling shall be provided to couple the motor-shaft to the pump-shaft. The spacer shall be of sufficient length to allow the mechanical seal to be removed without disturbing the motor. The motor coupling shall be a three-piece or spacer type four-piece rigid coupling. The coupling shall be of steel, designed to transmit the required*

torque and horsepower of the attached pump and other rotating elements. The pump side of the coupling shall be keyed to the head-shaft. The motor side shall have a radial key to support down thrust and an axial key to transmit torque. A threaded adjusting nut shall be located above the pump side coupling component to allow for the vertical adjustment of the shaft mounted impellers.

9.4.3 **(Optional)** *The discharge head shall be fitted with a mechanical seal. The seal housing shall be of ASTM A48 Class 30 cast iron. The seal shall be of the cartridge type, sleeve mounted, easily replaceable and have its face continuously flushed with the product being pumped. The mechanical seal shall include 316 stainless steel metal parts. The mechanical seal shall have a carbon stationary face, a tungsten carbide rotating face, and fluorocarbon O-rings. The mechanical seal shall be rated for 600 psi and 400 Deg F. A seal housing bearing of the material listed in the subsection "materials of construction" shall be installed directly below the mechanical seal for stability. A nitrile O-ring shall be used to seal the seal housing to the discharge head. The seal shall be equivalent to the Chesterton 155 or 442.*

9.4.4 For well and sump applications, the pump shall be mounted and supported by a separate foundation baseplate. The baseplate shall be per subsection "Materials of construction". The baseplate shall be drilled to match the base flange drilling of the discharge head. The baseplate shall be square with radius corners, equal to or greater than the size of the base of the discharge head. The baseplate shall be uniformly faced on one side, with four drilled holes provided, one at each corner to accommodate anchor bolts. Abutting surfaces between the baseplate and the discharge head shall be machined to provide 100% surface contact with the discharge head base. The center opening diameter shall be of sufficient size to permit installation and removal of the complete pump assembly. The baseplate shall be permanently anchored, grouted and leveled within 0.005 inches per foot by the installation contractor. For booster can applications, the pump shall be mounted to the booster can outlined in section 9.5.

9.4.5 For enclosed lineshaft applications, the discharge head shall be equipped with a tube tensioning device to apply and maintain proper tension to the shaft enclosing tube. The stretch assembly shall consist of a stretch housing or a tension nut depending on pump setting. Both options are designed to maintain proper tension of the shaft enclosing tubes. For oil lubricated applications, a dust cover will be used above the stretch housing or a tension nut will provide a threaded port for attaching means of supplying drip oil to the enclosing tubes. For water flush applications, a seal housing will seal the stretch assembly and provide a threaded port for flush water injection.

9.5 BOOSTER CAN

9.5.1 Each pump barrel shall be of the ANSI/HI-9.8 length design and size recommended by the manufacturer and shall conform to Hydraulic Institute Standards. Barrel inlet nozzle and flange shall be located and sized properly per

ANSI/HI9.8 standard. Pump barrel (can) must be designed in such a manner as to prevent submerged vortices from being developed. The barrel's square top head-mounting flange shall match the discharge head base and be of sufficient thickness to drill and tap for 150# Class ANSI diameter and bolt pattern. The top mounting plate of the barrel shall be properly machined and be "O" ringed for a zero-leakage connection to the discharge head. The pressure rating of the barrel shall be capable of containing the maximum suction pressure. Each pump barrel shall be vented through the subbase to the air relief valve indicated. The pumping system shall be designed to be supported from the base of the can. The bottom of the barrel shall contain two direction vanes welded in a cross pattern perpendicular to one another to help minimize hydraulic swirling.

9.5.2 **(Optional pumps over 3000 GPM)** *[The suction barrel shall be fitted with two direction vanes to reduce hydraulic swirling. They should be welded to the inside of the barrel in line with the suction centerline and located 180 degrees apart.]*

9.5.3 **(Optional)** *[Foundation (support flange or anchor tabs) shall be attached to the bottom of the barrel for anchoring to the concrete support.]*

9.5 FACTORY TESTING

9.6.1 Each bowl assembly shall be tested at the factory for capacity, power requirement, and efficiency at minimum head, rated head, shutoff head or point of discontinuity, and at as many other points as necessary for accurate performance curve plotting. All tests and test reports shall conform to the requirements and recommendations of the Hydraulic Institute Standards. If the pump fails to operate properly or fails to meet the specified conditions, the pump manufacturer shall modify the pumping unit and perform additional tests. The pump manufacturer shall submit complete pump test reports, including test arrangement, test procedures, & test data in curve format.

9.6.2 **(Optional)** *[Each pump shall be tested with the actual motor unit to be installed in the field.]*

9.6.3 **(Optional)** *The test results are to be certified correct by a licensed Professional Engineer, whom may be an employee of the pump manufacturer.*

9.6.4 All test data shall be submitted to the engineer at least 5 (five) days prior to shipment.

9.6.5 The bowl assembly, flanged column, discharge head and booster can shall be non-witness factory pressure tested in accordance with the latest edition of Hydraulic Institute Standards.

9.7 FACTORY COATING

9.7.1 **(Optional)** *The bowl assembly OD, column ID & OD, discharge head ID, booster can ID/OD shall be factory painted with an NSF 61 approved coating. The*

coating shall be applied per manufacturer's standard process unless otherwise specified.

