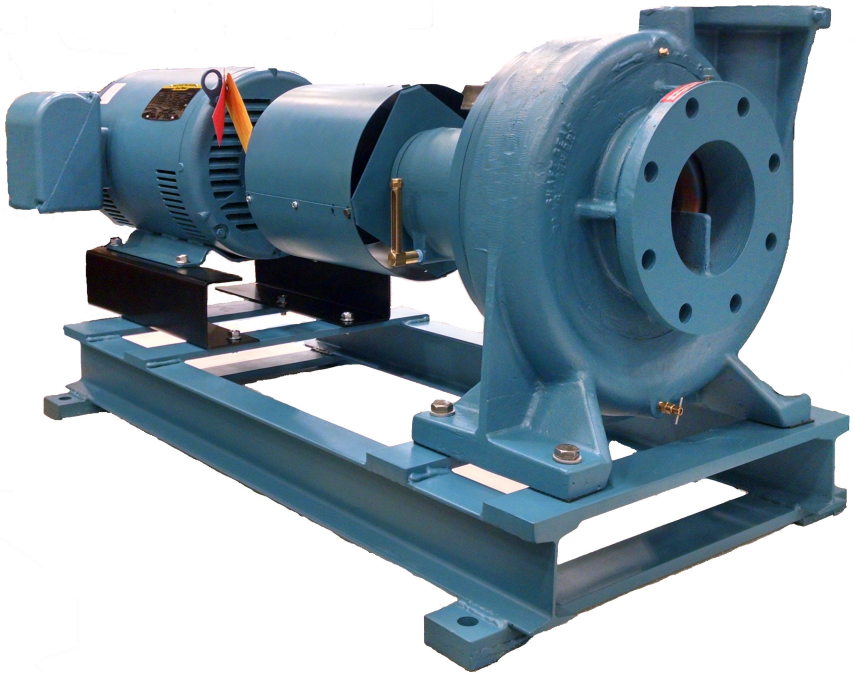
CENTRIFUGAL PUMPS

TYPE E11, E14 INSTALLTION, OPERATION AND MAINTENANCE



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INTRODUCTION

The MEPCO Type E pump is a radially split, horizontal, cantilevered single stage, base mounted centrifugal pump, featuring a double volute (to reduce radial hydraulic loads on the impeller and insure long bearing life) and double suction impeller (reducing NPSHR and balancing axial thrust). These pumps are supplied with an end face mechanical shaft seal installed, which is especailly selected for reliability and life on the particular pump application. Pumps are usually supplied as complete units including the motor which is connected to the pump through a flexible coupling. This flexible coupling has been selected for the required torque transmission, quiet operation and misalignment tolerance. All components are supplied on a rigid structural steel base which has been designed to eliminate any "sound box" effect.

SECTION I—INSTALLATION

A. LOCATION

1. For satisfactory operation of any centrifugal pump it is necessary that adequate net positive suction head (NPSH) be available at the pump suction connection (NPSH is the total head in feet absolute, less the vapor pressure of the liquid in feet absolute, available to the pump). For this reason the pump should be located as close to the liquid source as possible.

2. Adequate head room should be provided for the use of lifting equipment.

3. Adequate space should be allowed for inspection during pump operation.

B. FOUNDATION

The foundation should be solid and substantial enough to absorb mechanical vibration. In general, concrete foundations are the most satisfactory. Where concrete foundations are used, foundation bolts should be supplied (located as shown on dimensional drawings) which are imbedded in the concrete. It is recommended that each bolt be fitted with a pipe sleeve approximately 2½ times the bolt diameter and with a washer to support the head of the bolt in the sleeve. After the concrete is poured, the pipe sleeves remain in place allowing the foundation bolts to be shifted for alignment with the holes in the base (see Fig. 1 and 2).

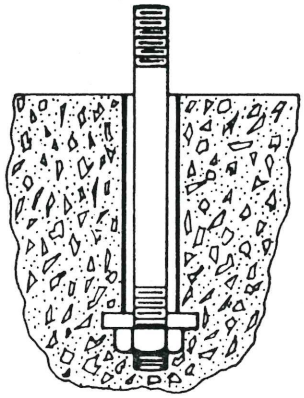


FIGURE 1

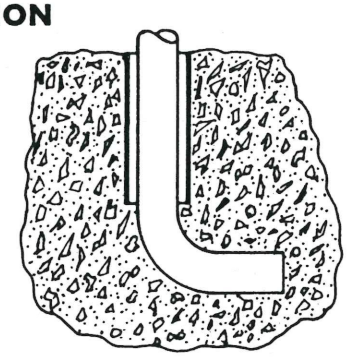


FIGURE 2

C. MOUNTING PUMP

1. Uncrate pump leaving all instructions attached and install at its' place of operation.

2. Locate leveling plates and shims at each foundation bolt.

3. Level base across driver end, shimming as necessary.

4. Level base across pump end, shimming as necessary.

5. Level base lengthwise and tighten nuts on the foundation bolts evenly.

D. PIPING

1. Both suction and discharge piping should be as short and as direct as possible. There should be as few as possible fittings and bends. Bends where used should, if possible, be made with a long radius.

