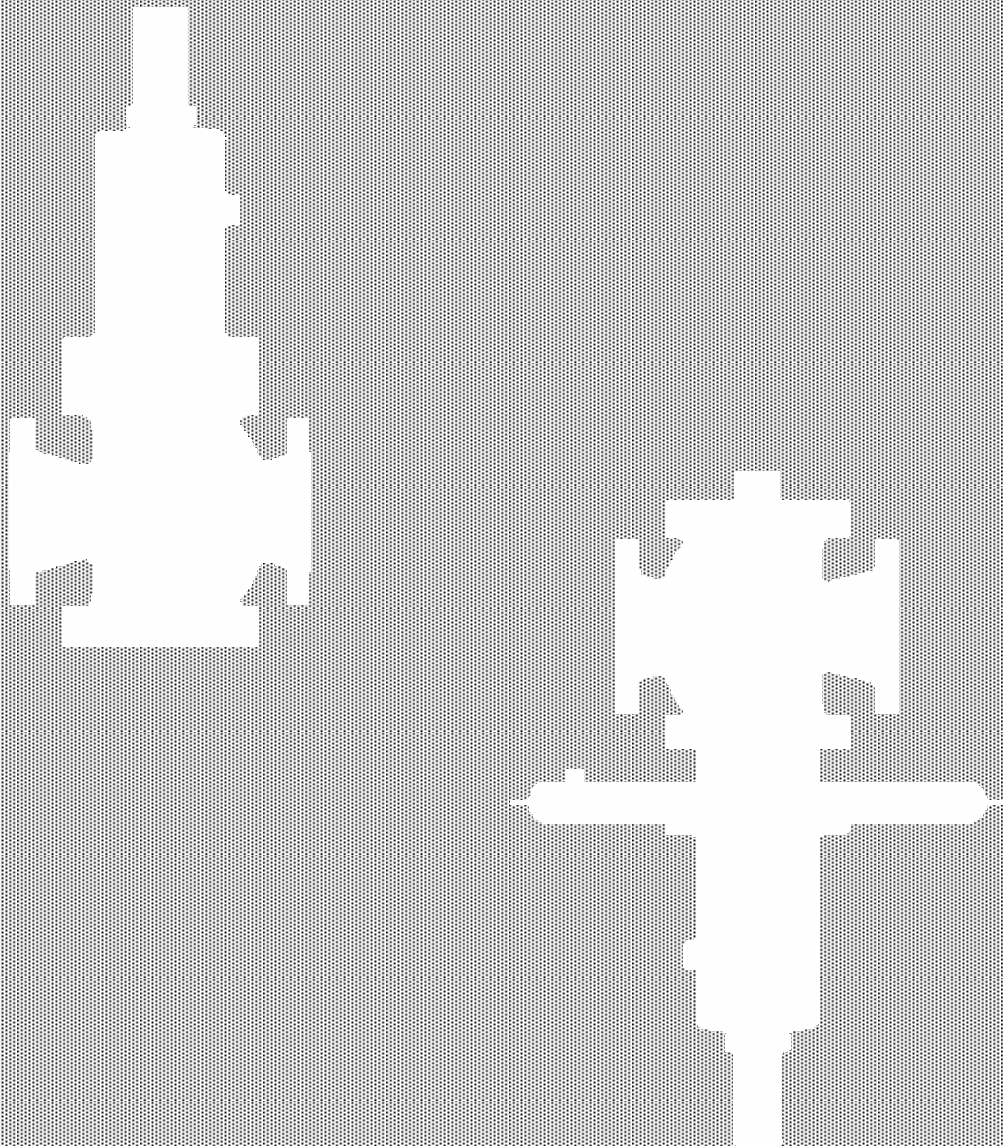




I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84





I N S T R U C T I O N S

**For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84**

MAIN INDEX

	<i>Page</i>
1. General information	3
2. Guarantee.....	3
3. Validità of instructions	3
4. Safety indications.....	4
5. Safety warnings	5
6. Safety precautions	6
7. Transport, handling and storage	7
8. BPM 71-72-73-74-81-82-83-84 pressure reducers and relief devices	8
Cross-section drawings BPM71-72.....	9
Cross-section drawings BPM73-74	10
Cross-section drawings BPM81-82.....	11
Cross-section drawings BPM83-84.....	12
9. Installation	13
10. Start-up and calibration	16
11. Maintenance.....	16
12. Repairs.....	19



I N S T R U C T I O N S

**For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84**

1. GENERAL INFORMATION:

1.1 - RIGHT TO MAKE MODIFICATIONS AND "COPYRIGHT"

The regulations, standards, etc. mentioned in these operating instructions are based on the knowledge that was available when they were drawn up and are not subject to modification. Users are responsible for applying the latest versions of these.

The supplier reserves the right to make modifications and technical improvements to data and information whenever it sees fit. Under no circumstances may users require modifications or improvements to be made to valves that have already been delivered.

2. GUARANTEE

The scope and duration of the guarantee are indicated in the manufacturer's "General Conditions of Sale".

The applicable conditions are those that were in force at the moment of delivery.

Amongst other things, the guarantee does not cover damage to valves deriving from the following:

- ° Ignorance or non-observance of these operating instructions!
- ° Insufficiently trained fitters, operators or maintenance men;
- ° Normal wear and tear;
- ° Incorrect or negligent use of the valves.

The manufacturer declines all liability for the following which are not covered by the guarantee:

- ° Non-observance of accident prevention regulations and/or safety legislation;
- ° Incorrect assembly, start-up or use;
- ° Improper or incorrect use, inappropriate use or different working conditions from those agreed.

Users are solely liable for physical injury and/or damage to property if the above is not observed.

3. VALIDITY OF INSTRUCTIONS

These instructions refer to pressure reducers and pressure relief devices:

BPM71 – BPM72 – BPM73 – BPM74

BPM81 – BPM82 – BPM83 – BPM84



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators type BPM71-72-73-74-81-82-83-84

4. PRODUCT SAFETY INDICATIONS AND TAG SYSTEM

If and where appropriate, safety indications have been put inside tags on the sides of the pages of this manual.

