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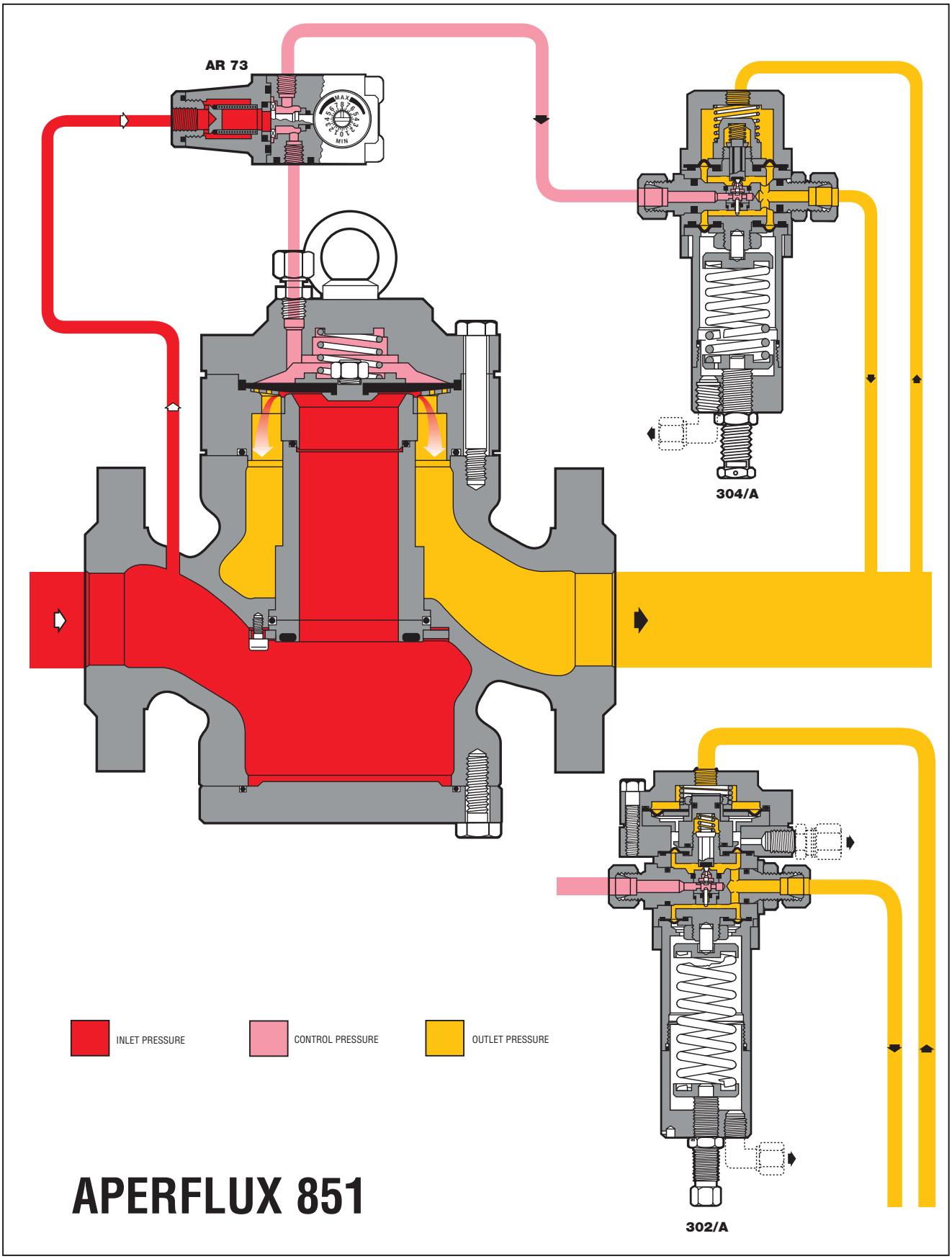
Pietro Fiorentini®

PRESSURE REGULATOR

APERFLUX 851

TECHNICAL MANUAL MT049

INSTALLATION, COMMISSIONING AND MAINTENANCE INSTRUCTIONS



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 Aperflux 851 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 Forschungsstelle Richard – Wilstätter – Allee 5, 76131 Karlsruhe – report **02/140a/4301/855 issued 3rd May 2002.** In this report both the versions incorporating the safety shut-off devices series SB/82 or HB/97 when controlling overpressure and the monitor PM/819, 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 Rev. A issued 15th May 2002.**

Further we declare 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 and, only for the safety device HB/97, also according to the procedure given by prEN 14382. 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 trasportation 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 occured to any goods. If damage occured 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 Aperflux 851 are classified as fail open regulators according to the standard EN 334 therefore they are **pressure accessory** according to directive 97/23/EC (PED).
The incorporated safety device monitor PM/819 (as well as the in-line monitor REFLUX 819) being classified as fail close regulators according to the standard EN 334 is as **safety accessory** according PED, therefore it can be used both as pressure accessory and safety accessory to PED. The regulator Aperflux 851 when incorporating slam shut valve SB/82 or HB/97 with pressure switches for overpressure is a **safety accessory** according to PED, therefore it can be used both as pressure accessory and **safety accessory** to PED.
The conformity with Directive PED of pressure regulator and relevant accessory bearing the CE marking requires installation in systems with minimum requirements according to EN 12286

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1.0 INTRODUCTION

This manual proposes to provide the essential information for the installation, start-up, disassembly, reassembly and maintenance of the Aperflux 851 regulators.
It is also appropriate, however, to provide a brief illustration of the main features of the regulator and of its components.

1.1 MAIN FEATURES

The Aperflux 851 pressure regulator is a regulator of the piloted type for medium and high pressures.
The Aperflux 851 is a fail open type regulator and therefore opens in the event of:
- rupture of the main diaphragm;
- rupture of the pilot diaphragm/s;
- rupture of the pilot gasket;
- pilot circuit supply failure.

The main features of this regulator are:
- design pressure: up to 100 bar;
- design temperature: -20 °C to +60 °C;
- environmental temperature: -20 °C to +60 °C;
- range of the inlet pressure bpe: 1 to 80 bar;
- possible regulation range Wh: 0.6 to 74 bar (on the basis of the pilot installed);
- minimum differential pressure: 0.5 bar;
- precision class AC= up to 1.5;
- closing pressure class SG: up to 2.5.

1.2 OPERATION (FIG. 1)

In the absence of pressure, the main diaphragm 1 is maintained in the closed position by the spring 2 and rests on the seat of the valve 3 with grill 4. The seal is guaranteed by the contact between the valve seat 3 and the diaphragm 1.
In normal working conditions, the following forces act on the diaphragm 1:
- downwards: the load of the spring 2, the thrust deriving from the control pressure Pc in the control chamber A and the weight of the mobile assembly;
- upwards: the thrusts deriving from the upstream pressure Pe and downstream pressure Pa and the remaining dynamic components.

The control pressure Pc is obtained by drawing gas at the pressure Pe directly upstream from the diaphragm 1; the gas is filtered by the filter 6 incorporated in the AR73 flow regulating valve. The pressure Pc is governed by the pilot which regulates its value. Regulation is obtained from the comparison of the load of the setting spring 8 and the thrust on the diaphragm 12 deriving from the downstream pressure.
If during operation, for example, there is a drop in the downstream pressure Pa below the set point (as a result of an increase in the flow demand or of a reduction of the upstream pressure) a state of imbalance of the mobile assembly 11 is created and leads to an increase in the opening of the obturator 7 and therefore a reduction of the control pressure Pc.
As a result, the diaphragm 1 moves upwards increasing the opening of the regulator until the downstream pressure reaches the set point again.
On the other hand, when the downstream pressure rises beyond the set point (as a result of a reduction in the demand or with the increase in the upstream pressure), the obturator 7 closes and therefore the pressure Pc reaches the value of the upstream pressure Pe. In these conditions, the diaphragm 1 goes to the closed position.
In normal working conditions, the obturator 7 is positioned in such a way that the pressure Pc above the diaphragm 1 is such as to maintain the downstream pressure around the selected value.

