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Pietro[®]
Fiorentini

PRESSURE REGULATOR

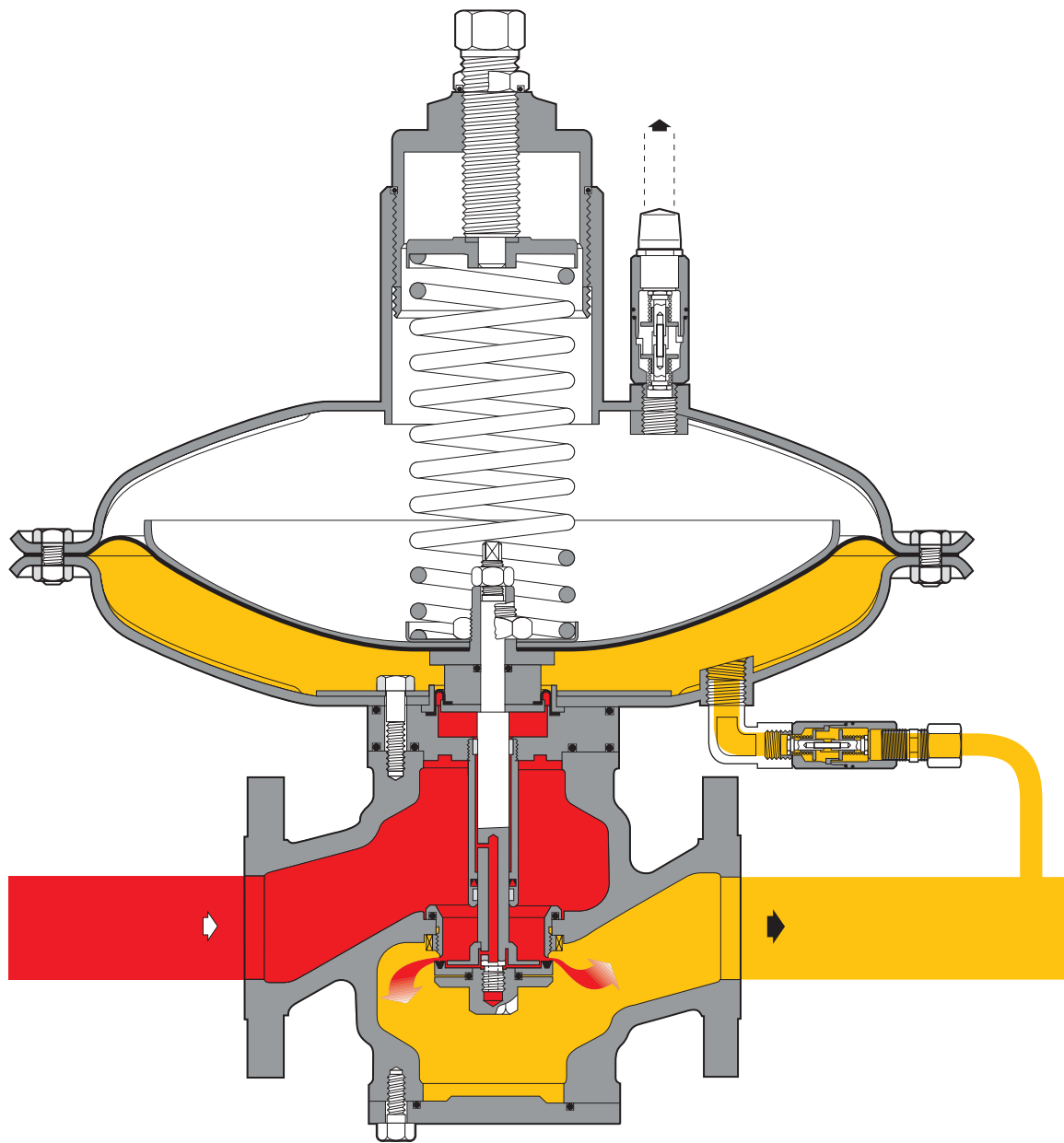
NORVAL



TECHNICAL MANUAL MT044

INSTALLATION, COMMISSIONING AND MAINTENANCE INSTRUCTIONS

NORVAL



 Inlet pressure.

 Outlet pressure.

Issue February 2003

DECLARATION OF CONFORMITY

The **PIETRO FIORENTINI SPA** with registered office in Milan (Italy) – via Rosellini, 1, declares under its sole responsibility that the apparatus series Norval bearing the CE marking showed in this manual are designed, manufactured, tested and inspected in accordance with the provisions of Pressure Equipment Directive 97/23/EC (PED).

Following conformity assessment procedure has been carried out:

- EC type-examination (module B) by DVGW (ID n° 0085) – report **02/102/4301/850 issued 12th April 2002**
In this report both the versions incorporating the safety shut-off devices series when controlling overpressure and in-line monitor system which includes a Norval with the function of active regulator and a 2° Norval with the function of in-line monitor, are classified as safety accessories according to clause 2.1.3 of art. 1 of PED.
- Production quality assurance (module D) by BUREAU VERITAS (ID n° 0062) – Attestation d'Approbation du Système Qualité N° **CE-PED-D-FIO001-02-ITA issued 15th May 2002.**

Further it declares that the classification of the performances characteristics has been verified by DVGW according to the procedures given by European standard EN 334 and/or by standard DIN 3381. The classification is detailed in the aforesaid DVGW report.

Arcugnano 25/9/2002

The Pietro Fiorentini SpA

PRECAUTIONS

GENERAL PRECAUTIONS

- The apparatus described in this manual is a device subject to pressure installed in systems under pressure;
- the apparatus in question is normally installed in systems for transporting flammable gases (natural gas, for example).

PRECAUTIONS FOR THE OPERATORS

Before proceeding with installation, commissioning or maintenance, operators must:

- examine the **safety provisions** applicable to the installation in which they must work;
- obtain the **authorisations** necessary for working when so required;
- use the necessary means of **individual protection** (helmet, goggles, etc.);
- ensure that the area in which they operate is fitted with the means of **collective protection** envisaged and with the necessary **safety indications**.

HANDLING

The handling of the apparatus and of its components must only be carried out after ensuring that the lifting gear is adequate for the **loads to lift** (lifting capacity and functionality). The apparatus must be handled using the **lifting points** provided on the apparatus itself.

Motorised means must only be used by the persons in charge of them.

PACKING

The packing for transportation of equipment and of relevant spare parts are designed and shaped to avoid damage to any part during transportation, warehousing and handling activities. Therefore the equipment and spare parts shall be kept into their packing until their installation in the final site. After packing is open, check that no damage occurred to any goods. If damage occurred inform the supplier and keep packing for any verification.

INSTALLATION

If the installation of the apparatus requires the application of **compression fittings** in the field, these must be installed following the **instructions of the manufacturer** of the fittings themselves. The choice of the fitting must be compatible with the use specified for the apparatus and with the specifications of the system when envisaged.

COMMISSIONING

Commissioning must be carried out by adequately trained personnel.

During the commissioning activities, the personnel not strictly necessary must be ordered away and the no-go area must be properly signalled (signs, barriers, etc.).

Check that the settings of the apparatus are those requested; if necessary, reset them to the required values in accordance with the procedures indicated in the manual.

When commissioning, the risks associated with any discharges into the atmosphere of flammable or noxious gases must be assessed.

In installations in natural gas distribution networks, the risk of the formation of explosive mixtures (gas/air) inside the piping must be considered.

CONFORMITY TO DIRECTIVE 97/23/EC (PED)

Pressure regulator Norval is classified as fail open regulator according to the standard EN 334 therefore it is categorized as **pressure accessory** according to directive 97/23/EC (PED).

The safety device in-line monitor is categorized as **safety accessory** according PED. The regulator Norval when incorporating slam shut valve with pressure switch for overpressure is categorized as **safety accessory** according to PED, therefore it can be used both as pressure accessory and **safety accessory** to PED.

Conformity with Directive 97/23/EC and CE marking of pressure regulator and relevant accessory require installation in the system with minimum requirements according to: EN 12286.

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1.0 INTRODUCTION

The scope of this manual is to provide the essential information for the installation, commissioning, disassembly, re-assembly and maintenance of NORVAL regulators.

It is also appropriate to provide a brief illustration of the main features of the regulator and of its accessories.

1.1 MAIN FEATURES

The NORVAL pressure regulator is a pressure regulator for previously cleaned gaseous fluids and is suitable for medium and low pressures.

The NORVAL is a normally open regulator and consequently opens in the event of:

- breakage of the main diaphragm
- no regulated pressure signal

The main specifications of this regulator are:

- Design pressure: up to 16 bar;
- Operating temperature range: -20 °C to 60 °C;
- Ambient temperature: -20 °C to 60 °C;
- Inlet pressure range bpe:
 - 0.1 to 16 bar for DN 1" to 3"
 - 0.1 to 8 bar for DN 4" to 8"
- Regulating range possible Wh:
 - 0.0075 to 4.4 bar for DN 1" to 4"
 - 0.012 to 1.8 bar for DN 6" to 8"
- Precision class AC: up to 5;
- Closing pressure class SG: up to 10.

1.2 OPERATION

NORVAL series regulators (Fig.1) are spring actuated devices with control of the downstream pressure by means of an external sensing line 1.

The downstream pressure is controlled by means of the equilibrium between the action of the spring 2 and the action exerted by the downstream pressure on the diaphragm 3.

The movement is transmitted by the shaft 4 to the obturator 5 which moves perpendicularly to the gas flow direction. Hermetic tightness is ensured by a rubber gasket fixed to the obturator.

Regulation is therefore obtained from the confrontation between the load of the setting spring 2 and the thrust on the diaphragm 3 deriving from the downstream pressure.

If during operation, for example, there is a drop in the downstream pressure P_a below the set-point (as a result of an increase in the requested flow rate or a drop in the upstream pressure) an imbalance is created which causes the obturator 5 to open and therefore an increase in the flow until the downstream pressure reaches the set-point again. Vice versa, when the downstream pressure rises above the set-point (as a result of a drop in the requested flow rate or an increase in the upstream pressure) the obturator 5 closes and the flow rate drops until the downstream pressure reaches the set-point again.

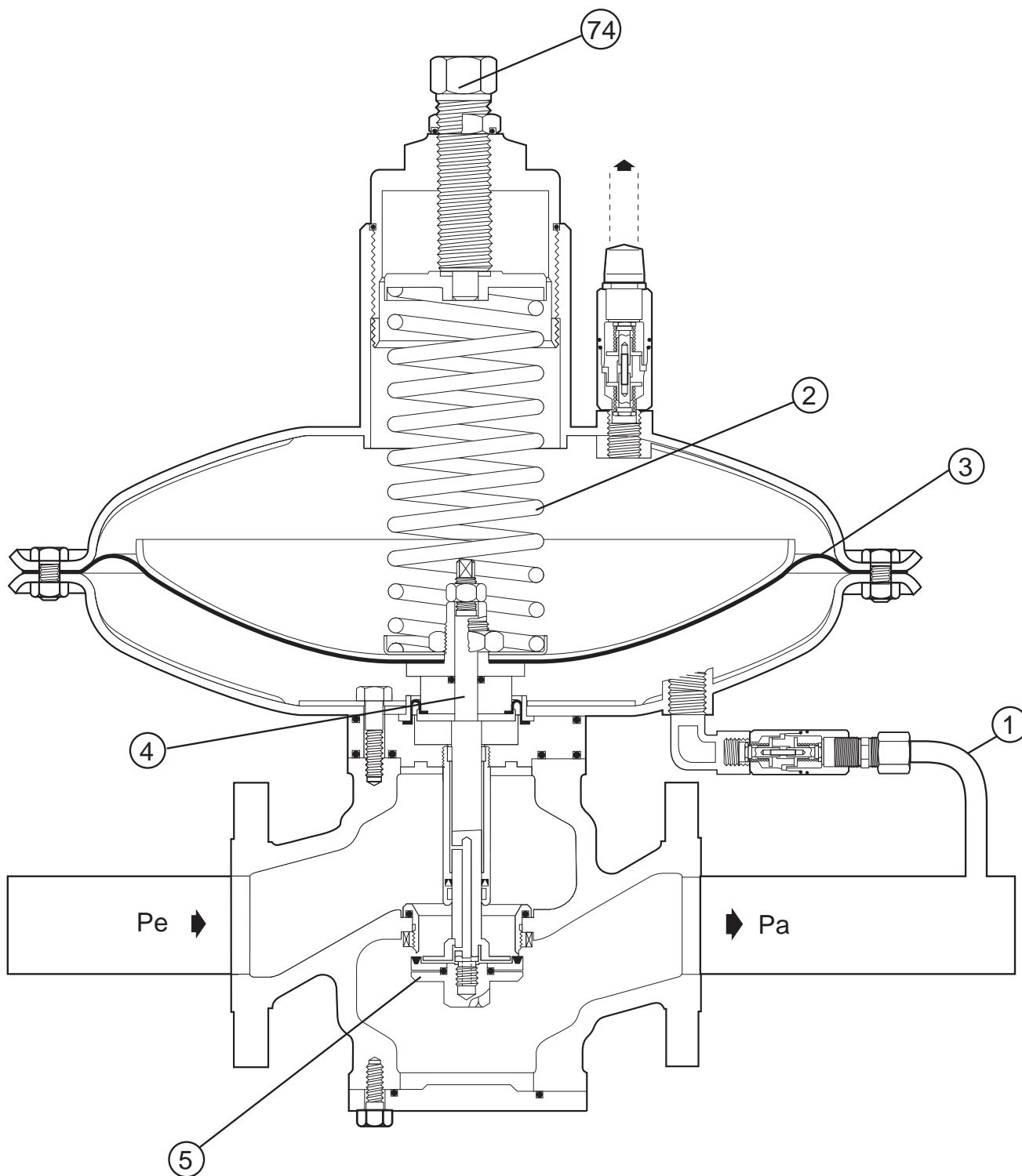


Fig. 1

1.3 TAB. 1 Standard Regulator Setting Springs (Fig. 2)

Springs characteristics							SETTING RANGE in mbar						
CodE	Colour	De	Lo	d	i	it	Covers						
							Ø 630		Ø 495		Ø 375		Ø 375 TR
							DN: 2 ^{3/4} " - 3"	DN: 4"	DN: 1" ÷ 2"	DN: 2 ^{3/4} " ÷ 4"	DN: 1" ÷ 2"	DN: 2 ^{3/4} " ÷ 4"	DN: 1" ÷ 4"
2701623	WHITE	85	350	4.0	9.00	11.00	7.5 ÷ 9.5	9.5 ÷ 11	12 ÷ 15				
2701700	YELLOW			4.2	9.00	11.00	8.5 ÷ 11	10.5 ÷ 12	13 ÷ 17				
2701863	ORANGE			4.5	9.00	11.00	10 ÷ 13	12 ÷ 14	15 ÷ 21				
2701966	RED			4.8	9.50	11.50	11 ÷ 16	13 ÷ 17	16 ÷ 23				
2702205	GREEN			5.0	9.00	11.00	12 ÷ 17	11 ÷ 19	21 ÷ 29				
2702385	BLACK			5.5	10.50	12.50	15 ÷ 21	16 ÷ 24	25 ÷ 35				
2702565	BLUE			6.0	11.50	13.50	19 ÷ 27	20 ÷ 28	31 ÷ 42				
2702755	WHITE		6.5	8.50	10.50	21 ÷ 36	22 ÷ 37	38 ÷ 60		80 ÷ 120			
2702975	YELLOW		7.0	8.50	10.50	28 ÷ 48	30 ÷ 50	55 ÷ 83	75 ÷ 85	115 ÷ 170			
2703175	ORANGE		7.5	9.25	11.25	43 ÷ 63	45 ÷ 65		80 ÷ 110	155 ÷ 230			
2703360	RED		8.0	9.00	11.00	53 ÷ 80	55 ÷ 80		95 ÷ 135	190 ÷ 280			
2703525	GREEN		300	8.5	9.00	11.00				125 ÷ 170	250 ÷ 360		
2703745	BLACK			9.0	9.00	11.00				150 ÷ 220	300 ÷ 430		
2703895	BLUE			9.5	9.50	11.50				170 ÷ 260	360 ÷ 500		
2704062	BROWN			10.0	9.00	11.00				230 ÷ 340		470 ÷ 720	
2704400	AZURE			11.0	9.50	11.50				300 ÷ 500	680 ÷ 950	680 ÷ 950	
2704515	WH.-YELL.	11.5		9.25	11.25				400 ÷ 530	850 ÷ 1100			
2704390	GREEN	260	11.0	7.50	9.50							900 ÷ 1600	
2704615	BLUE		12.0	8.00	10.00					900 ÷ 1250	1450 ÷ 2400		
2704820	VIOLET		13.0	8.00	10.00					1200 ÷ 1950	2100 ÷ 3150		
2704910	AZURE		14.0	8.00	10.00					1800 ÷ 2800	3000 ÷ 4400		

