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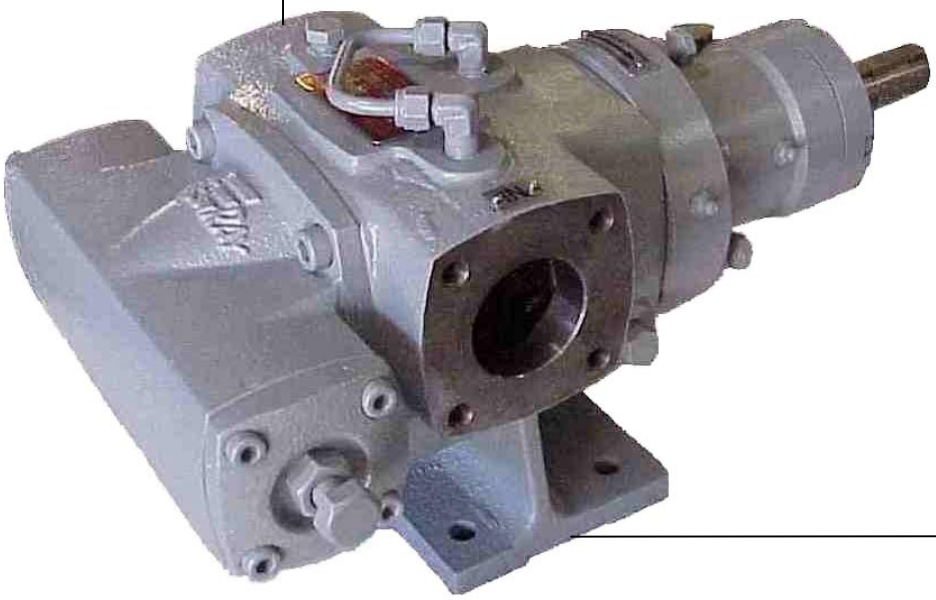
EBSRAY PUMPS

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS



E SERIES
MODEL E20HD

Quality System
Quality Endorsed Company ISO 9001 Lic 3332 Standards Australia
HEAD OFFICE & WORKS

EBSRAY AUSTRALIA

SECTION 1 – GENERAL

INTRODUCTION
This leaflet is intended to assist those involved with the installation, operation and maintenance of EBSRAY Model E20HD Internal Gear Positive Displacement Pumps. The design, materials and workmanship incorporated in the manufacture of EBSRAY pumps make them capable of reliable operation over a long working life. Correct installation is essential. Service life is enhanced by periodic inspection and careful maintenance.

1.1 CAUTION
INSTALLATION AND SERVICING OF THIS EQUIPMENT SHOULD BE PERFORMED BY QUALIFIED COMPETENT PERSONNEL IN ACCORDANCE WITH RELEVANT STATUTORY REGULATIONS OR CODES, IN CONJUNCTION WITH THESE INSTRUCTIONS.

When the equipment supplied utilises components other than those manufactured by EBSRAY e.g. couplings, speed reducers, electric motors etc, reference should be made to the original manufacturer's data before installation or servicing is commenced. Failure to observe these details may void the warranty.

1.2 WARNING
The pump must be operated within the original selected design parameters of speed, temperature, pressure and viscosity. Should any change be contemplated, please confer with EBSRAY in order to verify the suitability of such a change.

1.3 TRANSPORTATION AND PACKING
Standard domestic packing is suitable for shipment in covered transports. Ports must be sealed to exclude ingress of solids. When received on site the pump should be stored in a dry covered area.
If storage is required for other than a short period prior to installation, special preservatives and protective wrappings will be required.

1.4 INSPECTION ON RECEIPT - SHORTAGES
On receipt of equipment, check all items against the dispatch documents and inspect for damage. Any damage or shortage incurred during transit should be noted on the packing note and on both your own and the carrier's copy of the consignment note and a claim should be made immediately on the transport company.

Should a shortage be evident on receipt, notify EBSRAY immediately giving full details and packing note number.

