

SECTION 5 MAINTENANCE

Preventive Maintenance

To assure satisfactory operation of the pump, scheduled inspection and periodic maintenance are required. We suggest an inspection and maintenance log be kept and the inspector immediately report any problems.

This Layne/Verti-Line model 1100 vertical turbine pump is supplied with product lubricated column and bowl bearings. The suction bell bearing is grease packed at the factory. It is not necessary to re-lubricate this bearing except when the pump is to be torn down for maintenance and the bowl assembly is to be disassembled.

A guide for preventive maintenance for normal applications is given below. Unusual applications with abnormal heat, moisture, dust, etc., may require more frequent inspection and service.

Item	Action Required
Seal Box	Inspect every 150 hrs of operation for excessive leakage. Adjust or replace packing as required. Repair or replace Mechanical Seal
Driver Bearings	Lubricate according to instructions given in the driver O&M in Section 8 of this manual.
Pump Alignment	Check for changes annually. Correct as required.
Noise Level	Check for changes annually. Correct as required.
Pump Vibration	Check for changes annually. Correct as required.

Grease Recommendation

The following lubricants are recommended for both potable and non-potable pumping systems:

Non-Potable System

Manufacturer	Type
Generic	N.L.G.I. #2 Lithium base multi-purpose grease with a mineral oil viscosity of 750-1050 SSU at 100°F and 75-82 SSU at 210°F
Atlantic Richfield	ARCO MP #2
Gulf	Gulfcrown #2
Sinclair	Litholine MP #2
Texaco	Marfak #958

Potable Water System

Generic	N.L.G.I. #2 meeting FDA Regulation 178.3570 and has USDA Type H-1 and FDA approvals for incidental food contact
Chevron	FM Grade 2
Ideal	FG #2
Keystone	Nevastone HT/AW2
Lubriplate	FGL-2
Mobile	FM Grade 2

Mechanical Seal

The pump furnished on this order is equipped with a mechanical seal. Refer to the Mechanical Seal section of this manual for instructions regarding maintenance of the seal.

Packing Adjustment

Generally, packed box pumps should be checked every 150 hours of operation and the glands should be readjusted if necessary. Initial adjustment is accomplished by tightening the gland nuts finger tight.

CAUTION

Excessive tightening of the glands may cause shaft sleeve damage.

Packing Replacement

For general service application with pump temperature (0° C to 93° C), use a good grade of soft, square, long fiber graphite packing thoroughly lubricated.

For best results, use only genuine Layne/Verti-Line replacement packing. The replacement procedure should be as follows:

- A. Stop the pump.

DANGER

Lock out electrical power to prevent accidental starting and causing possible personal injury.

- A. Unbolt and remove the gland.
 B. Use a flexible packing tool* with a hook attachment for removal of the packing.
 *The packing tool can be purchased from the factory or local supply house.
 C. Clean the packing box and shaft sleeve.
 D. Inspect the shaft sleeve for wear or rough finish and replace the sleeve with a genuine Layne/Verti-Line sleeve if necessary.
 E. Install the new packing.

IMPORTANT

Stagger the packing end joints 180° and firmly seat each ring of packing as you install it.

- A. Refer to the technical data section for pertinent stuffing box and packing dimensions.
 B. Reinstall the gland and tighten the gland nuts finger tight. After the pump has been started adjust the glands so that there is a steady stream, approximately 1/8" diameter, from the packing box.

Pump Disassembly**WARNING**

Read this entire disassembly procedure and refer to the sectional drawings in this manual before starting.

Major maintenance beyond lubrication, adjustment of impeller or wear ring clearance, and replacement or adjustment of the packing will require disassembly of the pump. The following are step-by-step instructions and are essentially the reverse of the installation procedure.

Driver Removal**Vertical Hollow Shaft (VHS) Driver**

- A. Stop the pump and lock out the power to the driver. Close the discharge valve. Disconnect the electrical cables from the driver. Disconnect and remove gauges and all other auxiliary piping. (Stuffing box lubrication, oil, or grease lines, etc.)

DANGER

Check with proper electrical testing equipment to be certain all electrical power to the driver and accessories associated with the pump is disconnected.

- B. Remove the driver cover, adjusting nut lockscrew, and gib key. Lower the shaft until the impeller rests on the bowl seat. Remove the adjusting nut and driver coupling.
 C. Disconnect the shaft coupling under the driver (if used) and remove the top shaft. Remove the capscrews holding driver to discharge head or pedestal.
 D. Lift the driver from the head and set aside.

