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EBS-RAY
AUSTRALIA

# INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

## FOR EBS-RAY

# MODEL E20

## ROTARY INTERNAL GEAR PUMP

EBSRAY PUMPS PTY. LIMITED
ACN 000 061 003

Head Office and Works
628 Pittwater Road
Brookvale N.S.W. 2100
Phone (02) 9905 0234
Fax (02) 9938 3825

Branch Office Victoria
Phone (03) 9706 7263
Fax (03) 9706 7312

Branch Office Queensland
Phone (07) 3260 7411
Fax (07) 3260 7422

## SECTION I - GENERAL

### INTRODUCTION

This publication is intended to assist those involved with the installation, operation and maintenance of EBSRAY Model E20 Rotary Internal Gear Pump.

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.

### I-A 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 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.

### I-B 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.

### I-C 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.

### I-D INSPECTION ON RECEIPT - SHORTAGES

On receipt of equipment, check all items against the despatch 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.

I-E 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 II - INSTALLATION

II-A 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. Be sure to allow for crane or hoist access if required.

II-B FOUNDATIONS

Baseplate units 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.

II-C PUMP PIPING CONNECTIONS

All piping should be supported independently and line up accurately with the pump ports. NOTE: Pumps with screwed connections should employ a pipe joint close to both the suction and discharge ports to facilitate ease of maintenance NEVER DRAW PIPING INTO PLACE BY USE OF FORCE AT THE PORT CONNECTIONS OF THE PUMP.

II-D STRAINER PROTECTION

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

II-E 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.

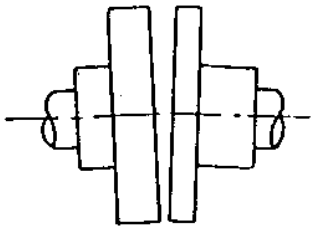


Fig.1

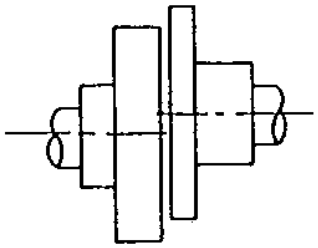


Fig.2

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.

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 one of the ends 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.