9.8 ENGINEERED ANALYSIS (ALL OPTIONAL)

9.8.1 If pumps are operating on VFD with a fabricated discharge head and a motor horsepower greater than 150, engineering analysis is recommended to ensure the discharge head can remove natural frequencies within the operating range with standoff margin outlined below.

9.8.2 Pump anchorages shall be designed for lateral earthquake effects in the appropriate zone as stated by the UBC, applied simultaneously with normal pump operation forces, as well as for maximum reactions due to other pump design events. Seismic design loads and anchoring design loads shall be calculated in accordance with ASCE 7 with supplied SDS and/or SS and Site Class values as required (III or below). Foundation design shall be the responsibility of the CONTRACTOR.

9.8.3 The pump assembly shall be designed to safely operate free of structural natural frequencies in accordance with HI 9.6.8. Either a calculation-based method or a Finite Element Analysis (FEA) method shall be used as specified or required. A report shall be provided to demonstrate the natural frequencies of the structure that have been considered in the design of the equipment and to certify that the primary pump assembly structural natural frequency is of sufficient margin to the specified operating speed range of the equipment. If FEA method is used, mode shapes shall be provided. All effects attributed to the supporting structure, as it pertains to the installation, foundation, or attached piping and equipment (system effects), on the pump and driver installed structural natural frequency shall be the responsibility of others.

9.8.4 A shaft torsional natural frequency analysis shall be performed on the rotating assembly. Either a calculation-based method or a Finite Element Analysis (FEA) method shall be used as specified or required. Steady state operation shall be assumed. A report shall be provided to demonstrate the torsional natural frequency has been considered in the design of the equipment and to certify that the primary rotating assembly torsional natural frequency is of sufficient margin to the specified operating speed range of the equipment. If FEA method is used, a Campbell Diagram shall be provided.

9.8.5 A shaft lateral natural frequency analysis shall be performed on the rotating assembly. Either a calculation-based method or a Finite Element Analysis (FEA) method shall be used as specified or required. Rotating assembly components shall be assumed to provide no stiffness contributions. Effects related to bearing stiffness shall be considered as needed. A report shall be provided to demonstrate the shaft lateral natural frequency has been considered in the design of the equipment and to certify that the primary rotating assembly lateral natural frequency is of sufficient margin to the specified operating speed range of the equipment. If FEA method is used, all primary mode shapes shall be provided.

9.9 ELECTRIC MOTORS

HP	XX
Shaft Type	Solid / Hollow Shaft
RPM	XXXX
Voltage	XXXX
Enclosure	WP1/WP2/TEFC/EXP PROOF
Efficiency Rating	Premium Efficiency
Non-Reverse	No / Yes
Motor Operation	Constant / Variable Speed
Service Factor	1.15 / 1.00

9.10 SPECIAL TOOLS AND ACCESSORIES

9.10.1 Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments and accessories, required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

9.11 SPARE PARTS

9.11.1 If required, to be specified by the engineer and/or owner.

9.11 MATERIALS OF CONSTRUCTION

Component	**Material**
Pump Bowls	Cast Iron (ASTM A48 c130 - Enamel Lined or Scotchkote lined)*
Impellers	CF8m 316SS* or C95500 NAB*
Bowlshaft	416 HT Stainless Steel - (ASTM A582)*
Bowl Bearings	Bronze (ASTM B505 C89835)*
Collets	316 SS*
Bolting	18-8 SS*
Bowl Wear Rings	(Optional)
Impeller Wear Rings	(Optional)
Strainer	304 Stainless Steel*
Column Pipe Thickness	AWWA Standard
Lineshaft	416 HT Stainless Steel – (ASTM A582)*
Lineshaft Couplings	416SS*
Lineshaft Sleeves	(Optional, not recommended)
Lineshaft Bearings	Nitrile Rubber*
Bearing Retainers	304 SS or Integral*
Discharge Head	Ductile Iron (ASTM 65-45-12)* Fabricated Steel - (A36 HR-Gr 70 plt, A105 flg, A53-Gr B pipe)*
Seal Housing	Cast Iron (ASTM A48 c130)*
Sole Plate or Booster Can	Fabricated Steel (A36-Gr 70 plt)*
Name Plate	Stainless Steel

Enclosed Lineshaft Materials

Component	**Material**
Tube Bearing	Bronze (ASTM C84400) Bronze (ASTM B505 C89835)*
Enclosing Tube	A53 Gr. B Carbon Steel for oil lube* 304SS for water flush*
Centering Spiders	Nitrile*
Lineshaft Couplings	416 HT Stainless Steel (ASTM A582)* for water flush C1215 Carbon Steel (ASTM A108)* for oil lube

* Denotes NSF approved materials

PART3-EXECUTION

10. FIELD QUALITY CONTROL

10.1 A representative of the manufacturer shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation and shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are signed off by all parties.

10.2 Manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

10.3 **(Optional)** *[The equipment manufacturer shall furnish a qualified field installation supervisor during the equipment installation. Such services shall be included in the contract price for the number of days and round trips to the site as required. Manufacturer's' installation supervisor shall observe, instruct, guide, and direct the installing contractor's erection or installation procedures. The equipment manufacturer will be provided with written notification 10 days prior to the need for such services.]*