These rectangular tags are placed vertically (as shown in the following examples) and contain four different messages communicating:

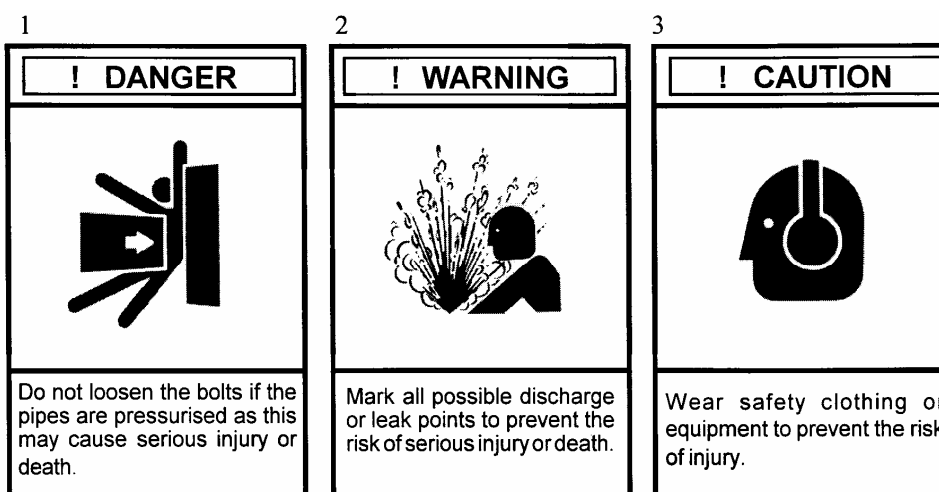
- The level of risk;
- The nature of the risk;
- The effects of the risk on people or products;
- Instructions, if necessary, on how to avoid the risk.

The box at the top contains a warning word (DANGER – WARNING – CAUTION – ATTENTION) which indicates the level of risk.

The box in the middle contains a drawing indicating the nature of the risk and its possible effects on people and property. In some cases, the drawing may suggest what preventive measures can be taken, such as wearing safety clothing.

The box at the bottom may contain a message with instructions on how to avoid the risk. In the event of risks for people, the message may also contain a more precise definition of the risk and its effects on people.

- 1) **DANGER** – Immediate risk which will certainly cause serious injury or death.
- 2) **WARNING** – Risk or hazardous behaviour which may cause serious injury or death.
- 3) **CAUTION** – Risk or hazardous behaviour which may cause minor injury.





I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators type BPM71-72-73-74-81-82-83-84

5. SAFETY WARNINGS

Thorough maintenance operations and overhauls are important for the safe and reliable operation of all valves.

The service procedures recommended by CARRARO and described in this manual are effective methods for carrying out maintenance operations. Please note that this service manual contains various warning and caution notices which should be read carefully in order to minimise the risk of injury to people or the possibility of using incorrect work methods which may damage the valves or make them unsafe. It is important to realise, however, that these warnings cannot be exhaustive.

CARRARO is unable to know, assess and inform customers or users of all the conceivable methods of performing maintenance operations and all the risks deriving from the use of such methods.

Consequently, CARRARO has not even attempted to start such a task. Therefore, whoever uses a service method or piece of equipment which is not recommended by CARRARO must make sure that neither his own or other people's safety, nor valve safety and performance are jeopardised by the chosen method.

In case of doubt about the method used, please contact CARRARO.

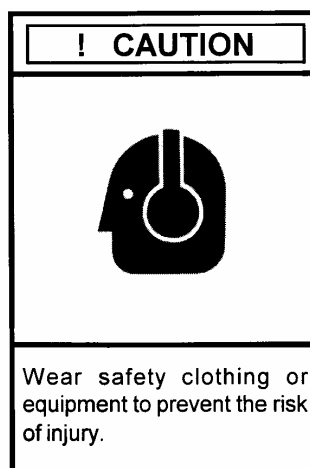
Testing, installing or dismantling the valves or accessories may cause you to come into contact with fluids at very high pressures or temperatures and/or corrosive or erosive, and capable of triggering potentially explosive atmospheres.

Therefore, take all safety precautions while testing, installing or dismantling the product; these include, wearing ear plugs, goggles and safety clothing, such as gloves, both in or near the work area.

Given the large number of conditions and circumstances that may arise while working on the products and the consequent risks deriving from the way this is done, CARRARO is not able to prevent all risks of injury to people and damage to property and can only help by asking you to take the utmost care and giving you the following safety suggestions.

Users of CARRARO products are responsible for training the staff that will use the product.

It is most important for these people to acquire a thorough knowledge of the instructions of the product, especially the ones contained in this manual.





I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84

6. SAFETY PRECAUTIONS

! DANGER



Decrease pressure and keep away from the discharge side when operating a valve in order to prevent serious injury or death.

! CAUTION



Wear suitable protection equipment in order to prevent injury.

! WARNING



Mark all possible discharge or leak points in order to prevent serious injury or death.

Always observe the current plant safety regulations together with the following indications:

°Wear safety clothing. Hot water can scald you and overheated steam is invisible.

° When dismantling a valve, wear safety clothing to prevent being sprayed by any process fluid that may have accumulated inside. Remember that this fluid may generate a potentially explosive mixture. Make sure the valve is isolated from any pressure source in the system before starting to dismantle it.

° Inspect/service the valves at least once a year.

°The outer surfaces of the valves reach the same temperature as that of the fluid flowing inside them. For this reason, when installing a valve in a potentially explosive atmosphere, make sure that the flashover temperature of the mixture surrounding the valve is safely above that of the fluid flowing inside the valve and do not allow inflammable powders to deposit on the outer surface of the valve.

° The system must be equipotential at the connection between the valve and the piping in order to prevent the accumulation of electrostatic electricity on the outer surfaces of the system that can act as an efficient flashover trigger in a potentially explosive atmosphere.

° Please consult CARRARO before working on valve parts.



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84

7. TRANSPORT, STORAGE AND HANDLING

! ATTENTION

Do not lift horizontally or attach to the lifting lever or the spring.

Transport

Depending on their size, valves can be transported loose, packed in cardboard boxes or in wooden crates.

All the valve ends are fitted with covers to prevent dirt from entering. Packs can be placed on pallets if required. Follow all and any indications written on the packaging.

! ATTENTION!

Operators moving loads must take all necessary precautions to prevent accidents.

! ATTENTION

Do not allow foreign bodies to entering the valve inlet and outlet.

Storage

Valves must be kept in a dry place to protect them from atmospheric conditions. They may only be removed from their crates or packing immediately prior to installation.

The end protections and covers must be kept on until the last moment. Valves, whether packed or not, must not be subject to violent knocks.

Valves, whether packed or not, must always be kept upright, that is, never lying on one side, in order to prevent distortion and damage to internal parts.

! ATTENTION

Handle with care. Do not drop or knock.

Handling

When unpacking the valves and removing the end protectors immediately prior to installation, take great care to make sure that foreign bodies do not enter the valve inlet and outlet holes while it is being connected.

! ATTENTION!

When handling the valve, make sure the work area is kept clear in order to prevent injury to people and damage to property.