Vertical Solid Shaft (VSS) Driver

- A. Stop the pump and lock out the power to the driver. Close the discharge valve.

Disconnect the electrical cables from the driver. Disconnect and remove gauges and all other auxiliary piping. (Stuffing box lubrication, oil, or grease lines, etc.)

DANGER

Check with proper electrical testing equipment to be certain all electrical power to the driver and accessories associated with the pump is disconnected.

- B. Remove the bolts holding the coupling halves together slowly so that the impeller does not drop.
- D. Remove the capscrews holding driver to discharge head or pedestal.
- E. Lift the driver from the head and set aside.

CAUTION

Always use protective eyewear.

Discharge Head Removal

- A. Remove and disassemble the pump head, the column, packing box and shafting according to the following procedure which is essentially the reverse of the installation procedure.
- B. Remove the packing gland bolts (8, 8A), glands (9), water slinger (6) and packing (15).
- C. Loosen and remove all the discharge piping flange bolts.

WARNING

Use a guide rope going from the sling joint, the head, attached to the discharge flange. This will keep the head from tipping over, possibly causing personal injury.

- D. Remove the packing box bolts and remove the packing box from the head and shaft to a work area for inspection & cleaning.

The packing box bearing (17A) is an interference fit in the packing box. The removal of this bearing will require the use of a mechanical press the bearing maybe removed by machining or other similar methods. Use care when removing bearings to not damage bores or hubs.

- E. Lift entire unit with the lifting lugs and install a column clamp just below the upper column flange leaving room to remove the flange bolting. Lower unit so that the column clamp rests on adequate supports.

DANGER

Use a crane or hoist of adequate capacity to prevent serious personal injury.

- F. Remove the bolts holding the column to the discharge head. Lift the discharge head off the unit and set aside.

Column Removal

Flanged Column

- A. Install eyebolts of sufficient size in the column flange holes and lift the unit and reposition the clamp below the next column flange.
- B. Use column and shaft clamps (or other acceptable method) to safely support and lift this assembly.
- C. Unbolt column flange and lift column enough to loosen the shaft coupling. When all components are loose, carefully lift this assembly from the pump unit. With soft skid boards under the column to protect the flange, slowly lower the column and shaft assembly onto the floor and move to a convenient work area.

IMPORTANT

Shaft threads are left-hand rotation.

- D. Repeat above steps A, B & C until all column and shaft sections have been removed from the unit.
- E. Remove the bearing retainer assembly for inspection and cleaning.
- F. Remove shaft section from column pipe. Remove couplings from shafts and inspect for wear or damage.
- G. Inspect bearings and retainers for damage.
- H. If the top and intermediate drive shaft sleeves (13 & 29) show wear or damage remove the sleeve by heating it to 350°F-400°F to break the Loctite bond.

IMPORTANT

Measure and record the position of the sleeves (13 & 29) on the shafts before removal. They must be put back in exactly the same place.

CAUTION

To prevent possible serious personal injury always wear heat resistant gloves when handling heated parts.

- I. Refer to Pump Bowl Disassembly for detailed bowl disassembly procedures.

Threaded Column

- A. Install eyebolts of sufficient size in the column flange holes and lift the unit and reposition the clamp below the next column coupling.
- B. Use column and shaft clamps (or other acceptable method) to safely support and lift this assembly.
- C. Unscrew the column coupling and lift column enough to loosen the shaft coupling. When all components are loose, carefully lift this assembly from the pump unit. With soft skid boards under the column to protect the threads, slowly lower the column and shaft assembly onto the floor and move to a convenient work area.

IMPORTANT

Shaft threads are left-hand rotation.

- D. Repeat above steps A, B, and C until all column and shaft sections have been removed from the unit.
- E. Remove the bearing retainer assembly for inspection and cleaning.
- F. Remove shaft section from column pipe. Remove couplings from shafts and inspect for wear or damage.
- G. Inspect bearings and retainers for damage.
- H. If the top and intermediate drive shaft sleeves (13 & 29) show wear or damage remove the sleeve by heating it to 350°F-400°F to break the Loctite bond.
- I. Refer to Pump Bowl Disassembly for detailed bowl disassembly procedures.

Pump Bowl Disassembly

For disassembly of the pump bowls, proceed in accordance with steps listed below. Select a clean area for work. Refer to assembly drawing and parts list for part identification.

