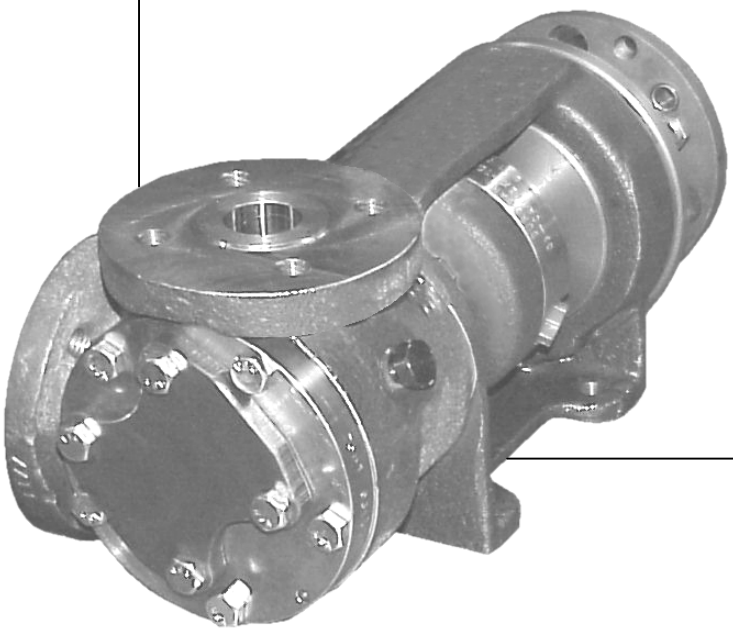
Publication # 1900-01

EBSRAY PUMPS

Installation, Operation & Maintenance Instructions



MD Series
Model MD100M

EBSRAY AUSTRALIA

SECTION 1 – GENERAL

INTRODUCTION
This leaflet is intended to assist those involved with the installation, operation and maintenance of EBSRAY Models MD340M and MD100M 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 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 are 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 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.

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

NOTE: NEVER DRAW PIPING 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
IMPORTANT ENSURE COUPLING HALF IS CORRECT SIZE AND IS PROPERLY FITTED. REFER SECTION 4.6 CLAUSE 14

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.

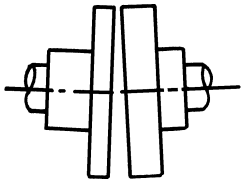


Figure 1

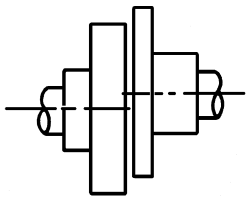


Figure 2

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.

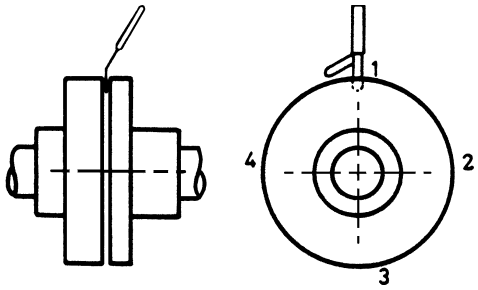


Figure 3

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 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.

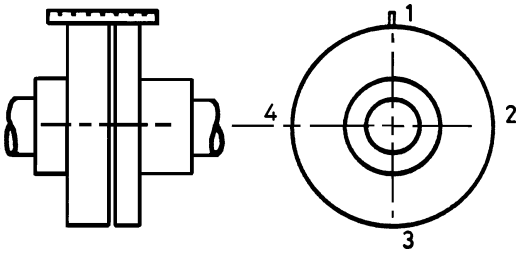


Figure 4

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

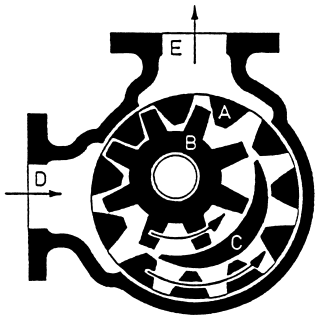


Figure 5

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'. 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 and bracket bearing is usually dependent on the pumpage's lubricating qualities and material selection of the bearing, however for some applications greasers or suction/pressure circulation harnesses may be employed. The ball bearing is lubricated at the time of assembly with high quality lithium based grease. Replacement of this grease is normally only necessary when major maintenance is carried out.

3.5 START-UP CHECKLIST

- ***WARNING: DO NOT RUN PUMP DRY.***
- Lubricate as required.
- Check alignment of couplings.
- Ensure freedom of rotation of shaft.
- Check direction of rotation.

