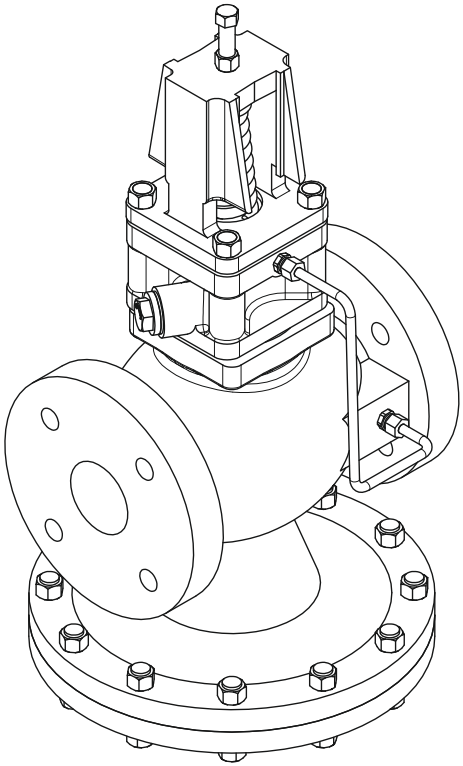
FORBES MARSHALL

Installation and Maintenance Manual

Double Seated Pressure Reducing Valve

DSPRV41



Energy Conservation | Environment | Process Efficiency

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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 productssafely and efficiently.

Double Seated Pressure Reducing Valve DSPRV41

Sizes: 1 ½" and 2"

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 ofequipments, 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 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 :

DSPRV41 is a SG Iron pilot operated pressure reducing valve suitable for steam applications with improved turndown.

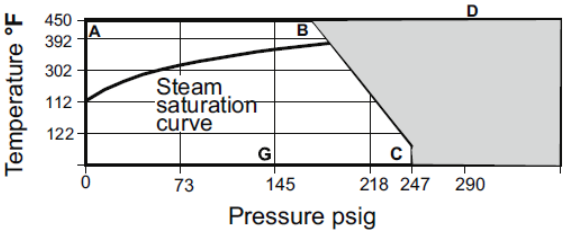
3.2 Available Sizes & Pipe Connections :

Flanged : ANSI CLASS 150 for DN40 & DN50

3.3 Limiting Conditions:

PMO - Maximum allowable Pressure	247 psi(g)
TMO –Maximum allowable Temperature	450 °F
Cold hydraulic test pressure	493 psi(g)
Spring range	3 to 247 psi(g)

3.4 Operating Range :



The product must not be used in this region.

3.5 Pressure Sensing Pipe:

The DSPRV41 controls the pressure by sensing the downstream pressure through a pressure sensing pipe taken to the union (item L) or through the internal sensing pipe (item M).

Note: Capacity is reduced and there is a possibility of hunting if an external pressure sensing pipe is not fitted.

3.6 Kv Values:

The Kv values are full capacities and should be used for safety valve sizing purpose only

SIZE	DN40	DN50
KV	17	28

For conversion Cv (UK) = Kv × 0.963
Cv (US) = Kv × 1.156

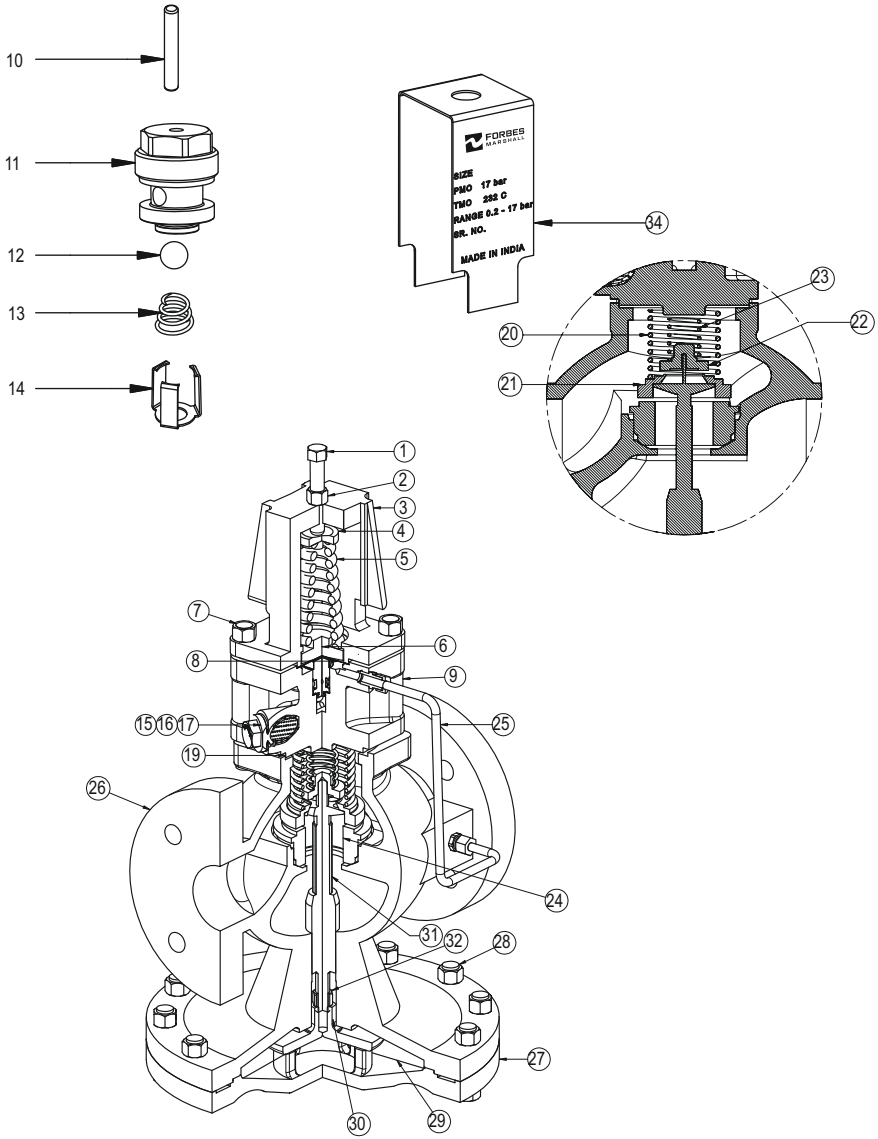


Figure 1: Double Seat Pressure Reducing Valve.

