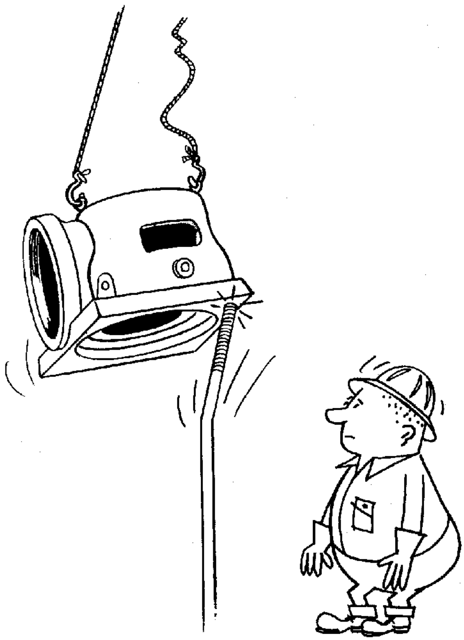


"...Take care not to bump or scrape the top shaft."

CAUTION

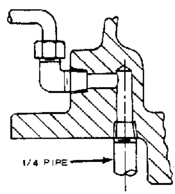
Never attempt to lift the pump by means of eye bolts screwed into the holes for mounting the driver. Never attempt to lift the pump by slinging to the driver. Driver mounting bolts are not strong enough to carry the weight of the entire pump.

R. If an air line is being installed with the pump, the final portion of it should be installed at this time. The procedure depends upon the type of discharge head and whether pipe or tubing is used for the air line.

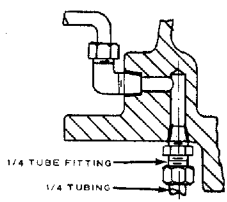
1. For a 4x4x10C.

   a. If pipe is used, bring the pipe up to the bottom of the head and thread it tightly into the 1/4 NPT hole. (See Fig. 8-4a.) Connection must be airtight. Tie the air line securely to the column in two places just below the uppermost coupling.

   b. If tubing is used, install the tube fitting tightly into the 1/4 NPT hole in the bottom of the head. Attach the tubing securely to the tube fitting. (See Fig. 8-4b.) All connections must be airtight. Tie the air line to the column in two places just below the uppermost coupling.



(a) Pipe Used As Air Line.



(b) Tubing Used As Air Line.

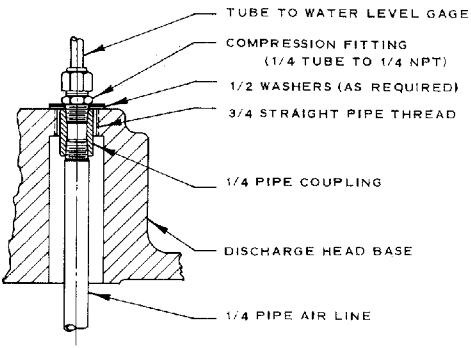
Fig. 8-4. Termination Of Air Line – 4 x 4 x 10C

2. For a 6 x 6 x 12 or larger discharge head:

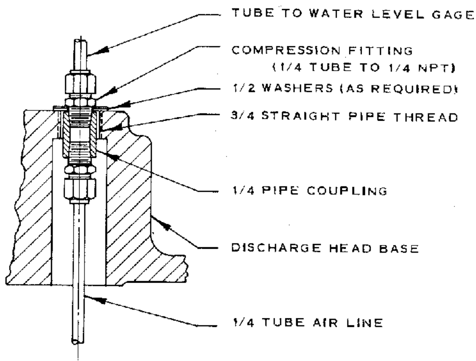
a. If pipe is being used, the last length of pipe will be passed through the 3/4-inch straight pipe thread hole in the discharge head base and supported by a 1/2-inch flat washer installed between a pipe coupling and a compression fitting (¼ tube x ¼ NPT). (See Fig. 8-5a.) Cut the pipe to such a length that when the joints are tightened, the washer will bear against the top of the hole, supporting the weight of the pipe. A second washer may be added if necessary. Install the coupling on the upper end of the pipe, and pass the pipe through the hole from below. Screw the pipe into the existing air line. Place the required number of washers over the coupling and install the compression fitting. Tie the air line securely to the pump column in two places just below the uppermost coupling.

b. If tubing is being used, the upper end of the tubing will enter the 3/4-inch straight pipe thread hole in the discharge head base and will be supported by a 1/2-inch flat washer installed between a pipe coupling and a compression fitting (¼ tube x ¼ NPT). (See Fig. 8-5b.) Cut the tubing to such a length that when the joints are tightened, the washer will bear against the top of the hole, supporting the weight of the tubing. A second washer may be added if necessary. Install the compression fitting at the upper end of the tube, and screw the pipe coupling on the fitting. Insert the tubing, with fitting and coupling attached, into the hole. Place the required number of washers over the coupling, and install another compression fitting. Tie the air line securely to the pump column in two places just below the uppermost coupling.

3. If a sealed well is required, install pipe plugs in any unused openings in the discharge head base.



(a) Pipe Used As Air Line



(b) Tubing Used As Air Line.

Fig. 8-5. Termination Of Air Line – 6x6x12 Or Larger Discharge Head.

SECTION 9

ALIGNING THE PUMP

CAUTION

Accurate alignment of the discharge head in relation to the pump shaft is absolutely essential for a smoothly operating, trouble-free and long lived installation. NEVER ATTEMPT TO ALIGN THE DISCHARGE HEAD BY MEANS OF A SPIRIT LEVEL. If the pump shaft does not hang freely plumb in the well, as might be the case when the well is drilled at a slight slant, leveling the discharge head will not ensure the necessary shaft alignment and clearance in the driver spindle. The discharge head base must be square with the pump shaft regardless of the result indicated by a spirit level. A bent shaft may mean early pump failure and an expensive repair job.

A. Remove the supporting timbers, rope and any other material from the top of the foundation, and sweep the top surface clean.

B. With the pump hanging from the hoist, orient the discharge outlet in the desired direction by rotating the entire pump as necessary. Slowly lower the pump and position the column concentric with the well casing. If foundation bolts are used, they should be directly below and in line with the holes in the discharge head base. Continue to lower the pump until the bolts just enter the holes. If no foundation bolts are used, lower the pump until the clearance between the discharge head base and the foundation is approximately two inches.

C. The discharge head will be aligned with the vertical column by making the tube nut opening in the discharge head as concentric as possible with the pump top shaft. (See Fig. 8-1 or 8-2.) Place wedges under the base of the discharge head, adjacent to the bolt holes, at least one under each of the four sides. Lower the pump slowly. Move the wedges as necessary so that the base contacts all of the wedges when the top shaft is centered in the tube nut opening. When the discharge head is firmly resting on the wedges, remove the sling.

D. Check the alignment and adjust the wedges as necessary. If the alignment is correct, the tube nut (Fig. 8-1 or 8-2) can be screwed over the tube with no interference with the opening in the discharge head. Snug up on any loose wedges to provide uniform support for the discharge head, and again check the alignment.

SECTION 10

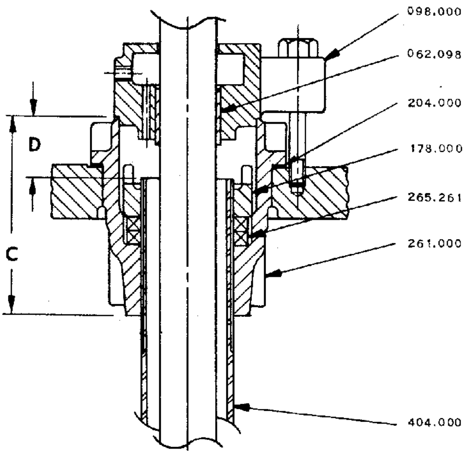
TENSIONING THE ENCLOSING TUBE

The enclosing tube sags slightly from its own weight as it is installed, and must be pulled tight (tensioned) to make it straight. The tube nut (Fig. 10-1) holds the tube in its straightened position. This section describes two methods of tensioning the tube. The direct method is more precise and is preferred for all pumps. The second method – the wrenching method – is given as an alternate for use with pumps having settings less than 500 feet.

