

Installation and Maintenance Manual

Forbes Marshall Pressure Reducing Station (Pilot Operated)

FMPRS-PO

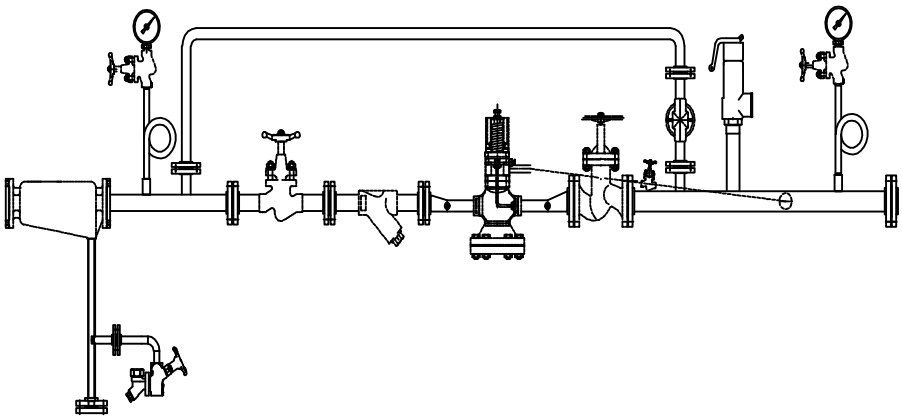


Table of Contents

1.	Preface	1
2.	Important Safety Notes.....	1
3.	Brief Product Information.....	3
4.	Operation	6
5.	Installation Guidelines	7
6.	Startup and Commissioning.....	8
7.	Maintenance Guidelines.....	10
8.	Troubleshooting	13
9.	Available Spares	21
10.	Warranty Period	21

PLEASE NOTE - Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes **CAUTION**, **WARNING** or **DANGER**.



1. Preface:

This manual is intended for anyone using, commissioning, servicing, or disposing the below mentioned product safely and efficiently.

Forbes Marshall Pressure Reducing Station (Pilot Operated)

PLEASE NOTE:

Throughout this manual the following cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked.

2. Important Safety Notes:



Read this section carefully before installing/operating/maintaining the product. The precautions listed in this manual are provided for personnel and equipment safety. Furthermore, Forbes Marshall accepts no responsibility for accidents or damage occurring as a result of failure to observe these precautions. Note that the product is designed to perform for non-contaminated fluids only. A contamination in the form of chemical, foreign particle etc. can lead to problem with product performance and life of the product.

If these products in compliance with the operating instructions are, properly installed, commissioned, maintained and installed by qualified personnel (refer Section 2.7) the safety operations of these products can be guaranteed. General instructions for proper use of tools and safety of equipments, pipeline and plant construction must also be complied with.

2.1 Intended use:

Check if the product is suitable for intended use/ application by referring to the installation and maintenance instructions, name plates and technical information sheets.

- i) The product is suitable for use as defined in the technical information sheet. In case the need arises to use the product on any other fluid please contact Forbes Marshall for assistance.
- ii) Check for the suitability in conformance to the limiting conditions specified in technical information sheet of the product.
- iii) The correct installation and direction of fluid flow has to be determined.
- iv) Forbes Marshall products are not intended to resist external stresses, hence necessary precautions to be taken to minimize the same.

2.2 Accessibility and Lighting:

Safe accessibility and working conditions are to be ensured prior to working on the product.

2.3 Hazardous environment and media:

The product has to be protected from hazardous environment and check to ensure that no hazardous liquids or gases pass through the product.

2.4 Depressurizing of systems and normalizing of temperature:

Ensure isolation and safety venting of any pressure to the atmospheric pressure. Even if the pressure gauge indicates zero, do not make an assumption that the system has been depressurized.

To avoid danger of burns allow temperature to normalize after isolation.

2.5 Tools and consumables:

Ensure you have appropriate tools and / or consumables available before starting the work. Use of original Forbes Marshall replacement parts is recommended.

2.6 Protective clothing:

Consider for the requirement of any protective clothing for you/ or others in the vicinity for protection against hazards of temperature (high or low), chemicals, radiation, dangers to eyes and face, noise and falling objects.

2.7 Permits to work:

All work to be carried out under supervision of a competent person. Training should be imparted to operating personnel on correct usage of product as per Installation and Maintenance instruction. "Permit to work" to be complied with (wherever applicable), in case of absence of this system a responsible person should have complete information and knowledge on what work is going on and where required, arrange to have an assistant with his primary goal and responsibility being safety. "Warning Notices" should be posted wherever necessary

2.8 Handling:

There is a risk of injury if heavy products are handled manually. Analyze the risk and use appropriate handling method by taking into consideration the task, individual, the working environment and the load.

2.9 Freezing:

Provision should be made to protect systems which are not self-draining, against frost damage (in environment where they may be exposed to temperatures below freezing point) to be made.