Materials

No.	Part	Material	Standard
1	Adjustment screw	Carbon steel	IS 1367 Gr.14
2	Adjustment lock nut	Stainless steel Type 304	
3	Spring housing	SG iron	EN-JS 1025 DIN EN 1563
4	Top spring pad	C-20	IS 2062
5	Pressure adjustment spring	Stainless steel	IS 4454 Part IV Gr.1
6	Bottom spring pad	SS Type 304	ASTM A 276
7	Spring housing securing nuts	Carbon steel	ASTM A194 Gr. 2H
	Spring housing securing bolts	Carbon steel	BS 970 EN9
8	Pilot diaphragm	SS Type 304	ASTM A 240
9	Pilot valve chamber	SG iron	EN-JS 1025 DIN EN 1563
10	Pilot valve plunger	SS Type 304	ASTM A 276
11	Pilot valve seat with integral seal	Stainless steel + PTFE	BS 970 431 S 29
12	Pilot valve ball	Stainless steel	AISI 420
13	Pilot valve spring	Stainless steel	BS 2057 302 S 26
14	Pilot valve clip	SS Type 301	ASTM A 240
15	Pilot filter cap gasket	Stainless steel	BS 1449-304-S16
16	Pilot filter cap	Stainless steel	ASTM A 743 Gr.CA 40
17	Pilot filter element	Bronze	
18*	Internal strainer screen	SS Type 304	ASTM A 240
19	Body gasket	Stainless steel Reinforced graphite	
20	Main valve head return spring	Stainless steel	BS 2056 302 S 26
21	Main valve head	SS Type 420	ASTM A 276
22	Auxiliary valve head	SS Type 420	ASTM A 276
23	Auxiliary valve head return spring	Stainless steel	BS 2056 302 S 26
24	Main valve seat	SS Type 420	ASTM A 276
25	Balance pipe assembly	SS Type 304	ASTM A 213
26	Main valve body	SG iron	EN-JS 1025 DIN EN 1563
27	Lower diaphragm chamber	SG iron	EN-JS 1025 DIN EN 1563
28	Lower diaphragm chamber Securing nuts	Carbon steel	ASTM A194 Gr 2H
	Lower diaphragm chamber Securing bolts	Carbon steel	ASTM A193 Gr B7
29	Main diaphragms	SS Type 304	ASTM A 240
30	Lower diaphragm pad	SS Type 304	ASTM A 276
31	Push rod	SS Type 431	ASTM A 276
32	Lock nut	SS Type 316	
33*	Control pipe assembly	SS Type 304	ASTM A 213
34	Name Plate	Stainless steel	

***Note :** Items 10, 11, 12, 13 and 14 are shown on the exploded view, as they are hidden by the pilot filter on the main illustration.

3.7 Product Dimension and Drawing :

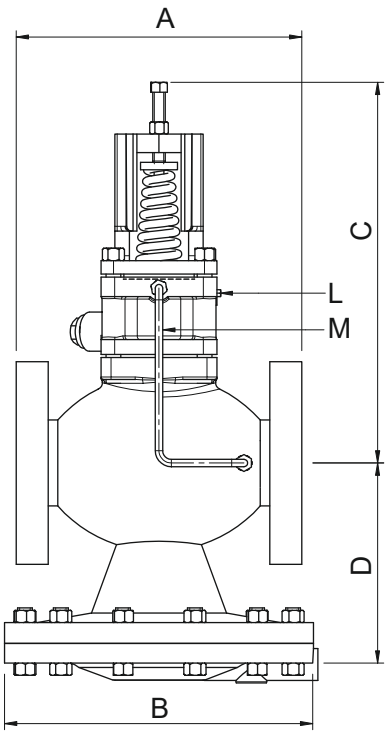
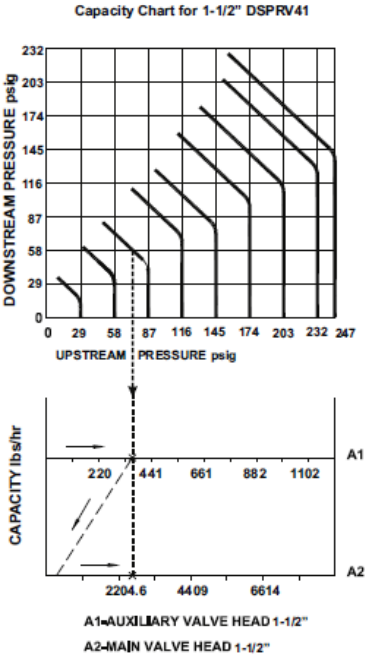


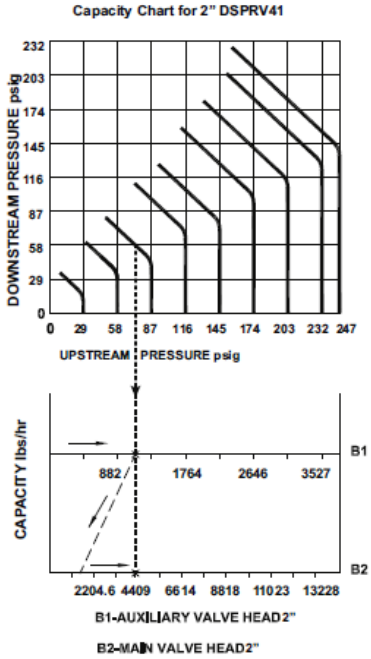
Figure 2 : Dimensional Drawing of DSPRV41

Dimensions (approx.) in inch and lbs

Size	Flange A	B	C	D	Weight(lbs)
1-1/2”	8.3”	9.9”	12.2”	6.8”	88
2”	9.1”	9.9”	12.2”	6.8”	92.6

3.8 Capacity Chart:





Note:

The capacities quoted above are based on valves fitted with an external pressure sensing pipe. Reliance on the internal pressure sensing pipe will mean that capacities may be reduced. In the case of low downstream pressure this reduction could be up to 30% of the valve Capacity.

How to use the chart:

Saturated Steam

From the intersection of the required upstream and downstream pressures, draw a perpendicular line until it intersects horizontal line A2.

This intersection represents the maximum valve capacity, approximately 2,650 lb/hr, when both the main and auxiliary valve heads are open.

In the same example, for flow requirements below approximately 330 lb/hr (intersection of the vertical line with horizontal line A1), only the auxiliary valve head remains open, while the main valve head stays closed.

This operating principle significantly improves flow turn down capability.

Superheated steam:

Due to the higher specific volume of superheated steam, a correction factor must be applied to the capacity obtained from the saturated steam chart.

For ≈ 100 °F of superheat, apply a correction factor of 0.95

For ≈ 180 °F of superheat, apply a correction factor of 0.90

Using the saturated steam example above:

A DN 40 valve with a saturated steam capacity of 2,650 lb/hr would pass:

≈ 2,520 lb/hr with 100 °F superheat

(2,650 × 0.95)

4. Product Working Principle: (Refer to Figure 1)

A double seated pressure reducing valve DSPRV41 balances the downstream pressure through the pressure sensing pipe **(25)** against the pressure adjustment spring **(5)**. This in turn moves the pilot valve plunger **(10)** in the pilot valve assembly **(10, 11, 12, 13, and 14)**, to modulate a control pressure which is directly proportional to the pilot valve opening. This control pressure is transmitted to the underside of the main diaphragm **(29)** through the control pipe **(33).** This movement in the diaphragm **(29)** pushes the pushrod **(31)** up, as both main valve head **(21)** and auxiliary valve head **(22)** are guided by the push rod **(31)** and operate in a sequence depending on the flow demand of application connected at the outlet.