2. Piping should be adequately supported near the pump to prevent strains being transmitted to the pump when tightening the flange bolts, or when pipe expansion may be expected due to operating temperature.

3. Pipes at the suction and discharge should be as large or larger than the openings in the pump.

4. Gate valves and pressure gages should be installed in both the suction and discharge line to facilitate pump maintenance and performance checks.

E. SUCTION PIPING

1. Suction lines must be free of vapor trapping pockets.

2. In horizontal lines leading to the pump only eccentric-reducers should be used (see Fig. 3 & 4).

3. The suction line must be free from air leaks and adequate provisions should be made for the expansion of hot lines.

4. It is recommended that a strainer be installed near the pump suction nozzle to catch scale or other foreign material. A pressure gauge installed on each side of the strainer can be used for measuring the pressure drop across the strainer.

5. If a strainer or foot valve is to be used on the inlet end of the suction line, the free area through the strainer or valve should be approximately 2½ to 4 times the area of the suction pipe.

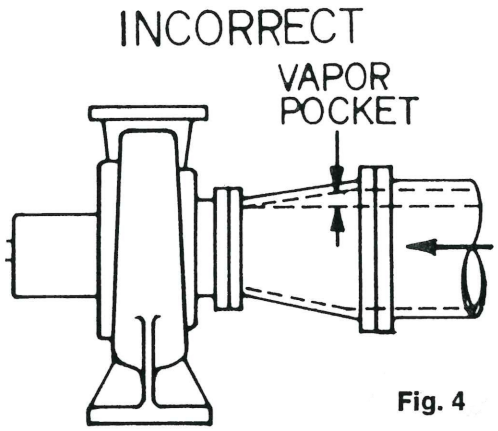


Fig. 4

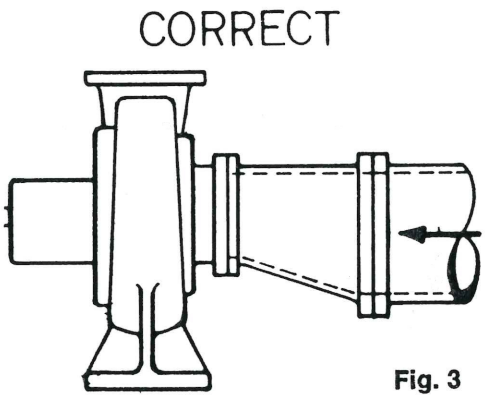


Fig. 3

F. DISCHARGE PIPING

1. On some installations, a check valve and balancing cock in addition to a gate valve may be required in the discharge line. The check valve is used to prevent liquid from running back through the pump in case of failure of the driver. The balancing cock is used to control the pumps' operating capacity by providing a changeable control of the piping system curve. The gate valve is used in priming, starting and when shutting down the pump.

2. When valves are required in the discharge line, they should be located as near as possible to the pump.

3. In some applications when the pump may be operated with zero flow, provisions should be made for recirculating a portion of the liquid from the discharge to the suction to reduce the possibility of the pump overheating.

G. PIPING FOR SPARE PUMPS

The operating and spare pumps in high temperature service should be piped so that hot liquid from the discharge of the operating pump circulates continuously through a by-pass to the spare pump and back to the suction of the operating pump. This can greatly reduce thermal shock when the spare pump is started.

H. INSTALLING PUMP

1. Make up the piping connections to the discharge and suction nozzle. All piping must be properly supported by hangers and not by the pump.

2. Fill bearing bracket assembly with American Rycon No. 21 or Sunoco Sunvis 747 Oil until oil level is between the high and low level marks on the sight glass (with pump stopped). Periodic inspections should be made to assure that adequate oil level is maintained.

3. Wire the pump motor for the voltage required per wiring diagram on motor nameplate or in cover of motor terminal box. All wiring must be in accordance with local regulations. If motor is damaged due to improper wiring, guarantee is void.

I. ALIGN PUMP & DRIVER

1. Woods type S or SB are standardly supplied on these pumps. They are assembled and aligned at the factory but the alignment should be checked due to loading, off-loading, transportation and leveling of base. The coupling size is die stamped in the coupling flange.

   a. Check parallel misalignment by placing a straight edge across the two coupling flanges (see Fig. 5) and measure the offset at various points around the periphery of the coupling to determine the maximum offset. This value should not exceed the value under Fig. 7 and should be as close to zero as possible. Do not rotate coupling.