NOTE

The correct tension, is the weight of the enclosing tube plus 10%.

Weights-per-foot for each tube size are given in Table 10-1. Multiply by the total length of tube to determine the total weight.



ITEM NO.	DESCRIPTION
265.261	Packing
098.000	Cap, Tube Nut
178.000	Follower, Packing
204.000	Gasket, Tube Nut
261.000	Tube Nut
404.000	Tube, Top
062.098	Bearing, Sleeve

Fig. 10-1. Tube Nut Assembly. (Plain Tube Nut Cap Shown.)

A. Apply a generous coating of grease to both sides of the gasket (Fig. 10-1) and place the gasket on the discharge head as shown in the figure. Install the tube nut, screwing it down manually until its shoulder rests firmly on the gasket.

Table 10-1. Weight-Per-Foot Of Enclosing Tube.

Tube Size (In.)	Weight Per Foot (LB.)	Tube Size (In.)	Weight Per Foot (LB.)
1¼	2.99	3½	12.50
1½	3.63	4	14.98
2	5.02	5	20.78
2½	7.66	6	28.57
3	10.25		

B. The upper end of the tube may be pulled by the hoist to obtain the predetermined tension value. This requires the use of a dynamometer scale and a specially made fitting to grip the tube. The fitting may be a short tube with welded-on lugs for gripping with a sling and an internal thread to mate with the tube thread. With the tube nut installed manually but not tightened, screw the special fitting onto the top of the tube to its full engagement. Attach the dynamometer scale to the lugs, and connect the upper end of the scale to the hoist hook. (See Fig. 10-2.) Operate the hoist to apply the required tension. This will pull the tube nut up off the gasket. Manually screw down the tube nut to reseat it. Reduce the tension to zero. Remove the dynamometer scale and the special fitting.

C. If a dynamometer scale is not available, the tube can be tensioned by wrenching the tube nut. **This is permissible only for pumps with settings under 500 feet.** A special wrench for tightening the tube nut may be obtained from the dealer. Apply the special wrench to the tube nut so that the slots in the wrench engage the lugs at the top of the tube nut. Using chain tongs strapped around the special wrench, turn the tube nut

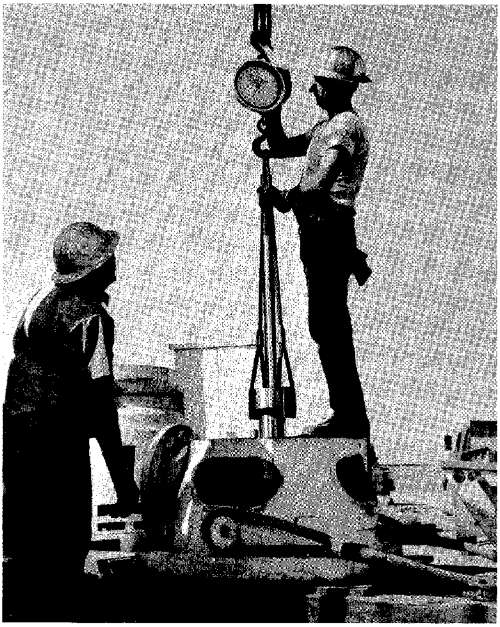


Fig. 10-2. Tensioning The Enclosing Tube By Pulling With The Hoist.

to take all the slack out of the tube and induce a reasonable amount of tension in it. The tube nut is properly torqued if it forms an effective seal with the gasket. This can only be determined when the pump is started. (See section 16, Part E.)

D. Insert the two packings (Fig. 10-1) into the recess in the tube nut. Screw the packing follower on the tube threads, tightening it firmly against the packings. Use the small end of the special tube nut wrench and a pipe wrench to turn the follower.

E. Place the tube nut cap in position over the tube nut and fasten it to the discharge head with the cap screws provided.

SECTION 11

INSTALLING THE DRIVER

A typical hollow-shaft driver (motor or gearhead) is shown in Fig. 11-1 coupled to the pump top shaft.

A. Remove the driver cover cap screws or nuts and lift off the cover. Remove the top drive coupling. Attach a sling to the lifting lugs on the driver, and hoist it to a convenient working height.

WARNING

Do not work under a heavy suspended object unless there is a positive support under it to stop its fall in event of sling or hoist failure. Disregard of this warning could result in grave personal injury.

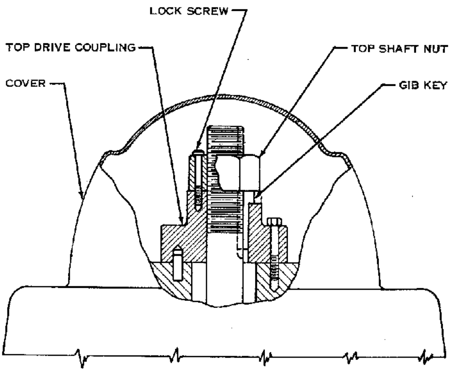


Fig. 11-1. Typical Hollow-Shaft Motor Or Gearhead Coupled To Pump Top Shaft.

Standing to the side of the driver, inspect the mounting surface and register, and clean these surfaces thoroughly. If any burrs are found, support the motor on two parallel supports and remove the burrs with a smooth mill file.

B. Hoist the driver over the discharge head.

CAUTION

When lowering the driver to the pump, take care not to bump or scrape against the top shaft protruding above the discharge head. This could result in bending of the shaft.

Lower the driver slowly, aligning the axial hole with the top shaft so that there will be no bumping or scraping as the shaft enters and passes through the hole.

C. Orient the driver with the conduit box (motor) or the input shaft (gearhead) in the desired position and the mounting holes aligned with the mating tapped holes in the discharge head. Lower the driver until the registers engage and the driver rests firmly on the discharge head. Install the driver-mounting cap screws and tighten them gradually and uniformly.

D. Check to see that the top shaft is concentric with the hollow shaft of the driver, and that the hollow shaft rotates freely when turned by hand. Eccentricity at this point may be due to a bent shaft section or to foreign particles between butting ends of shaft sections. **The cause must be found and corrected before proceeding.**

E. Some drivers are equipped with an oil-cooling system which is supplied with cooling water from the pump or from an external source. For gearheads, make cooling connections with flexible tubing or rubber hose.

CAUTION

Do not use rigid pipe for this purpose on gearheads. Rigid pipe is susceptible to leaking at the joints in this application, due to vibration.

F. Lubricate the driver per the manufacturer's instructions.

G. Make temporary wiring connections to the motor, if applicable. The motor voltage rating is given on the nameplate. **Do not use any other voltage.**

CAUTION

Motors having spring-loaded spherical roller bearings must not be allowed to run at normal speed without a load. When checking direction of rotation, do not hold the switch closed – just "tap" it.

Momentarily close the circuit to the motor to check the direction of rotation. The correct direction is counterclockwise when viewed from above. If the rotation is not correct, reverse it by changing the wiring connections to the motor. For a three-phase motor, interchange any two of the three leads. If the motor is single-phase, directions for reversing rotation are given on the nameplate. Mark the leads to indicate the correct connections.

H. Make the final electrical connections to the motor, using the lead markings previously designated to ensure correct direction of rotation. If there is any doubt, recheck the rotation **momentarily** (see CAUTION above). All connections must be insulated in accordance with the local electrical code.

J. Install the top drive coupling over the top shaft, the holes in the bottom of the coupling engaging the drive pins protruding from the rotor hub or ratchet coupling. Align the keyways in the shaft and in the coupling, and insert the gib key (See Fig. 11-2.) The key must fit snugly against the sides of the keyways but must have a slight clearance with the bottom of each keyway. File the key, if necessary, with a smooth mill file to obtain the proper fit. Apply a thin film of grease to the sides of the key before installing. Install the cap screws holding the top drive coupling to the rotor hub or ratchet coupling.

