

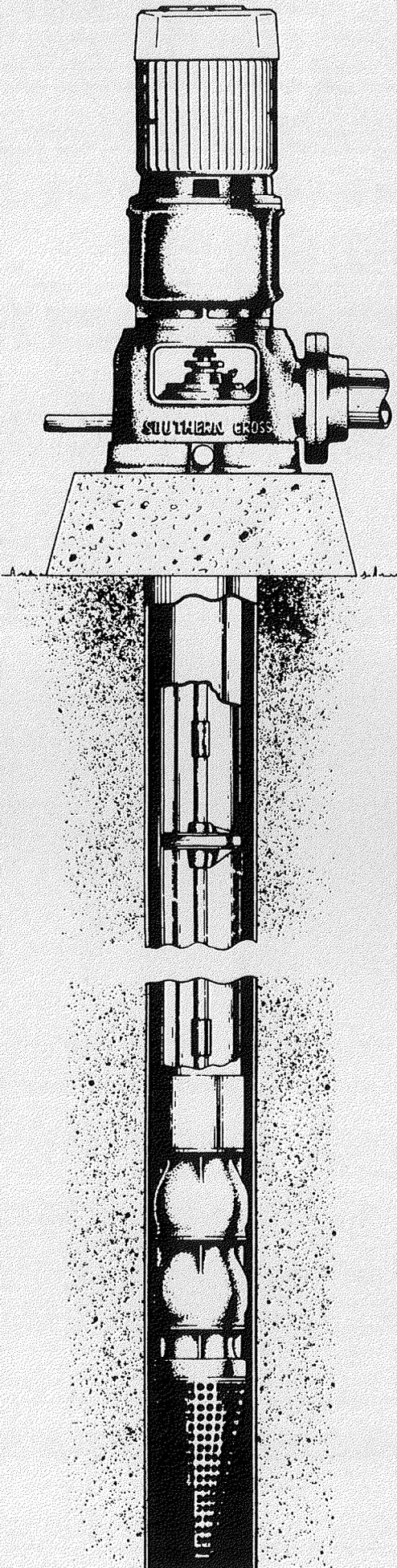
SOUTHERN CROSS

INSTRUCTION MANUAL

FOR

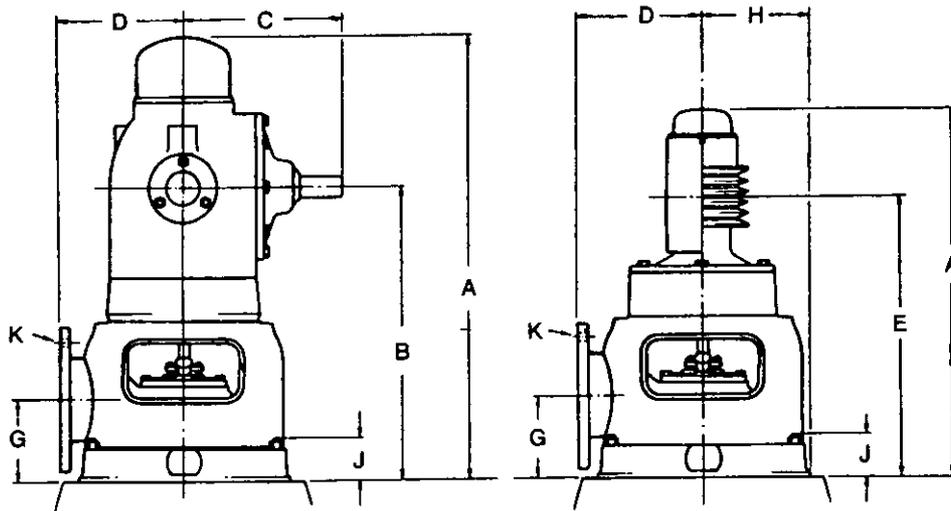
**VERTICAL
SHAFT DRIVEN**

**TURBINE
PUMPS**



IMPORTANT

The workmanship and material in Southern Cross Shaft Drive Vertical Turbine Pumps are covered by warranty, for a period of twelve months from the date of despatch, but it is emphasised that the warranty does not extend to circumstances outside the Manufacturers' control. These include: Over-pumping of bores, damage by abrasive substances in the water, corrosion due to chemical impurities in the water, and careless handling.



"General Arrangement — Drive Heads for Turbine Pumps"

DIMENSIONS OF DRIVE HEADS (Inches)

VERTICAL AND RIGHT ANGLE DRIVE HEADS:

DRIVE HEAD	A	B	C	D	E	G	H	J	K
MARK LE-C (Vertical)	25 $\frac{3}{4}$	-	-	8 $\frac{3}{4}$	19 $\frac{3}{4}$	5 $\frac{3}{4}$	-	3 $\frac{1}{2}$	SEE BELOW
MARK LF-D (Right Angle)	34 $\frac{3}{4}$	22 $\frac{1}{4}$	12 $\frac{3}{4}$	8 $\frac{3}{4}$	-	5 $\frac{3}{4}$	7 $\frac{1}{2}$	3 $\frac{1}{2}$	
MARK LF-E (Right Angle)	37 $\frac{3}{4}$	25 $\frac{1}{4}$	16	8 $\frac{3}{4}$	-	5 $\frac{3}{4}$	7 $\frac{1}{2}$	3 $\frac{1}{2}$	

K — 10 $\frac{1}{16}$ in. Diameter Flange with 8 11/16 Diam. Holes — 8 $\frac{1}{16}$ in. P.C.D.

ELECTRIC MOTOR DRIVE HEADS:

MOTOR FRAME	72	73	74	75
MOTOR DIAMETER	11 $\frac{1}{2}$ in.	12 $\frac{1}{2}$ in.	15 $\frac{1}{2}$ in.	17in.
HEIGHT OF UNIT (Concrete Base to Top of Motor)	32 $\frac{1}{4}$ in.	34 $\frac{1}{4}$ in.	38 $\frac{1}{4}$ in.	41 $\frac{1}{4}$ in.

INSTALLING INSTRUCTIONS

for

Southern Cross Shaft Drive Vertical Turbine Pumps

This Instruction Manual has been prepared to assist in the installation and operation of the Pumping Plant. It is recommended that the instructions be read carefully before attempting to install the Pump, and used as a guide throughout the installation, so that the maximum trouble-free life will be obtained from the installation.

IMPORTANT —

OVERPUMPING OF BORES

The warranty covers the failure of parts due to faulty materials or workmanship only and does not cover failure or excessive wearing of pump components or line shafting due to overpumping of the bore. **The Company will not accept any responsibility or liability for bores or pumps ruined as a result of overpumping.**

It is preferable that these pumps be installed in properly screened and developed bores. Where pumps are installed in uncased or slotted cased bores, great care should be taken to ensure that the bore is not being overpumped, as besides causing wear or other damage to the pumping unit, the bore itself will almost certainly be ruined, if solids are being discharged with the water.

Frequent or continuous pumping of sand indicates that erosion is occurring in the bore, and a cavity is being formed in the water-bearing strata. The eventual collapse of the bore is inevitable, but how long this will take to occur depends on the quantity of solids removed, and the ability of the cavity formed to remain self-supporting. Such a collapse will result in the loss of the water supply, and the possible loss of pump, piping, etc.

In properly screened and developed bores, damage to the bore by overpumping is less rapid, but damage to pump bearings and shafting will result from the intermittent supply of water to the pump inlet imposing varying tension on the line shaft, causing it to whip in the column pipe. This damage also results from overpumping in uncased and slotted cased bores.

It will be seen that overpumping can result in the following:—

Uncased and Slotted Cased Bores:

1. Collapse of the bore with resulting loss of output, if solids are frequently or continuously pumped.
2. Possible loss of pump, piping, etc., when bore collapses.
3. Wear within the pump due to whipping of the shaft.
4. Shaft wear and eventual breakage due to whipping.

Screened and Developed Bores:

1. Eventual reduction in output of bore.
2. Wear within the pump due to whipping of the shaft.
3. Shaft wear and eventual breakage due to whipping.

To guard against overpumping, the following rules should be observed:—

- (a) Do not use the pumping unit to clean out or test bores, as it is not designed for this purpose. This work should be carried out before installation by the well-borer or other competent person, using the correct type of pump and associated measuring equipment.

- (b) Determine accurately the capacity of the bore, and pumping levels, before installation so that the pump can be set at the correct pumping level in the bore.
- (c) The amount of water discharged should never exceed 80% of the rate at which the bore will deliver absolutely clear water.
- (d) Do not "overload" a bore by overpumping. If ruined, a bore is expensive to repair or replace.

CHECKING THE WELL

The well should be checked for —

- (1) **Straightness of Hole:**
The bore hole should be straight, as a crooked well can bend the Column Pipe and cause excessive vibration and rapid wear on the shaft and bearings.
- (2) **Diameter of Casing:**
The diameter of the casing should be checked to make sure that it is of sufficient diameter to allow the pump to be installed.
- (3) **Depth of Well:**
The depth of the bore should be checked before the work of installing the Pump commences. The position of the pump end in relation to the bottom of the bore can then be checked during the installation. This will also ensure that the Pump end does not rest on the bottom of the bore after installing. It is essential to allow a minimum clearance of 2 feet between the Pump Strainer and the bottom of the bore.

DEVELOPMENT OF THE WELL

Southern Cross Vertical Turbine Pumps are designed to pump clean water, but they will operate satisfactorily in conditions where there is a little sand in the bore. Pumping excessive sand will cause rapid wear on the impellers and bowls in the Pump with resultant loss of efficiency.

The development of a well is usually carried out by the well borer, but if the Pump is to be used to clean a quantity of sand from the bore, the discharge from the Pump should be reduced until the excessive sand is cleared. This procedure will not, however, guarantee that the Pump will not be badly worn during the process, and **the customer is wholly responsible for any damage caused to the Pump when used for this purpose.**

If, for any reason, a Pump is stopped while cleaning sand from a bore, care must be taken to ensure that the Pump does not become "sand locked". This condition results from sand which settles as the water level drops down the delivery column, packing the clearances between the impellers and bowls. Do not attempt to start a "locked" Pump as severe damage can result.

TO PREVENT SAND LOCKING

Immediately the pump shaft has stopped rotating, raise the impellers to their top position, and then alternately lower and raise the impellers $\frac{1}{4}$ inch by adjusting the drive shaft adjustment nut on the drive head. This will agitate the sand and water in the pump, and assist in passing the sand through the pump back into the well. If a separate supply of clear water is available, this can be flushed down the column pipe, either through the pre-lubrication tank (if fitted), or through the discharge head, and will assist in clearing sand from the pump.

If this measure fails, the Pump must be brought to the surface and cleaned, before it is operated again.

AIR OR GAS IN BORE

Air or gas in a bore can cause poor pump performance, vibration and damage. Where excessive quantities of air or gas are present, the Pump may be prevented from delivering any water at all.

THE PUMP FOUNDATION

A substantial concrete foundation of generous proportions is recommended. The stability of the foundation will guarantee a solid mounting for the Discharge Head assembly from which is suspended the Column Pipe, Pump, and Shafting. The original Pump and Shaft adjustment will be disturbed if the foundation subsides.

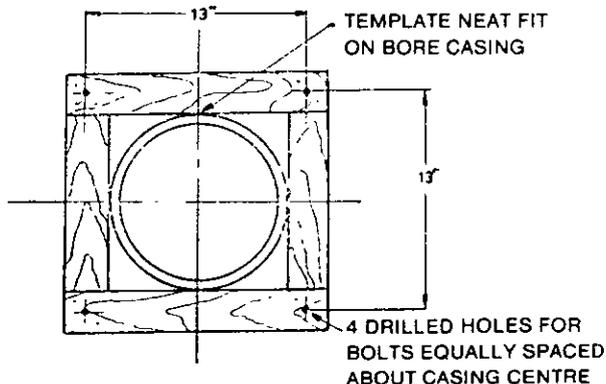
For installations incorporating direct coupling to a Right Angle Drive Head, it is preferable to make the foundation for the Pump and driving unit integral.

The sides of the concrete block should slope outwards and downwards from the top, and the depth should be sufficient to extend into the subsoil. The depth of the block and its size depend on the firmness of the earth around the bore. The effects of rain and floods should be taken into consideration when planning the foundation.

Approximately $\frac{1}{2}$ in. of the bore casing should project above the concrete foundation, which should be a minimum of 2 feet square at the top, with the bore casing located centrally.

A piece of 2 in. screwed pipe set in one corner of the foundation block and projecting not more than $1\frac{1}{2}$ in. above the top of the finished block will prove convenient for coupling on a short length of pipe for anchoring the chain wrench when making up or dismantling column pipe joints. This pipe should extend well down into the foundation, and, when not in use, the exposed end should be greased and a protecting cap fitted.

A template is required so that the foundation bolts can be accurately positioned in the foundation block, and to ensure that the column pipe and pump will be situated centrally in the bore casing. This template consists of four pieces of timber, nailed together and drilled, as shown in the illustration. The position of the drilled holes in the template may be checked for accuracy against the bolt holes in the Discharge Head Base. Foundation bolts should be arranged so that $3\frac{1}{2}$ in. of their length will project from the concrete. Make sure that the distance from the outside of each bolt to the bore casing is the same.



"Foundation Bolt Template"

The concrete for the foundation block should consist of a mixture of 4 parts of stone or rubble, 2 parts of sand, and one part of cement. Arrange some steel bars in the bottom of the foundation and throughout the block to act as reinforcement. When filling, ram the concrete well, being careful not to disturb the template or forms.

HANDLING OF PARTS

All parts should be handled with extreme care, eye bolts and lifting lugs being used where possible, and care should be taken to see that no machined surface is damaged. Eye bolts are used for lifting individual parts only and not assemblies, as the threads may fail under the added load.

Column Pipes and Shafting require special attention, as these parts are manufactured to an accurate alignment. If dropped, or sprung in any way, misalignment, poor performance, and eventual failure will result.

PREPARING PARTS FOR INSTALLING

An area around the bore should be cleared. This will allow clear working space and an area for laying out the various Pump parts, ready for installing.

A derrick is required to handle heavy components while assembling and installing in the bore.

All parts should be carefully uncrated, particular attention being given to the storing or Column Pipe and Shafting, so that it will not be bent or burred.

Note: Any damaged Column Pipe or Shafting should not be installed as it can cause trouble, and it is cheaper to replace these damaged parts during installation than to have to pull up the whole installation later.

COMPOUNDS FOR USE ON THREADS

Drive Shaft: An anti-seize compound, such as "Kopr-Kote", should be used on threads of drive shafts.

Column Pipe: Before installing each section of column pipe, remove the thread protector and thoroughly clean the threads of the column pipe and coupling. Coat the threads with the brushable bituminous compound supplied. When the section has been installed and tightened, brush around joints so that the compound fills any voids and forms a fillet.

IMPORTANT: Anti-seize compound **must not be used** on column pipe threads.

INSTALLING THE PUMP

1. Drive Shafts and Drive Shaft Couplings are screwed right-hand thread.
2. Column Pipes and Column Pipe Sockets are screwed left-hand thread.
3. All Drive Shafts are exactly the same, except the Top Drive Shaft, which can be distinguished from the others by the long length of thread and a keyway at one end.
4. A Drive Shaft Bearing Housing is not fitted at the top of the total assembled Column Pipe. Two short lengths of Column Pipe are supplied and, with a Drive Shaft Bearing Assembly, are always fitted at the top of the Column Pipe.
5. If an Air Line Gauge is to be installed, the Air Line Pipe should be attached to the Column Pipe as it is being assembled. The bottom of the Air Line Pipe starts 2 feet above the top of the Strainer, and the Air Line Pipe is taped with approved tape to the Column Pipe every 5 feet at the Column Pipe Couplings. Compression fittings ($\frac{1}{4}$ in. x $\frac{1}{4}$ in. double) are used for joining the Air Line sections and must be positioned, so that they are not adjacent to the Column Pipe Couplings. (See Section, "Installation and Operation of Air Line Gauge", Page 5).

Place timber or equivalent supports around the Bore Casing, to act as supports for the pipe clamps.

The pump should be handled carefully to prevent damage to the coating on the pump, and it should not be unpacked until it is ready to be placed in the bore.

The packing case is used as a cradle to support the pump while it is being raised on the derrick.

To unpack the pump:—

- (a) Remove the lid from the case.
- (b) Saw off the section of case, as indicated by the marking on the outside of the case.
- (c) Wrap sacking around the end of the pump and fasten a pipe clamp securely around the sacking. Attach a sling to the pipe clamp and raise the pump to the vertical position.
- (d) Remove the remainder of the packing from the pump. Lower the pump into the bore casing, so that the pipe clamp rests on the support timbers. The sling can then be removed.

INSTALLING COLUMN PIPE AND SHAFTING

NOTE: One special length of column pipe is unpainted and has a groove in the thread at one end. This end must be fitted to the outlet of the pump and caulked with a bituminous compound when installing the column pipe and shafting. The section must not be painted — it will have a longer life if it remains unpainted.

Assemble lengths of column pipe and shafting with a drive shaft bearing as shown in the illustration, "10 Foot Length of Column Pipe Assembled", below.

Screw the pump shaft to drive shaft coupling, which is included with the discharge head packing gland, onto the pump shaft by hand, and then tighten.

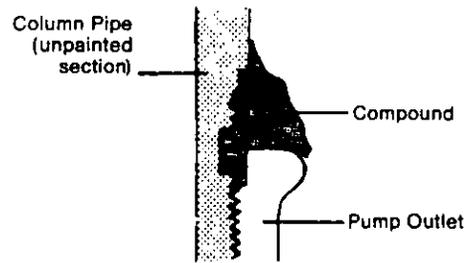
Screw a drive shaft coupling, by hand, onto the top end of the shaft of the assembled 5ft. or 10ft. section of column pipe and shafting.

CAUTION: When raising column pipe and shafting together for guiding into position over the bore, the lower end of the shafting must be held firmly, to prevent it from slipping through the bearing and causing damage to threads.

To install the lengths of column pipe, proceed as follows:—

- (a) The first length of assembled column pipe to be installed is the one which includes the unpainted section. Place a pipe clamp around the column pipe, just below the top coupling, and into this coupling screw the column pipe lowering tool.
- (b) Raise the column pipe assembly until the bottom end of the unpainted section of column pipe is just above the pump, and the drive shaft rests gently on the drive shaft coupling.
- (c) Make sure the threads and faces on the ends of the drive shafts are clean, and apply a coating of anti-seize compound to the threads. Screw the shaft into the coupling on the pump by hand and then tighten.
- (d) Coat the thread on the lower end of the column pipe assembly with bituminous compound. Lower the column pipe gently and screw it into the pump outlet. The erector should be careful to start the thread squarely by hand, the final tightening being done with chain wrenches. Wrap sacking around the pump where it is to be gripped, to prevent damage to the coating on the pump.

- (e) When the column pipe has been screwed into the pump, caulk the joint using bituminous compound. Work the compound well down into the groove formed by the pump outlet and the column pipe, completely covering the thread. Refer illustration, "Joint Between Pump and Column Pipe", below.