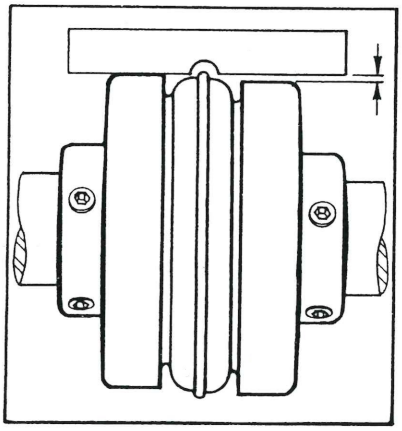


FIGURE 5

Note: Woods type S and SB couplings utilize a wire ring to hold the two halves of the flexible member together. This ring may be removed for alignment or a notched straight edge may be used.

   b. Check angular misalignment by using a micrometer or micrometer calipers to measure the gap between the two flanges (see Fig. 6). Measure this gap at intervals around the periphery of the coupling to determine the minimum and maximum gap. The differences in these two values should not exceed the values given in Fig. 7 and should be as close to zero as possible. If the angular misalignment was adjusted, go back and recheck the parallel alignment.

NOTE: If the shaft does not extend completely through the bore of the flange, it must engage the bore a distance equal to or greater than the diameter of the shaft. For example, a flange with 1 inch bore must grasp at least 1 inch of the shaft.

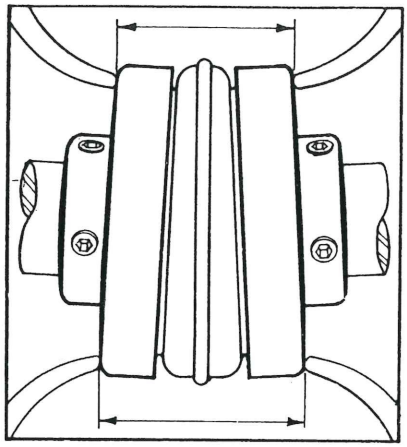


FIGURE 6

In no case should the distance between shafts be less than 1/8 inch.

If the coupling is being used on a sleeve bearing electric motor, the coupling should be made up with the motor armature at its electrical center.

DO NOT rotate the coupling while making alignment checks.

The wire ring must be in position in the groove in the center of the sleeve to operate the pump. It may be necessary to pry the ring into position with a blunt screwdriver.

2. Check the safety codes in your locality to see if protective guards and/or shields are required. Coupling guards are standardly supplied and must be replaced before operating the pump.

Flange Size	Type S & SB	
	Parallel	Angular
5	.015"	.056"
5J	.015"	.056"
6	.015"	.070"
6J	.015"	.070"
7	.020"	.081"
7J	.020"	.081"
8	.020"	.094"
8J	.020"	.094"
9	.025"	.109"
10	.025"	.128"
11	.032"	.151"
12	.032"	.175"
13	.040"	.195"
14	.045"	.242"
16	.062"	.330"

FIGURE 7

SECTION II – OPERATION

A. STARTING PUMP

1. Open suction and discharge valves to pump. These pumps have a mechanical seal and must NOT be run dry. Open cock at top of case to vent out any air.

   NOTE: a. If pump is above the level of the liquid to be pumped, close the discharge valve. If the pump is below the level of the liquid, open the discharge valve 1½ to 2 turns.

   b. Prime the pump. All air and vapor must be removed. The pump case and suction pipe must be filled with liquid before the pump is started.

2. Rotate the pump shaft by hand to be sure pump is not binding. Checking for sticking should also be done after a prolonged pump shutdown.

3. Start pump and check for correct rotation according to the arrow on the case. If running in wrong direction on three phase, change any two leads to the motor. Disconnect power before changing wiring.

4. Lack of capacity and head may indicate the passageways of the pump impeller have become clogged with foreign matter or motor speed is low. If speed of motor is low, check the wiring connections at the motor. If wired for 460 volt current, but actually operating on 230 volt current, the motor will never come up to proper speed and may burn out. If low voltage occurs, notify local power company. Slugging of air is another cause of low capacity and head on a closed system. Be sure the system is properly vented of all air – see further notes under Trouble Shooting – Section IV.

WARNING – DO NOT ATTEMPT TO OPERATE PUMP WITH CLOSED SUCTION VALVE!

5. As soon as the pump is up to full speed, open the discharge valve slowly. Do not let the pump run with the discharge valve closed.
6. Check pressure gauges on each side of the strainer in the suction line. A pressure drop across the strainer indicates it is becoming clogged with dirt or scale. In this case, the pump should be shut down and the screen cleaned or replaced. A clogged strainer can cause damage to the pump.
7. The pump should be shut down if it fails to develop its rated discharge pressure at operating speed, if bearings overheat or there is undue vibration or noise.

B. OPERATING AT REDUCED CAPACITY

If the pump is connected to a constant speed driver, capacity can be reduced by throttling the discharge. If the pump is connected to a variable speed driver, reduction of both the head and the capacity can be accomplished either by reducing the speed or by throttling the discharge.