Flanged Bowls

- A. Place the bowl assembly in a horizontal position, blocked to prevent rolling.
- B. Measure and record the axial end play of the shaft. This must be checked on reassembly of the bowls.
- C. Remove the shaft coupling(31).
- D. Remove the capscrews holding the discharge case (54) and top intermediate bowl (55) and remove from the pump shaft (32) and set aside for inspection. It is not necessary to disassemble these two bowls unless bearings are to be replaced.
- D. Remove the impeller (38) and collet (39) from the pump shaft according to the following procedure:

19GM & 19GH Bowls

1. Loosen and remove the impeller gib key setscrew.
2. Remove the impeller (38) from the shaft (32) and key (38A).
4. Remove the key (38A).

21EH Bowls

1. Remove the upper snap ring (27).
 2. Remove the impeller (38) from the shaft (32) and key (38A).
 3. Remove the lower snap ring (27).
 4. Remove the thrust ring halves (27A).
 5. Remove the key (38A).
- F. Remove the capscrews holding the next intermediate bowl (36). Remove the intermediate bowl from the pump shaft and set aside for inspection.

- G. Repeat steps E & F until all bowls and impellers have been removed.
- H. Remove the shaft from the suction bell (40), or suction case.
- I. Measure and record the location of the sand collar (58). Remove the sand collar only if it is damaged and replacement is required.
- J. This pump may be fitted with wear rings by machining the bowls (or impellers) for a ring seat. Refer to Wear Rings section of this manual for instructions on adding wear rings or replacing existing rings.

Inspection for Replacement

After the components are disassembled, each part should be thoroughly cleaned and inspected for wear and physical damage. During cleaning, do not allow any petroleum-based solvents on rubber bearings.

It is not necessary to remove bearings unless inspection indicates replacement is necessary. If it is necessary to remove bearings, they should be pressed from their seats and discarded.

CAUTION

Use care not to damage bores or hubs during bearing removal.

Any parts showing signs of excessive wear or damage should be replaced with genuine Layne/Verti-Line parts. Maximum clearances are shown on the technical data page found in the drawing section of this manual.

- A. Inspect the shafting (23) at each bearing location for damage or excessive wear and replace shaft if not salvageable.
- B. Inspect all line shaft bearings (26), packing box bushing (17A), and all bowl bearings (34, 35, 41, 50) for wear and excessive clearance. If the diametrical bearing clearance exceeds the limits, the bearings must be replaced.

- C. Inspect the bowl and/or impeller wear ring (if so equipped) for wear and excessive clearance. The correct clearance is shown on the technical data page in the drawing section of this manual. The ring should be replaced with a genuine Layne/Verti-Line replacement part.
- D. Inspect the shaft sleeves for wear. Replace as necessary. If the sleeves (13 & 29) show wear or damage, remove the sleeve(s) by heating it to 350°-400° F to break the Loctite bond.

CAUTION

If it is found that any of the bearings or sleeves have excessive wear, it is recommended that all bearings and sleeves be replaced (including bowl bearings).

CAUTION

Measure and record the position of the sleeve (13) on the shaft (19) before removal.

WARNING

To prevent possible serious personal injury, heat resistant gloves must be worn when handling heated parts.

Shaft Straightness

Prior to installation or reassembly, bowl shafts and line shaft should be checked for straightness. The maximum allowable total indicated runout must be less than .005".

Refer to the following illustrations showing the proper positions at which dial indicator readings should be taken. The shaft should be supported in V-blocks or on rollers as shown. Position the dial indicator and zero the dial face. Slowly rotate the shaft and observe the maximum runout.

If the shafts exceed the .005" maximum limit, straightening will be required. Consult the Layne/Verti-Line factory for straightening recommendations, or a local qualified machine shop.

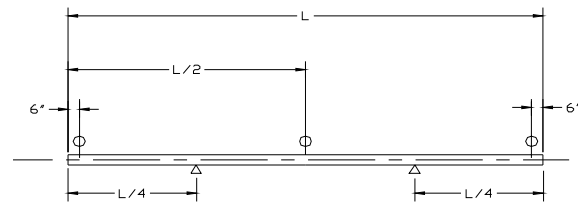


Figure C
(Shafts 10 ft long or less)

Pump Bowl Assembly

Prior to the start of reassembling the pump bowl the following is to be done:

- A. Apply grease to the bowl registers to improve assembly alignment.
- B. Clean all components before starting the assembly. Do not apply any petroleum based solvents to rubber bearings.
- C. Install bearings in their respective bowls if they have been removed. If they have not been replaced, they should be thoroughly cleaned and lubricated with a thin film of grease (except rubber bearings).
- D. Install new wear rings if they are to be replaced in all bowls. Refer to Wear Rings section of this manual for instructions.
- E. Remove the pipe plug from the suction bell and remove old grease. Apply a thin film of multi-purpose grease to the shaft and the suction bowl bearing. See Grease Recommendation in the drawing section of this manual.
- F. Lay out the parts in the order in which they will be assembled. Reused impellers are to be re-installed in the same bowl in which it was originally installed.
- G. Install shaft sleeves as required according to the following procedure:
 1. Refer to the previously recorded sleeve locations and scribe or mark shaft accordingly.