"Joint Between Pump and Column Pipe"

- (f) Take the weight of the pump and column pipe on the derrick and remove the pipe clamp and sacking from the pump. Lower the pump and column pipe until the top pipe clamp rests on the support timbers.
- (g) Unscrew the lowering tool from the column pipe coupling.
- (h) Adjust the column pipe coupling on the top of the column pipe, so that the distance from the top end of the column pipe to the top of the coupling is as shown in illustration, "10 Foot Lengths of Column Pipe Assembled", below.
- (i) Place a drive shaft bearing assembly over the drive shaft, with the circlip to the top, and assemble it into the column pipe coupling.
- (j) Screw the drive shaft coupling onto the drive shaft.

The remaining lengths of column pipe are installed by repeating the above procedure. Drive shafts should tighten together in the middle of the coupling.

INSTALLATION OF DISCHARGE HEAD

When all of the 10ft. lengths of Column Pipe have been installed in the bore, the assembly of the Discharge Head can be proceeded with.

Screw the top section of Drive Shaft into the Drive Shaft Coupling of the assembled Column Pipe and Shafting, so that the long threaded end with the keyway is to the top. Tighten the Shaft Coupling securely.

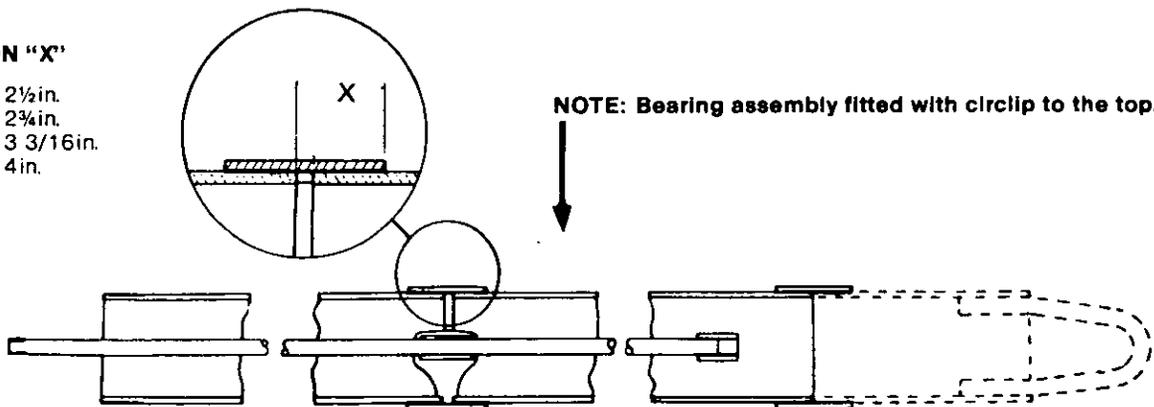
Separate the two short lengths of Column Pipe supplied and screw the length with the Coupling into the Coupling of the assembled Column Pipe, in the bore. Tighten the Column Pipe to clamp the Drive Shaft Bearing Assembly.

Place a Drive Shaft Bearing Assembly over the Drive Shaft, with the circlip to the top, and assemble it into the Column Pipe Coupling.

Screw the remaining short length of Column Pipe into the Discharge Head Base and tighten securely.

DIMENSION "X"

- 3in. Pipe — 2½in.
- 4in. Pipe — 2¾in.
- 5in. Pipe — 3 3/16in.
- 6in. Pipe — 4in.



10 Foot Length of Column Pipe Assembled.

Screw the six 2 1/4 in. x 5/8 in. studs, (Packed in the hessian bag), into the bottom of the Discharge Head and tighten the studs securely.

Fit the Discharge Head to Base Gasket. The Discharge Head can now be attached to the Discharge Head Base, making sure that the flange locates properly in the spigot. Spring washers are fitted under the nuts and the nuts tightened.

The complete Discharge Head Assembly is slung by the cast trunnions on the side of the Discharge Head Base and lowered over the Column Pipe in the bore. Connect the Column Pipes and tighten.

Note: Where an Air Line Gauge is to be fitted, the assembly of all fittings and connections on the underside of the Discharge Head Base will have to be done before lowering the Discharge Head Assembly on to the foundation. (See "Installation and Operation of Air Line Gauge", Page 5). Where an Air Line Gauge is not fitted the connection hole in the Discharge Head Base is plugged with the plug provided.

Take the weight of the Discharge Head Assembly and Column Pipes on the derrick, and remove the pipe clamp. The complete Assembly is lowered until the bottom of the Discharge Head Base is just above the top of the Foundation Bolts, and guided over the Foundation Bolts until they just protrude through the Discharge Head Base.

Check to see that the Column Pipe is hanging centrally in the bore casing, and place the four levelling wedges supplied, one under the middle of each side of the Discharge Head Base. Lower the Assembly to sit on the wedges. The wedges are used to centralise the Drive Shaft in the Shaft Packing Gland Body hole, by driving them under the side to be raised. This is the only method of obtaining accurate alignment, and must be done carefully.

Accurate alignment can be checked by placing the Driving Head or bearing housing assembly on top of the Discharge Head. There is only a small clearance between the hollow shaft spindle of the Driving Head and the Drive Shaft, and if the Drive Shaft has a tendency to be off centre in the Driving Head, the wedges must be further adjusted to obtain the correct alignment.

The Packing Gland can now be fitted.

TO FIT THE PACKING GLAND

Remove the Packing Gland and Packing from the Packing Gland Body, noting the order in which the rings are fitted. Attach the Packing Gland Body to the Discharge Head.

Re-assemble the Packing Rings around the Drive Shaft, pressing them in squarely, one at a time, in the order in which they were originally fitted. The Gland is used for pushing the rings into position. All joints in the packings should be staggered around the shaft. Place the Shaft Packing Gland in position on the studs, fit spring washers and nuts on the studs, but do not tighten nuts.

The Rubber Water Slinger is pressed into place on the Drive Shaft, just above the Packing Gland.

REFER NOW TO INSTRUCTIONS FOR INSTALLING DRIVING HEADS — PAGE 6.

After fitting the Driving Head, the Discharge Head Assembly can be grouted to the foundation. To do this, construct a wooden frame around the foundation, the top of the frame reaching up to 1/2 in. above the bottom of the Discharge Head Base.

A mixture of 2 parts of fine sand and one part of cement should be used for the grouting. The levelling wedges are not removed, but are grouted in position with the mixture. Allow the grouting to set for at least 48 hours before tightening down the foundation bolt nuts. One plain washer and one spring washer is fitted under each foundation bolt nut.

When the Discharge Pipe is installed, it must be supported so that no strain is transmitted to the Discharge Head, causing misalignment and possible injury to the Pump Unit.

ADJUSTMENT OF PUMP

It is important that the adjusting nut on the drive shaft should be carefully adjusted before starting pump, to give the impellers the correct running clearance. To do this, screw the adjustment nut down on the drive shaft, about a third of a turn at a time. After each tightening, rotate the drive shaft by spinning the pulley (vertical belt drive head), gearwheel shaft (right-angle drive head), or rotor (electric motor drive head). Adjustment should only be continued till the drive shaft cannot be spun freely. This will indicate that the impellers are at the top of their adjustment. To provide running clearance, the adjustment nut is unscrewed **one turn**, and locked in this position, with the round head screw provided, through one of the three holes in the adjustment nut.

Failure to adjust the impeller clearance correctly may cause the pump shaft to be stretched, or pulled through the impellers, causing the impellers to bind in the stage casings.

INSTALLATION AND OPERATION OF THE PRE-LUBRICATION TANK

The Pump and Drive Shaft Bearings are lubricated by the water being pumped and, in installations where the distance from the static water level to the Discharge Head is greater than 50 feet, provision must be made to pre-lubricate the bearings by means of a pre-lubrication tank, during the period it takes to raise the water in the Column Pipe.

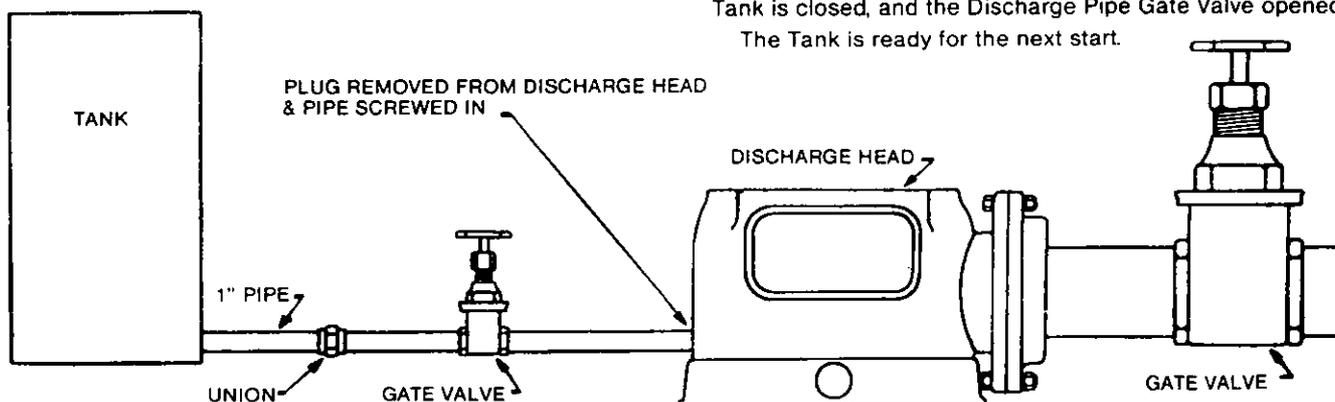
Caution: Where a pre-lubrication tank is fitted, never start the Pump without pre-lubrication of the bearings. One start without pre-lubrication, irrespective of the interval between starts, may be sufficient to burn out the rubber bearings.

The pre-lubrication tank should be set up so that water from the tank will gravity-feed back into the Discharge Head by means of a Pipe, connected into the Discharge Head. This Connection is made on the opposite side of the Discharge Head to the Discharge Pipe Flange. A Gate Valve is fitted in the Connecting Pipe.

For the initial start, the tank is filled with water and the Gate Valve in the Connecting Pipe opened, to allow 75% of the water in the tank to drain into the Discharge Head. The Pump may then be started.

After the Pump has started to pump, the tank will refill with water. In installations where there is insufficient pressure in the Discharge Head to fill the Tank a Gate Valve will be required in the Discharge Pipe to restrict the flow from the Pump, until the Tank is filled. The Gate Valve in the line to the Tank is closed, and the Discharge Pipe Gate Valve opened.

The Tank is ready for the next start.



"Pre-Lubrication Tank Installation"

INSTALLATION AND OPERATION OF THE AIR LINE GAUGE

If accurate "Standing" or "Static" water level readings or "Pumping Level" and "Draw-down" readings are required, an Air Line Gauge is installed. See "Installing the Pump", Section 5, Page 2.

"Standing" or "Static" water level readings should be taken when the Pump has been stopped for a sufficient period to allow the well water conditions to return to normal.

"Pumping level" and "Draw-down" readings are taken after the Pump has been operating against normal head for a sufficient period of time for the water level to remain stationary.

When the Column Pipe and Discharge Head are assembled, and before they are lowered into the bore, the connections for the Air Line Gauge through the Discharge Head Base must be made.

Remove the plug from the discharge head base and pass the end of the air line pipe through the hole. On the bottom side of the base, the air line pipe is bent so that when the discharge head assembly is in position, the air line pipe will clear the top of the bore casing.

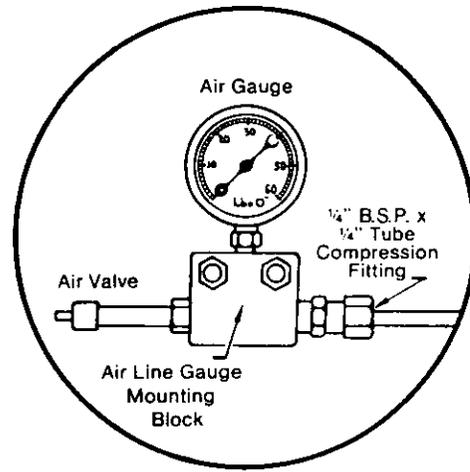
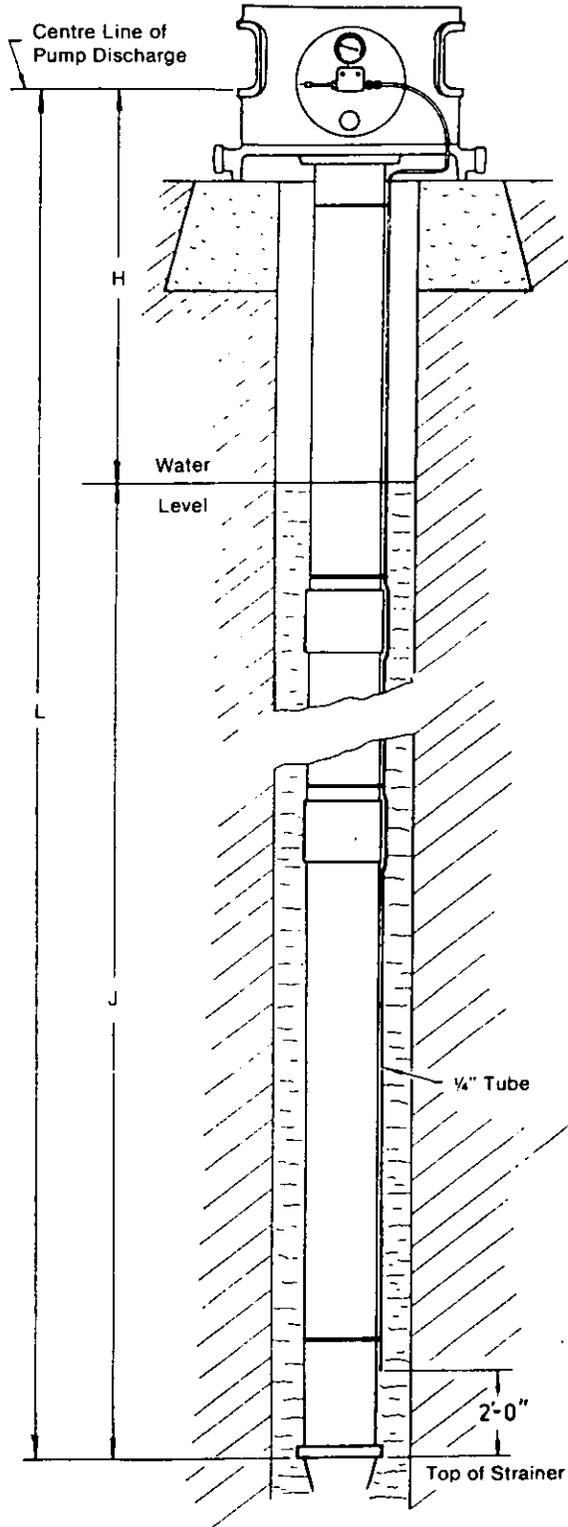
Screw the air line gauge into the mounting block, and attach the mounting block to the pad on the discharge head, with the two setscrews provided.

Fit the compression fitting connection into the air line gauge mounting block, and connect the air line pipe into the fitting. The air line charging valve is screwed into the remaining opening. All connections must be absolutely air-tight.

The discharge head assembly and column pipe can now be lowered into position.

To operate the Air Line Gauge to estimate the distance from the water level to the centre of the Discharge Head Flange, pump air into the system until the Air Pressure Gauge reads its maximum reading and stop pumping. The Gauge Pointer will return to a certain pressure reading ("P") in pounds per square inch.

To estimate the level of the water in the bore refer to the illustration "Air Line Gauge Installation", below.



Depth H (in feet) = L - 2.31 P - 2
Depth of Water, J = 2.31 P + 2
(P = Pressure Gauge Reading in lbs./square inch)

"Air Line Gauge Installation"

DRIVE HEADS

NON-REVERSE RATCHET

All Southern Cross Drive Heads are fitted with a non-reverse ratchet as standard. The function of this ratchet is to prevent the receding column of water in the column pipe from driving the pump in reverse direction when the driving unit is stopped. At deep settings, speeds of almost normal pumping speed can be attained in this manner, which can cause serious damage to the equipment through column pipe or shaft couplings unscrewing, or bearings burning out through lack of lubrication at high speed.

Recommendations for the use of the non-reverse ratchet are as follows:—

Electric Motor Drive Head: Non-reverse ratchet used on all installations, as the motor is free to run in reverse direction once it is switched off.

Vertical Belt Drive Head: Non-reverse ratchet used on all installations. If the drive is by power take off on engine or tractor, fitted with a clutch, the pump would reverse when the clutch is disengaged. This causes the pulley to run in the opposite direction, and the flat belt to run down the pulley. The belt is damaged by stretching and fraying where it comes in contact with the drive head. Damage to the installation from column pipe and couplings unscrewing, and burnt out bearings can also result.

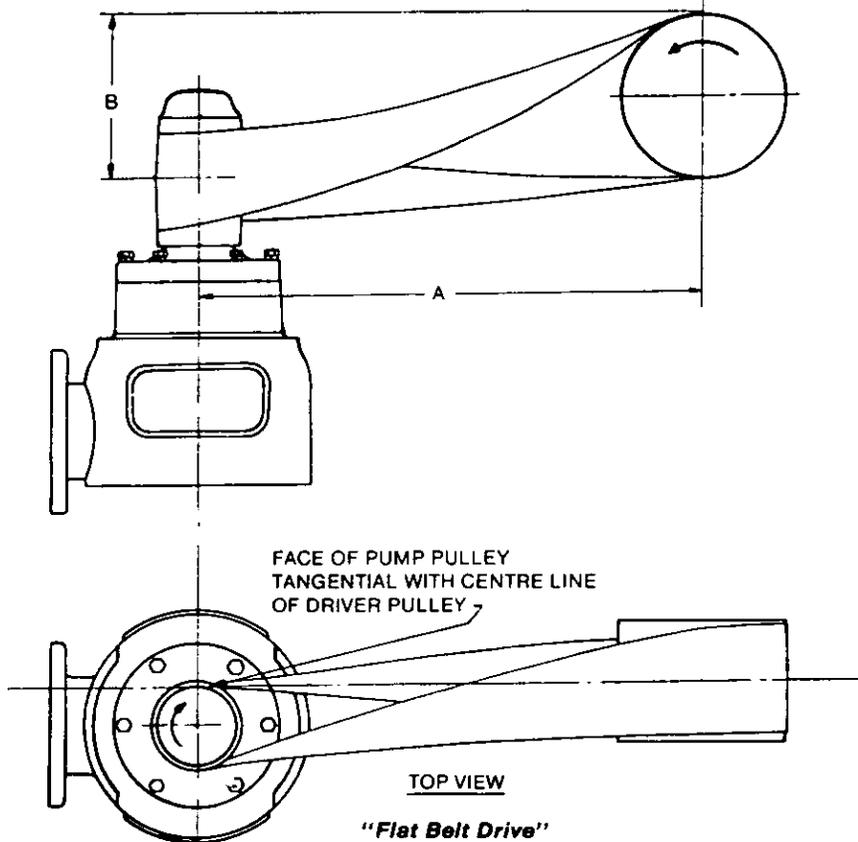
Right Angle Drive Head: Non-reverse ratchet required when installation driven by engine with clutch. When engine drive has no clutch, the ratchet should be made inoperative by removing the four ratchet plungers from the Drive Head. Some engines kick back when stopping, causing excessive shock load which can break the ratchet plungers and cause damage to the drive head.

