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AMERICAN STANDARD
for
VERTICAL TURBINE PUMPS

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Table of Contents

Part A—Line Shaft Pumps	Sec.	Part B—Submersible Pumps	Sec.
Scope and Purpose.....	A1	Scope and Purpose.....	B1
Definitions	A2	Definitions	B2
Nomenclature	A3	Nomenclature	B3
General Specifications	A4	General Specifications	B4
Engineering Data	A5	Engineering Data	B5
Factory Inspection and Tests.....	A6	Factory Inspection and Tests.....	B6

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Latest Revisions to ASA B58.1

The latest changes in ASA B58.1 were approved by the American Standards Association on Jan. 31, 1961. The most important change was the inclusion of a new section (Part B) on submersible pumps. In addition, portions of the original standard (now Part A) were extensively revised, the major revisions occurring in Sec. A4.3 and A5.5.

Designation. The former designation, "B58.1-1955," has been changed to "B58.1-1961."

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American Standard for
Vertical Turbine Pumps
Part A—Line Shaft Vertical Turbine Pumps

Section A1—Scope and Purpose

This standard is recommended as a guide for users of the line shaft vertical turbine pump in selecting new equipment. The suggested standards are to be considered a minimum requirement for a first-quality vertical turbine pump, but do not preclude the use of more elaborate specifications on the part of either user or manufacturer,

nor is it the intent to restrict the use of any equipment not meeting the requirements of this standard should the user not consider such compliance necessary.

This standard is applicable primarily to pumps that are constructed of accepted standard materials of the best quality and workmanship.

Section A2—Definitions

2.1. *A line shaft vertical turbine pump* is a vertical-shaft centrifugal or mixed-flow pump with rotating impeller or impellers, with discharge from the pumping element coaxial with the shaft. The pumping element is suspended by the conductor system which encloses a system of vertical shafting used to transmit power to the impellers, the prime mover being external to the flow stream. The unit is used for pumping from open pools or closed suction systems. A basic pump consists of three elements, defined as follows:

2.1.1. *The pump bowl assembly* is either a single or multistage, centrifugal or mixed-flow vertical pump with discharge coaxial with the shaft. It has open, semiopen, or enclosed impellers. Assemblies are constructed for use with either open or enclosed line shafts.

2.1.2. *The column-and-shaft assembly* consists of the column pipe which

suspends the pump bowl assembly from the head assembly and serves as a conductor for the fluid from the pump bowl assembly to the discharge head. Contained within the column pipe is the line shaft which transmits the power from the driver to the pump shaft. The line shaft is supported throughout its length by means of bearings and may be enclosed in a shaft-enclosing tube and generally lubricated with oil, or it may be open and lubricated with the fluid being pumped.

2.1.3. *The head assembly* consists of the base from which the column and shaft assembly and the bowl assembly are suspended, the discharge head, which directs the fluid into the desired piping system, and the driver.

2.1.3.1. *The driver* is the mechanism mounted on the discharge head which transmits the power to the top shaft. It contains means for impeller

adjustment and provides a bearing to carry the thrust load. It may or may not be a prime mover.

2.1.3.2. *In underground discharge*, the discharge tee is separated from the head assembly and installed in the column pipe at the desired distance below the head assembly.

2.2. *Types of drivers* are defined as follows:

2.2.1. *The vertical hollow-shaft motor drive* is an electric motor having a motor shaft which has been bored on the center of its axis to receive the top shaft of the pump. Impeller adjustment is made at the upper end of the motor, and a means to carry the thrust on a bearing within the motor is provided.

2.2.2. *The vertical hollow-shaft right-angle gear drive* is a gear mechanism having a shaft which has been bored on the center of its axis to receive the top shaft of the pump. The horizontal shaft of a gear drive receives its power from the prime mover and, through a pair of bevel gears, transmits it to the top shaft. Impeller adjustment is made at the upper end of the gear drive, and a means to carry the thrust on a bearing within the gear drive is provided.

2.2.3. *The vertical hollow-shaft belted drive* is a flat- or V belt-driven mechanism having a shaft which has been bored on the center of its axis to receive the top shaft of the pump. Impeller adjustment is made at the upper end of the belted drive, and a means to carry the thrust on a bearing within the belted drive is provided.