2.10 Product Disposal:

It is necessary to dispose this product only in accordance with local regulations at the authorized, qualified collecting point specified for equipment's and its parts—Please refer the part details mentioned in the material table of this manual. Please follow all waste disposal guidelines (Management & Handling) as published by local governing authorities in India & abroad

2.11 Returning products:

Customers and Stockist are reminded that, when returning products to Forbes Marshall they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk.

This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

3. Brief Product Information:

3.1 Description:

Forbes Marshall Pressure Reducing Stations (Pilot Operated), FMPRS-PO, are specially designed and fabricated as a complete packaged product with all necessary steam ancillaries to maintain the desired pressures for desired flow rates of steam making the system more reliable, safe and easy to operate. A bypass loop is provided to enable online maintenance of the pilot operated pressure reducing valve, ensuring no downtime.

3.2 Limiting Conditions:

	Class 300 with FMPRV53	Class 150 with FMPRV41
PMO	17.5 bar g	13 bar g
TMO	209 deg C	195 deg C

Note: For higher pressures and class ratings contact the nearest Forbes Marshall branch or head office.

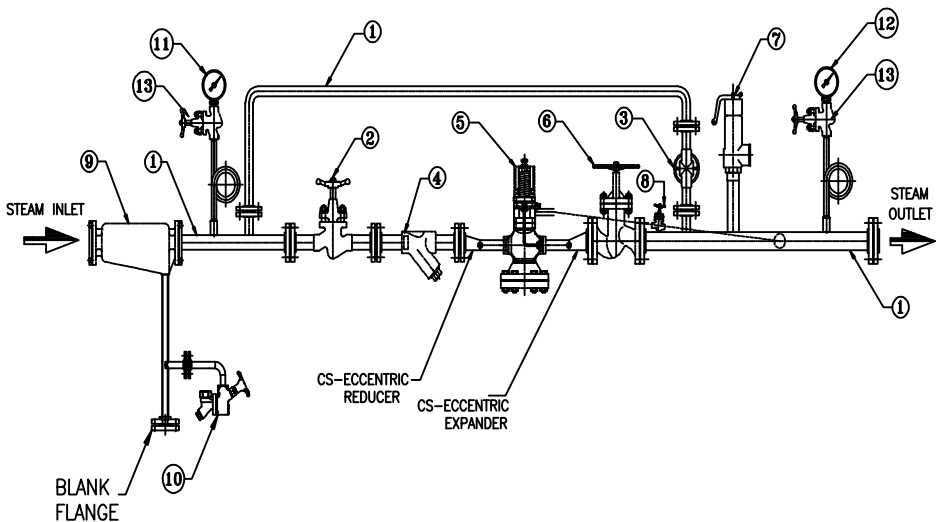


Figure 1 : Forbes Marshall Pressure Reducing Station (Pilot Operated)

NOTE: * The FMPRS-PO sizing should be done for minimum differential pressure and maximum flow conditions. Example - if upstream variation is 10 bar g - 7 bar g and downstream requirement is 3 bar g - 4 bar g, then FMPRS-PO should be sized for 7 bar g - 4 bar g conditions at full flow condition.

Material Specifications:

Part No.	Description	Material
1	Interconnecting pipework	Carbon Steel
2	FM Piston valve - inlet isolation	Cast Steel
3	FM Piston valve - bypass	Cast Steel
4	FM Strainer	Cast Iron / Cast Steel
5	FMPRV41 / FMPRV53 - pilot operated pressure reducing valve	S.G iron / Cast Steel
6	FM Piston valve - outlet isolation	Cast Steel
7	FM Safety relief valve	S.G iron / Cast Steel
8	FM Piston valve - for pressure balancing	Forged Carbon Steel
9	FM Moisture separator	Cast Iron / Cast Steel
10	FMPC51/52 - for drain assembly	Forged Carbon Steel
11	Pressure gauge	Stainless Steel
12	Pressure gauge	Stainless Steel
13	FM Piston valve for pressure gauge	Forged Carbon Steel

How to Size FMPRS-PO:

FMPRS-PO can be sized for inlet and outlet pipe size using relative equation based on steam flow rate and velocity method given below:

$$d = \sqrt{\frac{4}{\pi} \times \frac{m \cdot v}{3600 \cdot p}}$$

Where, m: Steam Flow Rate (kg/h)

d: Pipe Inner Diameter (m)

v: Steam Velocity (m/s) (25 - 30 m/s)

V: Specific volume (³m/kg) at given steam pressure

Example: For parameters

a) Steam Flow rate – 2000 kg/hr

b) Inlet steam pressure – 6 bar g

c) Outlet pressure – 3 bar g

With the above given equation the inlet size of FMPRS-PO will be DN100 and outlet size

Note:

- ☒ The pilot operated pressure reducing valve can operate fine with an upstream pressure fluctuation of 20% without change in downstream pressure.
- ☒ The pilot operated pressure reducing valve will control within 0.035 bar g of the set pressure for a minimum load (flow) turndown of 8:1 of the maximum capacity.