							Ø 817	Ø 658	Ø 630	Ø 495
							DN: 6" ÷ 8"	DN: 6" ÷ 8"	DN: 6" ÷ 8"	DN: 6" ÷ 8"
2702599	WHITE	100	400	6.0	10.5	12.5	12 ÷ 14.5			
2702790	YELLOW	100		6.5	11.5	13.5	14 ÷ 18			
2703015	ORANGE	100		7.0	12.0	14.0	17 ÷ 21			
2703199	RED	100		7.5	12.5	14.5	20 ÷ 25			
2703380	GREEN	100		8.0	12.5	14.5	24 ÷ 31			
2703560	BLACK	100		8.5	12.0	14.0	30 ÷ 39			
2703827	BLUE	100		9.0	11.5	13.5	38 ÷ 49			
2703930	BROWN	100		9.5	11.0	13.0	47 ÷ 62	75 ÷ 100		
2704108	VIOLET	100		10.0	10.5	12.5	60 ÷ 79	95 ÷ 130		
2704440	AZURE	100		11.0	11.0	13.0		125 ÷ 170		
2704670	WH.-YELL.	100		12.0	10.5	12.5		165 ÷ 230	220 ÷ 300	390 ÷ 535
2704108	VIOLET	100		10.0	10.5	12.5				
2703720	WHITE	65		9.0	15.5	17.5		> 210 ÷ 280	> 280 ÷ 360	> 500 ÷ 650
2704440	AZURE	100		11.0	11.0	13.0				
2703720	WHITE	65		9.0	15.5	17.5		> 270 ÷ 330	> 330 ÷ 420	> 600 ÷ 750
2704670	WH.-YELL.	100		12.0	10.5	12.5				
2703720	WHITE	65	9.0	15.5	17.5		> 320 ÷ 405	> 400 ÷ 520	> 700 ÷ 930	
2704670	WH.-YELL.	100	12.0	10.5	12.5					
2704210	RED	65	10.5	15.5	17.5			> 500 ÷ 650	> 900 ÷ 1310	
2704985	WH.-YELL.	100	14.0	11.0	13.0					
2704210	RED	65	10.5	15.5	17.5				> 1290 ÷ 1800	

De = Ø external diameter d = Ø wire diameter i = active coils Lo = spring length it = total coils

1.3.1 TAB. 2 Upturned Regulator Setting Springs (Fig. 3)

Springs characteristics							SETTING RANGE in mbar							
Code	Colour	De	Lo	d	i	it	Covers							
							Ø 630		Ø 495		Ø 375		Ø 375 TR	
							DN: 2 ³ / ₂ - 3"	DN: 4"	DN: 1" ÷ 2"	DN: 2 ³ / ₂ ÷ 4"	DN: 1" ÷ 2"	DN: 2 ³ / ₂ ÷ 4"	DN: 1" ÷ 4"	
2701966	RED	85	350	4.8	9.50	11.50			8 ÷ 12					
2702205	GREEN			5.0	9.00	11.00	9 ÷ 13	9 ÷ 12	10 ÷ 17					
2702385	BLACK			5.5	10.50	12.50	12 ÷ 15	11 ÷ 15	14 ÷ 22					
2702565	BLUE			6.0	11.50	13.50	14 ÷ 18	14 ÷ 19	20 ÷ 28					
2702755	WHITE			6.5	8.50	10.50	17 ÷ 28	16 ÷ 26	25 ÷ 45		80 ÷ 120			
2702975	YELLOW			7.0	8.50	10.50	25 ÷ 40	22 ÷ 40	40 ÷ 70	60 ÷ 70	115 ÷ 170			
2703175	ORANGE		7.5	9.25	11.25	35 ÷ 45	35 ÷ 55	65 ÷ 90	65 ÷ 95	155 ÷ 230				
2703360	RED		8.0	9.00	11.00	45 ÷ 67	50 ÷ 70		80 ÷ 120	190 ÷ 280				
2703525	GREEN		8.5	9.00	11.00	62 ÷ 90	62 ÷ 90		110 ÷ 155	250 ÷ 360				
2703745	BLACK		9.0	9.00	11.00				135 ÷ 205	315 ÷ 470				
2703895	BLUE		9.5	9.50	11.50				155 ÷ 245	360 ÷ 540				
2704062	BROWN		10.0	9.00	11.00				215 ÷ 325	470 ÷ 720	470 ÷ 720			
2704400	AZURE		11.0	9.50	11.50				285 ÷ 500	680 ÷ 1050	680 ÷ 1050			
2704040	ORANGE		10.0	8.00	10.50									
2704390	GREEN		11.0	7.50	9.50								900 ÷ 1600	
2704615	BLUE		12.0	8.00	10.00						900 ÷ 1400	1450 ÷ 2400		
2704820	VIOLET		13.0	8.00	10.00						1200 ÷ 1950	2100 ÷ 3150		
2704910	AZURE		14.0	8.00	10.00						1800 ÷ 1050	3000 ÷ 4400		

							Ø 817	Ø 658	Ø 630	Ø 495
							DN: 6" ÷ 8"	DN: 6" ÷ 8"	DN: 6" ÷ 8"	DN: 6" ÷ 8"
2703380	GREEN	100	400	8.0	12.5	14.5	8 ÷ 13			
2703560	BLACK	100		8.5	12.0	14.0	12 ÷ 21			
2703827	BLUE	100		9.0	11.5	13.5	20 ÷ 31			
2703930	BROWN	100		9.5	11.0	13.0	29 ÷ 45			
2704108	VIOLET	100		10.0	10.5	12.5	42 ÷ 71	75 ÷ 110		
2704440	AZURE	100		11.0	11.0	13.0	65 ÷ 95	100 ÷ 150		
2704670	WH-YELL	100		12.0	10.5	12.5		140 ÷ 210	190 ÷ 270	340 ÷ 480
2704108	VIOLET	100		10.0	10.5	12.5		> 190 ÷ 260	> 250 ÷ 330	> 450 ÷ 600
2703720	WHITE	65		9.0	15.5	17.5		> 250 ÷ 310	> 300 ÷ 390	> 550 ÷ 700
2704440	AZURE	100		11.0	11.0	13.0		> 300 ÷ 405	> 370 ÷ 490	> 650 ÷ 880
2703720	WHITE	65		9.0	15.5	17.5			> 470 ÷ 600	> 850 ÷ 1260
2704670	WH-YELL	100		12.0	10.5	12.5				> 1240 ÷ 1800
2703720	WHITE	65		9.0	15.5	17.5				
2704670	WH-YELL	100		12.0	10.5	12.5				
2704210	RED	65		10.5	15.5	17.5				
2704985	WH-BLUE	100		14.0	11.0	13.0				
2704210	RED	65		10.5	15.5	17.5				

De = Ø external diameter d = Ø wire diameter i = active coils Lo = spring length it = total coils

2.0 INSTALLATION

2.1 GENERAL

Pressure regulator does not require any supplementary upstream safety accessory for protection against overpressure compared with its design pressure PS, when upstream reducing station is sized for a max downstream incidental pressure $MIPd \leq 1,1 PS$.

Before installing the regulator it is necessary to ensure that:

- the regulator can be inserted in the space provided and that subsequent maintenance operations will be sufficiently practicable;
- the upstream and downstream piping is at the same level and capable of supporting the weight of the regulator;
- the inlet/outlet flanges of the piping are parallel;
- the inlet/outlet flanges of the regulator are clean and the regulator itself has not been subject to damage during transport;
- the piping upstream has been cleaned to expel residual impurities such as welding scale, sand, paint residues, water, etc.

The normally recommended set-up is:

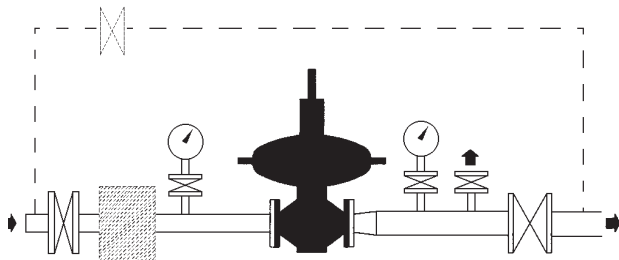


Fig. 2 (Standard Regulator)

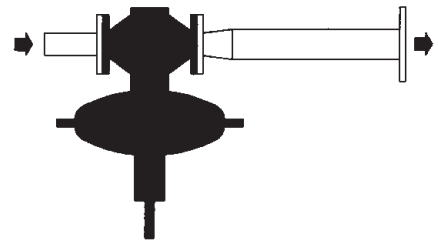
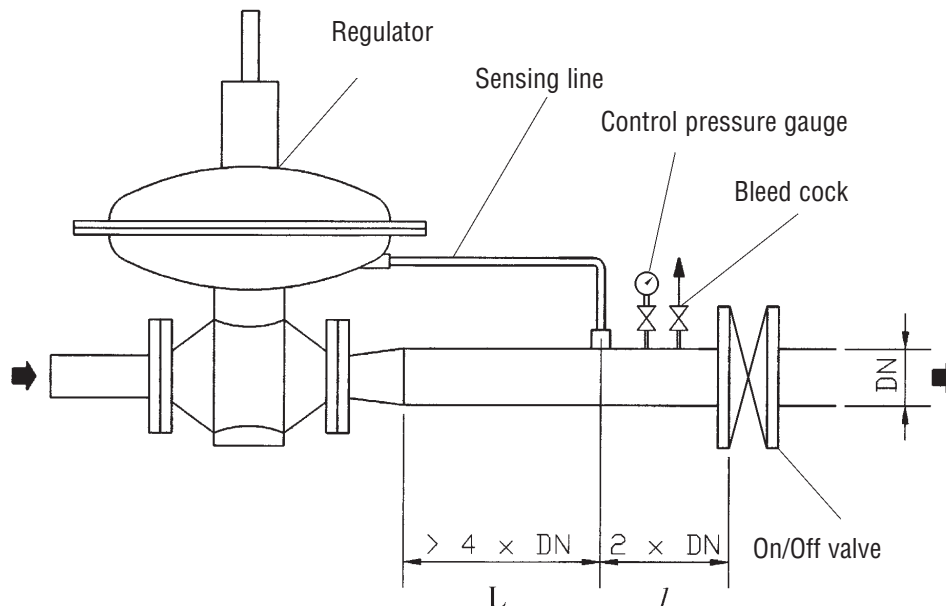


Fig. 3 (Upturned Regulator)

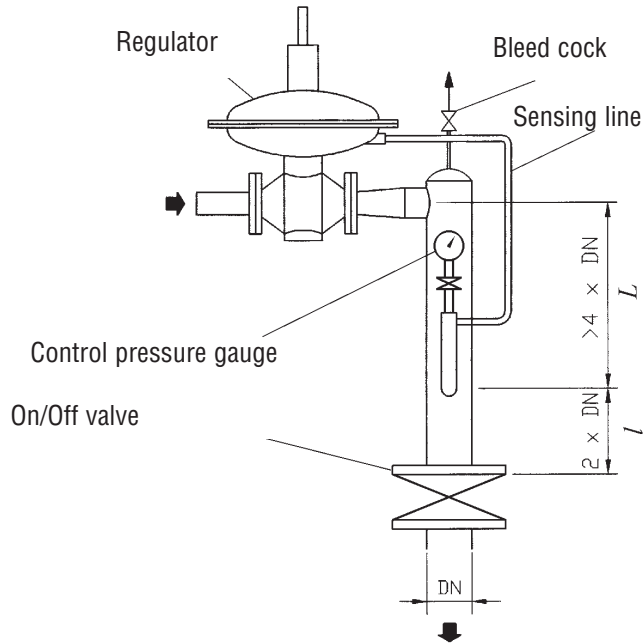
TAB. 3 CONNECTING THE APPARATUS

The connections between the apparatus and the main piping must be made using stainless steel or cooper pipe with minimum internal diameter of 12 mm.

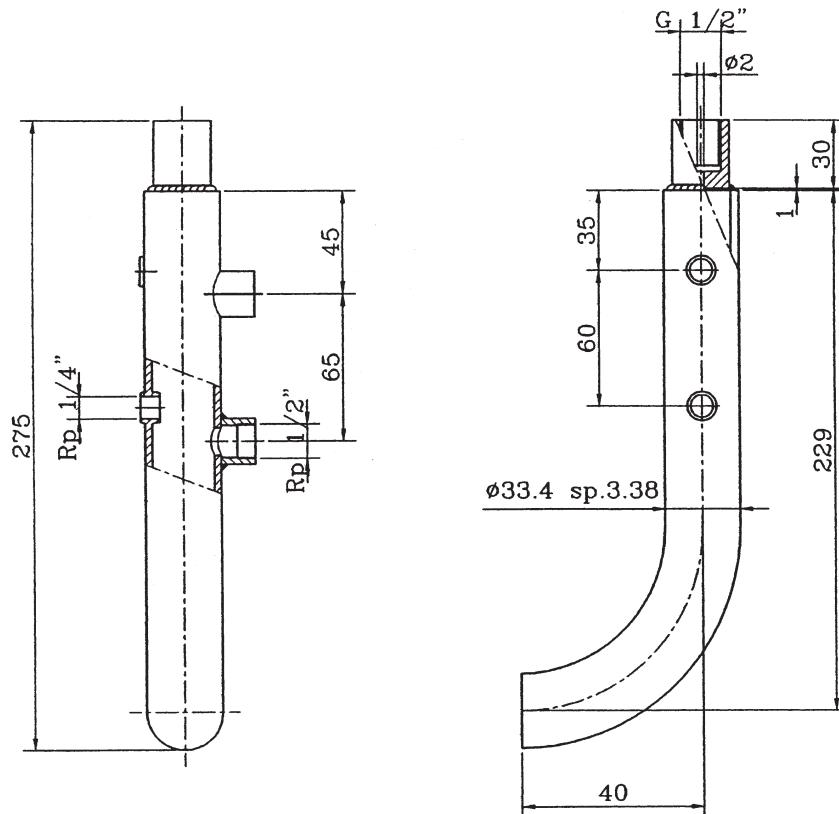
IN-LINE INSTALLATION



INSTALLATION AT RIGHT ANGLES



TAB. 4 DETAIL OF MULTIPLE TAKE-OFF



The regulator must be installed in the line **with the arrow on the body pointing in the gas flow direction.**

It is indispensable for good regulation for the position of the downstream pressure take-offs and the speed of the gas at the take-off point to respect the values given in tables 3 and 4 (positioning) and 5 (speed).

The pressure regulator, when installed on a reducing station, shall be installed at least according to the requirements of standard EN 12186.

All venting connections shall be connected as required by above mentioned standard.

The following is recommended so as to prevent the accumulation of impurities and condensate in the lines of the pressure take-offs:

- a) the lines themselves must slope down towards the downstream piping with a slope of about 5-10%;
- b) the connectors on the piping must always be welded on the top of the piping itself and there must be no burr or inward protrusions in the hole in the piping.

NB. WE RECOMMEND NOT TO PUT ON/OFF VALVES ON THE IMPULSE TAKE-OFFS

TAB. 5

The speed of the gas must not exceed the following values in the piping downstream from the regulator:

$$V_{\max} = 25 \text{ m/s for } 1,5 < P_a < 4 \text{ bar}$$

$$V_{\max} = 20 \text{ m/s for } 0,5 < P_a < 1,5 \text{ bar}$$

$$V_{\max} = 15 \text{ m/s for } P_a < 0,5 \text{ bar}$$

DOWNSTREAM VOLUME REQUIRED FOR INSTALLATION

In the case of a service regulator of the ON-OFF type (stopping or starting of burners), you should remember that though the NORVAL apparatus is classified as being of the fast reaction type, it requires an appropriately dimensioned volume of gas between the apparatus itself and the burner so as to partly absorb the pressure swings caused by fast flow rate variations.

3.0 ACCESSORIES

3.1 RELIEF VALVE

The relief valve is a safety device which releases a certain quantity of gas to the exterior when the pressure at the control point exceeds the set-point as a result of short-lasting events such as, for example, the very fast closing of the on/off valves and/or overheating of the gas with zero flow rate demand. The release of the gas to the exterior can, for example, delay or block the intervention of the slam-shut valves for transitory reasons deriving from damage to the regulator.

Obviously the quantity of gas released depends on the extent of the overpressure with respect to the set-point. The different models of relief valves available are all based on the same operating principle which is illustrated below with reference to the valve VS/AM 55 (fig. 4).

It is based on the contrast between the thrust on the diaphragm 24 deriving from the pressure of the gas to control and the thrust from the setting spring 20. The weight of the mobile assembly, the static thrust and the residual dynamic thrust on the obturator 4 also contribute to this contrast. When the thrust deriving from the pressure of the gas exceeds that of the setting spring, the obturator 4 is raised and a certain quantity of gas is released as a result.

As soon as the pressure drops below the set-point, the obturator returns to the closed position.

Proceed as indicated below to control and adjust intervention of the relief valve.

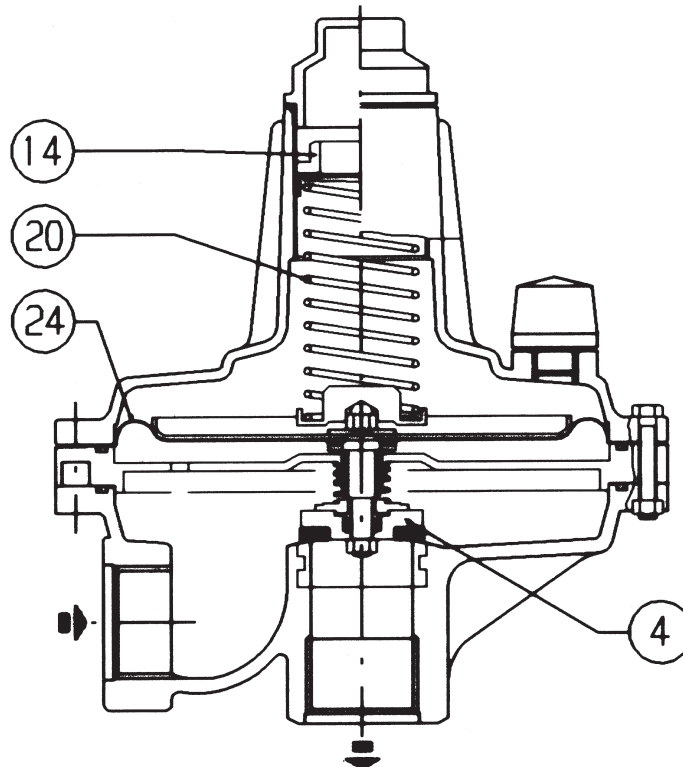


Fig. 4

3.1.1 DIRECT INSTALLATION IN THE LINE (Fig. 5)

When the relief valve is fitted directly in the line that is, without the interposition of an on/off valve, we recommend proceeding as follows:

- 1) ensure that the downstream on/off valve V2 and the bleed cock 6 are closed;
- 2) increase the pressure in the downstream section to the value at which intervention should occur by connecting a controlled auxiliary pressure to the cock 6 and stabilise it at the desired value;
- 3) check intervention of the relief valve and adjust it if necessary by turning the internal adjustment ring 14 appropriately (clockwise to increase the set-point, anticlockwise to reduce it).