2.2.4. *The flexible-coupling drive* is a mechanism having a thrust bearing capable of carrying the pump thrust, providing means of impeller adjustment, and having a flexible coupling. The top of this driver is designed to mount solid-shaft prime movers, in-

capable of supporting external thrust including electric motors, steam turbines, radial engines, or any other type of prime mover having a solid shaft and suitable for mounting with the shaft in a vertical position.

2.2.5. *The combination drive* includes means for operating the pump with two or more drivers.

2.3. *The datum* shall be taken as the elevation of that surface from which the weight of the pump is supported. This is normally the elevation of the underside of the discharge head or head base plate.

2.4. *The setting* is the nominal distance in feet from the datum to the column pipe connection at the bowl assembly.

2.5. *The static water level* is the vertical distance in feet from the datum to the level of the free pool while no water is being drawn from the pool.

2.6. *The pumping water level* is the vertical distance in feet from the datum to the level of the free pool while the specified fluid flow is being drawn from the pool.

2.7. *Drawdown* is the difference in feet between the pumping water level and the static water level.

2.8. *Specific yield*, expressed in gpm (US gallons per minute) per foot of drawdown, is the rate of flow from the free pool, divided by the drawdown, in feet.

2.9. *The capacity of the pump* is the volume rate of flow (Q), expressed in gpm, produced by the pump, calculated for specified conditions.

2.10. *The pump speed of rotation* (N) is the rate of rotation of the pump shaft, expressed in rpm (revolutions per minute).

2.11. *Head* is a quantity used to express the energy content of the liquid per unit weight of the liquid, referred to any arbitrary datum. In

terms of foot-pounds of energy per pound of liquid being pumped, all head quantities have the dimension of feet of liquid.

2.11.1. *Head below datum (h_b)* is the vertical distance in feet between the datum and the pumping level.

2.11.2. *Head above datum (h_a)* is the head measured above the datum, expressed in feet of liquid, plus the velocity head (Sec. 2.11.3) at the point of measurement.

2.11.3. *Velocity head (h_v)* is the kinetic energy per unit weight of the liquid at a given section. Velocity head is specifically defined by the expression:

$$h_v = \frac{v^2}{2g}$$

2.11.4. *Suction head (h_s)* is the algebraic sum of the pressure head (measured at the elevation of the suction case lower connection) and the velocity head at that point. The value of the suction head is not required when the surface of the liquid being pumped is exposed to atmospheric pressure.

2.11.5. *Pump total head (H)* is the bowl assembly head (Sec. 2.11.6) minus the column loss (Sec. 2.12) and discharge head loss. This is the head generally called for in pump specifications.

2.11.5.1. *On open-suction installations*, it is the sum of the head below datum and the head above datum.

2.11.5.2. *On closed-suction installations*, it is the algebraic difference of the suction head, the distance between the suction case flange and the datum, and the head above datum.

2.11.6. *Bowl assembly head (h_l)* is the energy imparted to the liquid by the pump (expressed in foot-pounds per pound of liquid). It is the head of a pump installed with a minimum

length of column and shaft, as in the manufacturer's laboratory.

2.11.6.1. *On open-suction installations*, it is the sum of the head below datum and the head above datum.

2.11.6.2. *On closed-suction installations*, it is the algebraic difference of the suction head, the distance between the suction case flange and the datum, and the head above datum.

2.12. *The column loss (h_c)* is the value of the head loss (expressed in feet) due to the flow friction in the column pipe. This value is subtracted from the bowl assembly head to predict the pump total head.

2.13. *The line shaft loss (hp_1)* is the power (expressed in horsepower) required because of the rotation friction of the line shaft. This value is added to the bowl assembly input (Sec. 2.14.3) to predict the pump input (Sec. 2.14.1).

2.14. *Power* is expressed in units of horsepower. One horsepower is equivalent to 550 ft-lb per second, 33,000 ft-lb per minute, 2,545 Btu per hour, or 0.746 kw.

2.14.1. *Pump input* is the power delivered to the line shaft, expressed in horsepower.

2.14.2. *Driver power input* is the power input to the driver, expressed in horsepower.