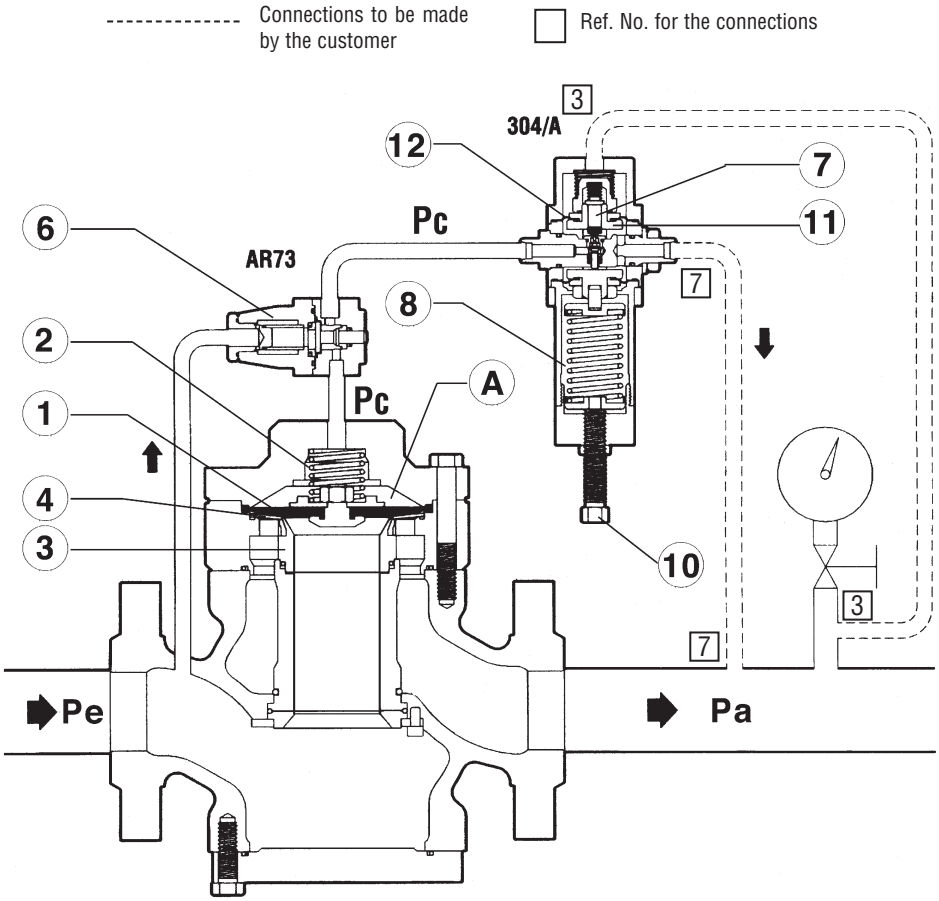


Fig. 1

302/A PILOT

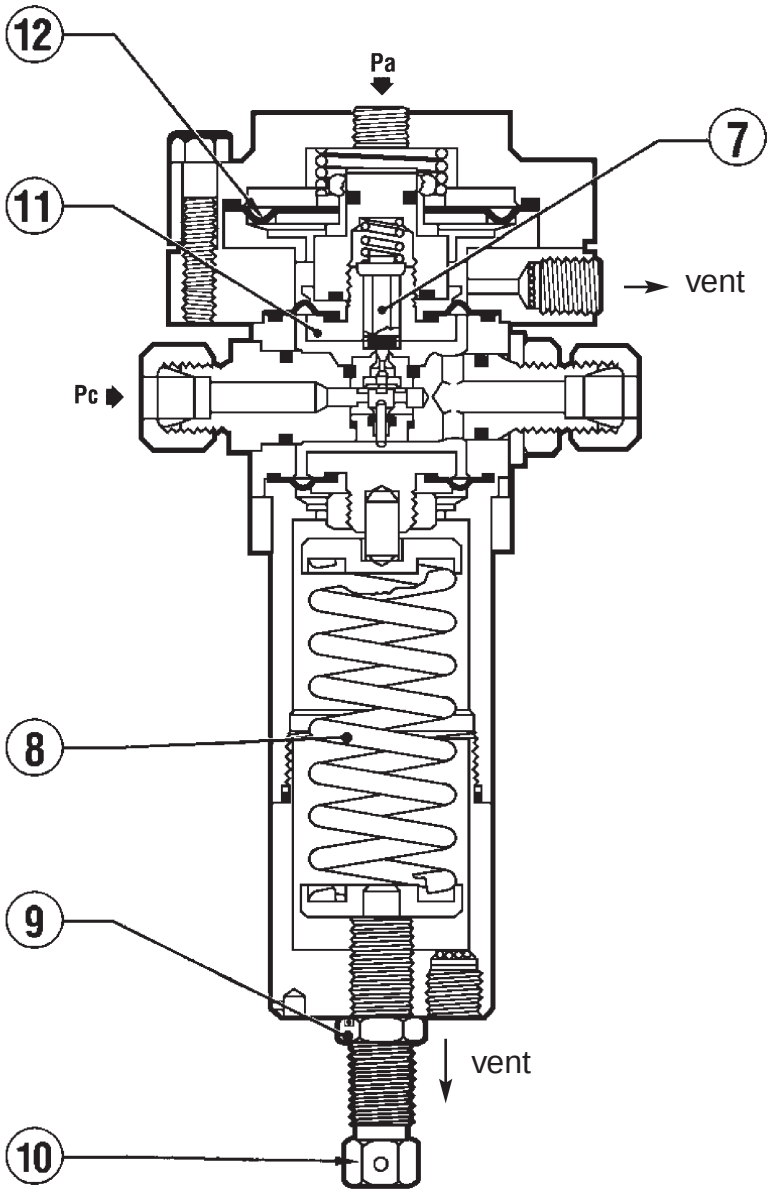


Fig. 2A

304/A PILOT

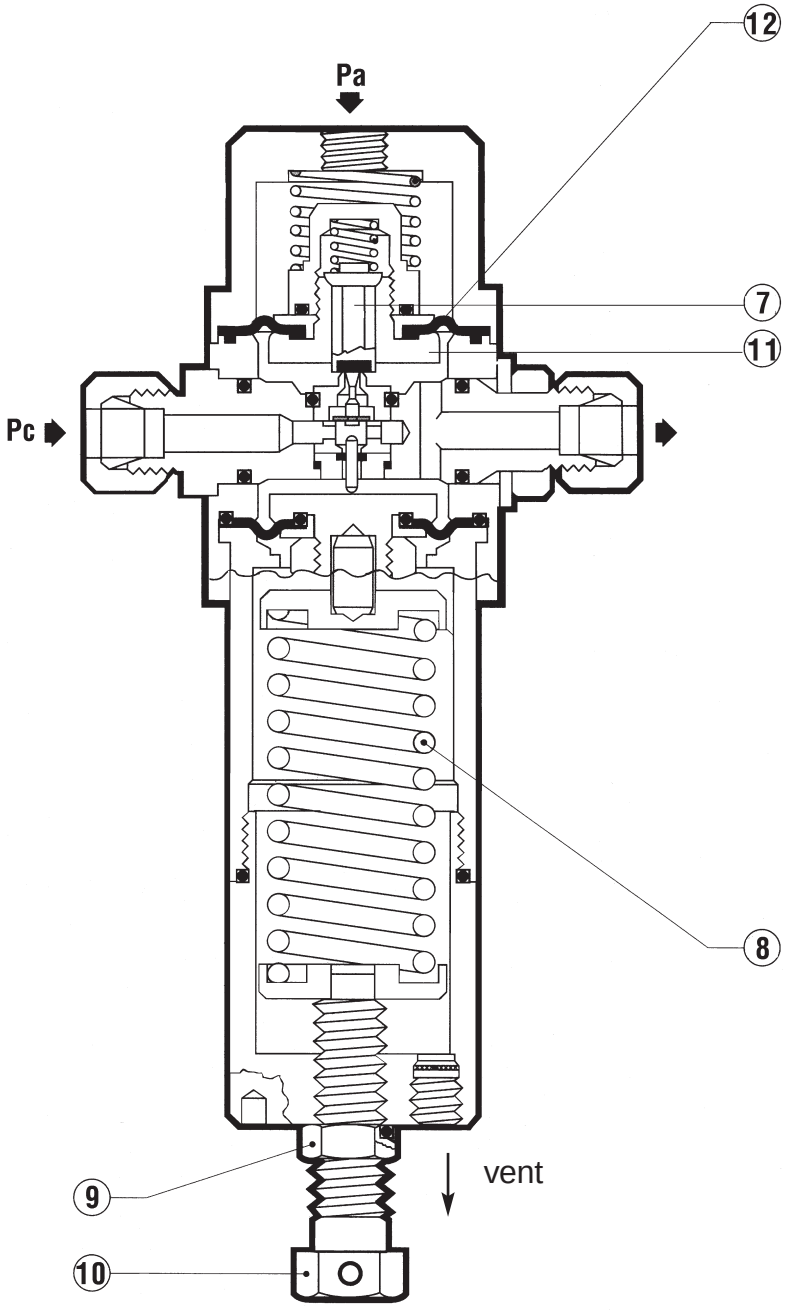


Fig. 2B

1.3 AR73 REGULATING VALVE

The AR73 regulating valve is an adjustable flow regulation device. Its function is to adjust and differentiate the regulator's response times so as to optimize its operation.
Small openings of the valve result in a greater regulating precision of the regulator, but also in a greater sensitivity to instability phenomena (pumping); the opposite is true in the case of larger openings.
The opening is varied by turning the pin 4 with the reference mark which can be read on the graduated scale on the front of the valve (fig. 3).
The positions 0 and 8 on the scale indicate the minimum and maximum valve openings respectively. To pass from one valve opening position to another, the pin can be turned clockwise or anticlockwise indifferently; the two graduated scales on the plate are in fact perfectly equivalent.

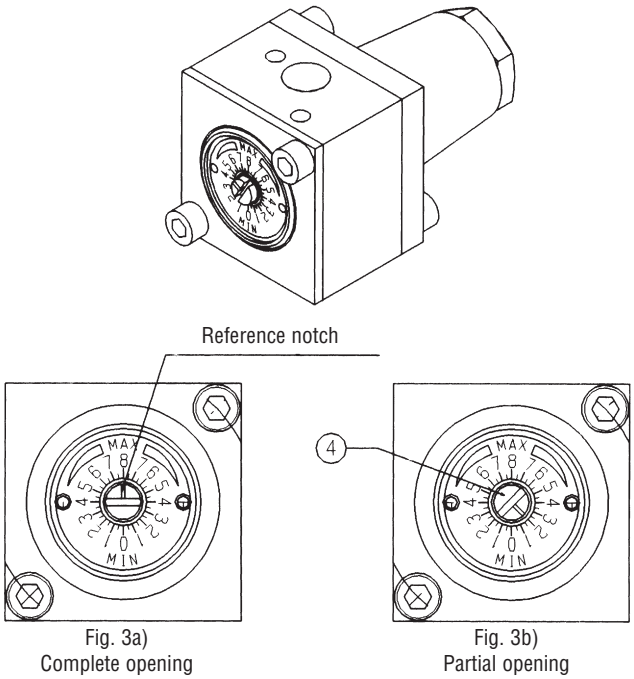


Fig. 3a)
Complete opening

Fig. 3b)
Partial opening

Fig. 3

1.4 SETTING SPRINGS

The Aperflux 851 regulator uses the 302/A, 304/A, 305/A and 307/A pilots. The regulation range of the different pilots is given in the tables below.

Tab. 1 302/A Pilot setting springs

Code	Colour	De	Lo	d	i	it	Setting range in bar
2701541	WHITE	35	100	4	7.75	9.75	0.8 ÷ 1.3
2701800	YELLOW			4.5	8.25	10.25	1.2 ÷ 2.1
2702080	ORANGE			5	8.75	10.75	2 ÷ 3.3
2702290	RED			5.5	8.5	10.5	3 ÷ 4.8
2702460	GREEN			6	8.25	10.25	4.5 ÷ 7
2702660	BLACK			6.5	8.5	10.25	6 ÷ 9.5

Tab. 2 304/A Pilot setting springs

Code	Colour	De	Lo	d	i	it	Setting range in bar
2702290	RED	35	100	5.5	8.5	10.5	7 ÷ 12
2702460	GREEN			6	8.25	10.25	10 ÷ 17
2702660	BLACK			6.5	8.25	10.25	15 ÷ 25
2702820	BLUE			7	7	9	20 ÷ 35
2703045	BROWN			7.5	7.5	9.5	30 ÷ 43

Tab. 3 305/A Pilot setting springs

Code	Colour	De	Lo	d	i	it	Setting range in bar
2702820	BLUE	35	100	7	7	9	20 ÷ 35
2703045	BROWN			7.5	7.5	9.5	30 ÷ 43
2703224	GREY			8	7.5	9.5	40 ÷ 60

Tab. 4 307/A Pilot setting springs

Code	Colour	De	Lo	d	i	it	Setting range in bar
2703224	GREY	35	100	8	7.5	9.5	41 ÷ 74

De = Ø external diameter **d =** Ø wire diameter **i =** active coils **Lo =** Lenght **it =** total coils

The operating principle of the pilot has already been briefly illustrated in par. 1.2. Variation of the setting is obtained by turning the adjustment screw 10 (fig. 1). Clockwise rotation leads to an increase in the regulated pressure while anticlockwise rotation leads to a decrease. When the desired setting has been reached, the adjustment screw can be blocked by means of the provided nut 9.

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 ≤ 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 raccomended set-up is:

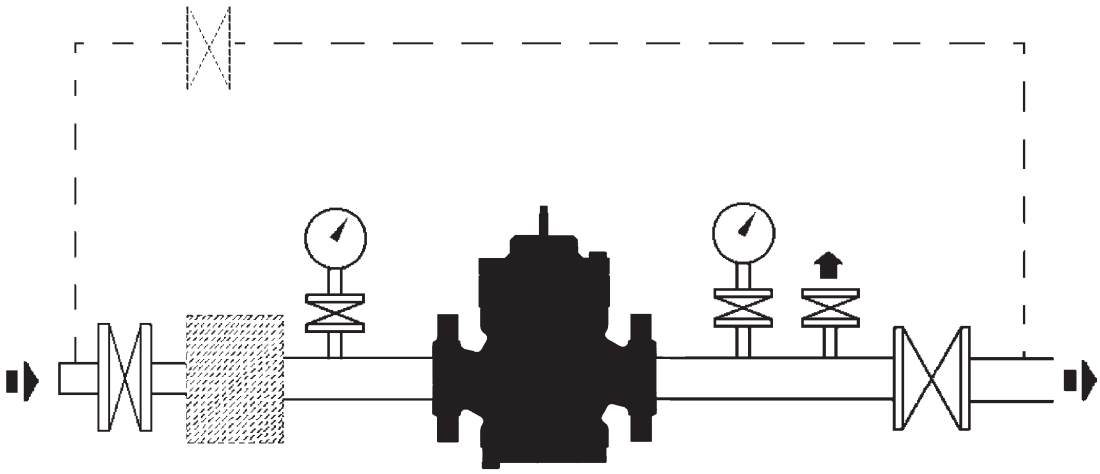
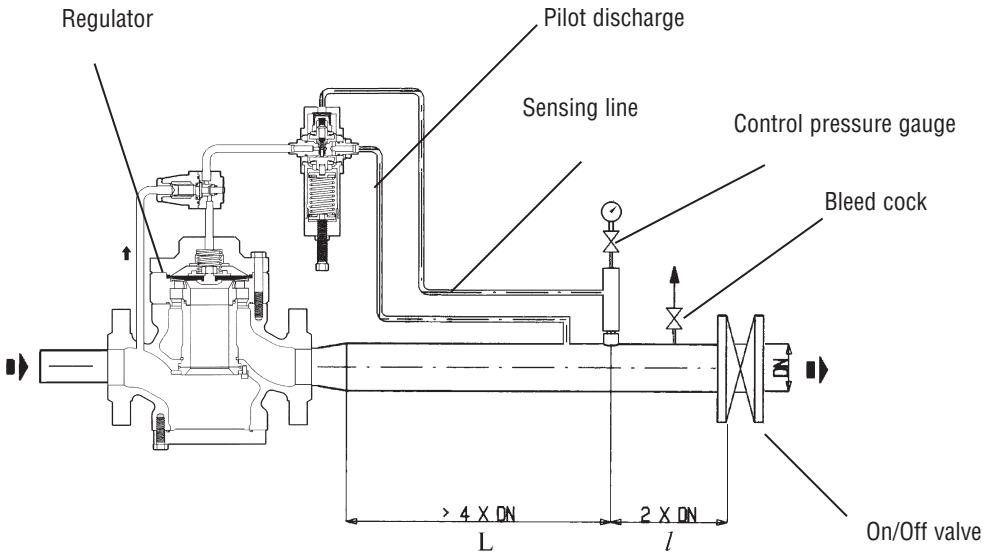


Fig. 4 (Standard regulator)

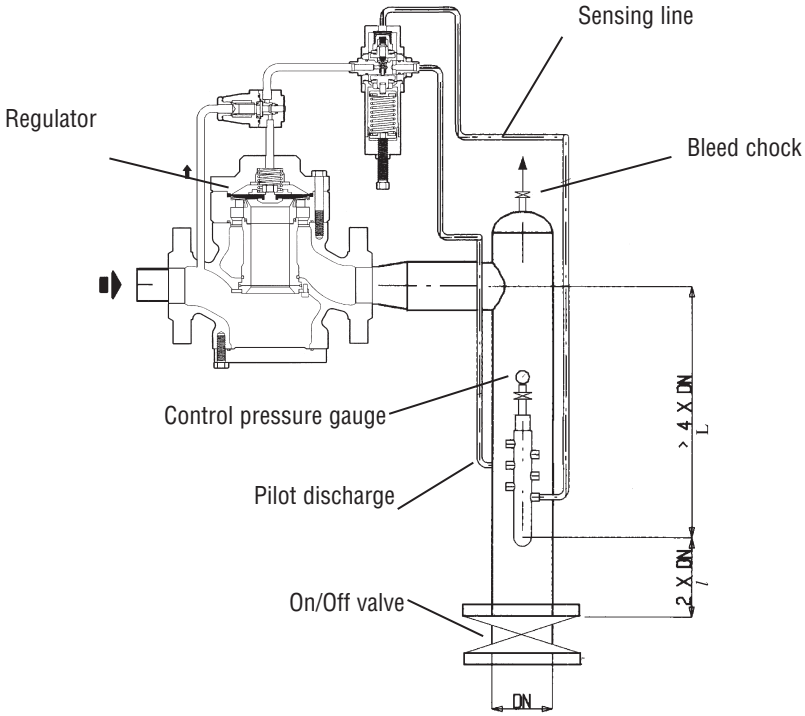
TAB. 5 CONNECTING THE APPARATUSES

The connections between the apparatus and the main piping must be made using stainless steel pipe with minimum internal diameter of 8 mm.

