

A. Scope

This specification covers a lineshaft turbine pump with above ground discharge, the lineshaft bearings lubricated by the water being pumped and furnished with suitable driver and accessories as specified herein. The pumping unit shall be designed and furnished in accordance with the latest Hydraulic Institute and AWWA Standards for lineshaft turbine pump.

B. Service Conditions

The pump shall be designed and constructed to operate satisfactorily with a reasonable service life, when installed in a dependable and adequate water resource location. The pump shall be the product of, and manufactured by Goulds Pumps, ITT Industries. Other manufacturers will be considered providing the unit offered is an approved equal in all respects to the brand and model preferred by the customer. Factory pump performance curves for alternate pumps shall be submitted with the bid.

C. Operating Conditions

Design flow conditions: _____ Gallons per minute

Design head: _____ Feet total dynamic head (TDH)

Minimum pump efficiency: _____ Percent

Maximum allowable speed: _____ RPM

Pump bowl setting: _____ Feet

Well diameter I.D.: _____ Inches

D. Pump Construction

- 1. Bowl assembly:** The bowls shall be flanged type constructed of close grained cast iron conform to ASTM A48, class 30. They shall be free from sand holes, blowholes, or other faults and must be accurately machined and fitted to close tolerances. They shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at rated flow or 1.5 times shut-off head, which ever is greater. The intermediate bowls shall have enamel or epoxy lined waterways for maximum efficiency and wear protection. All intermediate bowls shall be of identical design for interchangeability. A discharge bowl shall be used to connect bowl assembly to the discharge column. All the bowls (include the discharge bowl) shall be fitted with sleeve type bearings of bronze alloy C89835.
- 2. Impellers:** The impellers shall be constructed from ASTM B584 Silicon Bronze and shall be the enclosed (or semi-open) type. They shall be free from defects and must be accurately cast, machined and filed for optimum performance and minimum vibration. Impellers shall be balanced to grade G6.3 of ISO 1940 as minimum. They shall be securely fastened to the bowl shaft with taper locks of C1018 steel.
- 3. Suction:** The suction bowl shall be provided with a non-soluble grease packed bronze bearing. A bronze sand collar shall be provided to protect this bearing from abrasives in the pumping fluids. The bearing housing shall have sufficient opening at the bottom for easy removal of the bearing.
- 4. Shaft:** The bowl shaft shall be constructed from ASTM 582 type 416 stainless steel. It shall be precision ground and polished with surface finish better than 40 RMS.

E. Column Assembly-Water Lubricated

- 1. Column pipe:** The column pipe shall be furnished in sections not exceeding a nominal length of 10 ft and shall be connected by threaded-sleeve couplings. Pump speeds between 2200 RPM and 3600 RPM shall have

intermediate column length and bearing spacing no greater than 5 feet. The length of the top and bottom sections shall not be more than 5 ft. The pipes shall be of ASTM A53 grade B steel pipe and the weight shall be not less than schedule 30. The end of the pipe shall be with 8 threads per inch with 3/16" taper per foot thread and faced parallel to butt against the centering spiders of ASTM B584 Silicon Bronze to form accurate alignment. The inside diameter of the pipe shall be such that the head losses shall not be more than 5 feet per 100 feet of pipe based on rated flow of the pump.

2. **Lineshaft:** The lineshaft shall be of ASTM A108 Grade C1045 steel, ground and polished with surface finish not to exceed 40 RMS. They shall be furnished in interchangeable section not over ten feet in length, and shall be coupled with threaded steel couplings machined from solid steel bar. It shall have left-hand thread to tighten during pump operation. The diameter of the shaft and coupling shall be designed in accordance with AWWA E101 Standard. The shaft shall be provided with type 304 stainless steel sleeve to act as a journal at each bearing location. The sleeve shall be placed on a full size shaft without undercutting and secured in position by a suitable adhesive.
3. **Bearing:** Bearing shall be fluted rubber retained in the centering spider by a shoulder on each end of the bearing

F. Discharge Head Assembly-Water Lubricated

1. **Discharge Head:** It shall be of the high profile type to allow shaft coupled above stuffing box and provided for mounting the driver and support the column and bowl assemblies. It shall be of high-grade cast iron, ASTM A48 Class 30, or fabricated steel. The above ground outlet shall be flanged to match ___ inch ANSI class 125 (for cast iron) or class 150 (for steel). It shall have a 1/2" NPT connection for a pressure gauge.
2. **Stuffing Box:** The stuffing box shall be cast iron and shall contain a minimum of five rings of packing. It shall have a pressure relief connection. The packing gland shall be a 316 SS split type secured in place with non-corrosive studs and nuts. The bearing shall be C89835 bronze. A rubber slinger shall be secured to the shaft above the packing gland.
3. **Headshaft:** The head shaft go through the stuffing box shall be of ASTM 582 type 416 stainless steel. It shall be precision ground and polished with surface finish better than 40 RMS.

