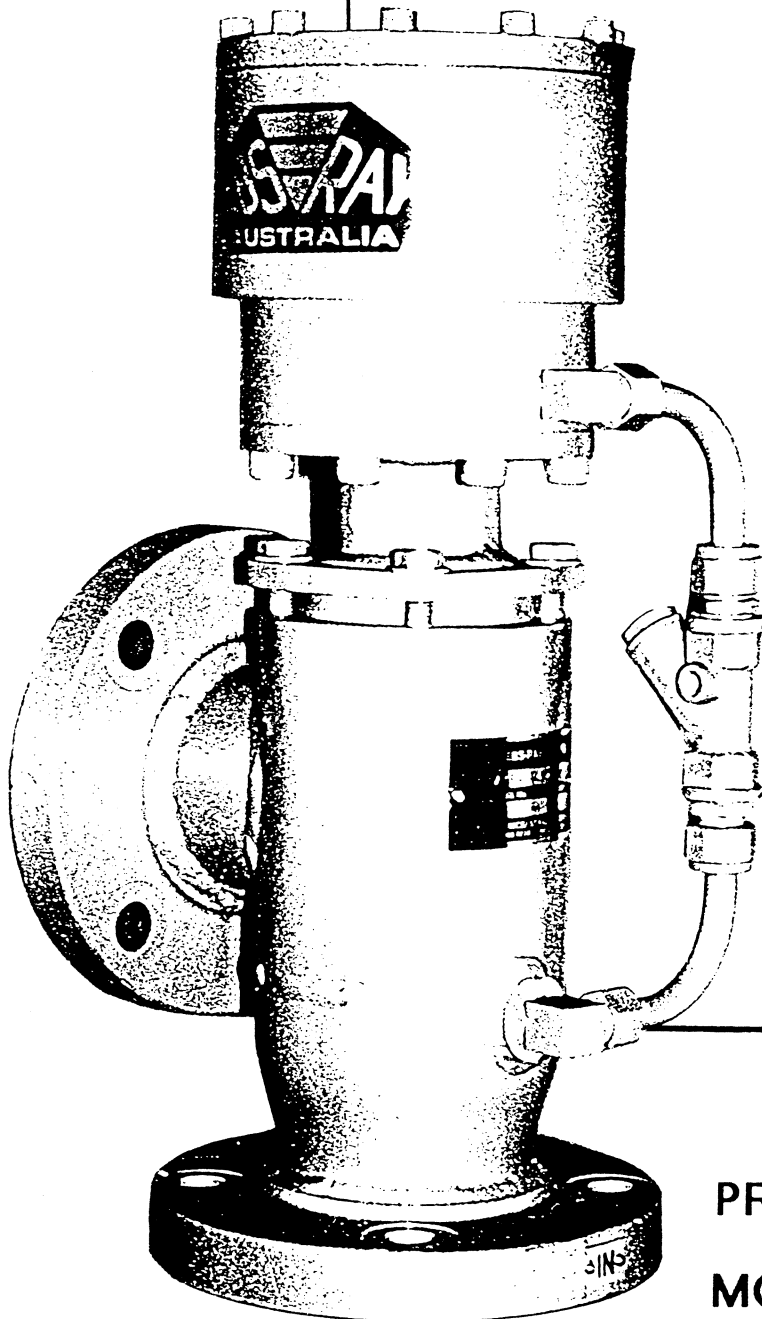


EBSRAY PUMPS

Installation, Operation and Maintenance Instructions



PFM

PRESSURE & FLOW
MODULATING VALVES

MODELS RV32, RV33 & RV34

SECTION 1 - GENERAL

1.1 INTRODUCTION

This publication is intended to assist those involved with the installation, operation and maintenance of EBSRAY RV Series PFM (Pressure and Flow Modulating) Valves. The design, materials and workmanship incorporated in the

manufacture of EBSRAY PFM Valves 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.

1.2 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. control air pressure regulators, electronic control devices 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.

1.3 WARNING

The PFM Valve must be operated within the original selected design parameters of product, flow rate, temperature, pressure, and viscosity.

Should any change be contemplated, please confer with EBSRAY in order to verify the suitability of such a change.

1.4 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 PFM Valve 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.