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators type BPM71-72-73-74-81-82-83-84

8. PRESSURE REDUCERS AND RELIEFE DEVICES (BPM71-72-73-74-81-82-83-84)

This series of pressure regulators derives from the MM51 series and features an actuator with a covered externally air-tight seal; this prevents the controlled fluid from leaking if the diaphragm breaks. Similarly to the MM51 valves, the use of the spring actuator means that the force applied by the spring on the diaphragm varies according to the opening of the valve, and therefore the width of the proportional band range varies according to the stroke of the plug. The band may have a very small effect if the flow rate does not vary a lot. The BPM series is even more compact and can be installed, if necessary and with suitable preparation, in positions other than upright. It can also be installed in on-board systems; the sensing line may either be internal or external. Another feature is the absence of a packing gland; this reduce stem friction to a minimum and maximizes the response sensitivity of the regulator. The series is divided into 2 main groups, shown below with codes, versions and uses.

Group A - Downline pressure regulators (**reducers**):
single seat, metal tightness: BPM81
double seat, metal tightness: BPM71
single seat, elastomeric tightness: BPM83
double seat, elastomeric tightness: BPM73

Group B - Upline pressure regulators (**relief devices**):
single seat, metal tightness: BPM82
double seat, metal tightness: BPM72
single seat, elastomeric tightness: BPM84
double seat, elastomeric tightness: BPM74

Available versions

All the valve types are available with flexible inserts on the plug in order to ensure a perfect seal when the valve is closed. The code for this version changes from BPM71-72-81-82 to BPM73-74-83-84.

The materials generally used for seals are CR-FKM.

Other kinds of elastomer are available on request. The maximum operating temperature depends on the type of elastomer used.

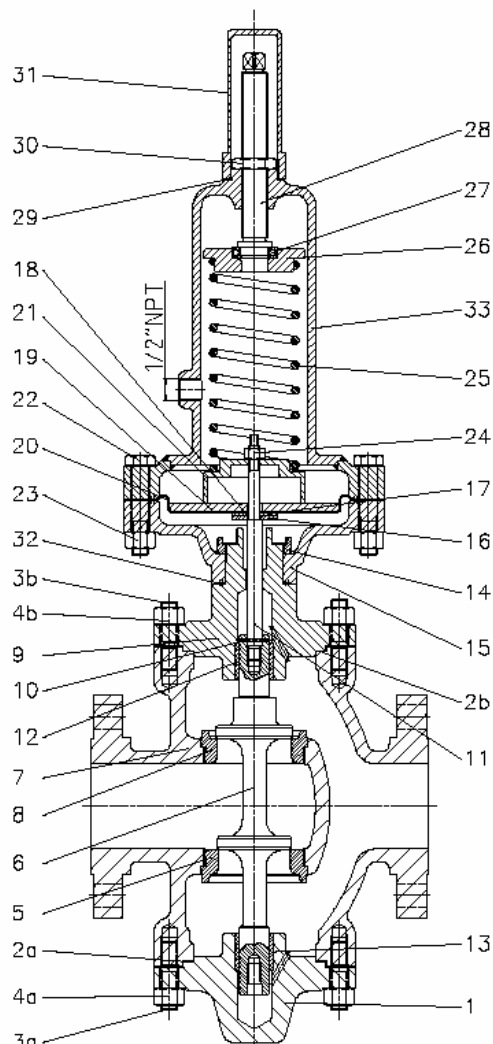
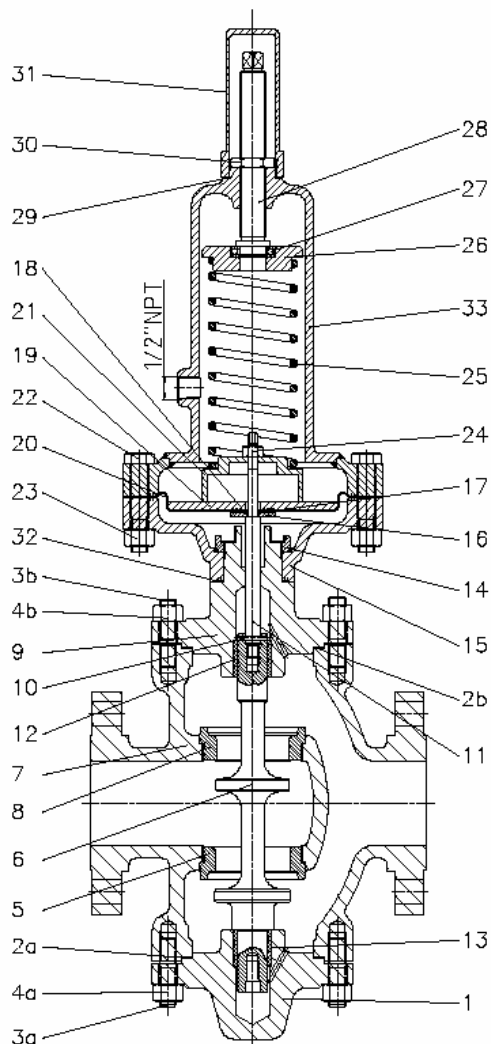
The cross-sections of the main versions of this type are shown in Fig.1→8.



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84

Cross-section drawings **BPM71 – BPM72** (Fig.1 – Fig.2)



1. Body cover
2. Gasket (a-b)
3. Studs (a-b)
4. Nuts (a-b)
5. Lower seat
6. Plug
7. Valve body
8. Upper seat
9. Bonnet
10. Pin
11. Plug stem
12. Upper plug guide bushing
13. Lower plug guide bushing
14. Actuator fastening ring
15. Lower diaphragm case
16. Lower diaphragm sealing plate
17. Upper diaphragm sealing plate

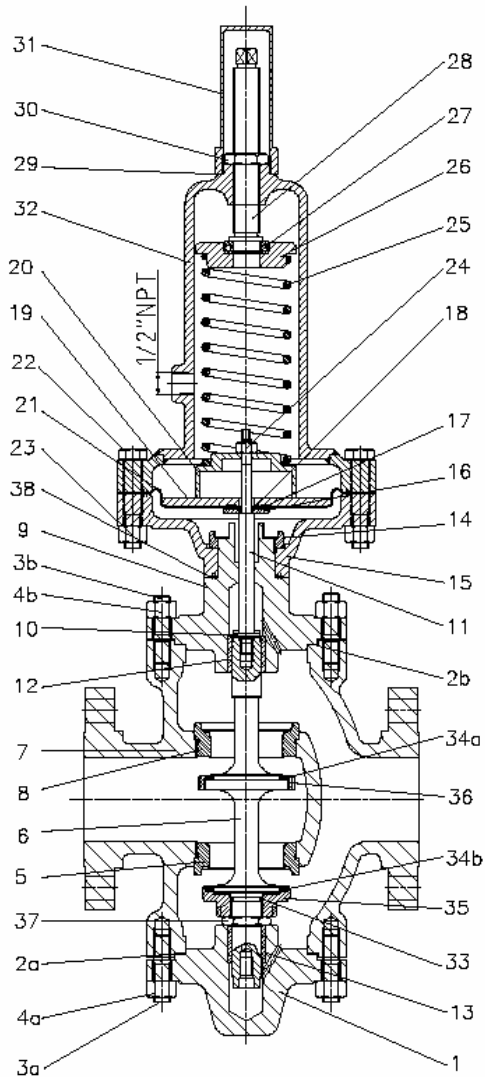
18. Diaphragm O-ring
19. Diaphragm plate
20. Diaphragm
21. Lower spring washer
22. Screw
23. Nut
24. Plug locknut
25. Spring
26. Upper spring washer
27. Bearing
28. Adjusting screw
29. Cap gasket
30. Adjusting screw locknut
31. Cap
32. Gasket
33. Spring case



