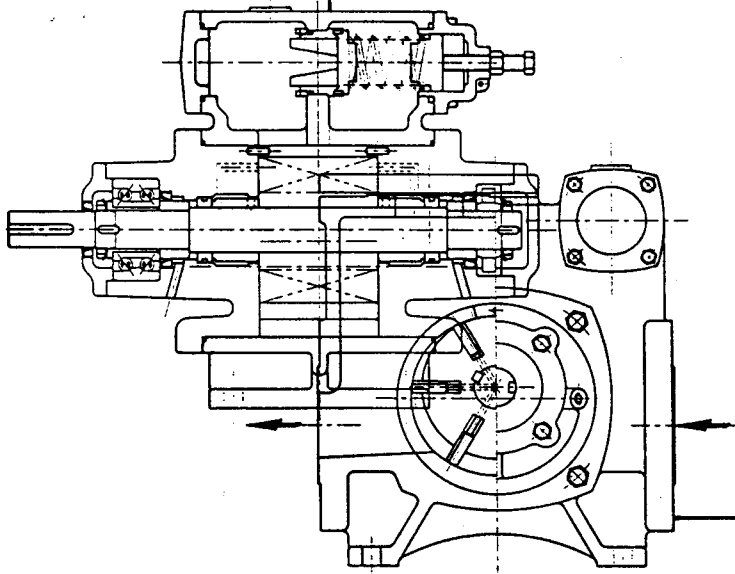


EBSRAY PUMPS

Installation, Operation and Maintenance Instructions



V Series

Models V20 & V30

Type 70 Group

EBSRAY
AUSTRALIA

CONTENTS

SECTION I - GENERAL	3
INTRODUCTION	3
I-A CAUTION	3
I-B WARNING	3
I-C TRANSPORTATION AND PACKING	3
I-D INSPECTION ON RECEIPT - SHORTAGES	3
I-E HANDLING	3
 SECTION II - INSTALLATION	 3
II-A LOCATION	3
II-B FOUNDATIONS	3
II-C PUMP PIPING CONNECTIONS	3
II-D STRAINER PROTECTION	4
II-E ALIGNMENT	4
 SECTION III - OPERATION	 4
III-A DESCRIPTION	4
III-B LUBRICATION	5
III-C START-UP CHECKLIST	5
III-D OPERATIONAL CHECKS	5
 SECTION IV - MAINTENANCE	 5
IV-A SPARE PARTS	5
IV-B PREPARATION FOR DISASSEMBLY	5
IV-C DISASSEMBLY	5
PART I - Bypass Valve	5
PART II - Pump	6
IV-D INSPECTION	6
STANDARD GENERAL CLEARANCES	7
IV-E REASSEMBLY - PRELIMINARY	7
IV-F REASSEMBLY	8
PART I - Pump	8
PART II-Bypass Valve	9
 SECTION V - INSTRUCTIONS FOR REVERSING DIRECTION OF ROTATION	 10
 SECTION VI - TROUBLE SHOOTING	 12
VI-A FAILURE TO DELIVER LIQUID	12
VI-B LOW OUTPUT	12
VI-C EXCESSIVE POWER CONSUMPTION	12
VI-D PUMP IS NOISY	12
VI-E LEAKAGE	12
 SECTION VII - PARTS DESIGNATION	 13

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SECTION I - GENERAL

INTRODUCTION

This publication is intended to assist those involved with the installation, operation and maintenance of EBSRAY Model V20/V30 Type 70 group Rotary Sliding Vane 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 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 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 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 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.

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.

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.

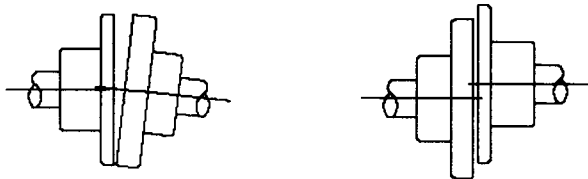


Figure 1

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.

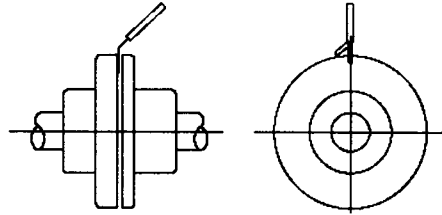


Figure 3

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.