NOTE

Some shallow setting pumps (usually less than 50 feet) require upthrust protection. If such is the case, above cap screws must be installed to provide this protection.

K. Place the top shaft nut on the shaft and screw it down manually until it contacts the top drive coupling. Do not tighten the nut at this time. Do not install the lock screws at this time. This will be done after the impeller adjustment has been made (Section 15).

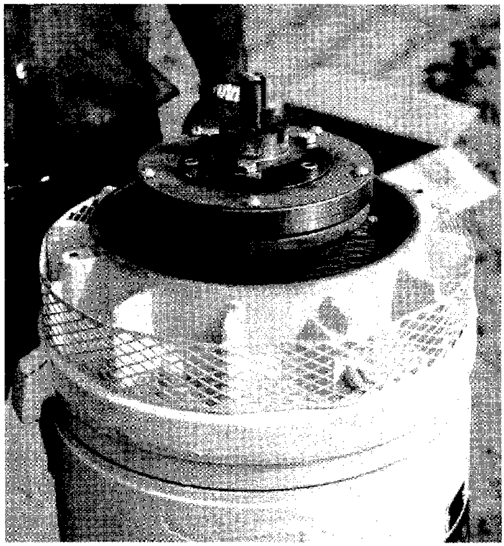


Fig. 11-2. Gib Key Inserted Into Top Shaft And Top Drive Coupling. Head Of Key Will Be Pushed Down Into Slot In Top Of Top Drive Coupling.

SECTION 12

GROUTING THE DISCHARGE HEAD

NOTE

It is recommended that only non-shrinking grouting material be used for grouting the discharge head to the foundation.

A. Build a frame or dam on the foundation, enclosing an area around the discharge head which includes all of the alignment wedges. The top of the dam should be approximately 1/2 inch above the bottom of the discharge head base. (See Fig. 4-1.)

B. Pour the grouting material into the dammed-in area, and force it between the discharge head and the foundation all around. Level off the grout flush with the top of the dam. Allow the grout to cure at least 48 hours before tightening the foundation bolts or starting the pump.

SECTION 13

INSTALLING THE DISCHARGE PIPING

CAUTION

The discharge piping must be independently supported so that it does not impose a load on the discharge head. If there is a difference in operating temperature between the discharge piping and the head, provision must be made in the installation for differential expansion. Any stress transmitted to the discharge head may cause misalignment and subsequent damage to the pump.

SECTION 14

INSTALLING THE LUBRICATION SYSTEM

A. The oil reservoir may be integral with the discharge head or it may be a separate tank. Inspect the inside of the reservoir for cleanliness. If necessary, flush it out with petroleum-base solvent.

B. If a separate tank is supplied with the pump, attach it to the side of the discharge head, using the brackets and cap screws provided.

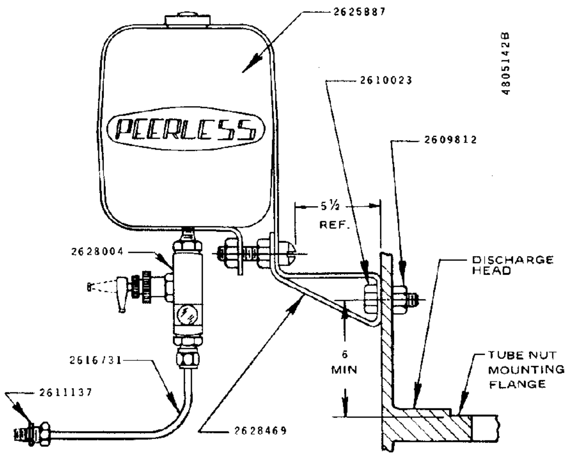
C. The oil system from the reservoir to the pump may be any one of the four types shown in Fig. 14-1 through Fig. 14-4. Connect the solenoid valve (if used) and the sight feed oil valve (either plain or temperature-compensated) to the reservoir as shown in the appropriate figure. Connect a short length of tubing from the bottom of the sight feed oil valve to the ¼ NPT hole in the side of the tube nut cap.

D. The solenoid valve is designed to open, permitting oil to flow, whenever the pump driver is started. The voltage rating of the solenoid valve is shown on the nameplate. **Do not use any other voltage.** If the pump is to be motor-driven and the correct voltage for the solenoid is available at the motor, connect the two solenoid leads to any two motor leads having the correct voltage. If the motor voltage is too high, the solenoid may be wired to suitable low voltage taps at the control panel, or a separate transformer may be used.

E. The ambient temperature compensated sight feed oil valve is maintained at a nearly constant temperature by water from the pump. Using a short length of tubing (Part No. 2625662, Fig. 14-3 and Fig. 14-4), connect either of the side outlets of the oil valve to the ¼ NPT pressure tap in the discharge head interior wall, adjacent to the tube nut cap. Connect a second short length of tubing to the other side outlet of the oil valve. This tube may be used to conduct the fluid back to the well through a hole in the discharge head base, or to any convenient drain.

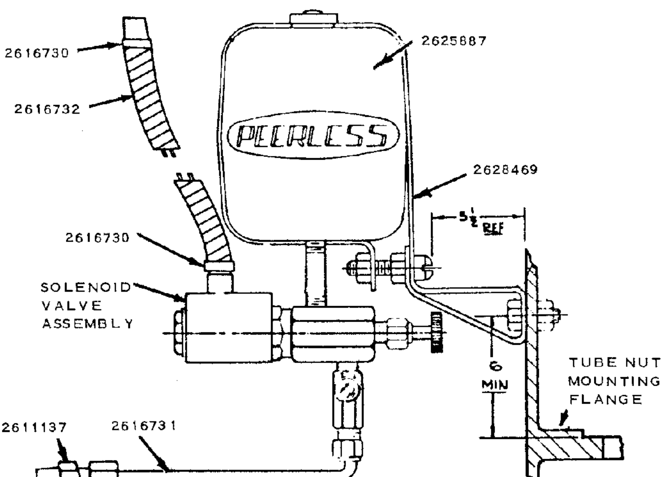
F. Use only high quality turbine oil. A list of acceptable oils is given in Table 14-2. Fill the reservoir with oil. Adjust the sight feed oil valve for a flow of 5 to 6 drops per minute for each hundred feet of pump depth. After two weeks of operation, reduce the flow to approximately 3 drops per minute for each hundred feet.

G. Keep the reservoir cover tightly in place at all times to prevent entry of dirt into the oil system. Maintain the oil level in the reservoir at least one-quarter full.



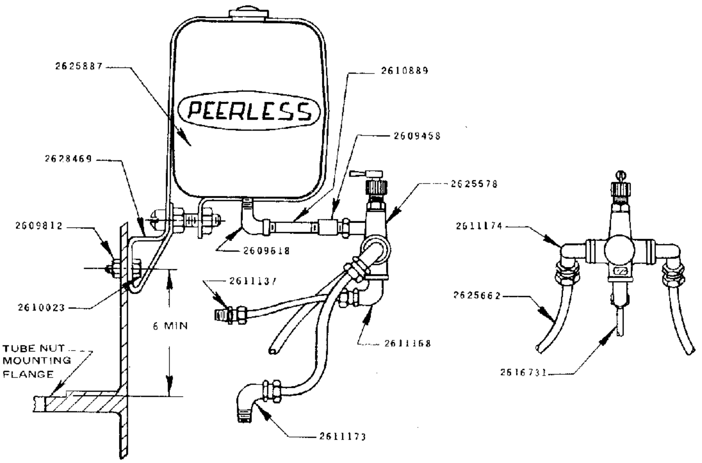
PART NO.	NAME
2609812	Nut, Hex, 3/8-16 UNC
2610023	Cap Screw, Hex, 3/8 - 16 UNC x 1
2611137	Connector, Tubing
2616731	Tubing, 1/4 O.D. x 36
2628004	Valve Assembly, Sight Feed
2625887	Container, Oil, 2 Gal.
2628469	Bracket, Oil Container