IN-LINE INSTALLATION

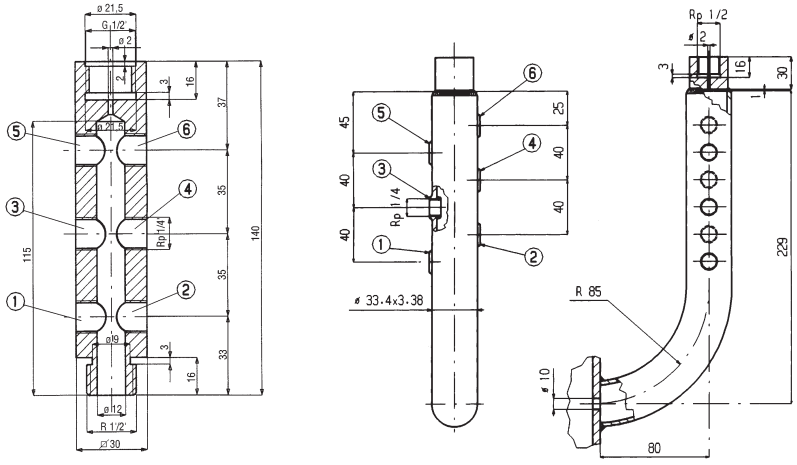


INSTALLATION AT RIGHT ANGELS



TAB. 6 DETAIL OF MULTIPLE TAKE - OFF WITH OF THE IMPULSE TAKE - OFF REFERENCE NUMBERS

1 and **2** Connect to regulators heads
3 and **4** Connect to pilots
5 and **6** Connect to accelerator and slam-shut



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 that the position of the downstream pressure take-offs and the speed of the gas at the take-off point respect the values given in tables 5 and 6 (positioning) and 7 (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 connectors 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. 7

The speed of the gas must not exceed the following values in the piping downstream from the regulator:
Vmax= 30 m/s for Pa > 5 bar Vmax= 25 m/s for 0,5 < Pa < 5 bar

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 intervention of the slam-shut valve 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 valve available are all based on the same operating principle which is illustrated below with reference to the valve VS/AM 56 (fig. 5).
It is based on the contrast between the thrust on the diaphragm 24 deriving from the pressure of the gas to being controlled 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.

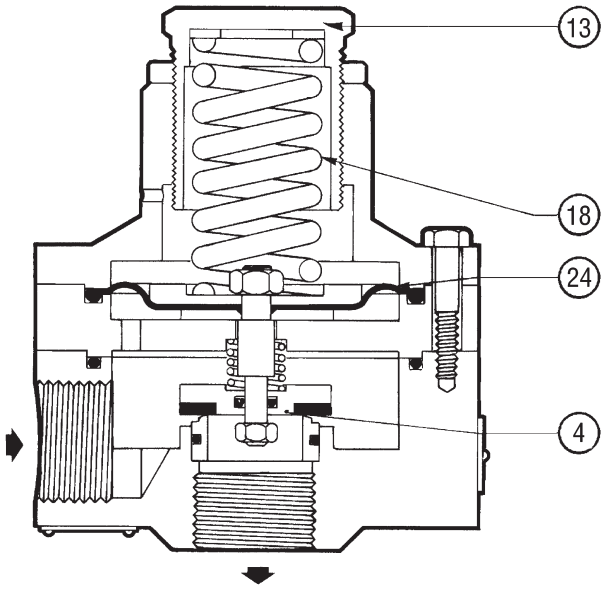


Fig. 5

3.1.1 DIRECT INSTALLATION IN THE LINE (FIG. 6)

When the relief valve is fitted directly in the line, that is without inserting an on-off valve, proceed 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 up to the value envisaged for intervention in one of the following ways:
   - if the spring fitted on the pilot permits it (see tables 1-2-3-4), increase the setting of the pilot itself until the desired value is obtained;
   - connect a controlled auxiliary pressure to the cock 6 and stabilize it at the desired value;
3) Check the intervention of the relief valve and adjust it if necessary by turning the adjustament plug 13 appropriately (clockwise to increase and anticlockwise to decrease).

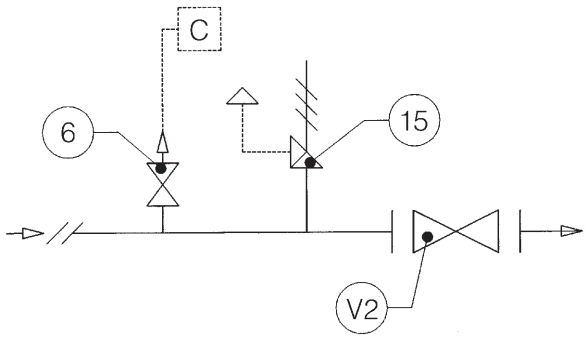


Fig. 6

3.1.2 INSTALLATION WITH ON/OFF VALVE (FIG. 7)

1) Close the on-off valve 16.
2) Connect a controlled auxiliary pressure to the nipple 17 and increase it slowly up to the value envisaged for intervention.
3) Check the intervention of the relief valve and adjust if necessary by turning the adjustament plug 13 appropriately (clockwise to increase and anticlockwise to decrease).

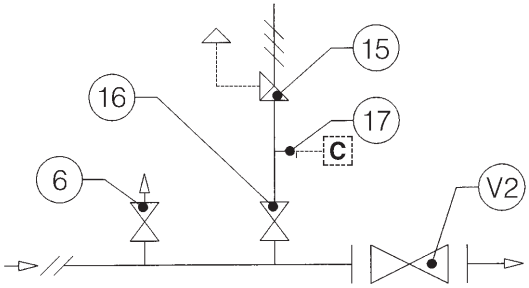
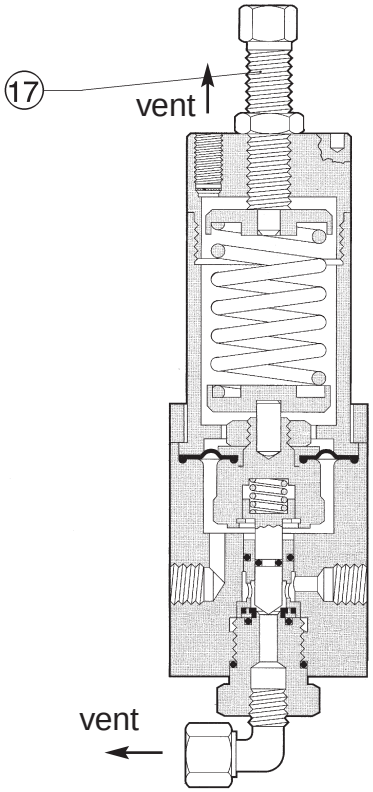


Fig. 7

3.2 ACCELERATOR

An accelerator (fig. 8) is installed on the PM/819 icorporated monitor and on the REFLUX 819 regulator (use as in-line monitor) to speed up their intervention in the event of failure of the active regulator (racommended when used safety accessory according to Directive 97/23/EC “PED”).
On the basis of a pressure signal from downstream this device discharges the gas into the monitor's motorization chamber into the atmosphere, thereby permitting rapid intervention. The set point of the accelerator must obviously be higher than that of the monitor.
Setting is made by turning the adjustment screw 17, clockwise to increase the value, anticlockwise to reduce it.
M/A range of intervention Who: 0,3 to 43 bar



Accelerator M/A

Fig. 8

4.0 MODULARITY

The modular-type design of APERFLUX 851 series regulators means that it is also possible to feitner the emergency monitor regulator PM/819 or it the slam-shut incorporated with the body itself even after the installation of the regulator without any modifications.

4.1 INCORPORATED SB/82 SLAM-SHUT VALVE

When closing the slam shut incorporated into pressure regulator to be considered as safety accessory according to Directive PED, cuts off the feeding of gas both to pressure regulator and to its pilot.

4.2 INCORPORATED SB/82 SLAM-SHUT VALVE

This is a device (fig. 9) which immediately blocks the gas flow if, following some kind of failure, the downstream pressure reaches the set-point for its intervention, or is operated manually.
On the APERFLUX 851 regulator, it is possible to have the SB/82 slam-shut incorporated both with the service regulator and on the one functioning as in-line monitor.
The main characteristics of the slam-shut device are:

- intervention with pressure increase and/or decrease;
- design pressure: 100 bar for all the components;
- intervention accuracy (AG): ± 1% of the pressure set-point for pressure increases; ± 5% for pressure drops;
- manual resetting with internal by-pass operated by the resetting lever.

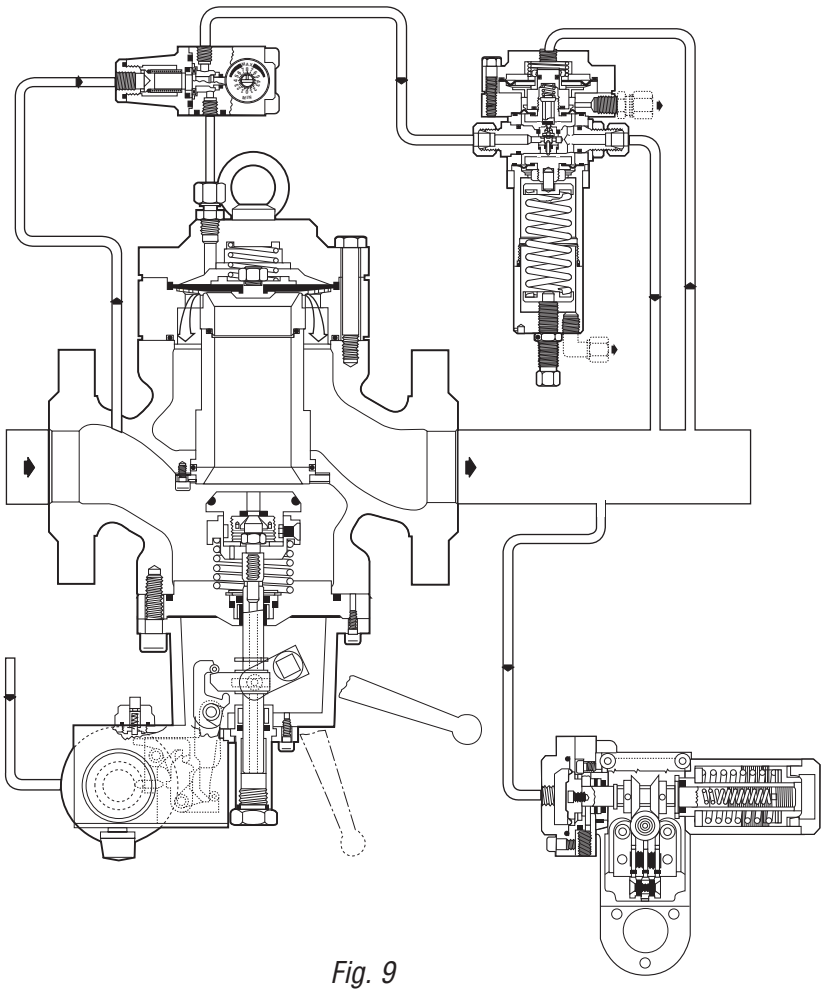


Fig. 9

4.2.1 SB/82 SLAM-SHUT OPERATION

The SB/82 slam-shut device (see fig. 10) consists of an obturator A, a releasing lever system, a control head B and a resetting system which is controlled manually by the lever C. The pressure in the circuit to control acts on the diaphragm in the control head B. This diaphragm, which is integral with a control rod D, receives a counter-force by means of the minimum pressure springs 17 and the maximum pressure springs 11, set at the preset values .
The translation movement of this rod provokes the displacement of the lever L which controls the release of the entire mobile system and frees the obturator which is closed by the action of the spring 48.
To reset the device, operate the lever C. This opens an internal by-pass in the first part of its stroke. This leads to the filling of the downstream zone and balances the pressure on the obturator. Then, complete resetting of the entire mobile system is obtained in the second part of the stroke of the lever C. Releasing can also be carried out manually by means of the button 101.