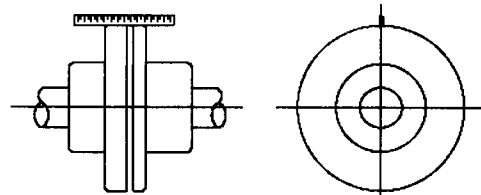


Figure 4

SECTION III - OPERATION

III-A DESCRIPTION

The Ebsray Model V20/V30 Type 70 group is a range of "self draining" positive displacement sliding vane pumps, primarily intended for the transfer of low to medium viscosity liquids. The pumps are of a multi-port design, allowing for either 90° or 180° porting options. A blanking plate may cover the unused port.

The pump body and liner are designed to allow the pump to self-drain through the horizontal discharge port, with no un-swept internal cavities below the level of the liner discharge ports.

The rotor/shaft assembly rotates within a cam form liner. Mechanical seals located within the bearing housings isolate the bearings from the pumpage.

The located end (drive end) bearing is a double row angular contact type and the non-located end (inspection end) bearing is a heavy duty roller type. Both bearings are grease packed. The drive end bearing is locked to the shaft and to the bearing housing thus providing positive axial positioning of the pump rotor. The inspection end bearing inner cone is secured to the shaft and due to the bearing design can float axially within the roller race, accommodating any expansion or contraction of the rotor shaft assembly and/or the casing assembly.

A lip seal is fitted to the drive end bearing cap to minimise ingress of dust/dirt along the shaft. The pump is protected from excessive differential pressure rise by an adjustable bypass valve. Depending on the model, balanced,

, pet or PFM (Pressure and Flow Modulating) valve options are available. System design must prevent sudden/excessive pressure rise, or shock due to thermal expansion.

III-B LUBRICATION

No 'in service' lubrication is required on EBSRAY V Series pumps.

III-C START-UP CHECKLIST

- ✓ Alignment of couplings.
- ✓ Direction of rotation.

- ✓ Freedom of shaft rotation.
- ✓ Do not start pump against closed discharge valve or with suction valve throttled.

DO NOT RUN PUMP DRY

III-D OPERATIONAL CHECKS

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

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 inspections and maintenance tasks 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.

The following instructions regarding disassembly/reassembly are relative to major maintenance.

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. CMP033A
3. Advise complete delivery instructions, transportation, etc.

IV-B PREPARATION FOR DISASSEMBLY

1. Obtain the appropriate Work Permit if required.

2. Isolate the 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. Note pump and bypass valve orientation relative to direction of pump rotation.
5. Disconnect porting connections.
6. Remove pump from installation.

IV-C DISASSEMBLY

CAUTION: TAKE CARE NOT TO DAMAGE COMPONENTS BY PRISING OR LEVERING IN ORDER TO RELEASE FITS.

PART I - Bypass Valve

NOTE: The following procedure is for pumps fitted with balanced or poppet type valves, for pumps fitted with PFM valve option, refer to separate instructions.

1. Unlock locknut, remove adjusting screw and locknut from bypass valve cover.
2. Remove bypass valve housing cover and 'O' ring together with valve, spring and retaining washer.
3. Remove 'O' rings from bypass cover.
4. Remove blanking cover if poppet valve fitted, or cartridge if balanced valve fitted.

'O' ring from blanking cover or cartridge as required.

PART II - Pump

NOTE: For pumps fitted with other than EBS-RAY mechanical seal, follow instructions below but refer to seal manufacturer's instructions where seal component assembly or disassembly is mentioned.

- 1 Remove pump coupling half from shaft.
- 2 Remove inspection end bearing cap.
- 3 Unlock lockwasher and remove locknut from inspection end of shaft.
- 4 Remove inspection end bearing housing, take care to avoid damage to mechanical seal faces.
- 5 Remove bearing outer ring assembly, lip seal and 'O'ring from bearing housing.
- 6 Remove bearing inner cone, spacer, stationary seal face, and mechanical seal assembly from inspection end of shaft.
- 7 Remove drive end bearing housing assembly as a complete unit, taking care to prevent vanes and pushrods dropping out during withdrawal.
- 8 *Note orientation of vanes in relation to pump rotation*, then remove vanes and pushrods from rotor.
- 9 Stand assembly upright in a suitable jig with the drive end bearing housing toward the top.
- 10 Remove drive end bearing cap.
- 11 Unlock lockwasher and remove locknut.
- 12 Lift bearing housing assembly from shaft complete with the bearing, 'O'ring, sleeve, spacer and the lip seal.

