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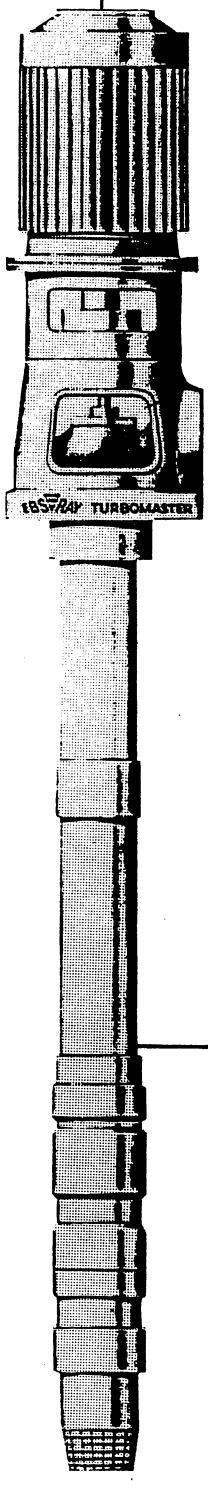
EBSRAY PUMPS

Installation, Operation and Maintenance Instructions



Turbomaster

HC Series

EBSRAY AUSTRALIA

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SECTION I - GENERAL

INTRODUCTION

This publication is intended to assist those involved with the installation, operation and maintenance of EBSRAY HC Series Mixed Flow Vertical Turbine Pumps. The design, materials and workmanship incorporated in the manufacture of EBSRAY HC Series pumps make them capable of reliable operation over a long working life. Correct installation is essential. Service life is enhanced by periodic inspection and careful maintenance.

1.1 CAUTION

INSTALLATION AND SERVICING OF THIS EQUIPMENT SHOULD BE PERFORMED BY QUALIFIED COMPETENT PERSONNEL IN ACCORDANCE WITH RELEVANT STATUTORY REGULATIONS OR CODES, IN CONJUNCTION WITH THESE INSTRUCTIONS.

When the equipment supplied utilises components other than those manufactured by EBSRAY-TURBOMASTER e.g. couplings, electric motors etc, reference should be made to the original manufacturers 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 change.

1.3 TRANSPORTATION AND PACKING

Standard domestic packing is suitable for shipment in covered transports.

The pump element and column/shaft assembly are supported at several points to withstand normal stresses incurred during transit. 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 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 carriers' copy of the consignment note and a claim should be made immediately on the transport company. Should any shortage be evident on receipt, notify EBSRAY immediately giving full details of packing note number.

1.5 HANDLING

Care should be taken when moving pumps. If moving in the horizontal position, slings should be placed around the pump element and the discharge assembly in accordance with safe lifting practice, ensuring that the unit is lifted in a level plane with the load evenly distributed between the two slings.

When moving the unit from the horizontal to the vertical plane, care should be taken not to impose any bending stress to the column assembly and that the end of the pump element is suitably protected where it is in contact with the ground. The lifting points provided on the unit should be utilised when lifting in the vertical plane.

SECTION 2 - INSTALLATION

2.1 LOCATION

The pump unit must be placed over the source of supply so that the pump element, including the first stage impeller, is submerged in the liquid with the end of the unit at least 100mm clear of the bottom of the sump. **Angle of installation must not exceed 3° from vertical**. For installation at angles greater than 3°, contact EBSRAY PUMPS to determine if extra lineshaft bearings are required. Ensure that floor area and headroom allotted are sufficient for inspection and maintenance. Be sure to allow for crane or hoist access if required. Provision must be made for adequate ventilation and cooling of motor.

2.2 FOUNDATIONS

Base of Discharge Head should be installed accurately. Ensure that the mounting surface is flat and level and that the foundation/mounting bolts have been correctly positioned to match the drilled holes in the Discharge Head base.

2.3 PUMP PIPING CONNECTIONS

All piping should be supported independently of, and line up accurately with the pump discharge flange.

NEVER DRAW PIPING INTO PLACE BY USE OF FORCE AT THE DISCHARGE FLANGE CONNECTION OF THE PUMP.

2.4 STRAINER PROTECTION

The pump inlet should always be protected by an efficient inlet strainer of adequate size to accommodate the liquid viscosity conditions without causing excessive inlet resistance. The pump will normally be fitted with the correct strainer prior to dispatch from the factory. Ensure that the strainer is in place and has remained undamaged in transit and handling.