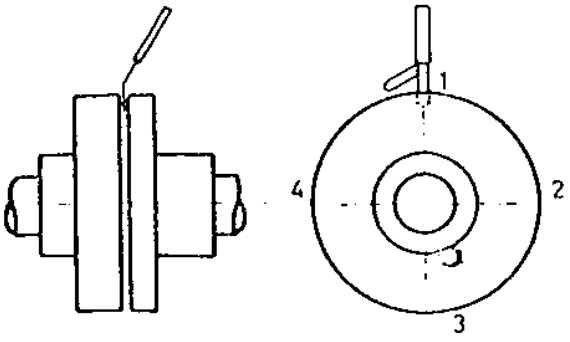



Fig 3

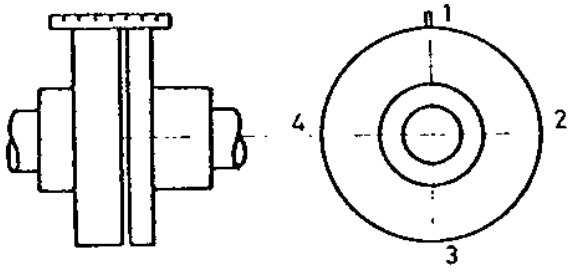


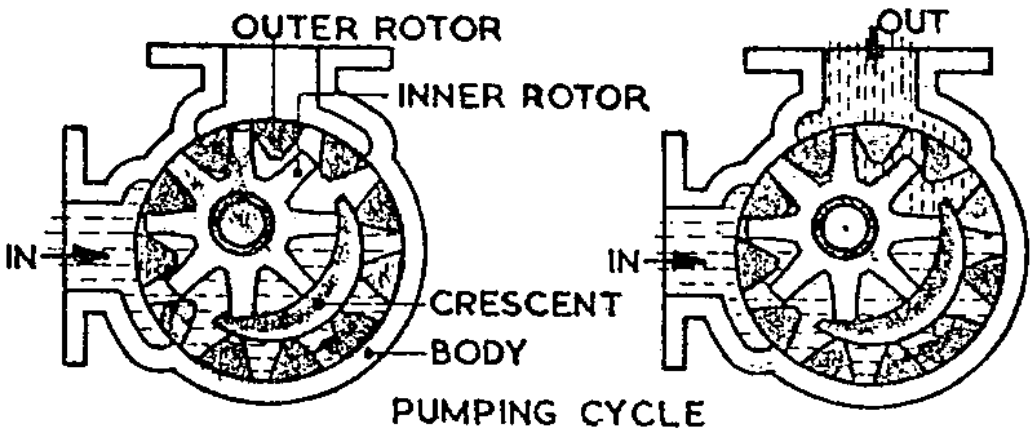

Fig 4

## SECTION III - OPERATION

### III-A DESCRIPTION

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

### III-B PUMPING PRINCIPLE



PUMPING CYCLE

When the pumping is started there is an increase in cell volume as the teeth come out of mesh. This creates a partial vacuum and the following pressure differential initiates movement of the liquid through the suction port 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. This sealing crescent establishes a labyrinth between the high and low pressure sides, and against fluid slip. When the teeth mesh on the pressure side the liquid is forced from the teeth cells and flows through the discharge port. 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, or idler remains in almost hydraulic balance requiring only limited torsional load to effectively follow the outer drive rotor.

III-C 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 variety of capacities and pressures, associated with viscous and non-viscous, hot or cold, and corrosive and non-corrosive conditions. Accordingly material, speed and power specifications vary and it is important to use such equipment in keeping with the manufacturer's recommendations.

III-D LUBRICATION

No 'in service' lubrication is required on EBSRAY's Model E20 Internal Gear rotary positive displacement pump.

Lubrication of the inner rotor bearing is dependent upon the pumpages' lubricating qualities whereas the outer rotor on shaft is supported on ball bearings of the sealed, grease packed type isolated from the pumpage.

III-E STARTUP CHECKLIST

Alignment of couplings.

Direction of rotation.

Freeness of shaft.

Do not start pump against closed discharge valve or with suction valve throttled DO NOT RUN PUMP DRY.

III-F OPERATIONAL CHECKS

Inspect pump frequently during the first few hours of operation for such items as excessive heating of bearings, vibration or unusal noises etc.

III-G BYPASS VALVE

Some configurations of EBSRAY's Model E20 pump incorporate an integral bypass valve, fully adjustable and reversible for change of rotation and flow. This feature, when fitted protects the pump from excessive pressure rise. However

fluid temperature will rise if differential pressure is high and bypass conditions are maintained for extended periods.

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 IV - 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.

### IV-A 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.
3. Advise complete delivery instructions.

### IV-B 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.

### IV-C DISASSEMBLY

#### Section I - Pump

1. Remove pump coupling half.

2. Remove dust cover complete with lip seal from shaft.
3. Remove inspection cover assembly complete with 'O' Ring, inner rotor pin, inner rotor and inner rotor bearing.
4. Unlock spacer sleeve from body by releasing nut on lockpin and tapping lockpin into body to break tightness.
5. Withdraw rotating assembly by lightly pressing on shaft end and supporting inspection end of assembly.
6. Remove locking collar from drive end bearing by unlocking grubscrew and releasing eccentric collar. Remove any burrs on shaft created by grubscrew.
7. Remove drive end bearing and spacer sleeve from shaft.
8. Remove locking collar from inspection end bearing by unlocking grubscrew and releasing eccentric collar. Remove any burrs on shaft created by grubscrew.
9. Remove inspection end bearing.
10. Remove adaptor plate complete with stationary seal face and 'O' Rings from shaft.
11. Remove mechanical seal rotary assembly by unlocking two grubscrews and withdrawing off shaft.
12. If replacing inner rotor pin withdraw from cover using a suitable puller.

Note: Tapping in end of inner rotor pin is M12 x 1,75.

Section II - Bypass Valve

13. Release pressure on bypass spring by releasing locknut and rotating adjusting screw anti-clockwise.
14. Remove bypass valve adjusting cover assembly complete with retaining washer and bypass spring.
15. Remove bypass valve blanking cover.
16. Unlock bypass valve seat locknut.
17. Remove acorn nut, release grubscrew and withdraw bypass valve seat complete with bypass valve.

IV-D 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 'O' Rings be replaced when pump has been disassembled.

