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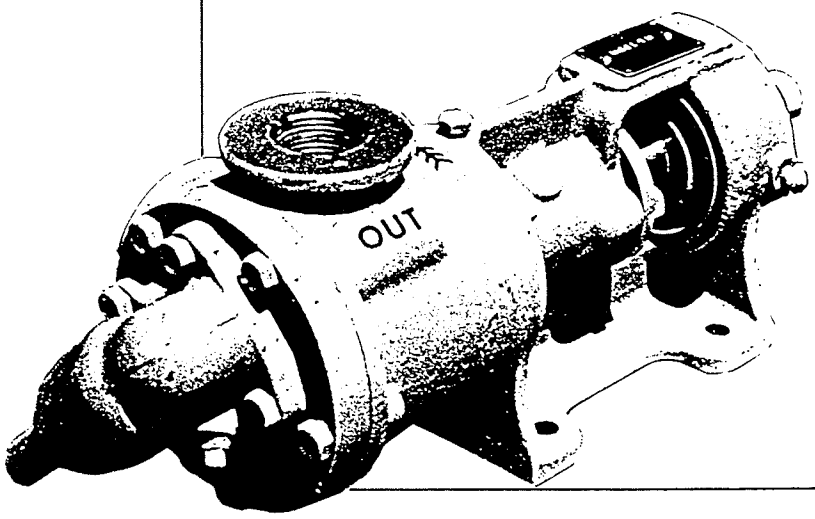
EBSRAY PUMPS

Installation, Operation and Maintenance Instructions



MD Series

Models MD340M & MD100M

EBSRAY AUSTRALIA

SECTION I - 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.

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 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.

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 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.

II-D 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.

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.

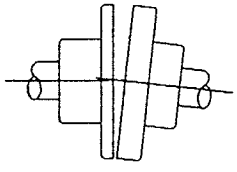


Figure 1

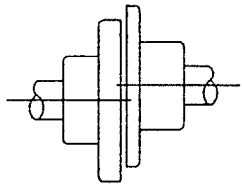


Figure 2

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.

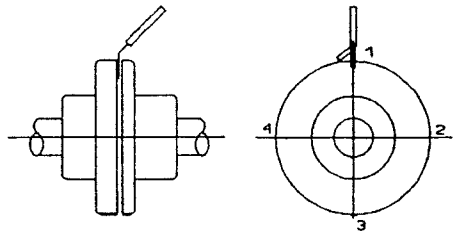


Figure 3

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.

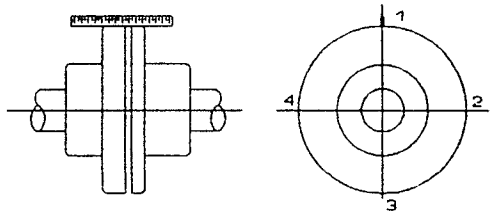


Figure 4

SECTION III - OPERATION

III-A 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)

III-B PUMPING PRINCIPLE

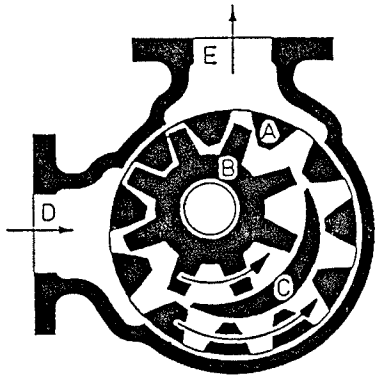


Fig.5

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 withdrawl 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.

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 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.

III-D LUBRICATION

Lubrication of the inner rotor bearing and bracket bearing is usually dependent on the pumpages' 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 a high quality lithium based grease. Replacement of this grease is normally only necessary when major maintenance is carried out.

III-E STARTUP CHECKLIST

- ✓ Lubricate as required.
- ✓ Alignment of couplings.
- ✓ Direction of rotation.
- ✓ Freeness 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.

III-F 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. **CAUTION:** DO NOT OVER TIGHTEN AND DO NOT TIGHTEN WHILST PUMP IS HOT.

III-G 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.

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 Cat #, description, and quantity required. Ref to Drg No. CMP026

3. Advise complete delivery instructions, transportation, etc.

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.

6. Mark relevant mating components for correct reassembly orientation.

IV-C DISASSEMBLY

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

2. Remove pump coupling half.

3. Release locking screw securing race carrier.

For pumps fitted with mechanical seals:

4. Release mechanical seal plate evenly to avoid damage.

5. 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.