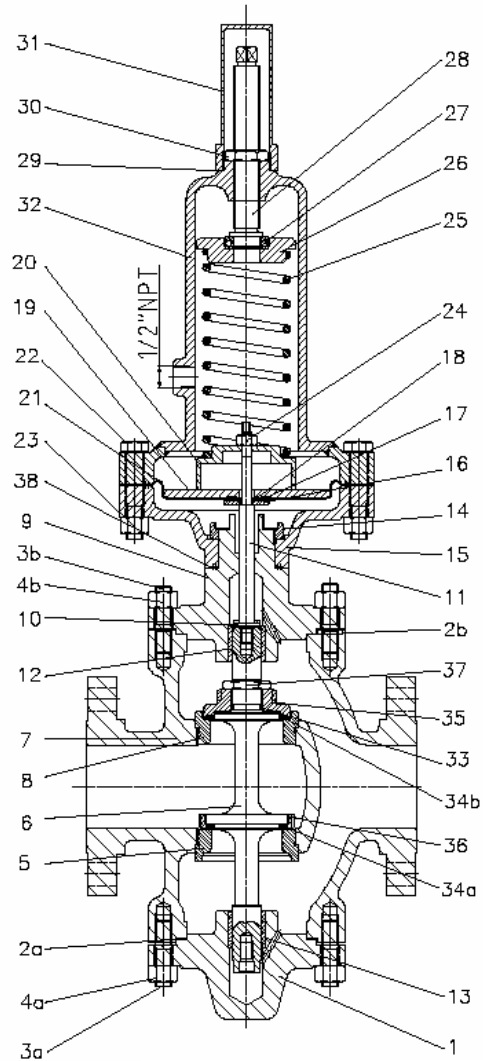
I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84

Cross-section drawings **BPM73 – BPM74** (Fig.3 – Fig.4)



1. Body cover
2. Gasket (a-b)
3. Studs (a-b)
4. Nuts (a-b)
5. Lower seat
6. Plug
7. Vave body
8. Upper seat
9. Bonnet
10. Pin
11. Plug stem
12. Upper plug guide bushing
13. Lower plug guide bushing
14. Actuator fastening ring
15. Lower diaphragm case
16. Lower diaphragm sealing plate
17. Upper diaphragm sealing plate
18. Diaphragm O-ring
19. Diaphragm plate



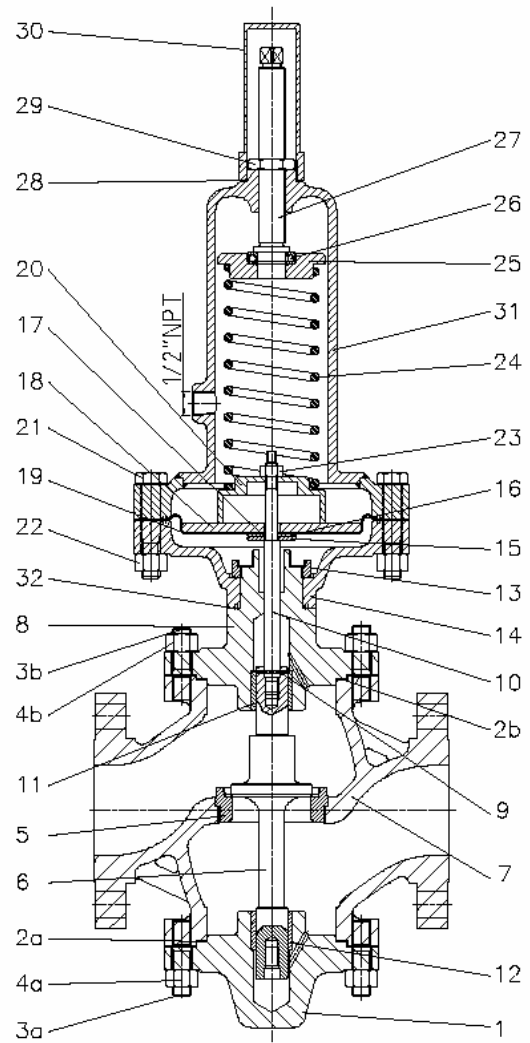
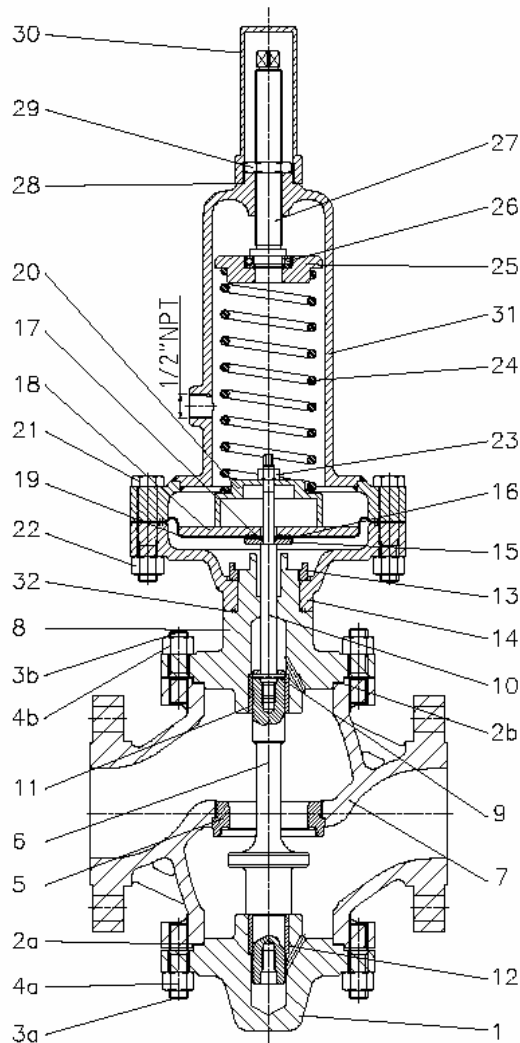
20. Lower spring washer
21. Diaphragm
22. Screw
23. Nut
24. Plug locknut
25. Spring
26. Upper spring washer
27. Bearing
28. Adjusting screw
29. Cap gasket
30. Adjusting screw locknut
31. Cap
32. Spring case
33. O-ring
34. Plug gasket (a-b)
35. Plug adjusting ring nut
36. Plug fastening ring
37. Locknut
38. Gasket