An engine driven installation which has a clutch for starting purposes only, and which will be stopped automatically or by remote control, must have the non-reverse ratchet made inoperative by removing the four ratchet plungers. In this installation the clutch must not be disengaged until the column pipe has been allowed to drain.

INSTALLATION OF VERTICAL BELT DRIVE HEAD

To instal the Vertical Belt Drive Head, proceed as follows:—

1. Place the Drive Head on the Discharge Head and attach it with the Setscrews and Spring Washers provided. If the Drive Shaft protruding through the head has a tendency to be off centre, the levelling wedges will have to be adjusted.
2. Unscrew the Pulley Retaining Nut from the hollow shaft, and remove the felt and steel protecting washers.
3. Fit the Pulley on to the hollow shaft, so that the side of the pulley with the eight drilled holes faces upwards. Make sure the Hollow Shaft Drive Key is fitted in the Hollow Shaft before assembling the Pulley on to the Shaft.
4. Screw on the Pulley Retaining Nut and tighten securely. To tighten the nut, a ½ in. tommy bar is inserted in the hole in the pulley, and the slogging spanner supplied with the drive head placed in the pulley, so the hexagon section locates over the nut. By hammering against the lugs on the spanner, drive the nut down hard against the pulley. Lock the grub screws in the retaining nut firmly on to the pulley.
5. Place the four non-reverse plungers through the holes in the pulley, to rest on the ratchet section of the Bearing Housing.
6. Sit the drive shaft flange in the pulley, and line up the untapped holes in the flange with the two tapped holes in the pulley. Place spring washers onto socket head setscrews and fit these through the holes and tighten setscrews securely, pulling the flange down onto the pulley. (The tapped holes in the flange are only used when disassembling drive head. To lift out flange, unscrew socket head setscrews and screw them into the tapped holes in the flange. Screwing the setscrews in will jack the flange out of the pulley).
7. Rotate the Pulley until the keyway in the Drive Shaft Flange lines up with the keyway in the Drive Shaft.
8. Insert the Key until the finger on it rests firmly in the recess in the top of the Coupling.



To allow for belt sag, raise the centre of the face of the Driving Pulley ¾ in. for each foot of centre to centre distance, as shown at "B". For example: If the centre distance "A" is 12 feet, then the dimension "B" will be 9 inches.

9. Screw the adjusting nut on to the Drive Shaft.
10. Position the Impellers. The positioning of the Impellers is important, as, if this is not correctly carried out, the performance of the Pump will be affected.
 - (a) Screw up the adjusting nut on the Drive Shaft until the Impellers lock on the top of the Pump Stages. This will be indicated when the Drive Shaft cannot be rotated.
 - (b) Unscrew the adjusting nut **one turn** and lock it in position, with the round head screw provided through one of the three holes in the adjusting nut.
11. A certain amount of Shaft will protrude through the top of the Nut, and any length over 1/2 in. above the nut should be cut off.
12. Replace the cover and tighten the Locking Screws.
13. Remove the Plug from the Oil Filler Cup and fill the Drive Head to the top with S.A.E. 20 Oil.
14. Adjust the Packing Gland with the pump operating, slowly screwing down the Shaft Packing Gland until it just leaks slightly. Do not tighten until no water flows, as the packing will not be lubricated and will wear quickly.
15. With the pump operating, introduce sufficient Southern Cross Grease through the grease nipple in the packing gland body to completely fill the packing gland. Introduce a small quantity of grease each day of running to refill the packing gland.

BELT DRIVES FOR VERTICAL BELT DRIVE HEADS

As the Vertical Belt Drive Head will, in most cases, be driven by a horizontal electric motor or engine with a quarter twist belt drive, the following data is set out to help in installing the driving unit correctly:—

Flat Belt Specifications

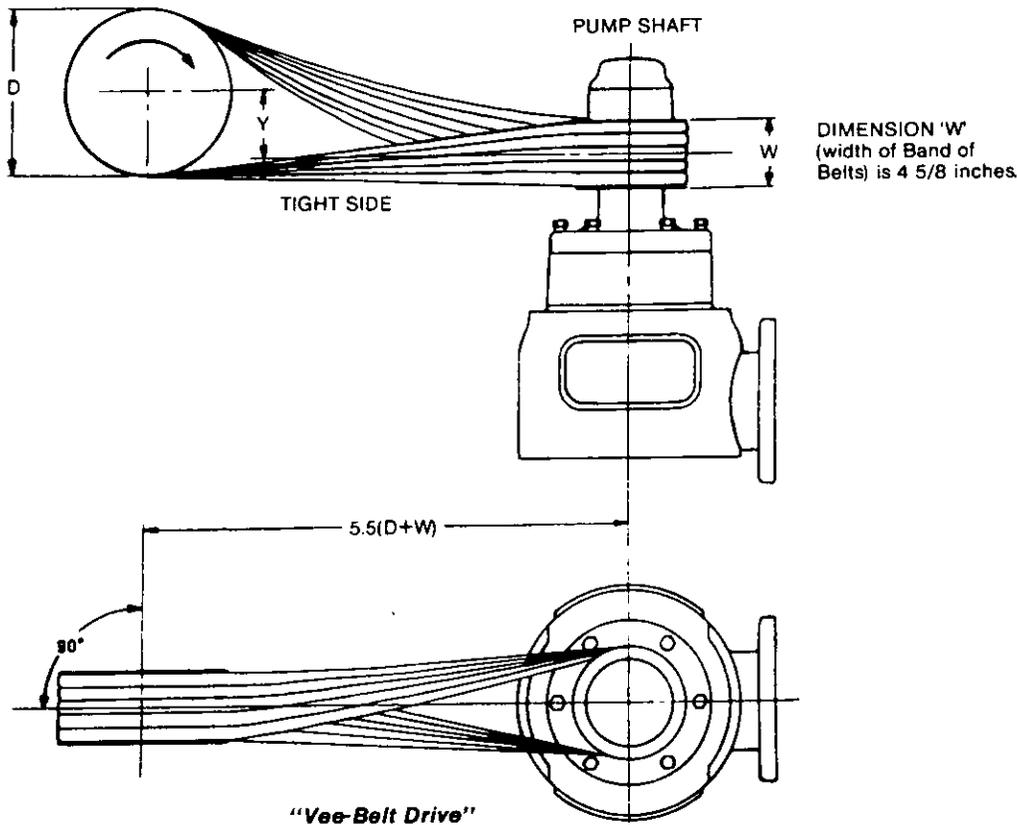
H.P.	Leather Belts		Rubber Belts		Min. Centre Distance "A"	
	Width	Ply	Width	Ply	Motor Drive	Engine Drive
10	4in.	1	5in.	3	10ft	15ft.
15	5in.	2	5in.	4	12ft	18ft.
20	6in.	2	6in.	4	14ft	22ft.
30	8in.	2	8in.	5	16ft	25ft.
50	10in.	2	10in.	5	18ft	30ft.

VEE-BELT DRIVES

1. **Minimum Centre Distance:** On these types of drives a belt length should be chosen which will give a minimum centre distance of 5.5 (D plus W). Where "D" is the diameter of the large pulley and "W" is the width of the band of belts.
2. **Direction of Rotation:** The rotation must be such that the tight side of the drive will be on the bottom. Set the horizontal driver (motor or engine) so that the bottom of the driver pulley moves away from the driven vertical shaft. Place belt on the vertical shaft to get the rotation needed.
3. **Aligning the Driver:** Looking down on the drive, a line from the centre of the vertical shaft should pass through the centre of the face of the pulley on the horizontal shaft, and the horizontal shaft should be at right angles to this line. Looking at the side of the drive, the centre of the horizontal shaft should be raised a distance "Y" above a level line through the centre of the face of the pulley on the vertical shaft.

Centre Dist. Inches.	Dimension "Y".	Centre Dist. Inches.	Dimension "Y".
60	5/16in.	160	2 1/4in.
80	1/2in.	180	2 7/8in.
100	7/8in.	200	3 1/2in.
120	1 1/4in.	220	4in.
140	1 3/4in.	240	5in.

4. **Adjusting the Tension:** Be sure that the belts are snug before you start to drive. Adjust the tension so that, when the drive is running, the middle belt on the slack side of the drive will not fall below its groove in the pulley on the vertical shaft. The driver (electric motor or engine) should be mounted on slide rails on a substantial concrete block so positioned that the drive will be in accordance with the above data. The slide rails allow the belt tension to be adjusted initially and also to take up any slack that may take place after the pump has been in use for some time. Check the direction of rotation by turning the unit over by hand to make sure the pump runs in the direction indicated by the arrows on the discharge head.



INSTALLATION OF RIGHT ANGLE DRIVE HEAD

When unpacking or handling the drive head, be extremely careful not to damage the two Oil Cooler Pipes protruding from the Oil Cooler Body, in the base of the Drive Head. Any constriction of the Oil Cooler Pipes, due to damage, can prevent efficient cooling, with resultant overheating of the Drive Head.

To install Right Angle Drive Head:—

1. Remove the cover from the top of the Drive Head by removing the Setscrews.
2. Undo the eight nuts around the Oil Cooler Body, in the base of the Drive Head, and slide out the Oil Cooler Body, complete with the Oil Retaining Sleeve.
3. Remove the ¼ inch B.S.P. plug which is fitted in the Packing Gland Body in the Discharge Head, and fit the Oil Cooling Tube Connection and fibre washer in the Packing Gland Body. Position the Packing Gland Body so that the Grease Lubricator points away from the discharge.
4. Set the Drive Head on the Discharge Head, so that the Gearwheel Shaft points in the direction convenient for driving, and the four mounting holes in the Drive Head line up with four of the stud holes in the Discharge Head.
5. Scribe a line from one of the four mounting holes down the side of the Drive Head, and out across the face of the Discharge Head.
6. Lift off the Drive Head and screw the four mounting studs into the Discharge Head, commencing with the marked hole, and placing studs in the alternate holes. Drive the studs in securely, using two nuts, locked together on each stud.
7. Carefully place the Oil Cooler Body in the Discharge Head, so that the Oil Cooler Inlet Tube locates in the Oil Cooler Tube Connection in the Packing Gland Body. Scribe a line from the line on the Discharge Head on to the Oil Cooler Body.
8. Re-assemble the Oil Cooler Body to the Drive Head, so that these two scribed lines coincide.
9. Place the Drive Head on to the Discharge Head, guiding the Oil Cooler Inlet Pipe into the Oil Cooling Tube Connection on the Packing Gland Body. This must be done very carefully to avoid damage to the Copper Tubes.
10. Connect the Oil Cooler Tube. To do this, attach the inlet end of the Oil Cooler Tube to the Oil Cooler Tube Connection in the Shaft Packing Gland Body by means of the Compression Fitting. The outlet end remains open and the water allowed to run to waste. Attach the Drive Head to the Discharge Head.
11. Fit the pinion shaft to drive shaft coupling key in position in the pinion shaft. Place the four non-reverse ratchet plungers in the pinion shaft to drive shaft coupling. Fit the pinion shaft to drive shaft coupling to the pinion shaft.
12. Rotate the coupling until the keyway in it lines up with the keyway in the Pump Shaft.
13. Insert the Key until the finger on it rests firmly in the recess in the top of the coupling.
14. Screw the adjusting nut on to the Drive Shaft.
15. Position the Impellers. The positioning of the Impellers is important, as, if this is not correctly carried out, the performance of the Pump will be affected.
 - (a) Screw up the adjusting nut on the Drive Shaft until the Impellers lock on the top of the Pump Stages. This will be indicated when the Drive Shaft cannot be rotated.
 - (b) Unscrew the adjusting nut **one turn**, and lock it in position, with the round head screw provided, through one of the three holes in the adjusting nut.
16. A certain amount of Shaft will protrude through the top of the Nut, and any length over ½ in. above the nut should be cut off.
17. Replace the cover and tighten the Locking Screws.
18. Remove the Oil Filler Cup Plug and fill the Drive Head with Southern Cross S.A.E. E.P. 90 Gear Oil up to the level at the top of the Cup, and replace the Plug.
19. Adjust the Shaft Packing Gland with the Pump operating, slowly screwing down the Shaft Packing Gland until it just leaks slightly. Do not tighten until no water flows, as the packing will not be lubricated and will wear quickly.

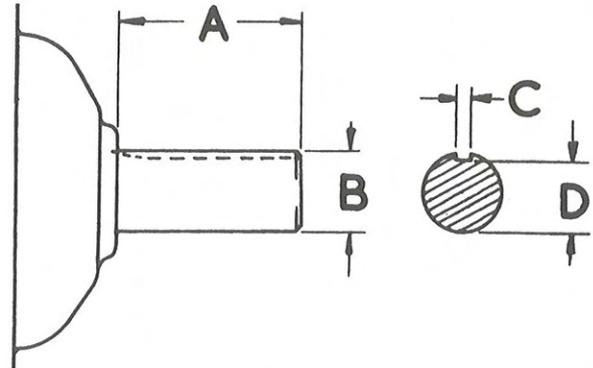
20. With the pump operating, introduce sufficient Southern Cross Grease through the grease nipple in the packing gland body to completely fill the packing gland. Introduce a small quantity of grease each day of running to refill the packing gland.

Caution: The Gears in the Right Angle Drive Head have been adjusted at the Factory. If it is ever necessary to dismantle the drive head, have it adjusted correctly in the same manner as an automotive crown wheel and pinion. Greatly reduced life and noisy operation will result from improper adjustment.

BELT DRIVE

If this head is to be belt driven, the driver should be mounted on a concrete block, and in such a position that the driven pulley will rotate in a clock-wise direction when viewed from the front.

It is advisable to mount the driver on slide rails so that adjustments can be made to the belt tension from time to time.



	MARK LF-C	MARK LF-D	MARK LF-E
A	2 15/16 in.	3 15/16 in.	4 ¼ in.
B	1.500 in. 1.499 in.	1.750 in. 1.749 in.	2.000 in. 1.999 in.
C	.375 in. .377 in.	.499 in. .500 in.	.499 in. .500 in.
D	1.348 in. 1.343 in.	1.560 in. 1.554 in.	1.812 in. 1.807 in.

Dimensions of Shafts for Right Angle Drive Heads

DIRECT COUPLING

If this head is to be direct coupled to the driver by means of a flexible coupling it is advisable that the driver base and pump base be one large reinforced concrete block so that correct alignment between the two will be maintained. Care must be taken in setting up so that the misalignment between the two is an absolute minimum. By doing this, vibration will be eliminated, excessive wear on coupling, driver and drive head will be eliminated also.

FLEXIBLE SHAFT DRIVE

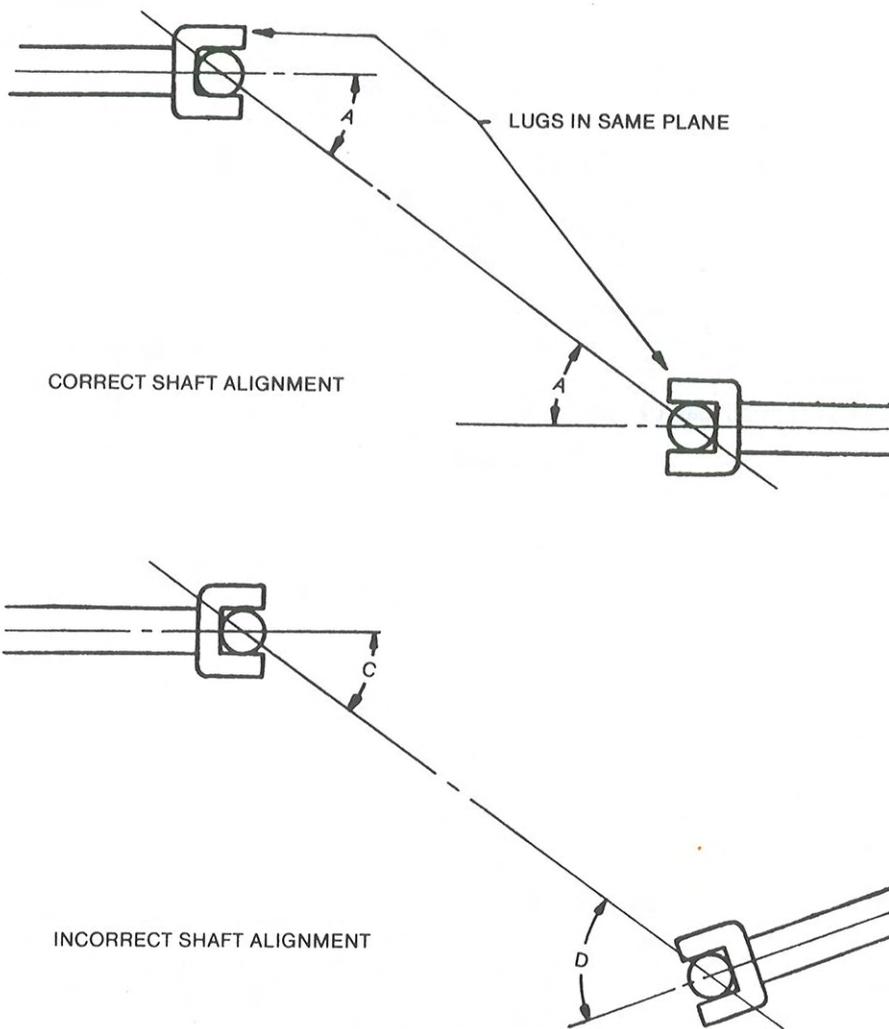
If a flexible drive shaft is used to connect the Drive Head to the driver, a flexible shaft for the required horsepower and duty should be used.

Regular lubrication should be applied to the parts provided with grease nipples on the shaft.

Installation of flexible shaft drives is simple, provided the following points are follows:—

The foundation should be solid and preferably integral with the pump base and reinforced throughout, so that misalignment over a period of time is cut to a minimum and vibration reduced.

2. The shafts to be connected need not line up axially, but should be parallel to one another within one or two degrees. For longest life, offset the driving and driven shafts so that the shafts operate at an angularity of from 1½ to 8 degrees. This permits bearings to roll, distributing the load over their entire area.
3. Keep the lugs on the flange yokes in the same plane as shown. Shafts are usually assembled correctly at the Factory, but if a spline joint has been removed, be sure it is reassembled correctly.



"Flexible Shaft Drive"

CORRECT SHAFT ALIGNMENT

The driving and driven shafts are parallel, making angles "A" equal. Lugs are in the same plane. The shorter the shaft, the more accurate must be the installation.

INCORRECT SHAFT ALIGNMENT

Arrangement not satisfactory. Driving and driven shafts are not parallel. Angles "C" and "D" not equal making unequal acceleration in the joints and causing vibration.