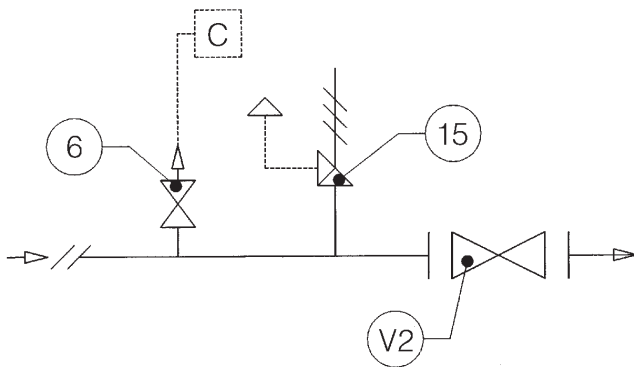


Fig. 5

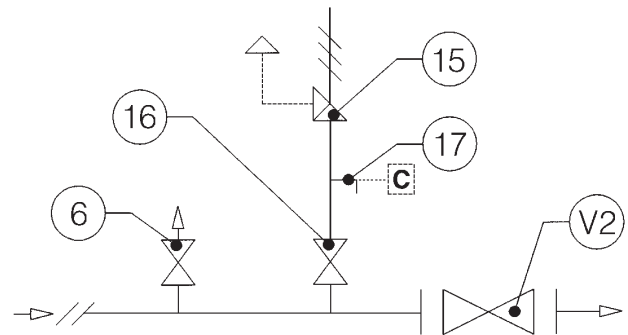


Fig. 6

3.1.2 INSTALLATION WITH ON/OFF VALVE (Fig. 6)

- 1) Close the on/off valve 16;
- 2) connect a controlled auxiliary pressure to the take-off 17 and increase it slowly to the envisaged intervention value;
- 3) check the intervention of the relief valve and adjust it if necessary by turning the internal adjustment ring 14 appropriately (clockwise to increase the set-point, anticlockwise to reduce it).

4.0 MODULARITY

The modular-type conception of NORVAL series regulators means that it is also possible to fit the slam-shut incorporated with the body itself even after the installation of the regulator.

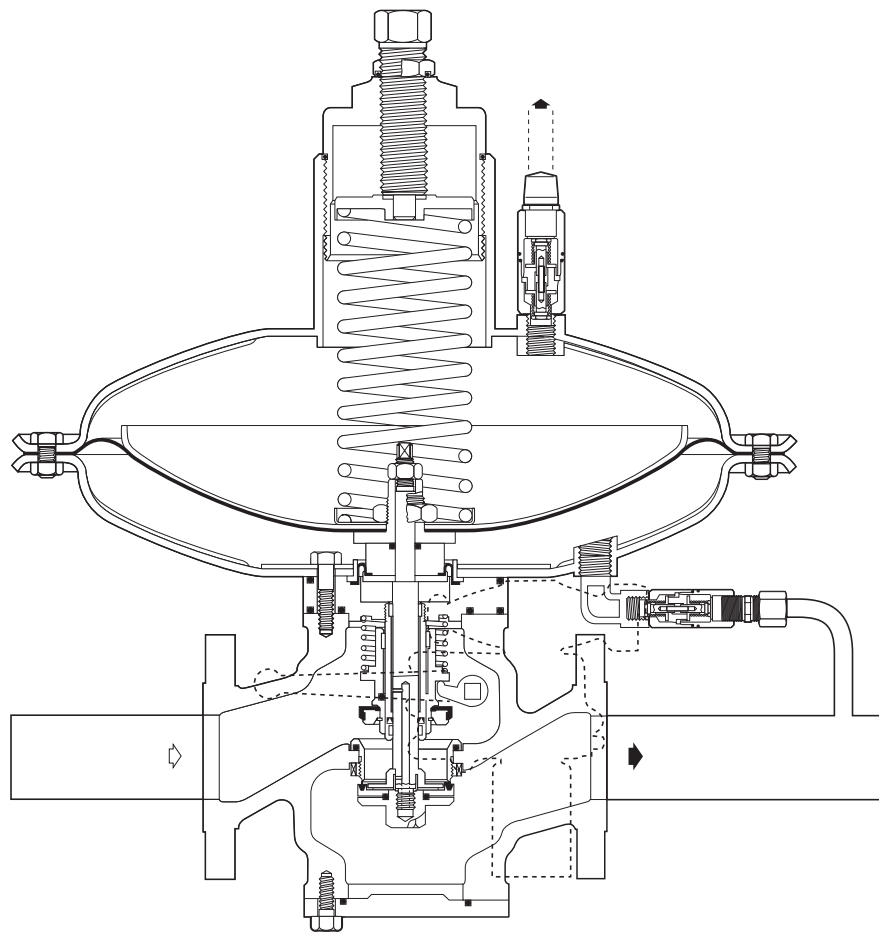
Furthermore, the regulator can be adapted for operation as an in-line monitor by installing a special device.

4.1 INCORPORATED SLAM-SHUT I-N

This is a device (fig. 7) which immediately blocks the gas flow if, following some kind of failure, the downstream pressure reaches the set-point for its intervention or if it is operated manually.

The main characteristics of the slam-shut device are:

- design pressure: 18.9 bar for all the components;
- intervention with pressure increase and/or decrease;
- intervention accuracy (AG): $\pm 1\%$ of the pressure set-point for pressure increases, $\pm 5\%$ for pressure decreases;
- incorporated by-pass for balancing the pressures and facilitating the resetting of the device.
- push-button manual control.



...+ I-N SLAM-SHUT

Fig. 7

The slam-shut mechanism consists of:

- a mobile obturator A with sealing gaskets subject to the load of the closing spring G;
- a lever assembly L whose rotation causes the movement of the obturator A;
- a pressure switch device I-N whose internal motion determines the open or closed position of the obturator A.

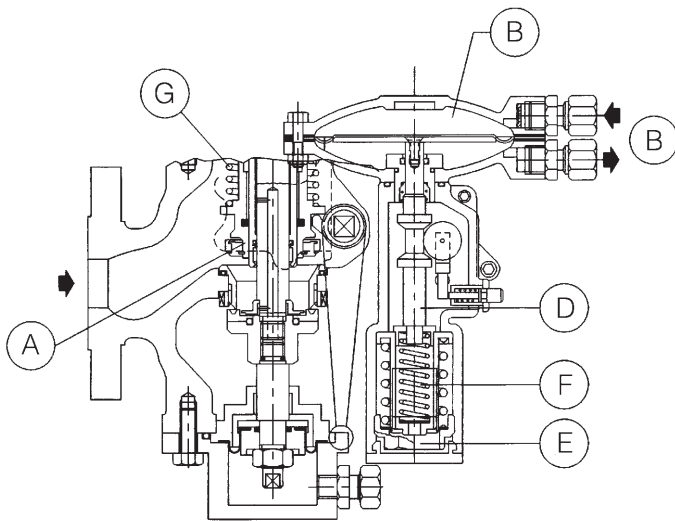


Fig. 8a

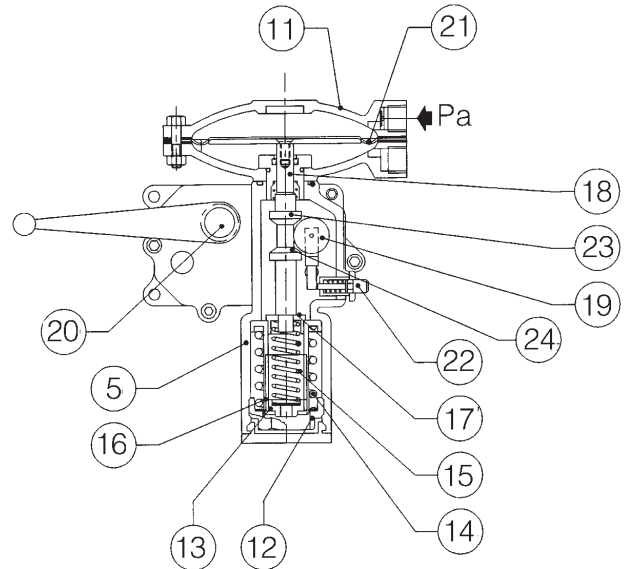


Fig. 8b

The pressure switch device (fig. 8) comprises a control head 11 in which the pressure to control P_a acts on the diaphragm 21 which is integral with the shaft with cams 18.

The load of the pressure P_a on the diaphragm is contrasted by the springs 14 and 15, which respectively determine intervention for a pressure increase or decrease.

The slam-shut device is set by adjusting the rings 12 and 13.

The intervention value is increased by turning the rings clockwise and vice versa when turned anticlockwise.

In the case of intervention for pressure increase, when the P_a exceeds the set-point, the load on the diaphragm 21 of the control head B increases until it overcomes the resistance of the spring 14 .

This provokes the downward displacement of the shaft 18 which shifts the feeler 19 and releases the lever mechanism 20 by means of the cam 23.

Intervention for a pressure decrease takes place as follows.

As long as the value of P_a stays above the set load of the spring 15, the spring support 17 rests on support 16.

If the pressure P_a drops below the set-point, the support of spring 16 stops its stroke on the beat of the body 5 and the spring 15 displaces the support 17 upwards and the shaft 18 as a result. The cam 24 then shifts the feeler 19 and causes the release of the lever mechanism 20.

Intervention of the slam-shut device can also be provoked manually by means of the release button 22. The connection between the control head 11 and the P_a control point can be made with the interposition of a device (Push) fig. 14 which makes it easy to control the operation of the pressure control device.

4.2 TAB. 6 SLAM-SHUT SETTING SPRINGS

Springs characteristics							SETTING RANGE mbar						
							I-N (Fig. 9)		I-N (Fig. 10)		I-N/TR (Fig. 9 and fig. 10)		
Code	Colour	De	Lo	d	i	it	max	min	max	min	max	min	
2700565	WHITE	35	50	2.0	5.25	7.25	13 ÷ 33		17 ÷ 35				
2700675	YELLOW			2.3	5.25	7.25	25 ÷ 50		30 ÷ 55				
2700820	ORANGE			2.5	5.00	7.00	40 ÷ 85		45 ÷ 85				
2700910	RED			2.7	6.00	8.00	65 ÷ 145		65 ÷ 145				
2701035	GREEN			3.0	5.25	7.25	100 ÷ 180		100 ÷ 180				
2701140	BLACK			3.2	4.50	6.50	150 ÷ 270		150 ÷ 270				
2701255	BLUE			3.5	4.50	6.50	200 ÷ 350		200 ÷ 350				
2701380	GREY			3.7	4.25	6.25						700 ÷ 1500	
2701525	BROWN			4.0	4.50	6.50	300 ÷ 550		300 ÷ 550		300 ÷ 550	900 ÷ 2000	
2701645	VIOLET			4.2	4.00	6.00	500 ÷ 900		500 ÷ 900		500 ÷ 900	1300 ÷ 2800	
2702065	AZURE	5.0	4.50	6.00	850 ÷ 1200		850 ÷ 1200		850 ÷ 1200	2500 ÷ 5000			
2700338	WHITE	15	40	1.3	8.75	10.75		5 ÷ 19		8 ÷ 23			
2700377	YELLOW			1.5	8.50	10.50		15 ÷ 50		20 ÷ 50			
2700464	ORANGE			1.7	8.50	10.50		45 ÷ 100		45 ÷ 100			
2700513	RED			2.0	8.50	10.50		70 ÷ 140		70 ÷ 140			
2700713	GREEN			2.3	8.50	10.50		120 ÷ 270		120 ÷ 270		150 ÷ 1550	
2700750	BLACK			2.5	6.00	8.25		250 ÷ 600		250 ÷ 600		1000 ÷ 2100	
2700980	BLUE			3.0	6.00	8.00		500 ÷ 900		500 ÷ 900		1800 ÷ 2700	
2701180	BROWN		3.5	6.25	8.25								

De = Ø external diameter d = Ø wire diameter i = active coils Lo = spring length it = total coils

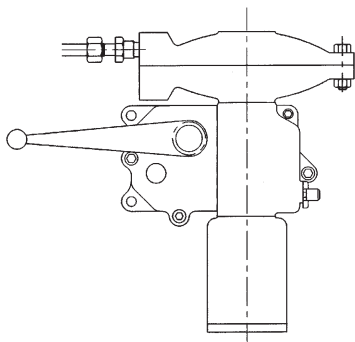


Fig. 9

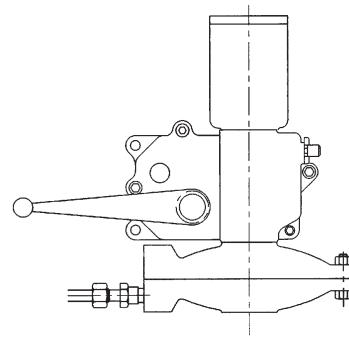


Fig. 10

4.3 NORVAL FUNCTIONING AS A MONITOR

The monitor is an emergency regulator whose function is to come into service instead of the main regulator when failure of the latter causes the downstream pressure to reach the point set for monitor intervention. PIETRO FIORENTINI has a solution for this emergency device for in-line installations.

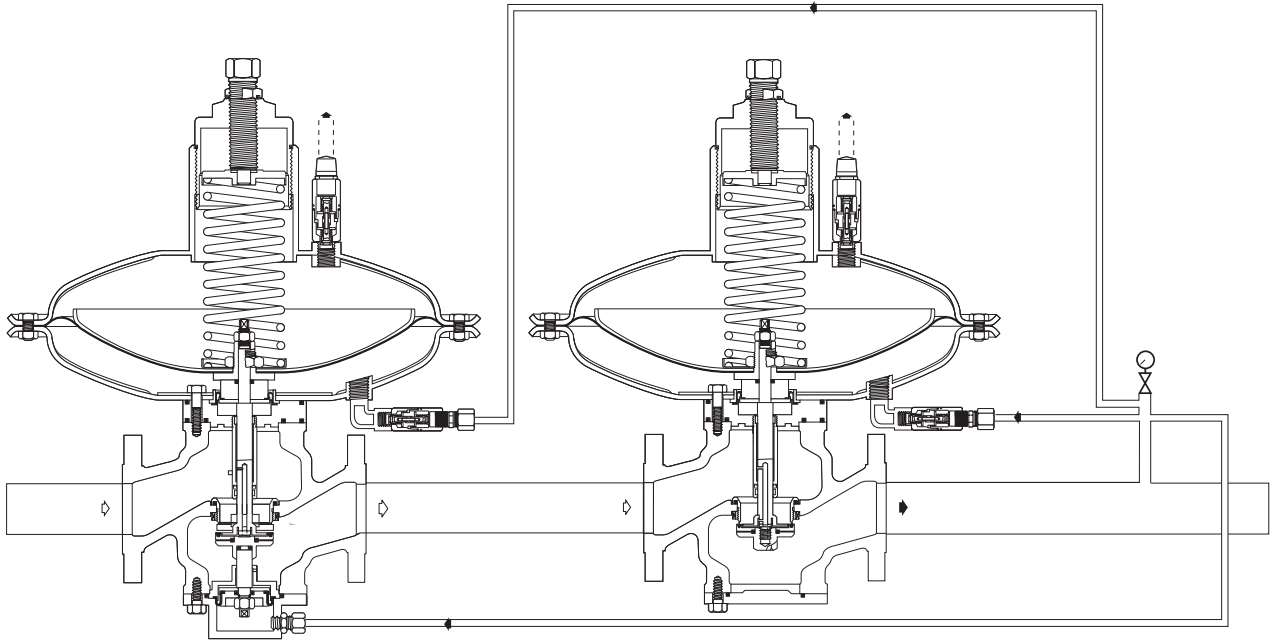


Fig. 11a

4.3.1 CHARACTERISTICS

- Reduced dimensions;
- Easy maintenance;
- Can also be mounted on a normal regulator already installed.

4.3.2 NORVAL OPERATION WITH MONITOR FUNCTIONS

The NORVAL (fig.11) with monitor functions is a regulator which, compared with the normal version, has a further mobile assembly balancing device which guarantees greater precision in the regulated pressure and therefore an equally precise pressure intervention value without problems of interference with the main regulator. Chamber A is subject to the downstream pressure.

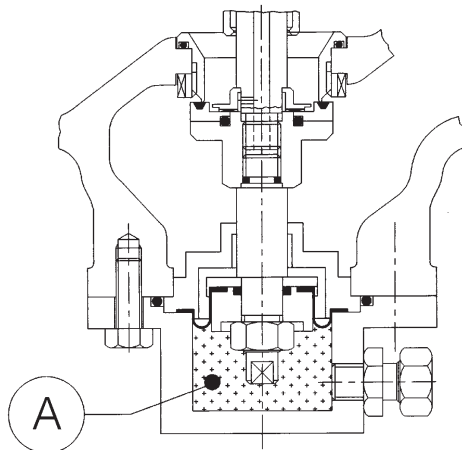


Fig. 11b




5.0 START UP



5.1 GENERAL

After installation, check that the inlet/outlet on/off valves, any by-pass and the bleed cock are closed. Before commissioning, you must ensure that the conditions of use comply with the characteristics of the apparatuses.

These characteristics are recalled by the symbols on the specification plates applied to each apparatus. We recommend actuating the opening and closing valves very slowly. The regulator could be damaged by operations which are too fast.