- 13 Remove bearing, 'O'ring, sleeve, spacer, lip seal and stationary seal face from bearing housing.
- 14 Remove mechanical seal assembly from shaft.
- 15 If required, remove locating pins and plug screws from both bearing housings.
- 16 Remove liner from body.
- 17 If required, remove port blanking plate and gasket.

IV-D INSPECTION

1. Inspect rotor/shaft assembly and liner. If damage or excessive wear is evident, it is recommended that both components be replaced.

NOTE:

- The rotor is a shrink fit on the shaft and is pinned for positive axial location.
2. Inspect vanes for wear or damage - Refer Table I.
 3. Inspect vane pushrods for wear, damage and straightness. Replace as required.
 4. Inspect bypass valve assembly and components for wear or damage. Replace or refurbish as required.
 5. It is recommended that all 'O' rings and lip seals be replaced at every major overhaul.
 6. Inspect both ball and roller bearings for wear. It is recommended on major overhauls that these Bearings be replaced.
 7. Ensure pressure relief ducts in bearing housings are not obstructed.
 8. Ensure weep holes in bearing housings are not obstructed.

STANDARD GENERAL CLEARANCES AND SIZES FOR TEMPERATURES 0°- 100°C

	V20	V30
Rotor to liner clearance measured radially at 12 o'clock position.	0.02 - 0.04 mm	0.025 - 0.05 mm
Total axial clearance - liner minus rotor length measured along axis.	0.16 - 0.25 mm	0.18 - 0.27 mm
Total vane clearance - liner length minus vane length measured along axis.	0.16 - 0.25 mm	0.18 - 0.27 mm
Standard vane height.	26.95 - 27.45 mm	35.8 - 35.81 mm
Recommended maximum wear on vane height.	4 mm	4mm

Notes:

1. Dimensions stated are design parameters.
2. High suction lift capability and optimum performance are achieved when the pump is maintained within these dimensions, however, adequate performance may still be achieved with clearances and dimensions outside those stated if application parameters allow.
3. If installing new vanes, check their lengths to comply with clearances stated. NOTE: New parts from EBSRAY should be the correct size. As vanes are made from a hygroscopic material which may swell during storage, some length adjustment may be required.

IV-E REASSEMBLY - PRELIMINARY

(Refer Drawing No. CMP033A)

1. Ensure all parts are clean and free from sharp edges, burrs etc.
2. Lightly smear all 'O' rings and lip seals with a compatible good quality lubricant before assembling.
3. Ensure correct orientation of components:

Bypass valve: For *clockwise* pump rotation, adjusting screw* position is *opposite* drive end. For *anti-clockwise* pump rotation, adjusting screw position is *at* drive end.

***Note:** For pumps fitted with PFM valve option, control cylinder replaces adjusting screw in the above orientation description.

Liner: After determining direction of rotation, liner orientation can be determined. The flow of pumpage through the pump follows the direction of movement of the bottom of the rotor. The liner must be installed with the cast "S" towards the suction side. The thick section of the liner must be towards the bottom. Refer Fig 5.

4. Using a suitable tool, lightly lap bypass valve into seat, valve should only be lapped until contact is achieved right around the seat. (Excessive lapping of the valve will increase the seat width and prevent the valve from functioning correctly) Ensure no lapping compound residue remains on components after lapping.

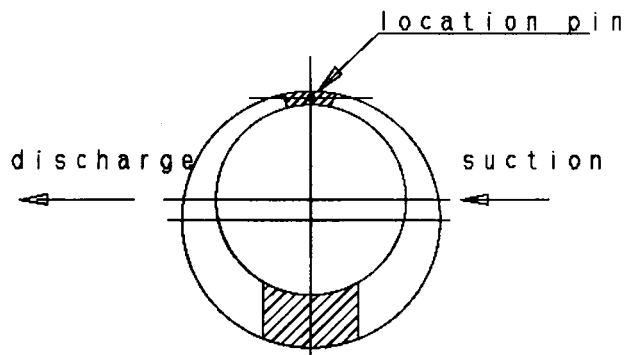


Figure 5

6. Press fit the two location pins into the bearing housings until they seat in their holes.

6. Press fit one lip seal into each bearing housing ensuring the sealing lips face inwards. (away from the bearing recess)

7. Press fit a lip seal to the drive end bearing cap with the lip toward the inside.

IV-F REASSEMBLY PART I - Pump

1 Insert liner half way into drive end of body, ensure correct orientation (see IV-E)

2 Using a suitable jig, stand rotor/shaft assembly with drive end up.

3 Place drive end bearing housing over drive end of shaft.

4 Fit spacer to shaft and push into position through lip seal.

5 Place a shim (approximately 1.00 mm thick) over shaft and resting on top of spacer. This shim is to provide a measurable gap between end of rotor and face of bearing housing, thickness is not critical provided it is known, shim must be of a material which will not compress.