Example: If we have flow condition of 1500 kg/h, pressure reduction from 10.5 to 3.0 bar g, we will select a DN 40 valve. The maximum flow possible through this valve is 2500 kg/h. Hence this valve can operate fine for a lowest flow of 350 kg/h without any problem.

- ☒ The FMPRV has a turndown of pressure - typically downstream pressure possible is (upstream pressure x 0.8) to (upstream pressure x 0.125)
- ☒ In case the downstream pressure approaches below 1 bar g and the upstream pressure is maximum then it is advisable to have the same done in two stages with the pilot operated pressure reducing valve in series to have better turndown of pressure in FMPRS-PO.

Refer FMPRV41 / FMPRV53 TIS for finding flow capacities of FMPRV for the given sizes of FMPRS-PO.

4. Operation:

The Forbes Marshall Pressure Reducing Station (Pilot Operated) provides right quality and quantity of steam to the process, at right pressure and temperature. It ensures reliability of the Pressure Reducing Valve since it is engineered with the requisite components upstream and downstream. The Forbes Marshall Pressure Reducing Station (Pilot Operated) comes with following assembled product.

1. Forbes Marshall Moisture Separator:

Moisture Separator ensures that dry steam reaches the FMPRV41/53 and process, hence improving the product life of the valve by reducing the chances of damage of valve seat due to erosion and pitting.

2. FMPC51/52 - for drain assembly:

FMPC51/52 - for drain assembly have integral stop valve which isolates upstream of the steam trap and is available with connections for the draining of upstream pipework, trap venting upstream of the steam trap and integral trap bypass valve.

3. Forbes Marshall Strainer:

Strainers ensure that clean steam reaches the FMPRV41/53 and that it contains no foreign particles which may hinder the normal working of the valve.

4. Piston Valve - Isolation valves (Upstream, Downstream and Bypass):

The isolation valves ensure the isolation of the whole station from the upstream and downstream pressure in case maintenance and troubleshooting work has to be carried out. The Bypass valve enables flow of steam when the FMPRV41/53 is under maintenance.

5. Forbes Marshall Pilot Operated Pressure Reducing Valve:

The pilot operated pressure reducing valve reduces upstream pressure, to a pressure value that is required in the process.

6. Forbes Marshall Safety Relief Valve:

A Forbes Marshall Safety Relief Valve is very essential in the unlikely event of overshoot in steam pressure. In such an event the Forbes Marshall Safety Relief Valve ensures that the extra pressure is vented off to the atmosphere, without damaging any equipment downstream. All upstream and downstream pipework and fittings must be adequately sized to ensure that the only appreciable pressure drop occurs across the pressure reducing valve itself.

7. Pressure Gauges : (Upstream and Downstream)

Pressure gauge indicate upstream and downstream pressure.

5. Installation Guidelines : (Refer to Figure 1)



Note: Before implementing any installations observe the 'Important Safety notes" in section 2. Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended installation.

1. Weld the respective mating flanges to the upstream and downstream plant piping.
2. Install the moisture separator (9) along with the FMPC51/52 - drain trap assembly (10) on to the FMPRS-PO inlet line and tighten with gasket and fasteners.
3. For supplies where the bypass line(1) is supplied loose, install as per drawing and tighten with gaskets and fasteners.

Precautions:-

1. Proper supports should be provided to support the PRS. Line stresses caused by expansion or inadequate support should not be imposed on the valve body.
2. The piping on both sides of the valve must be sized so that velocities do not exceed 30 m/s (98 ft/s). This means that a properly sized valve will often be smaller than the connecting pipe work.
3. Before installing upstream and downstream pressure gauges(11, 12), pour the water in SYPHON & Install DN15 Piston valve(8) on it.
4. Use gasket in between all flange joints and tighten all the Nut / Bolts with Spanner to ensure the leak proof flange joint.

6. Startup and Commissioning: (Refer to Figures 1)

6.1 Checks:

1. Ensure that all connections are properly made and that all valves are closed.
2. Check the FMPRV41/53 (5) adjustment screw is turned fully anticlockwise until spring is slack.
3. For correct operation of the FMPRV41/53 (5) it is important that the pilot valve and main valve are not subjected to dirt or other hard particles.
4. Therefore, prior to bringing the valve into operation, the upstream pipe work should be flushed.

Note: Refer FMPRV41/53 manual for detail commissioning.