2. Thoroughly clean the sleeve and shaft in the sleeve area using a cleaner as recommended by Loctite.
 3. Apply a coat of Loctite 609 on the shaft in the correct sleeve location area. Slide the sleeve over the shaft, rotating it several times while at the same time moving the sleeve axially on the shaft. This will spread the Loctite evenly.
- H. Proceed with the assembly of the pump bowl as follows:

Flanged Bowls

- A. Put the suction bell in a horizontal position and block from rolling. Insert the pump shaft into the bearing as far as it will go.
- B. Install the sand collar if it has been removed and secure with setscrews.
- C. Install the first impeller over the pump shaft and into position in the suction bell (case) seat. The impeller should rotate freely in the bowl. If it binds, remove and determine the cause.
- D. Install the impellers according to the following procedure:

19GM & 19GH Bowls

1. Install the gib key into the pump shaft (32) keyway.
2. Install the impeller (38) into position over the key.
3. Secure the impeller to the gib key with a setscrew.

21EH Bowls

1. Install the thrust ring (27A) and secure with the lower snap ring (27).
2. Install the key (38A) into the pump shaft keyway.
3. Install the impeller (38) over the pump shaft (32) and key (38A) and into position against the thrust ring halves (27A).

4. Install the upper snap ring (27).

CAUTION

Failure to properly install the impellers will result in damage to the pump.

- E. Install the intermediate bowl and tighten capscrews.
- F. Repeat steps C, D and E to install all additional stages until all pump bowls have been reassembled.
- G. Install the top intermediate bowl (55) and discharge case (54) over the pump shaft and bolt in place with capscrews and nuts.
- H. Remove the shaft locating tool holding the pump shaft in place. Check the bowl end play. It should be the same as previously recorded (or very close). If it is not, the bowl assembly should be disassembled to determine the reason. Pack the cavity with grease and replace the pipe plug in the suction bell (case) hub.
- I. Install the coupling (31) on the pump shaft.
- J. The bowl assembly is now complete.
- K. Refer to Wear Rings for instructions on wear ring replacement, if wear ring replacement is required.
- L. Refer to the Installation Section of this manual to complete pump assembly and reinstallation.

Wear Rings

If the pump is equipped with wear rings and replacement is required, refer to Wear Ring Removal below.

Wear Ring Removal

- A. If the wear ring requires replacement it can be more easily removed by heating it to 250° - 400° F.

WARNING

To prevent possible serious personal injury, heat resistant gloves must, be worn when handling heated parts.

- B. The ring may also be removed by splitting with a chisel and removed or machined.

Installing New Wear Ring**CAUTION**

Care should be used to avoid damage to the bowl ring seat.

IMPORTANT

If this bowl assembly is to be fitted with wear rings and was not equipped with wear rings at the factory, contact the factory for correct dimensions.

CAUTION

Machine work should be done by a qualified machinist experienced in similar machining work. If the wear rings are to be replaced they should be replaced with genuine Layne/Verti-Line wear rings. Install the wear rings as follows.

CAUTION

To prevent possible serious personal injury, approved safety glasses must be worn when grinding.

- A. To ensure proper bonding, thoroughly clean all mating parts with solvent to remove all grease, oil, dirt, etc.
- B. Apply a bead of Loctite 290 completely around the middle of the impeller or bowl wear ring fit, and press the wear ring(s) in place.

IMPORTANT

To avoid distortion and ensure proper installation, be careful to press the wear rings evenly and completely in place. They should be firmly butted against the corresponding impeller or bowl shoulder at the bottom of the wear ring fit.

Mechanical Seals

The mechanical seal covered by these instructions, when properly installed, will give satisfactory performance. To ensure the proper installation these instructions should be read carefully.

Description

Several types of mechanical seals are used. The most common types are the single inside seal, single outside seal and a cartridge type seal. Since seals supplied by different vendors may vary slightly these instructions are general in nature. Refer to any specific installation instructions that may be supplied with your pump or contact the factory.

General Application

The seals described in these instructions are acceptable for use in pumps handling water. It is not recommended for handling fluids which are highly acidic, highly alkaline, or contain gritty or dissolved substances that tend to crystallize.