2.5 ALIGNMENT

The pump and motor are a close-coupled unit with coupling alignment being taken care of by accurately machined locating spigots. If the motor is removed for any reason it should be ensured that the spigot and mating faces are clean and free of any damage prior to reassembly. The mounting flange, spigot and bolt holes are fitted with electrical insulators to isolate the electric motor. ***Care should be taken to ensure that these items are correctly fitted and are undamaged.***

SECTION 3 - OPERATION

3.1 DESCRIPTION

The EBSRAY-TURBOMASTER pump is a Mixed Flow Turbine utilising fully shrouded mixed flow Impellers. The stainless Steel shaft is supported at intervals by accurately machined non metallic Bearing Bushes. The discharge assembly is fitted with a vented Mechanical Seal with Throttle Bush to API610 and a heavy duty Thrust Bearing. Discharge is by way of the Column Pipe and fully cast Discharge Head flanged for interface with customers pipework.

3.2 LUBRICATION

No 'in service' lubrication is required on the EBSRAY-TURBOMASTER pump.

3.3 STARTUP CHECKLIST

✓ Freedom of rotation of Shaft.
(Should rotate freely by hand.)

✓ Before startup, ensure that there is sufficient fluid in tank to cover the First Stage Impeller - if uncertain of dimension, contact Ebsray.

✓ Direction of rotation.
(Corresponds with the direction arrow cast on the Discharge Head. If started in the wrong direction motor overload will occur as rotation will be prevented by the non-reversing mechanism.)

✓ ***Do not run pump for more than <u>one minute</u> against a closed discharge valve. (see 3.5)***

DO NOT RUN PUMP DRY.

3.4 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.

3.5 BYPASS VALVE

To protect the pump from over-pressure due to inadvertent shutting of discharge system, a Bypass/Pressure Relief Valve capable of circulating the entire pump output is available from EBSRAY. This is installed in the pump discharge line and returns to the supply tank of the pump.
On commissioning, the Bypass/Pressure Relief Valve should be set in accordance with the pre-determined pump differential pressure requirements.
Refer separate instructions for details.

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, de-pressurising and purging procedures have been carried out.

To service Mechanical Seal only: Follow instructions a), b), & c) in **4.2** (Preparation for disassembly) then proceed with steps **4.3.1** to **4.3.9** inclusive. Step **4.3.6** may be omitted if thrust assembly does not require service. See sections **4.5** & **4.6** for reassembly and adjustment procedures.

For major maintenance it is recommended that the pump unit be removed from the installation and returned to the EBSRAY works or an approved service centre where it would be serviced by trained technicians.

4.1 SPARE PARTS

a) When ordering spare parts, to ensure a minimum delay and correct replacement to original specifications, always quote the pump serial number which is located on the nameplate of the pump, normally located above the discharge port.

b) Advise the Cat #, description and quantity required. Refer to drawing number CMP018 on page 9.

c) Advise complete delivery instructions, transportation, etc.

4.2 PREPARATION FOR DISASSEMBLY

a) Obtain the necessary work permit if required.

b) Isolate pump from liquids in the discharge line, de-pressurise and purge out any toxic, flammable, corrosive or air hardening liquids.

c) Isolate power supply to motor.

d) Disconnect discharge pipework.

e) Remove pump from installation.

4.3 DISASSEMBLY

4.3.1 Remove motor complete with drive coupling.

4.3.2 Release 2 Grubscrews (Item 37) locking Shaft Sleeve to Shaft.

4.3.3 Remove two Lockscrews (Item 31) and then the Shaft Topnut (Item 32).

4.3.4 Remove Drive Key (Item 34).

4.3.5 Remove Motor Pedestal/Thrust Assembly from Discharge Head.

4.3.6 Dismantle Thrust Assembly:

a) Remove Ball Bearing Cover Plate (Item 13).
b) Remove Bearing Locknut and Tab Washer (Item 15).
c) Remove Bearing (Item 14) and Drive Coupling (Item 16).
d) Remove Ratchet Plate (Item 12).

4.3.7 Remove Seal Drain and Vent Tubes.

4.3.8 Remove Seal Assembly from Discharge Head.

4.3.9 Dismantle Seal Assembly:

a) Remove Stuffing Box (Item 20).
b) Release 3 Grubscrews in Abutment Ring.
c) Remove Rotating Seal Element (Item 21) from Shaft Sleeve.
d) Withdraw Shaft Sleeve from top of Seal Flange (Item 19).
e) Remove Stationary Seal Face (Item 21A) from Seal Flange.