G. Suction Pipe and Strainer

The suction pipe shall be ___ feet in length and shall have a minimum inside diameter and weight equal to or larger than that of the discharge column pipe. A suitable cone strainer of galvanized steel shall be provided having a free area of at least four times the flow area of the suction pipe.

H. Electric Motor

The motor shall be a heavy duty squirrel cage induction type, NEMA Class B or Class F insulation with WP-1 enclosure, ___ RPM vertical hollow (or solid) shaft motor, with a non-reverse ratchet (or self-release coupling) to prevent reverse rotation of the rotating elements. A thrust bearing of ample capacity to carry the weight of all rotating parts plus the maximum hydraulic thrust load under all conditions of operation calculated L10 life shall be no less than 8800 hours. The motor shall be standard (or premium) efficiency, 1.15 service factor, and suitable for use on ___ volt, three phase, 60 Hz electric service.

An adjusting nut shall be provided at the top of the motor for setting the impeller to bowl running clearance.

A. Scope

This specification covers a deep well lineshaft turbine pump with above ground discharge, arranged for oil lubrication of the lineshaft bearing by a manual or electric assembly and furnished with suitable driver and accessories as specified herein. The pumping unit shall be designed and furnished in accordance with the latest Hydraulic Institute and AWWA Standard for lineshaft turbine pumps.

B. Service Conditions

The pump shall be designed and constructed to operate satisfactorily with a reasonable service life, when installed in a dependable and adequate water resource location. The pump shall be the product of, and manufactured by Goulds Pumps, ITT Industries. Other manufacturers will be considered providing the unit offered is an approved equal in all respects to the brand and model preferred by the customer. Factory pump curves for alternate pumps shall be submitted with the bid.

C. Operating Conditions

Design conditions: _____ Gallons per minute

Design head: _____ Feet total dynamic head (TDH)

Minimum pump efficiency of: _____ Percent

Maximum allowable speed: _____ RPM

Pump bowl setting: _____ Feet

Well diameter I.D.: _____ Inches

D. Pump Construction

- 1. Bowl assembly:** The bowls shall be flanged type constructed of close grained cast iron conform to ASTM A48, class 30. They shall be free from sand holes, blowholes, or other faults and must be accurately machined and fitted to close tolerances. They shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at rated flow or 1.5 times shut-off head, which ever is greater. The intermediate bowls shall have enamel or epoxy lined waterways for maximum efficiency and wear protection. All intermediate bowls shall be of identical design for interchangeability. An oil lubricated adapter with drain ports and adapter bearing shall be used to connect the intermediate bowl to the enclosed column assembly. An extra long bronze throttle bushing shall be used in the top intermediate bowl and oil lube adapter to minimize the amounts of water leakage through the drain ports. Drain ports are to be provided with sufficient area and shape and angle to permit a non-horizontal escape of water that passes through the throttle bushing. All bowls shall be fitted with sleeve type bearing of bronze alloy C89835 or fluted rubber.
- 2. Impellers:** The impellers shall be constructed from ASTM B584 silicon bronze and shall be the enclosed (or semi-open) type. They shall be free from defects and must be accurately cast, machined for optimum performance and minimum vibration. Impellers shall be balanced to grade G6.3 of ISO 1940 as minimum. They shall be securely fastened to the bowl shaft with taper locks of C1018 steel.
- 3. Suction:** The suction bowl shall be provided with a non-soluble grease packed bronze bearing, A bronze sand collar shall be provided to protect this bearing from abrasives in the pumping fluids. The bearing housing shall have sufficient opening at the bottom for easy removal of the bearing.
- 4. Shaft:** The bowl shaft shall be constructed from ASTM A582 type 416 stainless steel. It shall be precision ground and polished with surface finish better than 40 RMS.