Installation

Prior to installation inspect the seal, seal housing and gland.

IMPORTANT

Seal faces are lapped and polished to a mirror finish. It is imperative that sealing faces be handled with care and kept perfectly clean. DO NOT touch the sealing faces.

Inside Single Seal

Use the following general procedure to install this type of seal prior to installing the motor:

- A. Remove the packing box capscrews (431 A) which hold the seal housing (17B) to the discharge head (or the driver pedestal).
- B. Install the seal box gasket (11) onto the seal housing.
- C. Adjust the impellers per instructions in this manual.
- D. With scribe or marker, place a mark on the sleeve that is level with the seal housing (17B) face.
- E. Position the end of the rotating seal (456) flush with the mark on the sleeve and tighten the locking screw.
- F. Install the stationary seat (456A) into the seal gland (431) using an o-ring lubricant or liquid soap on the o-ring.
- G. Pull the seal gland (431) down and secure with capscrews (431A).
- H. Connect piping to seal gland (431).

IMPORTANT

The seal gland must be piped to purge all air out of the seal housing cavity.

Outside Single Seal

Use the following general procedure to install this type of seal prior to installing the motor.

The seals described in these instructions are acceptable for use in pumps handling water. It is not recommended for handling fluids which are highly acidic, highly alkaline, or contain gritty or dissolved substances that tend to crystallize.

- A. Remove the packing box capscrews (431A) which hold the seal housing (17B) to the discharge head (or driver pedestal).

- B. Install the seal box gasket (11) onto the seal housing.
- C. Install the seal gland (431) containing the stationary seat (456A) on the seal housing face and secure with packing box capscrews.
- D. Install the rotating seat (456) and retainer (456B) sleeve over the sleeve. Do not fasten the retainer to the sleeve until impellers have been properly adjusted.
- E. Refer to the technical data page in the drawing section of this manual for the correct impeller setting.
- F. Compress the retainer and rotating assembly until the correct spring gap is attained. The gap is stamped on the seal retainer or may be included with the seal manufacturers printed instructions.
- G. Secure the retainer ring with setscrews.

Cartridge Seal

Use the following general procedure to install this type of seal prior to installing the motor:

- A. Remove the packing box capscrews (431 A) which hold the seal housing (17B) to the discharge head (or driver pedestal).
- B. Install the seal box gasket (11) onto the seal housing.
- C. Install the seal (456), gland (431) and retainer (456B) over the sleeve and into position on the seal housing and secure with packing box capscrews.
- D. Adjust the impellers.
- E. After the impellers have been adjusted, fasten the seal lock ring to the sleeve using setscrews provided.
- F. Loosen the retainer clips and rotate 90° and retighten the clip setscrews. These clips will be used if the seal is removed for any reason.

Operation

Special operating techniques are involved when using pumps equipped with mechanical seals. Certain precautions should be taken as follows:

Installation, Operation and Maintenance

- A. The seal should never be operated dry, even to check for rotation. A water source must be provided to cool and lubricate the seal faces during pump operation. The lubrication water can be either the pumped media or an external water source.
- B. If the pumped media is used for seal cooling and lubrication, a vent line must be provided to prevent air entrapment in the seal cavity (refer to the Technical Data Section). If an outside water source is used, a solenoid valve should be set to introduce seal water at or slightly before each motor start.

Lubrication via the pumped media is not recommended for extremely deep-set turbines as the time required for the media to reach the seal at each start is excessive. This can result in premature seal failure.

- C. Some seals may leak slightly at initial start-up. This condition should cease after a short period as the seal faces lap together. Operate and monitor the seal until leakage subsides.

Routine Maintenance

Routine maintenance is minimal as follows:

- A. Periodically (150 hours of operation) check to see that pumped liquid is going through stuffing box and out to wet well or drain.
- B. Check that the gland bolts have not loosened.

Seal Removal

General

Stop the driver and lock out the power so that the driver can not accidentally start.

DANGER

Check with proper electrical testing equipment to be certain all electrical power to the driver and accessories associated with the pump is disconnected.

Single Inside Seal

- A. Loosen the packing box capscrews (431 A).
- B. Raise the gland (431) and loosen the setscrews securing the retaining ring to the sleeve.
- C. Use the adjusting nut and lower the impellers until they rest on the bowl seats.
- D. Loosen the shaft coupling. Remove the driver shaft (19), or the VSS motor.
- E. Remove the seal gland (431).
- F. Remove the seal rotating seat and retainer.
- G. Inspect all parts of the seal. If any parts show signs of wear, the complete seal should be replaced.