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84

Cross-section drawings **BPM81 – BPM82** (Fig.5 – 6)



1. Body cover
2. Gasket (a-b)
3. Studs (a-b)
4. Nuts (a-b)
5. Seat
6. Plug
7. Valve body
8. Bonnet
9. Pin
10. Plug stem
11. Upper plug guide bushing
12. Lower plug guide bushing
13. Actuator fastening ring
14. Lower diaphragm case
15. Lower diaphragm sealing plate
16. Upper diaphragm sealing plate
17. Diaphragm O'ring
18. Diaphragm plate
19. Diaphragm

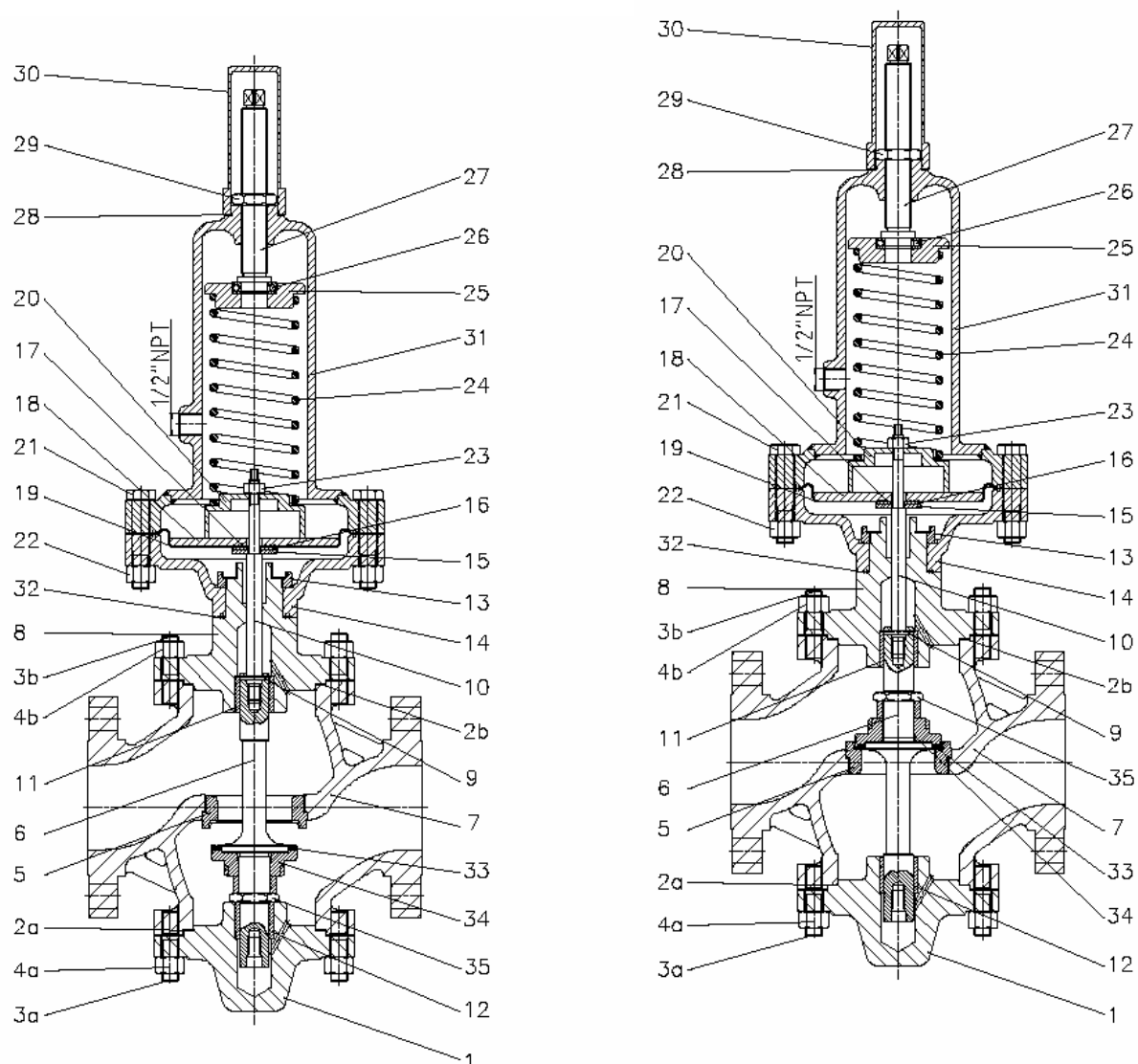
20. Lower spring washer
21. Screw
22. Nut
23. Plug locknut
24. Spring
25. Upper spring washer
26. Bearing
27. Adjusting screw
28. Cap gasket
29. Adjusting screw locknut
30. Cap
31. Spring case
32. Gasket



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84

Cross-section drawings **BPM83 – BPM84** (Fig.7 – 8)



- | | |
|-----------------------------------|-----------------------------|
| 1. Body cover | 19. Diaphragm |
| 2. Gasket (a-b) | 20. Lower spring washer |
| 3. Studs (a-b) | 21. Screw |
| 4. Nuts (a-b) | 22. Nut |
| 5. Seat | 23. Plug locknut |
| 6. Plug | 24. Spring |
| 7. Valve body | 25. Upper spring washer |
| 8. Bonnet | 26. Bearing |
| 9. Pin | 27. Adjusting screw |
| 10. Plum stem | 28. Cap gasket |
| 11. Upper plug guide bushing | 29. Adjusting screw locknut |
| 12. Lower plug guide bushing | 30. Cap |
| 13. Actuator fastener ring | 31. Spring case |
| 14. Lower diaphragm case | 32. Gasket |
| 15. Lower diaphragm sealing plate | 33. Plug gasket |
| 16. Upper diaphragm sealing plate | 34. Plug fastener ring |
| 17. Diaphragm O'ring | 35. Locknut |
| 18. Diaphragm plate | |



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators type BPM71-72-73-74-81-82-83-84

9. INSTALLATION

9.1. The reducing and pressure relief valves are installed upside-down (fig.B) in the following circumstances:

- If equipped with 345 o 515 actuator
- If used with steam
- In particular cases, if agreed with final user.

In the other cases, the standard installation is upright (fig.A)

An arrow on the valve indicates the direction of flow.