1.5 HANDLING
Care should be used in moving pumps. A sling should be placed under or around a bare shaft pump to minimise stress on the shaft or pump flanges. Baseplate mounted units should be lifted from under the baseplate below both the pump and driver ensuring compliance with the relevant lifting codes.

SECTION 2 – INSTALLATION

2.1 LOCATION
The pumping unit should be placed as close as practicable to the source of supply remembering to keep within the NPSH requirement of the pump. Ensure floor area and headroom allotted is sufficient for inspection and maintenance. Allow sufficient space and ventilation for motor cooling requirements. Be sure to allow for crane or hoist access if required.

2.2 FOUNDATIONS
Baseplate mounted pumpsets should be accurately installed. When on a concrete foundation ensure that it has been poured on a solid footing. NOTE: Position foundation bolts to match baseplate foundation plan. Pumps/pumpsets must be securely bolted down.

2.3 PUMP PIPING CONNECTIONS

All piping should be supported independently of and line up accurately with the pump ports.

SEVERE DAMAGE COULD RESULT IF PIPING IS DRAWN INTO PLACE BY USE OF FORCE AT THE PORT CONNECTIONS OF THE PUMP.

2.4 STRAINER PROTECTION

The pump suction should always be protected by an efficient suction strainer of adequate size to accommodate the liquid viscosity conditions without causing excessive suction resistance.

2.5 ALIGNMENT

Alignment of the pump and driver is of extreme importance for trouble free mechanical operation. Baseplate mounted units are accurately aligned at the factory. To ensure this has been maintained during transit, alignment ***MUST BE*** checked once before startup and again after the unit has been run under actual operating conditions. NOTE: The following procedures are typical only and reference should be made to data for specific coupling types.

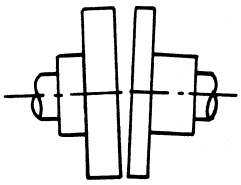


Figure 1

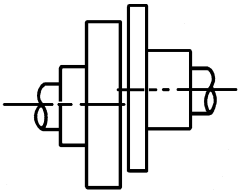


Figure 2

ANGULAR MISALIGNMENT as shown in Fig.1 should be corrected before eccentricity. Refer Fig.3; Use feeler gauge reading at 90◦ intervals, the amount of correction necessary can be easily determined to bring shaft axes in line.

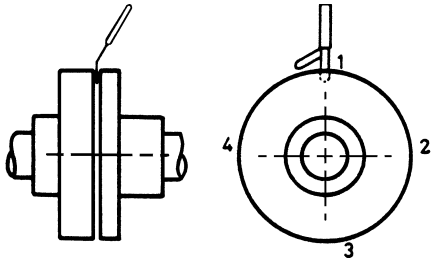


Figure 3

Misalignment due to ECCENTRICITY as shown in Fig.2 can now be corrected. Refer Fig.4; adjustment by use of shims under the driver or pump will effectively correct error in the vertical plane. Movement of Pump or Driver horizontally will correct error in the horizontal plane. NOTE: If both coupling halves are of identical diameter, concentricity may be checked with a straight edge at 90◦ intervals.

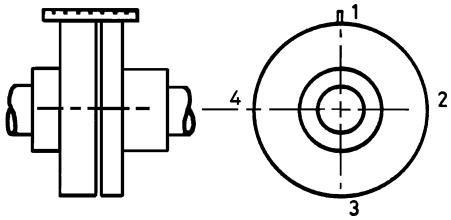


Figure 4

2.6 SEAL DRAIN

The pump is fitted with 1/4” BSP(RC) threaded seal drain connections. If pipe work is fitted to these connections, ensure the pipe work is connected such that the area behind the seal is maintained at atmospheric pressure at all times. Serious damage can occur if the seal drains become blocked and/or any pressure is allowed to build up behind the mechanical seal.