6 Fit bearing, spacer sleeve, lockwasher and locknut, tighten locknut.

7 Fit bearing cap and tighten setscrews.

8 Using feeler gauges, measure the clearance between the end of the rotor and the face of the bearing housing (measure opposite sides simultaneously to avoid errors in alignment).

9 The required clearance is one third of the total axial clearance (total axial clearance is equal to the difference in axial length between the rotor and the liner). After measuring the clearance, determine which shims will be required to replace the temporary shim in order to obtain the correct clearance upon reassembly.

10 Remove the bearing cap and shaft locknut and withdraw the bearing housing assembly complete with spacers and bearing.

11 Taking care to avoid damage to seal faces, fit mechanical seal assembly to shaft, ensure seal spacer is seated firmly against rotor and ensure seal sleeve is seated firmly against seal spacer, secure in place with two grubscrews. (grubscrews should be locked using Loctite 242 or similar)

12 Fit stationary seal face with 'O' ring to drive end bearing housing.

13 Lubricate seal faces and fit drive end bearing housing over shaft.

14 Lubricate spacer and fit to shaft and through lip seal.

15 Fit required shim/s against spacer, fit bearing, sleeve, lockwasher and locknut, tighten locknut and secure with lockwasher.

16 Re-check clearance between bearing housing face and rotor.

17 Fit 'O' ring to drive end bearing housing.

18 Fit three pushrods through the holes in the rotor shaft assembly.

19 Fit the six vanes into the slots in the rotor ensuring that the striker plates on the vanes are toward the pushrods and that the relief slots in the vanes are leading in the direction of rotation.

20 Cradle the vanes in the rotor by hand, or if positioning is awkward, tie a piece of string around the vanes to secure them whilst inserting the assembly through the liner.

21 Slide rotor assembly into liner, and if tied, remove the string once the vanes are retained. Push assembly home, ensuring that the locating pin in the bearing housing locates in the hole in the liner.

22 Fasten drive end bearing housing to pump body.

23 Taking care to avoid damage to seal face, fit mechanical seal assembly to inspection end of shaft, ensure seal spacer is seated firmly against rotor and ensure seal sleeve is seated firmly against seal spacer, secure in place with two grubscrews. (grubscrews should be locked by using Loctite 242 or similar)

Fit stationary seal face with 'O' ring to inspection end bearing housing.

- 25 Lubricate seal faces and fit inspection end bearing housing over shaft, ensuring locating pin locates in hole in liner.
- 26 Fasten inspection end bearing housing in position with setscrews.
- 27 Lubricate spacer and fit to shaft and through lip seal.
- 28 Fit inner race cone to shaft, lubricate roller bearing if required and fit assembly to bearing housing.
- 29 Fit lockwasher and locknut to shaft, tighten locknut and secure with lockwasher.
- 30 Fit inspection end bearing cap and tighten setscrews.
- 31 Fit appropriate screws with sealing washers to bleed holes (long screws in discharge side and short screws in suction side)
- 32 Check pump for freedom of shaft rotation.

THE HYDRAULIC RELIEF SLOTS IN THE VANE MUST LEAD IN THE DIRECTION OF ROTATION AND THE VANE PLATES MUST FACE THE PUSHRODS.

(Refer Fig. 6) **PART II-Bypass Valve**

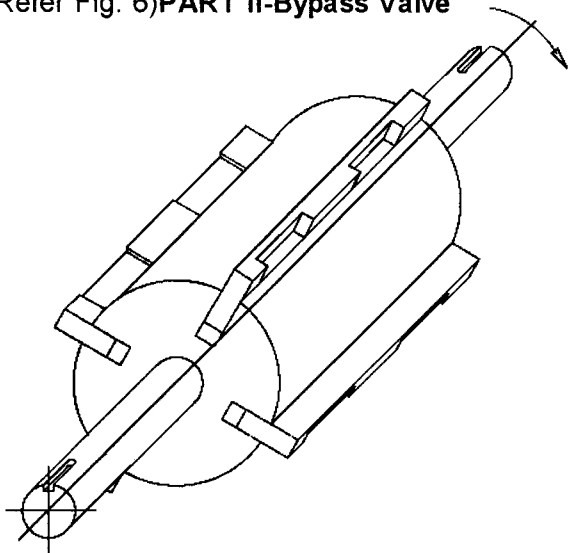


Figure 6

NOTE: The following procedures are for pumps fitted with balanced or poppet type valves, for pumps fitted with PFM valve option, refer to separate instructions.