E. Column Assembly-Oil Lubricated

1. **Column pipe:** The column pipe shall be furnished in sections not exceeding a nominal length of 20 ft. It shall be of ASTM A53 grade B steel pipe and weight shall be not less than schedule 30. The pipe ends shall be machined with 8 threads per inch with 3/16 taper and faced parallel to butt against subsequent column pipes. Inside diameter of the pipe shall be such that the head losses shall not be over 5 feet per 100 feet of pipe. The pipe shall be connected with threaded sleeve type steel couplings.
2. **Enclosing Tube:** The enclosing tube shall be made of ASTM A120 schedule 80 pipe in interchangeable section not more than 5 ft. in length. The top special section shall be designed for applying proper tension to the tube. Both ends of each tube length shall be bored, faced, and inside threaded with left hand threads. The ends of the tube shall be square with the axis and shall butt to ensure accurate alignment. The tube shall be of such overall assembled length to properly match the length of the discharge column. The enclosing tube shall be stabilized in the column pipe by rubber centering spider spaced 20 feet from the top and bottom, and 40 feet intervals throughout the balance of the column length.
3. **Bearings:** The lineshaft bearing which serves as a coupling for the shaft tubing shall be spaced at each tube length, to maintain alignment of pump shafting and to prevent excessive vibration. They shall be of bronze material and machined, threaded and grooved for proper lubrication.
4. **Lineshaft:** The lineshaft shall be of ASTM A108 Grade C1045 steel, ground and polished with surface finish not to exceed 40 RMS. They shall be furnished in interchangeable section not over 20 feet in length, and shall be coupled with threaded steel couplings machined from solid steel bar. It shall have left-hand threads to tighten during pump operation. The diameter of the shaft and coupling shall be designed in according with AWWA E101 Standard.

F. Discharge Head Assembly-Oil Lubricated

1. **Discharge Head:** It shall be of the high profile type to allow shaft coupled above tension plate/tension nut assembly and provided for mounting the driver and support the column and bowl assemblies. It shall be of high-grade cast iron, ASTM A48 Class 30, or fabricated steel. The above ground outlet shall be flanged to match ___ inch ANSI class 125 (for cast iron) or class 150 (for steel). It shall have a 1/2" NPT connection for a pressure gauge.
2. A tension plate and tension nut assembly shall be installed in the discharge head to allow proper tension to be placed on the shaft enclosing tube. The tension plate nut shall be of cast iron with O-ring at the bottom end to provide the seal. The tension nut/bearing shall be made of silicon bronze to maintain tube tension and support for the head shaft. After proper tensioning, the tension nut shall be locked into position by a steel capscrew.

G. Suction Pipe and Strainer

The suction pipe shall be ___ feet in length and shall have a minimum inside diameter and weight equal to or larger than that of the discharge column pipe. A suitable cone strainer of galvanized steel shall be provided having a free area of at least five times the flow area of the suction pipe.

H. Electric Motor

The motor shall be a heavy duty squirrel cage induction type, NEMA Class B or Class F insulation with WP-1 enclosure, ___ RPM vertical hollow (or solid) shaft motor, with a non-reverse ratchet (or self-release coupling) to prevent reverse rotation of the rotating elements. A thrust bearing of ample capacity to carry the weight of all rotating parts plus the maximum hydraulic thrust load under all conditions of operation calculated L10 life shall be no less than 8800 hours. The motor shall be standard (or premium) efficiency, 1.15 service factor, and suitable for use on ___ volt, three phase, 60 Hz electric service.

An adjusting nut shall be provided at the top of the motor for setting the impeller to bowl running clearance.

A. Scope

This specification covers a lineshaft turbine pump with above ground discharge, the lineshaft bearings lubricated by the water being pumped and furnished with suitable driver and accessories as specified herein. The pumping unit shall be designed and furnished in accordance with the latest Hydraulic Institute and AWWA Standards for lineshaft turbine pump.

B. Service Conditions

The pump shall be designed and constructed to operate satisfactorily with a reasonable service life, when installed in a dependable and adequate water resource location. The pump shall be the product of, and manufactured by Goulds Pumps, ITT Industries. Other manufacturers will be considered providing the unit offered is an approved equal in all respects to the brand and model preferred by the customer. Factory pump performance curves for alternate pumps shall be submitted with the bid.

C. Operating Conditions

Design flow conditions: _____ Gallons per minute

Design head: _____ Feet total dynamic head (TDH)