When the flow demands are low – only auxiliary head **(22)** gets lifted thus maintaining constant downstream pressure. Under stable load and high flow conditions, both main valve head **(21)** and auxiliary head **(22)** are lifted. When the flow demands drops, the main valve head **(21)** along with push rod **(31)** travels downwards to close over the main valve seat **(24)**. If the flow demand falls further then auxiliary head **(22)** also starts closing over the main valve head **(21)** with further downward movement of push rod **(31).**

When downstream pressure rises, the pressure under the pilot diaphragm **(8)** becomes greater than the force created by the pressure adjustment spring **(5)** and this makes pilot diaphragm **(8)** to move upwards. This closes the pilot valve seat **(11)** and will interrupt the transmission of steam pressure underneath the main diaphragm **(29)**. The top of the main diaphragm **(29)** is always subjected to downstream pressure at all the times and, as there is more pressure above the main diaphragm **(29)** than below, the main diaphragm **(29)** moves down pushing the steam underneath it into the downstream outlet through the control pipe **(33)** and surplus pressure orifice. The pressure on either side of the main diaphragm **(29)** is balanced, and a small excess force created by the main valve return spring **(20)** closes the main valve seat **(24)**.

Any variation in load or pressure will immediately be sensed on the pilot diaphragm **(8**), which will act to adjust the position of the main valve accordingly, ensuring a constant downstream pressure.

5. Installation Guidelines:

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.

5.1 Fitting:

The valve should always be fitted in a horizontal pipeline with the main diaphragm chamber below the line (figure 3). For pressure turn down in excess of 10 to 1 consideration should be given to using the two valves in series. To avoid instability pipework volume between the valves should be equivalent to atleast 50 pipe diameters in length of the intermediate correctly sized pipework. To ensure adequate drainage of the space between the two reducing valves a trap set should be fitted as shown in figure 4.

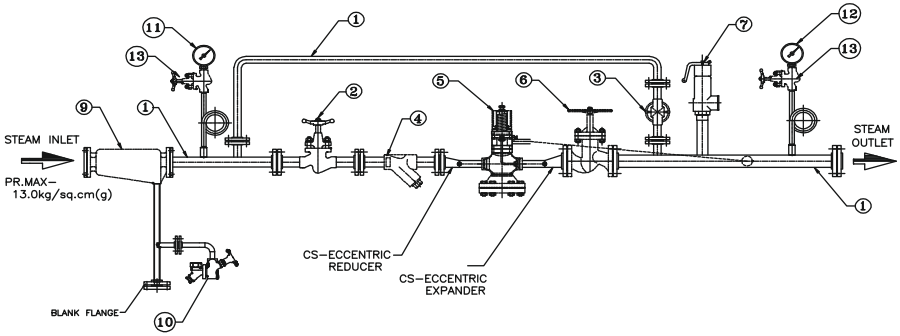


Figure 3 : Recommended installation of DSPRV41
***This is a typical representation of Double Seated Pressure Reducing Valve**

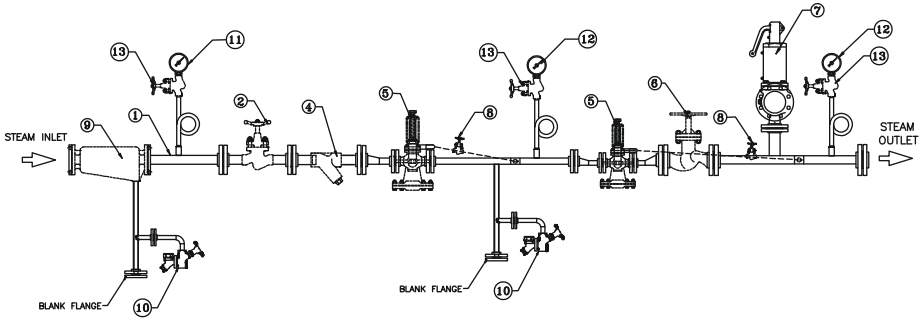


Figure 4 : Installation of Two DSPRV41
***This is a typical representation of Double Seated Pressure Reducing Valve**

Sr. No.	DESCRIPTION
1	Interconnecting Pipework for Pressure Reducing Station
2	Stop Valve (Inlet)
3	Stop Valve (Bypass)
4	Strainer
5	Double Seated Pressure Reducing Valve
6	Stop Valve (Outlet)
7	Safety Valve
8	Stop Valve (Pressure Balancing Line)
9	Moisture Separator
10	Drain Trap Assembly
11	Dial Pressure Gauge (Inlet)
12	Dial Pressure Gauge (Outlet)
13	Stop Valve (Dial Pressure Gauge)

5.2 Pipeline sizing:

The piping on both sides of the valve must be sized so that velocities do not exceed 30 m/s. This means that a properly sized valve will be smaller than the connecting pipe work.

5.3 Pipeline stresses:

Line stresses caused by expansion or inadequate support should not beimposed on the valve body.

5.4 Isolating Valves:

These should preferably be of the fullbore type.

5.5 Removal of condensate:

It is recommended that a separator with trap set is fitted upstream of the valve to ensure dry steam conditions. If there is a rise in the low pressure line from the valve then a further drain point should be provided to keep the valve drained after shutdown.

5.6 Protection from dirt:

The valve should be protected by a pipe line strainer with 100 mesh screen. The strainer should be fitted on its side to prevent the accumulation of water.

5.7 Pressure Control Pipe:

For applications requiring closer pressure control, improved operational stability, or maximum capacity, the internal balance pipe should be replaced with an external pressure-sensing pipe (to be supplied by others), as detailed below.
Remove the internal balance pipe assembly.
The resulting 1/8 in. BSPT tapping in the side of the valve body shall be blanked off using the plug provided in the linen bag attached to the valve.
The 1/4 in. BSPT tapping in the side of the pilot valve chamber shall be used for connection of the external pressure-sensing pipe. This tapping is suitable for connection to a pipe of approximately 0.54 in. outside diameter. If a suitable pipe is not available, the compression fitting may be removed and a 1/4 in. nominal bore steel pipe may be screwed directly into the pilot valve chamber. The pressure-sensing pipe shall be connected to the top of the reduced-pressure main at a location where, in either direction, there is a straight, uninterrupted pipe length of at least 3.28 ft or 15 pipe diameters, whichever is greater. The sensing pipe shall be installed with a continuous downward slope toward the main line, ensuring that any condensate drains away from the DSPRV41 valve. Where the size of the reduced-pressure main makes it difficult to maintain the required downward slope when connecting at the top of the pipe, the pressure-sensing pipe may alternatively be connected to the side of the main.

5.8 Pressure gauges:

It is essential to fit a pressure gauge on the downstream side so that thevalve can be properly set and monitored.

5.9 Continuous Duty:

For continuous duty applications where a constant steam supply is essential then a parallel stand- by PRV station is recommended to allow for planned maintenance. Alternatively a by-pass line can be used (see fig 6). It is important that the by-pass should have a similar capacity to the pressure reducing valve which is achieved by choosing an appropriately sized valve or by using a reduced orifice in the line.

The hand wheel should be pad locked to prevent unauthorised use, and when in use should be under constant manual supervision.

The by-pass may be arranged above or to the side of the main assembly but never below it.

5.10 Safety valve:

A safety valve should be fitted to protect the down steam equipment from excessive pressure. It should be set to lift below the safe working pressure of the downstream equipment and will normally be sized to pass the full capacity of the PRV. The safety valve set pressure should take account of its re seat characteristics and the 'No-load' pressure setting of the PRV. For example, the typical blowdown value (re seat differential) for a DIN type safety valve is 10% of the set pressure. The minimum possible safety valve set pressure must there for equal the no-load set pressure of the reducing valve plus the blowdown value of the safety valve plus a small margin of atleast 0.1bar. If the safety valve lifts and the working pressure is too close then it will not be able to close properly and will simmer, create a leak which is often wrongly diagnosed as a result of a leaking reducing valve.