TARGHETTE APPARECCHIATURE

	Pietro Fiorentini ®		ID n.0062 
REGULATOR	<input type="text" value="NORVAL/G"/>	T: <input type="text"/>	
S.n.: <input type="text"/>	PS: <input type="text"/>	Pemax: <input type="text"/> bar	
DN: <input type="text"/>	Flange: <input type="text"/>	AC: <input type="text"/>	
Wh: <input type="text"/>	Bpe: <input type="text"/> bar	SG: <input type="text"/>	
Wa: <input type="text"/>	Fluido: <input type="text" value="METANO"/>	Cg: <input type="text"/>	

	Pietro Fiorentini ®	
SLAM SHUT DEVICE	Type: <input type="text" value=".../IN"/>	
S.n.: <input type="text"/>	DN: <input type="text"/>	
T: <input type="text"/>	Fluido: <input type="text" value="METANO"/>	
Who: <input type="text"/>	Whu: <input type="text"/> bar	AG: <input type="text"/>
Wao: <input type="text"/>	Wau: <input type="text"/> bar	AG: <input type="text"/>

The list of symbols used and their meanings are listed below:

CE= Conformity to PED Directive

P_{max}= maximum operating pressure at the inlet of the apparatus

b_{pe}= range of variability of the inlet pressure of the pressure regulator in normal operating conditions

PS= massima pressione che può essere sopportata in condizioni di sicurezza dalla struttura del corpo dell'apparecchio

W_a= setting range of the pressure regulator/ pilot/pre-regulator which can be obtained using the parts and the setting spring fitted at the moment of testing (that is without changing any components of the apparatus). In piloted regulators, the pilot is considered as a separate apparatus with its own setting range W_a

W_h= setting range of the pressure regulator/pilot/ pre-regulator which can be obtained using the setting springs indicated in the associated tables and also by changing some other part of the apparatus (reinforced gasket, diaphragm etc.). In piloted regulators, the pilot is considered as a separate apparatus with its own setting range W_h

Q_{maxP_{emin}}= maximum flow rate with minimum pressure at the pressure regulator inlet

Q_{maxP_{max}}= maximum flow rate with maximum pressure at the pressure regulator inlet

C_g= experimental coefficient of critical flow

AC= regulation class

SG= closing pressure class

AG= intervention accuracy

W_{ao}= range of intervention for the over pressure of slam-shut, relief and safety valves and accelerators which can be obtained using the setting spring fitted at the moment of testing. In piloted safety valves, the pilot is considered as a separate apparatus with its own setting range W_{ao}

W_{ho}= range of intervention for the over pressure of slam-shut, relief and safety valves and accelerators which can be obtained using the setting springs indicated in the tables. In piloted safety valves, the pilot is considered as a separate apparatus with its own setting range W_{ho}

W_{au}= range of intervention for pressure decrease of slam-shut which can be obtained using the setting spring fitted at the moment of testing

W_{hu}= range of intervention for pressure decrease of slam-shut which can be obtained using the setting springs indicated in the tables.

5.2 GAS INPUT, CONTROL OF EXTERNAL TIGHTNESS AND SETTING

The apparatus pressurization operation must be carried out very slowly. To protect the apparatus from damage, the following operations **must never be carried out**:

- **Pressurization through a valve located downstream from the apparatus itself.**

- **Depressurization through a valve located upstream from the apparatus itself.**

External tightness is guaranteed if no bubbles form when a foam medium is applied on the element under pressure. The regulator and any other apparatuses (slam-shut, monitor) are normally supplied already set for the desired set-point. It is possible for various reasons (e.g., vibration during transport) for the settings to be changed while remaining within the values permitted by the springs used.

We therefore recommend checking the settings using the procedures illustrated below.

Tables 7 and 8 give the recommended set-points for the apparatuses in the various installation arrangements. The figures in these tables can be useful both when checking existing set-points and for modifying them should this become necessary later.

In installations consisting of two lines, we suggest commissioning one line at a time, starting from the one with the lower set-point, known as the “reserve” line. **The set-points of the apparatuses in this line will obviously deviate from those specified in the tables 7 and 8.**

Before commissioning the regulator you must check that all the on/off valves (inlet, outlet, any by-pass) are closed and that the gas is at a temperature which will not lead to malfunction.

5.3 COMMISSIONING THE REGULATOR

If there is also a relief valve in the line, refer to par. 3.1 to check it.

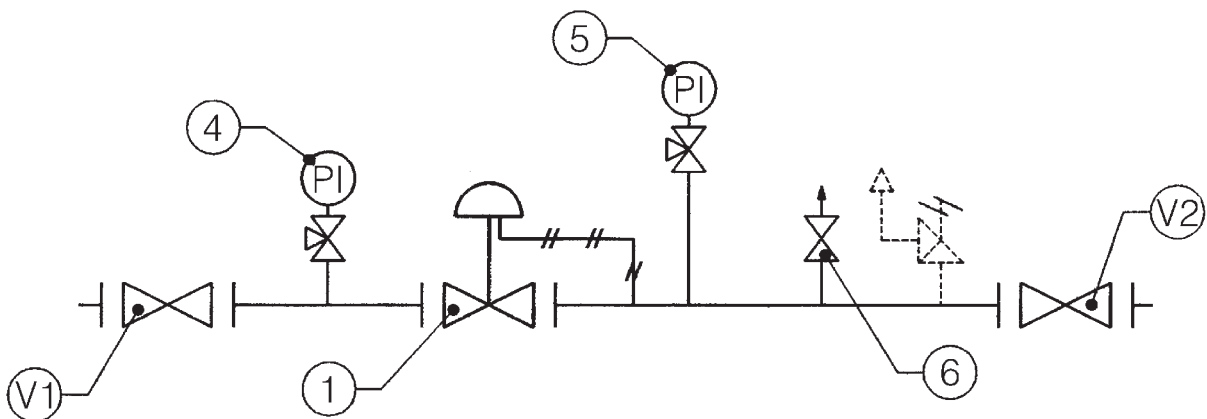


Fig. 12

- 1) very slowly open the inlet on/off valve V1;
- 2) check on the pressure gauge 5 that the pressure does not exceed the pre-established set-point, plus a tolerance of 10% due to the closing force of the regulator;
- 3) stabilise the upstream and downstream pressures and open the bleed cock 6;
- 4) check on the pressure gauge 5 that the downstream pressure is at the set-point. If it is not, adjust the setting by means of the provided screw 74 (fig. 1), turning it clockwise to increase it and anticlockwise to decrease it;
- 5) close the bleed cock and check the pressure set-point;
- 6) check the tightness of all the joints between the on/off valves V1 and V2 using a foam solution;
- 7) very slowly open the downstream on/off valve V2, until the line is completely filled.

5.4 COMMISSIONING THE REGULATOR WITH INCORPORATED I-N SLAM-SHUT

If there is also a relief valve in the line, refer to par. 3.1 to check it.

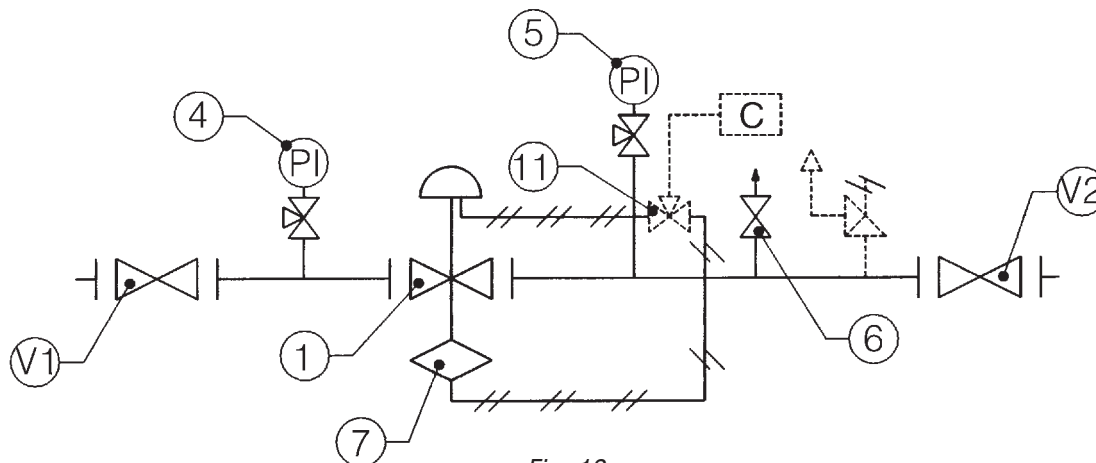
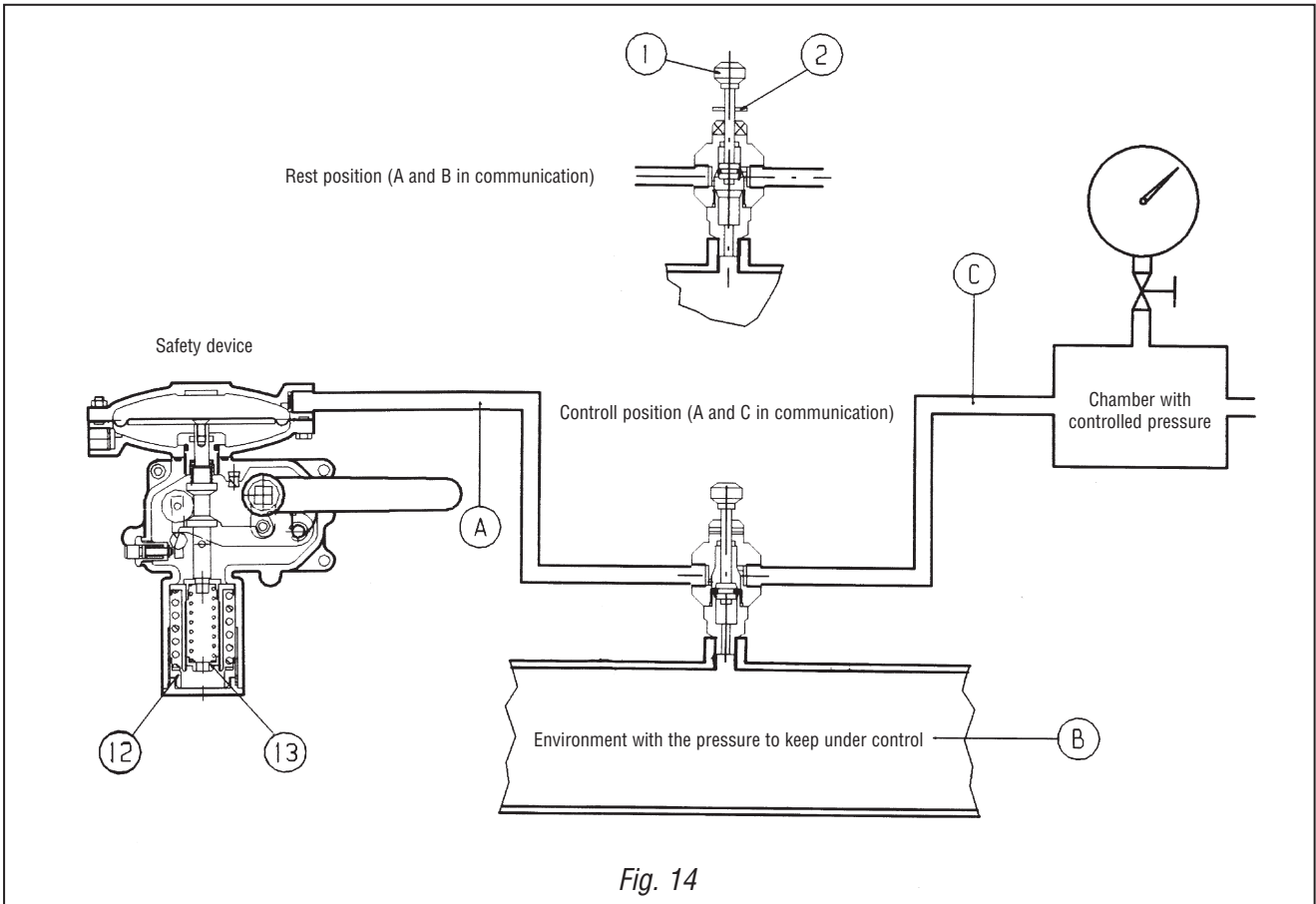


Fig. 13

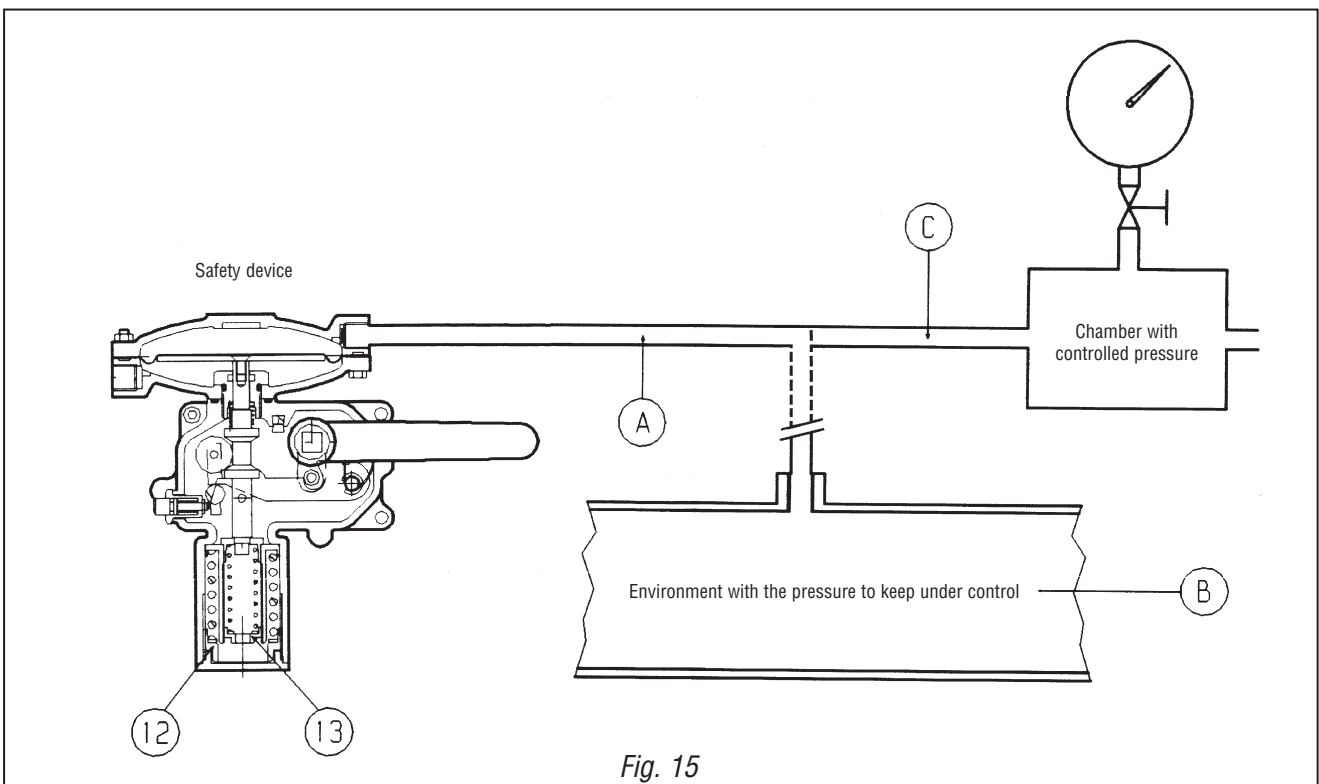
Check and adjust the intervention of the slam-shut 7 as follows:

A) For slam-shuts connected to the downstream piping by a three-ways deviator push valve 11, proceed as follows (Fig. 14):

- connect a controlled auxiliary pressure to path C;
 - stabilise this pressure at the set-point established for the regulator;
 - insert a reference pin 2 in the notch, pressing the knob 1 completely;
 - reset the slam-shut device by means of the provided threaded bushing;
 - keep the knob 1 pressed and:
 - for safety devices which intervene for maximum pressure: slowly increase the auxiliary pressure and check the intervention value. If necessary, increase the intervention value by turning the adjustment ring 12 clockwise, or anticlockwise to reduce the intervention value.
 - for safety devices which intervene for pressure increase and reduction: slowly increase the auxiliary pressure and record the intervention value. Restore the pressure to the set-point established for the regulator, and carry out the slam-shut reset operation.
- Check intervention for pressure reduction by slowly reducing the auxiliary pressure.
- If necessary, increase the intervention values for pressure increase or decrease by respectively turning the rings 12 and 13 clockwise and vice versa to reduce them.
- check proper operation by repeating the operations at least 2-3 times.



B) On devices without the "push" valve (fig. 15) we recommend connecting the control head separately to a controlled auxiliary pressure and repeating the operations described above.



ATTENTION

At the end of the operation, reconnect the control head to the downstream pressure take-off.

N.B.: The intervention tests should be repeated at least every 6 months.

At the end of the slam-shut check, proceed as follows:

- 1) check that the slam-shut is in the closed position;
- 2) open the inlet on/off valve V1;
- 3) very slowly open the slam-shut by turning the provided lever;
- 4) open the downstream bleed cock 6;
- 5) check on the pressure gauge 5 that the downstream pressure is at the desired regulator set-point. If it is not, adjust the setting by means of the provided screw, turning it clockwise to increase it and anticlockwise to decrease it;
- 6) close the bleed cock 6 and check the closing pressure value;
- 7) using a foam medium, check the tightness of all the joints between the on/off valves V1 and V2;
- 8) very slowly open the downstream on/off valve V2, until the line is completely filled;
- 9) check that when you operate the slam-shut manually, the flow in the line stops.