2.14.3. *Bowl assembly input* is the power delivered to the pump shaft, expressed in horsepower. It is the pump input of a pump installed with a minimum of column and shaft, as in the manufacturer's laboratory.

2.15. *Output* is defined as follows:

2.15.1. *Pump output* is defined as $\frac{QH}{3,960}$ for water having a specific weight of 62.4 lb per cubic foot. It is expressed in horsepower.

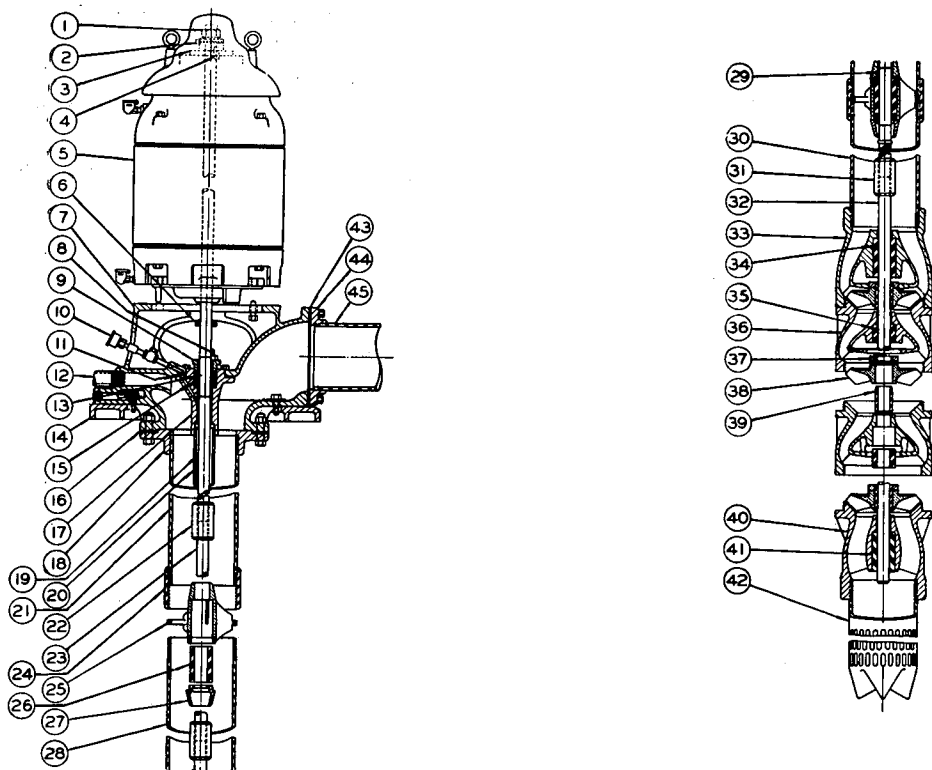


Fig. 1. Open Line Shaft Pump (Surface Discharge, Threaded Column and Bowls)

2.15.2. *Bowl output* is defined as $\frac{Qh_i}{3,960}$ for water having a specific weight of 62.4 lb per cubic foot. It is expressed in horsepower.

2.16. *Efficiency* is defined as follows:

2.16.1. *Pump efficiency* (E_p) is the ratio of pump output to pump input, expressed in per cent.

2.16.2. *Overall efficiency* (E) is the ratio of pump output to driver power input, expressed in per cent.

2.16.3. *Driver efficiency* (E_g) is the ratio of the driver output to the driver input, expressed in per cent.

2.16.4. *Bowl assembly efficiency* (E_i), is the ratio of the bowl output to the bowl assembly input, expressed in per cent.

Section A3—Nomenclature

Sec. A3.1—Standard Nomenclature

Table 1 lists the name of the part, together with its function and typical material. The material listed is intended to be typical only and does not constitute a recommendation. The

part number refers to the numbers in Fig. 1 and 2.

Sec. A3.2—Order Form

A recommended specification form for use in purchasing deep well turbine pumps is given in Table 2.