WARNING: To prevent damage to pumpset or system, disengage coupling before checking direction of rotation.

- Do not start pump against closed discharge valve or with inlet 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.

After initial run in period, (dependent on duty) nuts and setscrews securing face gasket jointed surfaces should be checked for tightness and re-tightened if required. This is particularly important for pumps operated in excess of 100°C. (Refer to torque settings section 4)

CAUTION: DO NOT OVER TIGHTEN AND DO NOT TIGHTEN WHILST PUMP IS HOT.

3.7 BYPASS VALVE

To protect the pump from overpressure due to inadvertent shutting of discharge system, EBSRAY can supply either integral or inline bypass valves which are capable of circulating the entire pump output. The integral valve recirculates liquid within the pump. The inline type valve may be installed in the pump discharge line and normally returns to the suction side of the pump or back to tank. With both types of valve fluid temperature will rise if differential pressure is high and bypass conditions are maintained for extended periods. The integral valve is normally factory preset while the inline bypass valve is normally set on commissioning. The bypass valve should be set on site in accordance with the predetermined pump or system differential pressure required. Refer separate instructions.

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 Cat #, description, and quantity required. Ref to Drawing No. CMP110

3. Advise complete delivery instructions, transportation, 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 Refer to separate instructions for removal/replacement details for mechanical seal.

1. Remove suction/pressure circulation harness assemblies if fitted.

2. Remove pump coupling half.

3. Lock Mechanical seal using the locking devices supplied by the manufacturer and then release mechanical seal from shaft (grubscrews)

4. Release grubscrew from race carrier lockring, unscrew lockring from race carrier.

5. Remove race carrier fastening setscrews and adjusting setscrews, replace the adjusting setscrews with 3/8" BSW bolts or setscrews with a thread length of at least 50mm.

6. Evenly tighten these replacement screws to withdraw the race carrier from the bracket.

7. Remove the bearing from the race carrier.

8. Remove spacer from shaft.

9. Release mechanical seal plate evenly to avoid damage.

10. Remove cover assembly complete with cover plate (if fitted) and inner rotor. If fitted with integral bypass valve, remove bypass valve as a unit and refer to bypass valve instructions for service. Care should be taken to prevent inner rotor sliding off inner rotor pin.

11. The rotor/shaft assembly can now be driven through the pump from the drive end taking care to adequately support the rotor end.

12. Remove mechanical seal taking care to avoid damage.

8. Disassemble cover assembly.

12. Remove body from bracket if required.

13. Press out inner rotor bearing and rotor bearing if replacement is required.

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.

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

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

2. Ensure free running fit of race carrier in bracket.

3. Fit felt sealing rings to race carrier and race lockring.

4. If replacing rotor bearing:

a) Metallic: Press-fit ensuring lubrication groove in bearing is adjacent to greaser hole in bracket.

b) Carbon: The recommended method of fitting carbon bearings is shrink fitting. Press-fitting carbon bearings may cause damage to the bearing. Fit bearing flush with spigot face. Care should be taken to ensure correct alignment.

Machine or ream to achieve correct clearance on shaft ensuring squareness and concentricity with locating spigot.

5. If replacing inner rotor bearing:

a) Metallic: Press in with bearing shoulder against one side of inner rotor. For bearing without shoulder, fit with end of bearing flush with one side of the inner rotor.

b) Carbon: Shrink-fit into inner rotor (See 4b) and position as above (5a).

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

Table of Clearances and settings (All dimensions are in millimetres) Refer Figure 6

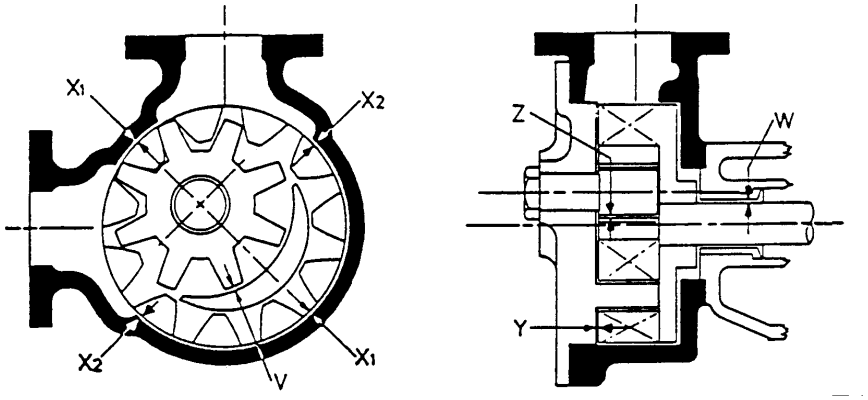
Clearances for MD100M	Grade A	Grade B	Grade C
V Radial - Inner Rotor to Crescent	0.025	0.025	0.025
W Diametral - Shaft to Bearing	0.04 - 0.06	0.05 – 0.07	0.05 – 0.07
X Diametral - Outer Rotor to Body	0.08 - 0.14	0.17 - 0.23	0.25 - 0.31
Y Axial - Rotors to Cover	0.04 - 0.06	0.08 – 0.10	0.16 – 0.19
Z Diametral - Rotor Pin to Bearing	0.05 - 0.08	0.05 - 0.08	0.05 - 0.08