Discharge pipe work should be taken to a safe place.

5.11 Position in relation to other control valves:

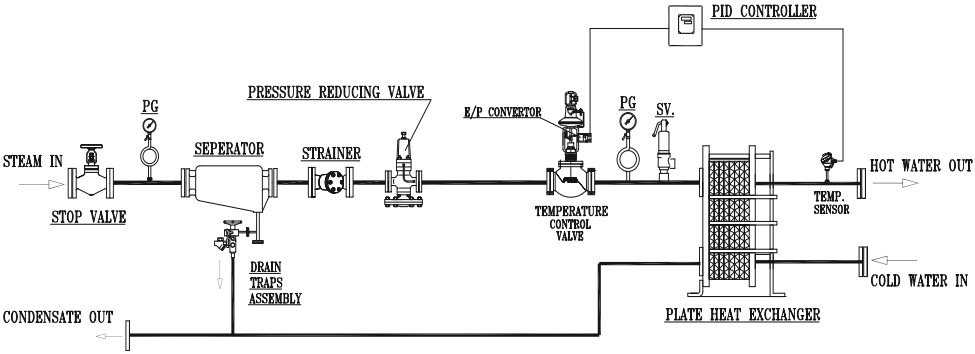


Figure 5 : DSPRV41 position in relation to other control equipment

***This is a typical representation of DSPRV41 position in relation to other control equipment.**

Line or system stop valve, either remotely actuated or manually, should be installed on the upstream side of the Double Seated Pressure Reducing Valve DSPRV41.

Where there is downstream control equipment, particularly temperature control valve, ensure the control equipment is atleast 50 pipe diameters away from the DSPRV41 to prevent pressure pulses being transmitted back causing unstable operation and premature wear or if this is impractical an intermediate vessel can provide a similar benefit.

Where a safety valve is required to protect the system downstream of a DSPRV41 and where a control valve is also being used downstream of the DSPRV41, it is recommended that the safety valve is fitted downstream of the control valve rather than in between the DSPRV41 and the control valve. If any slight leakage occurs this will avoid any pressure build-up causing nuisance operation of the safety valve but provide complete protection for the downstream system.

Where valves are installed downstream of the DSPRV41 the intermediate downstream pipework must be properly trapped to ensure no condensate can build up on the downstream side of the DSPRV41.

6. Startup and Commissioning : [Refer figure 3]

1. Ensure that all connections are properly made and that all stop valves **(2, 3 and 6)** are closed.
2. Close all valves **(2, 3 and 6)** at reducing valve station, including valves on bypassline if fitted.
3. Check that adjustment screw of the Double Seated Pressure Reducing Valve, DSPRV41 **(5)** is turned fully anti-close wise until spring is slack.
4. Check that the pressure gauge isolating valve **(13)** are open.
5. For correct operation of the DSPRV41 it is important that the pilot and main valves are not subjected to dirt or other hard particles .Therefore, prior to bringing the DSPRV41 **(5)** into operation ensure that the upstream pipework has been cleared of all the loose dirt and hard particles and that the main strainer screen **(4)** is examined and cleaned if necessary.
6. Slowly open the upstream isolating valve **(2)** until it is fully open.
7. Using a suitable sized spanner slowly turn adjustment screw of DSPRV41 **(5)** in a clockwise direction until desired downstream pressure reading is obtained.
8. Holding the adjustment screw of DSPRV41 **(5)** in position with the spanner tighten down the lock-nut to secure the setting of the adjustment spring.
9. Slowly open the downstream valve **(6)** until it is fully open.

Note: After installation or maintenance ensure that the system is fully functional. Carry out tests on any alarms or protective devices. It is recommended that after commissioning the pilot filter is changed and the spare one (supplied with the valve) is fitted.

7. Maintenance Guidelines:

Before undertaking any maintenance on the valve it must be isolated from both supply line and return line and any pressure should be allowed to safely normalize to atmosphere. The body gasket (all DSPRV41derivatives) and actuating chamber gasketcontains a thin stainless steel support ring which may cause physical injuryif not handled and disposed of correctly.

7.1 Routine and Preventive Maintenance:

Please refer to the maintenance schedule mentioned in the table below to undertake routine maintenance of the DSPRV41.

NO.	PARAMETERS TO BE CHECKED	FREQUENCY FOR CHECKING VARIOUS PARAMETERS					
A	PRESSURE REDUCING VALVE	Daily	Weekly	Monthly	Quarterly	Half Yearly	Annually
1	Clean Main valve strainer					Y	
2	Clean Pilot valve chamber assembly kit					Y	
3	Check & clean Main / Pilot diaphragm						Y
4	Clean SS tube & stud coupling with split pin					Y	
5	Main valve cleaning					Y	
6	PRV overhauling and push rod checking						Y
7	PV Chamber Strainer					Y	

7.2. Tool Kit:

To carry out maintenance of the pressure reducing valve DSPRV41 refer the tools mentioned in the table below.

Size	Component	Tool used and Size
DN 40	Main valve assembly (31mm slot and OD 37mm)	Customer made tool has to be designed.
	Veriner to measure depth and lift of the push rod (main valve head and seat assembly)	0.177 in lift
DN 50	Main valve assembly (42mm slot and OD 49 mm)	Customer made tool has to be designed.
	Veriner to measure depth and lift of the push rod (main valve head and seat assembly)	0.189 in lift
DN 40 / 50	Push rod lock nut	Open spanner 17mm (A/F)
	Stud coupling and long nut on lower plate	Box spanner 13 mm (A/F)
	M12 bolt and nut for bottom plate assembly	Box spanner 19 mm (A/F)
	Split Nut	Nose Plier
	Pilot Valve Chamber Assembly	
	M16 stud	Stud Runner M16 X 2.0
	Nut	Ring spanner 24mm (A/F)
	Strainer cap	Box spanner 19 mm (A/F)
	Pilot valve seat	Open spanner 19mm (A/F)
	M10 bolt for housing and spring	Box spanner 17 mm (A/F)
	4 No. control pipe (elbow fitting)	Open spanner 13 mm (A/F)
	Low drain	Open spanner 11mm (A/F)

7.3. Procedure to renew the pilot filter element: (Refer to Figure 6)

1. Isolate the reducing valve and depressurize the system completely.
2. Unscrew the filter cap**(1)** and carefully withdraw the filter element**(2)**.
3. Replace the element and tighten the filter cap to 90 – 100 Nm.

   Note: The gasket is re-usable.

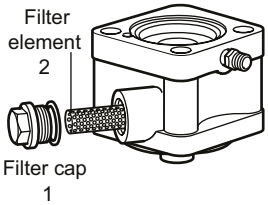


Figure 6 : Filter element

7.4. Procedure to renew or change the pressure adjustment spring: (Refer to Figure 7)

Isolate the reducing valve and completely depressurize the system in order tochange the pressure adjustment spring.