SECTION 3 - OPERATION

3.1 DESCRIPTION

The EBSRAY internal gear principle is based upon the use of an outer rotor 'A', idler gear, termed inner rotor 'B' and a crescent shaped spacer 'C' which is cast integral with the cover. Thus only two moving parts fulfil this efficient displacement cycle. Power is applied to the outer rotor 'A' and transmitted to the meshing idler or inner rotor 'B'. The rotor teeth cells which are not involved in the meshing cycle are sealed by the crescent 'C', body and cover. (Refer Fig.5)

3.2 PUMPING PRINCIPLE

When rotation is started there is an increase in cell volume as the teeth come out of mesh. This creates a partial vacuum and the pressure differential thus created initiates movement of the liquid through the suction port 'D', filling the teeth cells of the two displacement rotors. When the tooth meshing withdrawal cycle is complete and the tooth cell volume is filled with liquid, transfer to the pressure or discharge side is effected as the liquid is carried past the crescent sealing member 'C'.

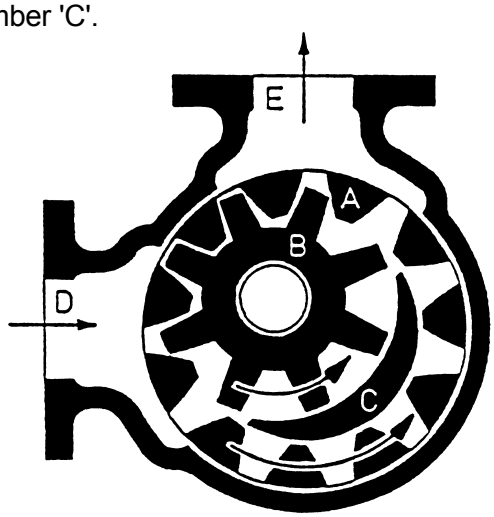


Figure 5

This sealing crescent establishes a labyrinth between the high and low pressure sides, minimising fluid slip. When the teeth mesh on the pressure side the liquid is forced from the teeth cells and flows through the discharge port 'E'. A noteworthy feature of this simple principle is the absence of high tooth contact pressures when compared with conventional gear pumps, many of which employ costly external timing gears to minimise tooth wear.
The inner rotor 'B', or idler remains in almost hydraulic balance requiring only minimal torsional load to effectively follow the outer drive rotor.

3.3 APPLICATIONS

The field of applications for Internal Gear rotary positive displacement pumps is extensive. These pumps are used to handle many kinds of liquids over a wide range of capacities and pressures, associated with viscous or non-viscous, hot or cold and corrosive or non-corrosive conditions. Accordingly material, speed and power specifications vary and it is important to use such equipment strictly adhering to the manufacturers' recommendations.

3.4 LUBRICATION

Lubrication of the inner rotor bearing is dependent upon the pumpages' lubricating qualities. The outer rotor on shaft is supported on tapered roller bearings. These bearings are lubricated with Premium Lithium Complex Multi-purpose Grease, ISO VG 220 NLGI # 2 grease (Mobilgrease XHP222 or equivalent). Regreasing cycle: add 3 grams of grease to each bearing every 3000 hours.

3.5 STARTUP CHECKLIST

Alignment of couplings.

Direction of rotation.

Freedom of rotation of shaft.

Do not start pump against closed discharge valve or with suction valve throttled. Ensure bypass valve (if fitted) is operational and set to the correct pressure. DO NOT EXCEED SYSTEM OR PUMP DESIGN PRESSURE AS EQUIPMENT FAILURE COULD RESULT. DO NOT RUN PUMP DRY. FAILURE TO REMOVE AIR/VAPOUR COULD PREVENT PUMP FROM PRIMING AND RESULT IN PUMP DAMAGE.

3.6 OPERATIONAL CHECKS

Inspect pump frequently during the first few hours of operation for such conditions as excessive heating of bearings or stuffing box, vibration, unusual noises etc.

3.7 VALVE

Some configurations of EBSRAY's Model E20HD pump incorporate an integral valve, which is fully adjustable. This feature, when fitted protects the pump from excessive pressure rise within the limits of the spring pressure range. However fluid temperature will rise if differential pressure is high and bypass conditions are maintained for extended periods.

The valve can be configured upon assembly for either CW or CCW rotation.

On commissioning, the bypass valve if fitted and not preset in the factory, should be set in accordance with the predetermined pump differential pressure required.