Minimum pump efficiency: _____ Percent

Maximum allowable speed: _____ RPM

Liquid to be pumped: _____

Pump length: _____ Feet

D. Pump Construction

- 1. Bowl assembly:** The bowls shall be flanged type constructed of close grained cast iron conform to ASTM A48, class 30. They shall be free from sand holes, blowholes, or other faults and must be accurately machined and fitted to close tolerances. They shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at rated flow or 1.5 times shut-off head, which ever is greater. The intermediate bowls shall have enamel or epoxy lined waterways for maximum efficiency and wear protection. All intermediate bowls shall be of identical design for interchangeability. All the bowls shall be fitted with sleeve type bearings of bronze alloy C89835.
- 2. Impellers:** The impellers shall be constructed from ASTM B584 Silicon Bronze and shall be the enclosed (or semi-open) type. They shall be free from defects and must be accurately cast, machined and filed for optimum performance and minimum vibration. Impellers shall be balanced to grade G6.3 of ISO 1940 as minimum. They shall be securely fastened to the bowl shaft with taper locks of C1018 steel (or key and split thrust ring of SS).
- 3. Suction:** The suction bowl or suction bell shall be provided with a non-soluble grease packed bronze bearing. A bronze sand collar shall be provided to protect this bearing from abrasives in the pumping fluids. The bearing housing shall have sufficient opening at the bottom for easy removal of the bearing. A strainer of cone or basket type may be provided. It shall have a net inlet area equal to at least three times the impeller inlet area. The maximum opening shall not be more than 75% of the maximum opening of the water passage through the bowl or impeller.
- 4. Shaft:** The bowl shaft shall be constructed from ASTM 582 type 416 stainless steel. It shall be precision ground and polished with surface finish better than 40 RMS.

E. Column Assembly-Open Lineshaft

1. **Column pipe:** The column pipe shall be furnished in sections not exceeding a nominal length of 10 ft and shall be connected by threaded-sleeve couplings (or flanges). Pump speeds between 2200 RPM and 3600 RPM shall have intermediate column length and bearing spacing no greater than 5 feet. The length of the top and bottom sections shall not be more than 5 ft. The pipes shall be of ASTM A53 grade B steel pipe and the weight shall be not less than schedule 30. The end of the pipe shall be with 8 threads per inch with 3/16" taper per foot thread and faced parallel to butt against the centering spiders of ASTM B584 Silicon Bronze to form accurate alignment. (All column flange faces shall be parallel and machined for rabbet fit to permit accurate alignment.) The inside diameter of the pipe shall be such that the head losses shall not be more than 5 feet per 100 feet of pipe or the flow velocity not to exceed 3 ft/sec based on rated flow of the pump.
2. **Lineshaft:** The lineshaft shall be of ASTM A582 type 416 stainless steel ground and polished with surface finish not to exceed 40 RMS. They shall be furnished in interchangeable section not over ten feet in length, and shall be coupled with threaded stainless steel couplings (up to 2-15/16" diameter) machined from solid steel bar. It shall have left-hand thread to tighten during pump operation. The diameter of the shaft and coupling shall be designed in according with AWWA E101 Standard.
3. **Bearing:** Bearing shall be fluted rubber retained in the centering spider by a shoulder on each end of the bearing

F. Discharge Head Assembly

1. **Discharge Head:** It shall be of the high profile type to allow shaft coupled above stuffing box and provided for mounting the driver and support the column and bowl assemblies. It shall be of high-grade cast iron, ASTM A48 Class 30, or fabricated steel. The above ground outlet shall be flanged to match ___ inch ANSI class 125 (for cast iron) or class 150 (for steel). It shall have a 1/2" NPT connection for a pressure gauge.
2. **Stuffing Box:** The stuffing box shall be cast iron and shall contain a minimum of five rings of packing (or mechanical seal). It shall have a pressure relief connection. The packing gland shall be a 316 SS split type secured in place with non-corrosive studs and nuts. The bearing shall be C89835 bronze. A rubber slinger shall be secured to the shaft above the packing gland.

G. Electric Motor

The motor shall be a heavy duty squirrel cage induction type, NEMA Class B or Class F insulation with WP-1 enclosure, ___ RPM vertical hollow (or solid) shaft motor, with a non-reverse ratchet (or self-release coupling) to prevent reverse rotation of the rotating elements. A thrust bearing of ample capacity to carry the weight of all rotating parts plus the maximum hydraulic thrust load under all conditions of operation calculated L10 life shall be no less than 8800 hours. Provision shall be made for momentary upthrust equal to 30% of the rated down thrust. The motor shall be standard (or premium) efficiency, 1.15 service factor, and suitable for use on ___ volt, three phase, 60 Hz electric service.

When vertical hollow shaft motor is used, an adjusting nut shall be provided at the top of the motor for setting the impeller to bowl running clearance. When vertical solid shaft motor is used, an adjustable shaft coupling shall be provided at the discharge head for setting the impeller to bowl running clearance.

A. Scope

This specification covers a deep well submersible turbine pump with above ground discharge and furnished with suitable driver and accessories as specified herein. The pumping unit shall be designed and furnished in accordance with the latest Hydraulic Institute and AWWA Standard for submersible turbine pumps.