Torque settings

Body to Bracket: 16.2 NM
Cover to body: 8.1 NM
Mechanical Seal to bracket: 8.1 NM

Figure 6

Measurement Points



6. Carry out preliminary sizing checks:

a) Outer rotor in body diametral clearance. To measure clearance insert feeler gauge at two opposite measurement points 'X_1'. Add the two clearances together. This will give the diametral clearance 'X' for the two points. Repeat this procedure for the other two measurement points 'X_2'. Note: When checking by this method, allowance or compensation must be made for axis misalignment caused by:
   1) Weight of rotor.
   2) Clearances between shaft and rotor bearing.
   3) Lack of bearing support at drive end

b) Axial length of inner rotor, outer rotor teeth and cover crescent must be matched to within +/- 0,02mm.

c) To check clearance between inner rotor and cover crescent, inner rotor should be held towards suction plane.

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

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

4.6 REASSEMBLY (Refer to Drg No. CMP110)

1. Apply a suitable sealant (eg. Loctite 515) to the inner rotor pin bore in the cover. Press inner rotor pin into cover ensuring lubrication groove points centrally towards crescent and adequate support is given

around the rotor pin bore boss when pressure is applied. Fit pin so that end is flush with outside of cover.

2. Fasten body to bracket with sealing gasket between faces; maintaining correct suction and discharge port orientation, securely tighten setscrews in a uniform manner.

3. Insert rotor/shaft assembly ensuring rotor bearing is lubricated.

4. Fit inner rotor over inner rotor pin in cover assembly with projecting side (if fitted) towards cover. If rotor has flush fitted bearing, fit with flush side towards cover. Ensure bearing is lubricated.

5. Fit cover assembly to body with sealing gasket between faces and making sure the seal land of the cover matches with the seal land in the pump body. Note: This seal land is diametrally opposite the centre of the cover crescent. Lubricate pump elements through pump port and check that rotor/shaft assembly turns freely.

6. If required, fit a new gasket to mechanical seal. Slide mechanical seal along shaft and loosely fit securing setscrews. NOTE: at this stage, do not tighten seal plate setscrews and do not fasten seal to shaft, this should be done after setting axial clearance.

7. If required, pack bearing with a high quality Lithium based grease in accordance with manufacturers recommendations. (DO NOT OVERFILL)

8. Fit inner spacer sleeve to shaft.

9. Lubricate outer diameter of bearing carrier and lipseal in bearing carrier with grease, slide bearing carrier along shaft and spacer until carrier flange makes contact with bracket. Fit three race carrier fastening setscrews through the clearance holes and screw into the threaded holes in the bracket to ensure alignment of holes. Allow about 5mm clearance between heads of these setscrews and bearing carrier.

10. Lubricate bearing. Fit bearing to shaft and drive bearing into position against spacer using a suitable drift. Force should only be applied to the inner ring. Tapping on the outer ring could damage the bearing.

11. Lubricate outer lockring lipseal with grease and screw outer lockring into bearing carrier until bearing is firmly locked between lockring and carrier.

12. Apply a medium strength thread locking adhesive (Loctite 243 or equivalent) to grubscrew and lock lockring in position with grubscrew.

13. Slide outer spacer sleeve over shaft and through race lockring seal.

14. Fit coupling key and coupling, lock onto shaft with shaft nut and shaft washer. **NOTE:** As spacers and coupling are used to lock ball bearing in position relative to shaft shoulder, coupling half must be correct size to ensure seating.