4.3.10 Remove Discharge Head (Item 24) from Column Pipe (Item 26).

4.3.11 Unscrew pump element and Column Assembly from the Discharge Head (Item 24), unscrew top Column Pipe (Item 26) and remove by sliding the Pipe over the Top-Shaft (Item 42). Care should be taken to support the Top-Shaft to prevent bending the Shaft. Remove Top-Shaft by unscrewing from the next Drive Shaft at the Rod Coupler, remove the Rod Coupler (Item 55). Repeat this process until all Column and Shaft has been removed from the from the pump element.

4.3.12 Dismantle pump element:

a) Hold pump element in a suitable pipe vice and drill out Bowl Locking Pins using a 3/16" drill.

NOTE: Depending on pumpage, some pumps are fitted with 1/4" BSW ss. grubscrews instead of brass pins.

NOTE: The plate mentioned below is also used to reset impellers in the correct position during reassembly. If the bottom of the shaft is not flush with the bottom of the suction bowl, measure the difference to determine what thickness spacer will be required between plate and shaft end for correct reassembly.
(see 4.6.1)

b) Lock Pump Shaft and Impellers to prevent rotation by bolting a flat plate to the bottom of the Suction Bowl (4 holes are provided for this purpose) and screwing a high tensile bolt through a clearance hole in the centre of the plate and into the tapped hole provided in the end of the Shaft to draw Shaft and Impellers downwards against Bowls.

c) Unscrew Discharge Bowl (Item 69).

d) Loosen Impeller Locknut (Item 61) with a 'C' spanner and undo one complete turn. With a suitable slide hammer, using sharp blows against the Impeller Nut, drive the Impeller Sleeve (Item 62) through the Impeller. Remove Impeller (Item 59) and Sleeve from Shaft. Remove 1st Intermediate Bowl (Item 67).

4.3.13 Repeat procedure until all stages have been removed.

4.3.14 Remove setting plate and remove Pump Shaft from Suction Bowl.

4.4 INSPECTION

4.4.1 Examine Coupling Drive Pins and Bushes for signs of wear. Replace if wear is evident.

4.4.2 Inspect Thrust Bearing for wear. It is recommended that at major overhauls the Bearing is replaced.

4.4.3 Check Mechanical Seal Faces for wear.

Replace as required.

4.4.4 Check clearance of Throat Bush and Throttle Bush. If clearance exceeds 0.9mm replace.

4.4.5 Check clearance of pump Bearings and Bushes. New clearance is 0.08mm - 0.18mm. Wear limit is 0.3mm.

4.4.6 Examine Impellers for wear and damage. Excessive wear on skirt diameter requires machining and fitting of Wear Rings in the Bowls. New clearance is 0.25mm-0.3mm. Wear limit is 0.5mm.

4.4.7 The Pump Shaft and Topshaft should be checked for straightness using vee blocks and a dial indicator. If misalignment exceeds 0.13mm, straighten or replace. If worn at the bearing journals the Shaft should be replaced.

4.4.8 All 'O' rings and Gaskets should be replaced.

4.5 REASSEMBLY-PRELIMINARY

4.5.1 Ensure all parts are clean and free of burrs.

4.5.2 Check that all mating parts fit accurately and freely on Shafts and keyways.

4.5.3 Lightly smear all 'O' rings with a compatible good quality lubricant before assembly.

CAUTION: AT ALL TIMES WHEN HANDLING AND INSTALLING MECHANICAL SEALS, CARE MUST BE TAKEN TO ENSURE LAPPED FACES AND SEATS ARE NOT DAMAGED. PARTICULAR ATTENTION MUST BE GIVEN TO CARBON SEATS TO PREVENT CHIPPING.

4.6 REASSEMBLY

4.6.1 The Pump Shaft should first be set in the Suction Bowl with the setting plate (and spacer if required see 4.3.12 b)) which is bolted to the bottom flange of the Suction Bowl.

NOTE: If the position of the end of the Pump Shaft was not noted prior to disassembly, its position can be determined by assembling all the pump bowls and the suction stage, then inserting the shaft until the end of the shaft projects 156mm from the bottom of the thread in the top of the Discharge Bowl. At this point the required setting position of the bottom of the Shaft can be measured and spacers made to suit if required.