SECTION 4 – MAINTENANCE

PRIOR TO ANY DISASSEMBLY OR SERVICE, VERIFY THAT ALL REQUIREMENTS OF STATUTORY REGULATIONS OR CODES ARE MET AND THAT SPECIFIC SITE REQUIREMENTS ETC ARE SATISFIED.

Some minor maintenance tasks and inspections can be performed with the pump 'in line' so long as complete isolation, depressurising and purging procedures have been completed. However for major maintenance it is recommended that the pump be removed from the installation.

4.1 SPARE PARTS

1. When ordering spare parts, to ensure a minimum of delay and correct replacement to original specification ALWAYS quote the pump Serial Number which is located on the nameplate of the pump.

2. Advise the name, item number and quantity required. (Refer to Drawing No. A300001H)

3. Advise complete delivery instructions, transport company etc.

4.2 PREPARATION FOR DISASSEMBLY

1. Obtain the appropriate Work Permit if required.

2. Isolate pump from liquids in suction and discharge lines, depressurise and purge out any toxic, flammable, corrosive or air hardening liquids.

3. Isolate power supply to motor.

4. Disconnect porting connections.

5. Remove pump from installation.

6. Mark relevant mating components for correct reassembly orientation.

4.3 DISASSEMBLY

1. Remove pump coupling half and key.

2. Remove cover assembly complete with 'O' Ring, inner rotor pin, inner rotor and inner rotor bearing.

3. Remove end cap complete with shims and lip seal.

4. Remove lockwasher, locknut and spacer from shaft.

5. Undo locknuts on the adjustment screws and loosen them. Tighten bearing carrier capscrews so carrier sits flush on body.

6. Note: Bearings are an interference fit on shaft.
   With pump in a vertical position, support body with a minimum of 100mm clearance below for rotor to push out. Press on drive end of shaft so that rotor comes through pump end of body to disengage shaft from bearing inner races. Take care not to allow rotor to drop on a hard surface after disengaging from bearings.

7. Remove bearing carrier capscrews and separate bearing carrier from body.

8. Remove lip seal from bearing carrier pump end.

9. Remove drive end bearing assembly, lip seal and bearing spacer by pushing through from pump end of bearing carrier.

10. Remove internal circlip.

11. Remove pump end bearing.

12. Remove adaptor plate complete with stationary seal face and 'O' Rings from body.

13. Remove mechanical seal rotary assembly by unlocking two grubscrews and withdrawing from shaft.

14. Release pressure on bypass spring by releasing locknut and rotating adjusting screw anti-clockwise.

15. Remove bypass valve adjusting cover assembly complete with retaining washer and bypass spring.

16. Remove bypass valve blanking cover.

17. Unlock bypass valve seat locknut.

18. Withdraw bypass valve seat complete with bypass valve.

4.4 INSPECTION

Inspect components for damage or excessive wear. Note that typical wear of components in EBSRAY's rotary internal gear positive displacement pumps tend to compensate each other and working clearances are to some extent maintained by this compensation. If pump performance has been satisfactory, existing components although worn, may still have adequate service life and could be used provided any burrs or sharp edges are removed prior to reassembly.

It is recommended that all 'O' Rings and oil selas be replaced when pump has been disassembled.

Check mechanical seal faces for wear or damage.

Major refurbishing of the pump should be done in line with reconditioning to an 'as new' status as replacing or repairing one component will have an effect on other components and the working clearances of the pump.

4.5 REASSEMBLY- PRELIMINARY

For dimensions & clearances, refer to table of clearances and figure 6.

1. Ensure all parts are clean before assembly. Remove any burrs.

2. If replacing inner rotor pin:

   Press in until home ensuring squareness to cover.

3. If replacing inner rotor bearing:

   Press in. Machine or ream to achieve required clearance on inner rotor pin ensuring squareness and concentricity with inner rotor O.D.

4. Carry out preliminary sizing checks:

a) Outer rotor in body radial clearance
Note: If checking by feeler gauge method allowance or compensation must be made for eccentricity caused by:

   1) Weight of rotor.

   2) Clearances in shaft bearings.

   3) Lack of support at drive end.