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

7. Remove mechanical seal components taking care to avoid damage to lapped faces.

8. Disassemble cover assembly.

9. Screw out race carrier.

11. Release grubscrew from race carrier lockring, screw out lockring and extract ballrace.

12. Remove body from bracket if required.

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

For pumps fitted with packed glands:

Standard packed glands require correct grade packing for duty. A lantern ring when fitted must be correctly positioned. The lantern ring is used for suction return and relief of packing pressure, and is installed between the rotor bearing and the packing.

4. Release glandplate.

5. 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.

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

7. Screw out race carrier.

8. Release grubscrew from race carrier lockring, screw out lockring and extract ballrace.

9. Using a suitable tool, remove packing and lantern ring.

10. Disassemble cover assembly.

11. Remove body from bracket if required.

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

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.

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.

IV-E 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.

6. Carry out preliminary sizing checks:

a) Outer rotor in body diametral clearance. To measure clearance insert feeler guage 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:

i) Weight of rotor.

ii) Clearances between shaft and rotor bearing.

iii) 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. Refer Fig. 7

Table of Clearances

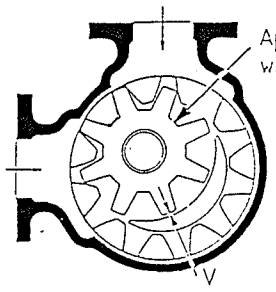
V Radial - Inner Rotor to Crescent
W Diametral - Shaft to Bearing
X Diametral - Outer Rotor to Body
Y Axial - Rotors to Cover
Z Diametral - Rotor Pin to Bearing

Standard "A" Clearances		
	MD340M	MD100M
V	0.025	0.025
W	0.04 - 0.05	0.04 - 0.05
X	0.08 - 0.13	0.08 - 0.13
Y	0.04 - 0.05	0.04 - 0.05
Z	0.04 - 0.06	0.04 - 0.06
Standard "B" Clearances		
	MD340M	MD100M
V	0.025	0.025
W	0.05 - 0.08	0.05 - 0.08
X	0.13 - 0.18	0.13 - 0.18
Y	0.05 - 0.08	0.05 - 0.08
Z	0.04 - 0.06	0.04 - 0.06

All dimensions are in millimetres

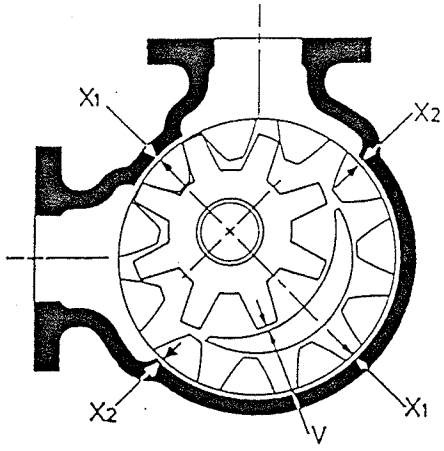
7. Ensure all suction/pressure circulation harness assemblies are clear of any obstructions.

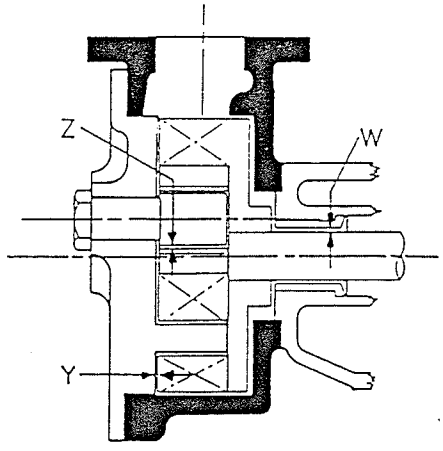
8. EBSRAY recommend replacement of all gaskets, seals and 'O' rings at every overhaul, to ensure positive sealing.



Apply pressure in this direction while checking inner rotor to crescent clearance 'V' with feeler guage.

Fig.7





IV-F REASSEMBLY

(Refer Drg No. CMP026)

1. Apply a suitable sealant (eg. Loctite 510) 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.

For pumps fitted with mechanical seals:

6. If pump is fitted with a non-headed bearing, fit 'O' ring to extraction washer, lubricate 'O' ring and slide extraction washer along shaft until seated against bearing.

7. Slide circlip along shaft until located in groove, (take care to avoid scratching shaft) slide circlip retainer along shaft until located against circlip (a suitable tube may help).

8. Insert spring, drivewasher, rotating 'O' ring, rotating face, stationary face, stationary 'O' ring and mechanical seal plate. Note: Particular care must be taken to avoid contamination oflapped seal surfaces by any foreign matter. All parts should be lubricated before assembly and drivepins must be located during assembly. Mechanical seal plate must be fastened evenly.

For pumps fitted with packed glands

6. Slide lantern ring along shaft and into position against bearing.

7. Place packing rings in position in accordance with normal packing procedures. For standard square packing with one (1) lantern ring use seven (7) rings of 6.5mm square packing. For other types of packing refer to suppliers instructions.

8. Position gland plate and tighten slightly.

Final adjustment is carried out during operation of pump. Packed glands, when adjusted correctly allow a very small amount of seepage. If packing is too tight it will generate excessive heat, if too loose it will leak excessively.

9. If required, pack bearing with a high quality Lithium based grease in accordance with manufacturers recomendations. (DO NOT OVERFILL)
10. Fit ball bearing to race carrier and secure in position with lockring. Tighten grubscrew in lockring.

11. Fit inner spacer sleeve to shaft.

12. Slide race carrier assembly over shaft. Using a suitable drift, gently tap race carrier onto shaft until race carrier threads can be engaged in bracket. Continue to "tap and turn" until bearing is seated against inner spacer sleeve. NOTE: **attempting to pull bearing onto shaft, by only screwing in the race carrier assembly, may damage the race carrier thread.**

13. Slide outer spacer sleeve over shaft and through race lockring felt seal, fit coupling key and coupling, lock onto shaft with shaft nut and shaft washer.

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

IV-G ROTOR AXIAL CLEARANCE ADJUSTMENT

The race carrier when finally positioned determines the ball bearing location within the bracket. As the ball bearing is firmly locked to the shaft shoulder by the spacer sleeve and coupling, the positioning of the ball bearing will control the rotor axial clearance.

To adjust axial clearance:

a) Ensure shaft turns freely.

b) Screw race carrier in a clockwise

direction whilst simultaneously rotating assembly. This enables sensing the rotor/cover point of contact i.e. a slight drag is felt by hand.

c) Mark race carrier position relative to bracket i.e. establish a datum point for setting axial clearance.

d) Back off race carrier 180 degrees to eliminate any backlash.

e) Retighten race carrier to a point measured radially from the previously marked datum equal to the amount of desired axial clearance.

Note: 2.6mm radial movement on the O.D. of the race carrier equals 0.025mm axial movement of the rotor/shaft assembly. Refer Table of Clearances for actual clearances.

f) At this point check for freeness of rotation of assembly. Axial clearance should now be established.

g) Firmly tighten lock screw to lock race carrier in position.

SECTION V - INTEGRAL BYPASS VALVES

V-A PREPARATION FOR DISASSEMBLY

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

V-B 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.

V-C INSPECTION:

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

V-D 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.

V-E 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.

V-F 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

VI-A 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.

VI-B 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.

VI-C 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.

VI-D 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.

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SECTION VII PARTS DESIGNATION

CAT #	DESCRIPTION	QTY
1	BODY	1
3	COVER	1
5	COVER GASKET	1
6	COVER LOCATING PIN	1
7	COVER SETSCREW	5
9	COVER SETSCREW SPRING WASHER	5
22	MECHANICAL SEAL ROTATING FACE	1
23	MECHANICAL SEAL STATIONARY FACE	1
24	MECHANICAL SEAL DRIVE WASHER	1
25	MECHANICAL SEAL SPRING	1
26	MECHANICAL SEAL DRIVESCREW	1
27	MECHANICAL SEAL PLATE	1
28	MECHANICAL SEAL PLATE LOCATING PIN	1
29	MECHANICAL SEAL STATIONARY "O"RING	1
30	MECHANICAL SEAL ROTATING "O"RING	1
31	MECHANICAL SEAL CIRCLIP	1
32	CIRCLIP RETAINER	1
34	MECHANICAL SEAL SCAVENGE ASSEMBLY	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 RETAINING WASHER	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
58	SETSCREW - BYPASS VALVE	4
59	WASHER - BYPASS VALVE SETSCREW	4
60	INNER ROTOR	1
61	INNER ROTOR BEARING	1
62	INNER ROTOR PIN	1
68	BRACKET	1
69	ROTOR BEARING (BRACKET BEARING)	1
70	BRACKET GASKET	1
71	SETSCREW - BRACKET	4
73	SPRING WASHER - BRACKET SETSCREW	4
74	BALL BEARING	1
75	BALL BEARING RACE CARRIER	1
79	INNER SPACER SLEEVE - BALL BEARING	1
80	FELT SEAL -INNER	1
81	BALL BEARING OUTER LOCK RING	1
82	GRUBSCREW - OUTER LOCKRING	1
83	OUTER SPACER SLEEVE - BALL BEARING	1
84	FELT SEAL - OUTER	1
95	WOODRUFF KEY	1

EBS-RAY MECHANICAL SEAL ARRANGEMENT

DRAWING # CMP026
PARTS DESIGNATION FOR:
MD340 MINOR & MD100 MINOR