Single Outside Seal

- A. Loosen the retainer ring setscrews.
- B. Use the adjusting nut and lower the impellers until they rest on the bowl seats.
- C. Loosen the shaft coupling. Remove the driver shaft (19), (or the VSS motor), (or VHS motor if one-piece head shaft).
- D. Loosen the capscrews securing the gland (431) to the seal housing. Remove the seal rotating assembly and the gland which contains the stationary seat.
- E. Inspect all parts of the seal. If any parts show signs of wear, the complete seal should be replaced.

Cartridge Seal

- A. Loosen the retainer clips and rotate 90° to secure the seal lock ring. Retighten the setscrews.
- B. Loosen the setscrews securing the lock ring to the sleeve.
- C. Use the adjusting nut and lower the impellers until they rest on the bowl seats.
- D. Loosen the shaft coupling. Remove the driver shaft (19), or the VSS motor.
- E. Loosen the capscrews securing the gland (431) to the seal housing. Remove the seal assembly.
- F. Inspect all parts of the seal. If any parts show signs of wear, the complete seal should be replaced.
- G. The o-rings may be replaced if necessary. Refer to the manufacturer's printed instructions shipped with the seal.

Assembly Tools

The pumps described in this manual do not require special tools. They are designed to be maintained using normal mechanics tools.

SECTION 6 REPAIR PARTS

Ordering Parts

When ordering parts, give pump serial number, size, model number, a complete description, and item number of each part. Refer to the drawings and parts list in the drawing section of this manual. You may order parts from your local Layne/Verti-Line distributor. Consult you local telephone yellow pages under "Pumps" for the office nearest you.

You may also contact Layne/Verti-Line directly as follows:

Layne/Verti-Line
3601 Fairbanks Avenue
Kansas City, KS 66106
Phone (913) 371-5000
Fax (913) 748-4025

Recommended Spare Parts

Refer to Table 1 for a list of recommended spare parts. This list is for normal duty. Where severe conditions exist or minimum down time is critical additional quantities and those items indicated should be considered.

Table 1 Recommended Spare Parts

Item	Description	Quantity
13	Sleeve, Top Drive Shaft	1
15	Packing, Set	1
17A	Bushing, Packing Box	1
26	Bearings, Line shaft, set	1
29	Sleeve, Line shaft, set	1
31	Couplings, Set	1
34	Bearing, Top Bowl	1
35	Bearing, Inter Bowl, set	1
41	Bearing, Suction	1
50	Bearing Connector, set	1
	Gasket, Set	1

Returning Parts

All materials or parts returned to the factory must have prior approval and a "Returned Goods Tag", listing the material to be returned and the reasons for the return. All material to be returned should be carefully

packaged to avoid damage in route from rough handling or exposure to weather. Contact the factory for shipping instructions. All material is to be returned freight prepaid.

Layne/Verti-Line makes improvements on its products from time to time and reserves the right to furnish improved parts for repairs. A part that is received and is not identical in appearance, or has a different symbol from the original part may be interchangeable. Examine the part carefully before contacting you Layne/Verti-Line representative. The parts should never be returned to the factory without first obtaining proper authorization from your Layne/Verti-Line representative.

Predicted Life

The predicted life of parts subject to wear, shown in Table 2, is based on pumping liquid without abrasives, the pump operating at sold conditions and that proper maintenance is performed.

The actual life encountered for the specific parts may vary significantly as a result of the content of liquid pumped, maintenance performed, actual operating conditions and other factors.

Table 2 Predicted Life

Item	Description	Life (Yr.)
7	Discharge Head	20
13	Shaft Sleeve	5
15	Packing, Set	1
17	Packing Box	20
17A	Packing Box Bushing	10
19	Top Shaft	10
21	Top Column	20
23	Line shaft	10
25	Bearing Retainer	20
26	Line shaft Bearing	10
29	Shaft Sleeve	5
30	Bottom Column	20
31	Shaft Coupling	10
32	Pump Shaft	10
34	Top Bowl Bearing	10
35	Inter Bowl Bearing	10
36	Inter Bowl	20
36W	Bowl Wear Ring	5
38	Impeller	10
38W	Impeller Wear Ring	5
40	Suction Bell (Case)	20
41	Suction Bell Bearing	10
50	Connector Bearing	10
54	Discharge Case	20
55	Top Inter Bowl	20
58	Sand Collar	10

Service**Warranty Service**

For Warranty Service contact the facility from which your pump was shipped.