   To measure clearance insert feeler gauge at two opposite measurement points 'X' and 'X'. Add the two clearances together and divide by 2. This will give the radial clearance 'X'.

b) Inner rotor width, outer rotor tooth depth and cover crescent length must be a matched dimension.

c) Clearance between inner rotor and cover crescent remembering to make allowance for inner rotor pin to bearing clearance.

5. Ensure all suction/pressure circulation tube assemblies are clear of any obstructions.

6. EBSRAY recommend replacement of all gaskets, seals and 'O' Rings at every overhaul, to ensure positive sealing.

Table of Clearances Refer to diagram below - All clearances in millimetres

	Running Clearances	STANDARD
X	Radial - Outer Rotor to Body	0.038 - 0.071
Y	Axial - Rotors to Cover	0.05
Z	Diametral - Rotor Pin to Bearing	0.038 - 0.063
V	Radial - Inner Rotor to Crescent	0.025 - 0.050

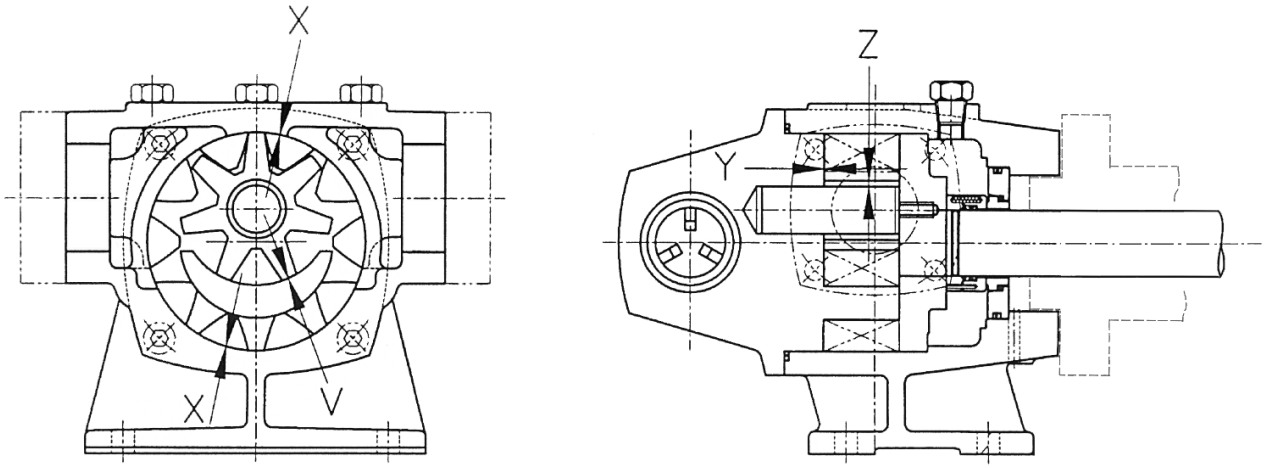


Figure 6

4.6 REASSEMBLY

(Refer Drawing No. A300001H)

Note: Ease of assembly of the pump is facilitated by assembling with the shaft in the vertical plane.

1. Fit two 'O' Rings and six springs to mechanical seal shaft sleeve, assemble mechanical seal rotating face over springs ensuring engagement of drive pins.

Note: Use of lubricant on 'O' Rings and a dab of grease on each spring will aid installation.

2. Assemble mechanical seal sub-assembly over shaft, apply a medium strength thread locking adhesive (Loctite 243 or equivalent) to the two grubscrews and lock into position ensuring grubscrews locate in groove of shaft.

3. Fit mechanical seal stationary face and 'O' Ring to adaptor plate complete with it's 'O' Ring and assemble into body. Ensure lapped seal faces oppose each other. Lubrication of seal faces is recommended.

4. Assemble body over rotor/shaft/ mechanical seal sub-assembly.

5. Press lip seal into bearing carrier pump end ensuring correct orientation per drawing.

6. Place 'O' Ring on groove at pump end of bearing carrier.

7. Lower bearing carrier over shaft end and position on body with grease tappings at 10 o'clock and 4 o'clock as viewed from drive end.