Check the direction of rotation by turning the unit over by hand to make sure the pump runs in the direction indicated by the arrow on the Discharge Head.

INSTALLATION OF ELECTRIC MOTOR DRIVE HEAD — HOLLOW SHAFT MOTOR

The Electric Motor Drive Head is completely assembled when it leaves the Factory.

1. Remove the cover from the top of the hollow shaft electric motor by removing cover setscrews from the electric motor.
2. Place the Electric Motor on the Discharge Head. If the Drive Shaft protruding through the motor has a tendency to be off centre, the levelling wedges will have to be readjusted.
3. Attach the motor to the Discharge Head with the setscrews and spring washers provided.
4. Rotate the motor by hand until the keyway in the coupling lines up with the keyway in the Drive Shaft.
5. Insert the Key until the finger on it rests firmly in the recess in the top of the coupling.
6. Screw the adjusting nut on to the Drive Shaft.
7. Position the Impellers. The positioning of the Impellers is important, as, if this is not correctly carried out, the performance of the Pump will be affected.

- (a) Screw up the adjusting nut on the Drive Shaft until the Impellers lock on the top of the Pump Stages. This will be indicated when the Drive Shaft cannot be rotated.
- (b) Unscrew the adjusting nut **one turn**, and lock it in one of the 4 tapped holes in the coupling by means of the round headed screw provided.

8. A certain amount of Shaft will protrude through the top of the Nut and any length over ½ in. above the Nut should be cut off.
9. Replace the cover and tighten the cover setscrews.
10. The bearings of the motor are grease packed and require no initial lubrication.
11. Adjust the Shaft Packing Gland with the Pump operating, slowly screwing down the Shaft Packing Gland until it just leaks slightly. Do not tighten until no water flows, as the Packing will not be lubricated and will wear quickly.
12. With the pump operating, introduce sufficient Southern Cross Grease through the grease nipple in the packing gland to completely fill the packing gland. Introduce a small quantity of grease each day of running to refill the packing gland.

Note: All wiring will have to be done by a qualified electrician and approved by the local Electricity Supply Authority.

DIRECTION OF ROTATION

The direction of rotation is as indicated on the discharge head, and if the rotation is not correct, the non-reverse ratchet in the bearing housing will prevent the motor from starting. When the motor is switched on, an audible 'buzz' will indicate that the direction of rotation is incorrect. The electrician should immediately switch off the motor and reverse the direction of rotation by inter changing any two of the phase leads.

INSTALLATION OF ELECTRIC MOTOR DRIVE HEAD – SOLID SHAFT MOTOR

Screw the eight 1 3/4 in. x 1/2 in. studs into the top of the discharge head and tighten them. Lock two nuts together on each stud, in turn, and tighten studs by using a spanner on the top nut. Unlock the nuts and screw them off.

With the packing gland removed from the discharge head, check alignment of the shaft in the drive head bearing housing, by fitting the bearing housing assembly onto the studs in the discharge head and observing the position of the drive shaft in the hole at top of the flexible coupling driven half. If the drive shaft is off-centre in the flexible coupling driven half, wedges fitted under the discharge head base must be further adjusted to obtain the correct alignment.

Remove the bearing housing from the discharge head and fit the packing gland body and packing gland, as shown on page 4.

Lower the drive head bearing housing, onto the studs in the discharge head, fit spring washers and nuts and tighten nuts securely.

Fit the drive shaft adaptor to the flexible coupling driven half and attach it by means of the three 7/8 in. x 5/16 in. setscrews, fitting spring washers under the heads of the setscrews. Tighten setscrews securely.

Turn the flexible coupling driven half so keyways in the drive shaft adaptor and the drive shaft are in line. Push the key into the keyways, so the dowel in the end of the key is located in the recess in the top of the drive shaft adaptor and the end of the key is below the top face of the drive shaft adaptor.

Screw the shaft adjustment nut onto the drive shaft.

Position the impellers in the pump. The positioning of the impeller is important because, if this is not correctly carried out, the performance of the pump will be affected.

- (a) Screw up the adjustment nut on the drive shaft until the impellers lock on the top of the pump stages. This will be indicated when the drive shaft cannot be rotated.
- (b) Unscrew the adjustment nut **one turn**, and lock it by lining up the next hole through the adjustment nut with the tapped hole in the drive shaft adaptor and fitting the round headed screw through the nut.

A certain amount of shaft will protrude through the top of the nut, and any length over 3/4 in. above the nut must be cut off. Place rags around the shaft while sawing off the shaft to catch any filings.

Fit the two non-reverse ratchet plungers into the holes in the flexible coupling driven half.

Attach the motor mounting plate to the shaft end of the motor, using bolts supplied, as shown below. Motor mounting plates are not used with 7 1/2 H.P. and 10 H.P. motors, as the motors bolt directly onto the bearing housing of the drive head.

For 4 H.P. and 5 1/2 H.P. Motors (180mm Spigot) use 1 inch x 1/2 inch bolts, without nuts, fitting spring washers under the heads of the bolts.

For 15 H.P., 20 H.P., 25 H.P. and 30 H.P. TEFC Motors (250mm Spigot), use 2 inch x 5/8 inch bolts, without nuts, fitting spring washers under the heads of the bolts. (1 1/2 in. x 3/8 in. bolts supplied are for use with 20 H.P. TEFC McColl Motors only).

For 40 H.P. and 50 H.P. TEFC Motors and 15 H.P., 20 H.P., 25 H.P., 30 H.P., 40 H.P. and 50 H.P. Drip Proof Motors (300mm Spigot), use 2 1/4 inch x 3/8 inch bolts, with nuts, fitting spring washers under the nuts.

Fit the key to the motor shaft and push the flexible coupling driving half on as far as the shoulder on the motor shaft. Tighten locking screws lightly down onto the key and then tighten the remaining locking screw lightly to hold the flexible coupling driving half in position on the motor shaft.

Lift the motor into position on the bearing housing. Bolt the motor or motor mounting plate to the bearing housing, using 2 inch x 1/2 inch bolts and nuts, and fitting spring washers under the nuts.

Make sure there is clearance between the faces of the driving half and driven half of the flexible coupling. This clearance should not exceed 1/16 inch (1.5mm). Adjust clearance if necessary and tighten locking screws securely onto the coupling driving half key. Tighten remaining locking screws securely.

Place a flat washer on each flexible coupling bush bolt, then a rubber bush and then another flat washer. Smear the rubber bushes with soft soap, hydraulic brake fluid, household detergent or rubber grease.

Fit the bolts and bushes into the coupling so there is one flat washer below and another flat washer above each bush. Put on spring washers and screw on the nuts by hand.

To maintain the alignment of the flexible coupling, the four bolts must be tightened evenly a little at a time, until they are all fully tightened. This gradual tightening of the four bolts in turn is important. **DO NOT FULLY TIGHTEN BOLTS INDIVIDUALLY.**

Introduce grease into the thrust bearing through the grease nipple inside the bearing housing. The bearings in the motor are grease packed and require no initial lubrication.

Adjust the shaft packing gland with the pump operating, slowly screwing down the shaft packing gland until it just leaks slightly. Do not tighten until no water flows, as the packing will not be lubricated and will wear quickly.

With the pump operating, introduce sufficient Southern Cross grease through the grease nipple in the packing gland body to completely fill the packing gland. Introduce a small quantity of grease each day of running to refill the packing gland.

NOTE: All wiring will have to be done by a qualified electrician and approved by the local Electricity Supply Authority.

DIRECTION OF ROTATION

The direction of rotation is as indicated on the discharge head, and if the rotation is not correct, the non-reverse ratchet in the bearing housing will prevent the motor from starting. When the motor is switched on, an audible 'buzz' will indicate that the direction of rotation is incorrect. The electrician should immediately switch off the motor and reverse the direction of rotation by inter changing any two of the phase leads.

LUBRICATION

For safe and efficient operation, lubrication of the various parts of the installation should be carried out as follows:—

Vertical Belt Drive Head.

Each year or 2000 hours' running:

- (a) Remove drain plug and filler plug from the oil filler cup, and allow oil to drain.
- (b) Replace drain plug and fill drive head with S.A.E. 20 lubrication oil, up to the top of the oil filler cup.
- (c) After a few minutes, check oil level, and add oil, if necessary to bring oil level up to the top of the oil filler cup.
- (d) Replace filler plug.

Right Angle Drive Head.

Each year or 2000 hours' running:

- (a) Remove drain plug and filler plug from the oil filler cup, and allow oil to drain.
- (b) Place a tin or a spout under the other drain plug, situated in the bottom of the oil cooler body (inside discharge head) and remove plug. Allow remaining oil to drain.
- (c) Replace drain plugs and fill drive head with Southern Cross S.A.E. E.P. 90 gear oil up to the top of the oil filler cup.
- (d) After a few minutes, check oil level, and add oil, if necessary, to bring oil level up to the top of the oil filler cup.
- (e) Replace filler plug.

Electric Motor Drive Heads — Hollow Shaft Motor.

Each 500 hours' running:

- (a) Unscrew cap from the thrust bearing lubricator, and fill the cap with Southern Cross grease.
- (b) Replace cap and screw it down one turn. One cap full of grease is sufficient for 500 hours' running, and the lubricator cap should be screwed down each day, so that the amount of grease in the cap will last 500 hours approximately.
- (c) A grease nipple is fitted for lubrication of the radial bearing. Once every 500 hours, introduce approximately one teaspoon full of Southern Cross grease to the bearing.

Electric Motor Drive Heads — Solid Shaft Motor.

Each 500 hours running, introduce a small quantity of Southern Cross grease to the thrust bearing in the bearing housing. Access to the grease nipple is through the opening in the bearing housing, after removing a weather shield. If Southern Cross grease is not available, any other suitable ball bearing grease, as recommended by a reputable Oil Company, may be used.

Bearings in the motor are packed with grease during manufacture of the motor, and required no further attention. It is recommended that if the motor is dismantled for cleaning and maintenance, bearings and bearing housings are cleaned and repacked with fresh grease.

Shaft Packing Gland (all installations).

Introduce a small quantity of Southern Cross Grease each day of running, through the grease nipple in the packing gland body, to refill the packing gland.

NOTES:

- (1) It is recommended that lubricating oil in Vertical Belt Drive Heads and Right Angle Drive Heads is changed after the installation has been operating for some time and is still warm. This will enable oil to be drained and replaced more readily.
- (2) If Southern Cross S.A.E. E.P. 90 gear oil is not available, any other S.A.E. 90 gear oil, as recommended by a reputable oil company, may be used.
- (3) If Southern Cross grease is not available, any other suitable ball bearing grease, as recommended by a reputable oil company, may be used.

MAINTENANCE

If, for any reason, the Pump is to be raised to the surface for maintenance, the following procedure will have to be adopted:—

1. **Electric Motor Drive Head with Solid Shaft Motor:** Remove weather shields, flexible coupling bushes and motor from drive head bearing housing.
Other Drive Heads: Remove cover from the top drive head.
2. Unscrew the round head Locking Screw and remove the adjusting Nut.
3. For Right Angle Drive Head only, disconnect the Oil Cooler Tubes.
4. Lift off the Drive Head.
5. Break away the grouting from the foundation and remove foundation bolt nuts.
6. Disconnect the Discharge Pipe.
7. Disconnect the Pre-lubrication Tank Connecting Pipe, if fitted.
8. Raise the Discharge Head and Column Pipe Assembly, lifting under the cast trunnions on the Discharge Head Base.
9. If an Air Line Gauge is fitted, remove the Air Line Pipe from the Compression fitting on the Air Line Gauge Mounting Block. As the Column Pipe is raised, remove tapes attaching Air Line Pipe to the Column Pipe.
10. Raise the Discharge Head Assembly and Column Pipes to a sufficient height to allow the first Column Pipe Coupling and Drive Shaft Coupling to be unscrewed. The first section to be unscrewed is 5 feet below the Discharge Head Base. Pipe clamps must be placed below Couplings when handling Column Pipes.
11. Subsequent lengths of Column Pipe are raised and unscrewed in 10ft. lengths.
12. Finally, carefully raise the Pump Unit, and attach it to timber supports.

TO DISMANTLE THE PUMP UNIT

1. Unscrew the strainer.
2. Remove the inlet. The inlet is unscrewed from the stage casing, the threads being **left-hand threads**. Chain wrenches may be used to unscrew the sections.
3. Place a piece of tube around the pump shaft, and drive the impeller sleeve from the bottom impeller. The tube should be square on the end, and a close sliding fit on the shaft, so that the ends of the impeller sleeves are not damaged while being driven out.
4. Slide off the bottom impeller and impeller sleeve.
5. Remove the next Stage Casing in the same manner as from removing the inlet.
6. Continue to remove impellers and impeller sleeves, and stage casings, until the whole pump is dismantled.
7. If bearing bushes are to be renewed, spring retaining circlips out of their grooves and press out the bushes. Press in the new bushes and replace retaining circlips.

TO REASSEMBLE THE PUMP UNIT

1. Screw the inlet bearing bush lubrication filter from the inlet.
2. Place the end of the shaft through the inlet bearing bush.
3. On to a 1½in. x 5/16in. S.A.E. or U.N.F. bolt, fit a washer, larger in diameter than the section from which the inlet bearing lubrication filter was removed. Then, on to the bolt fit washers, or a spacer, of a total thickness of ¾in. These washers, or the spacer, must be small enough to fit inside the section of the inlet from which the inlet bearing lubrication filter was removed. Screw the bolt into the end of the shaft, to clamp the washers or spacer.
4. Stand the assembly upright, on the head of the bolt, and fit an impeller and impeller sleeve over the shaft.
5. Press the impeller into position against the inlet, and drive in the impeller sleeve.
6. Screw the bottom stage casing on to the inlet.

7. The remaining impellers, impeller sleeves, and stage casings are fitted as in 5 and 6, on page 11.
NOTE: On Mark LA-D and Mark LA-F Pumps, the first stage casing must be fitted at the top of the pump, directly under the outlet. The first stage casing does not have a neck ring for the impeller fitted.
8. Assemble the outlet to the first stage casing, and fit the outlet bearing bush and flinger (if fitted), and press it down over the mating section of the outlet.
9. Remove the bolt and spacers from the end of the shaft. The shaft and impellers should be free to move approximately $\frac{3}{16}$ in. in the stage casings, if the assembly of the pump is correct.
10. Refit the inlet bearing lubrication filter.
11. Screw on the strainer.

PUMP FITTED WITH FOOTVALVE AND STRAINER

If the pump is fitted with a footvalve and strainer, these parts are unscrewed from the inlet as an assembly, when dismantling the pump.

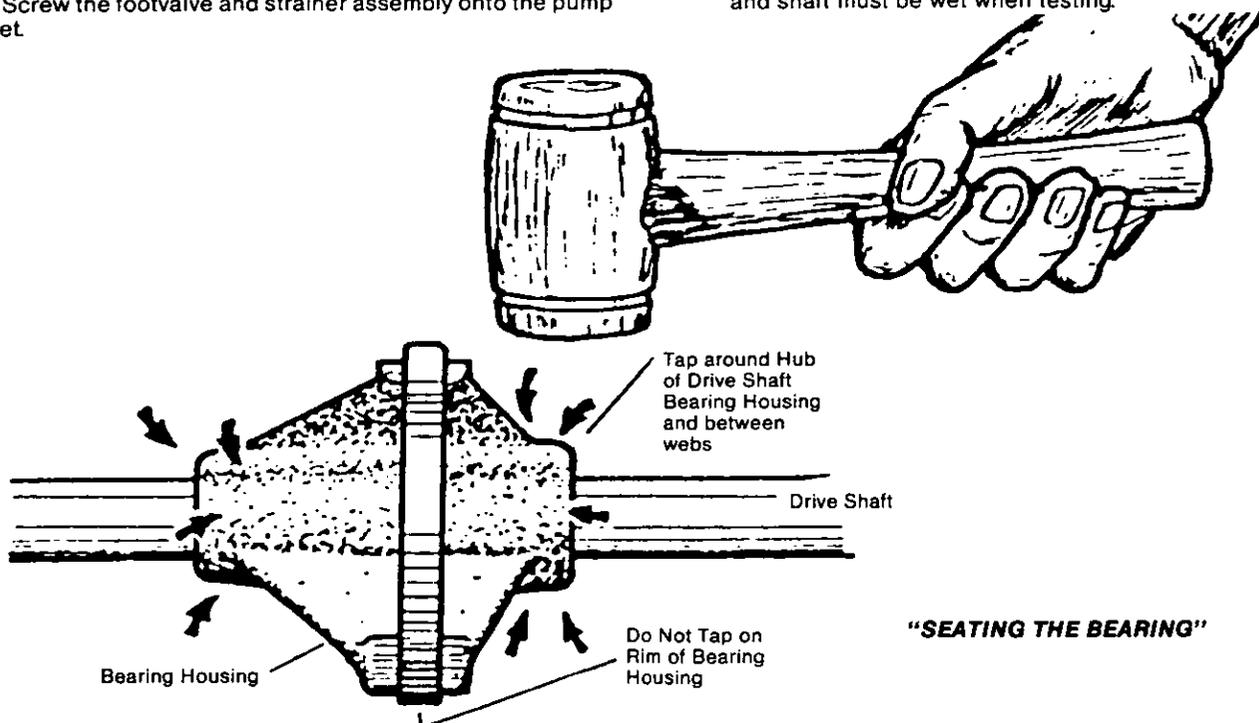
To dismantle the footvalve and strainer assembly and examine the rubber non-return valve sealing ring, unscrew the strainer and connection from the non-return valve housing and slide the valve from the valve stem. Examine the valve sealing ring and fit a new one to the valve if necessary.

Refit the valve to the valve stem and screw the strainer and connection onto the non-return valve housing.

Screw the footvalve and strainer assembly onto the pump inlet.

FITTING RUBBER DRIVE SHAFT BEARING — COLUMN PIPE

- (a) Spring the retaining circlip out of its groove and press the worn bush from the drive shaft bearing housing.
 - (b) Clean the inside of the drive shaft bearing housing thoroughly and wet the inside of the bearing housing and the bearing with water.
- IMPORTANT: WATER ONLY MUST BE USED WHEN FITTING BEARINGS. Other substances such as grease, detergents, soft soap, etc. must not be used.**
- (c) Press the new bearing into position. Work the bearing in carefully with the thumbs. When the bearing is flush with the end of the bearing housing, push it in the rest of the way with a flat-ended piece of dowel or bar.
 - (d) Refit the circlip.
 - (e) Wet the inside of the bearing and fit the drive shaft bearing housing and the bearing onto one of the lengths of drive shaft. Generally, the bearing will be tight.
 - (f) Using a piece of timber or a wooden mallet, tap around the hub of the drive shaft bearing housing, at both ends and between the webs to fully seat the bearing. Do not tap on the rim of the bearing housing. Refer illustration, "Seating the Bearing", below.
 - (g) Wet the bearing and shaft with water and spin the bearing housing on the shaft. The bearing should run freely on the shaft. If it does not, continue to tap around the housing as in (f) above until it runs freely. The bearing and shaft must be wet when testing.