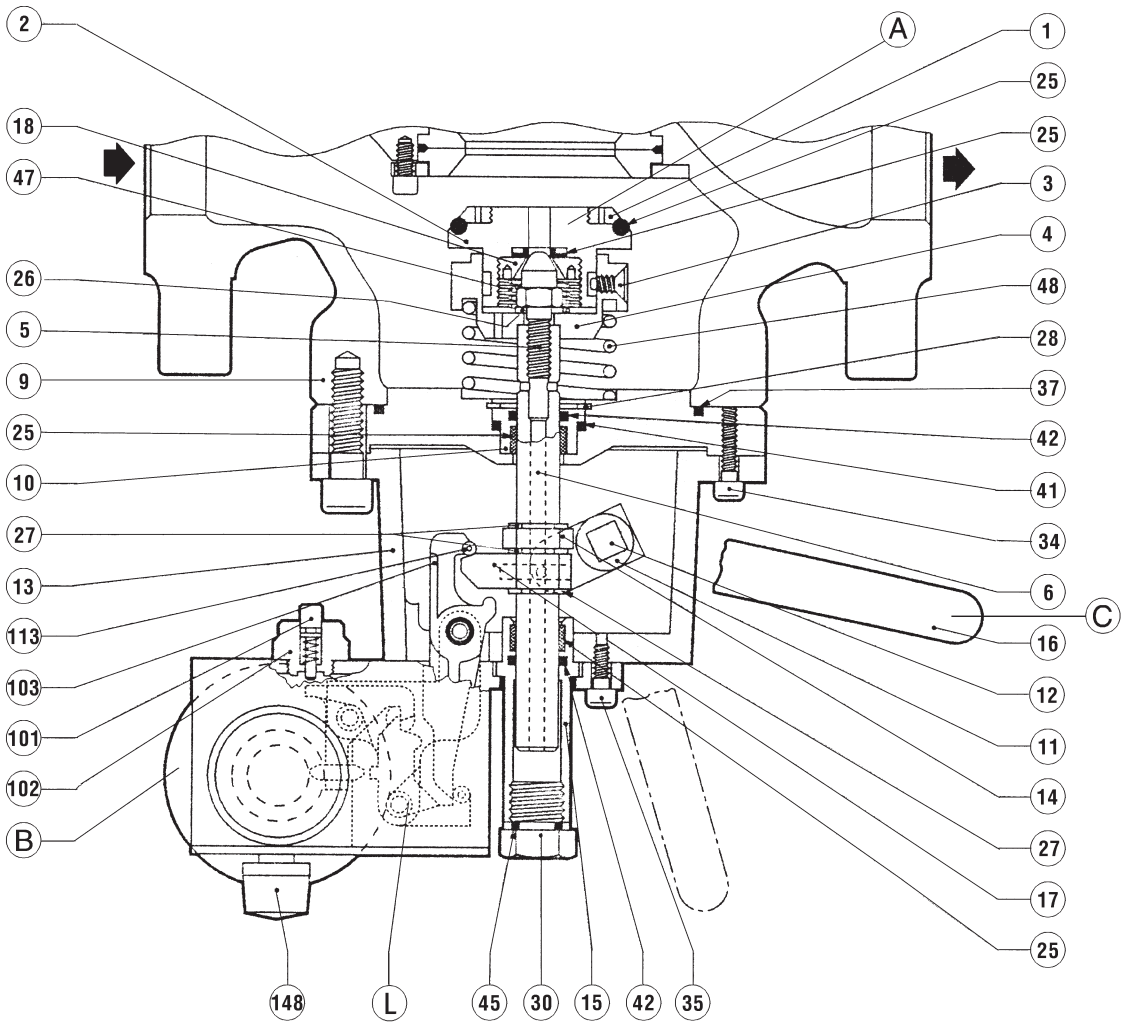
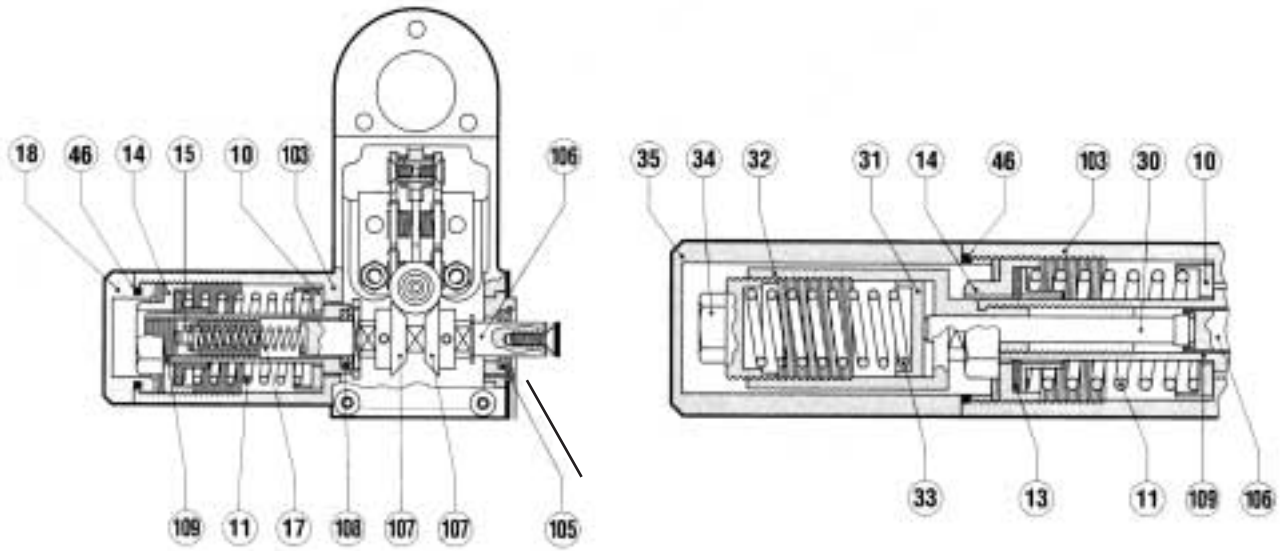


Fig. 10

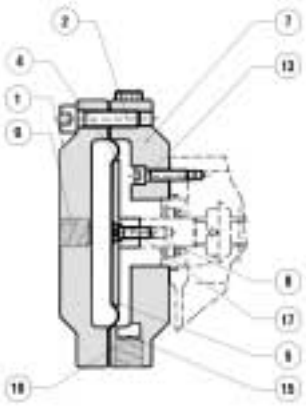
CONTROL DEVICE



Mod. 102 - 103 - 104 - 105 **Mod. 106 - 107 - 108 - 109**

Fig. 11

SLAM-SHUT CONTROL HEADS



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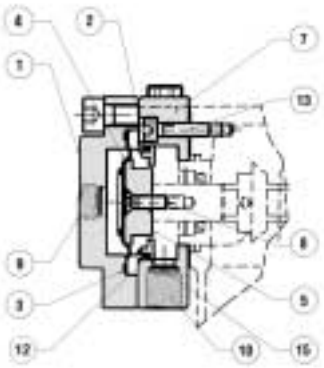

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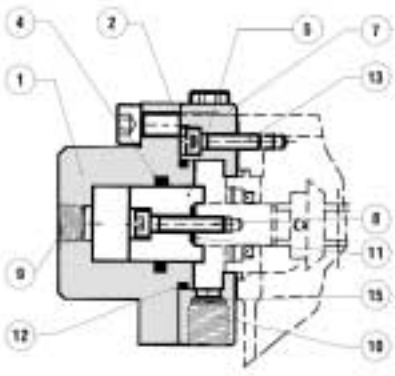

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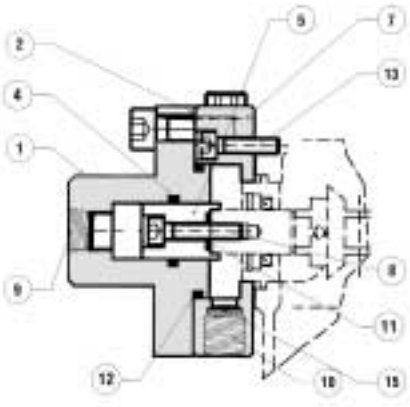

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Fig. 12

4.2.2 TAB. 8 SB/82 SLAM-SHUT SETTING SPRINGS

	Spring characteristics							SETTING RANGE in bar													
								102	106	102	106	103	107	103	107	104	108	104-108	105	109	105-109
	Code	Colour	De	Lo	d	i	it	bar/min		bar/max		bar/min		bar/max		bar/min		bar/max	bar/min		bar/max
1	2700565	WHITE	10	40	1	12	14														
2	2700314	YELLOW			1,3	13	15	0,04 ÷ 0,1				0,2 ÷ 0,5									
3	2700345	ORANGE			1,5	11	13	0,07 ÷ 0,2				0,4 ÷ 1,2									
4	2700450	RED			1,7	11	13	0,15 ÷ 0,3				0,8 ÷ 2				1,6 ÷ 4			3,2 ÷ 8		
5	2700495	GREEN			2	11	13	0,25 ÷ 0,45				1,4 ÷ 2,7				2,8 ÷ 5,4			5,6 ÷ 10,8		
6	2700635	BLACK			2,3	10	12	0,40 ÷ 0,7				2,3 ÷ 4				4,6 ÷ 8			9,2 ÷ 16		
7	2700790	ORANGE	25	55	2,5	8	10		0,1 ÷ 0,25												
8	2701010	RED			3	7	9		0,2 ÷ 0,6				1 ÷ 3								
9	2701225	GREEN			3,5	6	8		0,5 ÷ 1				2 ÷ 5								
10	2701475	BLACK			4	6	8		0,7 ÷ 1,6				3,5 ÷ 8				7 ÷ 15			14 ÷ 30	
11	2701740	VIOLET			4,5	6	8		1,3 ÷ 2,15				6 ÷10				12 ÷ 20			24 ÷ 30	
12	2702015	AZURE			5	6	8		2 ÷ 3,25				9 ÷ 14				18 ÷ 28			36 ÷ 56	
13	2702245	GREY			5,5	6	8		3,5 ÷ 5				13 ÷ 22				26 ÷ 44			52 ÷ 88	
14	2700680	BROWN	35	60	2,3	6	8														
15	2700830	RED/BLACK			2,5	5,5	7,5														
16	2700920	WHITE/YEL.			2,7	5,5	7,5														
17	2701040	WHI./ORAN.			3	5,5	7,5														
18	2701260	WHITE			3,5	5,5	7,5			0,2 ÷ 0,5	0,2 ÷ 0,5										
19	2701530	YELLOW			4	5	7			0,45 ÷ 1,1	0,45 ÷ 1,1			2 ÷ 5	2 ÷ 5						
20	2701790	YEL./BLACK			4,5	4,5	6,5			0,7 ÷ 1,7	0,7 ÷ 1,7			3,5 ÷ 8,5	3,5 ÷ 8,5						
21	2702070	ORANHE			5	5	7			0,9 ÷ 2	0,9 ÷ 2			5 ÷ 10,5	5 ÷ 10,5						
22	2702280	WHI./RED			5,5	5	6,5			1,5 ÷ 3	1,5 ÷ 3			7,5 ÷ 15	7,5 ÷ 15			15 ÷ 30			30 ÷ 60
23	2702450	RED			6	5	7			2,2 ÷ 3,5	2,2 ÷ 3,5			10,5 ÷ 16,5	10,5 ÷ 16,5			21 ÷ 33			42 ÷ 66
24	2702650	GREEN			6,5	5	7			3,5 ÷ 5	3,5 ÷ 5			15 ÷ 22	15 ÷ 22			30 ÷ 44			60 ÷ 88

De = Ø external diameter **d =** Ø wire diameter **i =** active coils **Lo =** Lenght **it =** total coils

4.3 INCORPORATED HB/97 SLAM-SHUT VALVE

This is a device (fig.13) which immediately blocks the gas flow if, following some kind of failure, the downstream pressure reaches the set-point for its intervention, or is operated manually.
On the Aperflux 851 regulator, it is possible to have the HB/97 slam-shut incorporated both with the service regulator or on the one functioning as in-line monitor.
The main characteristics of the slam-shut device are:
- balance valvue obturator;
- indirect, self-fed, pneumatic actuation;
- local close button;
- interventation with pressure increase and/or decrease;
- design pressure: 100 bar for all the components;
- precision (AG): ±1% of the pressure set-point for pressure increases; ± 5% for pressure drops;
- incorporated by-pass;
- manual reset only;

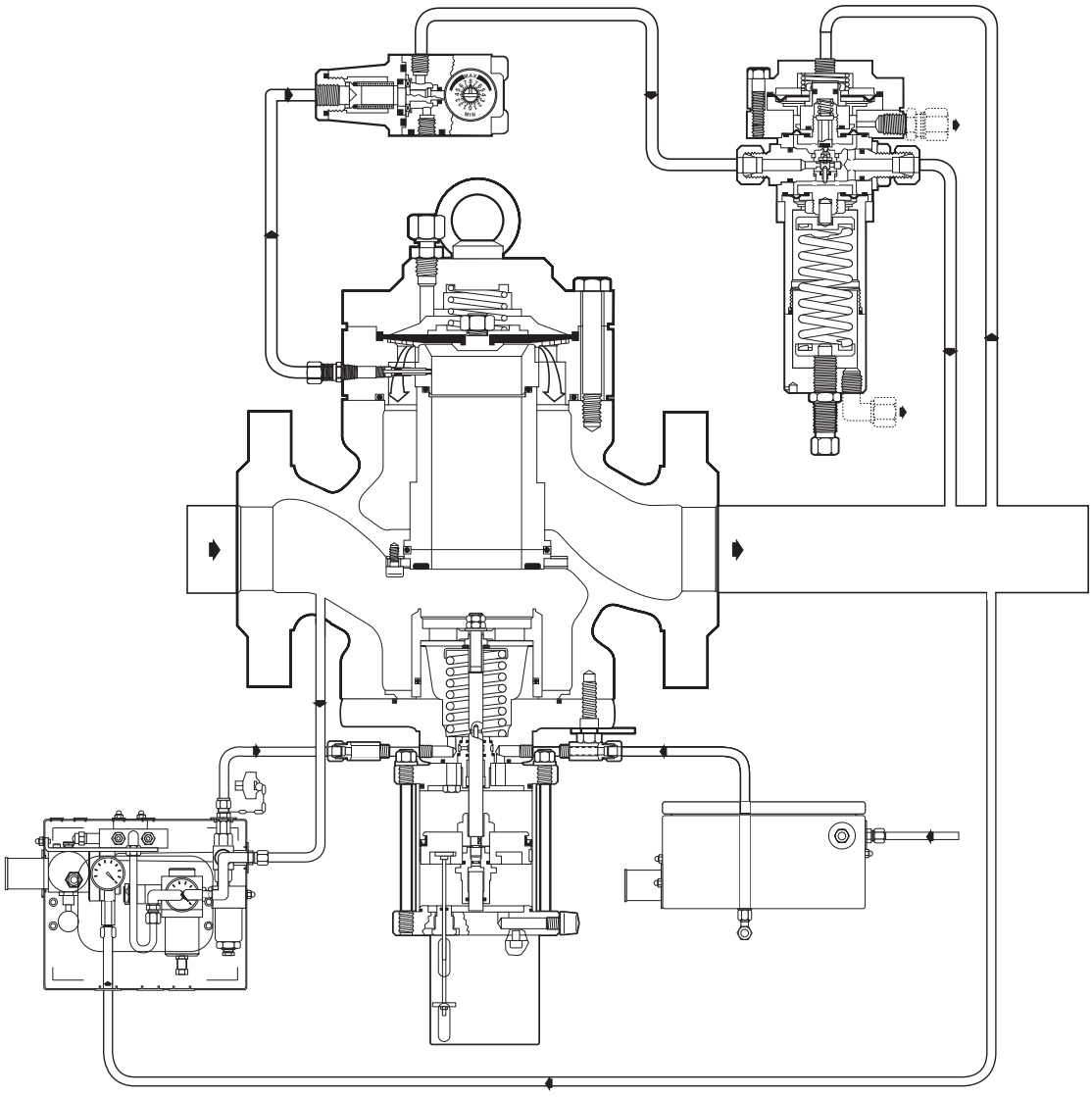


Fig. 13

4.3.1 HB/97 OPERATION (FIG. 14)

The cut-off device consist principally of the following parts:
- on/off valve (pos. 12);
- single action pneumatic actuator (pos. 11);
- line-off device (from pos.1 until pos. 10);

When there is no pressure, the valve obturator is held in the closed position by the spring, (pos. 13), and rests on the valve seat. The control pressure is obtained by taking off gas at pressure Pe directly upstream from the valve. The gas passes through the valve (1) (which can deviate pressure towards the downstream piping through a bypass line) and, appropriately filtered by the filter (2), enters the pressure regulator (4), the purpose of which is to stabilize the control pressure to the valve 3/2 (8) and then passes to the actuator (11). When the actuator is filed, the valve opens.