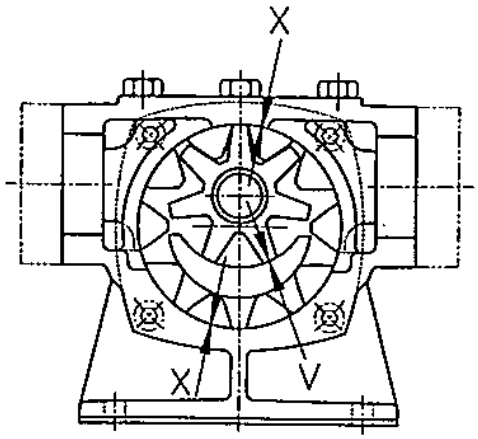
Check mechanical seal faces for wear or damage.

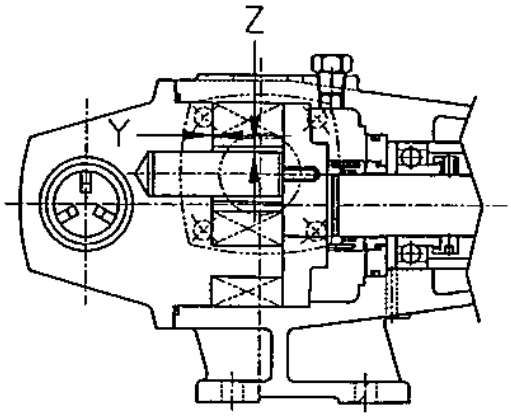
Major refurbishing of the pump should be done in line with reconditioning to an 'as new' status as replacing or repairing one component will have an effect on other components and the working clearances of the pump.

**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 |

Tightening Torque for Cotter Pin Nut: 30NM



IV-E REASSEMBLY- PRELIMINARY

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 diametral clearance Note: If checking by feeler gauge method allowance or compensation must be made for eccentricity caused by:

      i) Weight of rotor.

      ii) Clearances between shaft and bracket bearing.

      iii) Lack of support at drive end.

   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.

4. Ensure ease of entry of adaptor plate with 'O' Ring fitted into body.

IV-F REASSEMBLY

Section I - Pump

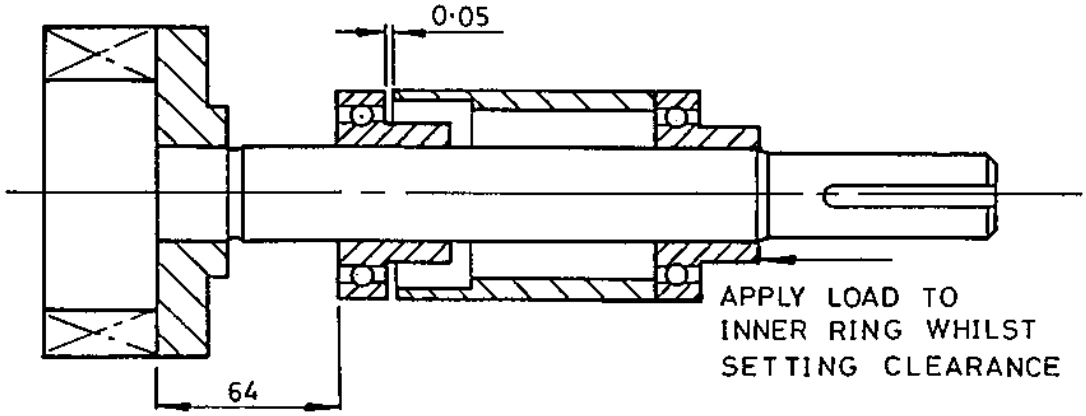
Note: Ease of assembly of the rotating elements of the pump is facilitated by assembling with the shaft in the vertical plane.

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 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 over shaft. Ensure lapped seal faces oppose each other. Lubrication of seal faces is recommended.

Note: Bearing installation - It is recommended that both lock collars be locked in the same direction as rotation and that the rotor be restrained whilst locking lock collars.




4. Assemble inspection end bearing over shaft and lock to shaft by means of the eccentric lock collar at a distance of 64mm measured from the root of the rotor teeth to the face of the bearing. Apply a medium strength thread locking adhesive to the grubscrew and lock to shaft.
5. Position spacer sleeve over shaft with counterbored end facing towards rotor
6. Assemble drive end bearing over shaft and lock to shaft by means of the eccentric lock collar maintaining a total clearance of 0,05mm between spacer sleeve and bearings. Apply a medium strength thread locking adhesive to the grubscrew and lock to shaft.
7. Position lock pin in body with recess in lock pin facing bore of body.
8. Lubricate adaptor plate 'O' Ring.
9. Assemble body over rotating element sub-assembly, draw shaft through body and whilst holding shaft lay pump horizontal.
10. Assemble inner rotor over inner rotor pin and fit cover assembly complete with 'O' Ring.