MARK LD-F ELECTRIC MOTOR DRIVE HEAD — SOLID SHAFT MOTOR

Should it ever be necessary to fit a replacement thrust bearing in the bearing housing, proceed as follows:—

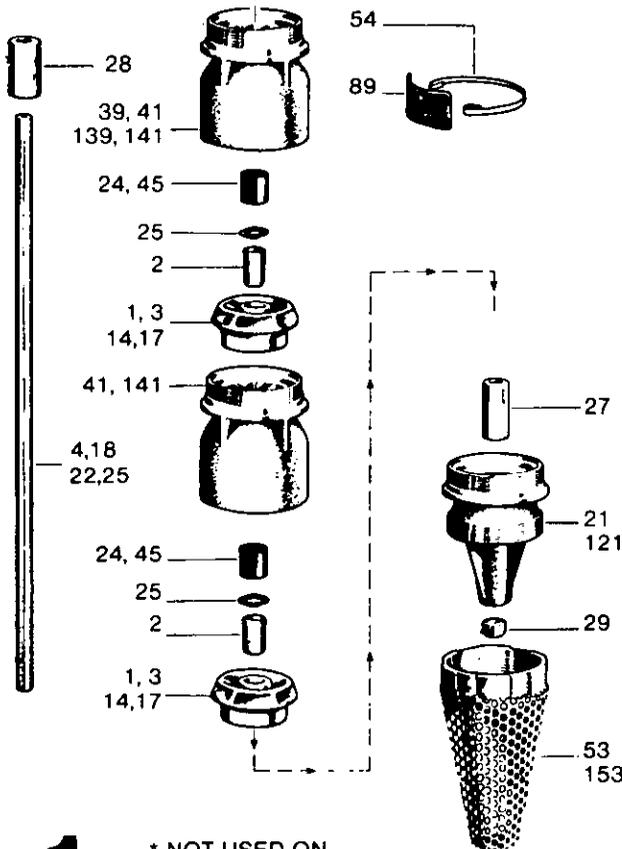
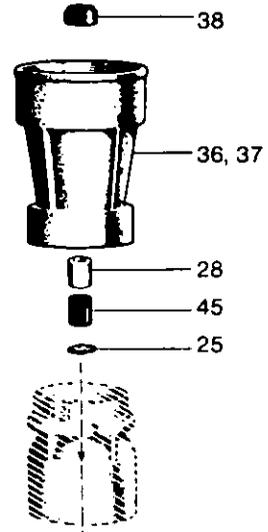
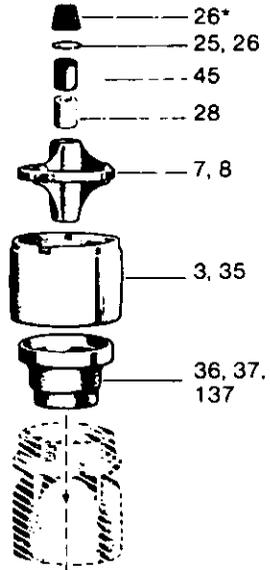
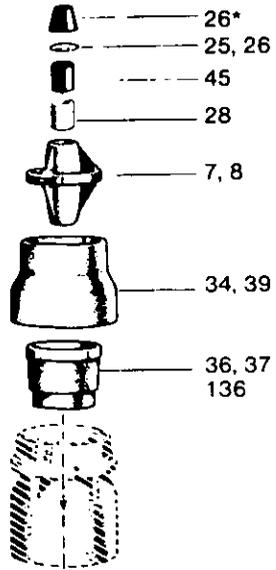
- (a) Remove the weather shields.
- (b) Remove the flexible coupling bush bolts.
- (c) Remove the motor from the bearing housing.
- (d) Unscrew the drive shaft adjustment nut locking screw and remove the drive shaft adjustment nut.
- (e) Remove nuts and spring washers from studs around the bearing retaining plate and pull the flexible coupling driven half, bearing retaining plate and thrust bearing from the bearing housing. Remove the drive shaft key as the assembly clears the drive shaft. Remove circlip fitted against bearing.
- (f) Screw three $\frac{3}{16}$ in. — 16 UNC Jacking Bolts into the three tapped holes near the middle of the flexible coupling driven half and screw these down onto the tops of the non-reverse ratchet ramps, on the bearing retaining plate. Tighten the jacking bolts evenly to jack the coupling driven half from the bearing. Remove the jacking bolts.
- (g) Check the condition of the seal in the bottom of the bearing housing, the V-ring on the flexible coupling — driven half and the O-ring around the top face of the bearing mounting and fit new parts if necessary. The V-ring must be fitted to the flexible coupling — driven half, before fitting the new bearing.
- (h) Fit the new bearing to the flexible coupling driven half. The bearing may be fitted with either side to the top, except if the bearing supplied has a filling slot in one of the races, in which case, the side with the slot is fitted towards the top of the installation. Press the bearing onto the flexible coupling driven half, right up to the shoulder, and refit the circlip against the bearing.
- (i) Reassemble the bearing housing by reversing the dismantling procedure above.
- (j) Grease the bearing by introducing grease through the grease nipple.
- (k) Position the impellers as shown in the installing instructions and refit the motor to the bearing housing.
- (l) Reconnect the flexible coupling halves.

OUTLET PARTS

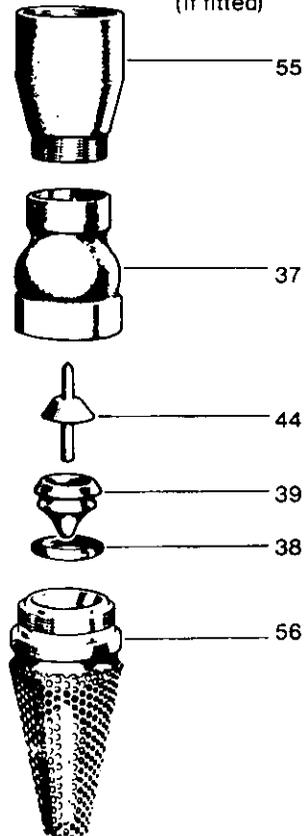
PUMP	COLUMN PIPE
LA-A	.....3in.
LA-B	.....3in.
LA-H	.....4in.

PUMP	COLUMN PIPE
LA-A	.....4in.
LA-B	.....4in.
LA-H	.....5in.
LA-J	.....6in.

PUMP	COLUMN PIPE
LA-D	.....4in.
LA-F	.....4in.
LA-D	.....5in.
LA-F	.....5in.

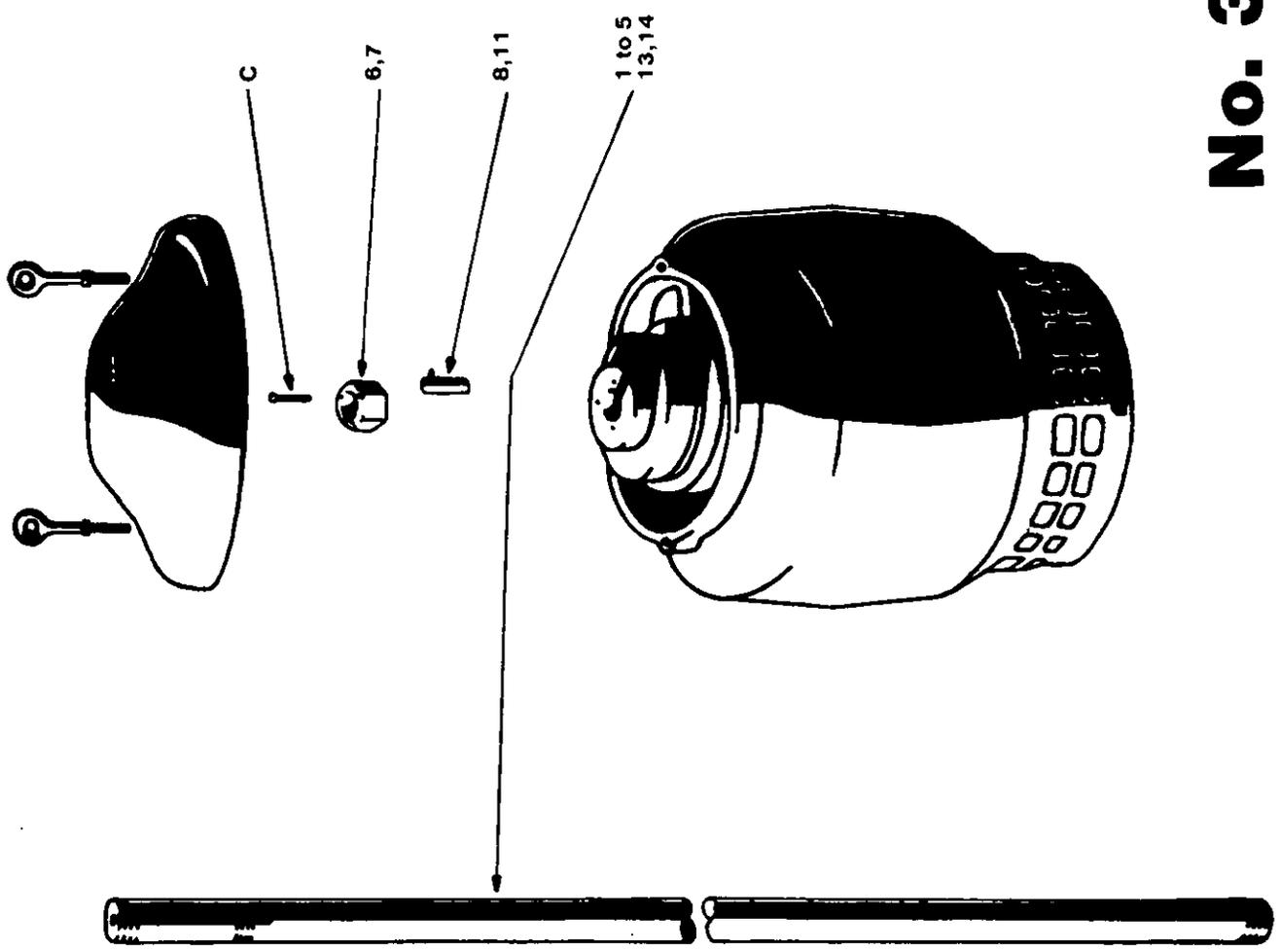


FOOTVALVE & STRAINER
(If fitted)

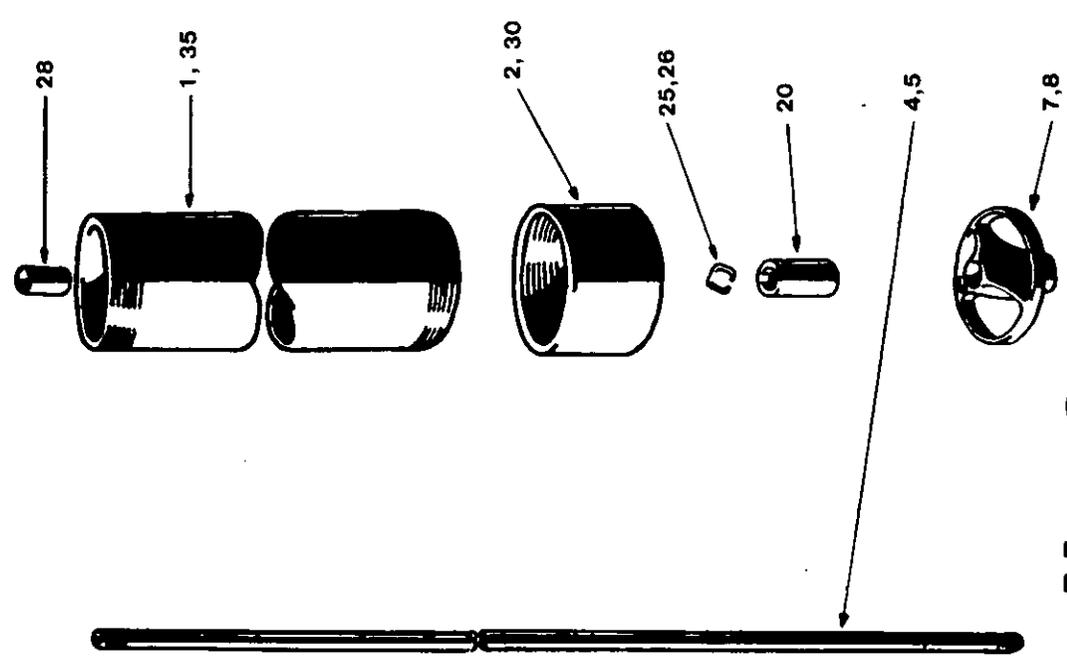


No. 1

* NOT USED ON
LA-A & LA-B PUMPS

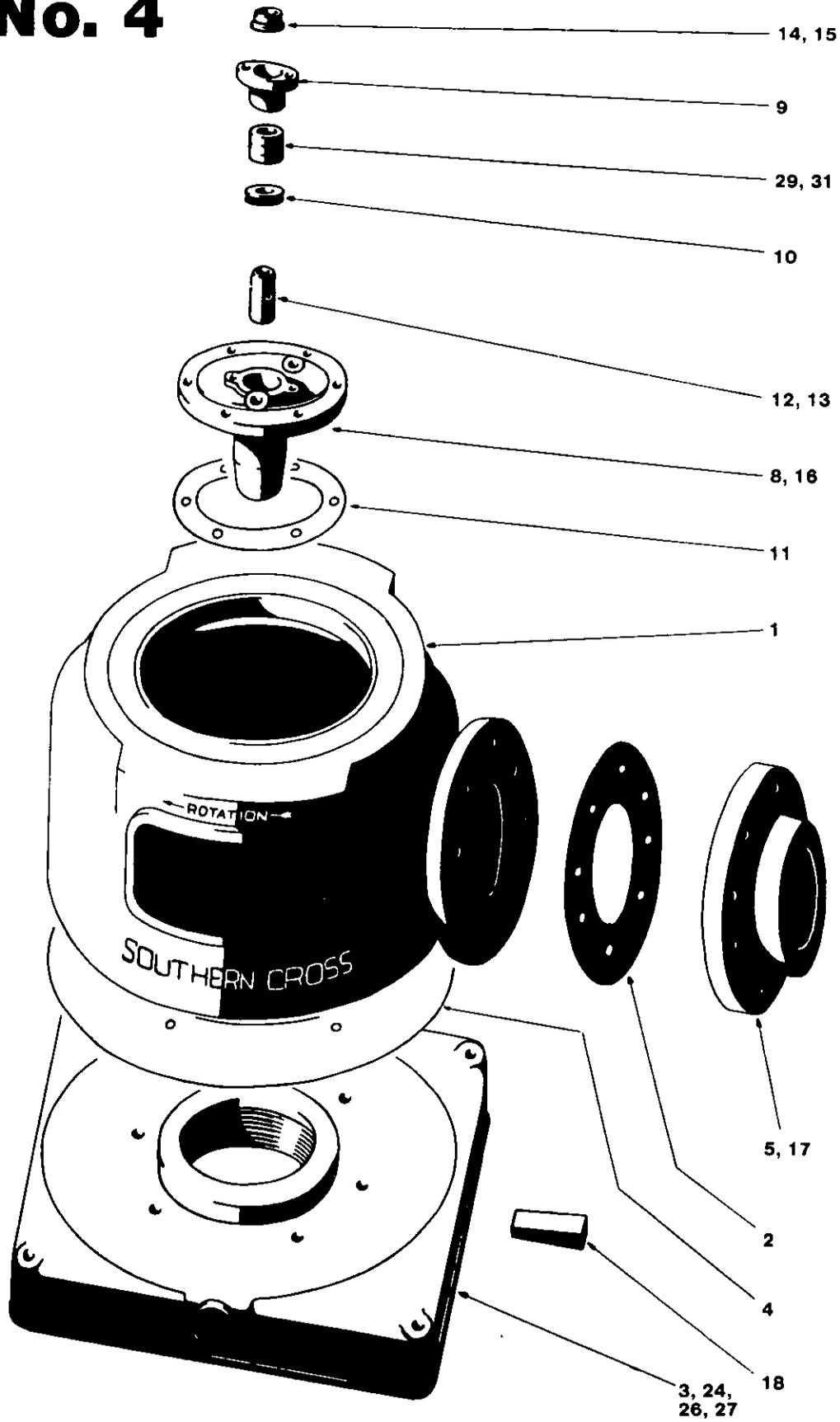


No. 3

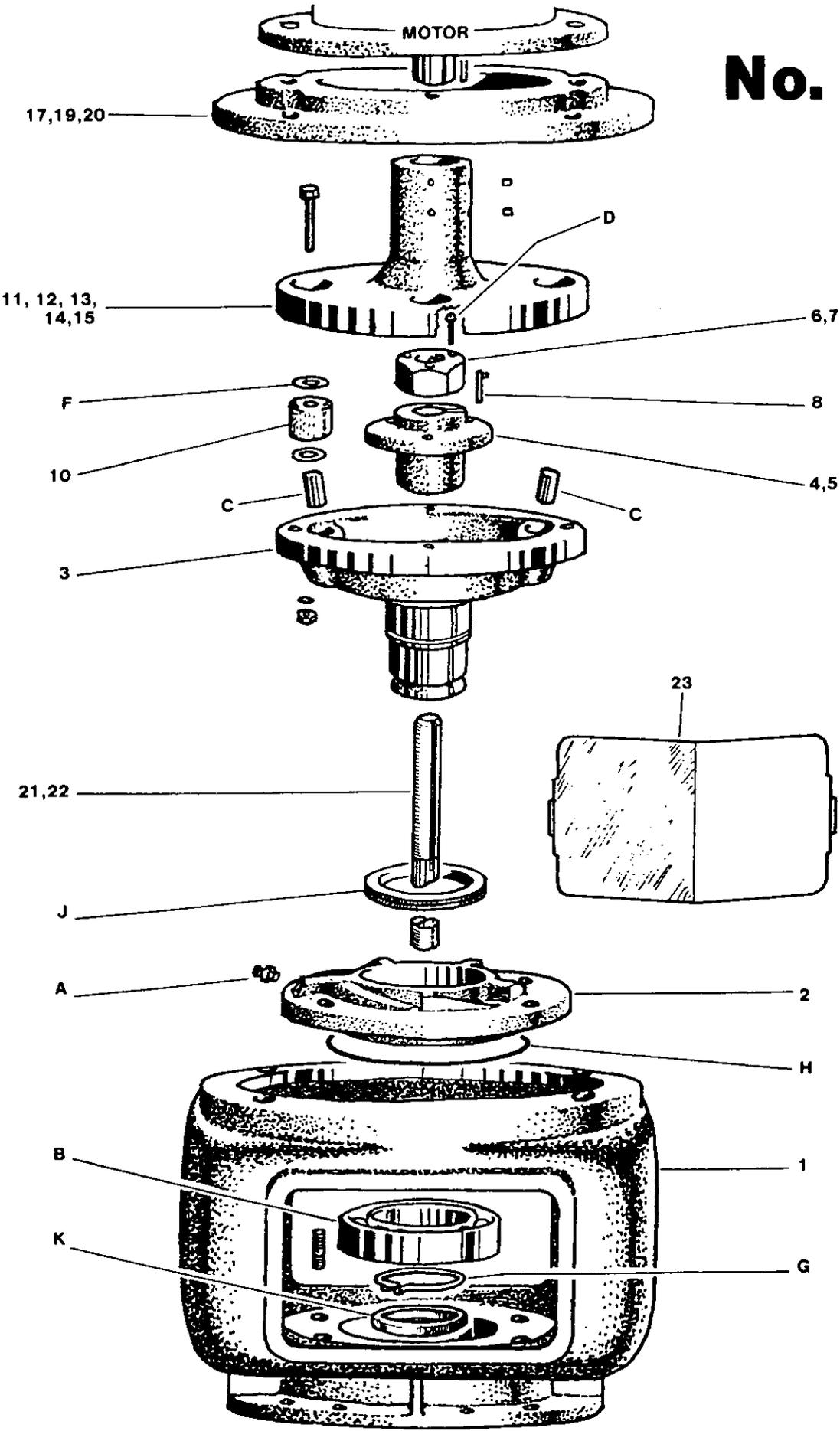


No. 2

No. 4



No. 7



PARTS LIST

MARK LA-A and MARK LA-B TURBINE PUMPS

(Parts Illustration No. 1)