Ensure correct orientation with reference to pump rotation. (see section IV-E)

1 - Poppet Valves

- 1.1 If valve seat has been removed: Using thread locking adhesive, Fit valve seat to pump body. screw seat locknut onto seat and tighten with a suitable tool.
- 1.2 Position bypass valve in seat.
- 1.3 Fit 'O'rings to bypass valve cover and spring retaining washer, then fit spring retaining washer to cover.
- 1.4 Fit cover assembly to body and fasten with four cap screws.
- 1.5 Fit valve blanking cover to body with "O"ring, fasten with four cap screws.
- 1.6 Fit adjusting screw with cap and fibre washer to cover. **Note:** The bypass valve will require setting when the pump is recommissioned.

2 - Balanced Valves

- 2.1 Fit bypass valve into cartridge.
- 2.2 Fit 'O'ring to cartridge and fit cartridge assembly into body-
- 2.3 Fit 'O'rings to bypass valve cover and spring retaining washer, then fit spring retaining washer to cover.
- 2.4 Fit cover assembly to body and fasten with four cap screws. **Note:** The bypass valve will require setting when the pump is recommissioned.

3 Refit pump coupling half

4 Re-install pump into system.

BEFORE STARTING PUMP RUN THROUGH STARTUP CHECKLIST IN SECTION III

Bypass Valve Adjustment - For increased bypass pressure, rotate adjusting screw in clockwise direction (i.e. screw in). For decreased bypass pressure, rotate adjusting screw anticlockwise (i.e. screw out). Always lock adjusting screw locknut after adjustment is made.

SECTION V - INSTRUCTIONS FOR REVERSING DIRECTION OF ROTATION

The pump has its direction of rotation handed upon assembly (either clockwise or anti-clockwise when looking at the shaft)

from the shaft end which is the drive end). Figure 7 shows the flow path of the liquid and the orientation of the bypass valve for the different configurations.

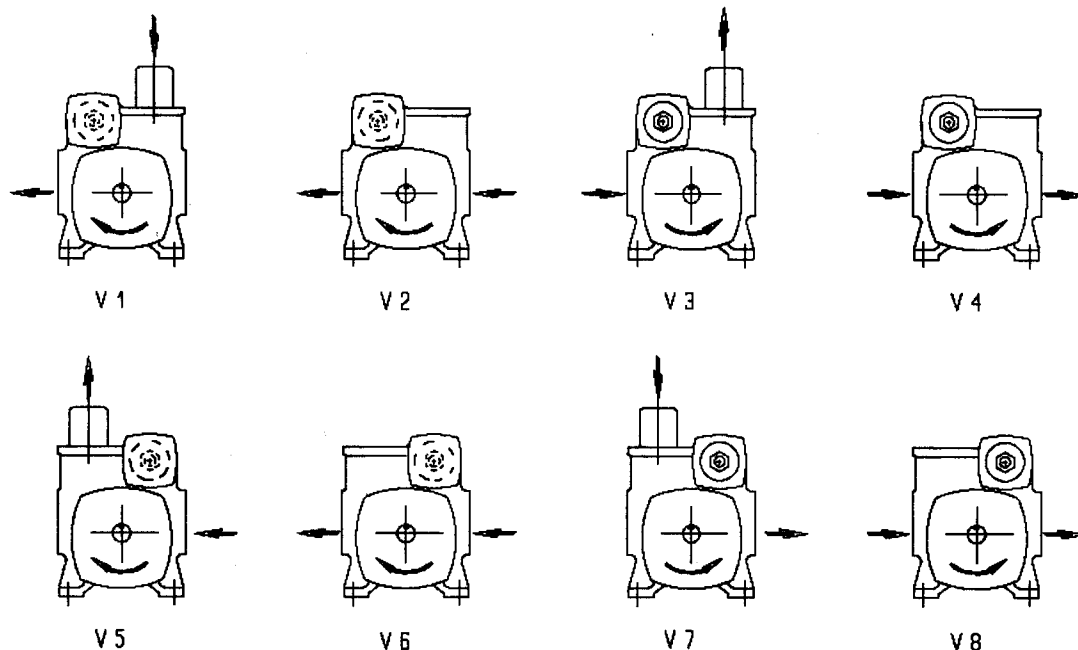


Figure 7

CLOCKWISE ROTATION PUMP:

