

Data

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**1100 VERTICAL TURBINE PUMP SPECIFICATIONS
ENCLOSED LINESHAFT CONSTRUCTION – OIL LUBRICATED**

PART 1. GENERAL

- 1.01 This specification includes the supply of ____ vertical turbine oil lubricated enclosed lineshaft pump(s). Each unit shall include a bowl assembly, suction strainer, column, lineshaft, enclosing tube, discharge head, sealing assembly and driver.
- 1.02 **QUALITY ASSURANCE**
 - A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.
 - B. Unit responsibility. Pump(s), complete with motor, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.
 - C. The vertical turbine pump(s) specified in this section shall be furnished by and be the product of one manufacturer.
 - D. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.
 - E. Pump(s) are to be engineered and manufactured under the certification of ISO-9001:2000.
- 1.03 **PERFORMANCE**
 - A. The pump(s) shall be designed for continuous operation and will be operated continuously under normal service.
 - B. **OPERATION CRITERIA**

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Max. Solids Passage	Max. Shutoff Head (ft.)	Minimum Submergence (inches)
Design Condition						
Secondary Condition						

- C. Total dynamic head shall be as measured at the discharge of the pump and shall include velocity head and vertical static head from the minimum water level to the centerline of the pump discharge.
- D. Minimum water level shall be at elevation _____ feet.
- E. Pump(s) are to be mounted at _____ feet elevation with the sump floor at _____ feet elevation.
- F. Pump discharge centerline shall be at _____ feet elevation.
- G. Maximum pump speed shall not exceed _____ RPM.
- H. Driver size shall be limited to _____ HP maximum.
- I. Liquid pumped is _____ with a maximum temperature of ____ deg. F.

PART 2, PRODUCTS

- 2.01 **PUMPS**
 - A. **Manufacturers**
 - 1. Pump(s) shall be the product of Layne/Verti-Line.
 - 2. Manufacturer shall have installations of like or similar application with a minimum of 5 years service for this pump size.
 - B. **Design**
 - 1. **Rotation**
 - a. The pump will be counterclockwise rotation when viewed from the driver end looking at the pump.
 - 2. **Impeller**
 - a. The impeller shall be of bronze construction conforming to ASTM B584, C83600. They shall be of one-piece construction, single suction, enclosed ____-vane, and radial flow design. The waterways through the impeller shall have extremely smooth contours, devoid of sharp corners, so as to promote maximum efficiency.
 - b. The impeller is to be balanced and secured to the shaft by means of a stainless steel drive collet for bowl sizes 18" and smaller. For bowl sizes 19" and larger, impellers shall be securely keyed to the shaft.
 - c. Impellers shall be adjustable by means of a top shaft-adjusting nut.

3. Bowls
 - a. The bowls shall be made of close-grained cast iron conforming to ASTM A48 CL30. Castings shall be free from blowholes, sand holes and shall be accurately machined and fitted to close dimensions.
 - b. Bowls 13" and above shall be flange connected. Bowls below 13" nominal diameter may use either flanged or threaded connections.
 - c. Bowls shall be designed with smooth passages to ensure efficient operation and their interior shall be coated with Tnemec N140 Pota-Pox Plus, or equal.
 - d. The casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head whichever is greater.
4. Impeller Shaft
 - a. Impeller shaft shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
 - b. The shaft shall be supported by bronze or neoprene bearings located on both sides of each impeller.
 - c. Impeller shaft coupling shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
5. Wear Rings
 - a. Wear rings shall be provided on both the impellers and bowls on bowls of nominal diameter of 8" or larger so that clearances can be maintained throughout the life of the rings and minimize recirculation.
 - b. Impeller wear rings shall be of the radial-type.
 - c. Bowl wear rings shall be of the radial-type.
 - d. Wear rings shall be attached to the impellers and bowls using an interference fit and Loctite.
 - e. Wear rings shall be bronze conforming to ASTM, B505 C93200.
6. Column
 - a. Total length of discharge column shall be ___ feet, ___ inches.
 - b. Column pipe shall be not less than ___ inches inside diameter and weigh not less than ___ pounds per foot.
 - c. Column pipe in sizes 4" through 12" diameter shall be furnished in interchangeable sections not over ten feet in length, and shall be connected with threaded, sleeve-type couplings. Column pipe 14" diameter and larger shall be flanged and furnished in interchangeable sections not over ten feet in length.
 - d. Threaded column sections shall be connected with threaded, sleeve-type couplings. Column joints are to be butted to insure perfect column alignment after assembly.
7. Lineshafts
 - a. Lineshafting shall be of ample size to transmit the torque and operate the pump without distortion or vibration.
 - b. Lineshafting shall be made of carbon steel conforming to AISI 1045 and be furnished in interchangeable sections not over ten feet in length.
 - c. Lineshafting shall be coupled with extra-strong threaded steel couplings machined from solid bar steel.
 - d. An enclosing tube shall be provided to house the lineshaft. It shall be of extra-strong ASTM A120, Schedule 80 pipe construction and furnished in interchangeable sections not over five feet in length. Each end of the enclosing tube shall be machined to receive a bronze connector bearing.
 - e. Enclosing tube connector bearings shall be of bronze material conforming to ASTM B505 C93200 material.
 - f. Units with overall lengths exceeding 30 feet shall incorporate an enclosing tube stabilizer for each additional 50 feet of the tube assembly.
8. Discharge Head Assembly (above ground, tube tension assembly)
 - a. The pump discharge head shall be of the above ground type of either cast iron or fabricated steel construction with an ANSI 125# discharge flange.
 - b. The discharge head shall be of sufficient design to support the entire weight of the pump and driver.
 - c. If the application uses a variable frequency drive, the discharge head shall be fabricated steel and specifically designed to elevate the discharge head natural frequency above the operating speed.
 - d. A drive shaft of the same material as the lineshaft shall extend through the sealing assembly of the discharge head and be coupled to a vertical hollow shaft driver.
 - e. The shaft sealing assembly shall consist of a bronze tension nut, a suitable oiler and oil reservoir to ensure proper lubrication for the bearings when the pump is in operation. The oiler shall be furnished with a ___ volt solenoid for automatic operation.
 - f. Discharge head openings shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