1. Release the adjustment lock-nut **(2)** by turning in the anticlockwise direction.
2. Turn the adjustment screw **(1)**anticlockwise. Ensure thereis no compression on the pressure adjustment spring**(4)**.
3. Undo the 4 off spring housing securing nuts and bolts **(3)** and removethe spring housing.
4. Remove and replace the pressure adjustment spring **(4)** and the top spring plate**(5)**.
5. Reassemble in reverse order.

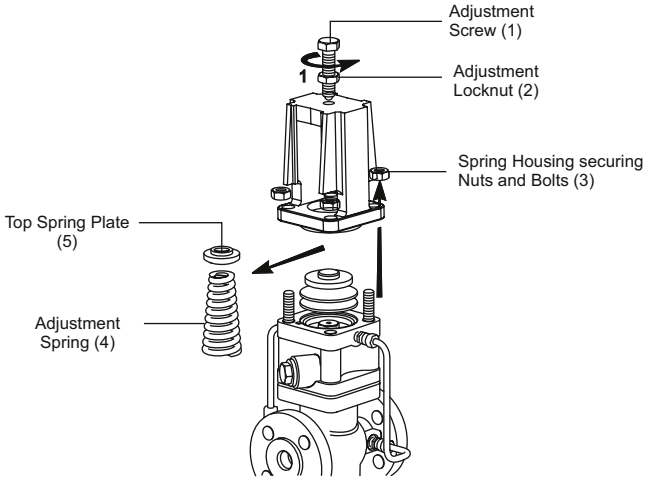


Figure 7 : Pressure adjustment spring

7.5. Procedure to renew the pilot valve assembly: (Refer to Figure 8)

1. Unscrew the unions of balancing pipe and controlling pipe **(1)** and release the pipe work.
2. Unscrew spring housing securing nuts and bolts **(2)**, thereby releasing the spring housing, spring **(3)**, top spring plate **(4)**, bottom spring plate **(5)** and pilot diaphragm **(6).**
3. Unscrew and remove the pilot valve assembly**(7)** (19 mm A/F). The pilot assembly has an integral PTFE seal.

The following handling precautions should be observed.

Handling precautions for PTFE

Within its working temperature range PTFE is a completely inert material, but when heatedto its sintering temperature it gives rise to gaseous decomposition products or fumeswhich can produce unpleasant effects if inhaled. Fumes can be produced duringprocessing: for example, when the material is heated to sinter it, or when brazedconnections are being made to cable insulated PTFE. The inhalation of these fumes is easily prevented by applying local exhaust ventilation to atmosphere as near to theirsource as possible.

Smoking should be prohibited in workshops where PTFE is handled because tobaccocontaminated with PTFE will during burning give rise to polymer fumes. It is thereforeimportant to avoid contamination of clothing, especially the pockets, with PTFE and tomaintain a reasonable standard or personal cleanliness by washing hands and removingany PTFE particles lodged under the fingernails.

4. Screw the new pilot valve into the housing. Torque required is 33.2–36.9 ft·lbf
5. Check that there is a very slight clearance between the top of the plunger and a straight edge placed across the diaphragm location recess.

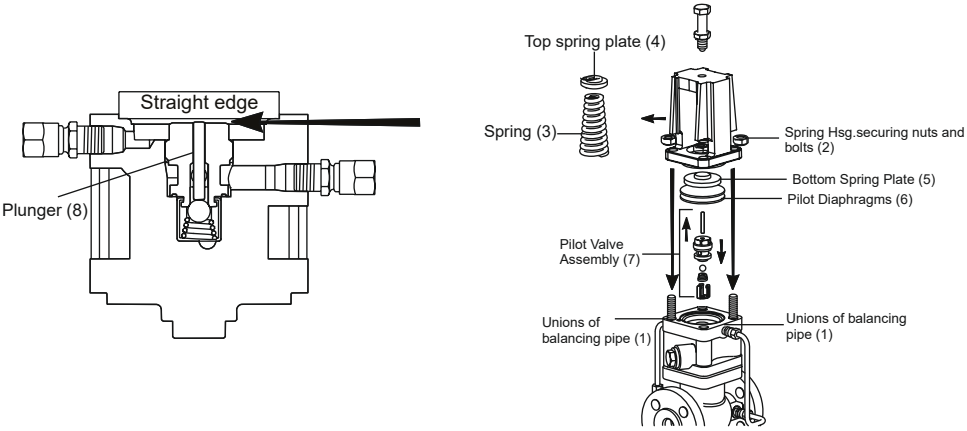


Figure 8 : Pilot valve assembly

6. Refit the two pilot diaphragms**(6)** and ensure that all contact faces are clean. Diaphragms showing signs of wear or damage should be replaced.
7. Replace the bottom spring plate**(5)**.
8. Assemble the spring housing and tighten the nuts to the recommended torques as shown in Table 1.

SIZE OF VALVE	NUT SIZE	TIGHTENINGA TORQUES
1-1/2" & 2"	M12	33.2–36.9 ft·lbf

Table 1 : Recommended tightening torques for spring housing nuts

7.6. To renew the pilot valve assembly: (Refer to figures 9)

Isolate the reducing valve and zero the pressure.

1. Unscrew the unions of balancing pipe and controlling pipe **(1)** and release the pipe work
2. Unscrew spring housing securing nuts and bolts **(2)**, thereby releasing the spring housing, spring **(3)**, top spring plate **(4)**, bottom spring plate **(5)** and pilot diaphragm **(6).**

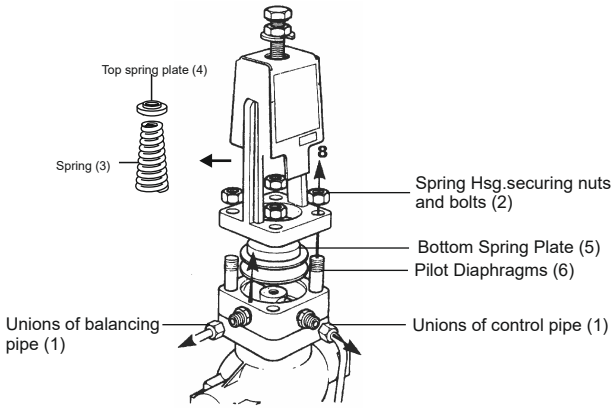


Figure 9 : Disassembling the pilot valve assembly

3. Remove pilot valve housing.
4. Ensure main return spring is still in position.
5. Unscrew and remove pilot valve assembly(22 mm A/F)
6. Screw new pilot valve into housing. Torque 33.2–36.9 ft·lbf
7. Check that there is a very slight clearance between the top of the plunger and a straight edge placed across the diaphragm location recess.

Note: The plunger is usually longer than what is required owing to production tolerances. In order to achieve the correct length, it is generally necessary to grind or machine material of the top end. Ensure the sharp edges formed as a result of machining are removed, as these can damage the diaphragm.

7.7. Procedure to clean or replace the internal strainer screen: (Refer to Figure 10)

Isolate the reducing valve and zero the pressure.

1. Unscrew the unions **(1)** and release the pipework.
2. Unscrew the spring housing securing nuts and bolts **(2)**.
3. Remove the pilot valve housing **(3)**.
4. Remove the internal strainer screen **(4)** and clean or replace.
5. Ensure the gasket**(5)** faces are clean.
6. Check that the main valve return spring**(6)** is in position.
7. Fit a new gasket.
8. Replace the internal strainer screen.
9. Assemble the pilot valve housing **(3)** complete with spring housing assembly **(2)** and tighten the nuts to the recommended torques as shown in Table 1.
10. Refit the pipework and retighten union to ensure tight seal. Bring the valve into commission , following as many steps as necessary in section 6.