TAB. 7:	Settings of in-line apparatuses consisting of Regulator + Slam-shut + Relief valve		
Regulator set-point (Pas) mbar	Set-point RELIEF VALVE	Set-point SLAM-SHUT Max	Set-point SLAM-SHUT Min
8<Pas≤12	20 mbar	25 mbar	Slam-shut not available
12<Pas≤15	↑	↓	↓
15<Pas≤19	Pas x 1.5	↑	10 mbar
19<Pas≤24	↓	Pas + 20 mbar	↑
24<Pas≤30	Pas x 1.4	↓	Pas -10 mbar
30<Pas≤60	↑	Pas + 30 mbar	↓
60<Pas≤80	Pas x 1.25	↓	Pas -20 mbar
80<Pas≤110	↓	Pas + 40 mbar	Pas -40 mbar
110<Pas≤200	↑	Pas + 100 mbar	Pas -60 mbar
200<Pas≤400	↓	Pas + 150 mbar	Pas -100 mbar
400<Pas≤800	Pas x 1.15	↓	Pas -200 mbar
800<Pas≤1000	↓	Pas + 300 mbar	↑
1000<Pas≤2500	↑	Pas + 500 mbar	↓
2500<Pas≤4000	↓	Pas + 1000 mbar	Pas -300 mbar

5.5 COMMISSIONING THE REGULATOR PLUS NORVAL IN-LINE MONITOR WITH INCORPORATED I-N SLAM-SHUT VALVE

If there is also a relief valve in the line, refer to par. 3.1 to check it.

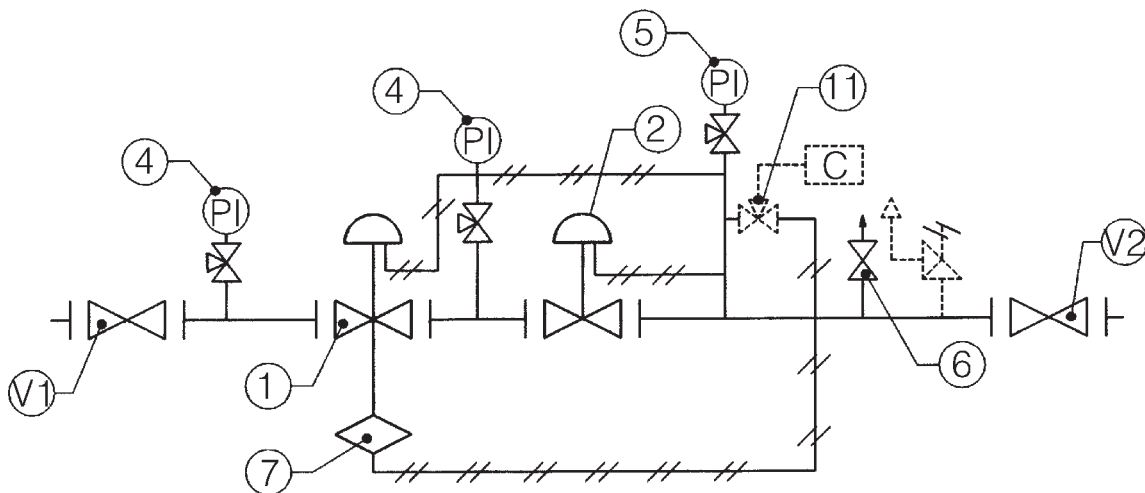


Fig. 16

Check and adjust the intervention of the slam-shut 7 as follows:

A) For slam-shuts connected to the downstream piping by a three-ways deviator push valve 11, proceed as follows (Fig. 14):

- connect a controlled auxiliary pressure to path C;
 - stabilise this pressure at the set-point established for the regulator;
 - insert a reference pin 2 in the notch, pressing the knob 1 completely;
 - reset the slam-shut device by means of the provided threated bushing;
 - keep the knob 1 pressed and:
 - for safety devices which intervene for maximum pressure: slowly increase the auxiliary pressure and check the intervention value. If necessary, increase the intervention value by turning the adjustment ring 12 clockwise, or anticlockwise to reduce it.
 - for safety devices which intervene for pressure increase and reduction: slowly increase the auxiliary pressure and record the intervention value. Restore the pressure to the set-point established for the regulator, and carry out the slam-shut reset operation.
- Check intervention for pressure reduction by slowly reducing the auxiliary pressure. If necessary increase the intervention values for pressure increase or decrease by respectively turning the rings 12 or 13 clockwise and vice versa to reduce them.
- check proper operation by repeating the operations at least 2-3 times.

- B) On devices without the "push" valve (fig. 15) we recommend connecting the control head separately to a controlled auxiliary pressure and repeat the operations described above.

ATTENTION

At the end of the operation, reconnect the control head to the downstream pressure take-off.

N.B.: The intervention tests should be repeated at least every 6 months.

At the end of the slam-shut check, proceed as follows:

- 1) ensure that the slam-shut is in the closed position;
- 2) disconnect the sensing line of the main regulator 2 and appropriately plug the connection fitting on the downstream section;
- 3) very slowly open the on/off valve V1;
- 4) very slowly open the slam-shut by turning the provided lever;
- 5) check on the pressure gauge 5 that the downstream pressure is at the set-point established for the monitor 1, taking account of the closing overpressure;
- 6) open the bleed cock 6;
- 7) check on the pressure gauge 5 that the downstream pressure has the established setting value. If it does not, adjust the setting by means of the special screw 74, turning it clockwise to increase its value and anticlockwise to reduce its value;
- 8) trip the slam-shut manually;
- 9) connect the sensing line of the main regulator;
- 10) very slowly open the slam-shut valve by turning the provided lever;
- 11) check on the pressure gauge 5 that the downstream pressure settles at the set-point established for the main regulator 2, taking account of the closing overpressure;
- 12) open the downstream bleed cock;
- 13) check on the pressure gauge 5 that the downstream pressure has the established setting value. If it does not, adjust the setting by means of the special screw 74, turning it clockwise to increase and anticlockwise to reduce;
- 14) close the bleed cock and check the value of the closing pressure;
- 15) check the tightness of all the joints between the on/off valves V1 and V2 using a foam medium;
- 16) very slowly open the downstream on/off valve V2, until the line is completely filled.
- 17) check that when you operate the slam-shut manually, the flow in the line stops.

TAB. 8:	Settings of in-line apparatuses consisting of Regulator + Monitor + Slam-shut + Relief valve			
Regulator set-point (Pas) mbar	Set-point MONITOR	Set-point RELIEF VALVE	Set-point SLAM-SHUT Max	Set-point SLAM-SHUT Min
8<Pas≤12	↑	25 mbar	30 mbar	Slam-shut not available
12<Pas≤15		↓	↓	↓
15<Pas≤19	↑	Pas x 1.8	↑	10 mbar
19<Pas≤24		Pas + 5 mbar	↓	Pas + 20 mbar
24<Pas≤30		Pas x 1.55	↓	↑
30<Pas≤60	↓	Pas x 1.4	↑	Pas -10 mbar
60<Pas≤80		↑	Pas + 30 mbar	↓
80<Pas≤110		↑	Pas + 40 mbar	Pas -20 mbar
110<Pas≤200	Pas x 1.15	Pas x 1.3	↑	Pas -40 mbar
200<Pas≤400	↓		Pas x 1.46	Pas -60 mbar
400<Pas≤800	↑		Pas x 1.4	Pas -100 mbar
800<Pas≤1000	↓	↑	↑	Pas -200 mbar
1000<Pas≤2500	Pas x 1.15		Pas x 1.3	↑
2500<Pas≤4000	↓	Pas x 1.16	Pas x 1.25	Pas -300 mbar

6.0 TROUBLE-SHOOTING

The problems of various kinds which could arise over time are highlighted below.

They derive from phenomena associated with the conditions of the gas as well, of course, as with the natural ageing and wear of the materials.

It must be remembered that all operations on the apparatuses must be carried out by highly qualified personnel with appropriate knowledge of the subject. Tampering with the apparatuses by unsuitable personnel relieves us from all responsibility of any kind.

You must therefore train your maintenance personnel or avail yourself of the service centres officially authorised by us.

6.1 TAB. 9 REGULATOR (FIG. 17)

PROBLEM	POSSIBLE CAUSES	REMEDY
Operating anomalies	Dirt	Clean the parts subject to movement
	Anti-pumping valve not suitable for the particular type of installation	Adjust or replace the internal part
	Compensating diaphragm [29] worn	Replace
	Incorrect assembly of diaphragm [20]	Check
	Setting spring [41]	Check and, if necessary, replace
	Incorrect assembly of compensating diaphragm [29]	Check
	Reinforced gasket [4] with wrong hardness	Replace
	Incorrect sensing line take-off arrangement	Change arrangement
No tightness at Q=0	Reinforced gasket [4] damaged	<i>Replace</i>
	Valve seat dented	Grind or replace

6.1 TAB. 9 REGULATOR (FIG. 17)

PROBLEM	POSSIBLE CAUSES	REMEDY
No tightness at Q=0	Dirt on the reinforced gasket [4]	Clean
	O-ring [60] worn	Replace
	O-ring [60] worn	Replace
	Compensating diaphragm [29] ruptured	Replace
	Compensating diaphragm [29] improperly fixed	Fix
Pressure increase at Q>0	Reinforced gasket [4] damaged	Replace
	Shaft locked by incrustation during start-up	Clean
	Setting higher than spring limit	Replace spring
	Diaphragm [20] ruptured	Replace
	Incorrect assembly of diaphragm [29]	Fix
	No sensing signal from take-off	Check
Pressure drop	Demand higher than regulator flow rate	Replace
	No pressure upstream	Check any line filter

6.2 TAB. 10 REGULATOR SLAM-SHUT (FIG. 18)

PROBLEM	POSSIBLE CAUSES	REMEDY
Slam-shut obturator does not close	Control diaphragm [16] ruptured	Change the diaphragm
Leakage from slam-shut obturator	Obturator gasket [10] deteriorated	Change the gasket
	O-ring [66] worn	Change
	Obturator seat [7] eroded or pitted	Change the seat
Incorrect intervention pressure	Wrong setting of maximum and/or minimum spring	Make the setting again using the rings [12] and/or [13]
	Friction in lever system	Change the box containing the whole assembly
Rearming not possible	Persistence of the cause which led to pressure increase or decrease downstream	Decrease or increase the downstream pressure
	Lever system broken or chipped	Change the standard box containing the assembly outside the regulator

N.B. If the slam-shut has intervened, close the inlet and outlet valve (**V1** and **V2**) on the line and discharge the pressure before carrying out any operation.
Eliminate the causes which gave rise to intervention before reactivating it.

In the event of operating problems when personnel qualified for a specific operation are not available, call the service centre nearest you. For further information contact our SATRI service at our Arcugnano (Vicenza) works.

7.0 MAINTENANCE

7.1 GENERAL


Periodical inspection and maintenance shall be carried out according to the regulations in force (kind and frequencies). Before carrying out any operation it is important to ascertain that the regulator has been cut off both upstream the regulator and the on/off valves.

The maintenance operations are closely associated with the quality of the gas transported (impurities, humidity, gasoline, corrosive substances) and with the efficiency of the filtering.

Preventive maintenance should be carried out at intervals which, if not established by regulations in force, depend on:

- the quality of the gas transported;
- the cleanliness and conservation of the piping upstream from the regulator: in general, for example, when starting the equipment for the first time, more frequent maintenance is required because of the precarious state of cleanliness inside the piping;
- the level of reliability required from the regulation system.

Before starting the disassembly operations on the apparatus you should check that:

- a set of recommended spares is available. The spares must be original **Fiorentini**  ones, bearing in mind that the more important ones such as diaphragms are marked
- A set of wrenches is available as specified in table 11.

For a proper maintenance the recommended spare parts are unequivocally identified by labels indicating:

- The No of assembly drawing SR of the apparatus for which the spare parts are suitable,
- The position showed in the assembly drawing SR of the apparatus

N.B. The use of non-original spare parts relieves us of all responsibilities.

In the maintenance is carried out by your own authorized personnel, we recommend putting reference markings, before the disassembly, on those parts which could have directional or reciprocal positioning problems when reassembling. Finally, we would remind you that O-Rings and sliding mechanical components (rods, etc.) must be lubricated, before the re-assembly, with a fine **layer** of silicone grease. Before recommissioning of equipment after maintenance, external tightness shall be verified at appropriate pressure to assure no external leakage. When equipment is used as safety accessory to PED, internal sealing shall be verified at appropriate pressure to assure the internal sealing at the maximum expected operating pressure. Both verifications are essential to assure safe use at foreseen operating conditions; they have, anyhow, to comply with the national regulations in force.

7.2 NORVAL REGULATOR MAINTENANCE PROCEDURE

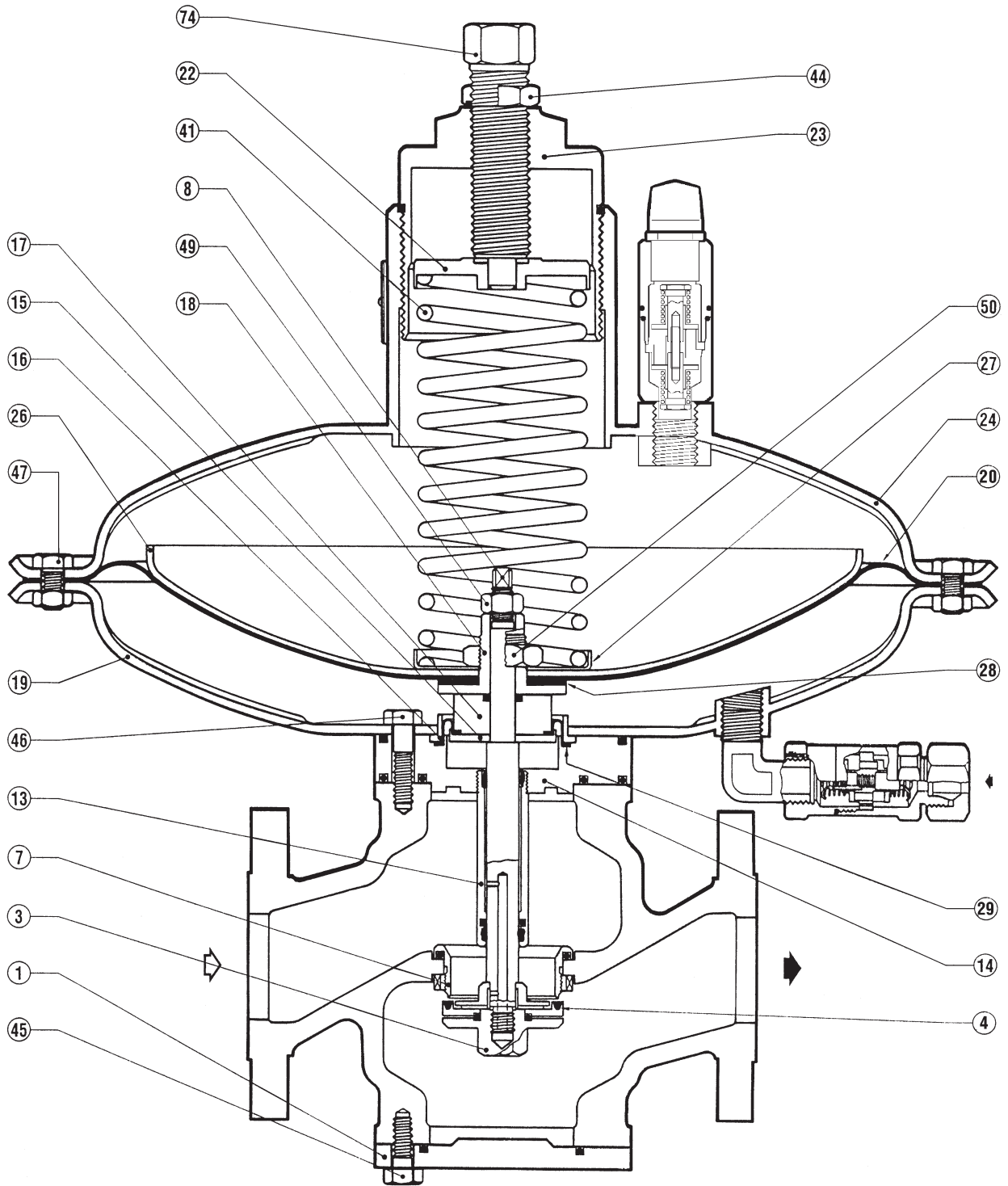


Fig. 17

Procedure for the disassembly, complete replacement of the spare parts and re-assembly of the NORVAL pressure regulator (PROGRAMMED PREVENTIVE MAINTENANCE)

PRELIMINARY OPERATIONS

- A. Render the regulator safe;**
B. Ensure that the pressure upstream and downstream from it is 0.
-
-

DISASSEMBLY
(The positions refer to fig. 17)

- 1) Slacken the fixing screws, pos. (45), in the bottom flange.
- 2) Remove the bottom flange, pos. (1).
- 3) Remove the gasket from the obturator, pos. (4), unscrewing the gasket support pos. (3), and acting with a sharp blow.
- 4) Slacken the lock-nut, pos. (44).
- 5) Slacken the adjustment screw, pos. (74), until it comes out.
- 6) Unscrew and remove the spring-holder plug, pos. (23).
- 7) Remove the adjustment spring, pos. (41), along with the top spring support, pos. (22).
- 8) Slacken and remove the fixing screws, pos. (47).
- 9) Remove the top cover, pos. (24).
- 10) Keeping the diaphragm support, pos. (18), fixed, slacken the lock-nut, pos. (50). Remove it and then remove the spring support, pos. (27), the diaphragm protection disc, pos. (26), the diaphragm, pos. (20), and the rubber gasket, pos. (28).
- 11) Keeping the rod, pos. (8), fixed, remove the self-locking nut, pos. (49).
- 12) Remove the rod, pos. (8), from the bottom part of the regulator body.
- 13) Remove the diaphragm support, pos. (18), and the spacer, pos. (17).
- 14) Disconnect the sensing line which connects the bottom cover, pos. (19), to the downstream piping by unscrewing the taper seal connections.
- 15) Slacken and remove the bottom cover fixing screws, pos. (46).
- 16) Remove the bottom cover, pos. (19).
- 17) Remove the bushing, pos. (16), the balancing diaphragm, pos. (29) and the lock ring, pos. (15).
- 18) Remove the intermediate flange, pos. (14), along with the rod guide sleeve, pos. (13).
- 19) Check and clean the inside of the regulator body.
- 20) Carefully check that the valve seat, pos. (7), is in a good state.
- 21) **Replace all the components included in the spare parts list.**

RE-ASSEMBLY

Remembering that the O-rings and the sliding parts (rods, etc.) must be lightly lubricated with a fine layer of silicone grease before re-assembly, while static parts require grease to render them softer but, especially, to hold them in their slots:

- 22) Fit back the intermediate flange, pos. (14), along with the rod guide sleeve, pos. (13).
- 23) Put back the lock ring, pos. (15), the balancing diaphragm, pos. (29), and the bushing, pos. (16).
- 24) Put the bottom cover, pos. (19), back in its original position with the sensing line take-off turned towards the downstream piping, and fix the screws, pos. (46).
- 25) Reconnect the sensing line which connects the bottom cover, pos. (19), to the downstream piping, repositioning it and fixing the taper seal connections.
- 26) Fit the spacer, pos. (17), and the diaphragm support, pos. (18).
- 27) Put the rod, pos. (8), back on the bottom part of the regulator body, and screw in the self-locking nut, pos. (49).
- 28) Keeping the rod, pos. (8), fixed, fully tighten the self-locking nut, pos. (49).
- 29) Proceeding slowly, carry out vertical movements of the top of the rod to check that it moves properly.
- 30) Reassemble the gasket, pos. (28), the diaphragm, pos. (20), the diaphragm protection disc, pos. (26) and the spring support, pos. (27), and screw in the lock-nut, pos. (50).
- 31) Check that the holes in the diaphragm and bottom cover match and, keeping the diaphragm support fixed, tighten the lock-nut, pos. (50).
- 32) Check once again that the holes in the diaphragm and bottom cover line up properly.
- 33) Put the top cover back into its original position with the anti-pumping valve towards the downstream side.
- 34) Put back and fix the screws, pos. (47), with a torque of 5 KG.M.
- 35) Put back the regulation spring, pos. (41), with the top spring cover, pos. (22).
- 36) Screw the spring-holder plug, pos. (23), as far as it goes.
- 37) Put back the obturator gasket, pos. (4), with the gasket support, pos. (3), as far as it goes.
- 38) Fix the above with a sharp blow.
- 39) Put back the bottom flange, pos. (1) by means of the fixing screws, pos. (45).