8. Fit adjustment screws with locknuts to bearing carrier. Fit bearing carrier capscrews and tighten so that carrier sits flush on body, ensuring that 'O' Ring is seated in body groove.

9. Pack pump end bearing fully with grease and press fit the bearing over shaft end into bearing carrier until inner cone is fully seated against shaft shoulder.
CAUTION: Do not over grease the bearings by filling the bearing cavity with grease as this can cause overheating and damage to the bearings.

10. Fit bearing spacer to shaft. Fit internal circlip in groove in bearing carrier. Press oil seal into place against internal circlip, ensuring correct orientation as per drawing.

11. Pack drive end bearing fully with grease and press fit on shaft.

12. Place pump in horizontal position and firmly attach bracket to a baseplate or bench.

13. Fit spacer, lockwasher and locknut on shaft. Tighten and secure locknut by bending lockwasher tab into locknut.

14. Fit shims on end cap. Shim quantity should be as originally factory set. If shims are being replaced, begin with 0.6mm's of shims and follow steps 15 and 16 to set bearing clearance. Align grease tapping drain hole in end cap with the 4 o'clock grease tapping on bearing carrier. Fit end cap with capscrews.

15. Using suitable turning device, rotate shaft by hand to ensure no restriction to rotation of shaft.

16. Using a dial indicator, measure bearing clearance by pushing the shaft back and forth within body, continually rotating shaft by hand between measurements. Adjust shim quantity until clearance is set to 0.05 to 0.08 mm.

17. Loosen bearing carrier capscrews and slowly tighten adjustment screws until rotor is pulled back in body. Assemble inner rotor over inner rotor pin and fit cover assembly to body complete with 'O' Ring.

18. Loosen adjustment screws and slowly and evenly tighten bearing carrier capscrews whilst rotating the shaft slowly by hand using a suitable turning device. When slight drag is felt by hand the point of contact of outer rotor to cover has been sensed (0.0mm axial clearance).

19. Ensuring the bearing carrier flange is parallel with the body, measure the gap between bearing carrier flange and body i.e. establish a datum point for setting axial clearance.

20. Back off bearing carrier capscrews and evenly screw in the adjustment screws until the gap between the bearing carrier flange and body equals the original gap plus the desired axial clearance (0.05 mm as shown in the table of clearances). Evenly tighten the bearing carrier capscrews and once again check the gap, ensuring the bearing carrier flange is parallel to the body. Axial clearance should now be established.

21. Turn shaft by hand with a suitable turning device to ensure smooth rotation.

22. Fit grease nipples and grease reservoirs with elbow fittings to bearing carrier. Orientate reservoirs so that they will be in a vertical position depending on whether the pump is mounted in a shaft horizontal or shaft vertical position.

23. Apply 10 grams of grease through each grease nipple.

Bypass Valve Assembly:

Note: For correct orientation of bypass valve - adjusting screw should be on the same side of the pump as the suction port as determined by rotation and direction of flow.

24. Fit bypass valve seat to bypass housing and using a low strength thread-locking adhesive (Loctite 243 or equivalent), lock into position with locknut.

25. Fit bypass blanking cover complete with 'O' Ring.

26. Position bypass valve in housing.

27. Fit 'O' Ring to adjusting cover and fit retaining washer.

28. Position spring on retaining washer and fasten cover to housing ensuring end of spring locates on top of valve.

Note: The bypass valve will require setting when the pump is re-commissioned.

For increased bypass pressure rotate adjusting screw in clockwise direction.

For decreased bypass pressure rotate adjusting screw in anti-clockwise direction.

SECTION 5 - TROUBLE SHOOTING

5.1 PUMP FAILS TO PRIME OR DELIVER LIQUID

1. No liquid in tank.

2. Incorrect direction of rotation.

3. Speed too low:

(a) If motor driven, check speed, line voltage and phases.

(b) If engine driven, check governor setting and engine speed.

4. System discharge head too high - check system head, friction losses and bypass valve setting.

5. Excessive suction restrictions - check NPSH available (inadequately sized suction piping may cause high friction losses, vapour pressure of liquid may be too high). Check with vacuum or compound gauge.