OR

8. Discharge Head Assembly (below ground, tube tension assembly)
 - a. The pump discharge shall be of the below ground construction and consist of a driver mounting-base, underground elbow and riser pipe.
 - b. The driver mounting-base shall be of sufficient design to support the entire weight of the pump and driver.

-
- c. If the application uses a variable frequency drive, the mounting-base shall be fabricated steel and specifically designed to elevate the mounting-base natural frequency above the operating speed.
 - d. The underground elbow shall be of fabricated steel and have an ANSI 125# discharge flange.
 - e. A driveshaft of the same material as the lineshaft shall extend through the sealing assembly of the driver-mounting base and be coupled to a vertical hollow shaft driver.
 - f. The shaft sealing assembly shall consist of a bronze tension nut, a suitable oiler and oiler reservoir to ensure proper lubrication for the bearings when the pump is in operation. The oiler shall be furnished with a ___ bolt solenoid for automatic operation.
 - g. Driver mounting-base shall be fitted with guards to prevent access to the rotating shaft and/or coupling.
9. Vibration Limitations (Field)
 - a. The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.
10. Testing
 - a. A certified factory hydrostatic and performance test shall be performed on each bowl assembly in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.
 - b. Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment.

**1100 VERTICAL TURBINE PUMP SPECIFICATIONS
OPEN LINESHAFT CONSTRUCTION**

PART 1. GENERAL

- 1.01 This specification includes the supply of ____ vertical turbine product lubricated open lineshaft pump(s). Each unit shall include a bowl assembly, suction strainer, column and open lineshaft, discharge head, sealing assembly and driver.
- 1.02 **QUALITY ASSURANCE**
- A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.
 - B. Unit responsibility. Pump(s), complete with motor, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.
 - C. The vertical turbine pump(s) specified in this section shall be furnished by and be the product of one manufacturer.
 - D. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.
 - E. Pump(s) are to be engineered and manufactured under the certification of ISO-9001:2000.
- 1.03 **PERFORMANCE**
- A. The pump(s) shall be designed for continuous operation and will be operated continuously under normal service.
 - B. **OPERATION CRITERIA**

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Max. Solids Passage	Max. Shutoff Head (ft.)	Minimum Submergence (inches)
Design Condition						
Secondary Condition						

- C. Total dynamic head shall be as measured at the discharge of the pump and shall include velocity head and vertical static head from the minimum water level to the centerline of the pump discharge.
- D. Minimum water level shall be at elevation _____ feet.
- E. Pump(s) are to be mounted at _____ feet elevation with the sump floor at _____ feet elevation.
- F. Pump discharge centerline shall be at _____ feet elevation.
- G. Maximum pump speed shall not exceed _____ RPM.
- H. Driver size shall be limited to _____ HP maximum.
- I. Liquid pumped is _____ with a maximum temperature of ____ deg. F.