6.2 Steam Line Flushing Procedure : (Refer to Figure 1)

1. Close the isolation valve installed prior to FMPRS-PO and prior to FMPRV41/53. Also close handwheel of FMPC51/52 - drain trap assembly, now open the blank flange provided at bottom of moisture separator.
2. Start steam by gradually opening the isolation valve installed prior to FMPRS-PO allow the steam to pass through the blank flange till all the foreign particles are drained and we see clean steam is coming out.
3. Close the isolation valve installed prior to FMPRS-PO & reassemble the blank flange with gasket.
4. Re-flush the steam line by opening the strainer(4) cap & screen.
5. Isolate the steam supply & reassemble the strainer cap with screen & gasket.
6. Open the isolation valve installed prior to FMPRS-PO also prior to FMPRV41/53 and handling of FMPC51/52 drain trap assembly

6.3 FMPRS-PO setting Procedure : (Refer to Figure 1)

1. Before adjusting the FMPRV51/53 (5) please make sure that the process isolation valves are in closed condition.
2. Open the FMPC51/52 - drain assembly (10) valve, pressure gauge valves (11,12), inlet (2), outlet (6) & balancing line isolation valves of pressure reducing station.
3. Ensure that the upstream steam pressure is within the range& FMPC51/52 - drain assembly steam trap (10) is in working condition.
4. When the adjustment bolt of FMPR V41/53 (5) is fully loose – steam pressure at the downstream will remain Zero.
5. Using a 19 mm A/F spanner slowly turn adjustment bolt of FMPRV41/53 (5) in a clockwise direction & set the safety relief valve (7) at 10% higher pressure than the desired working pressure in the process. (See below Forbes Marshall Safety Relief Valve setting)
6. Slowly turn adjustment bolt of the FMPRV41/53 in anticlockwise direction to get the desired downstream pressure.
7. By rotating the adjustment bolt in clockwise direction downstream pressure increases & it decreases by rotating it in anticlockwise direction.
8. Hold the adjustment bolt in position with the spanner & tighten down the lock-nut to secure the setting of the adjustment spring.
9. Slowly open the process isolation valves.

Forbes Marshall Safety Relief Valve setting : Model – FMSRV (Refer to Figure 2)

1. The Forbes Marshall Safety Relief Valve should be set at a pressure, which is 10% above the working pressure of the system.
2. Forbes Marshall Safety Relief Valve comes with 6 color-coded springs w.r.t. set pressure ranges

White - 05 to 15 psi	Yellow – 15 to 35 psi
Green – 35 to 75 psi	Blue 75 to 125 psi
Red – 125 to 175 psi	Black 175 – 250 psi

The range is punched on the Safety Relief Valve cover body; Safety Relief Valve can be set in this range.

3. To set the Safety Relief Valve, please remove the easing lever(1) and cap.
4. Before setting of Safety Relief Valve, please ensure that the Safety Relief Valve discharge is routed at safe location.
5. Charge the steam line and ensure that the steam pressure is 10% more than the system operating pressure and test the safety valve by shutting down the downstream stop valve without the chance of downstream process being over pressurized.
6. If Safety Relief Valve is not blowing at that pressure, then loosen the lock nut(3) and do the set pressure adjustment with adjustment bolt(2). By rotating adjustment bolt(2) in clockwise direction, set pressure increases and it decreases by rotating it in anticlockwise direction.
7. After setting the required set pressure, hold the adjustment bolt and tighten the lock nut(3).

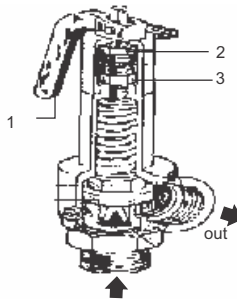


Figure2: Safety Relief Valve

Model- VSR1/VSR2

8. To do the valve setting, follow the steps:

Remove the Lead Valve Seal. Unscrew the Bolts on the Cap and Lift the Lever in counter clockwise direction so that the Lift Fork in the Cap does not Foul with the Spindle Nut. Lift the Cap assembly from the Valve Bonnet.

Hold the Spindle Nut Firmly with the Help of Spanner and with the Other Spanner Rotate the Spring Tension Adjusting Bolt Clockwise to Increase the Set Pressure. If the Spindle Nut is not Held Firmly, it will rotate the Spindle & therefore the Disc and Damage the Disc. After adjusting the Set Pressure the Lock Nut is Tightened and Cap Assembled onto the Valve Bonnet.

7. Maintenance Guidelines:



Before undertaking any maintenance on the PRS it must be isolated and any pressure should be allowed to safely normalize to atmosphere. With suitable isolation, repairs can be carried out with the PRS in the line. When re-assembling, make sure that all joint faces are clean. Once completed open isolation valves slowly and check for leaks.