For further details, refer to the installation sketches.

9.2. Pressure sensing is internal as a standard configuration (fig. A-B), but can be supplied as external upon request. In the latter case, Connect the actuator to the pressure sensing downline (for pressure reducers) or upline (for pressure relief devices) with a 1/2" tube, at a distance from the valve of at least 10 times pipe diameter. The pressure sensing must always be connected to the side of the pipe or on top of it, never underneath, otherwise solid substances may obstruct the pressure sensing itself. To dismount the actuator, attach the joints in three pieces in the appropriate positions on the pressure sensing line.

9.3. Make sure the inside of the piping is clean before fitting the valve. Any solid particles circulating after start-up could seriously damage the seats of the regulators. If possible, carefully clean the piping, especially the part upline.

9.4. The installation of pressure gauges (on pressure sensing line or pipeline), check or by-pass valves, filters, is permitted according to the plant technical specification.

9.5. In case of any risk of pressure higher than the maximum allowable for the equipment, it is necessary to install a safety valve, without any check valve interposed.

9.6. **WARNING ON ATEX FORM** (ATEX Gr II Cat.2):

° In case of *non-flammable* fluids (e.g., inert gases like nitrogen, carbon dioxide, noble gases) the 1/2" NPT threaded discharge hole on the spring cover (see Figs.1÷8), in case of the diaphragm rupture, can discharge in atmosphere or can be connected to a tube for the process fluid conveyance.

° In case of *flammable* fluids the 1/2" NPT threaded discharge hole on the spring cover (see Figs.1÷8) must be connected to tube conveying the discharge in inert atmosphere (at atmospheric pressure) (see Fig. A).

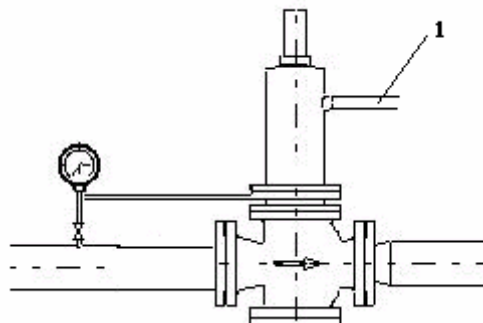
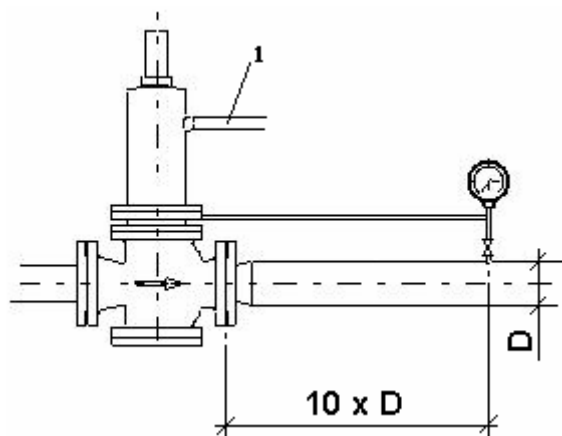


I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators
type BPM71-72-73-74-81-82-83-84

Downstream installation sketch (**Reducers**)
(actuators 120-130-140-182-245-320)

Upstream installation sketch (**Relief devices**)
(actuators 120-130-140-182-245-320)



1: tube to be connected in inert atmosphere
for **ATEX Gr.II Cat.II, flammable fluids**

Fig. A

Downline installation sketch (**Reducers**)
(actuators 345 o 515)

Upline installation sketch (**Relief devices**)
(actuators 345 o 515)

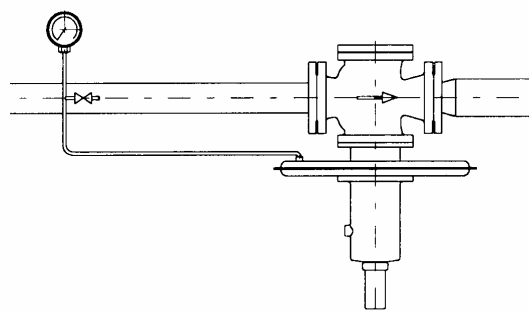
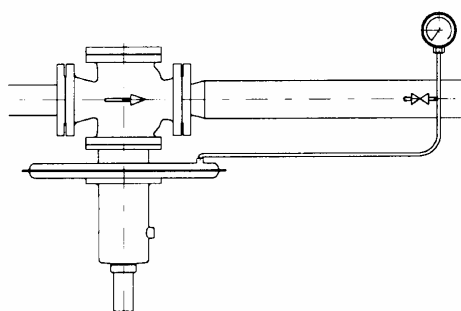


Fig.B



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators type BPM71-72-73-74-81-82-83-84

9.7. If in the plant there is the possibility that the pressure in contact with the diaphragm exceeds the maximum diaphragm rating, it is necessary to install the safety relief device shown in Fig. D. The device is mounted on the lower actuator flange, through a 3/8" Gas female threaded hole (on the opposite side respect the pressure sensing in case of external pressure sensing construction). It consists (see Fig. D) in a plug, pressed by a spring properly calibrated depending on the maximum diaphragm rating, that can move inside a cylindrical body, due to the fluid action, gradually discovering a 1/4" NPT threaded female discharge hole. The discharge flow, discharged versus ground, can be released in atmosphere or properly collected, depending on working medium nature. It's foreseen, if necessary, an ATEX version of the device: in this case, the discharge flow must be collected in inert atmosphere, through an appropriate tube with 1/4" NPT male threaded connection, to avoid potentially explosive mixtures generation.