Sym. No.	Name of Part	Number Off														
		No. of Pump Stages														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-A1	Impeller, Mark LA-A Pump	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-B1	Impeller, Mark LA-B Pump	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-C2	Impeller Sleeve	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-A2	4in. Column Pipe to Pump Coupling	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C4	Pump Shaft	1														
LA-C5	Pump Shaft		1													
LA-C6	Pump Shaft			1												
LA-C7	Pump Shaft				1											
LB-B7B	3in. Outlet Bearing Housing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LB-C7B	4in. Outlet Bearing Housing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C8	Pump Shaft					1										
LA-C9	Pump Shaft						1									
LA-C10	Pump Shaft							1								
LA-C11	Pump Shaft								1							
LA-C12	Pump Shaft									1						
LA-C13	Pump Shaft										1					
LA-C14	Pump Shaft											1				
LA-C15	Pump Shaft												1			
LA-C16	Pump Shaft													1		
LA-C17	Pump Shaft														1	
LA-C18	Pump Shaft															1
* LA-A21	Inlet Casing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C25	Stage Casing Bearing Bush Retaining Circlip	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LB-B25	Outlet Bearing Bush Retaining Circlip	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-A27	Inlet Bearing Bush - Bronze	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-A28	Outlet Bearing Bush - Bronze	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C29	Inlet Bearing Bush Lubrication Filter	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
* LA-A36	Outlet for 3in. Col. Pipe	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
* LA-A37	Outlet for 4in. Col. Pipe	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-A39	3in. Column Pipe to Pump Coupling (as reqd.)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
* LA-A41	Stage Casing, Mark LA-A Pump	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
* LA-B41	Stage Casing, Mark LA-B Pump	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-C45	Outlet Bearing Bush - Rubber	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C45	Stage Casing Bearing Bush	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-C53	Strainer and Connection (if ord.)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C54	Warning Label Fix. Strip	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NB-B89	Warning Plate	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
† LA-A121	Inlet Casing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
† LA-A136	Outlet for 3in. Column Pipe	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
† LA-A137	Outlet for 4in. Column Pipe	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
† LA-A141	Stage Casing, Mark LA-A Pump	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
† LA-B141	Stage Casing, Mark LA-B Pump	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
† LA-C153	Strainer and Connection (if Ord.)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

* Gunmetal Parts. — † Cast Iron Parts.

MARK LA-D TURBINE PUMP

(Parts Illustration No. 1)

Sym. No.	Name of Part	Number Off														
		No. of Pump Stages														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-D1	Impeller	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-C2	Impeller Sleeve	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-F4	Pump Shaft	1														
LA-F5	Pump Shaft		1													
LA-F6	Pump Shaft			1												
LA-F7	Pump Shaft				1											
LA-F8	Pump Shaft					1										
LA-F9	Pump Shaft						1									
LA-F10	Pump Shaft							1								
LA-F11	Pump Shaft								1							
LA-F12	Pump Shaft									1						
LA-F13	Pump Shaft										1					
LA-F14	Pump Shaft											1				
LA-F15	Pump Shaft												1			
LA-D16	Pump Shaft													1		
LA-D17	Pump Shaft														1	
LA-D18	Pump Shaft															1
* LA-D21B	Inlet Casing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C25	Stage Casing Bearing Bush Retaining Circlip	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-C25	Outlet Bearing Bush Retaining Circlip	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-A27	Inlet Bearing Bush — Bronze	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-A28	Outlet Bearing Bush — Bronze	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C29	Inlet Bearing Bush Lubrication Filter	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
* LA-D36B	Outlet 5in. Column Pipe	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
* LA-D37B	Outlet 4in. Column Pipe	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C38	Outlet Bearing Bush Sand Flinger	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
* LA-D39	First Stage Casing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
* LA-D41	Stage Casing	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-C45	Stage Casing Bearing Bush	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LA-C45	Outlet Bearing Bush — Rubber	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C53	Strainer and Connection (if Ord.)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LA-C54	Warning Label Fix. Strip	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NB-B89	Warning Plate	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
† LA-D121	Inlet Casing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
† LA-D139	First Stage Casing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
† LA-D141	Stage Casing	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14
† LA-C153	Strainer and Connection (if Ord.)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

* Gunmetal Parts. — † Cast Iron Parts.

MARK LD-C ELECTRIC MOTOR DRIVE HEAD — HOLLOW SHAFT MOTOR

(Parts Illustration No. 3)

Sym. No.	Name of Part	No. per drive head.
LD-C3	¾in. Dia. Shaft for 15kW T.E.F.C. Motors — Frame No. 74	1 As Req'd
LD-C4	1in. Dia. Shaft for 30, 37 and 45 kW Drip Proof and 15, 18 and 22 kW T.E.F.C. Motors — Frame No. 74	1 As Req'd
LD-C5	1in. Dia. Shaft for 55 kW Drip Proof and 30 and 37 kW T.E.F.C. Motors — Frame No. 75	1 As Req'd
PF-Q6	1in. Shaft Adjustment Nut	1 As Req'd
PF-Q7	¾in. Shaft Adjustment Nut	1 As Req'd
LD-C8	Shaft Drive Key Assembly for 15 to 55 kW Drip Proof and 7.5 to 37 kW T.E.F.C. Motors	1 As Req'd
LD-C11	Shaft Drive Key Assembly for 2.2 to 11 kW Drip Proof and 2.2 to 5.5 kW T.E.F.C. Motors	1 As Req'd
LD-C13	¾in. Dia. Shaft for 2.2 kW Drip Proof and 2.2 kW T.E.F.C. Motors — Frame No. 71	1 As Req'd
LD-C14	1in. Dia. Shaft for 15, 18.5 and 22 kW Drip Proof and 11 kW T.E.F.C. Motors — Frame No. 73	1 As Req'd
LD-C15	¾in. Dia. Shaft for 4, 5.5, 7.5 and 11 kW Drip Proof and T.E.F.C. Motors — Frame Nos. 72 and 73	1 As Req'd
C	Shaft Adjustment Nut Locking Screw (1½in. x 3/16in. Whit. Br. M.S. Round Head Screw)	1
	Motor Mounting Setscrew for Motor Frame Nos. 71, 72, 73 and 74 (1½in. x ¾in. — 16 U.N.C.)	4 As Req'd
	Motor Mounting Setscrew for Motor Frame No. 75 (2¼in. x ¾in. — 16 U.N.C.)	4 As Req'd
	Motor Mounting Screw Washer (¾in. x 3/32in. — Blk. Spring Washer)	4

MARK LA-F TURBINE PUMP

(Parts Illustration No. 1)

Sym. No.	Name of Part	Number Off											
		No. of Pump Stages											
		1	2	3	4	5	6	7	8	9	10	11	12
LA-F1	Impeller	1	2	3	4	5	6	7	8	9	10	11	12
LA-C2	Impeller Sleeve	1	2	3	4	5	6	7	8	9	10	11	12
LA-F4	Pump Shaft	1											
LA-F5	Pump Shaft		1										
LA-F6	Pump Shaft			1									
LA-F7	Pump Shaft				1								
LA-F8	Pump Shaft					1							
LA-F9	Pump Shaft						1						
LA-F10	Pump Shaft							1					
LA-F11	Pump Shaft								1				
LA-F12	Pump Shaft									1			
LA-F13	Pump Shaft										1		
LA-F14	Pump Shaft											1	
LA-F15	Pump Shaft												1
LA-F21	Inlet Casing	1	1	1	1	1	1	1	1	1	1	1	1
LA-C25	Stage Casing Brg. Bush Retaining Circlip	1	2	3	4	5	6	7	8	9	10	11	12
LA-C25	Outlet Bearing Bush Retaining Circlip	1	1	1	1	1	1	1	1	1	1	1	1
LA-A27	Inlet Bearing Bush — Bronze	1	1	1	1	1	1	1	1	1	1	1	1
LA-A28	Outlet Bearing Bush — Bronze	1	1	1	1	1	1	1	1	1	1	1	1
LA-C29	Inlet Bearing Bush Lubrication Filter	1	1	1	1	1	1	1	1	1	1	1	1
LA-F36B	Outlet — 5in. Column Pipe	1	1	1	1	1	1	1	1	1	1	1	1
LA-F37B	Outlet — 4in. Column Pipe	1	1	1	1	1	1	1	1	1	1	1	1
LA-C38	Outlet Bearing Bush Sand Flinger	1	1	1	1	1	1	1	1	1	1	1	1
LA-F39B	First Stage Casing Assembly	1	1	1	1	1	1	1	1	1	1	1	1
LA-F41B	Stage Casing	1	2	3	4	5	6	7	8	9	10	11	12
LA-C45	Stage Casing Bearing Bush	1	2	3	4	5	6	7	8	9	10	11	12
LA-C45	Outlet Bearing Bush — Rubber	1	1	1	1	1	1	1	1	1	1	1	1
LA-C53	Strainer and Connection (if ordered)	1	1	1	1	1	1	1	1	1	1	1	1
LA-C54	Warning Label Fixing Strip	1	1	1	1	1	1	1	1	1	1	1	1
NB-B89	Warning Plate	1	1	1	1	1	1	1	1	1	1	1	1

MARK LA-J TURBINE PUMP

(Parts Illustration No. 1)

Sym. No.	Name of Part	Number Off						
		No. of Pump Stages						
		1	2	3	4	5	6	7
LA-J1	Impeller — 5 15/16in. Dia. (As Req'd, Max, 5/Pump)	—	—	—	—	—	—	—
LA-J2	Impeller Sleeve	1	2	3	4	5	6	7
LA-J3	Column Pipe Coupling — 6in.	1	1	1	1	1	1	1
LA-J4B	Pump Shaft	1						
LA-J5B	Pump Shaft		1					
LA-J6B	Pump Shaft			1				
LA-J7B	Pump Shaft				1			
LB-E7	Outlet Bearing Housing	1	1	1	1	1	1	1
LA-J8B	Pump Shaft					1		
LA-J9B	Pump Shaft						1	
LA-J10B	Pump Shaft							1
LA-J14	Impeller — 5 7/8in. Dia. (As Req'd — Max 5/Pump)	—	—	—	—	—	—	—
LA-J15	Impeller — 5 7/8in. Dia. (As Req'd — Max 6/Pump)	—	—	—	—	—	—	—
LA-J16	Impeller — 5 7/8in. Dia. (As Req'd — Max 6/Pump)	—	—	—	—	—	—	—
LA-J17	Impeller — 5 7/8in. Dia. (As Req'd — Max 7/Pump)	—	—	—	—	—	—	—
LA-J21	Inlet Casing	1	1	1	1	1	1	1
LA-J24	Stage Casing Bearing Bush	1	2	3	4	5	6	7
LA-J25	Stage Casing Bearing Bush Retaining Circlip	1	2	3	4	5	6	7
LA-H26	Outlet Bearing Bush Sand Flinger	1	1	1	1	1	1	1
LB-C26	Outlet Bearing Retaining Circlip	1	1	1	1	1	1	1
LA-J27	Inlet Bearing Bush — Bronze	1	1	1	1	1	1	1
LA-H28	Outlet Bearing Bush — Bronze	1	1	1	1	1	1	1
LB-C28	Pump Shaft Coupling	1	1	1	1	1	1	1
LA-C29	Inlet Bearing Bush Lubrication Filter	1	1	1	1	1	1	1
LA-J36	Outlet for 6in. Column Pipe	1	1	1	1	1	1	1
LA-J41	First Stage Casing	1	1	1	1	1	1	1
LA-J41	Multi-Stage Casing			2	3	4	5	6
LA-H45	Outlet Bearing Bush — Rubber	1	1	1	1	1	1	1
LA-J53B	Strainer and Connection (if ordered)	1	1	1	1	1	1	1
LA-H54	Warning Label Fixing Strip	1	1	1	1	1	1	1
NB-B89	Warning Plate	1	1	1	1	1	1	1

MARK LA-H TURBINE PUMP

(Parts Illustration No. 1)

Sym. No.	Name of Part	Number Off											
		No. of Pump Stages											
		1	2	3	4	5	6	7	8	9	10	11	12
LA-H2	Impeller Sleeve	1	2	3	4	5	6	7	8	9	10	11	12
LA-H3	Impeller — 5 9/32in. Dia. (As Req'd)	—	—	—	—	—	—	—	—	—	—	—	—
LA-H4	Pump Shaft	1	—	—	—	—	—	—	—	—	—	—	—
LA-H5	Pump Shaft	—	1	—	—	—	—	—	—	—	—	—	—
LA-H6	Pump Shaft	—	—	1	—	—	—	—	—	—	—	—	—
LA-H7	Pump Shaft	—	—	—	1	—	—	—	—	—	—	—	—
LB-C8B	Outlet Bearing Housing — 4in. (As Req'd)	1	1	1	1	1	1	1	1	1	1	1	1
LB-D8B	Outlet Bearing Housing — 5in. (As Req'd)	1	1	1	1	1	1	1	1	1	1	1	1
LA-H8	Pump Shaft	—	—	—	—	1	—	—	—	—	—	—	—
LA-H9	Pump Shaft	—	—	—	—	—	1	—	—	—	—	—	—
LA-H10	Pump Shaft	—	—	—	—	—	—	1	—	—	—	—	—
LA-H11	Pump Shaft	—	—	—	—	—	—	—	1	—	—	—	—
LA-H14	Impeller — 5 5/32in. Dia. (As Req'd)	—	—	—	—	—	—	—	—	—	—	—	—
LA-H15	Impeller — 5in. Dia. (As Req'd)	—	—	—	—	—	—	—	—	—	—	—	—
LA-H16	Impeller — 4 7/8in. Dia. (As Req'd)	—	—	—	—	—	—	—	—	—	—	—	—
LA-H17	Impeller — 4 3/4in. Dia. (As Req'd)	—	—	—	—	—	—	—	—	—	—	—	—
LA-H21	Inlet Casing	1	1	1	1	1	1	1	1	1	1	1	1
LA-H22	Pump Shaft	—	—	—	—	—	—	—	—	1	—	—	—
LA-H23	Pump Shaft	—	—	—	—	—	—	—	—	—	1	—	—
LA-H24	Pump Shaft	—	—	—	—	—	—	—	—	—	—	1	—
LA-H25	Pump Shaft	—	—	—	—	—	—	—	—	—	—	—	1
LB-C25	Stage Casing Brg. Bush Retaining Circlip	1	2	3	4	5	6	7	8	9	10	11	12
LB-C26	Outlet Bearing Bush Retaining Circlip	1	1	1	1	1	1	1	1	1	1	1	1
LA-H26	Outlet Bearing Bush Sand Flinger	1	1	1	1	1	1	1	1	1	1	1	1
LA-H27	Inlet Bearing Bush — Bronze	1	1	1	1	1	1	1	1	1	1	1	1
LA-H28	Outlet Bearing Bush — Bronze	1	1	1	1	1	1	1	1	1	1	1	1
LB-C28	Pump Shaft to Drive Shaft Coupling	1	1	1	1	1	1	1	1	1	1	1	1
LA-C29	Inlet Bearing Bush Lubrication Filter	1	1	1	1	1	1	1	1	1	1	1	1
LA-H34B	4in. Column Pipe to Pump Coupling	1	1	1	1	1	1	1	1	1	1	1	1
LA-H35	5in. Column Pipe to Pump Coupling	1	1	1	1	1	1	1	1	1	1	1	1
LA-H36	Outlet — 5in. Column Pipe (As Req'd)	1	1	1	1	1	1	1	1	1	1	1	1
LA-H37	Outlet — 4in. Column Pipe (As Req'd)	1	1	1	1	1	1	1	1	1	1	1	1
LA-H41	First Stage Casing Body	1	1	1	1	1	1	1	1	1	1	1	1
LA-H41	Multi-Stage Casing Body	—	1	2	3	4	5	6	7	8	9	10	11
LA-H45	Stage Casing Bearing Bush	1	2	3	4	5	6	7	8	9	10	11	12
LA-H45	Outlet Bearing Bush — Rubber	1	1	1	1	1	1	1	1	1	1	1	1
LA-H53	Strainer and Connection (if ordered)	1	1	1	1	1	1	1	1	1	1	1	1
LA-H54	Warning Label Fixing Strip	1	1	1	1	1	1	1	1	1	1	1	1
NB-B89	Warning Plate	1	1	1	1	1	1	1	1	1	1	1	1
	Stage Casing Body Sealing Ring (383 002 032/G)	1	2	3	4	5	6	7	8	9	10	11	12

FOOT VALVE AND STRAINER

MARKS LA-A, LA-B, LA-D and LA-F TURBINE PUMPS
(If Required)

(Parts Illustration No. 1)

Sym. No.	Name of Part	No. Off
NA-D37B	Non-Return Valve Housing	1
NA-C38	Non-Return Valve Sealing Ring	1
NA-D39C	Non-Return Valve	1
NA-D44B	Non-Return Valve Guide	1
LA-A55	Non-Return Valve Housing to Inlet Casing Adaptor	1
LA-A56	Strainer and Connection	1

TAILSHAFT FOR RIGHT ANGLE DRIVE HEADS

Sym. No.	Name of Part	No. Off
EDG679	Tailshaft Driven Unit Adaptor (Mark LFD Drive Head)	1
EDG681	Tailshaft Driven Unit Adaptor (Mark LFE Drive Head)	1
	Tailshaft Driven Unit Adaptor Locking Screw (M16 x 16 Knurled, Cup Point)	4
	Tailshaft Driven Unit Adaptor Setscrew (1in. x 7/16in. — 14 U.N.C. H. Tensile)	4
	Tailshaft Driven Unit Adaptor Setscrew Washer (7/16in. x 1/8in. x 1/8in. Spring)	4
	Locking Screw Wrench (8mm. A/F Short Series)	1

AIR LINE GAUGE AND FITTINGS

(Not Illustrated)

Symol No.	Name of Part	No. Off
	Air Line Gauge (475001003M)	1
LA-C101	Air Line Charging Valve ("Schrader" Type No. 5622 Air Valve and Cap)	1
LA-C104B	Air Line	As reqd.
LA-C105B	Air Line Joiner (1/4in. Tube Double Union with 2 Nuts)	As reqd.
LA-C106B	Air Line Gauge Mounting Block	1
	Air Line Gauge Mounting Block Set-screw (1 1/4in. x 1/4in. Whit)	2
	Air Line Connection in Gauge Mounting Block (1/4in. B.S.P. x 1/4in. Tube Union and Nut)	1

PRE-LUBRICATION TANK

(Not Illustrated)

Symbol No.	Name of Part	No. Off
LA-C81	100 Gal. Pre-Lubrication Tank (fitted to pumps with standing water level of 50ft. or more below the surface)	1 As reqd.
LA-C82	Pre-Lubrication Tank to Discharge Head Pipe	3
	Pre-Lubrication Tank Outlet Reducing Bush (1 1/2in./1in. Reducing Bush)	1
	Pre-Lubrication Tank to Discharge Head Pipe Union (1in. Galv. Pipe Union)	1
	Pre-Lubrication Tank to Discharge Head Pipe Gate Valve (1in. Gate Valve)	1
	Pre-Lubrication Tank Refilling Valve	1 As reqd.