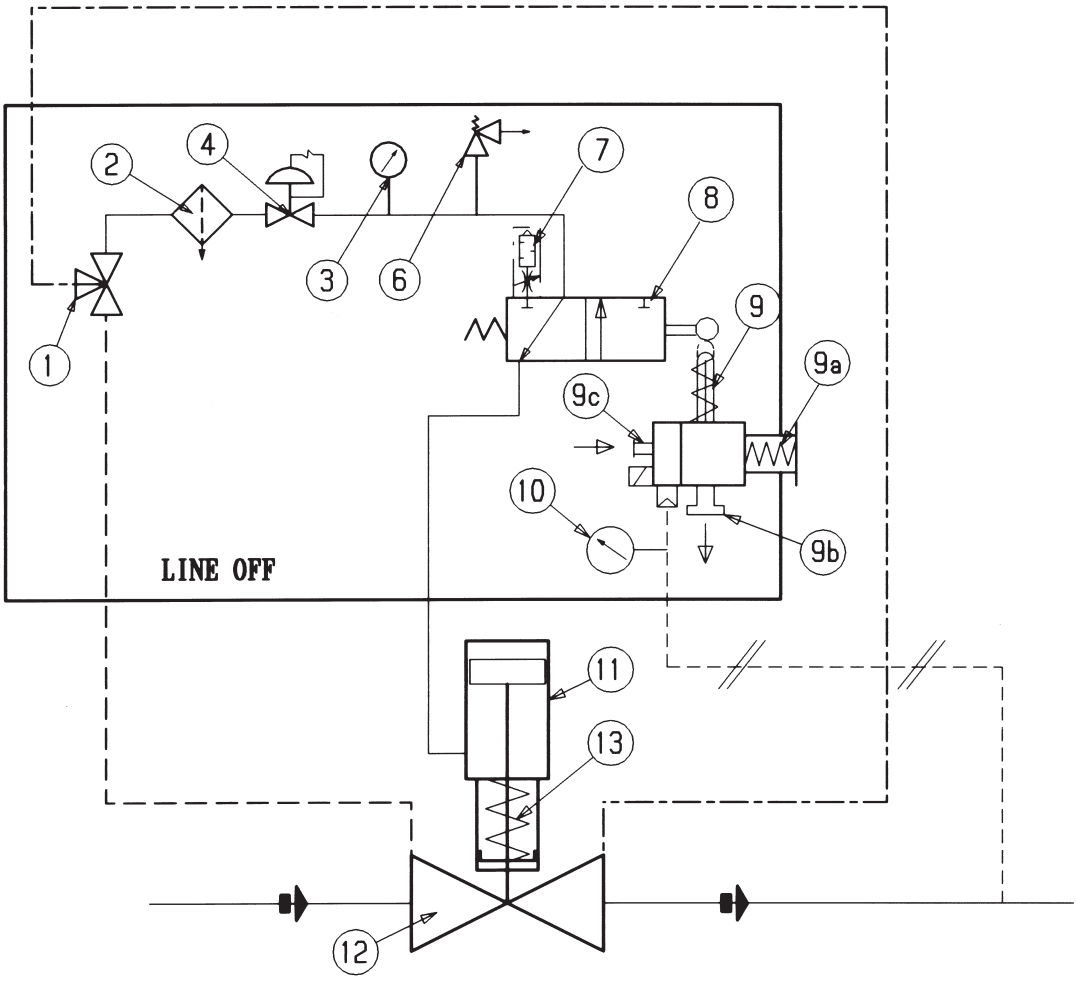
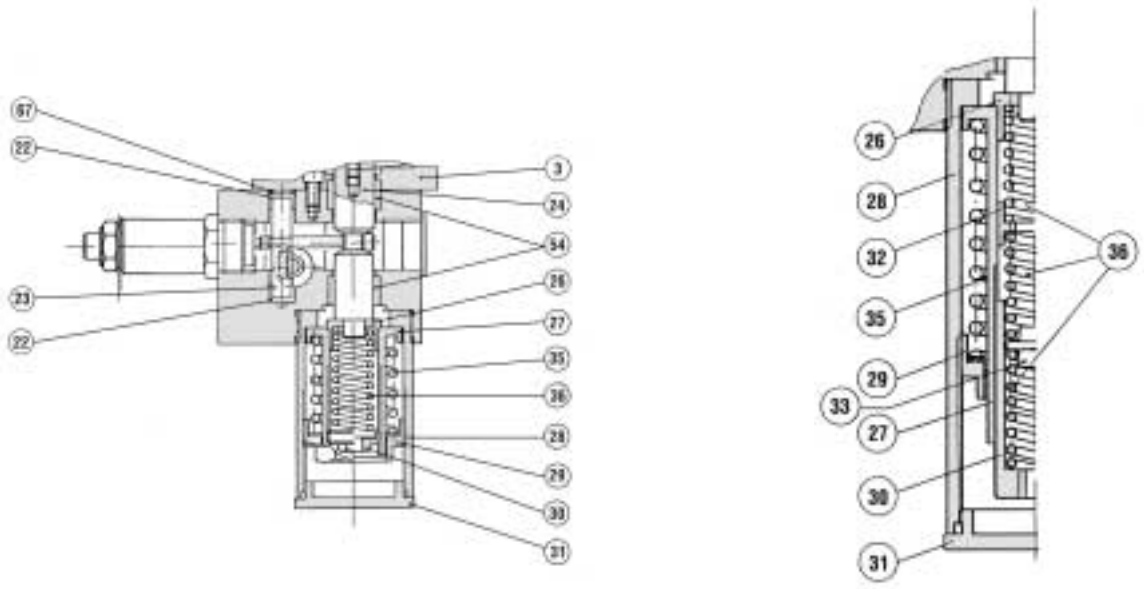


Fig. 14

CONTROL DEVICE

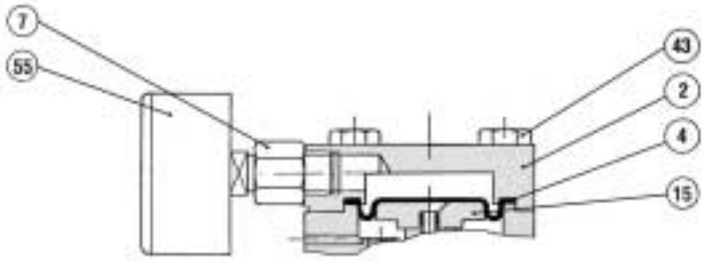


Mod. 103 - 104 - 105

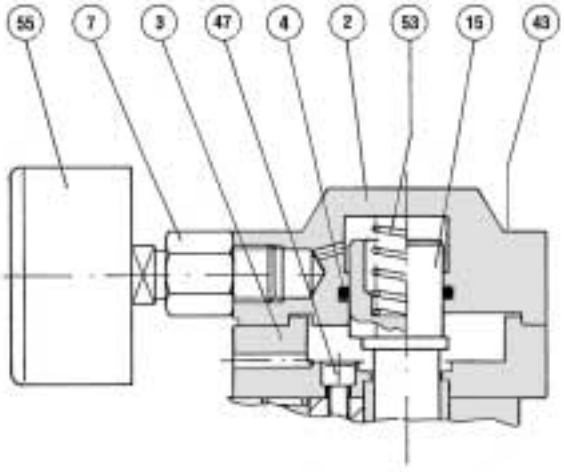
Mod. 105/92

Fig. 15

SLAM-SHUT CONTROL HEADS



Mod. 103



Mod. 104 - 105

Fig. 16

4.3.2 TAB. 9 HB/97 SLAM-SHUT SETTING SPRINGS

								SETTING RANGE in bar							
	Spring characteristics							SH1190/103		SH1190/104		SH1190/105		SH1190/105/92	
	Code	Colour	De	Lo	d	i	it	bar/min	bar/max	bar/min	bar/max	bar/min	bar/max	bar/min	bar/max
1	2700513	RED	15	40	2	8.5	10.5	0.4 ÷ 1							
2	2700713	GREEN			2.3	8.5	10.5	1 ÷ 1.9							
3	2700750	BLACK			2.5	4.25	8.25	1.8 ÷ 2.8		4.7 ÷ 6.8		11 ÷ 16.5			
4	2700985	YELLOW			3	6.5	8.5	2.7 ÷ 5		6.8 ÷ 20.6		16.5÷ 50			
5	2701182	BLUE			3.5	6	8							45 ÷ 75	

								SETTING RANGE in bar							
	Spring characteristics							SH1190/103		SH1190/104		SH1190/105		SH1190/105/92	
	Code	Colour	De	Lo	d	i	it	bar/min	bar/max	bar/min	bar/max	bar/min	bar/max	bar/min	bar/max
6	2701260	WHITE	35	60	3.5	5.5	7.5		1.3 ÷ 2.1						
7	2701530	YELLOW			4	5	7		2 ÷ 3.7						
8	2701790	YEL./BLACK			4.5	4.5	6.5		3.6 ÷ 6.8		10 ÷ 17		25 ÷ 41		
9	2702070	ORANGE			5	5	7		5 ÷ 7.8		14 ÷ 19		34 ÷ 48		
10	2702280	WHI./RED.			5.5	5	6.5		7.2 ÷ 11		17.2 ÷ 31.5		43 ÷ 76		
11	2702290	BLUE			6	5.5	7								58 ÷ 85

De = Ø external diameter **d =** Ø wire diameter **i =** active coils **Lo =** Lenght **it =** total coils

4.4 MONITOR

The monitor is an emergency regulator which takes over from the active regulator if for any reason the latter permits the downstream pressure to rise up to the value set for its intervention.
When pressure regulator Reflux 819 or incorporated monitor PM/819 are used as monitor, to increase response time an accelerato is installed.
Installation of accelerator is recommended fo use as safety accessory according to Directive 97/23/EC (PED).
Two alternative solutions are offered for this safety device associated to Aperflux 851 regulators: incorporated monitor or in-line monitor.

4.4.1 PM/819 INCORPORATED MONITOR

This emergency device (fig. 17) is fixed directly on the body of the service regulator. In this way, the two pressure regulators use the same valve body but:
- they are governed by two distinct pilots and two independent servomotors;
- they work on independent valve seats.

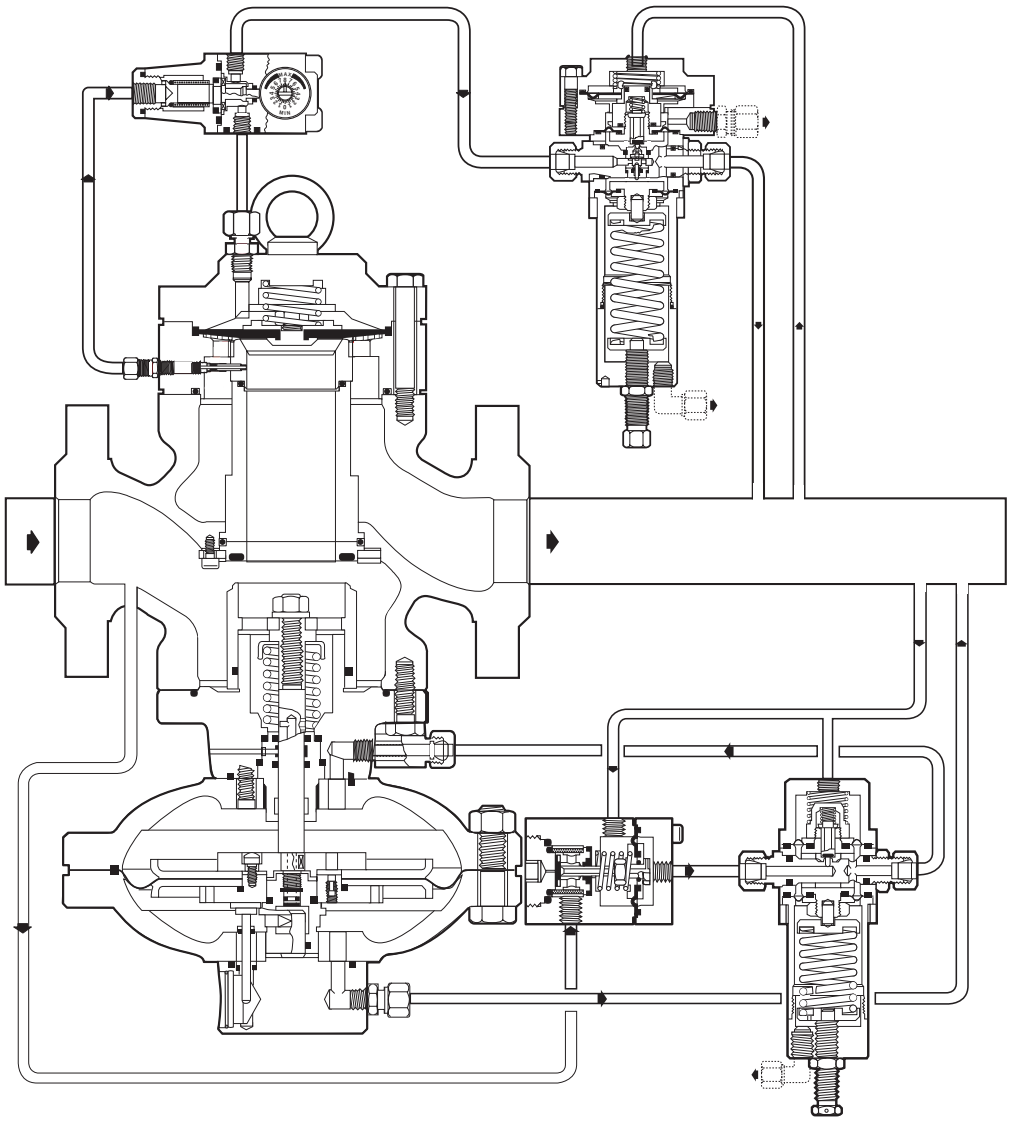


Fig. 17

4.4.2 IN-LINE MONITOR

With this kind of application, the emergency regulator is installed upstream from the service one. Depending on the specific requirements of the system, the regulator acting as monitor can be chosen between:
- Reflux 819 regulator (fig. 18);
- Aperflux 851 regulator, the same in all ways as the main regulator (fig. 19).