AXIAL CLEARANCE ADJUSTMENT

The bearing carrier when finally positioned determines the ball bearing location within the bracket. As the ball bearing is firmly locked to the shaft by the locknut, the positioning of the ball bearing will control the rotor axial clearance. To adjust axial clearance:

a) A turning carrier should be affixed on the coupling end of the shaft to facilitate rotating of assembly.

b) Evenly tighten the three race carrier fastening setscrews whilst simultaneously rotating assembly. This enables sensing the rotor-cover point of contact ie. a slight drag is felt by hand.

c) Measure the clearance between the race carrier flange and the bracket i.e. establish a datum point for setting axial clearance.

d) Fit locknuts to the three adjusting setscrews and fit them to the threaded holes in the race carrier flange.

e) Back off race carrier fastening setscrews and evenly screw in the race carrier adjusting setscrews until the clearance between the race carrier flange and the bracket is equal to the original clearance plus the desired axial clearance (as shown in the clearance table). Tighten the race carrier fastening setscrews and once again check the clearance. Axial clearance should now be established.

NOTE When carrying out steps 15 – 17, refer to the seal manufacturer's drawing.

15. Evenly tighten seal plate setscrews.

16. Apply a medium strength thread locking adhesive (Loctite 243 or equivalent) to the seal sleeve grubscrews and evenly tighten them to lock the sleeve to the shaft.

17. Loosen the manufacturers seal setting pieces, rotate them clear of the cover (seal plate) and lock them back onto the driver for future use if required.

18. Rotate shaft to ensure that mechanism is not binding.

19. Replace suction/pressure circulation harness assemblies if fitted.

SECTION 5 - INTEGRAL BYPASS VALVES

5.1 PREPARATION FOR DISASSEMBLY

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

5.2 DISASSEMBLY

1. Remove adjusting screw cap.

2. Unscrew adjusting screw locknut and remove adjusting screw to relieve spring tension.

3. Unscrew bypass valve housing cap and withdraw internal components.

4. Remove bypass valve housing from pump cover if required.

5.3 INSPECTION:

1. Inspect all components for damage or excessive wear. Repair or replace components as required.

5.4 REASSEMBLY_-_PRELIMINARY

1. Lap valve into valve seat. Ensure no lapping compound remains as this may damage pump.

2. EBSRAY recommend replacement of gaskets during every overhaul.

5.5 REASSEMBLY

1. Screw locknut onto adjusting screw and screw latter partially into housing cap.

2. Fit valve in housing, ensuring

   freedom of movement.

3. Fit spring on top of valve.

4. Fit washer on top of spring.

5. Fit gasket to housing cap and screw cap into housing, taking care not to dislodge spring or washer. Tighten firmly then fit adjusting screw cap and gasket.

6. Fasten valve housing to pump. The adjusting screw is oriented towards the suction port.

5.7 BYPASS VALVE ADJUSTMENT

1. Remove adjusting screw cap.

2. **For increased bypass pressure**, rotate adjusting screw **clockwise** (i.e.screw in).
   For decreased bypass pressure, rotate adjusting screw **anticlockwise** (i.e. screw out).

4. Firmly lock adjusting screw locknut against cap immediately after any adjustment is made then refit adjusting screw cap and gasket.

NOTE: Bypass valves characteristically exhibit two distinct pressures during their operation:

a) The setting or cracking pressure which occurs when product initially begins to be bypassed against the preset spring load.

b) Maximum pressure, which occurs when the full flow of the bypassed product passes through the bypass valve.

It is important to ensure both these characteristics are understood fully in order to correctly apply the Bypass Valve in a given system.

SECTION VI - TROUBLE SHOOTING

6.1 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.

6.2 LOW OUTPUT

1. Discharge head too high.

2. Entrained air or gases in pumpage.

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, or overload motor etc.

6. Insufficient NPSH available.

7. Excess axial clearance setting of rotor to cover.

8. Excess clearances in pump due to wear.

6.3 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.

6.4 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) Reduce product viscosity.