'LB' PATTERN COLUMN PIPE & SHAFTING

Mark LB-B — 3in. — (with 3/4in. Dia. Shaft).
 Mark LB-C — 4in. — (with 3/4in. or 1in. Dia. Shaft).
 Mark LB-D — 5in. — (with 3/4in. or 1in. Dia. Shaft).
 Mark LB-E — 6in. — (with 1in. Dia. Shaft).

(Parts Illustration No. 2)

Sym. No.	Name of Part
LB-B 1	3in. Column Pipe (5ft. length)
LB-C1	4in. Column Pipe (5ft. length)
LB-D1	5in. Column Pipe (5ft. length)
LB-E1	6in. Column Pipe (4ft. 11 1/2in. length)
LB-B2B	3in. Column Pipe Coupling
LB-C2B	4in. Column Pipe Coupling
LB-D2B	5in. Column Pipe Coupling
LB-E2B	6in. Column Pipe Coupling
LB-C4	5ft. Section of Drive Shaft — 3/4in. Dia.
LB-D4	5ft. Section of Drive Shaft — 1in. Dia.
LB-C5	10ft. Section of Drive Shaft — 3/4in. Dia.
LB-D5	10ft. Section of Drive Shaft — 1in. Dia.
LB-B7B	3in. Drive Shaft Bearing Housing (3/4in. Shaft)
LB-C7B	4in. Drive Shaft Bearing Housing (3/4in. Shaft)
LB-D7B	5in. Drive Shaft Bearing Housing (3/4in. Shaft)
LB-E7	6in. Drive Shaft Bearing Housing (1in. Shaft)
LB-C8B	4in. Drive Shaft Bearing Housing (1in. Shaft)
LB-D8B	5in. Drive Shaft Bearing Housing (1in. Shaft)
LB-B11	Male Thread Protector for 3in. Column Pipe (not illus.)
LB-C11B	Male Thread Protector for 4in. Column Pipe (not illus.)
LB-D11	Male Thread Protector for 5in. Column Pipe (not illus.)
LB-E11	Male Thread Protector for 6in. Column Pipe (not illus.)
LB-B13	3in. Column Pipe Lowering Tool (as req'd; not illus.)
LB-C13	4in. Column Pipe Lowering Tool (as req'd; not illus.)
LB-D13	5in. Column Pipe Lowering Tool (as req'd; not illus.)
LB-E13	6in. Column Pipe Lowering Tool (as req'd; not illus.)
LB-B20	Drive Shaft Bearing — 3/4in. Dia. Shaft
LB-C20	Drive Shaft Bearing — 1in. Dia. Shaft
LB-B25	Drive Shaft Bearing Retaining Circlip — 3/4in. Dia. Shaft
LB-C26	Drive Shaft Bearing Retaining Circlip — 1in. Dia. Shaft
LB-B27	3in. Column Pipe (Pump End Section) (not illus.)
LB-C27	4in. Column Pipe (Pump End Section) (not illus.)
LB-D27	5in. Column Pipe (Pump End Section) (not illus.)
LB-E27	6in. Column Pipe (Pump End Section) (not illus.)
LB-B28	3/4in. Drive Shaft Coupling
LB-C28	1in. Drive Shaft Coupling
LBB30	3in. Column Pipe Coupling — Galv.
LBC30	4in. Column Pipe Coupling — Galv.
LBD30	5in. Column Pipe Coupling — Galv.
LBE30	6in. Column Pipe Coupling — Galv.
LBB35	3in. Column Pipe — Galv.
LBC35	4in. Column Pipe — Galv.
LBD35	5in. Column Pipe — Galv.
LBE35	6in. Column Pipe — Galv.
LBB40	3in. Column Pipe — Pump End Section — Galv. (not illus.)
LBC40	4in. Column Pipe — Pump End Section — Galv. (not illus.)
LBD40	5in. Column Pipe — Pump End Section — Galv. (not illus.)
LBE40	6in. Column Pipe — Pump End Section — Galv. (not illus.)

MARK LC-C DISCHARGE HEAD

(Parts Illustration No. 4)

Symbol No.	Name of Part	No. per Discharge Head	Symbol No.	Name of Part	No. per Discharge Head
Discharge Head Body:			Packing Gland for 1 in. Shafting:		
LC-C1	Discharge Head	1	LC-C7	Pump Shaft to Drive Shaft Coupling (not illus.)	1
GX-J2	Discharge Pipe Flange Gasket	1	LC-C9	Shaft Packing Gland	1
LC-C4	Discharge Head to Base Gasket	1	LC-C10	Lantern Ring	1
LC-C11	Shaft Packing Gland Body Gasket	1	LC-C13	Shaft Packing Gland Body Bearing Bush	1
LC-C18	Levelling Wedge	4	LC-C15	Water Slinger	1
	Shaft Packing Gland Body to Discharge Head Stud (1½ in. x ¾ in. — 16 U.N.C.)	6	LC-C16C	Shaft Packing Gland Body	1
	Discharge Head to Discharge Head Base Stud (2¼ in. x ¾ in. — 11 U.N.C.)	6	PF-H16	Shaft Packing Gland to Shaft Packing Gland Body Stud	2
	Discharge Pipe Flange to Discharge Head Bolt (2¼ in. x ¾ in. Whit.)	8	LB-C20	Shaft Packing Gland Body Rubber Bearing (not illus.)	1
	Foundation Bolt (M16 x 220)	4	LB-C26	Shaft Packing Gland Body Rubber Bearing Retaining Circlip (not illus.)	1
	Shaft Packing Gland Body to Discharge Head Stud Nut (¾ in. — 16 U.N.C.)	6	LC-C31	Packing Gland Ring	4
	Discharge Head to Discharge Head Base Stud Nut (¾ in. — 11 U.N.C.)	6		Cooling Coil Connection Plug (¼ in. B.S.P. Plug)	1
	Shaft Packing Gland Body to Discharge Head Stud Washer (¾ in. x 3/32 in. x 3/32 in. Spring)	6		Shaft Packing Gland to Shaft Packing Gland Body Stud Nut (¾ in. Whit. Brass)	2
	Discharge Head to Discharge Head Base Stud Washer (¾ in. x 5/32 in. x 5/32 in. Spring)	6		Shaft Packing Gland to Shaft Packing Gland Body Stud Washer (¾ in. x 3/32 in. x 3/32 in. Spring)	2
	Foundation Bolt Washer (¾ in. x 5/32 in. x 5/32 in. Spring)	4		Shaft Packing Gland Lubricator (¼ in. B.S.P. x 67½° Grease Nipple)	1
	Discharge Pipe Flange to Discharge Head Bolt Washer (¾ in. x 5/32 in. x 5/32 in. Spring)	8	Discharge Head Base (3 in. Column Piping):		
	Foundation Bolt Plain Washer (¾ in. Plain)	4	LB-B2B	Column Pipe Coupling (not illus.)	1
	Air Line Depth Measuring Hole Plug (¼ in. B.S.P. Plug)	1	LB-B11	External Thread Protector (not illus.)	2
	Pre-Lubrication Hole Plug (1 in. B.S.P. Plug)	1	LC-C24	Discharge Head Base	1
Packing Gland for ¾ in. Shafting:			LBB30	3 in. Column Pipe Coupling — Galv.	
LC-C8C	Shaft Packing Gland Body	1	LC-C34	Column Pipe (not illus.)	2
FM-B9	Shaft Packing Gland	1	LCC134	3 in. Column Pipe — Galv. (not illus.)	
FM-B10	Lantern Ring	1	Discharge Head Base (4 in. Column Piping):		
LC-C12	Shaft Packing Gland Body Bearing Bush	1	LB-C2B	Column Pipe Coupling (not illus.)	1
LC-C14	Water Slinger	1	LC-C3	Discharge Head Base	1
PF-H16	Shaft Packing Gland to Shaft Packing Gland Body Stud	2	LB-C11B	External Thread Protector (not illus.)	2
LB-B20	Shaft Packing Gland Body Rubber Bearing (not illus.)	1	LBC30	4 in. Column Pipe Coupling — Galv.	
LB-B25	Shaft Packing Gland Body Rubber Bearing Retaining Circlip (not illus.)	1	LC-C35	Column Pipe (not illus.)	2
LB-B28	Pump Shaft to Drive Shaft Coupling (not illus.)	1	LCC135	4 in. Column Pipe — Galv. (not illus.)	
LC-C29	Packing Gland Ring	4	Discharge Head Base (5 in. Column Piping):		
	Cooling Coil Connection Plug (¼ in. B.S.P. Plug)	1	LB-D2B	Column Pipe Coupling (not illus.)	1
	Shaft Packing Gland to Shaft Packing Gland Body Stud Nut (¾ in. Whit. Brass)	2	LB-D11	External Thread Protector (not illus.)	2
	Shaft Packing Gland to Shaft Packing Gland Body Stud Washer (¾ in. x 3/32 in. x 3/32 in. Spring)	2	LC-C26	Discharge Head Base	1
	Shaft Packing Gland Lubricator (¼ in. B.S.P. x 67½° Grease Nipple)	1	LBD30	5 in. Column Pipe Coupling — Galv.	
			LC-C36	Column Pipe (not illus.)	2
			LCC136	5 in. Column Pipe — Galv. (not illus.)	
			Discharge Head Base (6 in. Column Piping):		
			LB-E2B	Column Pipe Coupling (not illus.)	1
			LB-E11	External Thread Protector (not illus.)	2
			LC-C27	Discharge Head Base	1
			LBE30	6 in. Column Pipe Coupling — Galv.	
			LC-C37	Column Pipe (not illus.)	2
			LCC137	6 in. Column Pipe — Galv. (not illus.)	
			Discharge Flange:		
			LC-C5	Discharge Pipe Flange (Screwed 4 in. B.S.P.)	1
			LC-C17	Discharge Pipe Flange (Screwed 5 in. B.S.P.)	1

MARK LE-C VERTICAL DRIVE HEAD

(Parts Illustration No. 5)

Symbol No.	Name of Part	No. per Drive Head
LE-C1	Thrust Bearing Housing	1
LE-C2	Thrust Bearing (Hoffman Bearing No. 555 ACD)	1
LE-C5	Hollow Shaft	1
LE-C6B	Hollow Shaft Bearing (S.K.F. Bearing No. NU1010)	1
PF-Q6	1in. Drive Shaft Adjustment Nut	1
LE-C7B	Hollow Shaft Bearing Housing	1
PF-Q7	3/4in. Drive Shaft Adjustment Nut	1
LD-C8	3/4in. Drive Shaft Key Assembly	1
LE-C8	Hollow Shaft Bearing Housing Gasket	1
LE-C10	1in. Drive Shaft Key Assembly	1
LE-C12	3/4in. Drive Shaft	1
LE-C14B	3/4in. Drive Shaft Flange	1
LE-C15	Drive Shaft Non-Reverse Ratchet Plunger	4
LE-C17B	1in. Drive Shaft Flange	1
LE-C18	1in. Drive Shaft	1
LE-C19	Oil Filler Cup	1
LE-C20	Oil Filler Cup Connection	1
LE-C21	Oil Retaining Sleeve	1
LE-C24	Pulley Retaining Nut Locking Screw Spanner (not illus.)	1
LE-C25B	Vee-Belt Pulley	As req'd.
LE-C26B	Flat Belt Pulley	As req'd.
LE-C27	Pulley Cap	1
LE-C28B	Pulley Retaining Nut	1
LE-C29	Pulley Cap Locking Screw	4
LE-C30	Pulley Cap Locking Screw Spanner (not illus.)	1
LE-C31B	Pulley Retaining Nut Locking Screw (not illus.)	2
LE-C32B	Slogging Spanner for Pulley Retaining Nut (not illus.)	1
IZ-B43C	Drive Shaft Flange Retaining Cap Screw Spanner (not illus.)	1
	Hollow Shaft Bearing Housing to Thrust Bearing Housing Setscrew (1 1/2in. x 3/4in. — 16 UNC H. Tensile Hex. Setscrew)	4
	Mounting Setscrews (4 1/2in. x 1/2in. — 13 UNC Bk M.S. Hex Bolt)	4
E	Drive Shaft Adjustment Nut Locking Screw (1 1/2in. x 3/16in. Whit. M.S. Round Head Setscrew)	1
Q	Drive Shaft Flange Retaining Cap-screw (1 1/2in. x 3/4in. — 16 U.N.C.)	2
	Hollow Shaft Bearing Housing to Thrust Bearing Housing Setscrew Washer (3/4in. x 3/32in. x 3/32in. Blk. Spring Washer)	4
	Drive Shaft Flange Retaining Cap-screw Washer (3/4in. x 3/32in. x 3/32in. Spring)	2
	Mounting Setscrew Washer (1/2in. x 1/4in. x 1/4in. Blk. Spring Washer)	4
	Hollow Shaft Drive Key (1 1/4in x 1/2in. x 5/16in. M.S. Plain Parallel Key)	1
F	Drain Plug (3/4in. B.S.P. Plug)	1
G	Oil Filler Cup Plug (1/2in. B.S.P. Plug)	1

MARK LF-D RIGHT ANGLE DRIVE HEAD

(Parts Illustration No. 6)

Symbol No.	Name of Part	No. per Drive Head
LF-D1	Gearbox	1
LF-D2B	Gearbox Cover	1
LF-D3	Gearbox Cover Gasket	1
LD-C3	3/4in. Drive Shaft	1
LD-C4	1in. Drive Shaft	1
LF-C5	Gearbox Side Plate	2
PF-Q6	Drive Shaft Adjustment Nut (1in. Dia. Shaft)	1
LF-D6	Pinion Shaft Bearing (S.K.F. Bearing No. 6012)	1
LF-D7	Pinion	1
PF-Q7	Drive Shaft Adjustment Nut (3/4in. Dia. Shaft)	1
LF-D8	Pinion Shaft	1
LD-C8	Drive Shaft Key Assembly	1
LF-D9	Pinion Thrust Bearing (S.K.F. Bearing No. 3313A)	1
HD-E9	Gearbox Side Plate Gasket	2
LF-D10	Pinion Thrust Bearing Retaining Cir-clip	1
LF-D11	Pinion Thrust Bearing Housing	1
LF-D12	Pinion Thrust Bearing Housing Gasket	As reqd.
LF-D13	Pinion to Pinion Shaft Key	1
LF-D14	Gearwheel Hub (not illus.)	1
LF-D15B	Drive Shaft Non-Reverse Ratchet Plunger	4
LF-D16	Ring Gear	1
LF-D17	Gearwheel Shaft	1
LF-D18	Gearwheel Thrust Bearing (S.K.F. Bearing No. 3211A)	1
ET-B18	Gearwheel Locknut	1
LF-D20	Gearwheel Thrust Bearing Housing	1
LE-C20	Oil Filler Cup Connection	1
LF-D21	Gearwheel Thrust Bearing Housing Gasket	As reqd.
LF-D22	Gearwheel Shaft Bearing (S.K.F. Bearing No. 6210)	1
HX-G22	Gearwheel Thrust Bearing Retaining Circlip	1
LF-D26B	Pinion Shaft to Drive Shaft Coupling (3/4in. Dia. Shaft)	1
LF-D27B	Pinion Shaft to Drive Shaft Coupling (1in. Dia. Shaft)	1
LF-D32	Oil Filler Cup	1
LF-D33	Oil Retaining Sleeve	1
LF-D34	Oil Pump Impeller	1
LF-D36	Oil Pump to Pinion Oil Tube	1
ET-B36	Pinion Thrust Bearing Housing Locating Dowel	1
LF-C37	Oil Pump to Pinion Oil Tube Con-nection on Oil Tube	1
LF-D38	Gearwheel Bearing Oil Pipe	1
LF-D39	Gearwheel Bearing Oil Pipe Bracket (not illus.)	1
LF-D41	Oil Cooler Body	1
LF-C42	Oil Cooler Body Gasket	1
LF-C43	Oil Cooling Tube	1
LF-C44	Oil Cooling Tube Connection in Oil Cooler Body	2
LF-C44	Oil Cooling Tube Connection in Discharge Head	1
LF-C45	Oil Cooling Tube Connection on Oil Cooling Tube	3
LF-D48	Vee Belt Pulley (not illus.)	As reqd.
LF-D49	Flat Belt Pulley (not illus.)	As reqd.
LF-D55	Gearwheel Shaft Oil Seal	1
HD-F61	Gearwheel Locknut Tab Washer	1
YC251	Oil Cooling Tube Connection in Oil Cooler Body Washer	2

Continued on page 26

MARK LF-D RIGHT ANGLE DRIVE HEAD

(Continued from page 25)

(Parts Illustration No. 6)