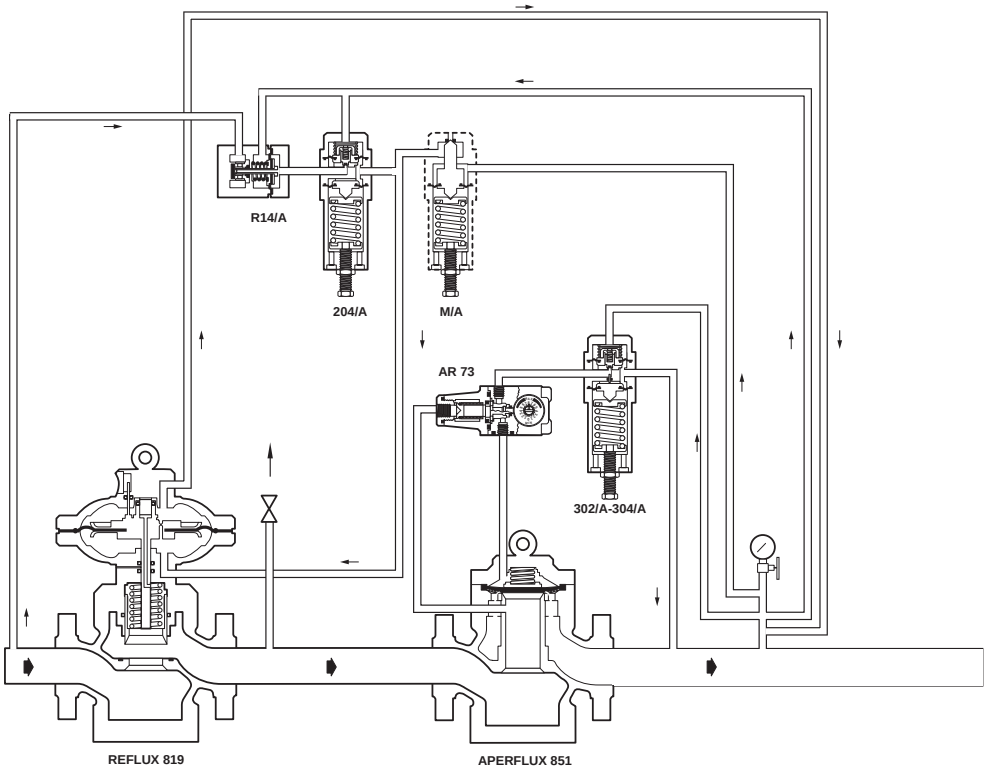


Fig. 18

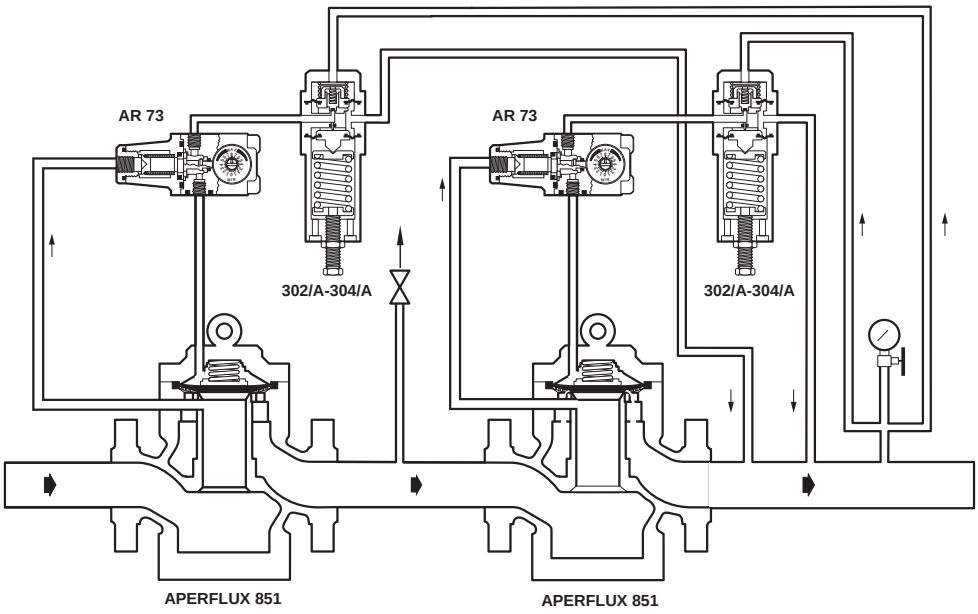


Fig. 19

4.5 SETTING SPRINGS

The REFLUX 819 regulator and the monitor PM/819 uses the 204/A, 205/A and 207/A pilots. The regulation range of the different pilots is given in the tables below.

Tab. 10 Pilot 204/A, 204/A/1

Code	Colour	De	Lo	d	i	it	Setting range in bar
2701260	WHITE	35	60	3.5	7.5	7.5	0.3 ÷ 1.2
2701530	YELLOW			4	7	7	0.7 ÷ 2.8
2702070	ORANGE			5	7	7	1.5 ÷ 7
2702450	RED			6	7	7	4 ÷ 14
2702815	GREEN			7	7	7	8 ÷ 20
2703220	BLACK			8	6	6	15 ÷ 33
2703420	BLUE			8.5	6	6	22 ÷ 43

Tab. 11 Pilot 205/A

Code	Colour	De	Lo	d	i	it	Setting range in bar
2702820	BLUE	35	100	7	7	9	20 ÷ 35
2703045	BROWN			7.5	7.5	9.5	30 ÷ 43
2703224	GREY			8	7.5	9.5	40 ÷ 60

Tab. 12 Pilot 207/A

Code	Colore	De	Lo	d	i	it	Setting range in bar
2703224	GREY	35	100	8	7.5	9.5	41 ÷ 74

De = Ø external diameter **d =** Ø wire diameter **i =** active coils **Lo =** Lenght **it =** total coils

5.0 START UP

5.1 GENERAL

After installation, check that the inlet/output on-off valves, any by-pass and the bleed cock are closed.
Before starting up, checking is recommended to ascertain that the conditions of use are in conformity with the specifications of the equipment. These specifications are recalled with the symbols on the plate fitted on every component (fig. 20).

APPARATUS SPECIFICATION PLATES

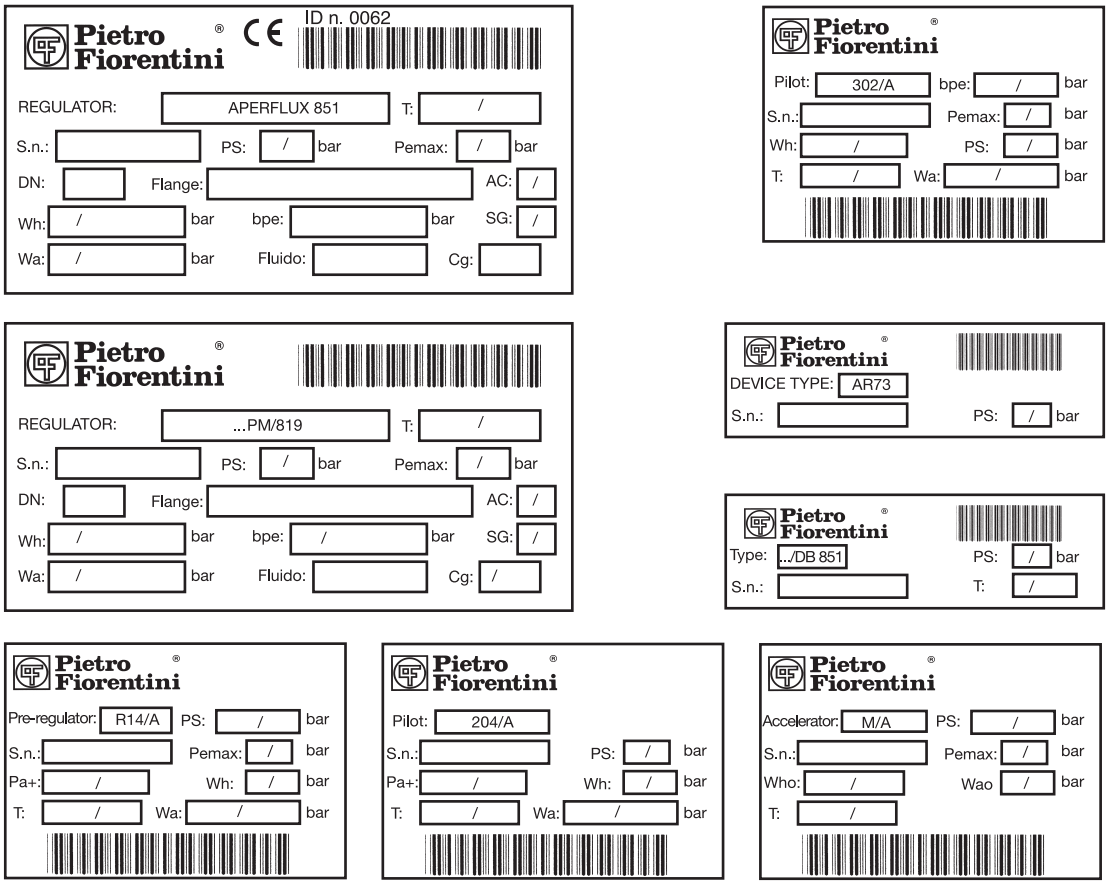


Fig. 20

The list of symbols used and their meanings are listed below:
CE = According to Directive PED
Pemax= maximum inlet operating pressure of the apparatus

bpe= range of variability of the inlet pressure of the pressure regulator in normal operating conditions

PS= maximum pressure which can be supported by the structure of the body of the apparatus in safety conditions

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

Wh= range of setting 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, diaphragms etc.). In piloted regulators, the pilot is considered as a separate apparatus with its own setting range Wh

QmaxPemin= maximum flow rate with minimum pressure at the pressure regulator inlet

QmaxPemax= maximum flow rate with maximum pressure at the pressure regulator inlet

Cg= experimental coefficient of critical flow

AC= regulation class

SG= closing pressure class

AG= intervention accuracy

Wao= 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 the piloted safety valves, the pilot is considered as a separate apparatus with its own setting range Wao

Who= 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 Who

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

Whu= range of intervention for pressure decrease of slam-shut pressure which an 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.
Table 13 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 table 13.**

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 (FIG. 21)

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

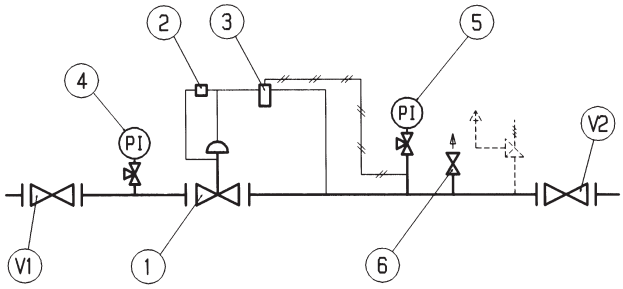


Fig. 21

1) Open the bleed cock 6.
2) Open the AR73 valve in position 8.
3) Open the inlet on-off valve V1 very slowly.
4) By means of the pressure gauge 5, check that the pressure does not exceed the maximum value permitted by the setting spring fitted in the pilot. If necessary suspend the operation by closing V1 and completely reduce the load of the spring by turning screw 10 anticlockwise (fig. 22). Reopen valve V1 slowly.
5) Adjust the setting by alternately adjusting the AR73 regulating valve and the 30./... pilot so that the value of the set pressure is obtained with the minimum opening possible of the AR73 valve; then block the screw 10 of the pilot with the provided nut 9 (fig. 22).
6) Close the bleed cock 6 and check that the downstream pressure, after a period of increase, stabilizes and at a slightly higher value than that of closure of the pilot/regulator combination. Otherwise eliminate the causes of the internal leakage.
7) Using a foam substance, 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 to obtain the complete filling of the pipe. If at the beginning of this operation the pressure in the pipe is much lower than the set point, the opening of this valve should be choked so as not to go beyond the maximum flow value for the installation.
9) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point 5 so as to readjust the setting, increasing the opening of the AR73 valve. If, on the other hand, there is an excessive reduction of the regulated pressure with an increase in flow, repeat the above operations with a smaller opening of the AR73 valve.