When throttling the discharge, a by-pass connection may be used to by-pass sufficient liquid to prevent overheating.

C. OPERATING ROUTINE

1. Check bearing temperatures periodically. If there is overheating, check the oil level in the reservoir and the oil temperature. When ambient temperature is normal, the skin temperature should not exceed 165°F. American Rycon No. 21 or Sunoco Sunvis 747 oil should be used when adding or changing oil.
   a. Normal inspection consists of periodic checks of oil gauge for proper oil level which is between the high and low level marks on the sight glass with the pump stopped.
   b. Replacement of the oil in the bearing bracket depends upon the application of the pump, breakdown or contamination of the oil. The major cause of premature bearing failure is oil contamination and as such the oil should be changed after the first 100 hours of operation. Thereafter, 2000 hours is normal for oil changes for average pump applications. This may be accomplished by disconnecting power to pump and removing oil level gauge then flushing out with kerosene or fuel oil. Replace oil level gauge and fill bearing bracket with oil until oil level is between high and low oil level marks.
2. Lubricating pump motor should be done per motor manufacturer's recommendations.
3. Check seals for leakage.
4. Check suction and discharge pressure gauges. If the differential pressure drops critically, shut down the pump at once.

D. STOPPING

The pump should be shut down rapidly to keep liquid in the pump and prevent parts from seizing. After stopping the driver, close the discharge valve and then the inlet valve, in that order. When pumps are operating in parallel, it is sometimes necessary to close the discharge valve immediately after stopping the driver to prevent reverse rotation. If pumps are to remain idle under freezing conditions, precautions, such as draining the case, should be taken to avoid damage.