- A. Inlet RH side, Outlet LH side.
- B. Bypass valve adjusting screw located on pump opposite drive end.

ANTI-CLOCKWISE PUMP:

- A. Inlet LH side, Outlet RH side
- B. Bypass valve adjusting screw located on pump at drive end.

To reverse the direction of rotation three conditions must be met :

1. The bypass valve must be turned 180° in order to maintain bypass protection in the new direction. i.e. adjusting screw must be at the opposite end to where it was originally relative to the drive shaft.
2. The hydraulic relief grooves in the vanes must lead the direction of rotation.
3. The cast "S" on the liner must be towards the suction port.

Procedure for Reversing Direction of rotation of Pump:

NOTE: Before starting this procedure carefully read SECTION IV and follow any relevant preparation instructions.

1. Follow disassembly procedure steps 1, 2, 3, 5, 6 & 7
2. Remove drive end bearing housing, assembly including rotor/shaft, vanes etc. by pressure applied to inspection end of shaft. During this procedure cradle vanes in rotor by hand.
Note orientation of vanes in relation to pump rotation.

Depending on which configuration is required either:

a. Rotate body through 180° with liner still in its original position.

or

b. Remove liner from body and rotate liner through 180° i.e. the thick section of the liner is still at the bottom and the cast "S" is opposite its original position.

4. Reverse vanes in their respective rotor slots in order to have the relief grooves leading the new direction of rotation.

5. Reassemble the removed components taking care not to damage the 'O'rings or lip seals. The complete drive end housing assembly should be fitted first, followed by the inspection end housing. Care should be exercised to ensure the location pins in the housings engage in their holes before tightening the housing cap screws. The pump shaft should now rotate freely. Should this not occur, check for binding of components and/or foreign matter in pump.

7. If procedure 3 a. has been followed the pump is now ready for re-commissioning. If only the liner has been rotated (3.b) the bypass valve must now be re-oriented to provide protection in the new direction of flow:

1. Follow the procedure in SECTION IV-C PART 1 - Bypass Valve.

2. Using an appropriate tool, unscrew the bypass valve seat locknut, then remove the seat.

3. Replace the seat from the opposite end of the body then follow the procedure in SECTION IV-F PART II Bypass Valve.

Should further assistance or guidance be required please contact your supplier or EBSRAY PUMPS direct.

SECTION VI - TROUBLE SHOOTING

VI-A FAILURE TO DELIVER LIQUID

1. Incorrect direction of rotation.
2. Suction filter/strainer blocked or leaking air.
3. Liquid too viscous.
4. No liquid in tank.
5. High static discharge on pump combined with air in suction pipe.
6. Valves closed or air leaks in suction system.
7. Excess internal clearances.
8. Bypass valve jammed open.

VI-B LOW OUTPUT

1. Pump speed too low.
2. Cavitation or vaporisation on suction side of pump.
3. Obstruction in suction or discharge pipe.
4. Air leakage in suction pipes or fittings.
5. Bypass valve setting too low - increase pressure by screwing in adjusting screw. DO NOT exceed system design pressure or overload driver.
6. Differential pressure higher than specified duty point.
7. Viscosity of liquid lower than specified duty point.
8. Pump parts worn - have pump reconditioned or replace worn parts.

VI-C EXCESSIVE POWER CONSUMPTION

1. Obstruction in discharge line.
2. Pump operating outside the specified duty point (i.e. high pressure or viscosity)
3. Rotating parts binding - disassemble pump and inspect.
4. Misalignment between pump and driver - check coupling and realign as required.
5. Inherent pipe stresses causing distortion of pump and casing - rectify and realign before reassembling.
6. Bearings worn - inspect and replace as required.