PART 2, PRODUCTS

- 2.01 **PUMPS**
- A. **Manufacturers**
 - 1. Pump(s) shall be the product of Layne/Verti-Line.
 - 2. Manufacturer shall have installations of like or similar application with a minimum of 5 years service for this pump size.
 - B. **Design**
 - 1. **Rotation**
 - a. The pump will be counterclockwise rotation when viewed from the driver end looking at the pump.
 - 2. **Impeller**
 - a. The impeller shall be of bronze construction conforming to ASTM B584, C83600. They shall be of one-piece construction, single suction, enclosed ____-vane, and radial flow design. The waterways through the impeller shall have extremely smooth contours, devoid of sharp corners, so as to promote maximum efficiency.
 - b. The impeller is to be balanced and secured to the shaft by means of a stainless steel drive collet for bowl sizes 18" and smaller. For bowl shafts 19" and larger, impellers shall be securely keyed to the shaft.
 - c. Impellers shall be adjustable by means of a top shaft-adjusting nut.

3. Bowls
 - a. The bowls shall be made of close-grained cast iron conforming to ASTM A48 CL30. Castings shall be free from blowholes, sand holes and shall be accurately machined and fitted to close dimensions.
 - b. Bowls 13" and above shall be flange connected. Bowls below 13" nominal diameter may use either flanged or threaded connections.
 - c. Bowls shall be designed with smooth passages to ensure efficient operation and their interior shall be coated with Tnemec N140 Pota-Pox Plus, or equal.
 - d. The casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head whichever is greater.
4. Impeller Shaft
 - a. Impeller shaft shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
 - b. The shaft shall be supported by bronze or neoprene bearings located on both sides of each impeller.
 - c. Impeller shaft coupling shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
5. Wear Rings
 - a. Wear rings shall be provided on both the impellers and bowls on bowls of nominal diameter of 8" or larger so that clearances can be maintained throughout the life of the rings and minimize recirculation.
 - b. Impeller wear rings shall be of the radial-type.
 - c. Bowl wear rings shall be of the radial-type.
 - d. Wear rings shall be attached to the impellers and bowls using an interference fit and Loctite.
 - e. Wear rings shall be bronze conforming to ASTM, B505 C93200.
6. Column
 - a. Total length of discharge column shall be ___ feet, ___ inches.
 - b. Column pipe shall be not less than ___ inches inside diameter and weigh not less than ___ pounds per foot.
 - c. Column pipe in sizes 4" through 12" diameter shall be furnished in interchangeable sections not over ten feet in length, and shall be connected with threaded, sleeve-type couplings. Column pipe 14" diameter and larger shall be flanged and furnished in interchangeable sections not over ten feet in length.
 - d. Top and bottom sections of column pipe shall not exceed five feet in length.
 - e. Threaded column sections shall be connected with threaded, sleeve-type couplings. Column joints are to be butted to insure perfect column alignment after assembly.
7. Lineshafts
 - a. Lineshafting shall be of ample size to transmit the torque and operate the pump without distortion or vibration.
 - b. Lineshafting shall be made of carbon steel conforming to AISI 1045 and be furnished in interchangeable sections not over ten feet in length.
 - c. Lineshafting shall be coupled with extra-strong threaded steel couplings machined from solid bar steel.
 - d. Lineshafting shall be fitted with stainless steel replaceable sleeves at each bearing and shall conform to AISI 304 material.
 - e. Lineshaft bearings shall be of neoprene material construction.
 - f. Lineshaft bearings shall be retained in bronze guides that are fitted into the column coupling and secured in place by the butted column pipe ends. (for column sizes larger than 16" retainers shall be steel and fabricated into the column assembly).
8. Discharge Head Assembly (above ground, packed box)
 - a. The pump discharge head shall be of the above ground type of either cast iron or fabricated steel construction with an ANSI 125# discharge flange.
 - b. The discharge head shall be of sufficient design to support the entire weight of the pump and driver.
 - c. If the application uses a variable frequency drive, the discharge head shall be fabricated steel and specifically designed to elevate the discharge head natural frequency above the operating speed.
 - d. A drive shaft of the same material as the lineshaft shall extend through the sealing assembly of the discharge head and be coupled to a vertical hollow shaft driver.
 - e. The shaft sealing assembly shall consist of a cast iron packing box, cast iron packing gland, bronze packing box bushing, stainless steel packing gland nuts and bolts, synthetic packing and a Teflon water seal ring.
 - f. Packing box shall be rated for 175 PSI.
 - g. Discharge head openings shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

OR

8. Discharge Head Assembly (above ground, mechanical seal)
 - a. The pump discharge head shall be of the above ground type of either cast iron or fabricated steel construction with an ANSI 125# discharge flange.
 - b. The discharge head shall be of sufficient design to support the entire weight of the pump and driver.