7.1 Routine and Preventive Maintenance:

SR.	PARAMETERS TO BE CHECKED	FREQUENCY FOR CHECKING VARIOUS PARAMETERS					
A	Forbes Marshall Pressure Reducing Station (Pilot Operated)	Daily	Weekly	Monthly	Quarterly	Half Yearly	Annually
1	Clean Strainer before FMPRS-PO				Y		
2	Pressure gauge calibration						Y
3	Safety relief valve testing				Y		
4	Cleaning & overhauling of safety relief valve						Y
5	Feed Back line cleaning					Y	
B	FMPRV41/53						
6	Clean Pilot valve strainer				Y		
7	Clean Main valve strainer					Y	
8	Clean Pilot valve chamber assembly kit					Y	
9	Check & clean Main / Pilot diaphragm						Y
10	Clean SS tube & stud coupling with split pin					Y	
11	Main valve cleaning					Y	
12	PRV overhauling and push rod checking						Y
C	Piston Valve						
13	Manually Operate the valve			Y			
14	Lubrication of piston valves				Y		
15	Visual inspection and cleaning of threads				Y		
16	Refilling of *Loctite Anti-Seize (in grease cap) for DN 15/20/25.				Y		
D	Other Products						
16	Manual operation of FMPC51/52-drain trap assbly			Y			
17	Strainer & Internal cleaning					Y	
E	Forbes Marshall Safety Relief Valve						
18	Visual inspection for leakages	Y					
19	Testing of Forbes Marshall Safety Relief				Y		
20	Cleaning of internals						Y

Flush lines properly before taking FMPRS-PO in operation	
Change Body bonnet gasket	Each time it is opened for cleaning / maintenance
Change gasket of drain trap.	Each time it is opened for cleaning / maintenance
Valves - Gland nut tightening	Immediately in case of visual leak
Valves - Body / bonnet nut tightening	Immediately in case of inline leak
Please do not use "F" key for opening and closing of piston valve	
Use Molykote M30 oil for lubrication*	

*In case Molykote M30 lubricating oil is not available, please use an equivalent lubricating oil with specification as shown below.

Specification of Molykote M30			
Colour			Black
Composition			Synthetic oil Molybdenum disulphide Dispersant
Density	Density at 20°C (68°F) (Standard - DIN 51 757)		1.0 g/ml
Viscosity	Base oil viscosity at 40°C (104°F) (Standard - DIN 51 562)		120 mm3/s
Temperature	Service temperature range		Oil lubrication up to +200°C (397°F)
			Dry lubrication up to +450°C (842°F)
Load –carrying capacity, wear protection.	Four-ball tester (VKA)	Weld Load (Standard – DIN 51 562 pt.2)	2000 N
		Wear scar under 800 N (Standard – DIN 51 350 pt.3)	1.02 mm
		Almen-Wieland machine OK load.	20000 N
Storage life			1 years

7.2 In addition to the preventive maintenance, follow the points below to keep the system in working condition:

1. Strainer must be cleaned from time to time.
2. The process equipments on downstream when FMPRS-PO is under maintenance must be protected against excess pressure.
3. Valve mountings such as actuators, hand wheels, hood must not be used to take external forces e.g. they are not designed for use as climbing aids, or as connecting points for lifting gear
4. Suitable material handling and lifting equipment's should be used.
5. Handling and warning must be carried out by expert personnel or all activities must be supervised and checked.
6. Remove flanges cover if present.
7. The interior of valve and piping line must be free from foreign particles.
8. Note installation position with reference to flow, see mark on valve.
9. Lay pipelines so that damaging transverse, bending and torsional forces are avoided.
10. Protect valves from dirt during construction work.
11. Connection flanges must mate exactly.
12. Connecting bolts for pipe flanges should be mounted preferably from the counter flange side (Hexagon nuts from the valve side)
13. For application outside or in adverse environments like corrosion promoting condition (sea water, chemical vapors etc.), special constructions or protection measures are recommended
14. Before installing the FMPRV41/53 rinse and clean the system otherwise seat/disc will be damaged.

Note: For a detailed maintenance procedure for each product of the pressure reducing station, please refer to the individual user manuals of the respective product.

8. Troubleshooting:

If the expected performance is unachievable after the installation of FMPRS-PO, check the following points for appropriate corrective measures.

8.1 Pressure Reducing Valve:

Before undertaking the following fault finding procedure, ensure the valve has been isolated and that upstream and downstream pressures are zero. Possible fault checks are given in a logical order below.

A PRV typically has the following failure modes:

1) Downstream pressure zero or too low:

If downstream pressure of Pressure reducing valve is zero, please check following before dismantling the Pressure reducing valve.

1. Downstream pressure gauge: - Please ensure that it should be in working condition.
2. Upstream pressure: - It Should be as per the PRV upstream design pressure.
3. Isolation valve not fully Open - Ensure Upstream & Downstream Isolation valves are in full open condition
4. Upstream Strainer Clogged – Ensure upstream Strainer is in clean condition: Clean it if it is found as clogged.

Failure Mode	Possible Cause	Remedy
Downstream pressure zero or too low	Pressure adjustment bolt	Please ensure that pressure adjustment bolt is not in loose condition. If so, rotate it clockwise slowly to set the desired downstream pressure.
	Clogging in PRV	Ensure Pilot valve strainer, Control pipe assembly & SS hex coupling fixed to bottom diaphragm chamber are clean. If found clogged clean it properly. Check the internal balancing line for blockage.
	Main Diaphragms	If main diaphragms are permanently deformed or punctured - replace the same.
	Jamming of push rod	Please check if Pushrod is jammed in liner bush at lower position. Open & clean it.
	Main valve lift disturbed:	Check that pushrod lock nut is intact & it is in full tighten condition. If it is loose there is a chance that the main valve lift may be reduced. To re adjust the main valve lift, Please refer the main valve lift setting video clip.