B. Service Conditions

The pump shall be designed and constructed to operate satisfactorily with a reasonable service life, when installed in a dependable and adequate water resource location. The pump shall be the product of, and manufactured by Goulds Pumps, ITT Industries. Other manufacturers will be considered providing the unit offered is an approved equal in all respects to the brand and model preferred by the customer. Factory pump performance curves for alternate pumps shall be submitted with the bid.

C. Operating Conditions

Design conditions: _____ Gallons per minute

Design head: _____ Feet total dynamic head (TDH)

Minimum pump efficiency of: _____ Percent

Maximum allowable speed: _____ RPM

Pump bowl setting: _____ Feet

Well diameter I.D.: _____ Inches

D. Pump Construction

- 1. Bowl assembly:** The bowls shall be flanged type constructed of close grained cast iron conform to ASTM A48, class 30. They shall be free from sand holes, blowholes, or other faults and must be accurately machined and fitted to close tolerances. They shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at rated flow or 1.5 times shut-off head, which ever is greater. The intermediate bowls shall have enamel or epoxy lined waterways for maximum efficiency and wear protection. All intermediate bowls shall be of identical design for interchangeability. All the bowls shall be fitted with sleeve type bearings of bronze alloy C89835. A discharge bowl shall be used to connect bowl assembly to the discharge pipe. An extra long bronze bearing packed with non-soluble grease shall be provided in the top bowl and extended into the discharge bowl The bearing shall have a threaded cast iron cap or plug at the top to protect the bearing from abrasives. The hub of the discharge bowl should be such that the bearing can be easily removed through the top of the hub. A thrust ring shall be above the top impeller to prevent excessive vertical upthrust.
- 2. Impellers:** The impellers shall be constructed from ASTM B584 Silicon Bronze and shall be the enclosed type. They shall be free from defects and must be accurately cast, machined, balanced, and filed for optimum performance and minimum vibration. Impellers shall be balanced to grade G6.3 of ISO 1940 as minimum. They shall be securely fastened to the bowl shaft with taper locks of C1018.
- 3. Motor Adapter:** The inlet motor adapter shall be of ASTM A536 Gr. 60-40-18 ductile iron and shall contain an extra long bronze bearing. The inlet area shall have a net open area of at least four times the eye of the impeller and shall be protected with a 304 stainless steel screen. The openings on the screen shall not be more than 75% of the minimum opening of the water passage through the bowl or the impeller.
- 4. Shaft:** The pump shaft shall be of ASTM 582 type 416 stainless steel. It shall be precision ground and polished with surface finish better than 40 RMS.
- 5. Coupling:** The shaft coupling shall be of stainless steel and be capable of transmitting the total torque and total thrust of the bowl assembly in either direction of rotation.

E. Discharge Pipe

The discharge pipe shall be ASTM A53 grade B standard weight steel pipe, in ___ feet (or random) lengths and connected by threaded sleeve type steel coupling. The ends of the pipes shall have ANSI B1.20.1 standard tapered pipe threads. Inside diameter of the pipe shall be such that the head losses shall not be over 5 feet per 100 feet of pipe.

F. Submersible Cable

Pump cable shall be sized to limit the voltage drop to no more than 5%. The cable shall have three separate conductors and a ground and shall be included in a single continuous jacketed assembly. The insulation shall be water and oil resistant, and suitable for continuous immersion. The cable should be the length of the discharge pipe plus ___ feet to extend from the surface plate to the electrical controller. The cable should be adequately secured to the discharge pipe by plastic ties, or other non metallic means, at 10 foot intervals.

G. Surface Plate

The surface plate shall be of fabricated steel. The plate shall incorporated a long radius elbow welded securely to a ANSI Class 150 ___ " flange and shall rigidly support the total weight of the motor, bowl assembly, discharge pipe, cable, and column of water. The plate shall have a cable seal of adequate size to accommodate the cable size and well vent and water level indicator.

H. Submersible Electric Motor

The motor shall be a heavy duty canned (or wet wound) type of NEMA design ___ RPM, with outside diameter not to exceed ___ inches. The motor shall be capable of continuous operation under water at the specified conditions outlined above. A suitable thrust bearing shall be incorporated in the lower end of the motor adequate to receive the entire hydraulic thrust load of the pump unit plus the weight of the rotating parts regardless of the direction of rotation. The motor shall have a 1.15 service factor, and suitable for use on ___ volt, three phase, 60 Hz electric service.

The motor leads shall be of sufficient length so that they may be spliced above the bowl assembly and the leads shall be protected by a type 304 stainless steel cable guard held in place with stainless steel banding. As the motor lead exit the top of the cable guard it shall be properly protected to prevent damaging or cutting the lead by the cable guard material.