Symbol No.	Name of Part	No. per Drive Head
YC251	Oil Cooling Tube Connection in Discharge Head Washer	1
	Mounting Stud (2in. x 1/2in. — 13 U.N.C. Br. M.S. Stud)	4
	Gearbox to Pinion Thrust Bearing Housing Stud (1 3/4in. x 1/2in. — 13 U.N.C. Br. M.S. Stud)	4
	Gearwheel Thrust Bearing Housing to Gearbox Stud (1 1/2in. x 3/8in. — 16 U.N.C. Br. M.S. Stud)	8
	Gearbox Side Plate to Gearbox Stud (1 1/2in. x 3/8in. — 16 U.N.C. Br. M.S. Stud)	6
	Oil Cooler Body to Pinion Thrust Bearing Housing Stud (1 1/4in. x 5/16in. — 18 U.N.C. Br. M.S. Stud)	8
	Drive Shaft Adjusting Nut Locking Screw (1 1/2in. x 3/16in. Whit. M.S. Round Head Setscrew)	1
	Gearbox Cover to Gearbox Setscrew (1 1/2in. x 3/8in. — 16 U.N.C. H. Tensile Hex. Setscrew)	3
	Ring Gear to Gearwheel Hub Bolts (1 1/4in. x 3/8in. — 16 U.N.C. H. Tensile Hex. Setscrew)	6
	Oil Cooler Body to Pinion Thrust Bearing Housing Stud Nut (5/16in. — 18 U.N.C. Br. M.S. Hex. Nut)	8
	Gearwheel Thrust Bearing Housing to Gearbox Stud Nut (3/8in. — 16 U.N.C. Br. M.S. Hex. Nut)	8
	Gearbox Side Plate to Gearbox Stud Nut (3/8in. — 16 U.N.C. Br. M.S. Hex. Nut)	6
	Ring Gear to Gearwheel Hub Bolt Nut (3/8in. — U.N.C. "Nyloc" Hex. Nut Simmonds NT/N106)	6
	Gearbox to Pinion Thrust Bearing Housing Stud Nut (1/2in. — 13 U.N.C. Br. M.S. Hex. Nut)	4
	Mounting Stud Nut (1/2in. — 13 U.N.C. Br. M.S. Hex. Nut)	4
	Oil Cooler Body to Pinion Thrust Bearing Housing Stud Washer (5/16in. x 3/32in. x 3/32in. Blk. Spring Washer)	8
	Gearwheel Thrust Bearing Housing to Gearbox Stud Washer (3/8in. x 3/32in. x 3/32in. Blk. Spring Washer)	8
	Gearbox Side Plate to Gearbox Stud Washer (3/8in. x 3/32in. x 3/32in. Blk. Spring Washer)	6
	Gearbox Cover to Gearbox Setscrew Washer (3/8in. x 3/32in. x 3/32in. Blk. Spring Washer)	3
	Mounting Stud Washer (1/2in. x 1/8in. x 1/8in. Blk. Spring Washer)	4
	Gearbox to Pinion Thrust Bearing Housing Stud Washer (1/2in. x 1/8in. x 1/8in. Blk. Spring Washer)	4
H	Gearwheel to Gearwheel Shaft Key (1 1/2in. x 1/2in. x 5.16in. M.S. Plain Parallel Key)	1
J	Gearwheel Shaft Key (3in. x 1/2in. x 5/16in. M.S. Plain Parallel Key)	1
K	Pinion Shaft to Drive Shaft Coupling Key (1 1/2in. x 3/8in. x 7/16in. M.S. Plain Parallel Key)	1
M	Drain Plug (3/8in. B.S.P. Plug)	1
	Oil Cooler Body Drain Plug (3/8in. B.S.P. Plug)	1

MARK LF-D RIGHT ANGLE DRIVE HEAD

(Continued)

(Parts Illustration No. 6)

Symbol No.	Name of Part	No. per Drive Head
N	Oil Filler Cup Plug (1/2in. B.S.P. Plug)	1
	Gearwheel Bearing Oil Pipe Bracket	2
	Drive Screw (1/2in. Type "U" Drive Screw)	
	Oil Pump Impeller Locking Screw (3/8in. x 3/8in. — 16 U.N.C. Knurled Point)	2
	Pulley Locking Screw (not illus.) (M16 x 16 Knurled Point)	2
	Pulley Locking Screw Spanner (not illus.) (8mm A/F Long Series Metric Wrench)	As reqd.

MARK LF-E RIGHT ANGLE DRIVE HEAD

(Parts Illustration No. 6)

Symbol No.	Name of Part	No. per Drive Head
LF-D1	Gearbox	1
LF-D2B	Gearbox Cover	1
LF-D3	Gearbox Cover Gasket	1
LD-C5	1in. Drive Shaft	1
LF-C5	Gearbox Side Plate	2
PF-Q6	Drive Shaft Adjustment Nut	1
LF-D6	Pinion Shaft Bearing (S.K.F. Bearing No. 6012)	1
LF-D7	Pinion	1
LD-C8	Drive Shaft Key Assembly	1
LF-E8	Pinion Shaft	1
LF-D9	Pinion Thrust Bearing (S.K.F. Bearing No. 3313A)	1
HD-E9	Gearbox Side Plate Gasket	2
LF-D10	Pinion Thrust Bearing Retaining Circlip	1
LF-C10	Gearwheel Thrust Bearing Retaining Circlip	1
LF-E11	Pinion Thrust Bearing Housing	1
LF-D12	Pinion Thrust Bearing Housing Gasket	As reqd.
LF-D13	Pinion to Pinion Shaft Key	1
LF-E14	Gearwheel Hub (not illus.)	1
LF-D15B	Drive Shaft Non-Reverse Ratchet Plunger	4
LF-D16	Ring Gear	1
LF-E17	Gearwheel Shaft	1
LF-D18	Gearwheel Shaft Bearing (S.K.F. Bearing No. 3211A)	1
LF-E19	Gearwheel Locknut	1
LE-C20	Oil Filler Cup Connection	1
LF-E20	Gearwheel Thrust Bearing Housing	1
LF-D21	Gearwheel Thrust Bearing Housing Gasket	As reqd.
LF-E23	Gearwheel Shaft Bearing (S.K.F. Bearing No. 3212A)	1
LF-E26B	Pinion Shaft to Drive Shaft Coupling (1in. Dia. Shaft)	1
LF-D32	Oil Filler Cup	1
LF-E33	Oil Retaining Sleeve	1
LF-D34	Oil Pump Impeller	1
LF-D36	Oil Pump to Pinion Oil Tube	1
ET-B36	Pinion Thrust Bearing Housing Locating Dowel	1
LF-C37	Oil Pump to Pinion Oil Tube Connection on Oil Tube	1
LF-D38	Gearwheel Bearing Oil Pipe	1
LF-D39	Gearwheel Bearing Oil Pipe Bracket (not illus.)	1

Continued on page 27

MARK LF-E RIGHT ANGLE DRIVE HEAD

(Continued from page 26)
(Parts Illustration No. 6)

Symbol No.	Name of Part	No. per Drive Head
LF-E41	Oil Cooler Body	1
LF-C42	Oil Cooler Body Gasket	1
LF-E43	Oil Cooling Tube	1
LF-C44	Oil Cooling Tube Connection in Oil Cooler Body	2
LF-C44	Oil Cooling Tube Connection in Discharge Head	1
LF-C45	Oil Cooling Tube Connection on Oil Cooling Tube	3
LF-E55	Gearwheel Shaft Oil Seal (Gaco MIS20)	1
LF-E56	Gearwheel Locknut Tab Washer	1
YC251	Oil Cooling Tube Connection in Oil Cooler Body Washer	2
YC251	Oil Cooling Tube Connection in Discharge Head Washer	1
	Mounting Stud (2in. x 1/2in. — 13 U.N.C. Br. M.S. Stud)	4
	Gearbox to Pinion Thrust Bearing Housing Stud (1 1/4in. x 1/2in. — 13 U.N.C. Br. M.S. Stud)	4
	Gearwheel Thrust Bearing Housing to Gearbox Stud (1 1/2in. x 3/8in. — 16 U.N.C. Br. M.S. Stud)	8
	Gearbox Side Plate to Gearbox Stud (1 1/4in. x 3/8in. — 16 U.N.C. Br. M.S. Stud)	6
	Oil Cooler Body to Pinion Thrust Bearing Housing Stud (1 1/4in. x 5/16in. — 18 U.N.C. Br. M.S. Stud)	8
	Drive Shaft Adjustment Nut Locking Screw (1 1/2in. x 3/16in. Whit. M.S. Roundhead Screw)	1
	Gearbox Cover to Gearbox Setscrew (1 1/2in. x 3/8in. — 16 U.N.C. Br. M.S. Hex. Setscrew)	3
	Ring Gear to Gearwheel Hub Bolts (1 1/4in. x 3/8in. — 16 U.N.C. Blk. High Tensile Bolt — without Nut)	6
	Oil Cooler Body to Pinion Thrust Bearing Housing Stud Nut (5/16 — 18 U.N.C. Br. Hex. Nut)	8
	Gearwheel Thrust Bearing Housing to Gearbox Stud Nut (3/8in. — 16 U.N.C. Br. M.S. Hex. Nut)	8
	Gearbox Side Plate to Gearbox Stud Nut (3/8in. — 16 U.N.C. Br. M.S. Hex. Nut)	6
	Ring Gear to Gearwheel Hub Bolt Nut (3/8in. — 16 U.N.C. Nyloc Hex. Simmonds NT/N106)	6
	Gearwheel to Pinion Thrust Bearing Housing Stud Nut (1/2in. — 13 U.N.C. Br. M.S. Hex. Nut)	4
	Mounting Stud Nut (1/2in. — 13 U.N.C. Br. M.S. Hex. Nut)	4
	Oil Cooler Body to Pinion Thrust Bearing Housing Stud Washer (5/16in. x 3/32in. x 3/32in. Blk. Spring Washer)	8
	Gearwheel Thrust Bearing Housing to Gearbox Stud Washer (3/8in. x 3/32in. x 3/32in. Blk. Spring Washer)	8
	Gearbox Side Plate to Gearbox Stud Washer (3/8in. x 3/32in. x 3/32in. Blk. Spring Washer)	6
	Gearbox Cover to Gearbox Setscrew Washer (3/8in. x 3/32in. x 3/32in. Blk. Spring Washer)	3
	Mounting Stud Washer (1/2in. x 3/8in. x 3/8in. Blk. Spring Washer)	4
	Gearbox to Pinion Thrust Bearing Housing Stud Washer (1/2in. x 3/8in. x 3/8in. Blk. Spring Washer)	4

MARK LF-E RIGHT ANGLE DRIVE HEAD

(Continued)
(Parts Illustration No. 6)

Symbol No.	Name of Part	No. per Drive Head
H	Gearwheel to Gearwheel Shaft Key (2 1/4in. x 1/2in. x 5/16in. M.S. Plain Parallel Key)	1
J	Gearwheel Shaft Key (3 1/2in. x 1/2in. x 5/16in. M.S. Plain Parallel Key)	1
K	Pinion Shaft to Drive Shaft Coupling Key (2in. x 3/8in. x 7/16in. Plain Parallel Key)	1
	Oil Cooler Body Drain Plug (3/8in. B.S.P. Plug)	1
M	Drain Plug (1/2in. B.S.P. Plug)	1
N	Oil Filler Cup Plug (1/2in. B.S.P. Plug)	1
	Gearwheel Bearing Oil Pipe Bracket Drive Screw (1/4in. Type "U" Drive Screw)	2
	Oil Pump Impeller Locking Screw (3/8in. — 16 U.N.C. Knurled Point)	2

MARK LD-F ELECTRIC MOTOR DRIVE FOR SOLID SHAFT MOTOR

(Parts Illustration No. 7)

Symbol No.	Name of Part	No. per Drive Head
Bracket Assembly and Fittings:		
LD-F1B	Bearing Housing	1
LD-F2B	Bearing Retaining Plate	1
LD-F3B	Flexible Coupling — Driven Half	1
LD-F23	Weather Shield	2
KS-T10	Coupling Bush	4
	Flexible Coupling Bush Bolt — (2in. x 3/8in. — 24 U.N.F. H. Tensile Bolt and Nut)	4
	Drive Shaft Adaptor to Flexible Coupling Drive Half Screw — (7/8in. x 5/15in. — 18 U.N.C.)	3
	Bearing Housing to Discharge Head Stud — (1 1/4in. x 1/2in. — 13 U.N.C.)	8
	Bearing Retaining Plate Stud — (1 1/4in. x 3/8in. — 16 U.N.C.)	4
	Bearing Retaining Plate Stud Nut — (3/8in. — 16 U.N.C.)	4
	Bearing Housing to Discharge Head Stud Nut — (1/2in. — 13 U.N.C.)	8
	Bearing Retaining Plate Stud Washer (4)	8
	Flexible Coupling Bush Bolt Washer (4) — (3/8in. x 3/32in. x 3/32in. Spring)	8
	Bearing Housing to Discharge Head Stud Washer — (1/2in. x 3/8in. x 3/8in. Spring)	8
B	Thrust Bearing — (SKF 3313 Angular Contact)	1
A	Bearing Housing Grease Nipple — (3/8in. B.S.P. Straight Grease Nipple)	1
C	Non-Reverse Ratchet Plunger — (1 1/4in. x 1/2in. Dia. Heine Dowel)	2
F	Coupling Bush Clamping Washer — (3/8in. M.S. Plain)	8
G	Flexible Coupling — Driven Half Clip — (Anderton 1400-65)	1
J	Bearing Housing Vee Ring — (SKF Type V75S V-Ring)	1
K	Bearing Housing Oil Seal — (Repro Oil Seal — Type PR3209)	1
H	Bearing Housing 'O' Ring — ('O' Ring Gasket AN6230-35/BS257)	1

Continued on page 28

MARK LD-F ELECTRIC MOTOR DRIVE FOR SOLID SHAFT MOTOR

(Continued from page 27)
(Parts Illustration No. 7)

Symbol No.	Name of Part	No. per Drive Head
¾in. Shaft and Fittings:		
LD-F4	Drive Shaft Adaptor — ¾in. Shaft	1
PF-Q7	Shaft Adjustment Nut — ¾in. Shaft	1
LD-C8	Shaft Drive Key	1
LD-F21	¾in. Dia. Shaft for Solid Shaft Motors	1
D	Shaft Adjustment Nut Locking Screw — (1½in. x 3/16in. Whit. Round Head)	1
1in. Shaft and Fittings:		
LD-F5	Drive Shaft Adaptor — 1in. Shaft	1
PF-Q6	Shaft Adjustment Nut — 1in. Shaft	1
LD-C8	Shaft Drive Key	1
LD-F22	1in. Dia. Shaft for Solid Shaft Motors	1
D	Shaft Adjustment Nut Locking Screw — (1½in. x 3/16in. Whit. Round Head)	1
Driving Half Flexible Coupling — 28mm Bore:		
LD-F11	Flexible Coupling — Driving Half — (4 & 5½ H.P. Motors)	1
	Flexible Coupling Driving Half Locking Screw — (M10 x 1.5 x 10mm 'Unbrako' Socket Grub Screw)	4
Driving Half Flexible Coupling — 38mm Bore:		
LD-F12	Flexible Coupling — Driving Half — (7½ & 10 H.P. Motors)	1
	Flexible Coupling Driving Half Locking Screw — (M10 x 1.5 x 10mm 'Unbrako' Socket Grub Screw)	4
Driving Half Flexible Coupling — 42mm Bore:		
LD-F13	Flexible Coupling — Driving Half — (15 & 20 H.P. Motors)	1
	Flexible Coupling Driving Half Locking Screw — (M12 x 1.75 x 12mm 'Unbrako' Socket Grub Screw)	4
Driving Half Flexible Coupling — 48mm Bore:		
LD-F14	Flexible Coupling — Driving Half — (30 H.P. Motors)	1
	Flexible Coupling Driving Half Locking Screw — (M12 x 1.75 x 12mm 'Unbrako' Socket Grub Screw)	4
Driving Half Flexible Coupling — 55mm Bore:		
LD-F15	Flexible Coupling — Driving Half — (40 & 50 H.P. Motors)	1
	Flexible Coupling Driving Half Locking Screw — (M12 x 1.75 x 12mm 'Unbrako' Socket Grub Screw)	4
180mm Spigot Motor Adaptor Plate:		
LD-F17	Motor Mounting Plate (4 and 5½ H.P. Motors)	1
	Motor to Motor Mounting Plate Bolt — (1in. x ½in. — 13 U.N.C. H. Tensile Bolt without Nut)	4
	Motor Mounting Plate to Bearing Housing Bolt — (2in. x ½in. — 13 U.N.C. H. Tensile Bolt without Nut)	4
	Motor Mounting Plate to Bearing Housing Bolt Nut — (½in. 13 U.N.C. M. Steel Nut)	4
	Motor to Motor Mounting Plate Bolt Washer (4)	8
	Motor Mounting Plate to Bearing Housing Bolt Washer (4) — (½in. x ½in. Spring)	4

MARK LD-F ELECTRIC MOTOR DRIVE FOR SOLID SHAFT MOTOR

(Continued)
(Parts Illustration No. 7)

Symbol No.	Name of Part	No. per Drive Head
250mm Spigot Motor Adaptor Plate:		
LD-F19	Motor Mounting Plate — (15, 20, 25 and 30 H.P. Motors)	1
	Motor Mounting Plate to Bearing Housing Bolt — (2in. x ½in. — 13 U.N.C. H. Tensile Bolt, without Nut)	4
	Motor to Motor Mounting Plate Bolt — 2in. x ¾in. — 11 U.N.C. H. Tensile Bolt, without Nut)	4
	Motor Mounting Plate to Bearing Housing Bolt Nut — (½in. — 13 U.N.C. M. Steel Nut)	4
	Motor Mounting Plate to Bearing Housing Bolt Washer — (½in. x ½in. Spring)	4
	Motor to Motor Mounting Plate Bolt Washer — (¾in. x 5/32in. x 5/32in. Spring)	4
	Motor to Motor Mounting Plate Bolt Nut — (¾in. — 11 U.N.C. Mild Steel Nut)	4
	Motor to Motor Mounting Plate Bolt — Short — (1½in. x ¾in. — 11 U.N.C. H. Tensile Bolt, without Nut)	4
	For use with 20 H.P. T.E.F.C. McColl Motor Only	
300mm Spigot Motor Adaptor Plate:		
LD-F20	Motor Mounting Plate (40 & 50 H.P. T.E.F.C. - 15 - 50 H.P. Drip Proof Motors)	1
	Motor Mounting Plate to Bearing Housing Bolt — (2in. x ½in. — 13 U.N.C. H. Tensile Bolt, without Nut)	4
	Motor to Motor Mounting Plate Bolt — (2½in. x ¾in. — 11 U.N.C. H. Tensile Bolt, without Nut)	4
	Motor Mounting Plate to Bearing Housing Bolt Nut — (½in. — 13 U.N.C. M. Steel Nut)	4
	Motor to Motor Mounting Plate Bolt Nut — (¾in. — 11 U.N.C. M. Steel Nut)	4
	Motor Mounting Plate to Bearing Housing Bolt Washer — (½in. x ½in. Spring)	4
	Motor to Motor Mounting Plate Bolt Washer — (¾in. x 5/32in. x 5/32in. Spring)	4
Electric Motor:		
	T. E. F. C. Electric Motor	1
	4 H.P., 5½ H.P., 7½ H.P., 10 H.P., 15 H.P., 20 H.P., 25 H.P., 30 H.P., 40 H.P., 50 H.P.	As Ord.
	OR	
	Drip Proof Electric Motor	1
	15 H.P., 20 H.P., 25 H.P., 30 H.P., 40 H.P., 50 H.P.	As Ord.
Mounting Bolts — 7½ H.P. and 10 H.P. Motors:		
	Motor to Bearing Housing Bolt — (2in. x ½in. — 13 U.N.C. H. Tensile Bolt, without Nut)	4
	Motor to Bearing Housing Bolt Nut — (½in. 13 U.N.C. M. Steel Nut)	4
	Motor to Bearing Housing Bolt Washer — (½in. x ½in. Spring)	4

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MAINTENANCE NOTES