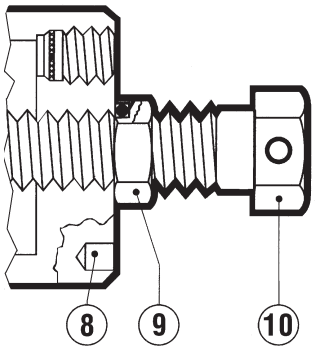


Fig. 22 - 30./...Pilot adjustment screw

5.4 COMMISSIONING THE REGULATOR WITH INCORPORATED SB/82 SLAM-SHU T (FIG. 23)

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

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

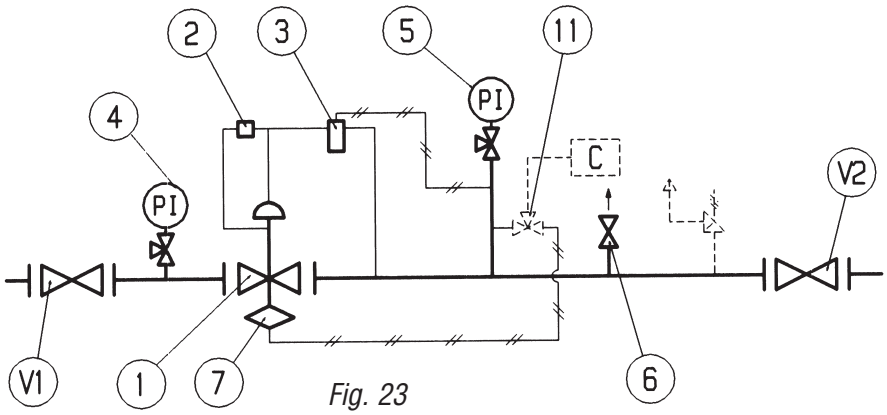


Fig. 23

A) For slam-shuts connected to the downstream piping by a three-way deviator push valve 11, proceed as follows (fig. 24):
- connect a controlled auxiliary pressure to path C;
- stabilise this pressure at the set-point established for the regulator;
- insert the reference pin 2 in the notch, pressing the knob 1 completely;
- reset the slam-shut device by means of the provided lever;
- keep the knob 1 pressed:

•)for safety devices which intervention for maximum pressure: slowly increase the auxiliary pressure and check the intervention value. If necessary, increase the intervention value by turning the adjustment ring 14 clockwise, or anticlockwise to reduce the intervention value.

•)for safety devices 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 14 or 15 clockwise and vice versa to reduce the intervention values.

- check proper operation by repeating the operations at least 2-3 times.

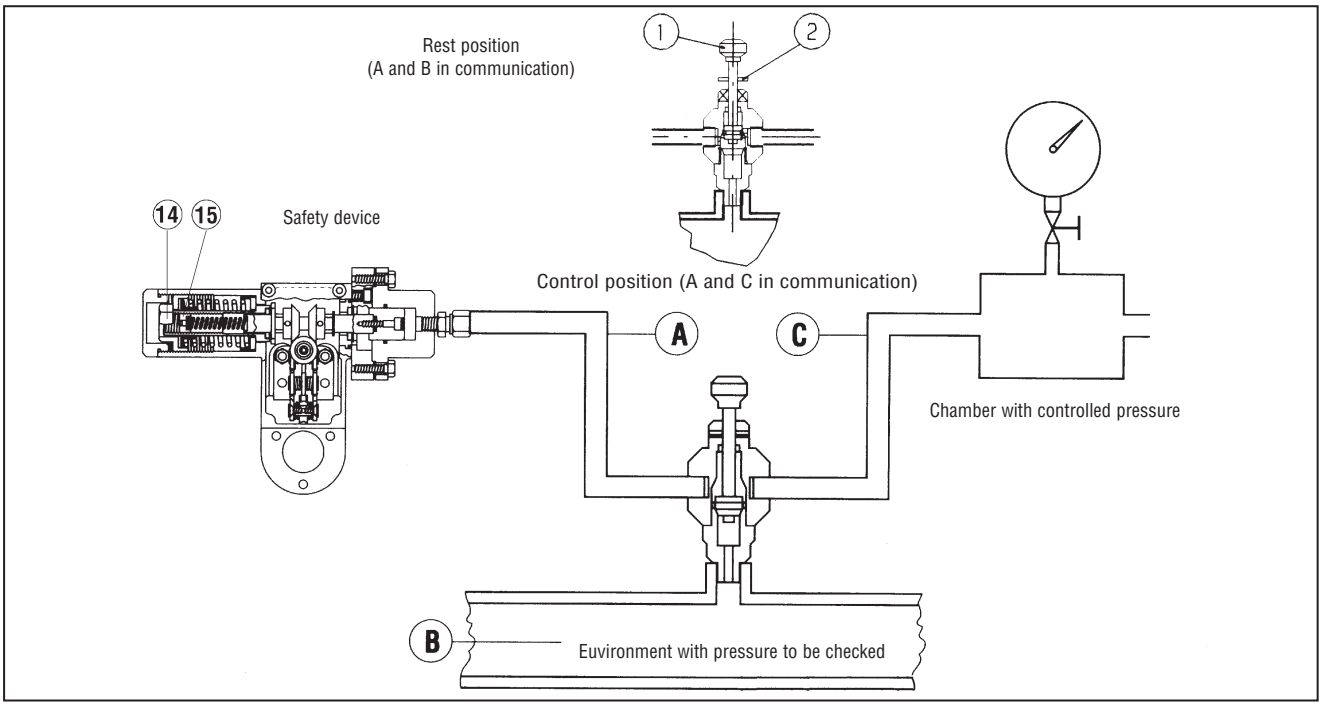


Fig. 24

B) On devices without the "push" valve (fig. 25) we recommend separately connecting the control head to a controlled auxiliary pressure and repeat the operations described above.

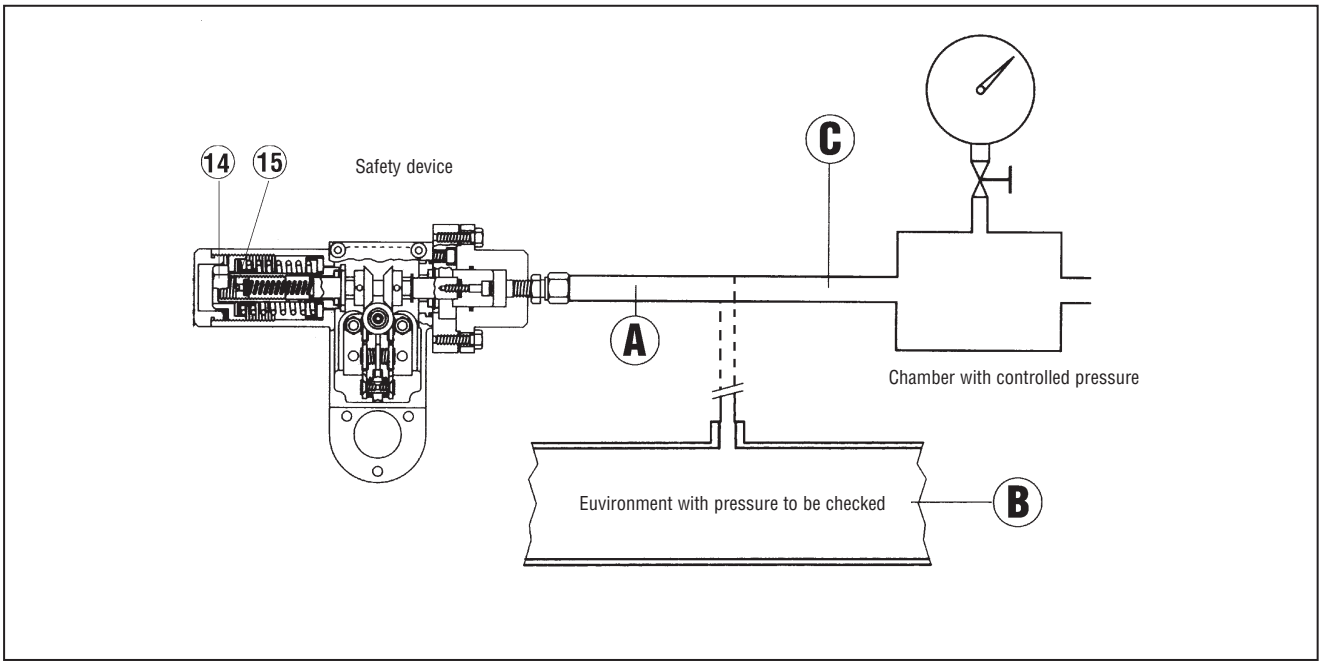


Fig. 25

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.

On completion of the slam-shut tests, proceed as follows:

1) Ensure that the slam-shut is in the closed position.
2) Open the AR73 valve in position 8.
3) Open the inlet on-off valve V1 .
4) Open the slam-shut very slowly, turning the pro-vided lever clockwise.
5) Open the bleed cock 6.
6) Adjust the setting by alternately adjusting the AR73 regulating valve and the 30./... pilot so that the value of the set pressure is obtained with the minimum opening possible of the AR73 valve; then block the screw 10 of the pilot with the provided nut 9 (fig. 22).
7) Close the bleed cock 6 and check that the downstream pressure, after a period of increase, stabilizes and at a lower value slightly higher than that of closure of the pilot/regulator combination. Otherwise eliminate the causes of the internal leakage.
8) Using a foam substance, check the tightness of all the joints between the on-off valves V1 and V2.
9) Very slowly open the downstream on-off valve V2 to obtain the complete filling of the pipe. If at the beginning of this operation the pressure in the pipe is much lower than the set point, the opening of this valve should be choked so as not to go beyond the maximum flow rate value for the installation.
10) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point 6 so as to readjust the setting, increasing the opening of the AR73 valve.
    If, on the other hand, there is an excessive reduction of the regulated pressure with an increase in flow, repeat the above operations with a smaller opening of the AR73 valve.
11) It is reccommended to check that the flow of the line stops when the slam-shut is tripped manually.

5.5 COMMISSIONIG THE REGULATOR WITH INCORPORATED PM/819 MONITOR AND ACCELERATING VALVE (FIG. 26)

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

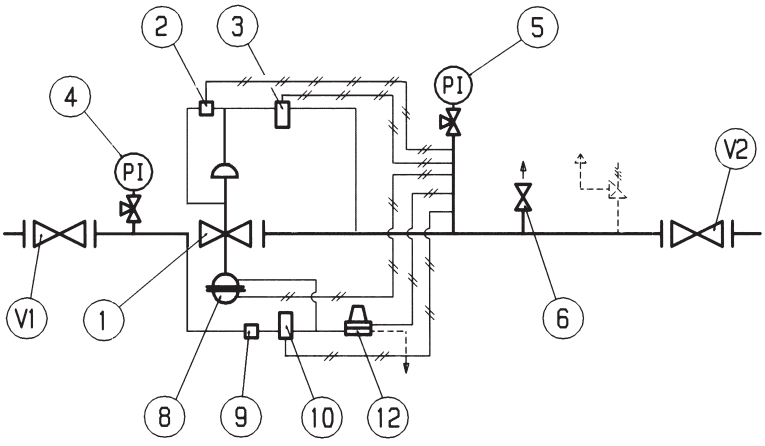


Fig. 26

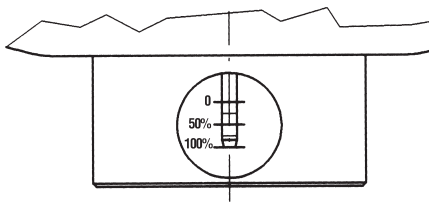


Fig. 27

1) Completely increase the setting of the pilot 3 by turning the ring 10 clockwise (fig. 22).
2) Completely increase the setting of the accelerating valve by turning the adjustment screw 17 (fig. 8) clockwise.
3) Close the AR73 valve in position 0.
4) Partially open the bleed cock 6.
5) Open the inlet on-off valve V1 very slowly.
6) Adjust the setting of the pilot of the monitor 10 to the intervention value set for the accelerating valve 12 (see table 13).
7) Lower the setting of the accelerating valve until, using a foam, foam medium gas is seen to come out of the discharge point.
8) Lower the setting of the pilot 10 of the monitor to the selected working value of the monitor, ensuring that the valve 12 is no longer discharging gas.
9) Adjust the setting of the pilot 10 of the monitor to the set value.
10) Open the AR73 valve in position 8.
11) Reduce the setting of pilot 3 to the selected working value of the service regulator.
12) Ascertain that the PM/819 monitor positions itself completely open, controlling the position of the stroke indicator through the port (fig. 27).
13) Adjust the setting by alternately adjusting the AR73 regulating valve and the 30./... pilot so that the value of the set pressure is obtained with the minimum opening possible of the AR73 valve; then block the screw 10 of the pilot with the provided nut 9 (fig. 22).
14) Close the bleed cock 6 and check that the downstream pressure, after a period of increase, stabilizes at a value than that slightly higher of closure of the pilot/regulator combination. Otherwise eliminate the causes of the internal leakage.
15) Using a foam substance, check the tightness of all the joints between the on-off valves V1 and V2.
16) Very slowly open the downstream on-off valve V2 to obtain the complete filling of the pipe. If at the beginning of this operation the pressure in the pipe is much lower than the set point, the opening of this valve should be choked so as not to go beyond the maximum flow rate value for the installation.
17) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point 13 so as to readjust the setting, increasing the opening of the AR73 valve.
    If, on the other hand, there is an excessive reduction of the regulated pressure with an increase in flow, repeat the above operations with a smaller opening of the AR73 valve.