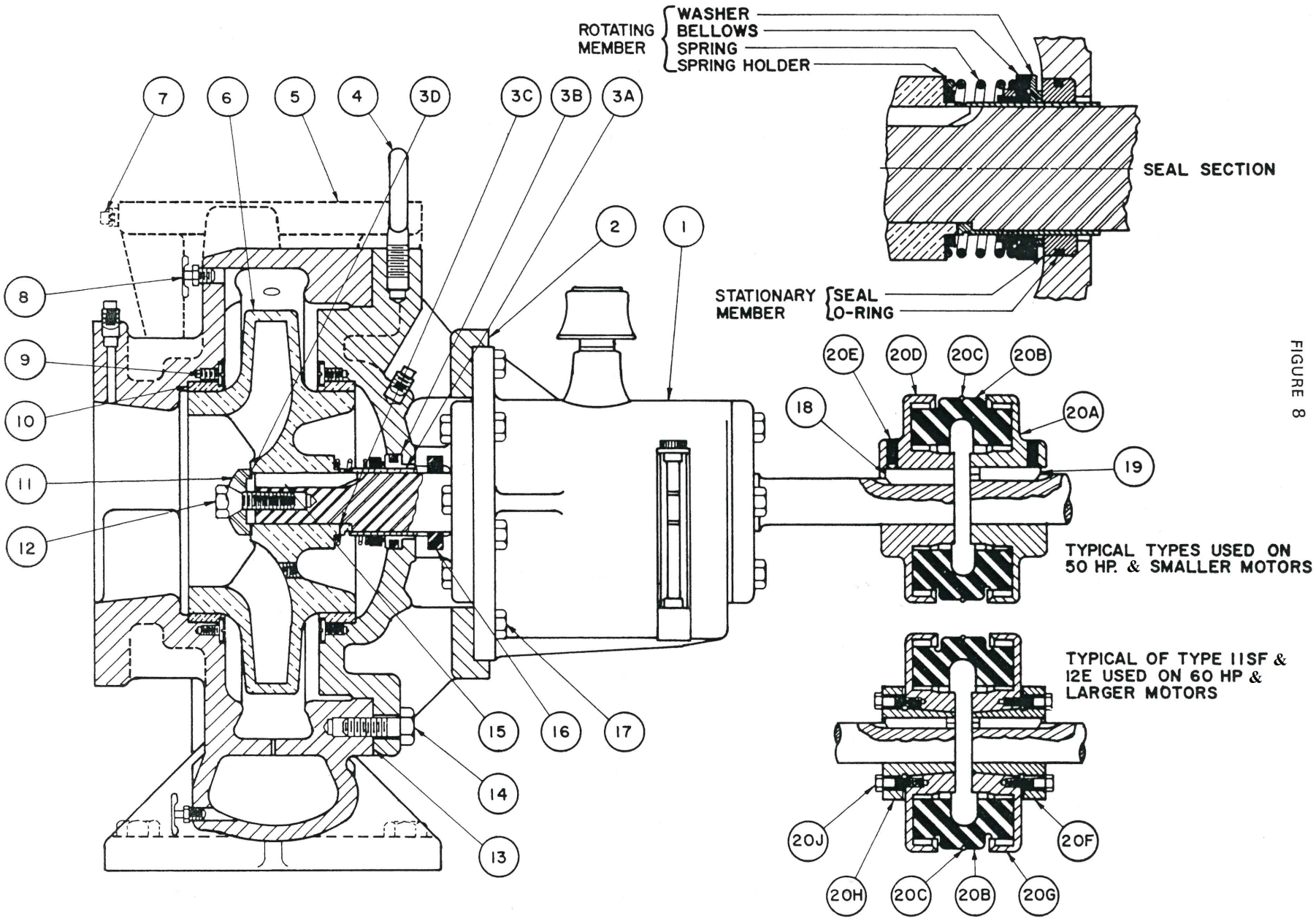

ROTATING MEMBER
WASHER
BELLOWS
SPRING
SPRING HOLDER
SEAL SECTION
STATIONARY MEMBER
SEAL
O-RING
7
6
5
4
3D
3C
3B
3A
2
1
8
9
10
11
12
15
16
17
14
13
20E
20D
20C
20B
20A
18
19
TYPICAL TYPES USED ON 50 HP. & SMALLER MOTORS
TYPICAL OF TYPE 11SF & 12E USED ON 60 HP & LARGER MOTORS
20J
20H
20C
20B
20G
20F

FIGURE 8

SECTION III —MAINTENANCE

A. DISASSEMBLY OF PUMP (Ref. Fig. 8)

1. Disconnect power to pump.
2. Disassemble coupling.
   a. Use the following procedure, if no bushing is used between coupling half and shaft.
      1. Slip ring (20C) from its groove in the sleeve (20B) and let it hang loose.
      2. Remove set screws (20E) from the pump flange (20D) and the motor flange (20A).
      3. Slide the flanges apart and remove the sleeve (20B) and ring (20C).
   b. If bushings are used between coupling half and shaft, proceed as follows.
      1. Slip ring (20C) from its groove in the sleeve (20B) and let it hang loose.
      2. Remove screws (20J) from the bushings (20F & 20H) and loosen the bushings (20F & 20H) from their flanges (20G).
      3. Slide flanges (20G) apart and remove the sleeve (20B) and ring (20C).
3. Remove the pump half of the coupling (20D or 20H) and the pump key (18) from pump shaft.
4. Disengage the 16 hex head screws (14) holding the head (2) to case (5).
5. The head (2) and bearing assembly (1) can now be removed from the case (5) using jack screws if necessary. Provisions are made on the head for 3 jack screws. Care must be exercised when using the jack screws as binding may occur on the inner fit of head to case if head is **not** jacked out evenly.

   NOTE: The bearing assembly must be supported during this procedure and not allowed to drop.
6. Remove the head gasket (13) from the case (5) or head (2) and clean both surfaces.
7. To remove the impeller screw (12) turn it counter-clockwise.
8. Remove the impeller cap (11) and washer (3D).
9. Remove the impeller (6) from the shaft.

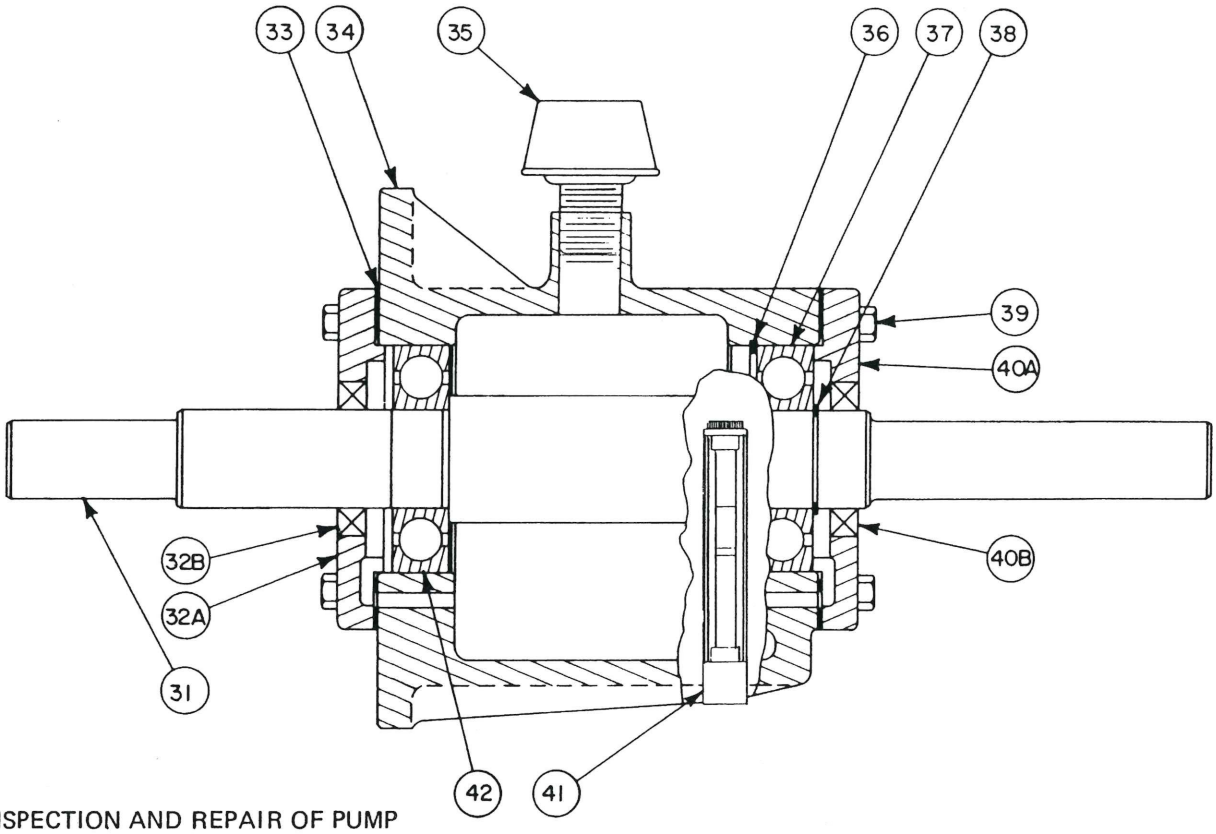
   NOTE: An impeller puller (SKB2-322) is available from Dunham-Bush. The impeller is drilled and tapped for its use.
10. The impeller key (15) and sleeve gasket (3C) may now be taken from the shaft.
11. Remove the sleeve (3A) and seal (3B) from the shaft.