1.5 INSPECTION UPON RECEIPT

On receipt of equipment, check all items against the dispatch documents and inspect for damage. Any damage or shortage incurred during transit should be noted on the packing note and on both your own and the carrier's copy of the

consignment note and a claim should be made immediately on the transport company. Should a shortage be evident on receipt, notify EBSRAY immediately giving full details and packing note number.

1.6 HANDLING

Care should be exercised whilst handling PFM Valves.

Never lift the PFM valve by its external pipework.

SECTION 2 - INSTALLATION

2.1 LOCATION

Inline type PFM valves may be installed at any convenient location in the discharge (pressure) side of the system. For both integral and inline types care should be taken to ensure that:

- 1 The valve and associated control mechanism are not subject to physical damage.
- 2 The atmospheric vent in the cylinder will remain clear and will not allow the ingress of contaminants (eg. driving rain, insect infestation etc.)

- 3 The condensate drain is readily accessible for routine purging. (This drain must be closed off during normal operation of the valve)

NOTE: When valve is mounted with condensate drain in any position other than straight down (6 'O'clock) provision should be made for regular flushing/purging.

- 4 The PFM Valve is accessible for any service/repair work.

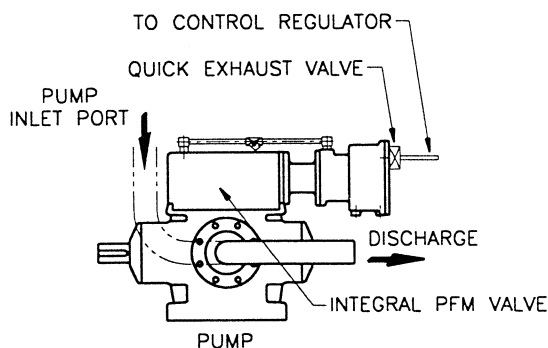
2.2 PUMP PIPING CONNECTIONS

All piping should be supported independently of and line up accurately with the PFM Valve ports.

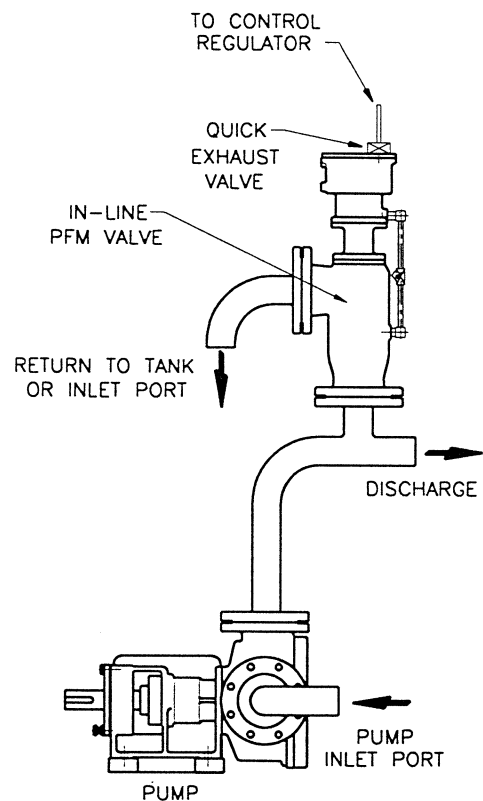
Note: never draw piping into place by use of force at the port connections of the PFM valve.

2.3 CONTROL SYSTEM REQUIREMENTS

A Quick Exhaust Valve (also called Vent Valve or Dump Valve) must be fitted between the control air/gas pressure regulator and the control cylinder (pneumatic operation only). This valve ensures that the PFM will operate correctly without excessive pressure rise. The closer the Quick Exhaust Valve is placed to the control cylinder, the more rapidly the PFM Valve will respond to pumping system pressure variations, thus minimising pressure spikes.



**Integral Pump mounted PFM Valve
Typical layout**



In-line PFM Valve - Typical layout

SECTION 3 - OPERATION

3.1 DESCRIPTION

EBSRAY's PFM Valve consists of a Control Piston attached to a Spool Valve assembly. The connecting Spindle passes through an alignment Bush. The Spool assembly operates within a ported Valve Cartridge attached to one end and the Piston operates within a Cylinder attached to the other end. The control piston forms two chambers, one of which is connected via a pipeline and strainer, to the inlet (pressure chamber) side of the valve body, the other is connected to the control medium source (air pressure regulator, hydraulic deadweight device etc.).