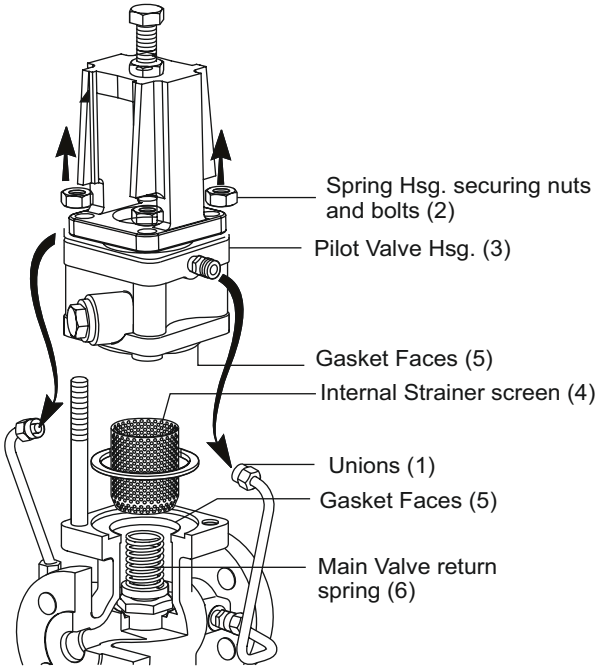


Figure 10 : Procedure to clean or replace the internal strainer screen

7.8. Procedure to renew the pilot valve diaphragms: (Refer to Figure 11)

Isolate the pressure reducing valve and zero the pressure.

1. Unscrew the unions of balancing pipe and controlling pipe **(1)** and release the pipe work.
2. Unscrew spring housing securing nuts and bolts **(2)**, thereby releasing the spring housing, spring **(3)**, top spring plate **(4)**, bottom spring plate **(5)** and pilot diaphragm **(6).**
3. Ensure the bottom spring plate **(5)** and pilot valve assembly is clean.
4. Replace the pilot valve diaphragms **(6)**.
5. Assemble the spring housing and tighten the nuts to the recommended torque as shown in table 1. Bring the valve back into commission following as many steps as necessary in section 6.

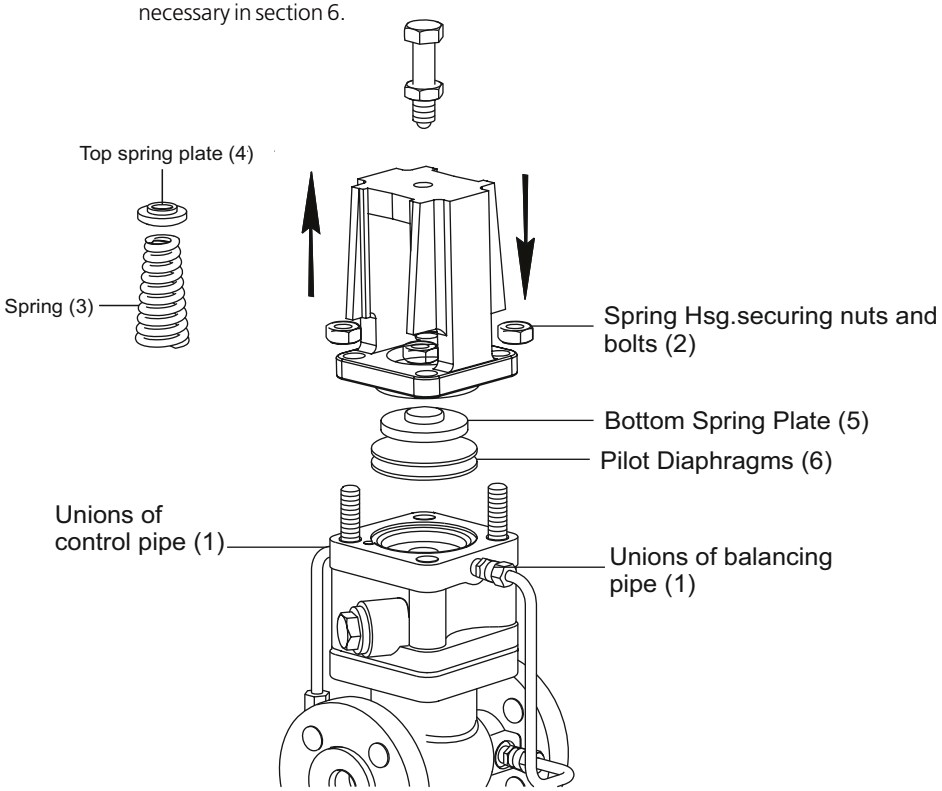


Figure 11 : Replacing/ Maintaining Pilot valve diaphragm

7.9. Procedure to renew or clean main diaphragms: (Refer to Figure 12)

Isolate the reducing valve and zero the pressure.

1. Undo the long union nut **(1)** and pull away.
2. Undo the M12 nuts and bolts **(2)**.
3. Drop away the lower diaphragm chamber**(3)**, the two main diaphragms**(4)**, diaphragm plate**(5)** andthe pushrod assembly**(6)**.
4. Thoroughly clean the lower diaphragm chamber**(3)** making sure contact faces are clean.
5. Replace the diaphragm plate **(5)** and pushrod assembly **(6)** and loosely fit the lower diaphragm chamber **(3)** on two bolts either side of the union connection **(See figure 13(b))** so that the spigot is located in to the recess.
6. Bring the two new diaphragms together and slide into position **(See figure 13(b)).** If the diaphragms are not renewed, but cleaned only, care must be taken to replacethe diaphragms in their original order.
7. Push the lower chamber **(3)** and tighten the M12 nuts and bolts **(2)**. Progressively and evenly tighten to a torque of 80 - 100 Nm **(See figure 13(c))**.
8. Retighten the long union nut to ensure a steam tight seal. **(See figure 13©)**.
9. Bring the valve back into commission, following as many steps as necessary in section 6.

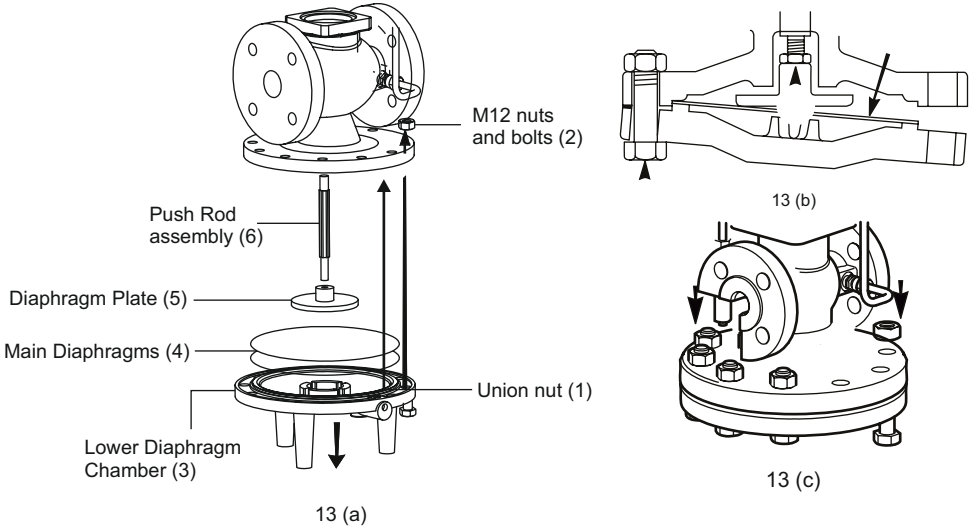


Figure 12 : Main Diaphragms

7.10. Procedure to service or renew the main valve and seat: (Refer to Figure 11, 12 & 13)

Isolate the reducing valve and zero the pressure.