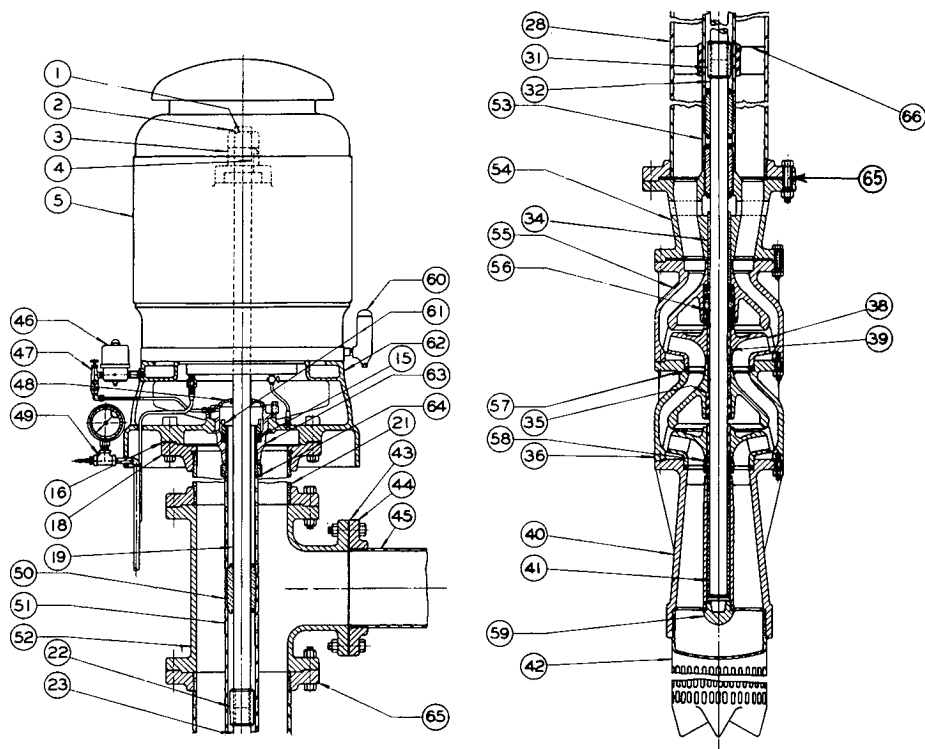


Fig. 2. Enclosed Line Shaft Pump (Underground Discharge, Flanged Column and Bowls)

Section A4—General Specifications

Sec. A4.1—General

4.1.1. *Descriptive matter.* The bidder shall submit, with his proposal, sufficient descriptive material or outline drawings to demonstrate compliance with these specifications, and a performance curve showing pump total head, pump input horsepower, and pump efficiency over the specified head range for the installed pump.

4.1.2. *Sanitary codes.* The pump shall conform to the sanitary codes governing the installation. The purchaser shall furnish, as a part of these

specifications, all information necessary for the construction of the pump to meet these requirements.

4.1.3. *Pump base.* A suitable base of cast iron or fabricated steel shall be provided for mounting the driver and supporting the pump column. The (aboveground or below ground) discharge outlet shall be flanged, or a nipple with a companion flange shall be furnished for a 125-lb ASA B16.1 connection, as specified.

4.1.4. *Driver.* With electric power, the motor shall be of the full-voltage

TABLE 1
Standard Nomenclature

Part No.	Name of Part	Typical Material	Function of Part
1	Top shaft adjusting nut	brass or steel	means of adjusting impellers vertically by raising or lowering shaft
2	Adjusting-nut lock screw	steel or brass	locks adjusting nut in place so that adjustment cannot change while pump is in operation (furnished as simple pin or screwed or threaded pin)
3	Top drive coupling	semisteel	couples top shaft with motor rotor
4	Key for top drive coupling	cold-rolled steel	keys top shaft to top drive coupling
5	Motor		drives pump
6	Water slinger	neoprene, rubber, or steel	keeps packing box leakage from shooting directly into hollow shaft of motor or driver unit
7	Surface discharge head	cast iron	supports driver and pump column; discharges water from pump column
8	Stuffing box stud bolts and hexagonal nuts	brass or steel	fastened in stuffing box to adjust stuffing box gland
9	Stuffing box gland	cast iron or bronze	compresses and holds packing in place
10	Stuffing box lubrication fittings		conduct grease to packing and journal bearing
11	Stuffing box gasket		placed under seat of packing containers to prevent leakage
12	Prelubrication fittings		conduct water to keep water-lubricated bearings wet during starting cycle
13	Top shaft sleeve	monel or stainless steel	sleeve operating within packed area in top shaft on open line shaft pumps
14	Head base plate	cast iron or steel	plate or casting that supports discharge head and may become permanent part of foundation after initial installation
15	Packing		flexible material which can be compressed by stuffing box gland in stuffing box so as to prevent leakage of fluid being pumped
16	Top column flange gasket		seals joint between flange faces
17	Stuffing box	cast iron	guides shaft and holds packing
18	Top column flange	cast iron	couples column to discharge head