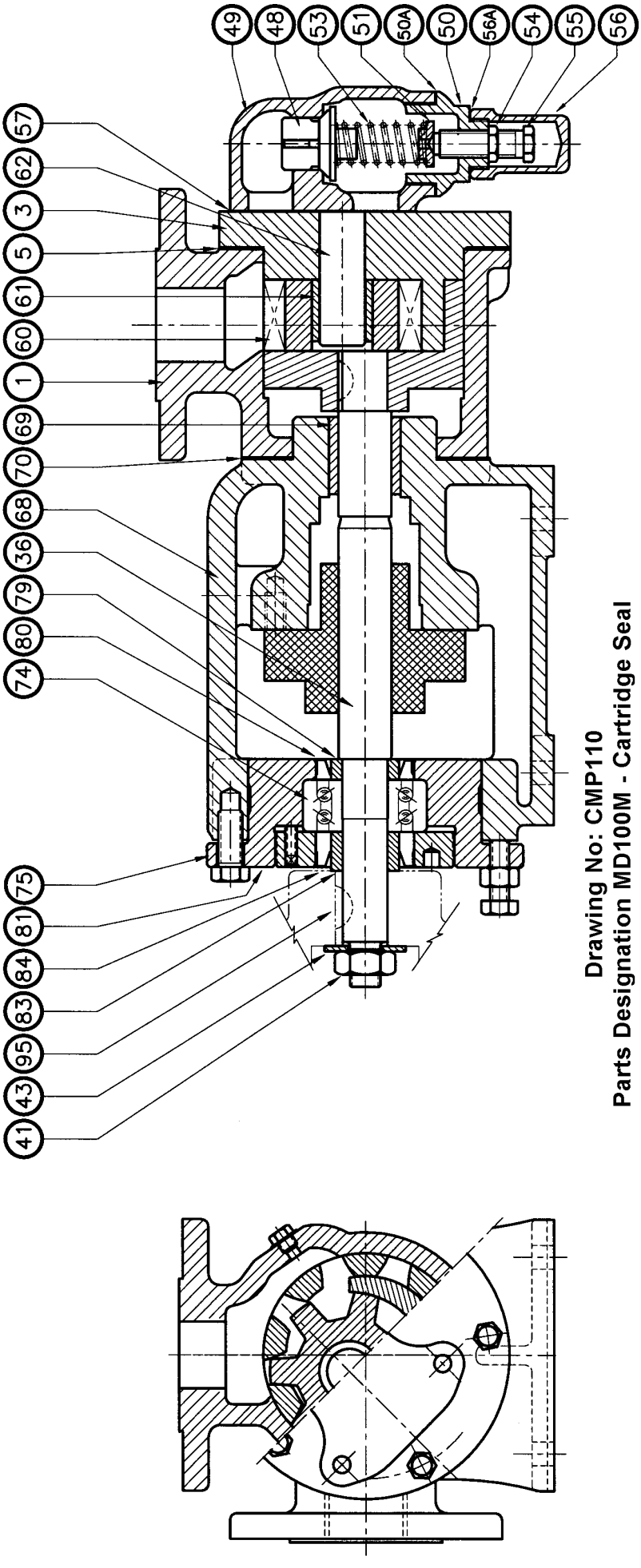
2. Rotating parts bind - check for proper clearances.

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

SECTION 7 PARTS DESIGNATION

Refer to Drawing No CMP110

CAT #	DESCRIPTION	QTY
1	BODY	1
3	COVER	1
5	COVER GASKET	1
36	ROTOR/SHAFT ASSEMBLY	1
41	SHAFT LOCKNUT	1
43	SHAFT LOCKNUT WASHER	1
48	BYPASS VALVE	1
49	HOUSING - BYPASS VALVE	1
50	CAP - BYPASS VALVE HOUSING	1
50A	GASKET - BYPASS VALVE CAP	1
51	SPRING CAP	2
53	SPRING - BYPASS VALVE	1
54	LOCKNUT - ADJUSTING SCREW	1
55	BYPASS ADJUSTING SCREW	1
56	CAP - BYPASS ADJUSTING SCREW	1
56A	GASKET - BYPASS ADJUSTING SCREW CAP	1
57	GASKET - BYPASS VALVE HOUSING	1
60	INNER ROTOR	1
61	INNER ROTOR BEARING	1
62	INNER ROTOR PIN	1
68	BRACKET	1
69	ROTOR BEARING	1
70	BRACKET GASKET	1
74	BALL BEARING	1
75	BALL BEARING RACE CARRIER	1
79	INNER SPACER SLEEVE - BALL BEARING	1
80	SEAL - INNER RACE CARRIER	1
81	BALL BEARING OUTER LOCK RING	1
83	OUTER SPACER SLEEVE - BALL BEARING	1
84	SEAL - OUTER LOCKRING	1
95	WOODRUFF KEY	1
133	BLANKING PLATE - BYPASS (ONLY USED FOR PUMPS WITHOUT INTEGRAL BYPASS VALVE FITTED)	1
	MECHANICAL SEAL ASSEMBLY	1



Drawing No: CMP110
Parts Designation MD100M - Cartridge Seal