For this section refer to figure 11

1. Unscrew the unions of balancing pipe and controlling pipe **(1)** and release the pipe work
2. Unscrew spring housing securing nuts and bolts **(2)**, thereby releasing the pilot valve housing **(3)**, complete with spring housing assembly **(4)**.

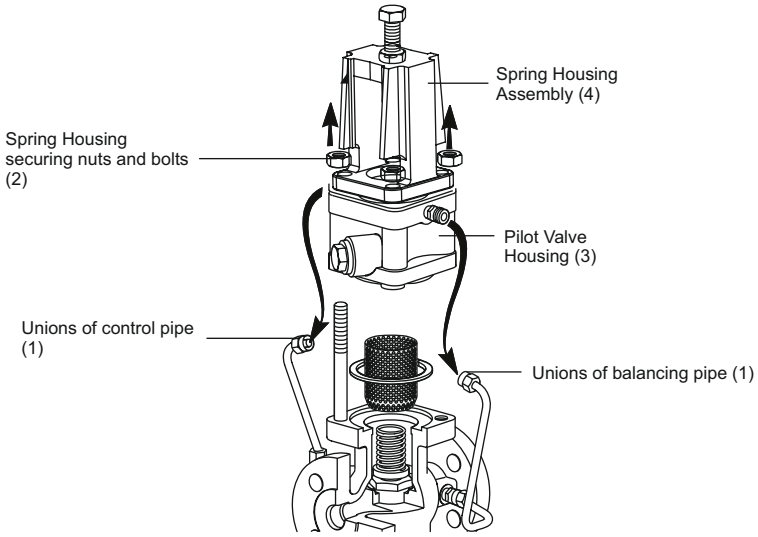


Figure 13 : DSPRV41

For this section refer to figure 12

3. Remove the strainer screen **(1)** and gasket **(2)** and clean.
4. Remove the main valve spring**(3)** and the main valve head**(4)**. Clean to remove dirt or scale as necessary.
5. Remove the main valve seat**(5)**. Clean and remove dirt and scale as necessary.
6. Examine the faces of the main valve head**(4)** and seat**(5)**. If they are only slightly worn they may be lapped on a flat plate using a fine grinding paste. If either is badly worn or unfit for further use they must be replaced.
7. Refit the valve seat **(5)** applying jointing compound to the seating faces and tighten to the recommended torque as shown in Table 2.

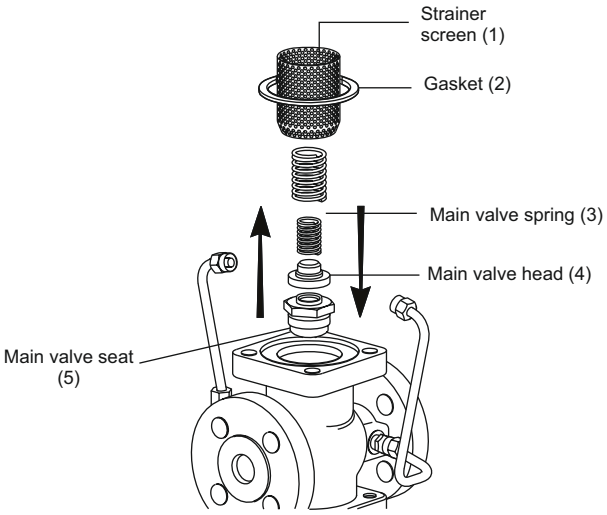


Figure 14 : Cleaning the main valve head and seat

Where a new part has been fitted it will be necessary to reset the main valve pushrod to give the correct valve lift: (Refer to Figure 13)

To do this it is necessary to expose the main diaphragm plate **(2)** and pushrod assembly **(5)**.

1. Undo the long nuts and pull away.
2. Undo the M12 nuts and bolts **(1)**.
3. Drop away the lower diaphragm chamber **(4)**, the two diaphragms **(3)**, and diaphragm plate**(2)** and pushrod assembly**(5)**.

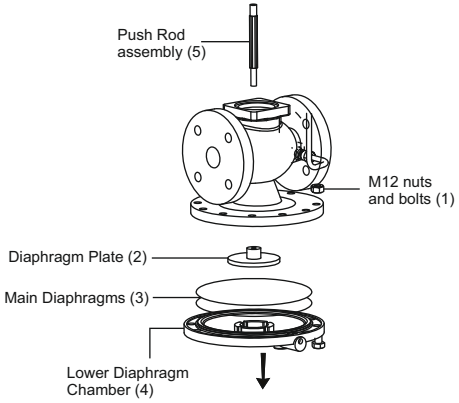


Figure 15 : Resetting the main valve pushrod

Size of valve	Width across flats	Tightening torques
1-1/2"	30 mm A/F (Inside)	332 – 361 ft·lbf
2"	41 mm A/F (Inside)	457 – 502 ft·lbf

TABLE 2 : TORQUE FOR MAIN VALVE SEAT

4. Refit the pushrod assembly.
5. Refit the main valve head, cum seat and auxiliary valve head, make sure valve locates on seat.
6. Check the valve lift shown in Table3 below using a depth gauge and adjust if necessary byscrewing the pushrod in or out of the diaphragm plate.

Size of Valve	Valve Lift	Lift of auxiliary valve head for reference
1-1/2"	0.196 inch	0.0787 inch
2"	0.261 inch	0.11 inch

Table 3 VALVE LIFT

For this section refer to figure 17

7. Thoroughly clean the lower diaphragm chamber**(4)** making sure contact faces are clean.
8. Replace the diaphragm plate **(2)** and pushrod assembly **(1)** and loosely fit the lower diaphragm chamber on two bolts **(5)** either side of the union connection to locate the spigot in the recess.
9. Refit the diaphragms **(3)** in exactly the same way as when they were dismantled.
10. Push the lower diaphragm chamber **(4)** home to locate in the recess and refit the M12 nutsand bolts. Progressively and evenly tighten to a torque of 80 - 100 N m.
11. Retighten the long union nut to ensure a steam tight seal.