TABLE 1—*Standard Nomenclature (contd.)*

Part No.	Name of Part	Typical Material	Function of Part
19	Top shaft	steel	coupled to line shaft; connects latter to driver
20	Stilling tube	steel	suspended around top shaft from packing box to reduce flow of abrasive material into packing box
21	Top column pipe	steel	first section of column pipe below discharge
22	Line shaft coupling	steel	used to join all sections of line shafting throughout unit
23	Line shaft	steel	Those sections of line shafting between top shaft and pump shaft
24	Column pipe coupling	steel	couples sections of column pipe
25	Open line shaft bearing retainer	bronze	used to support line shaft bearing; generally located at end of each section of column pipe
26	Open line shaft bearing	rubber	bearing held in bearing retainer to guide line shafting of pump
27	Open line shaft bearing retainer cap	bronze	locks bearing within bearing retainer
28	Column pipe	steel	column pipe between top column and bottom column pipe; usually made of standard steel pipe
29	Open line shaft sleeve	monel or stainless steel	sleeve operating as journal for bearings
30	Bottom column pipe	steel	first section of column immediately above discharge case or discharge bowl
31	Pump shaft coupling	steel	connects bottom shaft to impeller shaft; may be tapped with two different thread diameters
32	Pump shaft	stainless steel	supports impellers; coupled to line shaft
33	Discharge bowl	cast iron	receives flow from top impeller and guides it to pump column
34	Top bowl bearing	bronze or rubber	supports portion of pump shaft
35	Intermediate bowl bearing	bronze or rubber	supports portion of pump shaft
36	Intermediate bowl	cast iron	guides flow received from impeller to next impeller above
37	Impeller collet lock nut	bronze	used to pull impeller on collet; locks collet in place

TABLE 1—*Standard Nomenclature (contd.)*

Part No.	Name of Part	Typical Material	Function of Part
38	Impeller	bronze or cast iron	pumping element; receives water and impels it centrifugally to bowl passage
39	Impeller lock collet	steel	locks impeller to shaft
40	Suction case	cast iron	receives water from well; guides to first impeller
41	Suction case bearing	bronze	supports bottom portion of pump shaft
42	Strainer	galvanized steel or bronze	keeps large foreign material out of pumps
43	Discharge companion flange gasket	rubberized cloth or rubber	seals joints between surface discharge head or underground elbow and companion flange
44	Discharge companion flange	cast iron	connects discharge pipe to integrally cast flanges on discharge head or underground discharge elbow
45	Discharge pipe	steel	conducts water away from pump.
46	Solenoid oil valve		starts oil flow to line shaft bearings when motor is started
47	Sight-feed oil valve		means of adjusting oil flow to line shaft bearings
48	Tubing tension nut cap	cast iron	covers top of oil tube to prevent entrance of dust
49	Water level indicator assembly		determines water level in well
50	Enclosed line shaft bearing	bronze	guides and supports shaft section may couple connecting sections of enclosing tube
51	Shaft-enclosing tube	steel	encloses line shaft
52	Underground discharge tee	cast iron	changes flow from vertical to horizontal when discharge is below surface; also forms part of column
53	Tubing adapter	cast iron or steel	encloses shaft; adapts standard tube size to off-standard tube size
54	Discharge case	cast iron	guides flow to pump column
55	Top bowl	cast iron	receives flow from top impeller and guides it to discharge case
56	Bypass seal		restricts leakage from bowls to oil tube; seals off bowl passages from enclosing tube