VI-D PUMP IS NOISY

1. Air leakage in suction piping.
2. Cavitation due to insufficient NPSH available i.e. suction conditions extreme - reduce suction losses.
3. Pump running dry - remove blockages in suction line/strainer.
4. Pump and driver misaligned - check coupling and realign as required.
5. Rotating elements binding or broken - disassemble and inspect.
6. Bearings worn - inspect and replace as required.

VI-E LEAKAGE

1. From covers and flanges:
 - a) Set screws not tight - retighten.
 - b) Damaged 'O' ring seals or gaskets - replace.
 - c) Check for thermal expansion of product when locked between valves either side of pump. Remove hydraulic lock potential.
2. From lip seal:
 - a) Lip seals incorrectly installed, worn or damaged - replace.
 - b) Misalignment between pump and driver causing excessive shaft distortion - check coupling and realign as required.
 - c) Worn or damaged shaft in seal zone - replace rotor/shaft.
 - d) Excess system pressure -
 - i) check for obstructions in discharge line.
 - ii) check for thermal expansion of product when locked between valves either side of pump. Remove hydraulic lock potential.

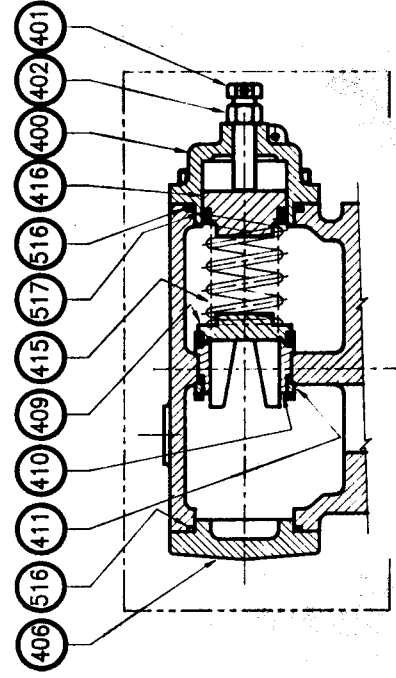
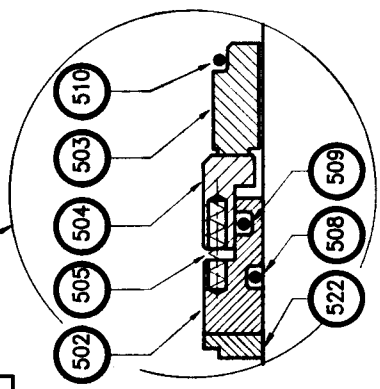
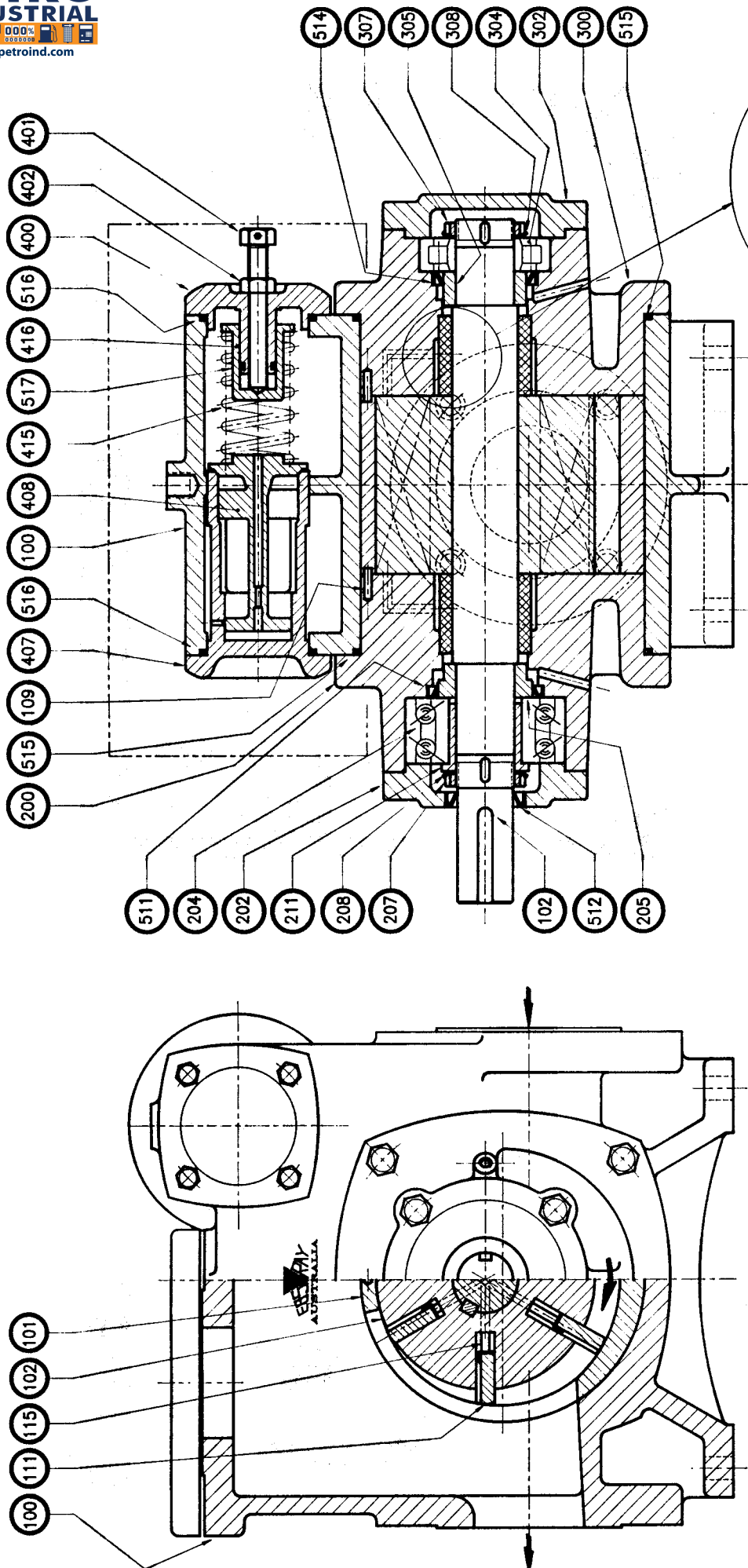
SECTION VII - PARTS DESIGNATION