- c. If the application uses a variable frequency drive, the discharge head shall be fabricated steel and specifically designed to elevate the discharge head natural frequency above the operating speed.
- d. A drive shaft of the same material as the lineshaft shall extend through the sealing assembly of the discharge head and be coupled to a vertical solid shaft driver using a spacer type coupling to permit easy field removal of the mechanical seal.
- e. The shaft sealing assembly shall consist of a cast iron packing box, balanced mechanical seal, and bronze throttle bushing. The mechanical seal shall ride on either an ASTM A582 (416 stainless steel) shaft, or an AISI 304 stainless steel shaft sleeve.
- f. The mechanical seal shall be field mounted to prevent damage during shipping.
- g. Packing box shall be rated for 175 PSI.
- h. Discharge head openings shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

OR

- 9. Discharge Head Assembly (below ground, packed box)
 - a. The pump discharge shall be of the below ground construction and consist of a driver mounting-base, underground elbow and riser pipe.
 - b. The driver mounting-base shall be of sufficient design to support the entire weight of the pump and driver.
 - c. If the application uses a variable frequency drive, the mounting-base shall be fabricated steel and specifically designed to elevate the mounting-base natural frequency above the operating speed.
 - d. The underground elbow shall be of fabricated steel and have an ANSI 125# discharge flange.
 - e. A driveshaft of the same material as the lineshaft shall extend through the sealing assembly of the driver-mounting base and be coupled to a vertical hollow shaft driver.
 - f. The shaft sealing assembly shall consist of a cast iron packing box, cast iron packing gland, bronze packing box bushing, stainless steel packing gland nuts and bolts, synthetic packing and a Teflon water seal ring.
 - g. Packing box shall be rated for 175 PSI.
 - h. Driver mounting-base shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

OR

- 10. Discharge Head Assembly (below ground, mechanical seal)
 - a. The pump discharge shall be of below ground construction and consist of a driver mounting-base, underground elbow and riser pipe.
 - b. The driver mounting-base shall be of sufficient design to support the entire weight of the pump and driver.
 - c. If the application uses a variable frequency drive, the mounting-base shall be fabricated steel and specifically designed to elevate the mounting-base natural frequency above the operating speed.
 - d. The underground elbow shall be of fabricated steel and have an ANSI 125# discharge flange.
 - e. A drive shaft of the same material as the lineshaft shall extend through the sealing assembly and be coupled to a vertical solid shaft driver using a spacer type coupling to permit easy field removal of the mechanical seal.
 - f. The shaft sealing assembly shall consist of a cast iron packing box, balanced mechanical seal, and bronze throttle bushing. The mechanical seal shall ride on either an ASTM A582 (416 stainless steel) shaft, or an AISI 304 stainless steel shaft sleeve.
 - g. The mechanical seal shall be field mounted to prevent damage during shipping.
 - h. Packing box shall be rated for 175 PSI.
 - i. Driver mounting-base shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

- 11. Vibration Limitations (Field)
 - a. The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.

- 12. Testing
 - a. A certified factory hydrostatic and performance test shall be performed on each bowl assembly in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.
 - b. Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment.

**1100 VERTICAL TURBINE PUMP SPECIFICATIONS
 ENCLOSED LINESHAFT CONSTRUCTION – WATER FLUSH LUBRICATED**

PART 1. GENERAL

- 1.01 This specification includes the supply of ____ vertical turbine water-flush lubricated enclosed lineshaft pump(s). Each unit shall include a bowl assembly, suction strainer, column, lineshaft, enclosing tube, discharge head, sealing assembly and driver.
- 1.02 **QUALITY ASSURANCE**
 - A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.
 - B. Unit responsibility. Pump(s), complete with motor, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.
 - C. The vertical turbine pump(s) specified in this section shall be furnished by and be the product of one manufacturer.
 - D. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.
 - E. Pump(s) are to be engineered and manufactured under the certification of ISO-9001:2000.
- 1.03 **PERFORMANCE**
 - A. The pump(s) shall be designed for continuous operation and will be operated continuously under normal service.
 - B. **OPERATION CRITERIA**