    NOTE: The stationary seat of the seal will remain in the head (2).
12. The stationary seat of the seal (3B) can now be removed from the head (2).
13. Clean the pump shaft with solvent.

    NOTE: If only the mechanical seal is to be replaced, go to assembly instructions, Item C, Step 9.
14. Remove the complete bearing assembly (1) from head (2) by unscrewing the eight cap screws (17).
15. The wear ring (10) can now be removed from head (2) by disengaging the binding head screws (9).
16. Remove the wear ring (10) from case (5) by removing the binding head screws (9).
17. Disassembly of Bearing Assembly (1).
    a. Remove water slinger (16) from the shaft.
    b. If the pump is supplied with ball bearings (Model EB) refer to Fig. 9 and proceed as follows:
       1. Remove the oil gauge (41) and drain the oil.
       2. Remove the outboard cap and the oil seal (40A & 40B) from housing (34) by removing the 6 cap screws (39).
       3. Remove the inboard cap and the oil seal (32A & 32B) from housing (34) by removing the 6 cap screws (39).
       4. Remove gaskets (33) both inboard and outboard ends and clean the surfaces on both caps and housing.
       5. Move the shaft (31) towards outboard end until the bearing (37) clears housing (34).
       6. Remove the retaining ring (36) from the housing (34) then remove the shaft (31) with bearings (37 & 42) from the housing (34).
       7. Remove the retaining ring (38) from the shaft (31).
       8. Remove the bearings (37 & 42) from the shaft (31) with a steady press. Do not hammer off as this can easily result in damage or introduction of foreign particles into the bearing.

BALL BEARING ASSEMBLY

FIGURE 9



B. INSPECTION AND REPAIR OF PUMP

1. Clean all parts and inspect for wear or damage giving particular attention to:

   a. Inspect the oil seals (32B & 40B on EB Models) for wear, abrasion or cuts.

   b. Check shaft for wear, scoring and for straightness. Shaft must be straight within 0.0015 inch total indicator runout.

   c. Inspect the mechanical seal faces (3B) for wear, scratches or gouges.

      NOTE: These are precision lapped surfaces and extreme care must be exercised not to handle or scratch them. If seal replacement is necessary, the complete assembly should be replaced (Seal replacement kit item No. 3).

   d. Polish out any scratches on shaft or replace it.

C. ASSEMBLY OF PUMP

1. If the pump is supplied with ball bearings (EB Models) refer to Fig. 9 and proceed as follows:

   a. Install bearing (42) on inboard end of the shaft (31) and bearing (37) on outboard end of the shaft, using a square, uniform pressure. Do not hammer or pound these bearings into place as damage and/or introduction of foreign particles will likely result.

   b. Replace the retainer ring (38) in its groove on the shaft.

   c. Slide the shaft with the bearings through the housing (34), positioning bearing (42) approximately under the demister (35) connection.

   d. Replace the retaining ring (36) in the housing (34), then slide the shaft and bearings into position. Be sure that the bearing (37) shoulders against the retaining ring (36).

   e. Install gaskets (33) on caps (32A & 40A).

      NOTE: Care must be exercised that the bolt holes and the oil return hole in (both) the caps (32A & 40A) and gaskets (33) properly line up.

   f. Install caps (32A & 40A) with oil seals (32B & 40B) onto the housing bolting it together with the cap screws (39).