The first Impeller is set on the Shaft and the Sleeve Nut tightened until the Impeller is drawn against the Bowl.

4.6.2 Fit the Intermediate Bowl, tighten with chain tongs.

4.6.3 Proceed with fitting of Bowls and Impellers until all stages are fitted.

4.6.4 Re-drill Bowl joints with 3/16" drill and re-pin using brass rod, peening to secure pin. If Bowls were locked with grubscrews either re-align the original tappings or re-drill and tap 1/4" BSW. Then lock Bowls with Grubscrews.

4.6.5 Assembly should proceed in the reverse order of the dismantling procedure with particular attention given to the following points.

Assembly of Mechanical Seal:

Lubricate components, fit Stationary Face to Seal Plate. Insert Shaft Sleeve through Seal Plate and fit Rotating Face, Spring, Spring Retainer and Abutment ring. Lock Abutment Ring to Sleeve with 12.5 mm of Sleeve protruding from Abutment Ring. (see figure 1.)

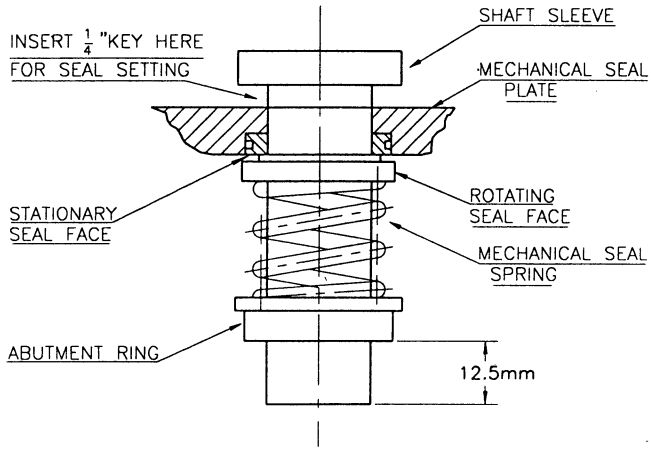


Figure 1

Adjusting axial clearance :

4.6.5 When the Adjusting Nut (Item 32) is fitted it should be tightened until the Impellers are just free of the Bowls and then rotated a further 1/2 turn, and locked in position with the two Locking Screws (Item 31).

Setting mechanical seal :

Items required for seal setting -
Hex Key to suit 3/16" BSW grubscrew.
Two pieces of 1/4" x 1/4" keysteel or similar stock.
Screwdriver or other small lever.

1. Loosen the three Grubscrews in the head of the Shaft Sleeve.

2. Insert two pieces of 1/4" keysteel (one each side of shaft) between the Mechanical Seal Plate and the head of the Shaft Sleeve (see Fig. 1).

NOTE: the Shaft Sleeve will have to be levered up in order to insert the keysteel.

3. Retighten Grubscrews.

4. Remove the keysteel spacers.

WHEN FITTING ELECTRIC MOTOR ENSURE THAT INSULATORS ON FLANGE FACE, SPIGOT AND BOLT HOLES ARE CORRECTLY FITTED AND UNDAMAGED.

FOLLOWING REASSEMBLY AND REINSTALLATION, THE START UP CHECKS SHOULD BE CARRIED OUT TO ENSURE CORRECT OPERATION

SECTION 5 - TROUBLE SHOOTING

5.1 FAILURE TO DELIVER LIQUID

a) No product in tank.

b) Incorrect direction of rotation.

c) Speed too low - Check speed and line voltage/phases.

d) System discharge head too high - check system head, friction losses and bypass valve setting.

e) Excessive suction restrictions - check NPSH available. Suction strainer may be blocked.

f) Bypass valve pressure setting too low - Increase pressure by screwing in adjusting screw.
DO NOT EXCEED SYSTEM DESIGN PRESSURE.

5.2 LOW OUTPUT

a) System discharge head too high - check system head, friction losses and bypass valve setting.

b) Entrained air or vapour in liquid pumped.

c) Inlet strainer offering excessive resistance to flow. (partial blockage)

d) Discharge piping of insufficient diameter, causing excessive friction loss.

e) Bypass Valve pressure setting too low - Increase pressure by screwing in Adjusting Screw.
DO NOT EXCEED SYSTEM DESIGN PRESSURE.

f) Impeller damaged. Repair or replace as required.

g) Pump clearances incorrect.