Fig. 14-1. Manual Oiler



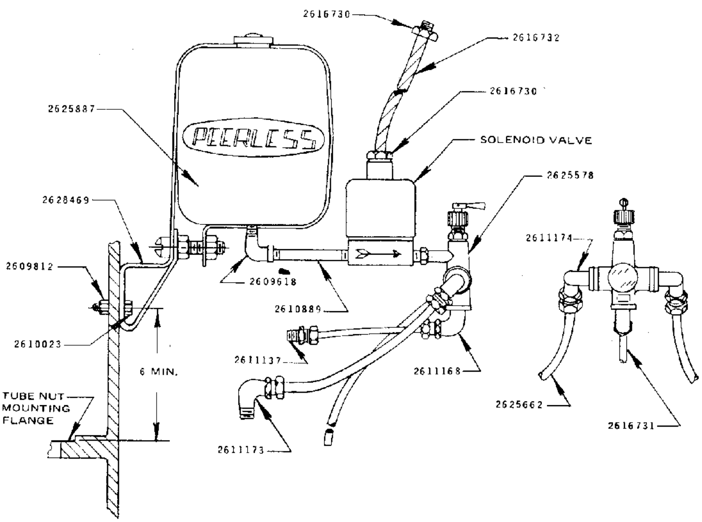
PART NO.	NAME
2611137	Connector, Tubing
2616730	Connector, Conduit
2616731	Tubing, 1/4 O.D. x 36
2616732	Conduit, Flexible, 1/2 x 36
2625887	Container, Oil, 2 Gal.
2628469	Bracket, Oil Container

Fig. 14-2. Automatic Oiler



PART NO.	NAME
2609458	Coupling, Pipe
2609618	Elbow, Street
2609812	Nut, Hex, 3/8-16 UNC
2610023	Cap Screw, Hex 3/8-16 UNC x 1
2610889	Nipple, Pipe
2611137	Connector, Tubing
2611168	Elbow, Tubing
2611173	Elbow, Tubing
2611174	Elbow, Tubing
2616731	Tubing, 1/4 O.D. x 36
2625578	Valve Assembly, Sight Feed
2625662	Tubing, 3/8 O.D. x 36
2628469	Bracket, Oil Container
2625887	Container, Oil

Fig. 14-3. Ambient Temperature Compensated Oiler – Manual.



PART NO.	NAME
2609618	Elbow, Street
2609812	Nut, Hex, 3/8-16 UNC
2610023	Cap Screw, Hex, 3/8-16 UNC x 1
2610889	Nipple, Pipe
2611137	Connector, Tubing
2611168	Elbow, Tubing
2611173	Elbow, Tubing
2611174	Elbow, Tubing
2616730	Connector, Conduit
2616731	Tubing, 1/4 O.D. x 36
2616732	Conduit, Flexible, 1/2 x 36
2625578	Valve Assembly, Sight Feed
2625662	Tubing, 3/8 O.D. x 36
2625887	Container, Oil, 2 Gal.
2628469	Bracket, Oil Container

Fig. 14-4. Ambient Temperature Compensated Oiler – Automatic. Head Mount Shown.

Table 14-1. Greases For Lubrication Of Lineshaft Bearings, Suction Manifold Bearings, And Shaft Packings. 3600 RPM Maximum. -20^{o}F. To $+120^{o}$F.

MANUFACTURER	PRODUCT
American Oil Co.	AMOCO Lithium Grease All-Weather
Atlantic Richfield Co.	ARCO Multipurpose Grease
Cato Oil & Grease Co.	Mystik JT-6
Cities Service Oil Co.	Citgo H-2
Continental Oil Co.	EP Conolith No. 1 (-20^{o} to $+40^{o}$F.) EP Conolith No. 2 ($+40^{o}$F. to $+120^{o}$F.)
Gulf Oil Co.	Gulfcrown No. 2 or EP 2
E.F. Houghton & Co.	Cosmolube No. 2
Exxon	Lidok EP 2
Hydrotex	Deluxe No. M-33 Super Shield
Imperial Oil & Grease Co.	Molub-Alloy No. 1
Keystone Div., Pennwalt Corp.	80 X LT
Mobil Oil Corp.	Mobilux EP No. 2
The Pennzoil Co.	Pennzoil 705 HDW
Phillips Petroleum Co.	Philube IB & RB
Shell Oil Co.	Alvania EP Grease 2 or Alvania EP Grease 1 (for prolonged ambient below 0^{o}F.)
Sun Oil Co.	Sunaplex No. 2 EP Prestige 42
Texaco, Inc.	Novatex Grease No. 2
Union Oil Co.	Unoba EP-2

Table 14-2. Turbine Oils For Lubricating Of Lineshaft Bearings And Similar Applications. 3600 RPM Maximum.

MANUFACTURER	PRODUCT	
	TEMPERATURES BELOW 32°F.	TEMPERATURES ABOVE 32°F.
American Oil Co.	Rykon Industrial Oil No. 11	Rykon Industrial Oil No. 31
Atlantic Richfield Corp.	Duro S-150	Duro S-150
Cato Oil & Grease Co.	2107 Water Well Turbine Oil or 1872 Antiwear Hyd./Ind. Oil A.5	2107 Water Well Turbine Oil or 1872 Antiwear Hyd./Ind. Oil A.5
Cities Service Oil Co.	Citgo Pacemaker 15	Citgo Pacemaker 15
Continental Oil Co.	Dectol 15 R & O	Dectol 33 R & O
Gulf Oil Co.	Paramount 22	Harmony 32 or 32 AW
E.F. Houghton & Co.	Cosmolubric 1133-A	Hi-Temp Oil 102
Exxon	Nuto 32 or Esstic 32	Teresstic 32 or Nuto 32
Hydrotex	Deluxe No. 216	Deluxe No. 216
Imperial Oil & Grease Co.	Molub-Alloy No. 588	Molub-Alloy No. 603
Keystone Div., Pennwalt Corp.	49X Light or KSL-213 (very low temp.)	KLC-6 or KSL (very high temp.)
Mobil Oil Corp.	DTE 13	DTE Heavy Duty
The Pennzoil Co.	Pennbell No. 1	Pennbell No. 2
Phillips Petroleum Co.	Magnus Oil 150	Magnus Oil 700
Shell Oil Co.	Tellus Oil 23	Tellus Oil 32
Sun Oil Co.	Sunvis 916 or Sunvis 816 WR	Sunvis 916 or Sunvis 816 WR
Texaco Inc.	Regal Oil R & O 32	Regal Oil R & O 32
Union Oil Co. Western Region	Unax AW 150 or Turbine Oil 150	Unax AW 315 or Turbine Oil 315
Eastern Region	Unax AW 150	Unax AW 315

Table 14-3. Turbine Oils For Lubrication Of Gear Drives For Vertical Pumps. 3600 RPM Maximum

MANUFACTURER	PRODUCT	
	TEMPERATURES BELOW 32°F.	TEMPERATURES ABOVE 32°F.
American Oil Co.	Rykon Industrial Oil No. 21	Rykon Industrial Oil No. 51
Atlantic Richfield Corp.	Duro AWS-315	Duro 600
Cato Oil & Grease Co.	1875 Antiwear Hyd./Ind. Oil C or 1837 R & O Gearhead C	Mystik JT-7 SAE 80/90 Antiwear Ind. Oil F, or 1855 R & O Gearhead F
Cities Service Oil Co.	Citgo Pacemaker 20	Citgo Pacemaker 60
Continental Oil Co.	Dectol 33 R & O	Dectol 76 R & O
Gulf Oil Co.	Paramount 45	Harmony 69
E.F. Houghton & Co.	Cosmolubric 1133-A	Hi-Temp Oil 102
Exxon	Nuto 32 or Esstic 32	Teresstic 100 or Nuto 100
Hydrotex	Deluxe No. 217	Deluxe No. 218
Imperial Oil & Grease Co.	Molub-Alloy No. 588	Molub-Alloy No. 603
Keystone Div., Pennwalt Corp.	KLC-6	KLC-1
Mobil Oil Corp.	DTE 13	DTE Extra Heavy or DTE AA
The Pennzoil Co.	Pennbell No. 2	Pennbell No. 5
Phillips Petroleum Co.	Magnus Oil 150	Magnus Oil 700
Shell Oil Co.	Tellus Oil 46	Tellus Oil 100
Sun Oil Co.	Sunvis 921 or Sunvis 821 WR	Sunvis 951 or Sunvis 851 WR
Texaco Inc.	Regal Oil R & O 68N	Regal Oil R & O 150
Union Oil Co. Western Region	Unax AW 215 or Turbine Oil 215	Unax AW 700 or Turbine Oil 700
Eastern Region	Unax AW 215	Unax AW 700

SECTION 15

ADJUSTING THE IMPELLERS

CAUTION

The impellers must be adjusted before any attempt is made to start the pump.