NOTE: f1. If the oil seals require replacement, it is recommended that they be replaced as an assembly (Part 32 or Part 40).

f2. The offset bolt will insure the proper positioning of the oil return hole.

f3. When placing the cap and oil seal assembly over the shaft, be careful not to cut or gouge the oil seal on the shaft.

f4. On some pumps a garter (or back up) spring is supplied in the oil seal. Do not allow it to slip down onto the shaft when bringing the seal over the shaft shoulders.

g. If demister (35) was removed, replace it.

h. Replace the oil gauge (41).

i. Slide the water slinger (8) onto shaft (31) from the impeller end of shaft. The slinger should be set so there is approximately ½" clearance to the bearing cap (32A).

2. Fill bearing assembly (1) with oil, American Rycon No. 21 or Sunoco Sunvis 747, until the level is between the high and low marks on the oil gauge. Turn the shaft by hand and inspect seals and gaskets for leaks.

3. Fasten the head (2) to the bearing assembly (1) by using the 8 cap screws (14).

4. Replace the wearing ring (10) in the head (2). Lock in place by using 2 binding head screws (9).

5. Replace the wearing ring (10) in the case (5). Lock in place by using 2 binding head screws (9).

NOTE: There are two reliefs cut into the wearing rings (10) for acceptance of screw heads (9).

6. Check the shaft for angular alignment and concentricity.

a. Angular alignment may be checked by fastening a dial indicator to the impeller end of the shaft and a reading taken from the face of the head flange (2). Rotate the shaft from the coupling end. Total indicator reading should not exceed 0.00005".

b. Concentricity may be checked by fastening a dial indicator as above but with a reading taken from the internal diameter of the wear ring which is parallel to the shaft. TIR should not exceed 0.005". Rotate the shaft from the coupling end.

c. A check for a bent shaft can be performed by clamping the dial indicator to the head flange and a reading taken from the impeller shaft diameter. Rotate the shaft from coupling end. TIR should not exceed 0.005".

7. Place "O" ring of mechanical seal into stationary seat. Make absolutely certain that the recess in the head (2) which accepts the stationary seat is clean and free of burrs. Slide the stationary seat (with lapped face towards impeller) over the shaft and into the recess in the head. This assembly must be squarely positioned with the head and well seated into its bore.

CAUTION: Do not scratch, gouge or in any way mar the lapped face or seal leakage can occur.

NOTE: A light coating of lubricant will ease assembly.

8. Place film of white lead on the inside diameter and on the outside diameter at impeller end of sleeve (3A).

9. Assemble rotating element of the mechanical seal onto sleeve (3A) such that the sealing face (this is identified by its lapped surface) is away from the key slot but so the seal spring holder is on the sleeve (Ref. seal detail Fig. 7).

CAUTION: Do not scratch, gouge or in any way mar the lapped face or seal leakage can occur.

NOTE: A light coating of lubrication on the inside diameter of the seal bellows will facilitate assembly.

10. Slip sleeve and seal assembly over shaft and slide back GENTLY until contact is made between the seal faces.

11. Place impeller key (15) into key slot of shaft, rotate sleeve (3A) until key slot matches and slide key back.

12. Place sleeve gasket (3C) over shaft and position on end of sleeve (3A).

13. Place coating of white lead in the bore and on the seal end of impeller (6) and slide the impeller onto shaft.

14. Coat a new impeller washer (3D) with white lead and place it on the impeller hub. Place the impeller cap (11) on the washer and fasten in place with the impeller screw (12).

15. Using a new gasket (13) bolt the head (2) onto the case (5) with 16 hex head bolts (14).

NOTE: One bolt hole is offset which insures proper alignment of head (2) to case (5).

16. Assemble the coupling

a. If no bushing is used

1. Place keys (18) in keyway.
2. Reposition flanges (20A & 20D) placing the sleeve (20B) into position. Hang the ring (20C) loosely on the sleeve.
3. Be sure the teeth on the sleeve are fully engaged with the teeth in both flanges and the keys are properly aligned and seated in their keyways.
4. Tighten set screws (20E) and place ring (20C) in its groove on the sleeve.