CAUTION

The vent to atmosphere (see parts designation drawing) must remain unobstructed at all times to ensure proper operation of the PFM Valve. If the vent becomes blocked, Pressure or Vacuum build up behind the control piston may prevent the valve from opening and closing at the pre-determined system pressure.

3.2 OPERATION

The EBSRAY PFM system operates by sensing the downstream pressure variation (either locally or at a remote station), which in response acts upon the control piston directly connected to the internal spool valve assembly in the pump casing (or valve housing). Constant discharge pressure is thus accurately maintained irrespective of variation in viscosity of product or variation of suction conditions (within $NPSH_r$ of the pump).

Maintenance of pre-determined pumping discharge pressure (locally at pump or remote), and/or flow rate, is controlled and modulated via connection of pneumatics (eg. factory air with regulated pressure, regulated local supply of nitrogen etc.), hydraulic or even a deadweight pressure source.

Predetermined operating pressures (as dictated by specific system operating requirements) can thus be adjusted or preset manually or electronically to achieve any number and combination of varied discharge pressures/flow characteristics. The latter depends upon the sophistication or simplicity of the control logic employed. However one simple setting may be adequate to achieve quite varied and universal downstream operational functions.

System pressure modulation is totally predictable, pressure variation (if desired) linear and response time between a change in system conditions and PFM compensation is near instantaneous.

The following table of Discharge Pressure (AT PUMP DISCHARGE OR PFM HIGH PRESSURE SIDE) to Control Pressure ratios is based on the assumption that Pump suction or return line pressure is equal to atmospheric pressure. Actual setting should be carried out under normal operating conditions

PFM Model	Discharge Pressure to Control Pressure ratio
RV 32	2.71 : 1
RV 33	2.66 : 1
RV 34	2.57 : 1

3.3 LUBRICATION

CONTROL PISTON

WARNING:
UNDER NO CIRCUMSTANCES SHOULD WATER OR ANY OTHER PRODUCT LIKELY TO CAUSE CORROSION, BE ALLOWED TO ENTER THE CONTROL CYLINDER.

- 1) For control via compressed air, clean, dry, lubricated air should be used.
- 2) Industrial dry nitrogen may be used without lubrication.

- 3) For control via hydraulics, the hydraulic oil will provide lubrication.

SPOOL VALVE:

The spool valve assembly and spindle bush are product lubricated and as such require no in service lubrication. (solids in product may cause accelerated wear)

3.4 OPERATIONAL CHECKS

During initial commissioning operation check all joints for leaks. The only checks required during normal operation are to

ensure that vent orifices are not blocked and that condensate in the control cylinder is regularly purged.

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.

complete isolation, depressurising and purging procedures have been completed. However for major maintenance, it is recommended that the pump be removed from the installation.

Some inspections and maintenance tasks can be performed with the pump 'in line', so long as

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

4.1 SPARE PARTS

1. When ordering spare parts, to ensure a minimum of delay and correct replacement to original specification, always quote the pump Serial Number which is located on the nameplate of the pump.
2. Advise the Cat #, description, and quantity required. Ref to Drawing No. CMP029
3. Advise complete delivery instructions, transportation, etc.

4.2 PREPARATION FOR DISASSEMBLY

1. Obtain the appropriate Work Permit if required.
2. Isolate the valve (or pump for integral valve installations) from liquids in suction and discharge lines, depressurise and purge out any toxic, flammable, corrosive or air hardening liquids.
3. Isolate power supply to pump motor.
4. Note PFM valve orientation relative to pump and/or pipework.

4.3 DISASSEMBLY

5. Remove discharge pressure sensing harness.
6. Remove entire valve assembly from housing. (or pump body as applicable)
7. Remove cover from cylinder.
8. Open lockwasher and remove ringnut from control piston end of spindle.
9. Remove the control piston, seals, 'O'ring and disc, from the spindle.
10. Withdraw spindle from cylinder and adaptor flange assembly.
11. If required, remove spool assembly from spindle (some models only), and cylinder from adaptor flange.
12. If sleeve bearing in adaptor flange requires replacement, press out using a suitable drift or remove by machining.