A. A pump operating in a new well should be run with its impellers in the midposition, which is approximately 3/16 inch above the lateral bowl wear rings. This is to minimize the possibility of damage due to sand in the water. When the water is clear of sand, the impellers should be reset to the most efficient pumping position.

B. When making the impeller adjustment, it is necessary to allow for the shaft stretch due to the weight of the shaft and impellers and the downward hydraulic force on the impellers (hydraulic thrust). For pumps with settings 500 feet or less, this can be determined as explained below. For pumps having settings over 500 feet, additional factors are involved. Consult your Peerless Pump dealer.

1. From Table 15-1, select the value for hydraulic thrust of the pump being installed. This is given in pounds **per foot** of pumping head, the maximum height to which the water can be raised by the pump. Multiply this value by the height (in feet) of the pumping head to determine the total hydraulic thrust of the impellers.

2. Select the weight per stage of the rotating element (impellers and impeller shaft) from Table 15-1 and multiply by the number of stages. Weights per foot of column shaft are given in Table 15-2. Multiply the appropriate figure by the length of the column shaft in feet. The total weights thus obtained (Rotating element and column shaft) plus the hydraulic thrust produce the total downward force.

Table 15-1. Hydraulic Thrust And Weight Data

Size	Thrust	②	Size	Thrust	②	Size	Thrust	②	Size	Thrust	②	Size	Thrust	②
4LO	1.6	1½	10LB	4.1	25	14HXB	12.4	32	20HH	48.0	137	30HH-OH	104.0	370
4LE	1.0	1½	10MA	5.5	12	14HH	20.0	44	24MA	46.1	200	32HXB	87.0	470
6LB	1.5	3½	10HH	9.5	35	15LC	6.4	46	24HXB	38.5	135	36MA	83.0	636
6MA	2.8	3	10HXB	5.8	15	15MA	15.0	56	24HH	57.0	190	36HXB	112.0	680
6HXB	2.2	3	11MB	6.2	58	16MC	12.7	50	24HH-OH	57.0	154	36HH	140.0	784
7LB	2.4	5	12LB	6.0	14	16HXB	20.3	35	26HXB	54.3	166	36HH-OH	140.0	679
7HXB	3.4	6	12LD	7.8	22	16HH	30.0	75	26HH	69.0	275	42HXB	152.0	870
8LB	2.6	7	12MB	7.5	21	18MA	22.5	54	26HH-OH	69.0	225	48HXB	208.0	1075
8MA	5.6	7	12HXB	8.5	17	18HXB	24.4	72	27MA	74.5	270	48HH	235.0	1600
8HXB	3.62	7	12HXH	11.0	27	18HH	35.0	151	28HXB	64.2	205	48HH-OH	235.0	1425
9LA	3.9	11	14LD	10.4	38	20MA	30.0	100	30LA	64.0	210	56 HH	338.0	2675
			14MC	10.0	33	20HXB	25.3	120	30HH	104.0	450	56HH-OH	338.0	2467

Thrust in pounds per foot of head, per stage. ② Weight of rotating element in pounds, per stage.

Subject to change without notice

Table 15-2. Column Shaft Weight Per Foot, In Pounds.

Shaft Diameter	3/4	1	1-3/16	1-1/2	1-11/16	1-15/16	2-3/16	2-7/16	2-11/16	2-15/16	3-3/16	3-7/16	3-11/16	3-15/16
Wt. Per Ft. Of Shaft	1.50	2.67	3.77	6.01	7.60	10.02	12.78	15.86	19.29	23.04	27.13	31.56	36.31	41.40

3. From Table 15-3, under the shaft diameter and across from the previously determined total downward force, read the value of the elongation (stretch) per 100 feet of shaft. Elongation values for forces not given in the table may be found by interpolation. This is explained in the example in Part C.

4. To find the total elongation (shaft stretch), multiply the elongation per 100 feet by the total length of the shaft, including the top shaft, divided by 100 feet.

C. Here is an example of a shaft stretch calculation. Problem: Determine the shaft stretch for an 8LB pump which operates against a 350-foot head and is equipped with a total of 250 feet of 1½ inch diameter shaft. The bowl unit consists of 12 stages.

1. From Table 15-1, select 2.6 pounds per foot as the hydraulic thrust of an 8LB pump. Multiply 2.6 by 350 to obtain the total hydraulic thrust of the impellers, 910 pounds.

2. From Table 15-1, select 7 pounds as the weight per stage of the rotating element. Multiply this by 12 to obtain the total weight of the rotating element, 84 pounds. Add to this the weight of the column shaft: 6.01 pounds per foot for a 1½ shaft (Table 15-2), times 250 feet equals 1502 pounds. Therefore the total weight to be added to the hydraulic thrust is 1586 pounds (84 + 1502), and the total downward force is 2496 pounds (910 + 1586). This can be rounded off to 2500 pounds.

3. Consulting Table 15-3, we find that 2500 pounds is not listed in the TOTAL DOWNWARD FORCE column. However, values are given for 2400 pounds and for 2800 pounds. From these we can find an in-between value for 2500 pounds. Reading down from the 1½ diameter heading, we find that the elongation per 100 feet is .056 for 2400 pounds and .066 for 2800. This is an elongation change of .010 for a difference in force of 400 pounds. The difference between 2500 pounds and 2400 pounds is 100 pounds, or 100/400 (1/4) of the difference between 2400 and 2800. If we take 1/4 of .010, therefore, we will obtain the amount to add to .056 (the elongation at 2400 pounds) to find the elongation at 2500 pounds. One quarter of .010 is about .002. Adding this to .056 gives us .058 as the elongation per 100 feet for a total downward force of 2500 pounds.

4. To find the total elongation (shaft stretch) for 250 feet of shafting:

$$.058 \times \frac{250}{100} = .145 \text{ inch}$$

D. Before any adjustment is made, the impellers will be resting on the lateral bowl wear rings, and considerable resistance due to friction can be felt when turning the shaft by hand. To set the impellers to mid-position, proceed as follows: Screw down the top shaft nut, while restraining the top shaft from turning, until the impellers just clear the seals and the shaft can be turned freely by hand. Scribe a line on the square or acme thread of the top shaft, flush with the top of the nut. Continue to turn down the nut until the distance from the scribe line to the top of the nut is 3/16 inch plus the total shaft stretch previously determined. Turn the nut an additional few degrees, if necessary, to align two of the holes in the top shaft nut with the tapped holes in the top drive coupling. Install the lockscrews in the top shaft nut. (See Fig. 15-1.)

E. To set the impellers to the most efficient position, follow the procedure of Par. 1, below, if the pump is driven by an electric motor. If the pump is driven by any other device, follow the procedure of Par. 2.

WARNING

The driver cover (Fig. 11-1) must be in place when the pump is in operation. Rotating parts below this cover could cause grave personal injury if exposed.