EBSRAY MODELS: V20 & V30 Type 70 group Rotary Sliding Vane pumps.

REFER TO DRAWING N°: CMP033A

Cat#	Description	Qty
100	Body	1
101	Liner	1
102	Rotor/Shaft assembly	1
109	Location pin - Liner/Bearing housing	2
111	Vane	6
115	Vane Pushrod	3
200	Bearing Housing - Drive End	2
202	Bearing Housing Cap - Drive End	2
204	Bearing -Drive End	2
205	Spacer - Drive End Bearing	1
207	Locknut - Drive End Bearing	1
208	Lockwasher - Drive End Bearing	1
211	Sleeve - Drive End Bearing	1
300	Bearing Housing - Inspection End	2
302	Bearing Housing Cap - Inspection End	2
304	Bearing - Inspection End	1
305	Spacer - Inspection End Bearing	1
307	Locknut - Inspection End Bearing	1
308	Lockwasher - Inspection End Bearing	1
400	Cover - Bypass Valve Housing	1
401	Adjusting Screw - Bypass Valve	1
402	Locknut - Bypass Valve Adjusting Screw	1
406	Blanking cover - Bypass Valve Housing	1
407	Cartridge - Bypass Valve	1
408	Bypass Valve - Balanced	1
409	Bypass Valve - Poppet	1
410	Seat - Bypass Valve	1
411	Locknut - Bypass Valve Seat	1
415	Spring -Bypass Valve	1
416	Retaining Washer - Bypass Valve Spring	1
502	Mechanical Seal Shaft Sleeve	2
503	Mechanical Seal Stationary Face	2
504	Mechanical Seal Rotating Face	2
505	Mechanical Seal Spring	12
508	Mechanical Seal 'O'Ring - Shaft	2
509	Mechanical Seal 'O'Ring - Shaft Sleeve	2
510	Mechanical Seal 'O'Ring - Stationary Face	2
511	Lip Seal - Drive End Bearing Housing	2
512	Lip Seal - Drive End Bearing Housing Cap	1
514	Lip Seal - Inspection End Bearing Housing	1
515	'O'ring - Body	2
516	'O'ring - Bypass Valve Cover	2
517	'O'Ring - Bypass Valve Spring Retaining Washer	1
522	Spacer - Seal	2

Note: This list covers pumps fitted with both balanced and poppet valves. Before ordering parts, please ensure that they are the correct type for your particular model.



TYPICAL PARTS DESIGNATION
V20/V30 SELF DRAINING PUMPS

DRG. No CMP033A