Shipping facility address:

Layne/Verti-Line
 3601 Fairbanks Avenue
 Kansas City, KS 66106
 Phone (913) 371-5000
 Fax: (913) 748-4030

Service After Warranty

For service after warranty on this pump or any other pumping equipment contact you local Layne/Verti-Line distributor or by contacting:

Pump Services Group, 1-800-648-PUMP

Or write:

Pump Services Group

Layne/Verti-Line
 3601 Fairbanks Avenue
 Kansas City, KS 66106
 Phone (913) 371-5000
 Fax: (913) 748-4025

TECHNICAL DATA

Table 1

Bowl Size	Shaft End Play (Inches)	
	At Full Diameter	At Minimum Diameter
19GM	.62	RTF
19GH	.62	RTF
21EH	.94	RTF

Table #2

Tube Tension Nut Torque Values	
Enclosing Tube Size	Required Torque
2	400 ft. lbs.
2 1/2	400 ft. lbs.
3	800 ft. lbs.
3 1/2	800 ft. lbs.
4	1200 ft. lbs.
5	1200 ft. lbs.

Table 3

Water Flush Packing Box Tube Tension Torque Values		
Tube Size	Installation and Removal Tool	Required Torque
2	MS1380A	400 ft. lbs.
2 1/2	MS1380A	400 ft. lbs.
3	MS1380B	800 ft. lbs.
3 1/2	MS1380B	800 ft. lbs.
4	MS1380C	1200 ft. lbs.
5	MS1380C	1200 ft. lbs.

Table 4

Impeller Position	
19GM	.125
19GH	.126
21EH	.120

Note: Dimension shown is the amount the impeller is to be raised above the bowl seat.

(1) Indicates inches to lowered from top most position.

Table 5

Shaft Diameter	Number of Turns				
	1	2	3	4	5
1	.07	.14	.21	.28	.35
1 1/4	.10	.20	.30	.40	.50
1 1/2	.10	.20	.30	.40	.50
1 11/16	.10	.20	.30	.40	.50
1 15/16	.10	.20	.30	.40	.50
2 3/16	.10	.20	.30	.40	.50

Table 6

Coupling Size	Torque (Ft. Lbs.)
1125	13
1625	26
2125	115
2625	115
2875	115
3125	115
3875	400
5000	550
6000	835
7250	835

Table 7

System Type	Grease	Oil
Non Potable	N.L.G.I. #2 Lithium base multi-purpose grease with a mineral based oil viscosity of 750-1050 SSU at 100°F and 75-82 SSU at 210°F.	High quality grade of non-detergent oil with an API/SAE rating 10W Rating
	Suggested Manufacturers: Atlantic Richfield- ARCO M/P #2 Gulf- Gulfcrown #2 Sinclair- Litholine M/P #2 Texaco- Marfak 958; M/P #2	Suggested Manufacturers: Mobil Sinclair Texaco
Potable	N.L.G.I. #2 meeting FDA regulation 178.3570 and has USDA Type H-1 and FDA approval for lubricants with incidental food contact.	USDA and FDA Approved
	Suggested Manufacturer: Chevron FM Grade 2 Ideal FG #2 Keystone Nevastone HT/AW2 Lubriplate FGL-2 Mobile FM Grade 2	Suggested Manufacturer: AMOCO White Mineral Oil No. 5 NF

Table #8

Bowl Size	Diametric Bowl and/or Impeller Wear Ring Clearance		Diametric Bowl Bearing Clearance (Inches)			
	Nominal	Replacement	Bronze		Rubber	
			Nominal	Replacement	Nominal	Replacement
19GM	.023	.031	.010/.011	.015	N/A	N/A
19GH	.023	.031	.010/.011	.015	N/A	N/A
21EH	.023	.031	.010/.011	.015	N/A	N/A