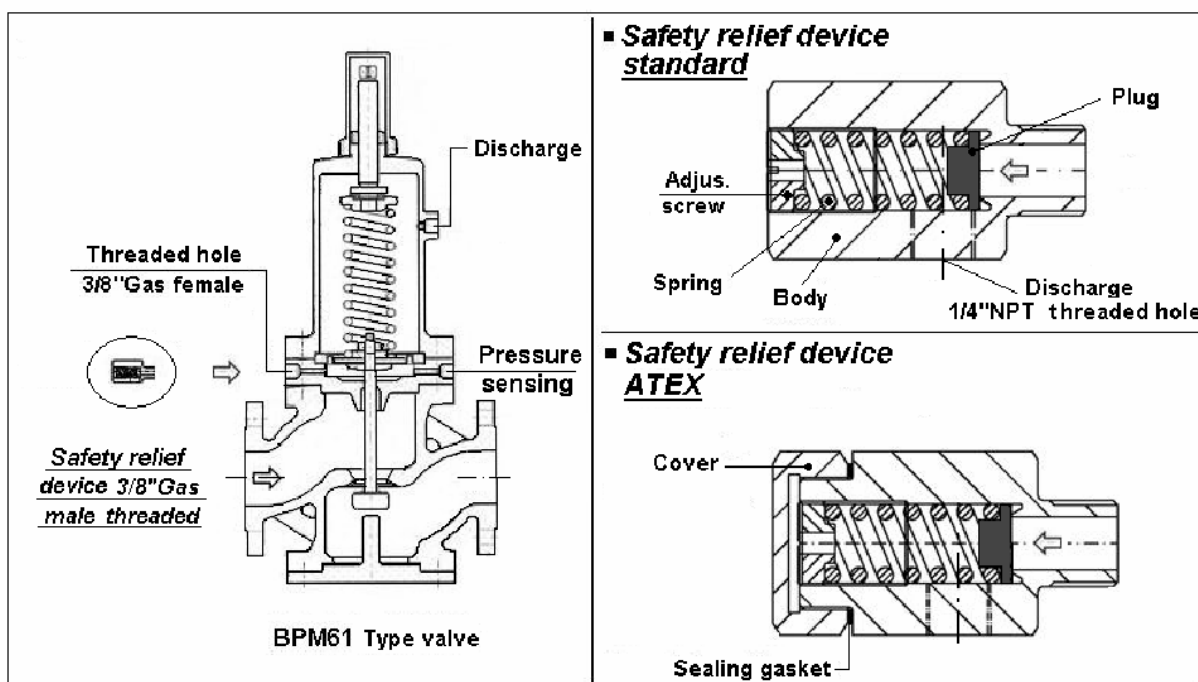


Fig. D

ATTENTION:

Generally speaking, the maximum allowable pressure of the valve actuator is inferior than the one of valve body. Hence, in case a hydraulic test in installed condition has to be carried out, the actuator shall be excluded. This purpose can be achieved by inserting a block valve along the pressure sensing line. In case of external pressure sensing, hydraulic testing of the complete valve must be avoided.



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators type BPM71-72-73-74-81-82-83-84

10. START-UP AND CALIBRATION

The regulators are factory calibrated at the set pressure indicated in the order. If necessary is possible to modify the set pressure at operating conditions on the plant as follow.

Remove the cap (refer to fig.1-8); loosen the nut and correct the position of the adjustment screw reading the pressure indicated by the gauge; this must be done when the system is working at normal operating condition. Then, tighten the nut and put back the cap.

11. MAINTENANCE

11.1. Before any operation on pressure parts of the valve is good to clear the inside pressure.

The components to take better control are the diaphragms, the sealing gaskets on the stem and the plug. Diaphragms and gaskets can visually inspected from the outside; in case of damage, a fluid leakage would be evident.

The user shall schedule an inspection and a possible replacement of those parts with a frequency related to severity of service conditions. Diaphragm and gaskets shall be replaced with original parts and by Carraro technicians or by Carraro-authorized Service Centres to ensure the air-tight and the proper working of valves.

The user shall inspect the seat(s) with a frequency related to the severity of service conditions and to the need to keep the trim tightness class. If the regulated fluid is clean and the plant is equipped with a filter, the maintenance operations should not be frequent.

To disassemble a regulator you must remove it from pipe line after resetting the pressure and disconnected the pressure sensing lines and the discharge line.

Before you proceed as described in the following paragraphs, check that the recommended spare parts are available.

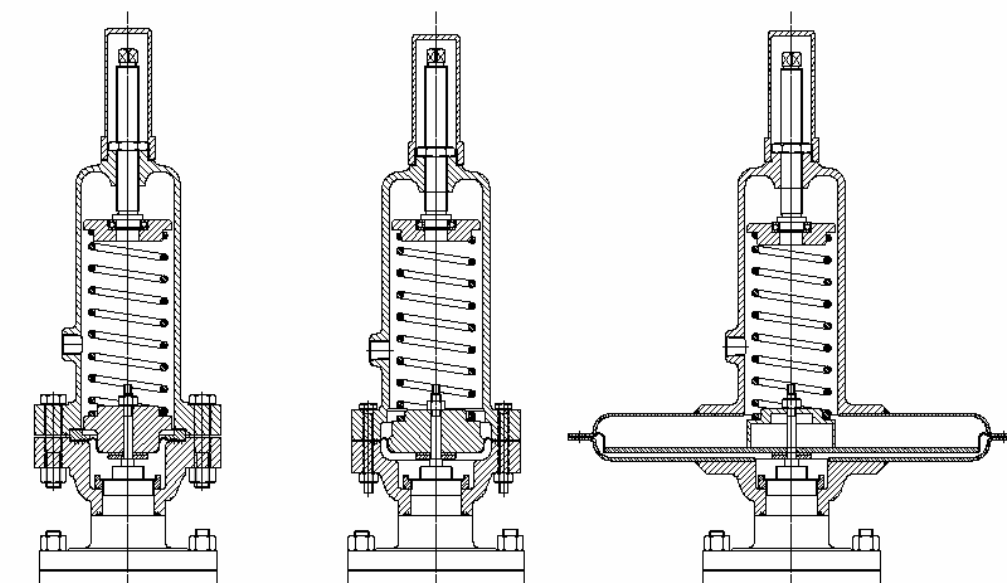


Fig.9



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators type BPM71-72-73-74-81-82-83-84

11.2. Actuator disassembling

Unscrew the cap, completely unload the spring (through the adjusting screw, after having unscrewed the locking nut). Remove the bolts between lower diaphragm case and spring case, then take off the latter. Take off the spring together with upper spring washer.

Unscrew the nut on the stem and, depending on the actuator diameter, take off the following components:

- actuator 120 – 140: remove diaphragm plate, gasket and actuator ring;
- actuator 182: remove only the diaphragm plate;
- actuator 245 – 345 – 515: remove the lower spring washer and the diaphragm plate.

Take off the diaphragm, upper and lower diaphragm sealing plates with the O-ring. Finally, unscrew the actuator fastener ring and take off the lower diaphragm plate.

11.3. Actuator maintenance

Clean all the elements. Lubricate the thread of the adjustment screw. Check the condition of the diaphragm and replace if necessary.

11.4. Replacing the diaphragm only

If the membrane deteriorates or breaks during operation or requires replacement without having to perform any other maintenance operations and if the valve is easy to access, perform the operations listed in paragraphs 11.2 and 11.3, leaving the valve on the piping after making sure that the inlet pressure to the valve is at zero and cannot be restored during operation.

Then remount the actuator in reverse order respect as described at paragraph 11.2.