Table 15-3. Shaft Elongation.

Inches Per 100 Feet Of Shaft

TOTAL DOWNWARD FORCE	SHAFT DIAMETER													
	3/4	1	1-3/16	1-1/2	1-11/16	1-15/16	2-3/16	2-7/16	2-11/16	2-15/16	3-3/16	3-7/16	3-11/16	3-15/16
500	.047	.026	.018	.012	.009	.007								
600	.056	.032	.022	.014	.011	.008	.006							
800	.075	.042	.030	.019	.015	.011	.009							
1000	.094	.053	.037	.024	.019	.014	.011	.009						
1200	.112	.063	.045	.028	.022	.017	.013	.011						
1400	.131	.074	.052	.033	.026	.020	.015	.012	.010					
1600	.150	.084	.060	.038	.030	.022	.018	.014	.012					
1800	.169	.095	.067	.042	.033	.025	.020	.016	.013	.011				
2000	.187	.105	.075	.047	.037	.028	.022	.018	.015	.012				
2400	.225	.127	.090	.056	.044	.034	.026	.021	.018	.015	.012			
2800	.262	.148	.105	.066	.052	.039	.030	.025	.020	.017	.015			
3200		.169	.119	.075	.059	.045	.035	.028	.023	.020	.017	.014		
3600		.190	.135	.085	.067	.051	.040	.032	.026	.022	.019	.016		
4000		.211	.150	.094	.074	.056	.044	.036	.029	.025	.021	.018	.016	
4400		.240	.164	.103	.081	.062	.048	.039	.032	.027	.024	.020	.017	
4800		.253	.179	.113	.089	.067	.053	.043	.035	.029	.025	.021	.019	.016
5200		.274	.194	.122	.096	.073	.057	.046	.038	.032	.027	.023	.020	.018
5600			.209	.131	.107	.079	.062	.050	.041	.034	.029	.025	.022	.019
6000			.224	.141	.111	.084	.066	.053	.044	.037	.031	.027	.023	.020
6500			.243	.153	.120	.091	.071	.058	.047	.040	.034	.029	.025	.022
7000			.260	.164	.129	.098	.077	.062	.051	.043	.036	.031	.027	.024
7500				.176	.139	.105	.082	.067	.055	.046	.039	.033	.029	.026
8000				.188	.148	.112	.088	.071	.058	.049	.042	.036	.031	.027
9000				.211	.167	.126	.098	.080	.066	.055	.047	.040	.035	.031
10,000				.234	.185	.140	.110	.089	.073	.061	.052	.045	.039	.034
12,000				.281	.222	.168	.132	.106	.088	.073	.062	.054	.047	.041
14,000					.259	.196	.154	.124	.102	.086	.073	.062	.055	.048
16,000					.296	.224	.176	.142	.117	.098	.083	.071	.062	.054
18,000						.252	.198	.160	.131	.110	.093	.080	.070	.061
20,000						.280	.220	.176	.146	.122	.104	.089	.078	.068
22,000							.242	.195	.160	.134	.114	.098	.086	.074
24,000							.264	.213	.175	.147	.124	.107	.094	.082
26,000							.286	.230	.190	.159	.135	.116	.102	.088
28,000								.248	.204	.171	.145	.125	.109	.095
30,000								.266	.219	.183	.156	.134	.117	.104
32,000								.283	.233	.196	.166	.143	.125	.109
34,000									.248	.208	.176	.152	.133	.116
36,000									.262	.220	.187	.160	.140	.122
38,000									.277	.232	.197	.170	.148	.129
40,000									.292	.245	.207	.178	.156	.136

$$e = \frac{L \times 12 \times F}{E \times G.S.A.}$$

e = Elongation (in inches)

L = Shaft Length (feet)

E = Modulus of Elasticity (29,000,000)

F = Total Downward Force (pounds)

G.S.A. = Gross Shaft Area (sq. inches)

Downward Force due to the hydraulic thrust of the pump and the weight of the shaft and impellers causes the shaft to stretch after the pump is in operation. Unless the impellers are raised off the bottom of the bowls enough to allow for this stretch plus some running clearance, the impellers will rub, causing the pump to wear and increase the horsepower required.

Table 15-4 Most Efficient Impeller Clearance.

Pump Size	Impeller Number	Clear-ance
6LB	2616324	1/32
	2618292	1/8
	2616318	1/8
6MA	V850 B	1/32
6HXB	2607800	1/4
7LB	2626207	1/8
	2626208	1/8
7HXB	2607926	1/8
	2607921	1/8
8LB	2616464	1/4
	2616465	1/8
8MA	T84229	3/16
	T84234	1/8
8HXB	2616348	1/16
9LA	T84391	1/8
	T84323	1/8
10LB	2625032	1/8
	2625033	1/8
10MA	T84363	1/8
	2624288	1/16
10HXB	T82337	3/16
	T82366	3/16
10HH	2622864	1/16
	2626818	1/16
11MB	2622504	1/16

Pump Size	Impeller Number	Clear-ance
12LB	2623849	1/32
	2616025	1/8
	2616011	1/16
12LD	2634820	1/16
12MB	2624331	1/32
	2626936	1/16
	2624332	3/16
12HXB	2608100	1/16
	2608379	1/8
	2608368	1/16
12HXH	2629933	1/8
14LD	2634704	1/16
14MC	2626082	1/16
	2626083	1/16
14HXB	V4399 C	1/8
	V4400 C	1/8
14HH	2621973	1/16
	2621959	1/16
15LC	2625920	1/8
15MA	2617049	1/8
	2617046	1/8
16MC	2626756	1/8
	2626757	1/16
16HXB	2617216	1/8
	2617215	1/8
16HH	2621593	1/32
	2620735	1/16

Dimensions shown are subject to change without notice.

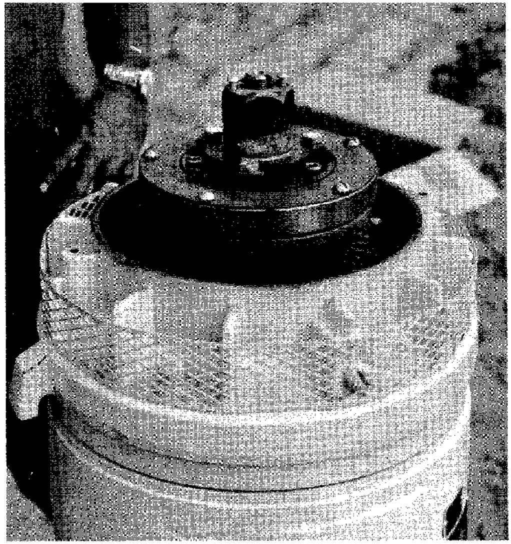


Fig. 15-1. Impeller Adjustment Completed. Lock Screws Shown In Position; Not Yet Tightened.

1. An accurate check for the most efficient impeller setting may be made by observing the electric power meter or, if more convenient, an ammeter connected to the power input to the motor. Operate the pump and watch the meter. When the impellers are rubbing on the wear rings, more electrical power will be consumed. As the impellers are adjusted to just clear the wear rings, there will be a definite decrease in power consumption. Set the impellers at a height slightly above where this definite decrease occurs. Install the lock screws in the top shaft nut.

2. When the driver is a device other than an electric motor, the impeller adjustment is made with the pump stopped. The most efficient impeller clearance (minimum clearance when the pump is running) is given in Table 15-4 for every pump size. Select the value for the pump being installed and add to this the calculated shaft stretch (Part B). Adjust the impellers to obtain this total clearance above the point where the impellers just clear the wear rings. Install the lock screws in the top shaft nut.