5.3 EXCESSIVE POWER CONSUMPTION

a) Differential pressure/head higher than rating - check for reason.

b) Liquid properties not as specified - check specific gravity and viscosity.

c) Rotating parts bind - check for proper clearances or foreign matter in pump.

d) Bearings worn - check and replace as required.

e) Shaft bent - replace as required.

5.4 PUMP IS NOISY

a) Cavitation is taking place - increase NPSH by:

* Removing inlet restriction - Strainer not permitting free flow of liquid to pump.
* Increasing static suction head in tank.
* Reducing temperature and thus vapour pressure of liquid pumped.

b) Rotating parts bind - check for proper clearances.

c) Shaft bent - repair or replace as required.

d) Bearings worn - inspect and replace as required.

5.5 LEAKAGE

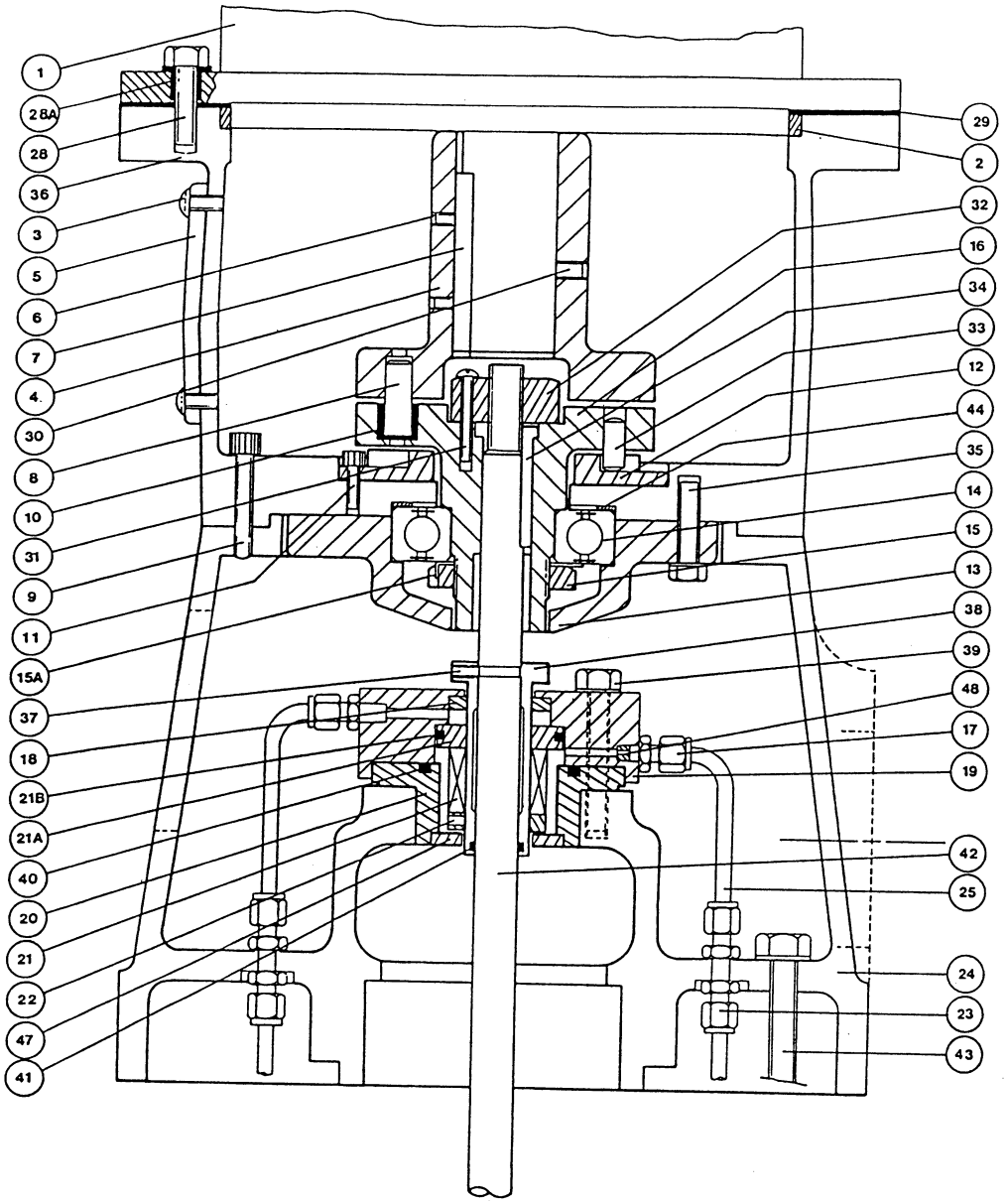
a) Leakage from Discharge Head - check gaskets.