6. Air leaks and/or air pockets in suction line - check suction piping.

7. Bypass valve open due to obstruction under seat of valve or setting too low.

8. Suction filter/strainer blocked or leaking air.

9. Pump cannot clear vapour due to excessive discharge pressure e.g. static head.

5.2 LOW OUTPUT

1. Discharge head too high.

2. Entrained air or gases in liquid pumped.

3. Strainer offering excess resistance to flow.

4. Suction and/or discharge pipes of insufficient diameter, causing excessive friction loss.

5. Bypass valve pressure setting too low - Increase pressure by screwing in adjusting screw. DO NOT exceed pump or system design pressure, overload motor etc.

6. Insufficient NPSH available.

7. Excess axial clearance setting of rotor to cover.

8. Excess clearances in pump due to wear.

9. Suction lift too high, i.e. static lift excessive, air leak in suction line.

5.3 EXCESSIVE POWER CONSUMPTION

1. Differential pressure higher than rating.

2. Liquid properties not as specified - check viscosity.

3. Rotating parts bind - check for proper clearances or foreign matter in pump.

4. Bearings worn - inspect and replace as required.

5. Obstructions in pipelines, clogged strainers, partially open valves.

6. Pump speed too high.

7. Voltage too low.

5.4 PUMP IS NOISY

1. Cavitation is taking place - increase NPSH by:

(a) Removing suction line restrictions created by:

(i) Inadequate pipe sizes / excessive line lengths.

(ii) Incorrect selection of valves, fittings etc.

(iii) Strainer not permitting free flow of liquid to pump.

(b) Increasing static head in suction vessel.

(c) Reducing product viscosity.

2. Rotating parts bind - check for proper clearances.

3. Pump and driver misaligned - check coupling and realign as required.

5.5 MISCELLANEOUS

1. Grease leaking out of reservoirs - Bearings may be over greased. Reservoirs should be in vertical positions when the pump is installed.

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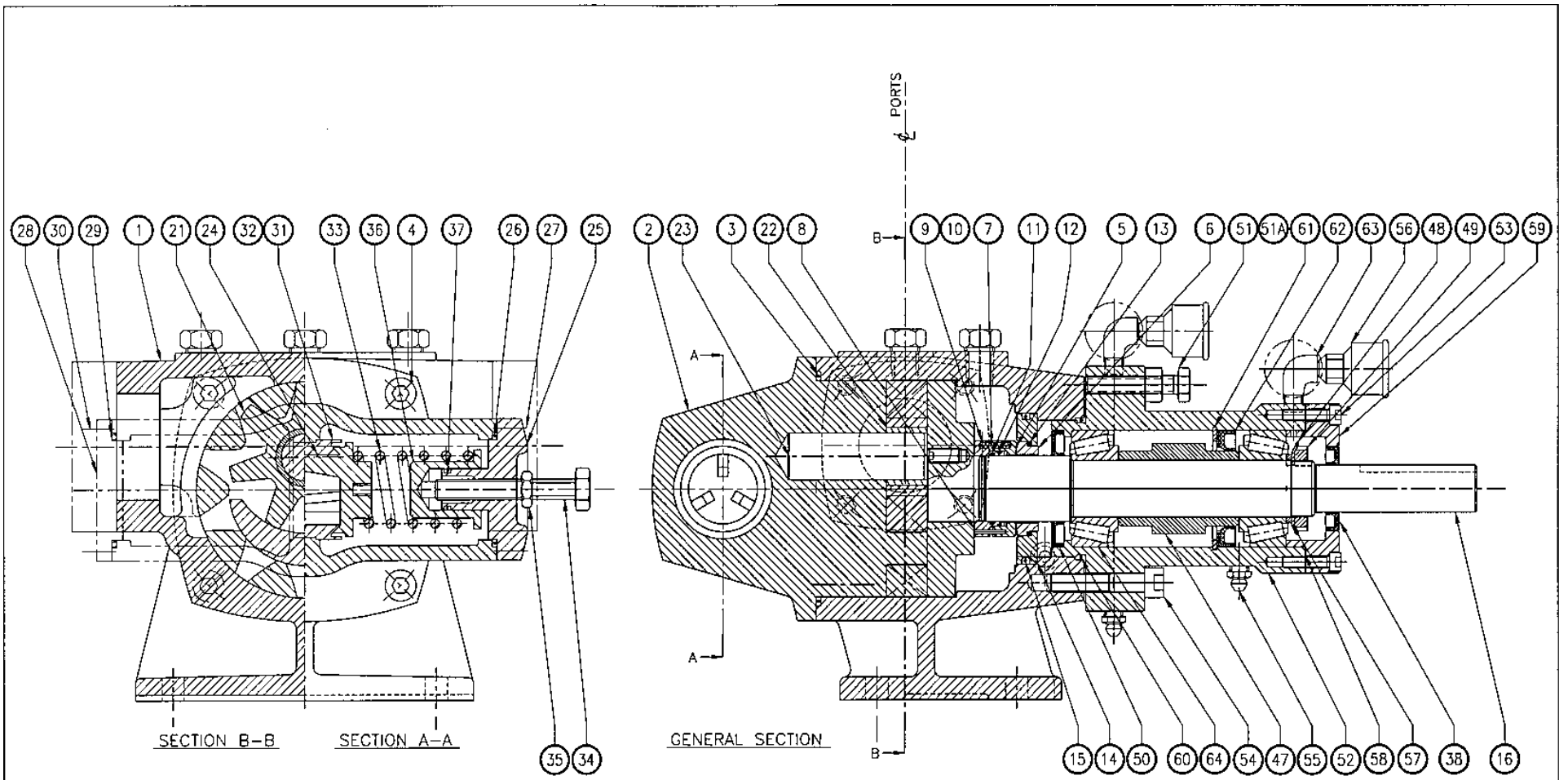
SECTION 6 - PARTS DESIGNATION