4.4 REASSEMBLY - PRELIMINARY

- | | | | |
|---|--|---|--|
| 1 | Ensure all components are clean and free from burrs and that orifices are not blocked prior to any assembly. | 3 | machine or ream to achieve correct clearance from spindle. (see clearance chart) |
| 2 | If previously removed, Press fit new sleeve into adaptor flange and | 4 | Check clearances of other components as indicated in the clearance chart. |

Clearance table - All measurements in millimetres

Clearance	RV 32	RV33	RV34
Spindle to Sleeve (diametral)	0.02 - 0.09	0.02 - 0.09	0.03 - 0.10
Valve Disc (Spool) to Cartridge (diametral)	0.02 - 0.07	0.02 - 0.07	0.04 - 0.09

4.5 REASSEMBLY

- | | | | |
|---|--|----|---|
| 1 | NOTE: This step is only required for models where spool and spindle are not "one piece". Fit the two valve discs and spacer tube to the spindle as shown in the drawing. Secure in place using lockwasher and ringnut. (use the machined flats on the spindle to prevent it turning whilst tightening the ringnut) | 6 | Lubricate and fit piston to spindle and through cylinder. Lock onto spindle using lockwasher and ringnut. (use the machined flats on the spindle to prevent it turning whilst tightening the ringnut) |
| 2 | Fit 'O' ring to the large spigot of the adaptor flange and fit cylinder to adaptor flange. (ensure correct orientation of cylinder to adaptor flange to keep control pipework in correct alignment when fitted to valve housing) | 7 | Fit 'O' ring to cover and fit cover to cylinder, ensuring correct orientation of control air orifice. |
| 3 | Lubricate spindle and insert it through the adaptor flange. | 8 | Fit 'O' ring to adaptor flange and fit valve cartridge over spool to locate on adaptor flange spigot. |
| 4 | Fit disc to spindle followed by small 'O' ring. | 9 | Fit 'O' ring to valve cartridge and Fit entire assembly to housing. (ensure correct orientation of all control orifices prior to fastening) |
| 5 | Fit seals to control piston with lip of smaller seal towards adaptor flange end. NOTE: For hydraulic operation a lip seal is fitted to the large end of the control piston with it's lip facing away from the spindle. <u>For pneumatic operation</u> a two part seal is fitted consisting of an 'O'ring and a seal ring fitted as follows: first fit 'O'ring to seal groove and then soften seal ring with hot water before fitting over 'O' ring. | 10 | Fit discharge pressure sensing harness (with inline strainer) between discharge chamber, and orifice tapping in cylinder. (adjacent to the adaptor flange) |