Table #9

Product Lubricated (Rubber Bearings)							
Lineshaft Diameter	1	1-1/4	1-1/2	2-3/8	1-15/16	2-3/16	2-7/16
Sleeve OD	1 3/16	1-7/16	1-11/16	1-7/8	2-1/8	2-3/8	2-5/8
Box ID	1-15/16	2-3/16	2-7/16	2-5/8	2-7/8	3-1/8	3-5/8
Box Depth	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	2-1/4
No. Rings Packing	4	4	4	4	4	4	4
Size Packing	3/8	3/8	3/8	3/8	3/8	3/8	1/2
Enclosed Lineshaft-Oil Lubricated							
Lineshaft Diameter	1	1-1/4	1-1/2	2-3/8	1-15/16	2-3/16	2-7/16
Tube Diameter	1-1/2	2	2-1/2	2-1/2	3	3	3-1/2
Enclosed Lineshaft-Water-Flush Lubricated (Bronze Bearings)							
Lineshaft Diameter	1	1-1/4	1-1/2	2-3/8	1-15/16	2-3/16	2-7/16
Sleeve OD	1 3/16	1-7/16	1-11/16	1-7/8	2-1/8	2-3/8	2-5/8
Box ID	1-15/16	2-3/16	2-7/16	2-5/8	2-7/8	3-1/8	3-5/8
Box Depth	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	2-1/4
No. Rings Packing	4	4	4	4	4	4	4
Size Packing	3/8	3/8	3/8	3/8	3/8	3/8	1/2

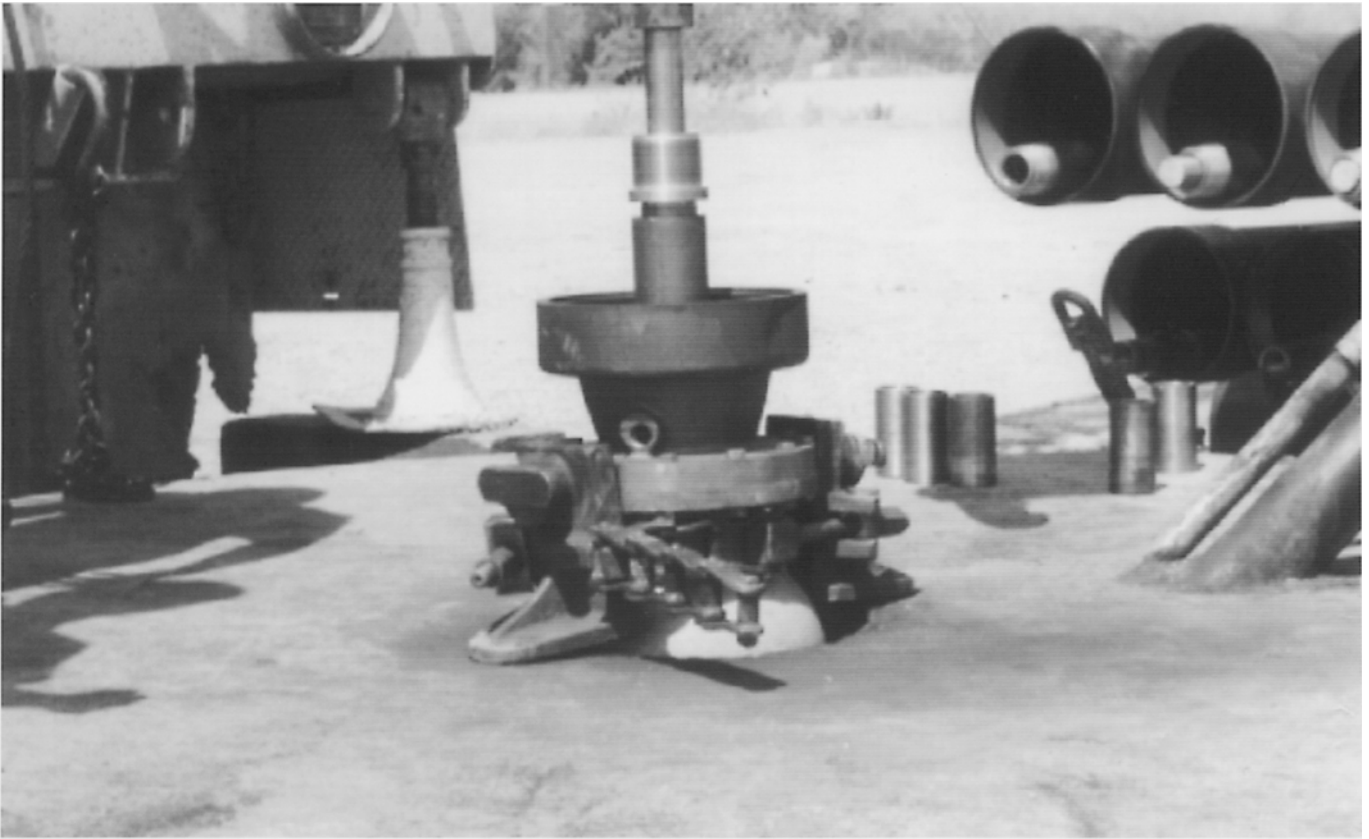


Fig. #1



Fig. #2



Fig. #3



Fig. #4