2) Downstream pressure is equal to upstream pressure

If downstream pressure of Pressure reducing valve is equal to upstream pressure, please check following before dismantling the Pressure reducing valve.

1. By Passisolation valve: - Please ensure that it should not be leaking & should be in full closed condition.
2. Feedback line: - Isolation valve installed in the feedback line should be fully open and the line should not be clogged, clean it if necessary

Failure Mode	Possible Causes	Remedy
Downstream pressure is equal to upstream pressure	Pressure adjustment bolt	<ol style="list-style-type: none"> 1. Please ensure that pressure adjustment bolt is not in full tight condition. Release it fully, ensure that the downstream pressure is zero and re adjust the required downstream pressure by slowly rotating it clockwise. 2. If downstream pressure does not respond to the adjustment bolt rotation, check the pilot valve or main valve leakage by following the next step. <ol style="list-style-type: none"> A) Close the upstream isolation valve B) Loosen the pressure adjustment bolt and Make the downstream pressure zero C) Remove the SS tubing from Pilot valve chamber & center T Joints D) Open the upstream isolation valve slowly & check for steam leakage E) If steam coming from Pilot valve chamber – it means Pilot valve is leaking. F) Clean the Pilot valve or replace it, if required. G) If steam coming from “T” joint – It means either Main valve is leaking or Main valve return Spring is broken - Clean & lap the main valve head or replace the MV return spring if found broken. If the problem still persists then follow the next step.
	Check the control orifice	Clean it if found clogged.
	Check pilot diaphragm	Replace if found deformed or damaged.
	Pushrod locknut	Check that pushrod lock nut is intact & it is in full tighten condition. If it is loose there is a chance that the main valve lift may be disturbed. To re adjust the main valve lift.

3) Hunting

Hunting or Pressure Fluctuations may coincide with variations in steam load. In such case, check following before dismantling the pressure reducing valve.

1. WET Steam- Ensure steam is not wet and Moisture separator is installed before the PRV & the steam trap below it, is operational.
2. Up Stream Pressure – It is recommended to have stable upstream pressure however the Pressure Reducing valve will give constant downstream pressure with + or - 20% variation in designed Upstream pressure.
3. Partial Blockage in Upstream - If the pressure drops during full-load conditions, it is possible that there is a partial blockage in the upstream line or that the upstream pipe work is undersized. Steam Line should be sized properly to carry the required steam flow rate at given pressure considering steam velocity of 25 M/S. Please refer steam line sizing chart for correct steam line size.
4. Isolation valves - Ensure Upstream & Downstream Isolation valves are in full open condition. By pass valve should be in full closed condition and it should not be leaking.
5. Upstream Strainer Clogged – Ensure upstream Strainer is in clean condition: Clean it if it is found as clogged.
6. Bypass valve – Check whether the bypass valve is leaking. Replace if found so.

Failure	Possible Causes	Remedy
Hunting	Sticking of push rod in the Main Valve Chamber	Check that the Main valve pushrod is not sticking. Open & clean it. Also check whether the push rod outer surface is not deformed. Replace the push rod if it is found deformed.
	Diaphragms Over Stretched / permanently deformed	If Pilot diaphragms or main diaphragms overstretched or deformed -replace the same.
	PRV sizing.	Set the PRV in no flow condition i.e. all process valves are closed. Now Apply full- load to the PRV by opening all the process valves. If the downstream pressure drops excessively during full-load condition but it is maintaining by opening of by-pass valve, it is likely that the valve is undersized; in which case it should be replaced. Please refer the PRV sizing chart given in Technical information sheet to know the correct PRV size. Consult Forbes Marshall for correct sizing of the valve.
	Check Split pin (NRV) port	Check the port is clean and the split pin is free to move

8.2 Moisture Separator:

Failure Mode	Possible Cause	Remedy
Not draining moisture	Drain/ Drip leg choked/ Drain trap choked	Remove the separator and flush it. Clean drain trap module
Steam Leaking	Flange Gasket damaged	Remove and replace the gasket