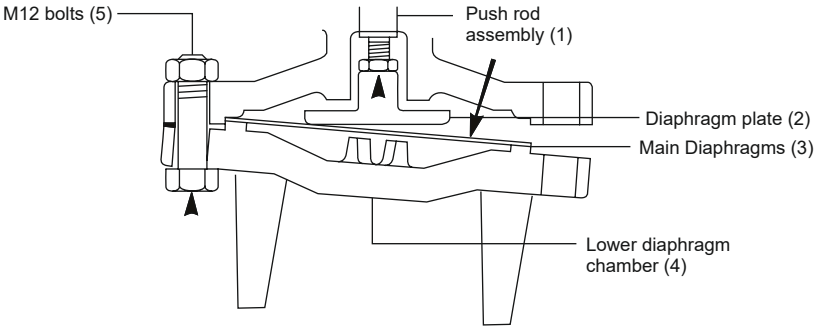


Figure 16 : Resetting the main valve pushrod

7.10. Procedure to reassemble the valve: (Refer to Figure 15)

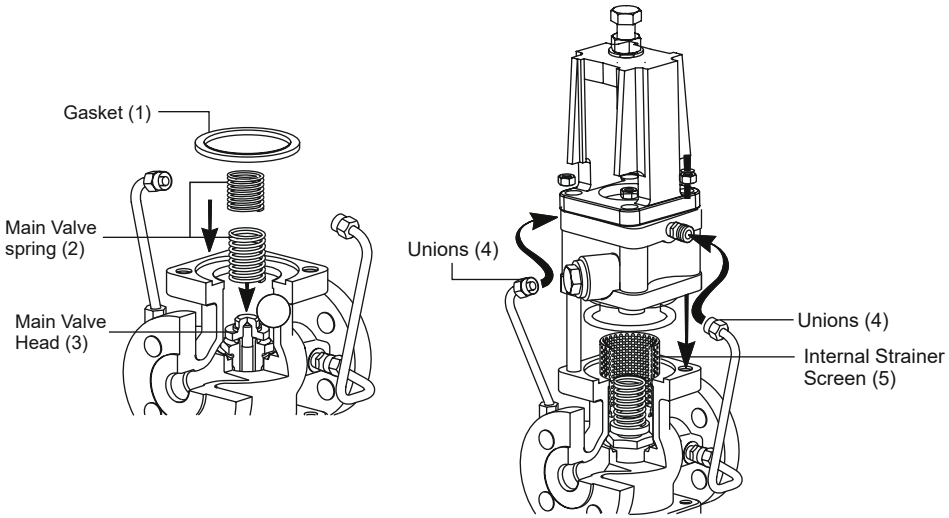


Figure 17 : Reassembling

1. Refit the main valve head **(3)**.
2. Replace the main valve return spring**(2)**.
3. Fit a new gasket**(1)**.
4. Replace the internal strainer screen**(5)**.
5. Assemble the pilot valve housing complete with spring housing assembly and tighten the nuts to the recommended torques.
6. Refit the pipework and retighten the unions**(4)** to ensure a tight seal. Bring the valve back into commission, following as many Steps as necessary in Section 6.

8. Troubleshooting:

Before undertaking the following fault finding procedure, ensure the valve has been isolatedand that upstream and downstream pressures are zero. Possible fault checks are given in alogical 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 chamberare 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 Push rod is jammed in liner bush at lower position. Open & clean it.
	Main valve lift disturbed:	Check that pushrod lock nut is intact and 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 Pass isolation 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 Cause	Remedy
Downstream pressure is equal to upstream pressure	Pressure adjustment bolt	**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. **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 Mode	Possible Cause	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

9. Available Spares:

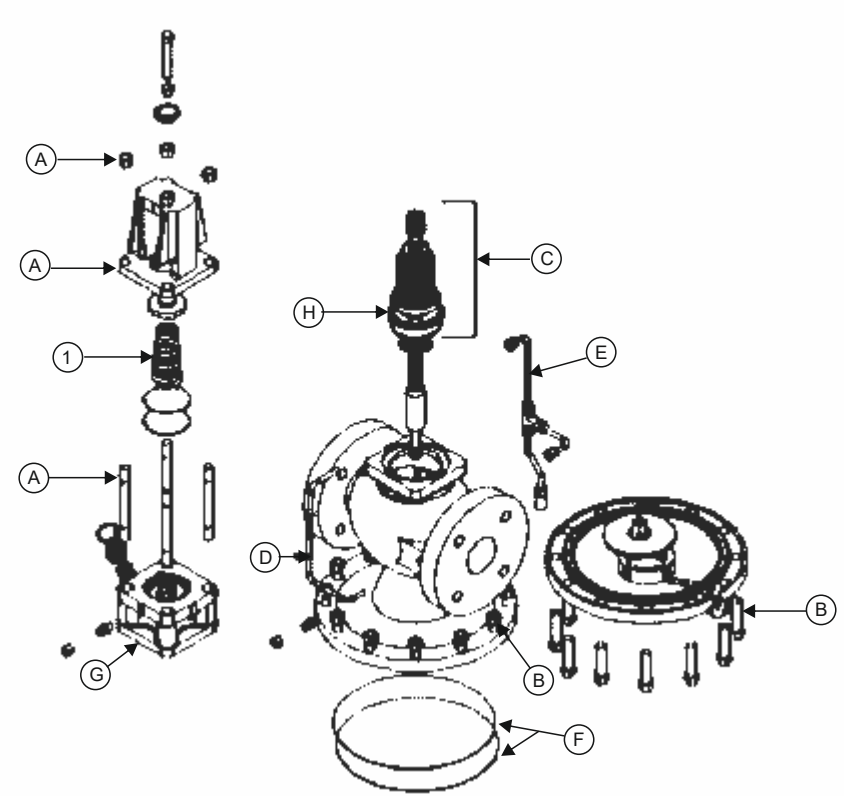


Figure 18 : Parts available as spares for DSPRV41

SR. NO.	Spares	Symbol	Spare code
1	SPRING HOUSING WITH STUD&NUT KIT FOR 1-1/2" & 2"	A	SPARE-4050FMPRV41-SHKIT
3	M.V. kit Assly.with Spring 1-1/2"	C	SPARE-040DSPRV41-MVSKIT
4	M.V. kit Assly.with Spring 2"	C	SPARE-050DSPRV41-MVSKIT
5	Control Pipe Assly. Kit 1-1/2"	D	S2055887
6	Control Pipe Assly. Kit 2"	D	S2055888
7	Pipe Assly. Kit 1-1/2"	E	S2055891
8	Pipe Assly. Kit 2"	E	S2055892
9	Main Diaphragm kit 1-1/2" & 2"	F	SPARE-4050FMPRV41-MDKIT
10	P.V. chamber Assly. Kit 1-1/2" & 2"	G	SPARE-4050DSPRV41-PCSKIT
11	Gasket kit 1-1/2" & 2"	H	SPARE-4050FMPRV41-BGKIT
12	Pressure adjustment conical spring	I	S2038822
13	Main Valve Return Spring kit 1-1/2" & 2"		SPARE-4050DSPRV41-MVRSKIT
14	1-1/2" REPAIR KIT		S20109255
15	2" REPAIR KIT		S20109256
16	Push Rod Assembly spare 1-1/2"		SPARE-40DSPRV41-PRKIT
17	Push Rod Assembly spare 1 2"		SPARE-50DSPRV41-PRKIT

How to Order:
1 no. Forbes Marshall Pilot Operated Pressure Reducing Valve, 1-1/2" DSPRV41 having a 3 – 247 psi(g) spring and flanged class 150 connections.

10. Warranty Period:

As per the ordering information and agreement in the contract.

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