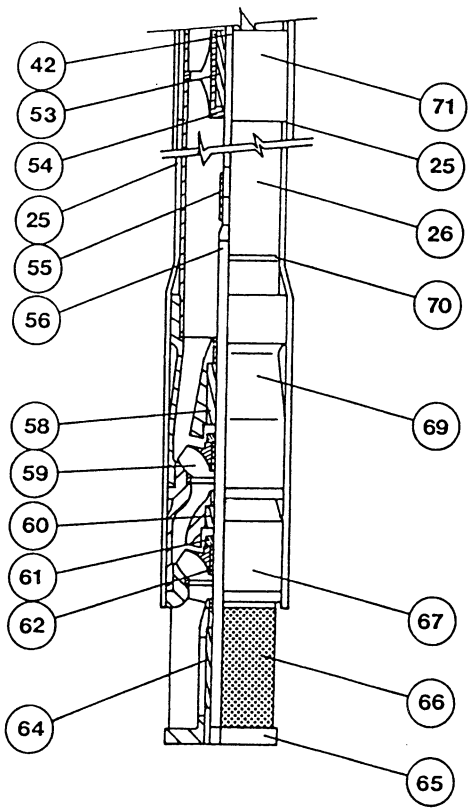
b) Leakage from Mechanical Seal - evident by liquid coming from Throttle Bush area.

* Check axial movement of Mechanical seal Rotating Face.
* Mechanical Seal Faces not properly in contact.
* Mechanical Seal is cracked or worn - inspect and replace as required.
* "O'rings damaged or worn - inspect and replace as required

SECTION 6 - PARTS DESIGNATION

Cat. #	DESCRIPTION	QUANTITY
1	Motor	1
2	Insulator	1
3	Screw	6
4	Coupling Motor Half	1
5	Cover Plate	2
6	Grub Screw	2
7	Key	1
8	Coupling Drive Pi	3
9	Cap-screw	4
10	Coupling Bush - Rubber	3
11	Cap-screw	4
12	Ratchet Plate	1
13	Bottom Bearing Dust Cover	1
14	Ball Bearing	1
15	Lock nut and Washer	1
16	Coupling Pump Half	1
17	Swagelok 1/8" male connector	2
18	Throttle Bush	1
19	Seal Flange	1
20	Stuffing Box	1
21	Mechanical Seal	1
22	Abutment Ring	1
23	Swagelok 1/8" Bulkhead union	2
24	Discharge Head	1
25	Tubing 1/4" O.D.	To Suit
26	Column pipe	To Suit
27	Adaptor Assembly	1
28	Screw	4
28A	Insulator	4
29	Gasket	1
30	Grub-screw	1
31	Machine Screw	2
32	Adjusting Nut	1
33	Ratchet Pawls	6
34	Key	1
35	Screw	4
36	Thrust Housing	1
37	Grub Screw	2
38	Shaft Sleeve	1
39	Screw	4
40	'O' Ring	1
41	'O' Ring	1
42	Top Shaft	1
43	Screw, Bolt or Cap screw	As req'd
44	Wave Washer	1
45	Gasket	1
46	Eye-bolt	2
47	Throat Bush	1
48	Restrictor Orifice	1
49	Gasket	1
50	Gasket	1
52	Gasket	1
53	Spider Bearing Bush	To suit
54	Column Bearing	To suit
55	Rod Coupler	To suit
56	Pump Shaft	1
58	Bearing Bush - Delivery	1
59	Impeller	To suit
60	Bearing Bush - Intermediate	To suit
61	Impeller Nut	To suit
62	Impeller Sleeve	To suit
64	Bearing Bush - Suction	1
65	Suction Bowl	1
66	Suction Screen	1
67	Intermediate Bowl	2
69	Delivery Bowl	1
70	Support Strap - Vent Tube	as req'd
71	Column Socket	2
72	Discharge Spool	1





Dwg. No CMP 018 Parts Designation
For TURBOMASTER HC Series.

EBS-RAY PUMPS PTY. LIMITED

(Incorporated in N.S.W.)

EBS-RAY AUSTRALIA