8.3 Safety Relief Valve:

Failure Mode	Possible Cause	Remedy
Valve Leakage	Check for spring range	Refer to the spring ranges given in the Technical Information Sheet
	Check for blow down ring setting	To have the required reset pressure for a particular set pressure, the blow down ring should be adjusted after removing the ring locking screw. Rotate the blow down ring in the clockwise direction towards the main valve head. Once the blow down ring touches the main valve head, rotate the ring in anticlockwise direction, away from the head by 1/4th of a turn. Ensure that the screw is tightened after adjustment.
	Valve seating surface dirty or damaged	It is usually sufficient to clean the seating surfaces and reassemble. If the seating surface has been damaged it is necessary to re-lap. When reassembling all foreign matter and scales should always be clear away from the surrounding components, all lapping paste removed and seating surface cleaned.
Not Releasing the Pressure	Check the pressure setting of the valve	<ol style="list-style-type: none"> 1. It should be only 10% above the working pressure of the system 2. Make sure the spring range selected is not higher than mentioned in the technical information Sheet, for a given pressure range.
Valve not giving popping action and delay in main valve head seating (blows off pressure till it drops off way below the set pressure)	Wrong Blow down ring setting (too far from the head)	To have the required reset pressure for a particular set pressure, the blow down ring should be adjusted after removing the ring locking screw. Rotate the blow down ring in the clockwise direction towards the main valve head. Once the blow down ring touches the main valve head, rotate the ring in anticlockwise direction, away from the head by 1/4th of a turn. Ensure that the screw is tightened after adjustment.

8.4 Sempell Safety Relief Valve:

Description	Cause	Troubleshooting Procedure
Safety Relief Valve Opens at Different Set Pressures	Condensate in Admission Line	Provide better Insulation to the Inlet Line.
	Pressure Change due to Vibration	Provide Proper Support to the Valve to Reduce Valve Vibration
Safety Relief Valve chatters or Opens and Closes Rapidly	Pressure Loss in Inlet Line to Valve is Higher than the Closing Pressure Difference The Inlet Pipe to the Valve is smaller than the Valve Inlet.	Increase Closing Pressure Difference. Reduce Flow Resistance in Inlet Line.
	Valve installed is Oversized	Reduce Lift of the Valve to Reduce Discharge Capacity Better install a lower orifice size valve
	High Back Pressure in the Discharge Line.	Reduce Resistance to Flow in the Discharge Line by Enlarging the Discharge Line or Shortening the Length of the Line.
Safety Relief Valve remains open after Discharge	Foreign Matter between the Disc and Seat or in the Valve Internals	Use Lifting Lever provided on Cap to Flush out Foreign Matter Between Disc and Seat. If Problem Persist, remove the valve for Inspection and cleaning at the first opportunity.
Safety Relief Valve Does not Close Tightly	Insufficient Pressure Difference between Set Pressure and Operating Pressure.	Increase the Set Pressure
	Deformation of Valve Body due to Excessive Piping Forces Lay Piping with Proper Hangers and Support	Lay Piping with Proper Hangers and Support
	Damage to Valve Seat	Disassemble the valve and lap the seat and Disc. If Problem Persists, replace with New Disc

8.5 FMPC51/52 - Drain Trap Assembly:

Failure Mode	Possible Cause	Remedy
No condensate is discharged (blocked).	Inlet drip leg or strainer screen is clogged with rust or scale.	Flush inline drip leg and clean strainer screen. If strainer screen is rusted, replace with new strainer screen.
	No condensate discharge.	Ensure upstream isolation valve is fully open.
	Seizing the isolation valve.	Lubricate the valve frequently with *Molykote M30 oil.
	Steam trap body is hot but no condensate discharge.	To release flash steam locked (trapped inside the steam trap, pour water on main bore cap of the steam trap to check it discharge condensate.
	Air – binding problem.	Loosen Main bore cap and tighten to suitable torque or replace with Anti air binding disc.
	Differential pressure is Low.	Verify inlet and outlet pressure. Minimum differential pressure required is 0.25 bar g.
	Back pressure exceeds allowable value.	Outlet pressure should not exceed 80% of the inlet pressure.

Failure Mode	Possible Cause	Remedy
Steam leakage	*trap bypass valve (DV1) and *trap vent valve (DV2) is open or partially closed.	Ensure *trap bypass valve (DV1) and *trap vent valve (DV2) is fully closed.
	Improper installation of the product.	Check installation i.e. main bore cap to be on top and fluid flow direction should be same as arrow on the FMPC51/52 body
	Sealing stack worn – out.	Check sealing stacks of upstream trap isolation valve, * trap bypass valve (DV1) and *trap vent valve (DV2) are damage or worn. If worn-out replace with new sealing stacks and nuts should be tighten to proper torque.
	Stem-piston is damaged or corroded.	Check if scouring, corrosion has occurred on stem-piston of upstream trap isolation valve, *trap bypass valve (DV1) and *trap vent valve (DV2) are damage. If damaged replace with new stem-piston and lubricate stem-piston with *Molykote M30 oil.
	Spiral Gasket deterioration or damage.	Replace inner and outer spiral gasket with new one and retain them in the grooves using suitable adhesive (Locktite). Note: Care must be taken not to damage gasket faces. Do not use sharp edges to clean gasket and gasket faces.
	Foreign material or oil film on disc or body seat.	Clean both disc and body seat, flatness on disc and body seating face can be improved by lapping individually on flat surface or glass plate. Note: The total amount of metal from body seat face removed should not exceed 0.25mm (0.01").
	Disc stuck to the main bore cap.	Give a light tap on top of the main bore cap and check if step (inner surface of the main bore cap) is worn out. If step is worn out replace with new steam trap.
Motor-Boating (Chattering) of disc	Scratch on disc or body seat.	Check if scratch depth is less, then disc and body seating face flatness can be improved by lapping individually on flat surface / glass plate. If scratch depth is more replace with new disc. Note: The total amount of metal from body seat face removed should not exceed 0.25mm (0.01").
	Disc or body seat is worn.	Replace with new disc. If body seat is slightly worn, it can be refaced by lapping on flat surface or glass plate. If body seat is worn beyond repair replace with new steam trap. Note: The total amount of metal from body seat face removed should not exceed 0.25mm (0.01").