TABLE 1—*Standard Nomenclature (contd.)*

Part No.	Name of Part	Typical Material	Function of Part
57	Impeller seal ring	rubber, bronze, or hardened steel	provides water seal at impeller
58	Suction case sand collar	bronze	prevents sand from entering suction case bearing
59	Suction case plug	black iron	plugs suction case grease container
60	Oil gage assembly for motor bearings		shows level of oil in motor oil reservoir
61	Packing follower	cast iron	tightens packing around enclosing tube
62	Underground discharge head	cast iron	supports motor above foundation when discharge is below surface
63	Tubing tension nut	semisteel	maintains tension on shaft-enclosing tube
64	Lock nut for tubing tension nut	cast brass	locks tubing nut
65	Column flange	steel	joins sections of column pipe
66	Enclosing tube stabilizer	bronze or rubber	stabilizes shaft-enclosing tube

starting, vertical hollow-shaft squirrel-cage induction type, and shall comply with ASA C50.2. The connection to the pump shaft shall be through a coupling or clutch in the motor head. The motor shall be of the proper size to drive the pump continuously over the specified operating range without the load exceeding the service factor. The motor shall be rated as drip-proof 40°C rise design with 1.15 service factor. (Standard motor voltages are 208, 220, 440, 550, 2,300.)

With an engine drive, the power shall be applied to the pump shaft through a right-angle gear set. The connection to the vertical shaft shall be through a coupling or clutch in the gear head. The horizontal shaft shall rotate in the same direction as the engine

drive, and shall be connected to the engine by a flexible-shaft coupling.

An optional method of driving, for an engine or horizontal electric motor, shall be a belt head—either a flat belt on a modified cylindrical pulley, or a V belt on a V-groove pulley.

Rotation of the vertical shaft shall be counterclockwise when viewed from above.

A thrust bearing of ample capacity to carry the weight of all rotating parts plus the hydraulic thrust shall be incorporated into the driver as an integral part of it. The bearing shall be of such a size that the average life rating is no less than 5 years' continuous operation.

4.1.5. *Suction pipe and strainer.* A strainer, if required, shall have a

TABLE 2

*Suggested Specification Form for the Purchase of ASA Vertical Turbine Pumps**

1. Purchaser.....

2. Address

3. Installation site.....

4. Job No. Item No. Quote No.
P.O. No.

5. No. required..... By Date.....

6. Driver: Electric motor Right-angle gear..... Belt.....
Engine

Pump Operating Conditions

7 Capacity gpm; Maximum speed rpm
Elevation at site ft

8. Pumping level below ground level at rated capacity ft

9. Pumping head above ground level, including discharge pipe friction ft

10. Rated total pump head (Lines 8 plus 9, above) ft

11. Operating range: Minimum total head ft
Maximum total head ft

12. Pump setting ft

Description of Well

13. Minimum inside diameter of well or casing in., to a depth of ft

14. Total depth of well ft

15. Well straight to a depth of ft (a well is considered straight if a 20-ft long cylinder equal to a bowl diameter will not bind when lowered to a depth equal to the pump setting)

16. Static water level below ground surface ft

17. Pumping drawdown ft at gpm

18. Well developed to per cent of rated pump capacity

19. Sand in water: None Average High Unknown

20. Gas in water: None Average High Unknown

21. Water corrosive: Yes No

22. Corrosive substances
Materials to resist corrosion

Driver Data

23. Electric power available: Maximum horsepower
Volts..... Cycles Phase.....

24. Other driver available: Maximum horsepower
(Gas) (Gasoline) (Diesel) engine; Drive: (Direct) (Belt)

25. V-belt size: Groove type sheave diameter
Flat belt width; Pulley diameter

Connections and Accessories

26. Discharge flange in., 125-lb ASA standard threaded companion flange above-ground standard (if underground discharge desired, centerline shall be ft below ground level)

27. Strainer required: Yes No

28. Solenoid oiler required: Yes No Voltage available

29. Prelube water tank required: Yes No

30. Automatic controls required: Time delay relay Float switch

*Pumps are to be furnished in accordance with ASA
Standard B58.1, with the following exceptions:*

* For submersible pumps, Item 6 would include electric motor only and Items 24, 25, and 28-30 do not apply.