SECTION 16

STARTING THE PUMP

A. Before attempting to start the pump, check the water level in the well to be sure that the first impeller of the bowl unit is submerged. **The pump cannot be expected to pump water if the first impeller is not submerged.**

B. Before attempting to start the pump, check the readiness of the following items.

Level of oil in the reservoir.
Tightness of all connections.
Prelubrication of tube bearings.
Lubrication of the driver.
Wiring of electric motor (if applicable).
Wiring of solenoid valve (if applicable).
Connection of gearhead to prime mover (if applicable).
Impeller adjustment.
Discharge piping connection.
Oil-cooling connections for the driver (if applicable).
Shut-off valve in discharge pipe – must be open.

C. If for any reason the bearings were not pre-lubricated as the tube sections were installed, allow the oil feed dripper to operate for two hours before starting the pump. If a solenoid valve has been installed, it will be necessary to disconnect the oil line at the solenoid valve outlet and prelubricate the pump manually. An alternate method is to raise the tube nut cap and pour oil into the enclosing tube directly.

D. Start the pump. **If there is excessive vibration or if the driver overheats, stop the pump.** Determine the cause and correct the problem before restarting.

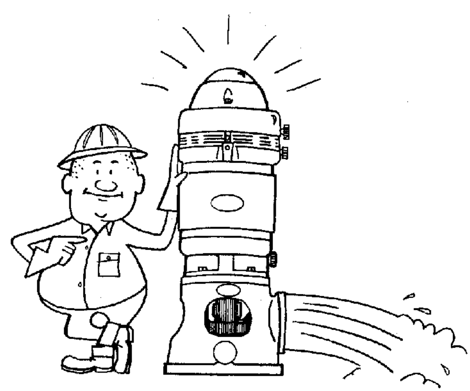
E. For pumps in which the enclosing tube was tensioned by wrenching the tube nut, check for leakage at the tube nut gasket. If the gasket does not seal properly, the tube nut (Item 261.000, Fig. 10-1) must be tightened. Stop the pump. Working through the hand holes with a bar and hammer, tighten the tube nut to ensure an adequate seal at the gasket.

F. If the pump is operating in a new well, a final adjustment of the impellers must be made after the water clears. (See Section 15.)

G. Restarting the pump after a shut-down:

CAUTION

When the pump has been idle for a week or longer, turn on the oil feed dripper two hours before starting the pump.



"Proper installation will contribute to maximum efficiency and long trouble-free life."

SECTION 17

DISASSEMBLING THE PUMP

WARNING

Do not attempt to lift the entire pump by the lifting lugs of the driver. These lugs and the bolts attaching the driver to the pump cannot support the weight of the entire pump.

WARNING

There are definite load limitations for the eyebolts or lifting lugs of cast discharge heads. See Table 8-1. Exceeding these loads may result in failure of the discharge head, serious damage to other parts of the pump and grave injury to nearby personnel.

WARNING

Do not work under a heavy suspended object unless there is a positive support under it to stop its fall in event of sling failure. Disregard of this warning could result in grave personal injury.

A. Clear a large area adjacent to the pump as a storage space for pump parts as they are disassembled. Arrange parallel timbers on the ground in the cleared area to support the pump column and shaft sections horizontally as shown in the background in Fig. 7-6.

B. Disconnect the discharge piping from the discharge head. If the driver is equipped with an oil-cooling system, remove the external tubing or piping used for this purpose. On pumps equipped with an air-pressure water-level testing system, remove the gauge and disconnect the tubing connection inside the discharge head. Some pumps have this connection below the base, in which case the tubing will be disconnected later.

C. On pumps which are driven through a gearhead, remove the coupling or drive shaft between the gearhead and the prime mover. If the driver is an electric motor, remove the electrical connection at the conduit box.

WARNING

Before opening the conduit box of an electric box of an electric motor, be certain that the current to the motor is shut off. An electrical shock from contact with live motor leads can be fatal.

Remove the driver from the discharge head in the following manner. (See Fig. 11-1). Remove the driver cover. Remove the lock screws, the top shaft nut, the gib key, and the top drive coupling. Remove the driver mounting screws. Attach the hoist sling to the lifting lugs of the driver and lift it off the discharge head. Place the driver on clean wooden blocks in the storage area.

D. (See Fig. 10-1.) Remove the cap screws retaining the tube nut cap (098.000), and lift it off the shaft. Unscrew the packing follower (178.000) from the tube nut (261.000), and pull out the packing rings (265.261). This can be done with a special packing removal tool or with a hooked, pointed wire. Apply the special tube nut wrench (may be obtained from the dealer) to the top of the tube nut, engaging the lugs protruding from the tube nut with the slots in the wrench. Strap chain tongs to the special wrench and unscrew the tube nut from the discharge head. Some older pumps have a lock nut below the tube nut. Remove this nut.

E. Remove the cap screws or nuts holding the discharge head to the sole plate or to the foundation. Attach the sling to the lifting ears of the discharge head, and hoist the entire pump straight upward to bring the discharge head base to a comfortable working height, If the pump has an air line with a connection point below the base, disconnect the line at this time.

F. The procedure for removing the discharge head and the top column section varies, depending on the size of the discharge head. The size is indicated in raised letters on the upper surface of the discharge head base.

1. For discharge heads 4 x 4 x 10C

a. Raise the pump until the uppermost column coupling is about three feet above the foundation. Attach an elevator clamp to the column about two feet below the coupling. Place two short lengths of timber on the foundation, one on either side of the well casing, directly below the ears of the elevator clamp; then lower the pump until the elevator clamp rests on the timbers. Remove the sling from the discharge head.

b. If an air line was installed with the pump, cut the wires attaching it to the column. When the air line is tubing, form the tubing into a coil as each column section is removed. If pipe was used, remove each pipe section before corresponding column section is uncoupled.

c. Unscrew the top column section from the coupling, using the chain tongs or a capstan drive and rope (cat head and cat line). Attach the sling to the discharge head lifting eye bolts and lift the top column about two feet, exposing the enclosing tube inside the column. Place over the column coupling a specially made wood or metal apron which covers the opening and fits closely around the tube. Wrap a clean rag tightly around the tube, over the apron. (See Fig. 7-6.) This will prevent entry of foreign matter into the pump.

d. Uncouple the top tube section from the next lower section, using a pair of pipe wrenches or chain tongs. With a special clamping tool or a suitable tail rope, fasten the lower end of the tube section to the lower end of the column section. The top shaft section inside the tube will later be fastened in the same manner. The rope must provide for both connections. (See Section 7, Part C and Fig. 7-5 or 7-6.) Unscrew the top shaft from the shaft coupling, using a pair of pipe wrenches.

NOTE

The shaft threads are left hand.

CAUTION

Do not strike the coupling with a hammer to assist in loosening the joint. This creates local stresses which may cause cracking of the coupling when torque is applied during subsequent pump operation.

When the top shaft is completely unthreaded from the coupling, let it rest on top of the coupling. Do not permit the shaft to move laterally off the coupling, as it will fall into the pump column.

Using the same tail rope, fasten the top shaft to the top tube. The remainder of the rope will be used to maintain tension on the knots during hoisting. Lift the discharge head, column, tube, and shaft as an assembly. The lower end should be guided by a dragline which is pulled by the hoist. (See Section 7, Part D and Fig. 7-4 and 7-5.) If a power-operated dragline is not available, the lower end must be guided manually. Move the assembly away from the pump, and set it down in the cleared storage area, placing it across the parallel timbers.

2. For discharge heads 6x6x12 or larger:

a. Fasten an elevator clamp to the pump column about two feet below the top column flange (Fig. 8-2.) Place two short lengths of timber on the foundation, one on either side of the well casing, directly below the ears of the elevator clamp; then lower the pump until the elevator clamp rests on the timbers. Remove the nuts holding the top column flange to the discharge head. Lift the discharge head from the pump and place it on clean wooden blocks in the storage area. Attach the sling to the elevator clamp and raise the pump until the uppermost column coupling is about three feet above the foundation. Fasten a second elevator clamp to the column about two feet below the column coupling. Lower the pump until the elevator clamp rests on the timbers, and remove the sling.

b. If an air line was installed with the pump, remove it per Part F, Paragraph 1.b, above.

c. Remove the top column and top shaft sections as explained in Part F, Paragraph 1.c, above, except that the sling will be attached to the elevator clamp near the top of the column instead of to the discharge head, which has already been removed.