E20HD Parts - Refer To drawing No: A300001H

CAT #	DESCRIPTION	QTY
1	BODY	1
2	COVER	1
3	'O' RING	1
4	CAP SCREW	4
5	SEAL FACE (rotating)	1
6	SEAL SEAT (stationary)	1
7	SPRING-SEAL	6
8	DRIVE PIN	3
9	SEAL SLEEVE	1
10	GRUBSCREW	2
11	'O' RING	1
12	'O' RING	1
13	'O' RING	1
14	ADAPTOR PLATE	1
15	'O' RING	1
16	ROTOR/SHAFT ASSEMBLY	1
21	INNER ROTOR	1
22	INNER ROTOR BEARING	1
23	INNER ROTOR PIN	1
24	VALVE	1
25	VALVE COVER	1
26	‘O’ RING	1
27	SOCKET HEAD CAPSCREW	4
28	BLANKING COVER	1
29	‘O’ RING	1
30	SOCKET HEAD CAPSCREW	4
31	VALVE SEAT	1
32	LOCK NUT	1
33	SPRING (BYPASS VALVE)	1
34	ADJUSTING SCREW (BYPASS VALVE)	1
35	LOCKNUT	1
36	SPRING CAP	1
37	‘O’ RING	1
38	OIL SEAL	1
47	SPACER-BEARING I.D.	1
48	LOCKWASHER	1
49	LOCKNUT	1
50	OIL SEAL	1
51	ADJUSTING SCREW (BEARING CARRIER)	3
51A	NUT	3
52	BEARING CARRIER	1
53	SOCKET HEAD CAPSCREW	4
54	SOCKET HEAD CAPSCREW	3
55	GREASE NIPPLE	2
56	GREASE RESERVOIR	2
57	SPACER-LOCKNUT	1
58	SHIMS	A/R
59	END CAP	1
60	‘O’ RING	1
61	INTERNAL CIRCLIP	1
62	OIL SEAL	1
63	ELBOW	2
64	ROLLER BEARING	2



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EBS-RAY
AUSTRALIA
EBS-RAY PUMPS PTY.LTD
ABN 52 000 061 003

EBSRAY E20HD PUMP
PARTS DESIGNATION
DRG. No. A300001H REV. 0
DATE: 09.1.04