SECTION 5 - TROUBLE SHOOTING

5.1 NO PRESSURE IN PUMP SYSTEM

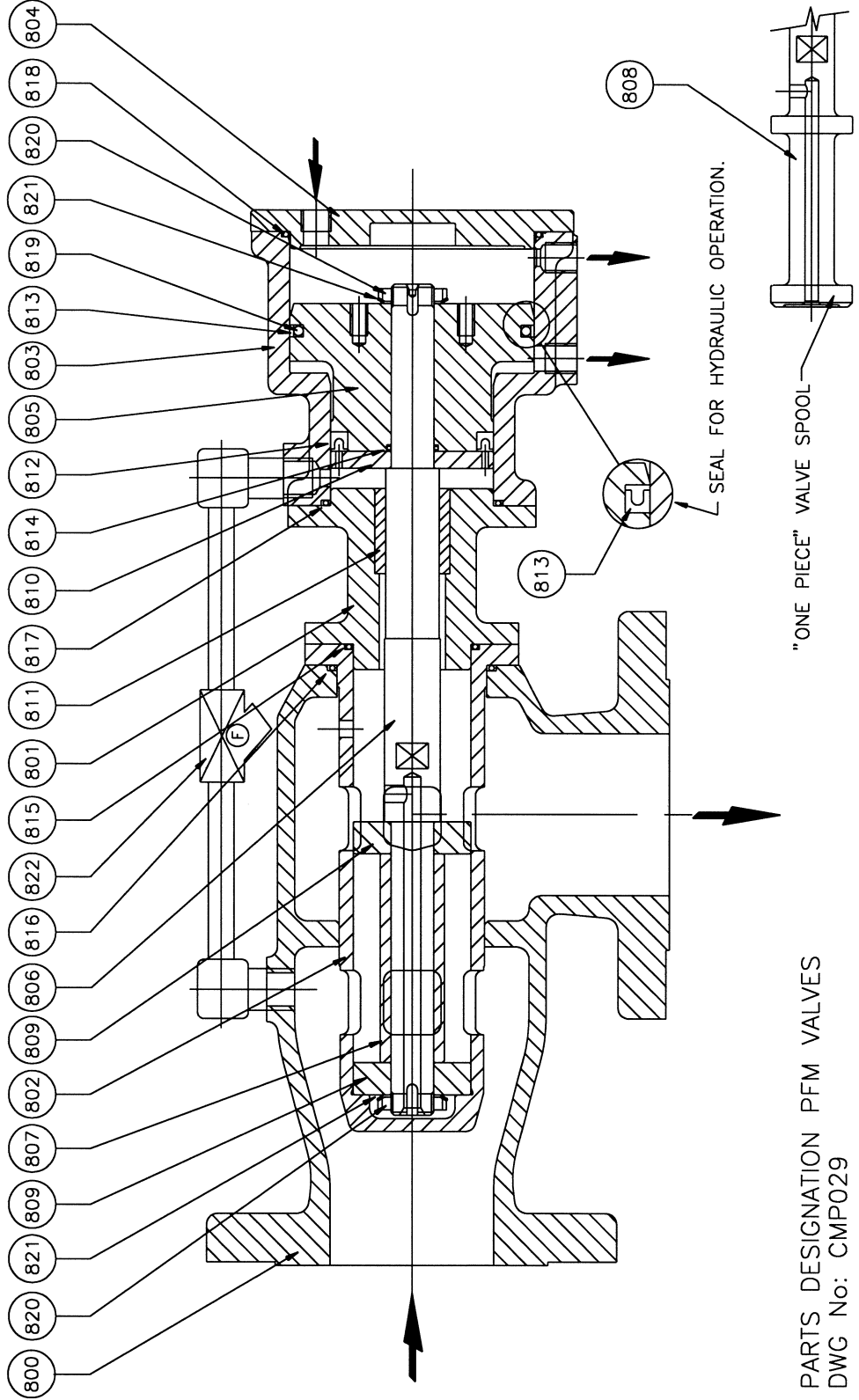
- | | | | |
|---|---|---|---|
| 1 | Check control source pressure, increase as required. (see table on page 4 for pressure ratio) | 3 | Check control piston for freedom of movement. |
| 2 | Check to see if PFM valve is locked open. | 4 | Check for leaks/faults in control system - especially if pneumatic. |

5.2 EXCESSIVE PRESSURE IN PUMP SYSTEM

- | | | | |
|---|---|---|---|
| 1 | Check control source pressure, reduce as required. (see table on page 4 for pressure ratio) | 3 | Check control piston for freedom of movement. |
| 2 | Check to see if PFM Valve is locked closed. | | |

5.3 SLOW RESPONSE OF PFM VALVE TO DOWNSTREAM SYSTEM PRESSURE VARIATIONS.

- | | | | |
|---|--|---|---|
| 1 | Check strainer in piping harness for blockage. | 3 | Check seals in control piston - if swollen or damaged replace. Also check product chemical/thermal compatibility. |
| 2 | Check PFM Valve and/or control piston for freedom of movement. | | |



PARTS DESIGNATION PFM VALVES
 DWG No: CMP029

CAT #	Description	QTY	Cat #	Description	QTY
800	HOUSING	1	812	SEAL	1
801	ADAPTOR FLANGE	1	813†	SEAL	1
802	VALVE CARTRIDGE	1	814	O-RING	1
803	CYLINDER	1	815	O-RING	1
804	COVER	1	816	O-RING	1
805	CONTROL PISTON	1	817	O-RING	1
806	SPINDLE	1	818	O-RING	1
807	SPACER	1	819†	O-RING	1
808 *	VALVE SPOOL	1	820	RINGNUT	2
809	VALVE DISC	2	821	LOCKWASHER	2
810	DISC	1	822	STRAINER	1
811	SLEEVE BEARING	1			

* This item replaces items 807, 809, and one each of items 820 and 821, in some models.

† Item 819 is only used with pneumatic operation seal, When ordering item 813 state whether PFM is used for pneumatic or hydraulic operation.

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