11. By holding shaft, draw rotating element sub-assembly away from cover and preload by pushing towards cover. Approximately 1,0mm end float should be able to be detected at this point. This procedure eliminates bearing backlash.
12. Whilst holding load towards cover, tighten lock pin nut.
13. Turn shaft to check for freeness of rotation.
14. Fit lip seal to dust cover and fit dust cover over shaft to body ensuring dust cover does not displace ball bearing outer ring.

    Note: Use of a shim will aid installation of the shaft through the lip seal.

Section II - Bypass Valve

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.

15. Lap valve to seat.
16. Assemble seat complete with valve into bypass housing and lock in position with locknut. Clamp seat by means of grubscrew through housing and secure and seal with acorn nut and fibre washer.
17. Fit bypass blanking cover complete with 'O' Ring.
18. Fit 'O' Ring to adjusting cover and fit retaining washer.
19. 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.

## V-A PUMP FAILS TO PRIME OR DELIVER LIQUID

1. Incorrect direction of rotation.
2. Speed too low:

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

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

3. Bypass valve open due to obstruction under seat of valve or setting too low.
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. Suction filter/strainer blocked or leaking air.

## V-B 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 setting too low - Increase pressure by screwing in adjusting screw. DO NOT exceed system design pressure.
6. Suction lift too high, i.e. static lift excessive, air leak in suction line.
7. Excess end clearance setting of rotor to cover.
8. Excess clearances in pump due to wear.

## V-C EXCESSIVE POWER CONSUMPTION

1. Differential pressure/head higher than rating - check for obstruction.
2. Liquid properties not as specified - check specific gravity and 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 pipe lines, clogged strainers, partially open valves.