7.3 NORVAL REGULATOR + I-N MAINTENANCE PROCEDURE

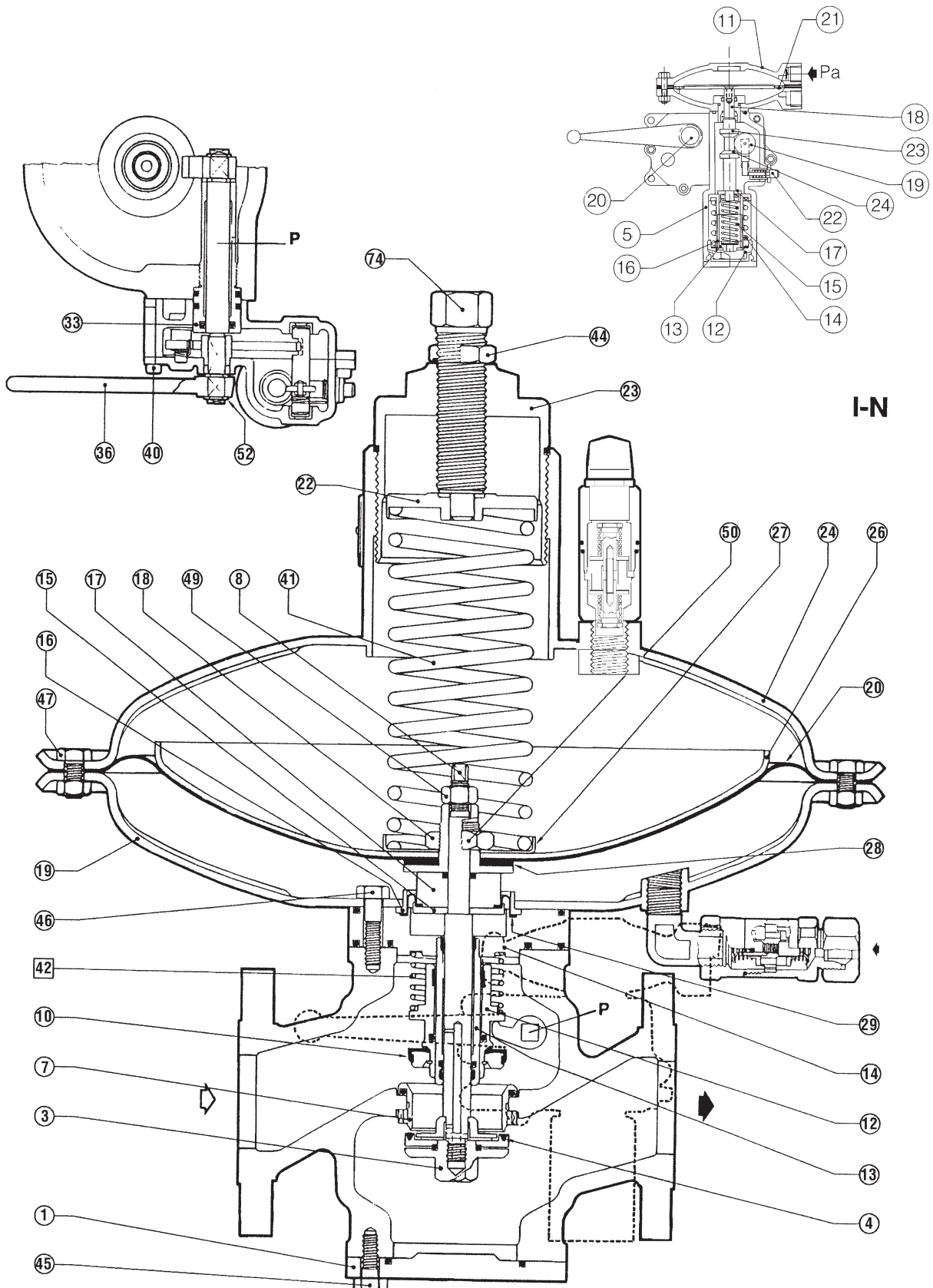


Fig. 18

Procedure for the disassembly, complete replacement of the spare parts and re-assembly of the NORVAL pressure regulator + I-N (PROGRAMMED PREVENTIVE MAINTENANCE)

PRELIMINARY OPERATIONS

- A. Render the regulator safe;**
- B. Ensure that the pressure upstream and downstream from it is 0.**
- C. Press the button to trip the slam-shut valve.**

DISASSEMBLY

(The positions refer to fig. 18)

- 1) Slacken the fixing screws, pos. (45), in the bottom flange.
- 2) Remove the bottom flange, pos. (1).
- 3) Remove the gasket from the obturator, pos. (4), unscrewing the gasket support pos. (3), and acting with a sharp blow.
- 4) Slacken the lock-nut, pos. (44).
- 5) Slacken the adjustment screw, pos. (74), until it comes out.
- 6) Unscrew and remove the spring-holder plug, pos. (23).
- 7) Remove the adjustment spring, pos. (41), along with the top spring support, pos. (22).
- 8) Slacken and remove the fixing screws, pos. (47).
- 9) Remove the top cover, pos. (24).
- 10) Keeping the diaphragm support, pos. (18), fixed, slacken the lock-nut, pos. (50). Remove it and then remove the spring support, pos. (27), the diaphragm protection disc, pos. (26), the diaphragm, pos. (20), and the rubber gasket, pos. (28).
- 11) Keeping the rod, pos. (8), fixed, remove the self-locking nut, pos. (49).
- 12) Remove the rod, pos. (8), from the bottom part of the regulator body.
- 13) Remove the diaphragm support, pos. (18), and the spacer, pos. (17).
- 14) Disconnect the sensing line which connects the bottom cover, pos. (19), to the downstream piping by unscrewing the taper seal connections.
- 15) Slacken and remove the bottom cover fixing screws, pos. (46).
- 16) Remove the bottom cover, pos. (19).
- 17) Remove the bushing, pos. (16), the balancing diaphragm, pos. (29) and the lock ring, pos. (15).
- 18) Remove the intermediate flange, pos. (14), along with the rod guide sleeve, pos. (13).
- 19) Remove the obturator support of the slam-shut valve, pos. (12), along with the spring, pos. (42), and the obturator, pos. (10).
- 20) Check and clean the inside of the regulator body.
- 21) Carefully check that the valve seat, pos. (7), is in a good state, both with regard to the regulator seat and the slam-shut seat.
- 22) Disconnect the sensing line which connects the pressure control of the slam-shut to the downstream piping, unscrewing the taper seal connections.

- 23) Slacken the fixing screws, pos. (42), of the slam-shut cover, pos. (17).
- 24) Remove the slam-shut cover, pos. (52).
- 25) Remove the retaining ring, pos. (52), which fixes the reset lever, pos. (36).
- 26) Remove the reset lever, pos. (36).
- 27) Remove the retaining ring, pos. (52).
- 28) Slacken and unscrew the screws, pos. (40).
- 29) Remove the pressure control from the regulator body.
- 30) Unscrew and remove the shaft guide, pos. (33).
- 31) **Replace all the components included in the spare parts list.**

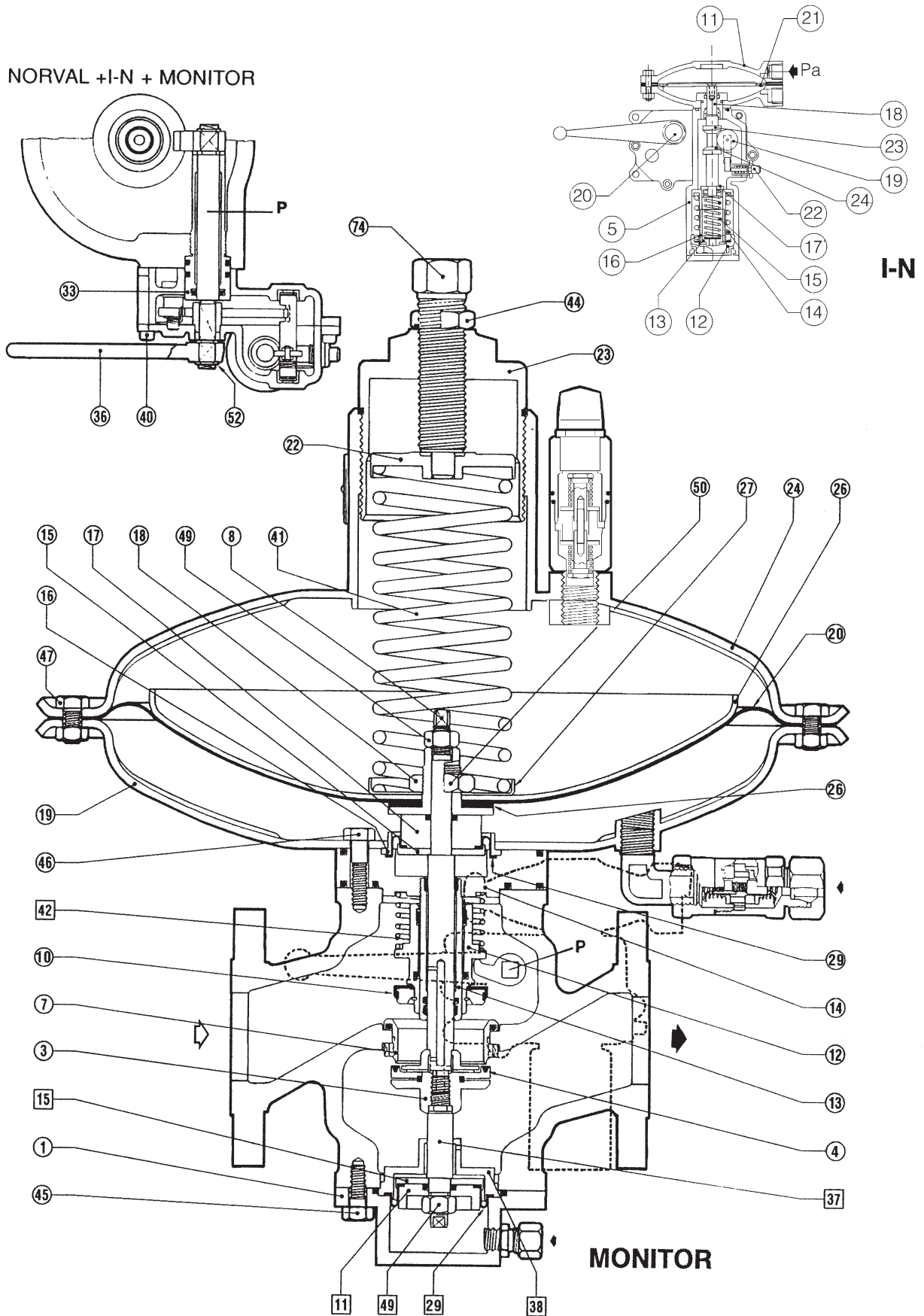
RE-ASSEMBLY

Remembering that the O-rings and the sliding parts (rods, etc.) must be lightly lubricated with a fine layer of silicone grease before re-assembly, while static parts require grease to render them softer but, especially, to hold them in their slots:

- 32) Fix the shaft guide, pos. (33), to the regulator body.
- 33) Fit the pressure control back on the regulator body.
- 34) Secure this by screwing in the screws, pos. (40).
- 35) Put back the retaining ring, pos. (52).
- 36) Position the reset lever, pos. (36).
- 37) Put back the retaining ring, pos. (52).
- 38) Put back the slam-shut cover, pos. (17).
- 39) Fix the screws, pos. (42), of the slam-shut cover, pos. (17).
- 40) Reconnect the sensing line which connects the pressure control of the slam-shut to the downstream piping, and fix the taper seal connections.
- 41) Put back the slam-shut obturator support, pos. (12), along with the spring, pos. (42), and the obturator, pos. (10).
- 42) Fit back the intermediate flange, pos. (14), along with the rod guide sleeve, pos. (13).
- 43) Put back the lock ring, pos. (15), the balancing diaphragm, pos. (29), and the bushing, pos. (16).
- 44) Put the bottom cover, pos. (19), back in its original position with the sensing line take-off turned towards the downstream piping, and fix the screws, pos. (46).
- 45) Reconnect the sensing line which connects the bottom cover, pos. (19), to the downstream piping, repositioning it and fixing the taper seal connections.
- 46) Fit the spacer, pos. (17), and the diaphragm support, pos. (18).
- 47) Put the rod, pos. (8), back on the bottom part of the regulator body, and screw in the self-locking nut, pos. (49).
- 48) Keeping the rod, pos. (8), fixed, fully tighten the self-locking nut, pos. (49).
- 49) Proceeding slowly, carry out vertical movements of the top of the rod to check that it moves properly.
- 50) Reassemble the gasket, pos. (28), the diaphragm, pos. (20), the diaphragm protection disc, pos. (26) and the spring support, pos. (27), and screw in the lock-nut, pos. (50).
- 51) Check that the holes in the diaphragm and bottom cover match and, keeping the diaphragm support fixed, tighten the lock-nut, pos. (50).

- 52) Check once again that the holes in the diaphragm and bottom cover line up properly.
- 53) Put the top cover back into its original position with the anti-pumping valve towards the downstream side.
- 54) Put back and fix the screws, pos. (47), with a torque of 5 KG.M.
- 55) Put back the regulation spring, pos. (41), with the top spring cover, pos. (22).
- 56) Screw the spring-holder plug, pos. (23), as far as it goes.
- 57) Put back the obturator gasket, pos. (4), screwing in the gasket support, pos. (3), manually as far as it goes, and fix it with a sharp blow.
- 58) Put back the bottom flange, pos. (1) by means of the fixing screws, pos. (45).

7.4 MAINTENANCE PROCEDURE FOR THE NORVAL REGULATOR + I-N + ER



Procedure for the disassembly, complete replacement of the spare parts and re-assembly of the NORVAL pressure regulator + I-N + ER (PROGRAMMED PREVENTIVE MAINTENANCE)

PRELIMINARY OPERATIONS

- A. Render the regulator safe;**
- B. Ensure that the pressure upstream and downstream from it is 0.**
- C. Press the button to trip the slam-shut valve.**

**DISASSEMBLY
(The position refers to fig. 19)**

- 1) Disconnect the sensing line which connects the monitor to the downstream piping, unscrewing the taper seal connections.
- 2) Slacken the fixing screws, pos. (50), in the bottom flange.
- 3) Remove the bottom flange, pos. (1).
- 4) Unscrew the nut, pos. (49), and with a blow remove the protection disc, pos. (11), the balancing diaphragm, pos. (29), the lock ring, pos. (15) and the locking flange, pos. (38).
- 5) Unscrew the balancing rod, pos. (37), with a sharp blow.
- 6) Remove the reinforced gasket, pos. (4), unscrewing the gasket support, pos. (3), with a sharp blow.
- 7) Slacken the lock-nut, pos. (44).
- 8) Slacken the adjustment screw, pos. (74), until it comes out.
- 9) Unscrew and remove the spring-holder plug, pos. (23).
- 10) Remove the adjustment spring, pos. (41), along with the top spring support, pos. (22).
- 11) Slacken and remove the fixing screws, pos. (47).
- 12) Remove the top cover, pos. (24).
- 13) Keeping the diaphragm support, pos. (18), fixed, slacken the lock-nut, pos. (50). Remove it and then remove the spring support, pos. (27), the diaphragm protection disc, pos. (26), the diaphragm, pos. (20), and the rubber gasket, pos. (28).
- 14) Keeping the rod, pos. (8), fixed, remove the self-locking nut, pos. (49).
- 15) Remove the rod, pos. (8), from the bottom part of the regulator body.
- 16) Remove the diaphragm support, pos. (18), and the spacer, pos. (17).
- 17) Disconnect the sensing line which connects the bottom cover, pos. (19), to the downstream piping by unscrewing the taper seal connections.
- 18) Slacken and remove the bottom cover fixing screws, pos. (46).
- 19) Remove the bottom cover, pos. (19).
- 20) Remove the bushing, pos. (16), the balancing diaphragm, pos. (29) and the lock ring, pos. (15).
- 21) Remove the intermediate flange, pos. (14), along with the rod guide sleeve, pos. (13).