*trap bypass valve(DV1) is available with FMPC51, additional * trap vent valve (DV2) is provided with FMPC52

Note: Never attempt to modify the product. When replacing old part with new part, use the spare parts listed in the manual. Please refer Forbes Marshall Universal Thermodynamic trap manual for available spare parts.

8.6 Piston Valve:

Failure Mode	Possible Cause	Remedy
Inadequate flow rate at outlet	The piston valve is not completely open	Ensure the piston valve is completely open.
Fluid leakage from end connection	End connection is not tight.	Tighten the end connection with proper torque for flange end and tighten the screwed end piston valve.
Fluid leakage from bonnet and body.	Sealing stack worn out	<p>For piston valve of sizes DN15- DN50 if any leakage is observed through bonnet hole, first close the valve till handwheel touches bonnet and then tighten all the nuts equally by half or one turn until leakage stops. (Refer table 1 for recommended tightening torque.) If leakage does not stop dismantle the valve, check if sealing stack is worn-out. If worn-out replace with new set of sealing stack.</p> <p>Note: Never tighten nuts when valve is in open condition.</p> <p>For piston valve of sizes DN65 – DN200 if any leakage is observed through the gland, tighten gland nut half or one turn until leakage stops. To stop the leakage between body and bonnet, first close the valve till handwheel touches bonnet and then tighten all the nuts equally by half or one turn until leakage stops. (Refer table 1 for recommended tightening torque.) If leakage does not stop dismantle the valve, check if gland sealing stack, bonnet sealing stack & body sealing stack is worn-out. If worn-out replace with new one.</p> <p>Note: Never tighten nuts when valve is in open condition.</p>
	Piston is damaged or corroded	Check if piston is damaged due to scouring, corrosion of the piston valve. If damaged replace with new piston kit.
Excessive force is required to turn the handwheel	Seizing of the piston valve	Lubricate the piston valve using *Molykote M30 lubricating oil on quarterly basis for sizes DN15- Dn50 lubricate spindle through the hole provided in the bonnet and spindle threads and for sizes DN65- Dn200 lubricate between the spindle and threaded bush at the upper part of bonnet and stem and also spindle at the lower part of the bonnet.

Note: Never attempt to modify the product. When replacing old parts with new parts, use the spare parts listed in the manual.

8.7 Strainer:

Failure Mode	Possible Cause	Remedy
No flow through strainer.	Strainer screen is clogged with rust or debris.	Flush inline drip leg or pipeline and clean the screen. If screen is rusted, replace with new screen.
Increased pressure drop across the strainer.	Screen is blocking up.	Clean or replace the screen.
Fluid leakage from strainer pocket.	Gasket deterioration or damage.	Replace with new gasket and tighten the cap / nut to the recommended torque.

Note: Never attempt to modify the product. When replacing old part with new part, use the spare parts listed in the manual.

9. Available Spares:

For available spares, please refer each product manual.

How to Order:

Example: Forbes Marshall Pressure Reducing Station (Pilot Operated) with FMPRV41 pilot operated pressure reducing valve, FMPRS-PO size Inlet - DN40 and Outlet – DN 50 with set pressures Inlet - 10 bar g and outlet – 3 bar g for steam flow rates 2000 kg/hr.

Note: Always specify inlet and outlet required set pressures and max – min steam flowrates while ordering the FMPRS-PO. This will help us in ensuring that you have selected the correct size.

10. Warranty Period:

As per the ordering information and agreement in the contract.



www.forbesmarshall.com

Forbes Marshall Arca

Codel International

Krohne Marshall

Forbes Vyncke

Forbes Marshall Steam Systems

A: Forbes Marshall Pvt. Ltd.

Opp. 106th Milestone, CTS 2220,
Mumbai-Pune Road, Kasarwadi,
Pune MH 411034 INDIA

P: +91(0)20-68138555

F: +91(0)20-68138402

E: ccmidc@forbesmarshall.com

Forbes Marshall International Pte. Ltd.

16A, Tuas Avenue 1,
#05-21, JTC Space @Tuas
Singapore - 639533

P: +65 6219 3890

CIN No: U28996PN1985PTC037806