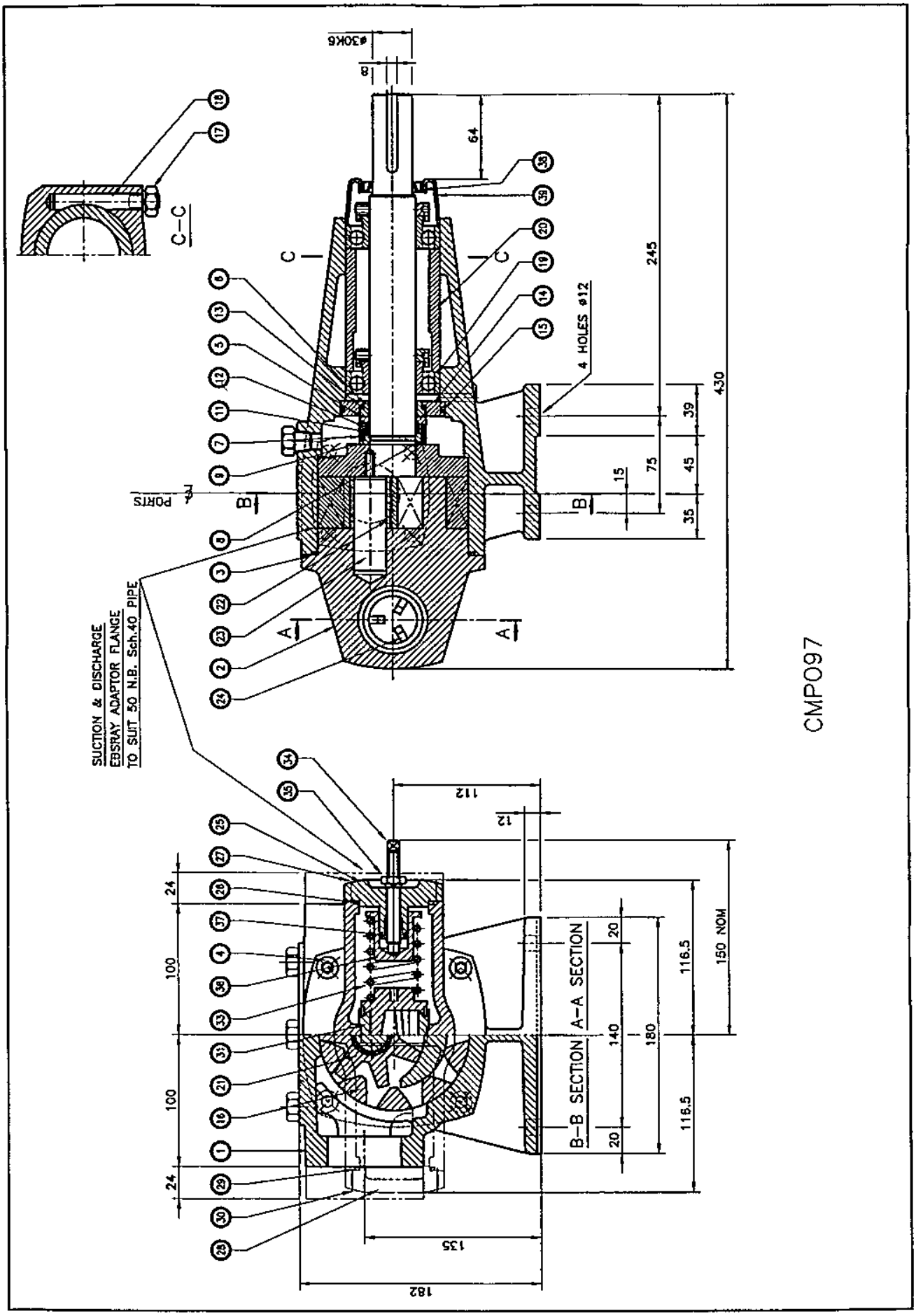
V-D PUMP IS NOISY

1. Cavitation is taking place - increase NPSH by:
   (a) Removing suction line restrictions created by:
      (i) Inadequate pipe sizes.
      (ii) Incorrect selection of valves.
      (iii) Strainer not permitting free flow of liquid to pump.
   (b) Increasing static head in suction vessel.
   (c) Reduce product viscosity.
2. Rotating parts bind - (a) check for foreign matter in pump.
   (b) check for proper clearances.
3. Pump and driver misaligned - check coupling and realign as required.
4. Air leak in suction line.

# SECTION 6 - PARTS DESIGNATION

Parts designation for Ebsray model E20 Refer to drawing No CMP 097

| CAT # | DESCRIPTION | QTY |
|---|---|---|
| 1 | BODY | 1 |
| 2 | COVER | 1 |
| 3 | 'O' RING | 1 |
| 4 | CAP SCREW | 4 |
| 5 | SEAL FACE ROTATING | 1 |
| 6 | SEAL FACE STATIONARY | 1 |
| 7 | SEAL SPRING | 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 |
| 17 | COTTER PIN | 1 |
| 18 | NUT, WASHER | 1 |
| 19 | BALL BEARING | 2 |
| 20 | SPACER | 1 |
| 17 | GLAND PLATE | 1 |
| 21 | INNER ROTOR | 1 |
| 22 | INNER ROTOR BEARING | 1 |
| 23 | INNER ROTOR PIN | 1 |
| 24 | BYPASS VALVE | 1 |
| 25 | BYPASS VALVE COVER | 1 |
| 26 | 'O' RING | 1 |
| 27 | CAP SCREW | 4 |
| 28 | BYPASS VALVE BLANKING COVER | 1 |
| 29 | 'O' RING | 1 |
| 30 | CAP SCREW | 4 |
| 31 | BYPASS VALVE SEAT | 1 |
| 33 | BYPASS VALVE SPRING | 1 |
| 34 | BYPASS VALVE ADJUSTING SCREW | 1 |
| 35 | BYPASS VALVE ADJUSTING SCREW LOCKNUT/WASHER | 1 |
| 36 | BYPASS VALVE SPRING CAP | 1 |
| 37 | 'O' RING | 1 |
| 38 | SHAFT LIP SEAL | 1 |
| 39 | SHAFT COVER | 1 |


SUCTION & DISCHARGE
EBSRAY ADAPTOR FLANGE
TO SUIT 50 N.B. Sch.40 PIPE
4 PORTS
4 HOLES ø12
C–C
A–A SECTION
B–B SECTION
245
430
64
8
ø30K6
182
135
112
12
150 NOM
116.5
180
140
100
24
CMP097