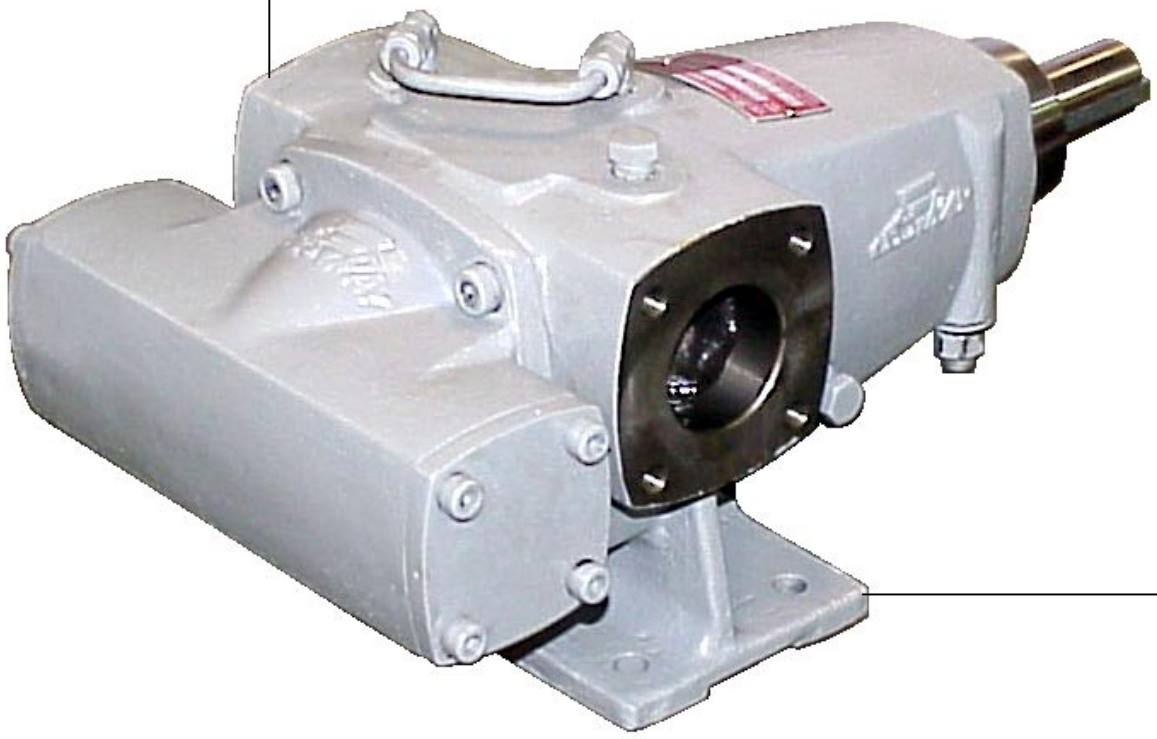
Pub # 1820-01

EBSRAY PUMPS

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS



E SERIES
MODEL E20

EBSRAY AUSTRALIA

SECTION 1 – GENERAL

INTRODUCTION
This leaflet is intended to assist those involved with the installation, operation and maintenance of EBSRAY Model E20 Internal Gear Positive Displacement 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.

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.

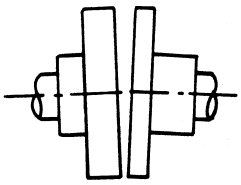


Figure 1

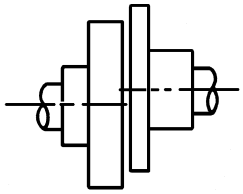


Figure 2

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.

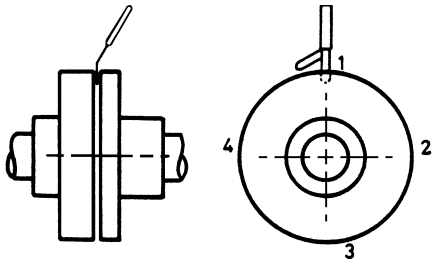


Figure 3

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.

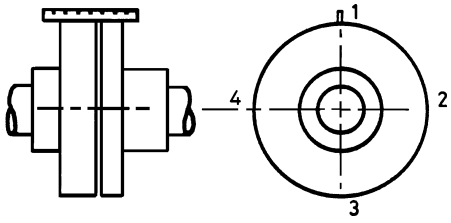


Figure 4

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'.

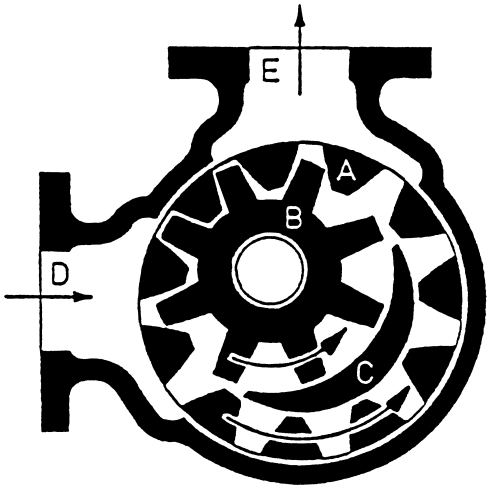


Figure 5

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
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.