11.5. Body disassembly

Once disassembled the actuator (par 11.1), the bonnet can be lifted and slip off from the stem. The plug extraction depends on the valve model:

- For models BPM82 (Fig. 6), BPM84 (Fig. 8) and BPM72 (Fig. 2), plug is extracted from above.
- For models BPM71 (Fig. 1), BPM81 (Fig. 5) and BPM83 (Fig. 7) it is necessary to disassemble the body cover and then extract the plug from the bottom.
- For model BPM73 (Fig. 3) it is necessary to unscrew the inferior seat with suitable tools: the plug can now be extracted from the bottom together with the inferior seat.
- For model BPM74 (Fig. 4) plug is extracted from above, after having taken off the bonnet and unscrewed the upper seat (8) with suitable tools.

11.6. Servicing the seats of the BPM71-72-81-82 valves

After removing the plug from the body inspect the seats both on the body and the plug. If they are marked or worn, they can be repaired by grinding the plug against the seat or seats using abrasive paste. If the cuts are deep turn it on the lathe and then grind. For double-seat valves do not alter the pitch between the seats. If worn is too much, it's necessary replace it. If there are no expert operators, the valve should be sent back to our factory.

11.7. Resilient seat maintenance (BPM73-74-83-84)

After removing the plug from the body, checking the conditions of the gaskets(37a-b) and replace them if they are worn.

For the plug of *single seated valves* (BPM83, BPM84):



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators type BPM71-72-73-74-81-82-83-84

- unscrew the locking nut and the plug adjusting ring nut, then if necessary replace plug gasket.

For the plug of *double seated valves* (BPM73, BPM74):

- unscrew the locknut (40) and the plug adjusting ring nut (38), then if necessary replace plug gasket (37a); unscrew the inferior ring nut (39) and if necessary replace plug gasket (37b).
- after replacing of plug gaskets only (37a-b), restore seal on both seats operating on the plug adjusting ring nut (38), screwing if the leak is on the upper seat, unscrewing if the leak is on the lower seat and then block the ring nut (38) with the Nut (40).
- In case the whole plug has to be replaced, it is necessary to restore the correct distance between the plug's upper and lower surfaces, keeping as a reference the real distance between the seats. To do so: assemble the inferior seat (5) to the body; insert the gasket (37b) to the lower nut (39) and screw it on the plug (6); insert the plug in the valve body and lay the gasket of lower nut to the lower seat; assemble the upper seat (8); with reference to fig.10, check that the dimension A is 0.2/0.3 mm: if it is greater, then the surface B on the lower seat has to be turned; if it is inferior, the surface B on upper seat has to be turned.

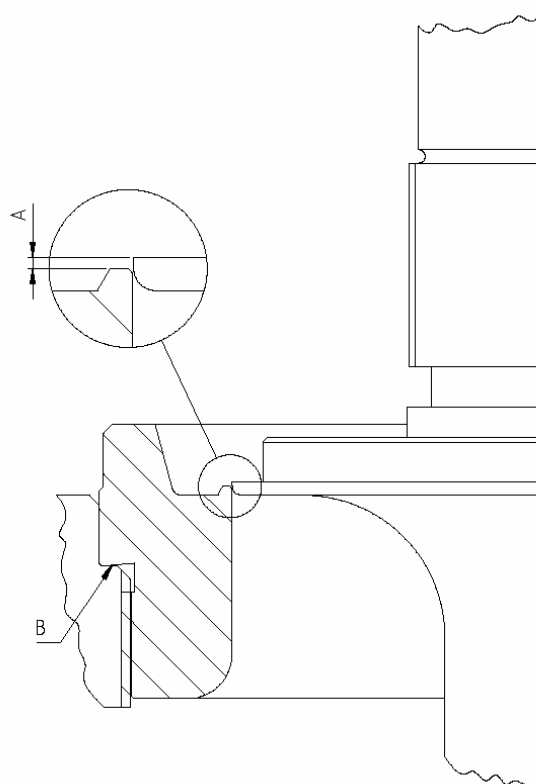


Fig.10

11.8. Stem tightness maintenance (only for external pressure sensing type)

Refer to fig.11 beside.

If the stem tightness is leaking, it is necessary to replace the lip seal gasket (41). To do so, the actuator has to be separated from the body. Unscrew the nut (39) and extract the bushing (40). Take off, replace the lip seal gasket and reassemble. It is suggested to replace this gasket whenever the stem is taken off from the guide.

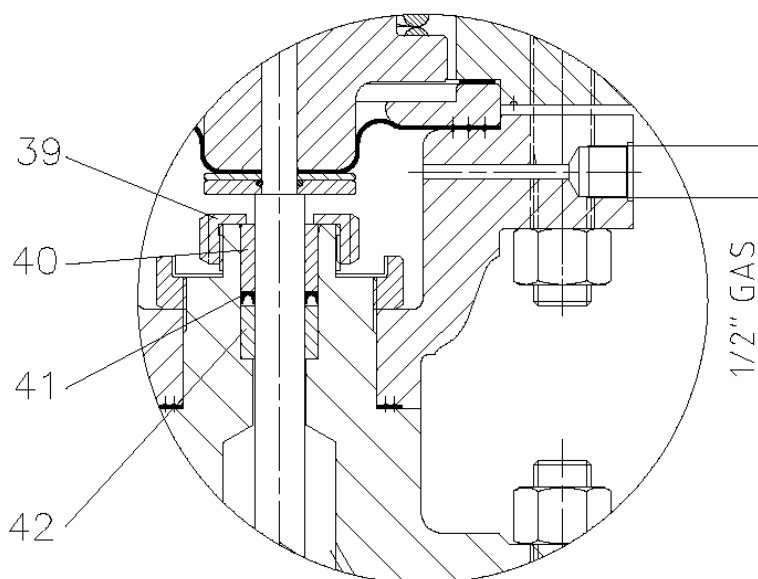


Fig.11



I N S T R U C T I O N S

For installation & maintenance of direct operated pressure regulators type BPM71-72-73-74-81-82-83-84

11.9. Reassembly

Perform the dismounting operations in reverse order, checking the cleanliness of the parts.
Replace the gaskets (2a-b) between the body and the covers. Restore the load of the spring according to the initial measurement. When starting work again, check calibration and adjust if necessary.

12. REPAIRS

12.1. If it is not possible to eliminate the problems, send faulty valves to the supplier/manufacturer, together with a description of the problem.

12.2. In order to receive spare parts or information, always quote the series number shown on the rating plate attached to the valve or punched on the outer surface of the flanges.

12.3. Rating plate (*example*)

○ Type of valve ○ Series n° Ends..... Upstr.press. Downstr.press. Q.....Mc/h Medium..... Temp..... ○ CARRARO tel.02/269912.1 ○
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12.4. To ensure the valves treated in this manual work correctly, they should be serviced by Carraro engineers or by Carraro-authorized Service Centres using original spare parts.

ATTENTION!

The maker declines all liability for modifications to the product or operations that are not contemplated in this manual.