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Max. Solids Passage	Max. Shutoff Head (ft.)	Minimum Submergence (inches)
Design Condition						
Secondary Condition						

- C. Total dynamic head shall be as measured at the discharge of the pump and shall include velocity head and vertical static head from the minimum water level to the centerline of the pump discharge.
- D. Minimum water level shall be at elevation _____ feet.
- E. Pump(s) are to be mounted at _____ feet elevation with the sump floor at _____ feet elevation.
- F. Pump discharge centerline shall be at _____ feet elevation.
- G. Maximum pump speed shall not exceed _____ RPM.
- H. Driver size shall be limited to _____ HP maximum.
- I. Liquid pumped is _____ with a maximum temperature of ____ deg. F.

PART 2, PRODUCTS

- 2.01 **PUMPS**
 - A. **Manufacturers**
 - 1. Pump(s) shall be the product of Layne/Verti-Line.
 - 2. Manufacturer shall have installations of like or similar application with a minimum of 5 years service for this pump size.
 - B. **Design**
 - 1. **Rotation**
 - a. The pump will be counterclockwise rotation when viewed from the driver end looking at the pump.
 - 2. **Impeller**
 - a. The impeller shall be of bronze construction conforming to ASTM B584, C83600. They shall be of one-piece construction, single suction, enclosed ____-vane, and radial flow design. The waterways through the impeller shall have extremely smooth contours, devoid of sharp corners, so as to promote maximum efficiency.
 - b. The impeller is to be balanced and secured to the shaft by means of a stainless steel drive collet for bowl sizes 18" and smaller. For bowl sizes 19" and larger, impellers shall be securely keyed to the shaft.
 - c. Impellers shall be adjustable by means of a top shaft-adjusting nut.

3. Bowls
 - a. The bowls shall be made of close-grained cast iron conforming to ASTM A48 CL30. Castings shall be free from blowholes, sand holes and shall be accurately machined and fitted to close dimensions.
 - b. Bowls 13" and above shall be flange connected. Bowls below 13" nominal diameter may use either flanged or threaded connections.
 - c. Bowls shall be designed with smooth passages to ensure efficient operation and their interior shall be coated with Tnemec N140 Pota-Pox Plus, or equal.
 - d. The casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head whichever is greater.
4. Impeller Shaft
 - a. Impeller shaft shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
 - b. The shaft shall be supported by bronze or neoprene bearings located on both sides of each impeller.
 - c. Impeller shaft coupling shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
5. Wear Rings
 - a. Wear rings shall be provided on both the impellers and bowls on bowls of nominal diameter of 8" or larger so that clearances can be maintained throughout the life of the rings and minimize recirculation.
 - b. Impeller wear rings shall be of the radial-type.
 - c. Bowl wear rings shall be of the radial-type.
 - d. Wear rings shall be attached to the impellers and bowls using an interference fit and Loctite.
 - e. Wear rings shall be bronze conforming to ASTM, B505 C93200.
6. Column
 - a. Total length of discharge column shall be ___ feet, ___ inches.
 - b. Column pipe shall be not less than ___ inches inside diameter and weigh not less than ___ pounds per foot.
 - c. Column pipe in sizes 4" through 12" diameter shall be furnished in interchangeable sections not over ten feet in length, and shall be connected with threaded, sleeve-type couplings. Column pipe 14" diameter and larger shall be flanged and furnished in interchangeable sections not over ten feet in length.
 - d. Threaded column sections shall be connected with threaded, sleeve-type couplings. Column joints are to be butted to insure perfect column alignment after assembly.
7. Lineshafts
 - a. Lineshafting shall be of ample size to transmit the torque and operate the pump without distortion or vibration.
 - b. Lineshafting shall be made of carbon steel conforming to AISI 1045 and be furnished in interchangeable sections not over ten feet in length.
 - c. Lineshafting shall be coupled with extra-strong threaded steel couplings machined from solid bar steel.
 - d. An enclosing tube shall be provided to house the lineshaft. It shall be of extra-strong ASTM A120, Schedule 80 pipe construction and furnished in interchangeable sections not over five feet in length. Each end of the enclosing tube shall be machined to receive a bronze connector bearing.
 - e. Enclosing tube connector bearings shall be of bronze material conforming to ASTM B505 C93200 material.
 - f. Units with overall lengths exceeding 30 feet shall incorporate an enclosing tube stabilizer for each additional 50 feet of the tube assembly.
8. Discharge Head Assembly (above ground, packed tube tension assembly)
 - a. The pump discharge head shall be of the above ground type of either cast iron or fabricated steel construction with an ANSI 125# discharge flange.
 - b. The discharge head shall be of sufficient design to support the entire weight of the pump and driver.
 - c. If the application uses a variable frequency drive, the discharge head shall be fabricated steel and specifically designed to elevate the discharge head natural frequency above the operating speed.
 - d. A drive shaft of the same material as the lineshaft shall extend through the sealing assembly of the discharge head and be coupled to a vertical hollow shaft driver.
 - e. The shaft sealing assembly shall consist of a bronze tension nut, cast iron tension box, cast iron packing gland, bronze connector bearing, stainless steel top shaft sleeve, stainless steel packing box washer, stainless steel packing gland nuts and bolts and synthetic packing.
 - f. Packing box shall be rated for 175 PSI.
 - g. Discharge head openings shall be fitted with guards to prevent access to the rotating shaft and/or coupling.
 - h. A sufficient clean water supply shall be supplied by the owner for this water flush lubrication.