G. Remove all of the remaining column, tube, and shaft sections in the same manner.

H. Pumps having columns longer than 50 feet are equipped with rubber tube stabilizers in the column, spaced 40 feet apart. Tube stabilizers have a cylindrical hub which fits tightly over the tube and three spokes which bear against the inside wall of the column. To remove a stabilizer, loosen the hub from the tube by prying in several places with a moistened blunt screwdriver; then grasp the spokes and pull out.

J. Remove all the remaining column, tube and shaft sections, and tube stabilizers in the same manner.

K. Pull the bowl unit from the well, using the elevator clamp and the hoist in the same manner as for column sections. Certain extra-long relatively small-diameter bowl units are susceptible to damage by bending and must be treated with special care. These units were originally shipped from the factory attached to special skids, which should have been retained for use in removing the unit from the well. With the bowl unit in a vertical position over the well, encase the unit in the special skid before moving it to the storage area. When placing this type of unit on the parallel timbers, add two or three additional supporting timbers to prevent sagging.

L. Pull out the suction pipe, using the elevator clamp and the hoist. A very short suction pipe may be left connected to the bowl unit, if desired, and the two removed as an assembly. Take care not to damage the strainer which, on some pumps, is attached to the bottom of the suction pipe.

SECTION 18

INSTALLING AND OPERATING THE WATER LEVEL TESTING SYSTEM

A. The air line may be 1/4 inch galvanized pipe or 1/4 inch OD copper or plastic tubing. It is tied to the pump column at regular intervals during the pump installation, as explained in Sections 7 and 8.

B. Assemble the water level gage and the air valve on the tee and bracket assembly. Attach the bracket to the side of the discharge head, using the cap screws, nuts and lock washers provided. (See Fig. 18-1 or Fig.18-2.)

C. The connection from the air line to the gage is made with the short length of 1/4OD copper tubing furnished. In the case of a 6x6x12 or larger discharge head, the air line was terminated with a compression fitting at the top of the discharge head base. Attach one end of the short tube to this fitting and the other end to the tee at the gage, using another compression fitting. (See Fig. 18-2.)

D. Determine the exact height from the center of the discharge outlet to the lower end of the air line. Mark this height to the nearest foot in the square provided on the gage dial.

E. Loosen the three dial lock screws on the face of the gage, and rotate the movable dial until the graduation corresponding to the predetermined height is in line with the pointer. Retighten the screws and check the dial position to be sure that it has not shifted.

F. Connect a suitable source of air pressure to the air line at the tee. A hand pump, as shown in Fig. 18-3, is satisfactory.

G. Pressurize the system and determine that all joints are air-tight and the air line is not plugged.

H. Standing (static) water level readings are taken before starting the pump or after a shut-down period long enough to allow the water level in the well to normalize. Drawdown (pumping level) readings are taken after the pump has operated against normal head for a period sufficient to draw the water level down to the maximum depth. (See Fig. 18-3.)

J. To obtain the required readings, increase the pressure in the system (operate the hand pump) until the gage pointer ceases to rise. Note the gage reading. This reading is the depth of the water level below the center of the discharge outlet.

K. For a complete history of the well's performance through the seasons, keep a record by date of all readings taken.

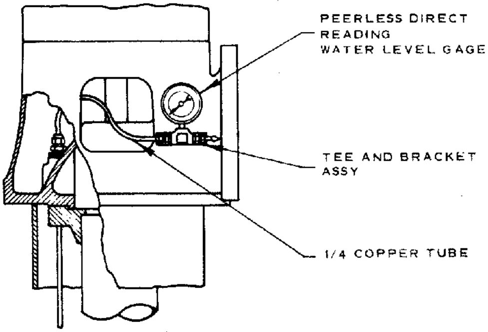


Fig. 18-1. Gage Installation – 6x6x12 Or Larger Discharge Head.

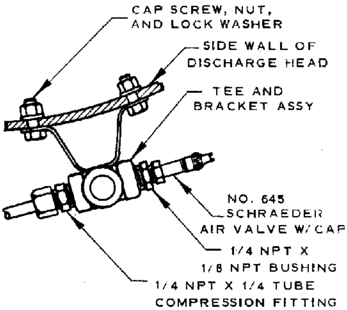


Fig. 18-2. Detail Of Tee And Bracket Assembly Attachment To Discharge Head Wall.

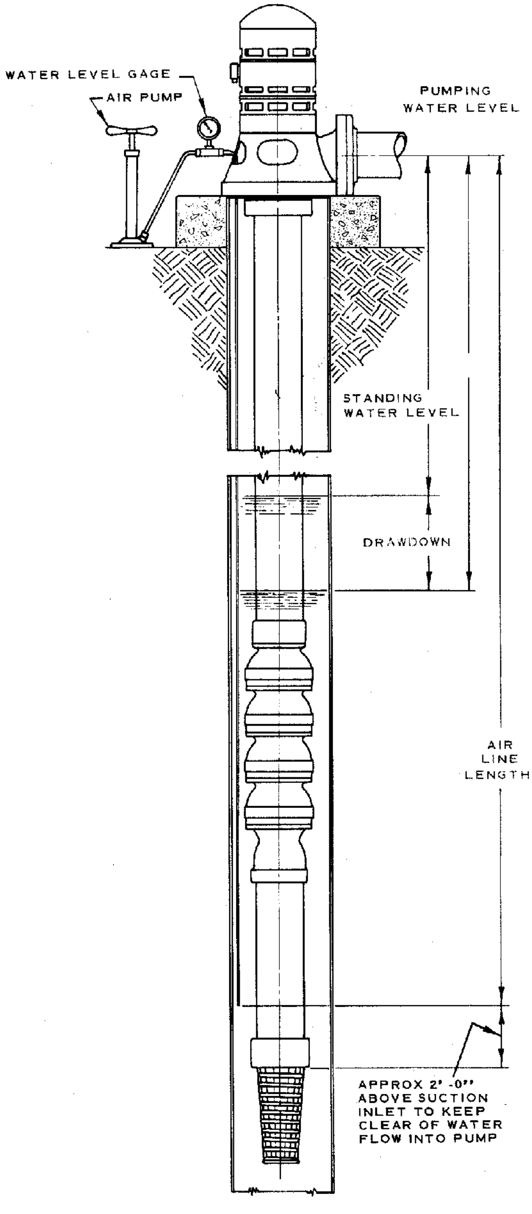


Fig. 18-3. Air Pressure Water Level Testing System.

PEERLESS PUMP®

LaBour Taber

Deep Well Types

Flows to 150,000 gpm
Heads to 2,300 ft.
Settings to 1,500 ft.
Horsepower to 5,000 hp
Pressure to 1,000 psi
Brochure B-100

For water supply from drilled wells.

Flows:

- **Verticals to 5,000 gpm**
- **Horizontals to 5,000 gpm**
- **In-Lines to 500 gpm**
- **End Suctions to 500 gpm**

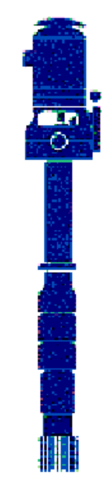
Heads:

- **Verticals to 1,176 ft.**
- **Horizontals to 630 ft.**
- **In-Lines to 406 ft.**
- **End Suctions to 340 ft.**

Pressures:

- **Verticals to 510 psi**
- **Horizontals to 640 psi**
- **In-Lines to 175 psi**
- **End Suctions to 147 psi**

Horsepowers to 800 hp



Peerless Pump Company
2005 Dr. Martin Luther King Jr. Street
Indianapolis, IN 46202
Phone: (317) 925-9661 • Fax: (317) 924-7388

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