3.5 STARTUP CHECKLIST
Lubricate as required.

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 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 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 Drg No. CMP102)

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

Note: Before proceeding, make sure bracket is firmly attached to baseplate or bench etc. to avoid overbalancing when rotor is withdrawn.
Mark relevant mating components to ensure correct replacement.

1. Remove pump coupling half.

2. Remove acorn nut and socket screw then unscrew lockring complete with lip seal from shaft.

3. Remove 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 release.

5. Withdraw rotating assembly by lightly pressing on shaft end and supporting rotor 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 from shaft.

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

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

14. Remove bypass valve blanking cover.

15. Unlock bypass valve seat locknut.

16. 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 '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.

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

6. Ensure all suction/pressure circulation harness assemblies are clear of any obstructions.

7. 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

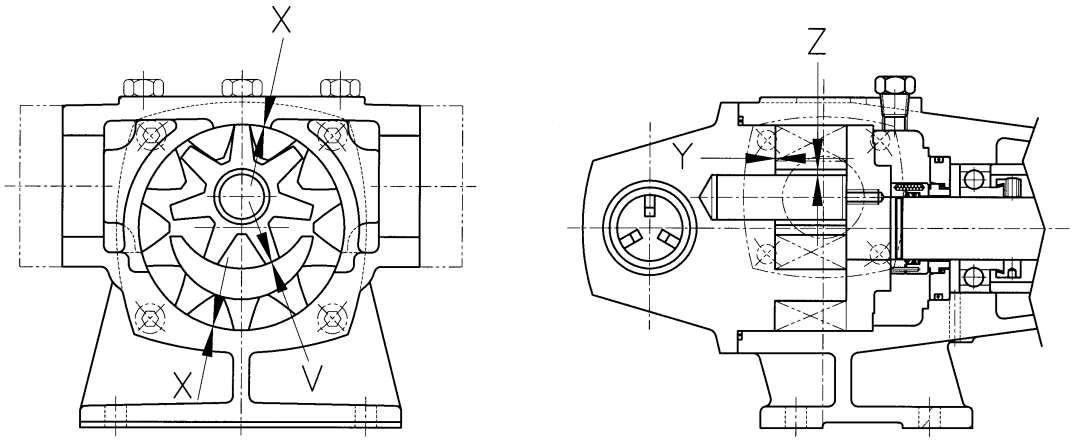


Figure 6

Tightening Torque for Cotter Pin Nut: 30NM

4.6 REASSEMBLY (Refer Drg No. CMP102)

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.

4. Assemble inspection end bearing over shaft and lock to shaft ***(See Note below)*** 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 (refer Fig 7). Apply a medium strength thread locking adhesive to the grubscrew and lock to shaft.

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.

5. Position spacer sleeve over shaft with counterbored end facing towards rotor

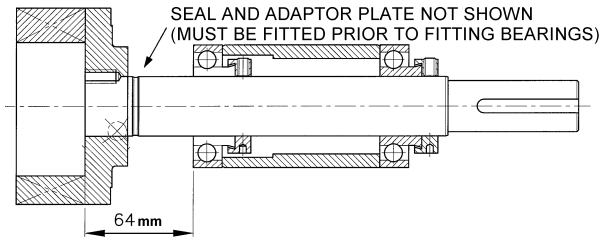


Figure 7

6. Assemble drive end bearing over shaft and lock to shaft by means of the eccentric lock collar maintaining contact 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 to body complete with 'O' Ring.

11. Fit lip seal to lockring, fit lockring over shaft and screw into body.
Note: Use of a shim will aid installation of the shaft through the lip seal.

12. Attach a suitable device to shaft to allow shaft to be turned by hand. Whilst tightening lockring, turn shaft until resistance to turning is felt.
Note: Do not over tighten lockring and do not continue to turn shaft when resistance becomes excessive as this may damage the rotors or cover.

13. Mark periphery of lockring and body (This establishes the point of zero axial clearance.)

14. Place a second mark on the body 12mm back from the point of zero clearance. Refer Fig 8

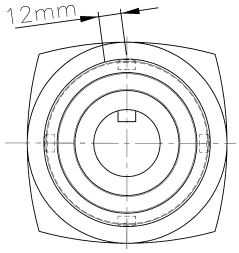


Figure 8

15 Unscrew lockring until the mark on the lockring is aligned with the new mark on the body.

16 Pull shaft back firmly, hold in position and tighten the nut on the locking pin.
Note: If pump is out of system, shaft can be held back using a suitable lever through the ports and levering back against the edges of the outer rotor. Take care to avoid damaging the rotor edges. If pump is in system, it may be necessary to lever the shaft back by using of a suitable packing piece against the pump body (not against the lockring) and levering against the coupling or turning device.