OR

8. Discharge Head Assembly (above ground, mechanical seal)
 - a. The pump discharge head shall be of the above ground type of either cast iron or fabricated steel construction with an ANSI 125# discharge flange.
 - b. The discharge head shall be of sufficient design to support the entire weight of the pump and driver.

- c. If the application uses a variable frequency drive, the discharge head shall be fabricated steel and specifically designed to elevate the discharge head natural frequency above the operating speed.
- d. A drive shaft of the same material as the lineshaft shall extend through the sealing assembly of the discharge head and be coupled to a vertical solid shaft driver using a spacer type coupling to permit easy field removal of the mechanical seal.
- e. The shaft sealing assembly shall consist of a cast iron tension box, cast iron packing gland, bronze connector bearing, stainless steel packing gland nuts and bolts and cartridge-type or split-type mechanical seal.
- f. Discharge head openings shall be fitted with guards to prevent access to the rotating shaft and/or coupling.
- g. A sufficient clean water supply shall be supplied by the owner for this water flush lubrication.

OR

- 8. Discharge Head Assembly (below ground, packed tube tension assembly)
 - a. The pump discharge shall be of the below ground construction and consist of a driver mounting-base, underground elbow and riser pipe.
 - b. The driver mounting-base shall be of sufficient design to support the entire weight of the pump and driver.
 - c. If the application uses a variable frequency drive, the mounting-base shall be fabricated steel and specifically designed to elevate the mounting-base natural frequency above the operating speed.
 - d. The underground elbow shall be of fabricated steel and have an ANSI 125# discharge flange.
 - e. A driveshaft of the same material as the lineshaft shall extend through the sealing assembly of the driver-mounting base and be coupled to a vertical hollow shaft driver.
 - f. The shaft sealing assembly shall consist of a cast iron tension box, cast iron packing gland, bronze connector bearing, stainless steel packing gland nuts and bolts and synthetic packing.
 - g. Driver mounting-base shall be fitted with guards to prevent access to the rotating shaft and/or coupling.
 - h. A sufficient clean water supply shall be supplied by the owner for this water flush lubrication.

OR

- 8. Discharge Head Assembly (below ground, mechanical seal)
 - a. The pump discharge shall be of below ground construction and consist of a driver mounting-base, underground elbow and riser pipe.
 - b. The driver mounting-base shall be of sufficient design to support the entire weight of the pump and driver.
 - c. If the application uses a variable frequency drive, the mounting-base shall be fabricated steel and specifically designed to elevate the mounting-base natural frequency above the operating speed.
 - d. The underground elbow shall be of fabricated steel and have an ANSI 125# discharge flange.
 - e. A drive shaft of the same material as the lineshaft shall extend through the sealing assembly and be coupled to a vertical solid shaft driver using a spacer type coupling to permit easy field removal of the mechanical seal.
 - f. The shaft sealing assembly shall consist of a cast iron tension box, cast iron packing gland, bronze connector bearing, stainless steel packing gland nuts and bolts, and cartridge-type or split-type mechanical seal.
 - g. Driver mounting-base shall be fitted with guards to prevent access to the rotating shaft and/or coupling.
 - h. A sufficient clean water supply shall be supplied by the owner for this water flush lubrication.
- 9. Vibration Limitations (Field)
 - a. The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.
- 10. Testing
 - a. A certified factory hydrostatic and performance test shall be performed on each bowl assembly in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.
 - b. Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment.

NOTES: