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EBSRAY PUMPS

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

T SERIES

Models T200M T300M T400M T400HD and T600HD

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

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EBSRAY AUSTRALIA

SECTION I — GENERAL

INTRODUCTION

This leaflet is intended to assist those involved with the installation, operation and maintenance of EBSRAY LOBE PUMPS, T SERIES MODELS; T200M, T300M, T400M, T400HD & T600HD. 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. 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. Pumps/units must be securely bolted down.

II-C 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.

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.

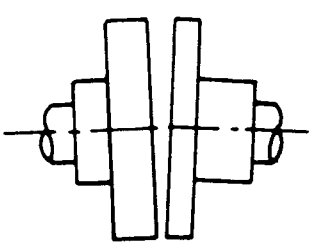


Fig.1

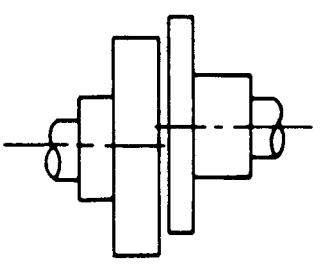


Fig.2

ANGULAR MISALIGNMENT as shown in Fig.1 should be corrected before eccentricity. Refer Fig.3; use feeler gauge reading at 90^{o} 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 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.

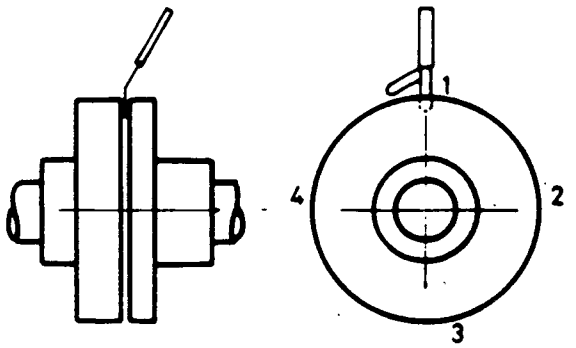


Fig. 3

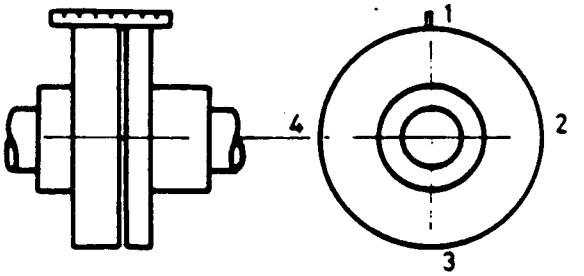


Fig. 4

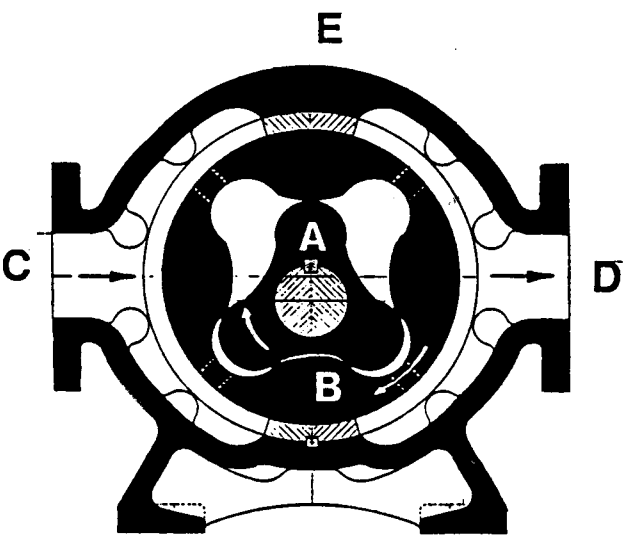
SECTION III — OPERATION

III-A DESCRIPTION

The EBSRAY lobe principle is a positive displacement pump based upon the use of a driving inner rotor 'A',and an idling outer rotor 'B'. The spaces between the inner and outer rotor lobes, which are not involved in the meshing cycle, are virtually sealed by the close clearances between the inner and outer rotors,the liner and the end covers.

(Refer Fig.5)

III-B PUMPING PRINCIPLE



When rotation is started and the lobes come out of mesh, there is an increase in the space between the rotors on the suction side. This creates a partial vacuum and the pressure differential thus created initiates movement of the liquid through the suction port 'C', filling the space between the two rotors. When the lobes are fully unmeshed, the space between the rotors is filled with liquid. Transfer to the discharge side is effected as the liquid is carried past the upper seal zone 'E'. When the lobes mesh on the pressure side the space between the two rotors is reduced, forcing liquid through the discharge port 'D'.

III-C APPLICATIONS

The field of applications for TRILOBE positive displacement pumps is extensive. These pumps are used to handle many kinds of viscous liquids over a wide range of capacities, pressures and temperatures. 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 outer rotor, liner and rotor bearings is dependent on the pumpages' lubricating qualities, speed of rotation, differential pressure and material selection.

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, unusal noises etc.

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.

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.
   Refer to Drg No. CMP013
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.
6. Mark relevant mating components for correct reassembly orientation.

IV-C DISASSEMBLY

Note: Before proceeding, make sure body is firmly attached to baseplate or bench etc. to avoid overbalancing when rotor is withdrawn.

FOR PUMPS FITTED WITH MECHANICAL SEALS

1. Remove suction/pressure circulation harness assemblies if fitted.
2. Remove pump coupling half and remove any burrs etc from shaft.
3. Remove mechanical seal plate complete with "O" ring, stationary face and stationary "O" ring. Take care to avoid damaging the lapped face.
4. Remove access plug and rotate shaft until drivescrew is accessible, loosen drivescrew 2 full turns to clear circlip groove.
5. Remove inspection end shaft cap and cover nuts.

6. Inspection end cover can now be removed, if cover is tight, tap on shaft from the drive end to loosen it. (some larger trilobe pumps have threaded extraction screw holes to facilitate removal of cover. If so fitted, insert suitable setscrews and tighten evenly to remove cover.)
7. The rotor/shaft assembly can now be driven through the pump from the drive end taking care to adequately support the inspection end.
8. Remove remaining mechanical seal components taking care to avoid damage to lapped face.
9. Remove drive end cover nuts and drive end cover, see note in 6. above.
10. Outer rotor and liner can now be removed.
11. If fitted with integral bypass valve, remove valve assembly as a unit and refer to bypass valve instructions for service.
12. Press out rotor bearings if replacement is required. NOTE: drive end bearing has a shoulder and must only be pressed out in the correct direction.

FOR PUMPS FITTED WITH PACKED GLANDS

Standard packed glands require correct grade packing for duty. A lantern ring when fitted must be correctly positioned. In some arrangements a lantern ring is used for suction return and relief of packing pressure, and is installed between the rotor bearing and the packing. in other arrangements it may be used for grease application to packing.

1. Remove suction/pressure circulation harness assemblies if fitted.
2. Remove pump coupling half and remove any burrs etc from shaft.
3. Remove gland plate.
4. Remove inspection end shaft cap and cover nuts.
5. Inspection end cover can now be removed, if cover is tight tap on shaft from the drive end to loosen it. (some larger trilobe pumps have threaded extraction screw holes to facilitate removal of cover. If so fitted, insert suitable setscrews and tighten evenly to remove cover.)
6. The rotor/shaft assembly can now be driven through the pump from the drive end taking care to adequately support the inspection end.
7. Remove packing and lantern ring .
8. Outer rotor and liner can now be removed.
9. Remove drive end cover nuts and drive end cover, see note in 5. above.
10. If fitted with integral bypass valve, remove valve assembly as a unit and refer to bypass valve instructions for service.
11. Press out rotor bearings if replacement is required. NOTE: drive end bearing has a shoulder and must only be pressed out in the correct direction.

IV-D INSPECTION

Inspect components for damage or excessive wear, replace or repair as required. Particular attention should be given to areas where wear is likely to occur. These areas are ; The driving and driven surfaces of the two rotors, the end covers, wear between outer rotor and liner, rotor bearings and mechanical seal components. If pump performance has been satisfactory, existing components although worn, may still have adequate service life.

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. If cover faces show excessive wear they should be machined prior to replacing bearings. The maximum amount of material that can be removed from the cover faces during the life of the cover, is about 1.5 mm , although pumps used in low pressure applications may tolerate more machining .
3. If replacing rotor bearings: Press-fit ensuring lubrication groove in bearing is adjacent to greaser hole in cover. Fit inspection end bearing flush with inner face. Fit drive end bearing with shoulder seated against step in bore. Care should be taken to ensure correct alignment. Machine or ream both bearings to achieve correct clearance on shaft, ensuring squareness with inner cover face.
4. Carry out preliminary sizing checks:
   a) Axial length of inner rotor, outer rotor and liner should be matched to within +/- 0,02mm.
   b) Outer rotor to liner diametral clearance.
   c) Rotor bearings to shaft clearance.
5. Ensure all suction/pressure circulation harness assemblies are clear of any obstructions.
6. EBSRAY recommend replacement of all gaskets, seals and "O"rings at every overhaul, to ensure positive sealing.

Table of Clearances

Running Clearances

X Radial - Outer Rotor to Liner

Y Axial - Rotors to Cover (total)

W Diametral - Shaft to Bearings

Pump Model	X	Y	W
T200M	0.10mm - 0.15mm	0.10mm - 0.15mm	0.05mm - 0.08mm
T300M	0.10mm - 0.15mm	0.10mm - 0.15mm	0.05mm - 0.08mm
T400M	**0.10mm - 0.15mm**	0.10mm - 0.15mm	0.05mm - 0.08mm
T400HD	**0.16mm - 0.18mm**	0.15mm - 0.20mm	0.08mm - 0.10mm
T600HD	0.16mm - 0.18mm	0.15mm - 0.20mm	0.08mm - 0.10mm

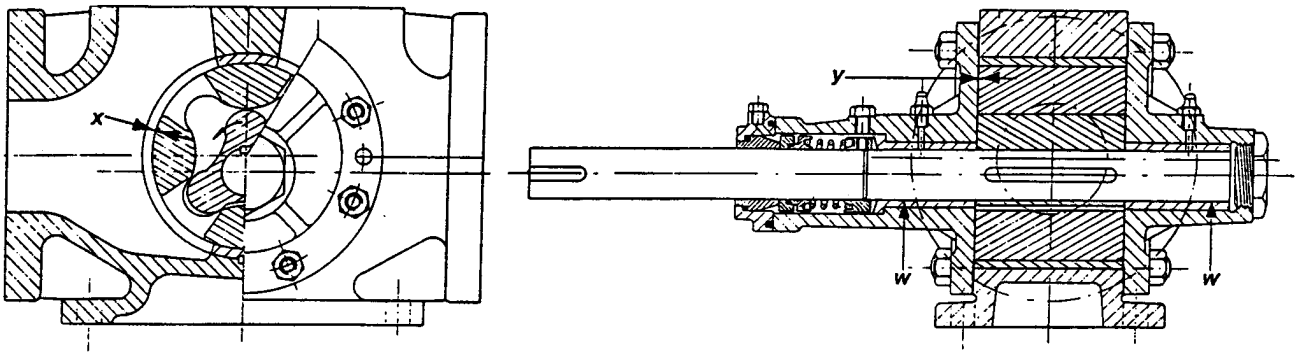


fig.6

IV-F REASSEMBLY (Refer Drg No. CMP013)

1. Fit liner to body with key in position. CAUTION ; Ensure key is not tight between body and liner as a tight key may distort liner.
2. Lubricate and insert outer rotor in liner, check for freedom of rotation.
3. Fit drive end cover to body using one gasket ensure correct orientation and locate using dowels. Tighten nuts firmly.
4. lubricate rotor/shaft assembly and Insert through outer rotor with drive end through drive end cover.
5. The axial clearance between rotors and covers will be set by the total thickness of the gaskets used. To determine the required thickness, the rotor/shaft assembly should be held firmly against the drive end cover. A straight edge is placed across the body and a feeler guage is used to measure the clearance between the straight edge and the rotors. This measurement is deducted from the required total clearance to determine the thickness of gasket required.

6. With the correct gasket/s fitted install the inspection end cover, ensuring correct alignment using the dowel pins. Tighten the cover nuts firmly.
7. Check rotor shaft assembly for freedom of rotation. Axial clearance can be checked at this stage using a dial indicator.

For pumps fitted with mechanical seals:

8. Slide circlip along shaft ensuring gap in circlip lines up with access hole. Take care to avoid scratching shaft.
9. Slide circlip retainer along shaft until located against circlip (a suitable tube may help), keep drive screw in line with access hole, tighten drive screw.
10. Insert spring, drivewasher, rotating 'O' ring and rotating face. Stationary face, stationary 'O' ring, mechanical seal plate and seal plate "O" ring can be assembled as a unit then fitted to pump Note: Particular care must be taken to avoid contamination of lapped 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.
11. Fit bypass valve to pump body taking care to ensure correct orientation.
12. Replace suction/pressure circulation harness assemblies if fitted.
13. Replace inspection end shaft cap; with screw type cap apply a suitable sealant to the cap, for other types a new gasket should be used.

For pumps fitted with packed glands

8. Place packing rings and lantern ring in position in accordance with normal packing procedures.
9. 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.
10. Fit bypass valve to pump body taking care to ensure correct orientation.
11. Replace suction/pressure circulation harness assemblies if fitted.
12. Replace inspection end shaft cap; with screw type cap apply a suitable sealant to the cap, for other types a new gasket should be used.

SECTION V — 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 if fitted.
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 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. Ensure bleed holes (if present) in valve and pressure pin are unobstructed.
2. EBSRAY recommend replacement of gaskets during every overhaul.

V-E REASSEMBLY

For valve as fitted to T200M.

1. Screw locknut onto adjusting screw and screw latter fully into housing cap.(this is to aid location of pressure pin during assembly) Fit gasket to housing cap.
2. Fit valve in housing, ensuring freedom of movement.
3. Assemble pressure pin, washers and spring as shown in drawing CMP 014 and hold the assembly in position on top of valve.
4. Whilst using a suitable tool to maintain position of pressure pin assembly, fit housing cap assembly over housing,locate pressure pin in adjusting screw. Gradually unscrew adjusting screw until housing cap can be screwed into housing. Firmly tighten cap then fit adjusting screw cap and gasket.
5. Fasten valve housing to pump. The adjusting screw is oriented towards the suction port.

For valves as fitted to T300M, T400M, T400HD &T600HD.

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 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, ensuring correct orientation.

V-F BYPASS VALVE ADJUSTMENT

1. Remove adjusting screw cap if fitted.
2. For increased bypass pressure, rotate adjusting screw clockwise (i.e.screw in).
3. 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 above 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 liquid pumped.
3. Strainer offering excess resistance to flow.
4. Suction and/or discharge pipes of insufficient diameter, causing excessive friction loss.

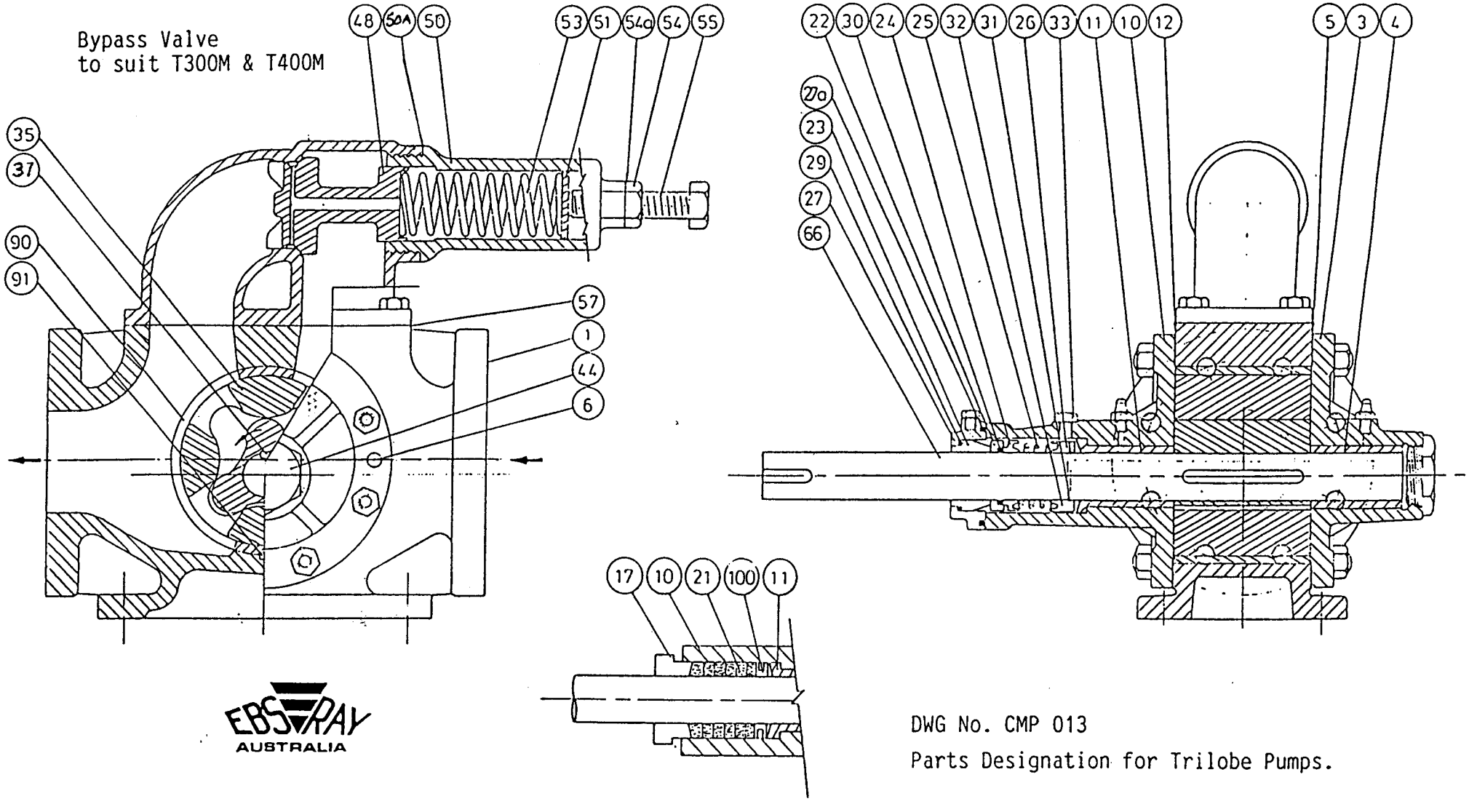
5. Bypass valve pressure setting too low - Increase pressure by screwing in adjusting screw. DO NOT exceed pump or system design pressure, or overload motor etc.
6. Insufficient NPSH available.
7. Excess axial clearance setting of rotor to cover.
8. Excess clearances in pump due to wear.

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.



DWG No. CMP 013

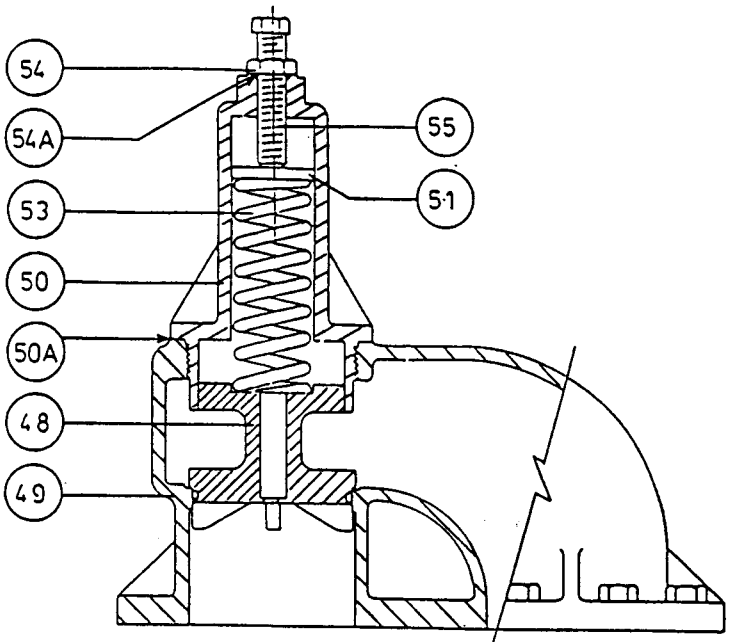
Parts Designation for Trilobe Pumps.

PARTS DESIGNATION FOR T200M, T300M, T400M, T400HD & T600HD.

Note: Refer Drg CMP013

ITEM NO.	DESCRIPTION	QTY	
1	BODY	1	
3	INSPECTION COVER	1	
4	" " BEARING	1	
5	" " GASKET	1	
6	" " LOCATION PIN	1	
10	DRIVE END COVER	1	
11	" " " BEARING	1	
12	" " " GASKET	1	
17	GLAND PLATE	1	
21	PACKING	1	
22	ROTATING FACE	1	
23	STATIONARY FACE	1	
24	DRIVE WASHER	1	
25	SPRING	1	
26	DRIVE SCREW	1	
27	MECHANICAL SEAL PLATE	1	
27A	" " " "O" RING	1	
29	'O' RING STATIONARY	1	
30	'O' RING ROTATING	1	
31	CIRCLIP	1	
32	CIRCLIP RETAINER	1	
33	ACCESS PLUG	1	
35	OUTER ROTOR	1	
37	INNER ROTOR KEY	1	
44	SHAFT CAP	1	
47	" " GASKET	1	
57	BYPASS GASKETS	1	(2 REQ'D FOR T200M)
66	ROTOR/SHAFT ASSEMBLY	1	
90	LINER	1	
91	" KEY	1	
100	LANTERN RING	1	

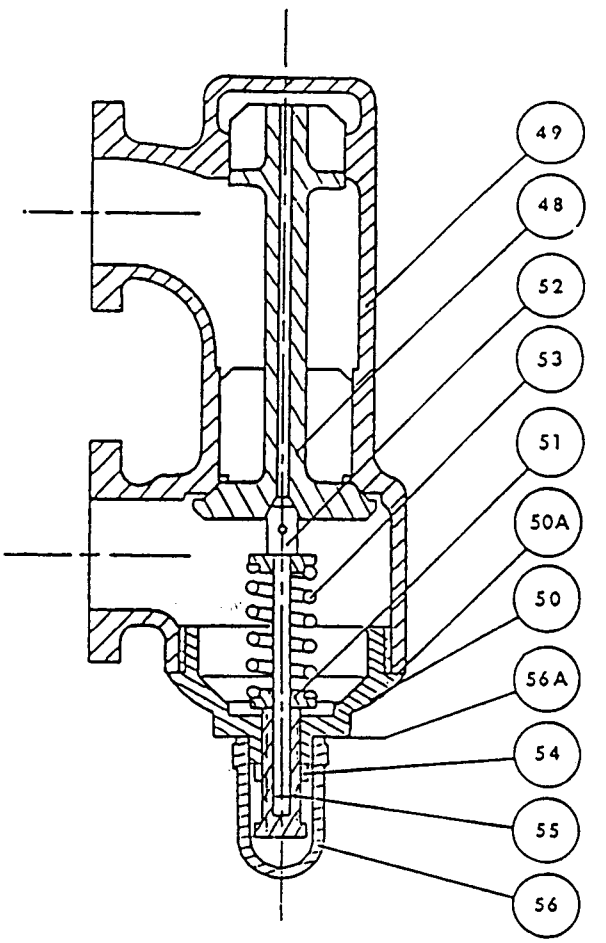
As there are many configurations of pumps covered by this parts list, not all the parts listed will be in any one pump. Before ordering parts, check that the items ordered are fitted to your pump.



To suit T400HD & T600HD

PARTS DESIGNATION BYPASS VALVES.

DWG No CMP 014.



To suit T200M

ITEM NO.	DESCRIPTION	QTY
48	BYPASS VALVE	1
49	HOUSING - BYPASS VALVE	1
50	CAP - BYPASS VALVE HOUSING	1
50A	GASKET - BYPASS CAP	1
51	SPRING RETAINING WASHER	1
52	PRESSURE PIN	1
53	SPRING	1
	To Suit Application	
54	LOCKNUT - ADJUSTING SCREW	1
55	ADJUSTING SCREW	1
56	CAP - ADJUSTING SCREW	1
56A	GASKET - BYPASS SCREW CAP	1