17 Tighten lockring back to take up any slack in the threads (do not overtighten and do not allow mark on lockring to go closer than 8mm from zero clearance mark).

18 Fit plastic spacer (thread protector) and grubscrew into body and tighten to lock the lockring in position. Fit acorn nut to grubscrew and tighten.

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.

19. Fit bypass valve seat to bypass housing and using a low strength thread-locking adhesive, lock into position with locknut.

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

21. Position bypass valve in housing.

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

23. 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 pipe lines, 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.

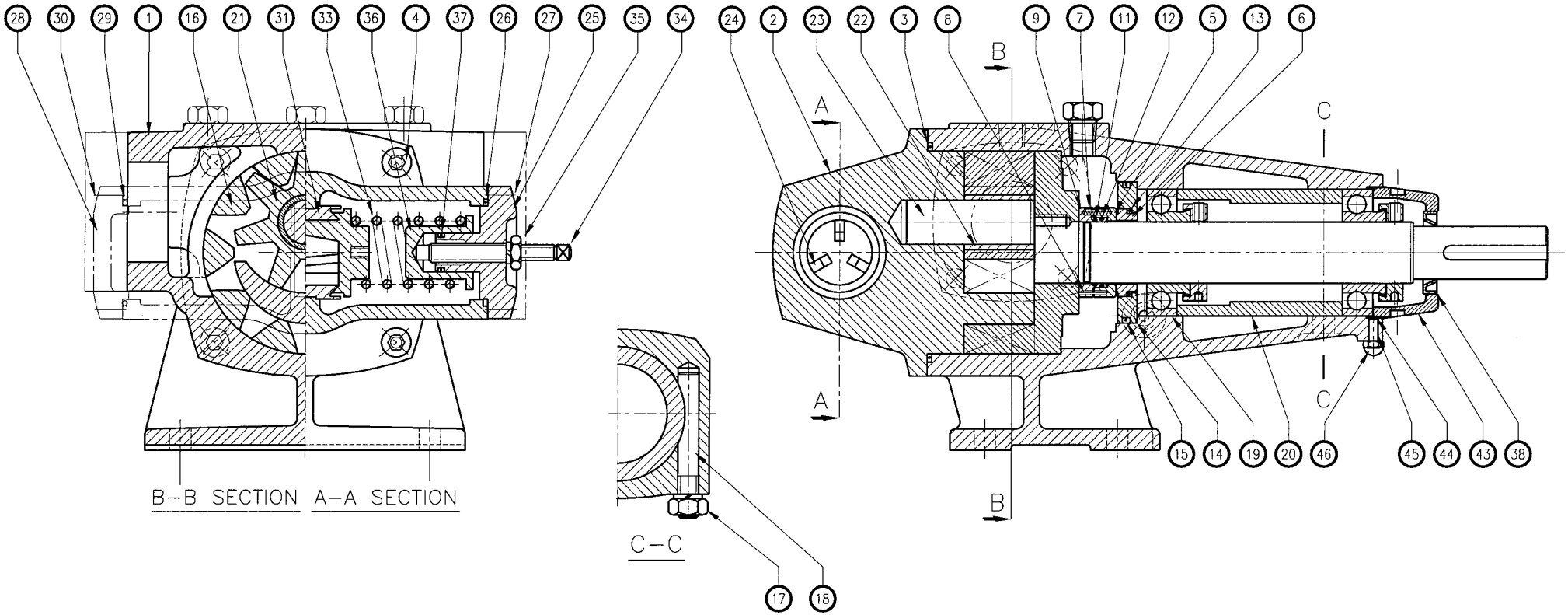
EBSRAY PUMPS PTY. LTD.
628 Pittwater Rd
Brookvale NSW 2100
AUSTRALIA

Phone 61 2 9905 0234
Fax: 61 2 9938 3825

SECTION 6 - PARTS DESIGNATION

E20 Parts - Refer To drawing No:CMP102

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	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 & SPRING WASHER	1
19	BALL BEARING	2
20	SPACER (BALL BEARING)	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		
33	SPRING (BYPASS VALVE)	1
34	ADJUSTING SCREW (BYPASS VALVE)	1
35	LOCKNUT & WASHER	1
36	SPRING CAP	1
37	‘O’ RING	1
38	OIL SEAL	1
40	BLANKING PLUG	1
41	CLAMP PLATE	1
42	BOLT (BLANKING PLUG)	1
43	LOCKRING	1
44	SPACER	1
45	GRUBSCREW	1
46	ACORN NUT	1


28
30
29
1
16
21
31
33
36
4
37
26
27
25
35
34
24
2
23
22
3
8
9
7
11
12
5
13
6
A
B
C
A
C
B
15
14
19
20
46
45
44
43
38
B–B SECTION
A–A SECTION
C–C
17
18

CMP102