- 22) Remove the obturator support of the slam-shut valve, pos. (12), along with the spring, pos. (42), and the obturator, pos. (10).
- 23) Check and clean the inside of the regulator body.
- 24) Carefully check that the valve seat, pos. (7), is in a good state, both with regard to the regulator seat and the slam-shut seat.
- 25) Disconnect the sensing line which connects the pressure control of the slam-shut to the downstream piping, unscrewing the taper seal connections.
- 26) Slacken the fixing screws, pos. (42), of the slam-shut cover, pos. (17).
- 27) Remove the slam-shut cover, pos. (17).
- 28) Remove the retaining ring, pos. (52), which fixes the reset lever, pos. (36).
- 29) Remove the reset lever, pos. (36).
- 30) Remove the retaining ring, pos. (52).
- 31) Slacken and unscrew the screws, pos. (40).
- 32) Remove the pressure control from the regulator body.
- 33) Unscrew and remove the shaft guide, pos. (33).
- 34) Replace all the components included in the spare parts list.**

RE-ASSEMBLY

Remembering that the O-rings and the sliding parts (rods, etc.) must be lightly lubricated with a fine layer of silicone grease before re-assembly, while static parts require grease to render them softer but, especially, to hold them in their slots:

- 35) Fix the shaft guide, pos. (33), to the regulator body.
- 36) Fit the pressure control back on the regulator body.
- 37) Secure this by screwing in the screws, pos. (40).
- 38) Put back the retaining ring, pos. (52).
- 39) Position the reset lever, pos. (36).
- 40) Put back the retaining ring, pos. (52).
- 41) Put back the slam-shut cover, pos. (17).
- 42) Fix the screws, pos. (42), of the slam-shut cover, pos. (17).
- 43) Reconnect the sensing line which connects the pressure control of the slam-shut to the downstream piping, and fix the taper seal connections.
- 44) Put back the slam-shut obturator support, pos. (12), along with the spring, pos. (42), and the obturator, pos. (10).
- 45) Fit back the intermediate flange, pos. (14), along with the rod guide sleeve, pos. (13).
- 46) Put back the lock ring, pos. (15), the balancing diaphragm, pos. (29), and the bushing, pos. (16).
- 47) Put the bottom cover, pos. (19), back in its original position with the sensing line take-off turned towards the downstream piping, and fix the screws, pos. (46).
- 48) Reconnect the sensing line which connects the bottom cover, pos. (19), to the downstream piping, repositioning it and fixing the taper seal connections.
- 49) Fit the spacer, pos. (17), and the diaphragm support, pos. (18).
- 50) Put the rod, pos. (8), back on the bottom part of the regulator body, and screw in the self-locking nut, pos. (49).

- 51) Keeping the rod, pos. (8), fixed, fully tighten the self-locking nut, pos. (49).
- 52) Proceeding slowly, carry out vertical movements of the top of the rod to check that it moves properly.
- 53) Reassemble the gasket, pos. (28), the diaphragm, pos. (20), the diaphragm protection disc, pos. (26), and the spring support, pos. (27), and screw in the lock-nut, pos. (50).
- 54) Check that the holes in the diaphragm and bottom cover match and, keeping the diaphragm support fixed, tighten the lock-nut, pos. (50).
- 55) Check once again that the holes in the diaphragm and bottom cover line up properly.
- 56) Put the top cover back into its original position with the anti-pumping valve at the downstream side.
- 57) Put back and fix the screws, pos. (47), with a torque of 5 KG.M.
- 58) Put back the regulation spring, pos. (41), with the top spring cover, pos. (22).
- 59) Screw the spring-holder plug, pos. (23), as far as it goes.
- 60) Put back the obturator gasket, pos. (4), screwing in the gasket support, pos. (3), manually as far as it goes.
- 61) Fix it with a sharp blow.
- 62) Reassemble the balancing rod, pos. [37], and fix it with a sharp blow.
- 63) Fit back the locking flange, pos. [38], together with the lock ring, pos. [15], the balancing diaphragm, pos. [29], and the protection disc, pos. [11], and fix the whole assembly by means of the nut, pos. [49], with a sharp blow.
- 64) Put back the bottom flange, pos. (1) by means of the fixing screws, pos. (45).

8.0 FINAL OPERATIONS

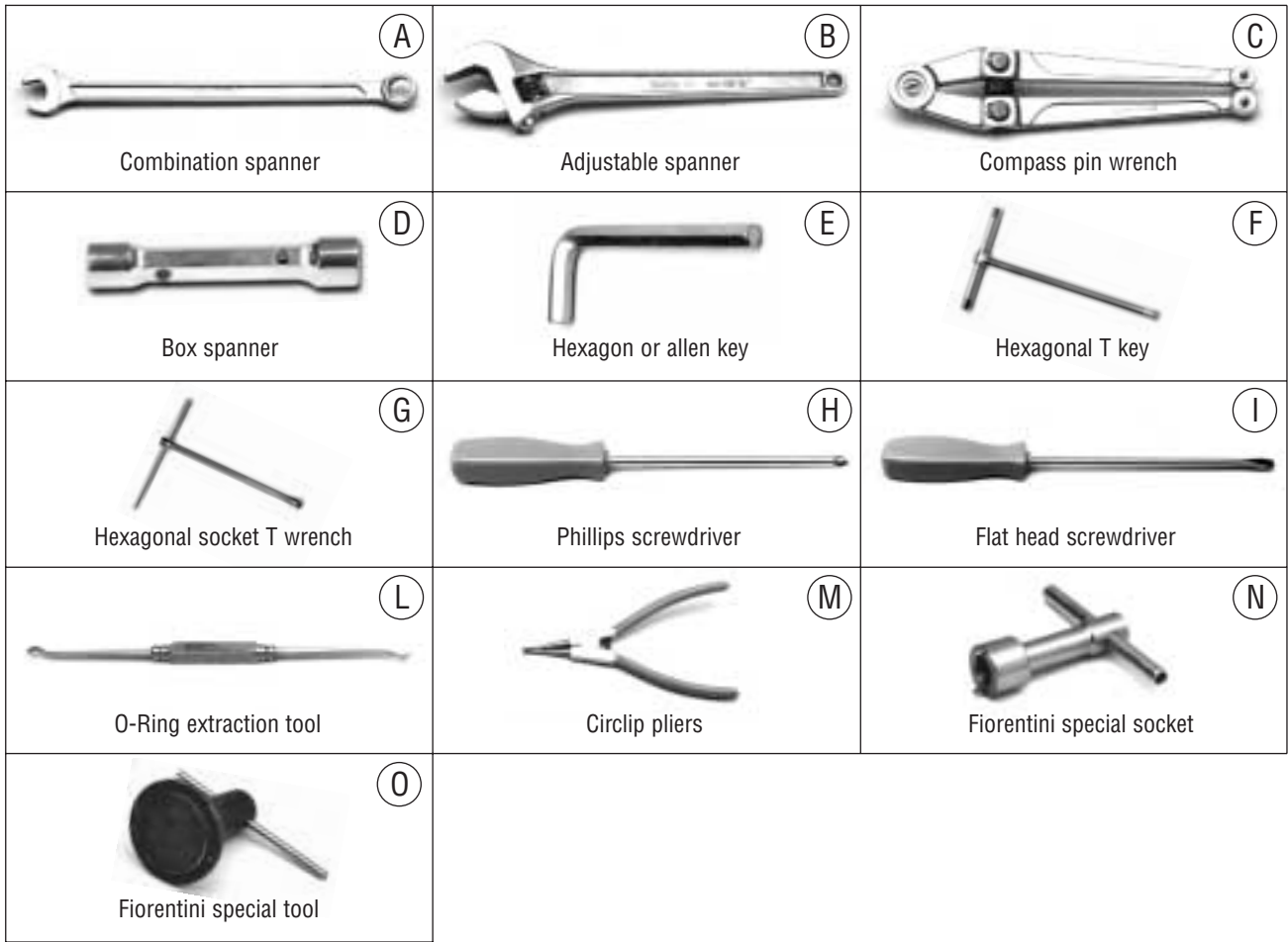
8.1 CHECKING THE TIGHTNESSES AND SETTING

- 1) Very slowly open the on/off valve upstream from the regulator and using a foam solution or the like check:
 - the tightness of the external surfaces of the regulator;
 - the tightness of the slam-shut;
 - the tightness of the internal surfaces of the regulator;
 - the tightness of the fittings.
- 2) Operating very slowly, turn the reset lever, pos. (36) , of the slam-shut from the vertical position towards the horizontal position until only the internal by-pass is opened. Then raise the lever completely to the re-engage position.
 - Check the tightness of the reinforced gasket of the regulator.
- 3) Open a bleed cock downstream from the regulator to create a small gas flow.
- 4) Screw in the adjustment screw pos. (74) until the desired set-point value is reached.
- 5) Close the bleed cock to the atmosphere.

8.2 START UP

- 1) Very slowly open the downstream on/off valve and, if necessary, adjust the regulator set-point by means of the adjustment screw, pos. (74) .
- 2) Fix the lock-nut, pos. (44) .

TAB. 11 MAINTENANCE WRENCHES FOR NORVAL PRESSURE REGULATORS (+I-N) (+ER)



	Type	DN	1" and 1 1/4"	1 1/2" and 2"	2 1/2" and 3"	4"	6"	8"
NORVAL	A	Ch.	8-13-19 27-32-36	8-13-19 27-32-36	8-13-19 27-32-36	8-19-24 27-32-36	10-17-19 22-27-32	10-17-19 22-27-32-36
	B	L.	300					
	E	Ch.				4	4	
	G	Ch.	13-17-22	17-22	17-22	17-24-27	17-27	17-27
	L	Cod	7999099					
	O	Cod	7999045	7999047	7999049			

	Type	DN	1" and 1 1/4"	1 1/2" and 2"	2 1/2" and 3"	4"	6"	8"
NORVAL + I-N	A	Ch.	8-13-19 23-27-32-36	8-13-19 23-27-32-36	8-17-19 23-27-32-36	8-19-23 24-27-32-36	8-10-13-17-19 22-27-32-36	8-10-13-17-19 22-23-27-32-36
	B	L.	300					
	D	Ch.	10-27	10-27	10-27	10-27	10-27	10-27
	E	Ch.	5	5	5	4-5	4-5	4-5
	G	Ch.	13-17-19-22	13-17-22	17-22	17-24-27	17-27	17-27
	I	Ch.	6.5 x 100					
	L	Cod	7999099					
	M	ø	19 ÷ 60					
	O	Cod	7999045	7999047	7999049			

	Type	DN	1" and 1 1/4"	1 1/2" and 2"	2 1/2" and 3"	4"	6"	8"
NORVAL + I-N + ER	A	Ch.	8-13-19 23-27-32-36	8-13-19 23-27-32-36	8-17-19 23-27-32-36	8-19-23 24-27-32-36	8-10-17-19 22-23-27-32-36	8-10-17-19 22-23-27-32-36
	B	L.	300					
	D	Ch.	10-27	10-27	10-27	10-27	10-27	10-27
	E	Ch.	5	5	5	4-5	4-5	4-5
	G	Ch.	13-17-19-22	17-19-22	17-19-22	17-19-27	17-19-27	17-27-27
	I	Ch.	6.5 x 100					
	L	Cod	7999099					
	M	ø	19 ÷ 60					
	O	Cod	7999045	7999047	7999049			

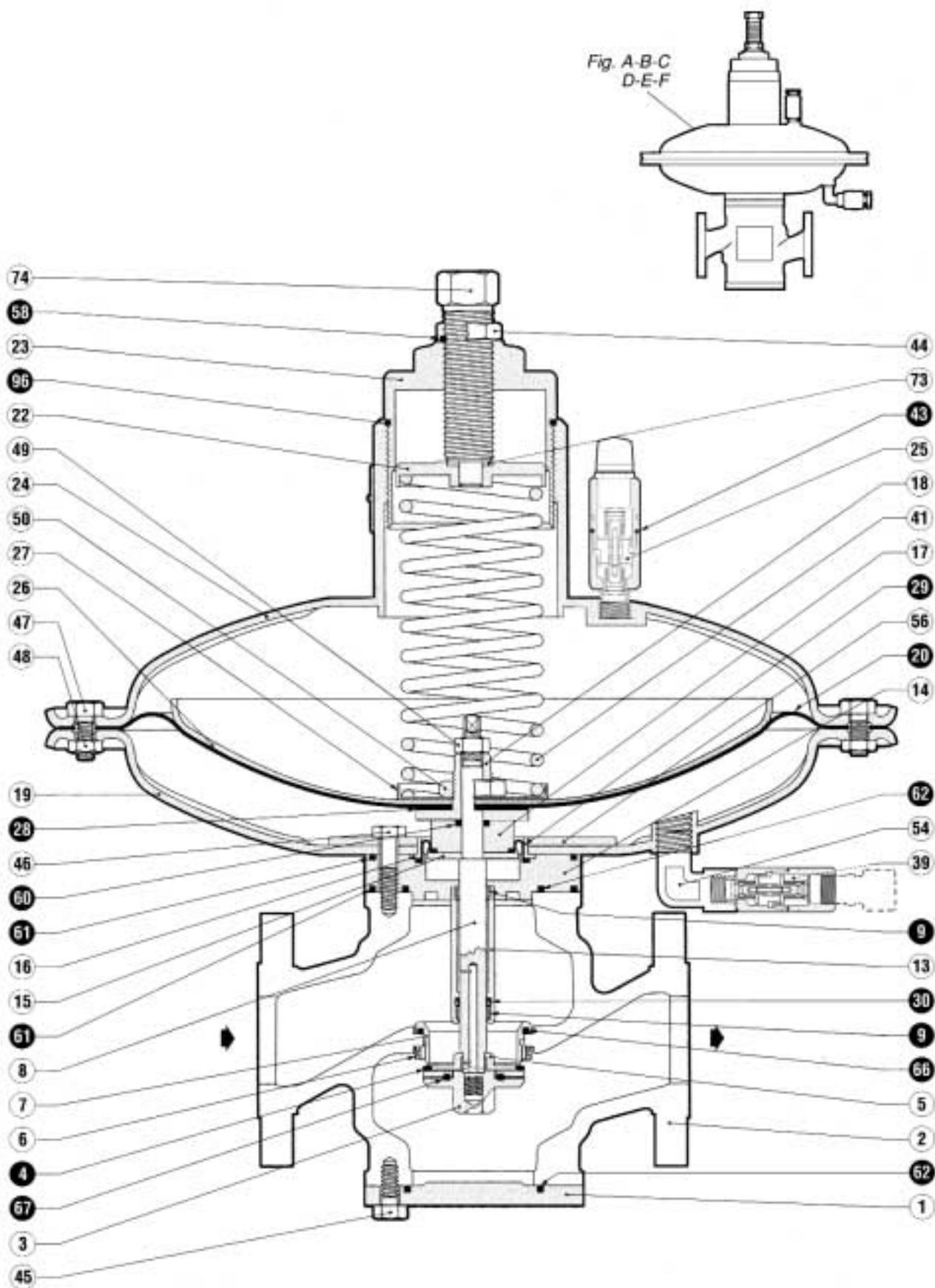
8.0 WEIGHT OF THE COMPONENTS

8.1 TAB. 12 WEIGHT OF THE COMPONENTS IN KG.

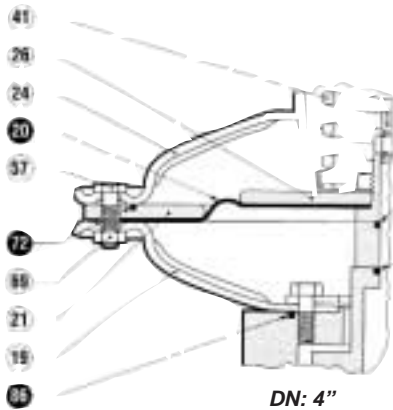
DN	1" 1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	8"
	3	3	3	3	3	3	5,5	5,5
	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7
	10,3	10,3	10,3	17,3	17,3	17,3	28	28
	4,3	4,3	4,3	6,4	6,4	6,4	10	10
	10,8	10,8	10,8	16,3	16,3	16,3	19	19
	/	/	/	/	/	12,5	22,5	36
	0,3	0,5	0,3	0,3	0,3	1,7	4,2	8,2
	1,3	2,5	2,1	4,5	4,5	5	10	14,5
	10	14,5	16,6	25,5	36,5	48	90	148
	0,3	0,3	0,3	0,4	0,4	0,5	1	1,3
	0,3	0,3	0,5	0,7	1	1,2	3,5	5,5
	0,8	1,3	2	2	5,75	10,4	16	22,3