b. If bushings are used

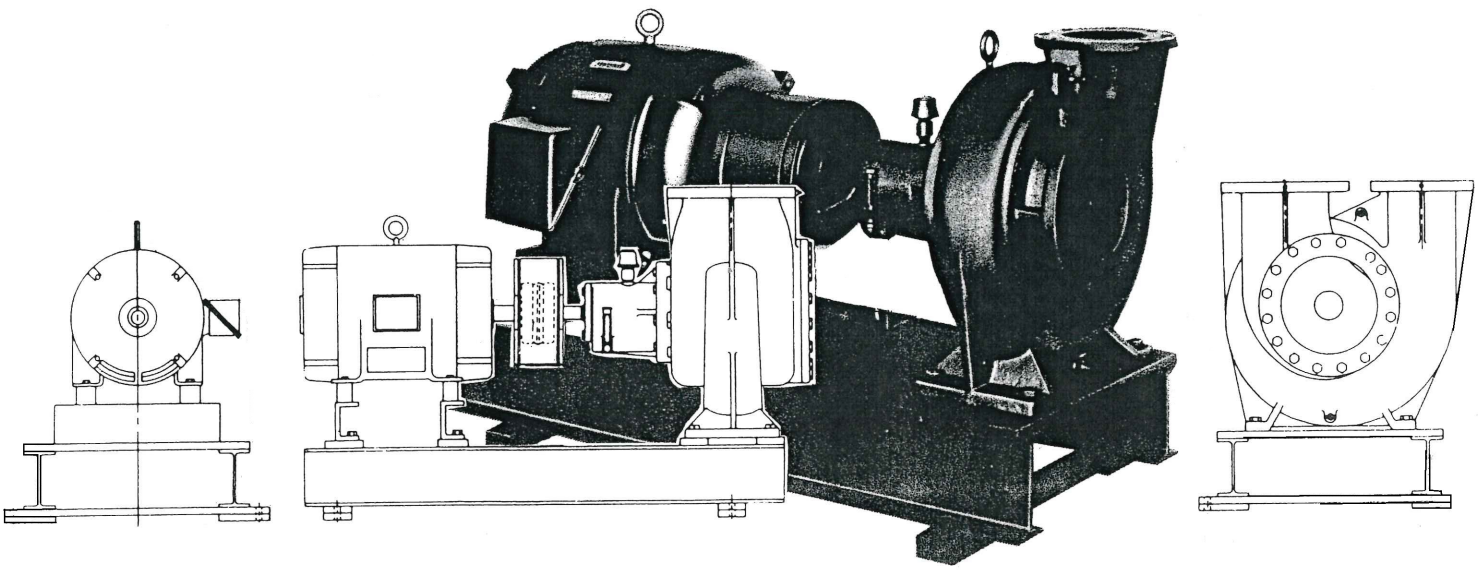
1. Place keys (18) in keyway.
2. Place flanges (20G) with bushings (20F & 20H) and sleeve (20B) into position. Hang the ring (20C) loosely on the sleeve.
3. Be sure the teeth on the sleeve are fully engaged with the teeth on both flanges, keys are properly aligned and seated in their keyways and the bolt holes in the bushings line up with those in the flange.
4. Fasten the bushing to the flange with screws (20J) and place the ring (20C) in its groove on the sleeve.

c. Check the coupling alignment (Section I — Paragraph 1).

d. Replace coupling guard.

e. Restore power to driver.

f. Follow the procedures for starting the pump (Section II).



SECTION IV—TROUBLE SHOOTING

Operating troubles and their probable causes are as follows:

A. INSUFFICIENT OR NO DISCHARGE

1. Wrong direction of rotation.
2. Pump not primed.
3. Suction line not full of liquid.
4. Air or vapor in suction line.
5. Suction pipe not submerged enough.
6. Available NPSH not sufficient.
7. Pump not up to rated speed.
8. Too much system head.

B. INSUFFICIENT PRESSURE

1. Wrong direction of rotation.
2. Suction line not full of liquid.
3. Air or vapor in liquid.
4. Air leaks in suction line.
5. Suction line not submerged enough.
6. Available NPSH not sufficient.
7. Pump not up to rated speed.
8. Mechanical defects:
   a. Wearing rings worn.
   b. Impeller damaged.
   c. Internal leakage.

C. CAVITATION AND NOISE

1. Air or gas in liquid.
2. Suction line not filled with liquid.
3. Suction line not submerged enough.
4. Available NPSH not sufficient.

D. PUMP LOSES SUCTION AFTER STARTING

1. Suction line not full of liquid.
2. Air leaks in suction line.
3. Air or vapor in liquid.
4. Air or vapor in suction line.
5. Suction line not submerged enough.
6. Available NPSH not sufficient.

E. EXCESSIVE POWER CONSUMPTION

1. Speed too high.
2. Insufficient head.
3. Mechanical defects:
   a. Misalignment.
   b. Shaft bent.
   c. Rotating element dragging.
   d. Piping improperly supported.

F. BEARINGS OVERHEAT

1. Improper or poor grade of oil.
2. Dirt in bearings.
3. Dirt or moisture in oil.
4. Failure in oiling system.
5. Bearings too tight.
6. Misalignment.
7. Pipe improperly supported.

G. VIBRATION

1. Suction line not full of liquid.
2. Air or vapor in suction line.
3. Misalignment.
4. Worn or loose bearings.
5. Rotating element out of balance.
6. Shaft bent.
7. Foundation not rigid.
8. Vibration in the driver.
9. Wrong location of control valve.
10. Pipe improperly supported.

FOR LIST OF PARTS AND PART NUMBERS, SEE FORM #2507