9.0 LIST OF RECOMMENDED SPARE PARTS

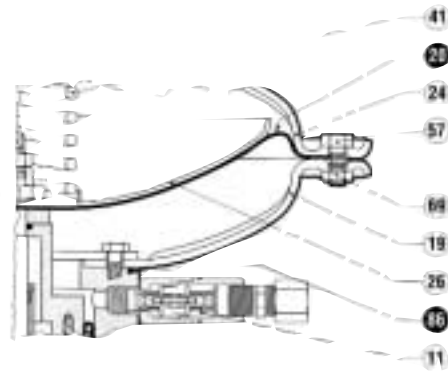
NORVAL pression regulator



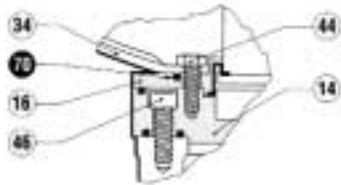
VERSIONS



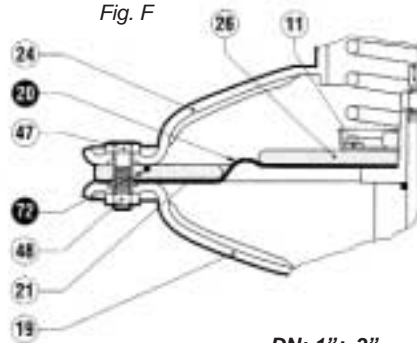
DN: 4"
Fig. E



DN: 4"
Fig. F



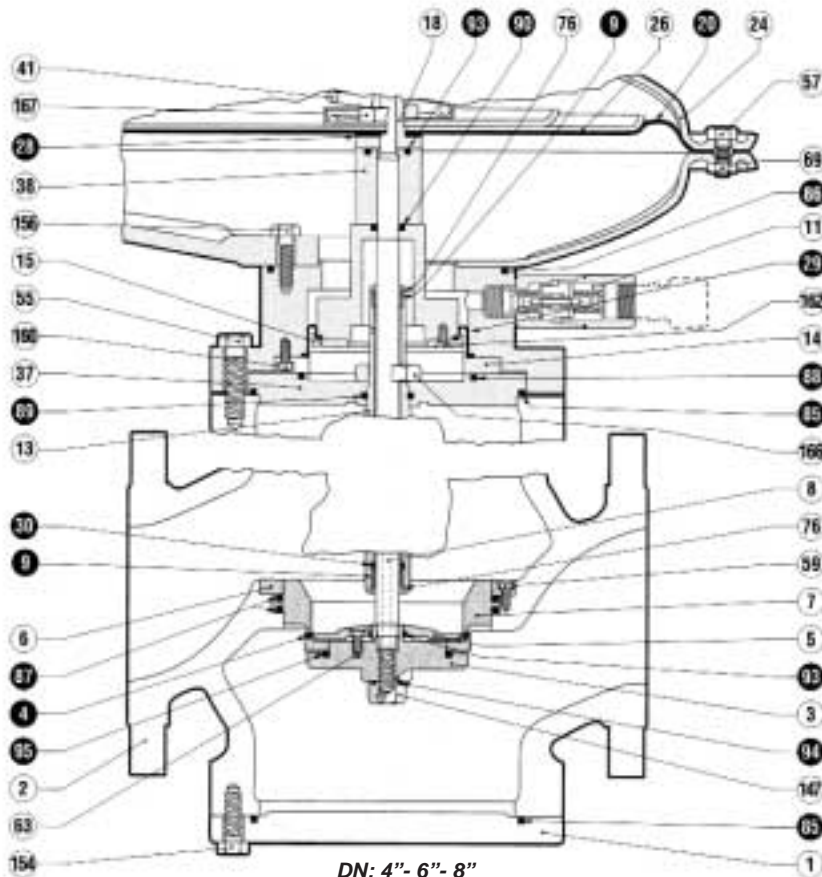
DN: 4" 1/2 ÷ 3"
Fig. B



DN: 1" ÷ 3"
Fig. C

ONLY COVERS Ø 375 OR Ø 375 TR

REDUCED HEAD (TR)



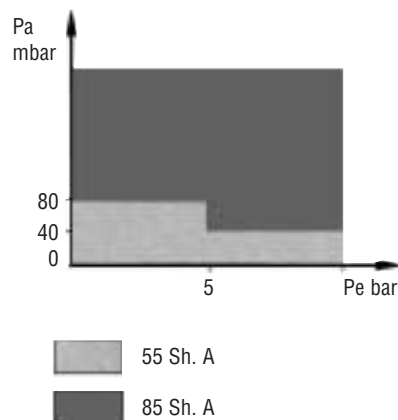
DN: 4"- 6"- 8"
Fig. D

POS.	DESCRIPTION	DN	N. OF PIECES				
			1" ÷ 3"	1" ÷ 3" TR	Only 2" ¹ / ₂ - 3" ø 375 TR	Only 4" TR	4" - 6" - 8"
4	Reinforced gasket		1	1	1	1	1
9	Guide ring		2	2	2	2	2
20	Diaphragm		1	1	1	1	1
28	Gasket		1	1	1	1	1
29	Diaphragm		1	1	1	1	1
30	U-ring		1	1	1	1	1
43	O. Ring		1	1	1	1	1
58	O. Ring		1	1	1	1	1
60	O. Ring		1	1	1	-	-
61	O. Ring		2	2	2	-	-
62	O. Ring		2	2	2	-	-
66	O. Ring		1	1	1	-	-
67	O. Ring		1	1	1	-	-
70	O. Ring		-	-	1	-	-
72	O. Ring		-	1	-	1	-
85	O. Ring		-	-	-	2	2
86	O. Ring		-	-	-	1	1
87	O. Ring		-	-	-	2	2
88	O. Ring		-	-	-	1	1
89	O. Ring		-	-	-	1	1
90	O. Ring		-	-	-	2	1
93	O. Ring		-	-	-	1	2
94	O. Ring		-	-	-	1	1
95	O. Ring		-	-	-	1	1
96	O. Ring		1	1	1	1	1

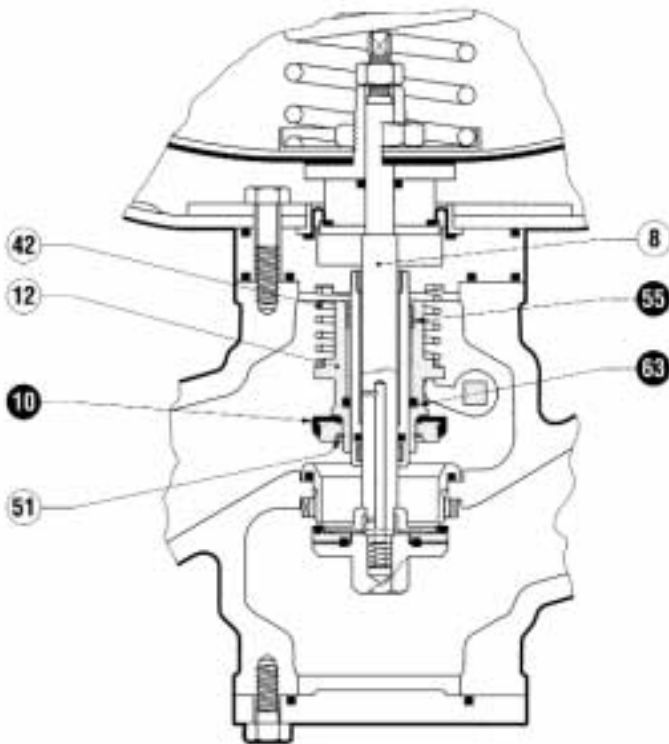
NB. The diaphragm (pos. 20) varies in diameter and thickness depending on the set-point. Its replacement should be assessed on the basis of its state of wear.

Table of reinforced gasket hardnesses

The hardness of the reinforced gasket (pos. 4) can be identified from a white mark for 55 ShA or a green one for 85 ShA.

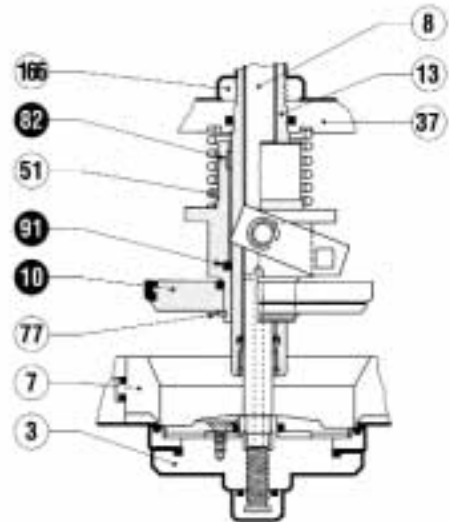
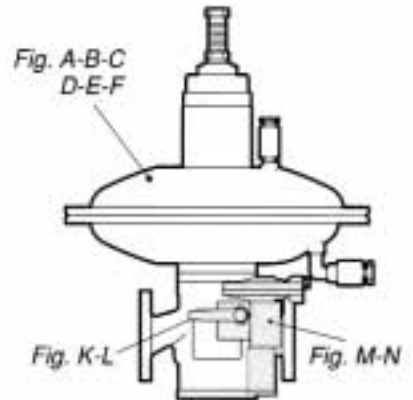


...+ I-N,...I-N/TR SLAM-SHUT



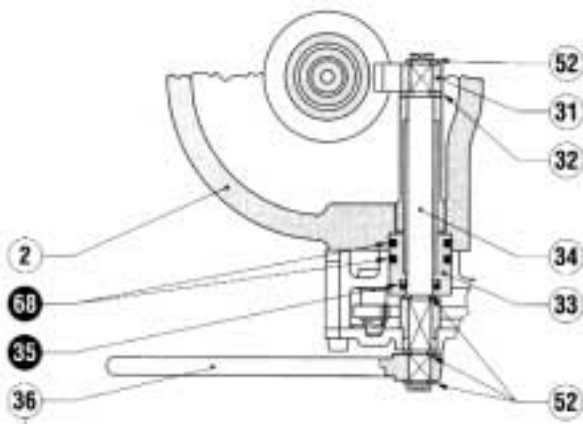
DN: 1" ÷ 3"

Fig. G



DN: 4" - 6" - 8"

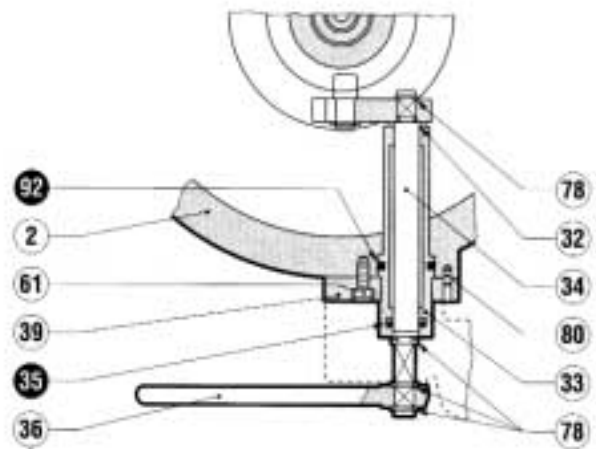
Fig. H



RESET LEVER

DN: 1" ÷ 3"

Fig. K



RESET LEVER

DN: 4" - 6" - 8"

Fig. L

SLAM-SHUT CONTROL DEVICE

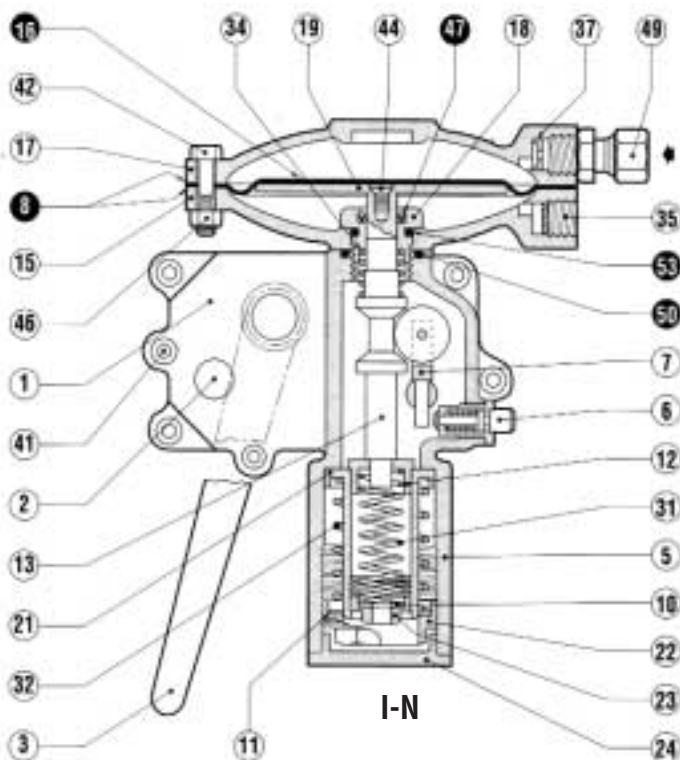
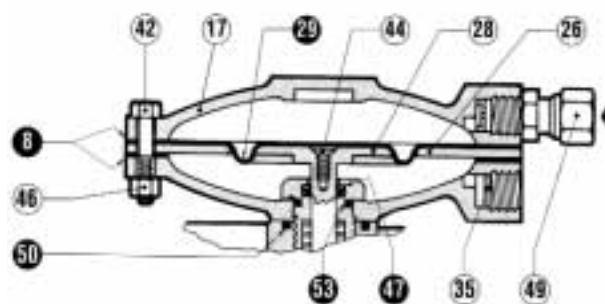


Fig. M

Versions
DVGW

...I-N/TR
Reduced head

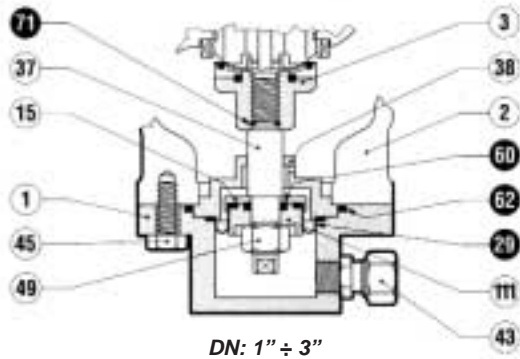
Fig. N



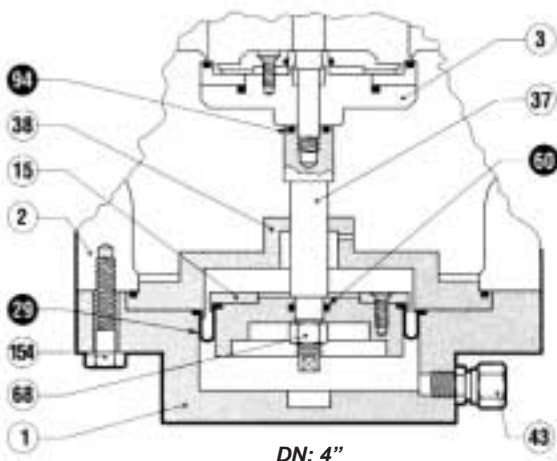
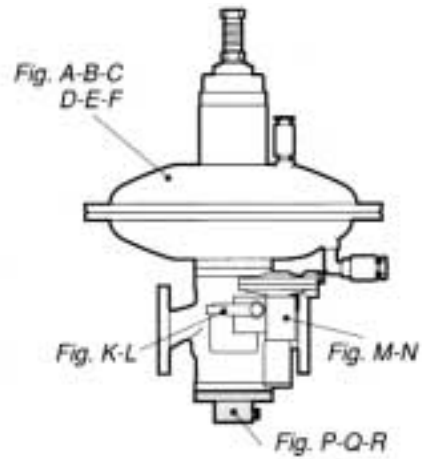
N. OF PIECES

		POS.	DESCRIPTION	DN	N. OF PIECES	
					1" ÷ 3"	4" - 6" - 8"
		10	Obturador		1	1
		35	U-ring		1	1
		55	Guide ring		1	-
		63	O. Ring		1	-
		68	O. Ring		2	-
		82	Guide ring		-	1
		91	O. Ring		-	1
		92	O. Ring		-	1
... + I-N- I-N/TR Slam-shut covers	IN	8	Gasket		2	2
		16	Diaphragm		1	1
		47	U-ring		1	1
		50	O. Ring		1	1
	IN/TR	53	O. Ring		1	1
		8	Gasket		2	2
		29	Diaphragm		1	1
		47	U-ring		1	1
		53	O. Ring		1	1

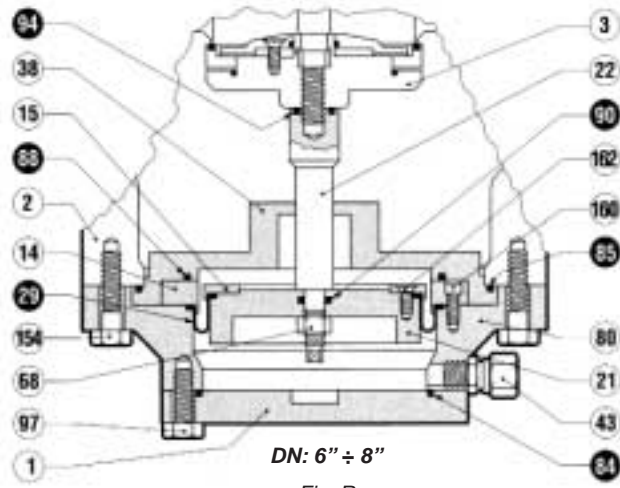
...+ MONITOR ER



DN: 1" ÷ 3"
Fig. P



DN: 4"
Fig. Q



DN: 6" ÷ 8"
Fig. R

POS.	DESCRIPTION	N. OF PIECES		
		DN 1" ÷ 3"	4"	6" + 8"
29	Diaphragm	1	1	1
60	O. Ring	1	-	-
71	O. Ring	1	-	-
84	O. Ring	-	-	1
88	O. Ring	-	-	1
90	O. Ring	-	1	1

...+ MONITOR ER

WHEN ORDERING SPARE PARTS, PLEASE SPECIFY:

Type of regulator

Dne (nominal input diameter)

Pe (inlet pressure)

Pa (outlet pressure)

Works no. (Serial no.)

Year of manufacture

Type of fluid used

Regulator cover **diameter**

Gasket hardness (55 or 85 ShA)

Type of head for slam-shut (I-N, I-N/TR) (if installed)

Monitor (if installed)

The no. of the part (position no.)

Quantity desired

The data are not binding. We reserve the right to make modifications without prior notice.

Pietro Fiorentini s.p.A.

OFFICES:

- | | |
|-------------------------------------|--|
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IMPAGINAZIONE E STAMPA
A CURA DI

Edigraf


MONTECCHIO MAGGIORE (VI)
FEBBRAIO 2003

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