5.6 COMMISSIONING THE REGULATOR WITH REFLUX 819 IN-LINE MONITOR WITH INCORPORATED SB/82 SLAM-SHUT AND ACCELERATING VALVE (FIG. 28)

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

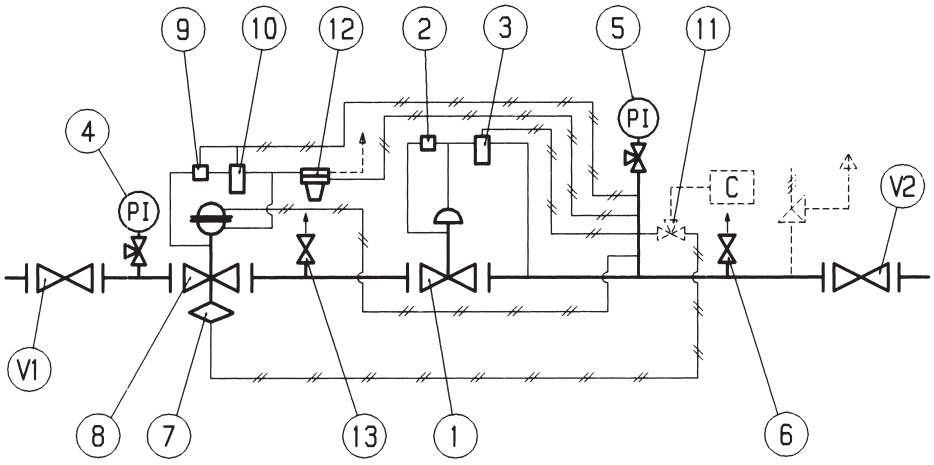


Fig. 28

Control and adjust slam-shut 7 operation as follows:

A) For slam-shut devices connected to the downstream piping by means of the three-way "push" valve 11, proceed as follows (fig. 24):
- connect a controlled auxiliary pressure to path C;
- stabilize this pressure at the regulator set point value;
- insert the reference pin 2 in the notch, pressing knob 1 completely;
- rearm the slam-shut by means of the provided lever;
- 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 trip value by turning the adjustment ring 14 clockwise, or vice versa to reduce the value;

•) for safety devices for pressure increase and decrease: slowly increase the auxiliary pressure and record the intervention value. Bring the pressure back to the regulator set point value and rearm the slam-shut.
Check operation for pressure decrease by slowly reducing the auxiliary pressure.
If necessary, increase the trip value for pressure increase or decrease by turning the rings 14 or 15 respectively clockwise; vice versa to reduce the value;
- check proper operation by repeating the operations at least 2-3 times.

B) On devices without the "push" valve, it is advisable to connect the control head separately to a controlled auxiliary pressure and repeat the operations described above (fig. 25).

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.

On completion of the slam-shut tests, proceed as follows:

1) Ensure that the slam-shut is in the closed position.
2) Open the inlet on-off valve V1 very slowly.
3) Completely increase the setting of the pilot 3 by turning the screw 10 clockwise (fig. 22).
4) Close the AR73 valve in position 0.
5) Completely increase the setting of the accelerating valve by turning the adjustment screw 17 (fig. 8) clockwise.
6) Open the slam-shut very slowly, turning the pro-vided lever clockwise.
7) Partially open the discharge cock 6.
8) Adjust the setting of the pilot of the monitor 10 to the intervention value set for the accelerating valve 12 (see table 13).
9) Lower the setting of the accelerating valve until, using a foam, gas is seen to come out of the discharge point.
10) Lower the setting of the pilot 10 to the selected working value of the monitor, ensuring that the valve 12 is no longer discharging gas.
11) Adjust the setting of the pilot of monitor 10 to the set value.
12) Open the AR73 valve in position 8.
13) Reduce the setting of pilot 3 to the selected working value of the service regulator.
14) Ascertain that the REFLUX 819 monitor positions itself completely open, controlling the position of the stroke indicator through the port (fig. 27).

15) Adjust the setting by alternately adjusting the regulating AR73 valve and the 30./... pilot so that the value of the set pressure is obtained with the minimum opening possible of the AR73 valve; then block the screw 10 of the pilot with the provided nut 9 (fig. 22).
16) Close the vent cock 6 and check that the downstream pressure, after a period of increase, stabilizes and at a lower value than that of closure of the pilot/regulator combination. Otherwise eliminate the causes of the internal leakage.
17) Using a foam substance, check the tightness of all the joints between the on-off valves V1 and V2.
18) Very slowly open the downstream on-off valve V2 to obtain the complete filling of the pipe. If at the beginning of this operation the pressure in the pipe is much lower than the set point, the opening of this valve should be choked so as not to go beyond the maximum flow rate value for the installation.
19) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point 16 so as to readjust the setting, increasing the opening of the AR73 valve.
If, on the other hand, there is an excessive reduction of the regulated pressure with an increase in flow, repeat the above operations with a smaller opening of the AR73 valve.
20) It is reccomended to check that the flow of the line stops when the slam-shut is tripped manually.

5.7 COMMISSIONING THE REGULATOR PLUS APERFLUX 851 IN LINE MONITOR WITH INCORPORATED SB/82 SLAM-SHUT (FIG. 29)

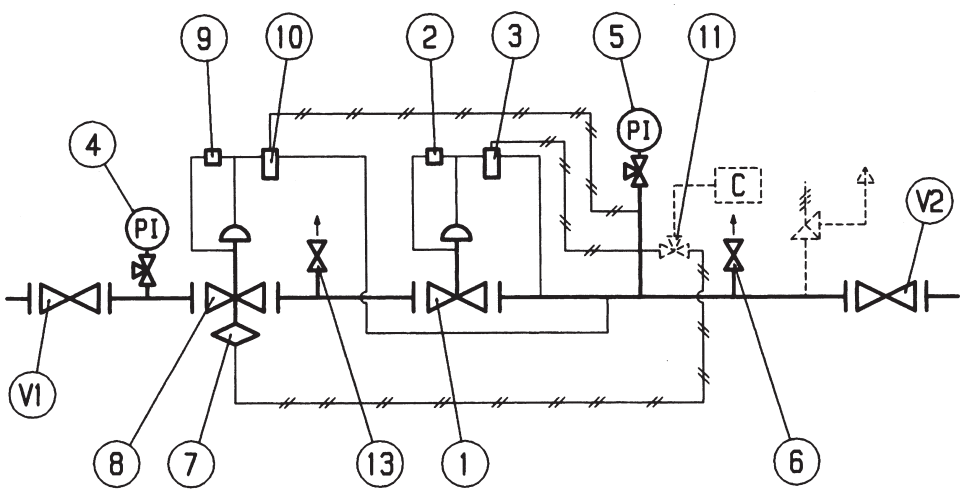


Fig. 29

Control and adjust slam-shut 7 operation as follows:

A) For slam-shut devices connected to the dowstream piping by means of the three-way "push" valve 11, proceed as follows (fig. 24):
- connect a controlled auxiliary pressure to path C;
- stabilize this pressure at the regulator set point value;
- insert the reference pin 2 in the notch, pressing knob 1 completely;
- rearm the slam-shut by means of the provided lever;
- 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 trip value by turning the adjustment ring 14 clockwise, or vice versa to reduce the value;

• for safety devices for pressure increase and decrease: slowly increase the auxiliary pressure and record the intervention value.

Bring the pressure back to the regulator set point value and rearm the slam-shut. Check operation for pressure decrease by slowly reducing the auxiliary

pressure. If necessary, increase the intervention value for pressure increase or decrease by turning the rings 14 or 15 respectively clockwise; vice versa to reduce the value.
- check proper operation by repeating the operations at least 2-3 times.

B) With devices without the "push" valve, it is advis-able to connect the control head separately to a controlled auxiliary pressure and repeat the operations described above (fig. 25).

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.

On completion of the slam-shut tests, proceed as follows:

1) Ensure that the slam-shut is in the closed position.
2) Open the AR73 (9) valve of the monitor in position 8.
3) Close the AR73 valve of the service regulator in position 0.
4) Open the inlet on-off valve V1 very slowly.
5) Completely increase the setting of the pilot 3.
6) Open the slam-shut very slowly, turning the pro-vided lever clockwise.
7) Partially open the discharge cock 6.
8) Using the pressure gauge 5, check that the downstream pressure settles at the value of the monitor set point. Adjust the setting by alternately turning the adjustment screw of the pilot 10 and the AR73 regulating valve so that the value of the set pressure is obtained with the minimum opening possible of the AR73 valve.
9) Open the AR73 (2) valve of the service regulator in position 8.
10) Slowly reduce the set-point of the pilot 3 to the set point of the service regulator.
11) Repeat the operations in point 8 for the pilot 3 and the valve 2.
12) Wait until the downstream pressure settles at the desired value and adjust it as described in point 8.
13) Close the bleed cock 6 and check that the downstream pressure, after a period of increase, stabilizes at a value slightly higher than that of closure of the pilot/regulator combination. Otherwise eliminate the causes of the internal leakage.
14) Using a foam substance, check the tightness of all the joints between the on-off valves V1 and V2.
18) Very slowly open the downstream on-off valve V2 to obtain the complete filling of the pipe. If at the beginning of this operation the pressure in the pipe is much lower than the set point, the opening of this valve should be choked so as not to go beyond the maximum flow value for the installation.
16) If pumping phenomena arise in normal working conditions, it is necessary of repeat the operations in point 8 so as to readjust the setting, increasing the opening of the AR73 valve.
If, on the other hand, there is an excessive reduction of the regulated pressure with an increase in flow, repeat the above operations with a smaller opening of the AR73 valve.
17) It is recommended to check that the flow of the line stops when the slam-shut is tripped manually.

TAB. 13:	Settings of in-line apparatuses consisting of Regulator APERFLUX 851 + Monitor + Slam-shut + Relief valve				
Set-point Regulator (Pas) bar	**Set-point MONITOR**	**Set-point ACCELERATING VALVE**	**Set-point RELIEF-VALVE**	**Set-point SLAM-SHUT Max**	**Set-point SLAM-SHUT Min**
0.8<Pas>2.1	Pas x 1.1	Pas x 1.2	Pas x 1.3	Pas x 1.5	Pas - 0.3 bar
2.1<Pas>5	Pas x 1.1	Pas x 1.2	Pas x 1.3	Pas x 1.4	Pas - 0.5 bar
5<Pas>25	Pas x 1.05	Pas x 1.1	Pas x 1.15	Pas x 1.3	Pas - 3 bar
25<Pas>60	Pas x 1.03	Pas x 1.06	Pas x 1.15	Pas x 1.3	Pas - 5 bar

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 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. 14 APERFLUX 851 REGULATOR (FIG. 30, 31 and 32)

PROBLEM	POSSIBLE CAUSES	APPARATUS	REMEDY
Operating anomalies	Unsuitable pressure at the regulator	AR73 (fig. 32)	Adjust the flow rate
	Diaphragm-holder assembly friction	302/A PILOT (fig. 32)	Centre the moviment of hole, assembly and shaft
	Worn diaphragm [16]		Replace
	Worn diaphragm [49]		Replace
	Spring [22] yielded or off level		Replace
	Worn diaphragm [20]	REGULATOR (fig. 30)	Replace
	Worn [20] off level		Check
	Incorrect [45] spring		Replace
Tightness failure Q= 0	Obturator [17] worn	302/A PILOT (fig. 32)	Replace
	Worn diaphragm [20]	REGULATOR (fig. 30)	Replace
	Diaphragm [20] off plane		Replace
Pressure increase with Q>0	Filter [11] cartridge dirty	AR73 (fig. 32)	Replace
	Obturator [17] worn	302/A PILOT (fig. 32)	Replace
	Worn diaphragm [49]		Replace

PROBLEM	POSSIBLE CAUSES	APPARATUS	REMEDY
Pressure drop	Incorrect adjustment	AR73 (32)	Adjust
	Formation of ice on the valve	302/A PILOTA (fig. 32)	Increase the pilot circuit gas input temperature
	Valve obstructed by dirt		Clean and check the AR73 filter cartridge
	No pressure upsteam	REGULATOR (fig. 30)	Check the line filter cartridge for dirt
	Formation of ice		Increase regulator input temperature

6.2 TABELLA 15 PM/819 MONITOR (FIG. 33 and 34)

PROBLEM	POSSIBLE CAUSES	APPARATUS	REMEDY
Pressure increase with Q>0	Guide ring [20] damaged	R14/A PREREGULATOR (fig. 34)	Replace
	Diaphragm [10] ruptured		Replace
	Obturator [17] damaged	204/A PILOT (fig. 34)	Replace
	Obturator [17] stuck in the open position		Control and clean if necessary
	Spring yielded [21]		Replace
	Reinforced gasket [7] damaged	REGULATOR (fig. 33)	Replace
	Ice formation between the reinforced gasket		Increase the gas temp. at the regulator and the plug inlet
	Dirt between the reinforced gasket and the obturador		Clean and check gas filtering
	Obturator blocked		Clean and check movement
	Diaphragm fixed incorrectly		Fix
	Downstream sensing line dirty		Clean
	Occlusion of pressure chamber vent nozzle		Clean
	Obturator guide ring [35] damaged		Replace
Pressure drop	Feed too low	R14/A PREREGULATOR (fig. 34)	Replace the spring [12]
	Filter cartridge [13] dirty		Replace
	Occlusion by frost		Increase temp. at the preregulator inlet
	Occlusion by dirty		Check cartridge [13] filtering level
	Diaphragm [10] ruptured		Replace
	Reinforced gasket [9] swollen		Replace
	Pilot feed line broken		Repair

PROBLEM	POSSIBLE CAUSES	APPARATUS	REMEDY
Pressure drop	Diaphragm [16] ruptured Motorisation line to the regulator broken	204/A PILOT (fig. 34)	Replace Repair
	Obturator blocked Diaphragm [50] ruptured Guide ring [36] damaged Breakage or leakage from vent nozzle calibrated hole screw No pressure upstream	REGULATOR (fig. 33)	Clean and check movement Replace Replace Repair Repair Check cleanliness of line filter cartridges

6.3 TAB. 16 SB/82 SLAM-SHUT (FIG. 35)

PROBLEM	POSSIBLES CAUSES	REMEDY
Slam-shut obturator does not close	Control head diaphragm [4] broker	Change diaphragm
Leakage from slam-shut obturator	Seal of obturator [40] deteriorated	Change seal
	Seat of obturator deteriorated	Change the seat
	Seal by-pass [19] deteriorated	Change seal
Incorrect intervention pressure	Wrong max. and/or min. spring setting	Make the setting again by means of the rings
	Friction in the lever mechanism	Change the box containing the whole assembly
Resetting not possible	Persistence of the cause of the increase or decrease of the downstream pres.	Decrease or increase the downstream pressure
	Lever mechanism broken or cracked	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 to you. For further information contact our SATRI service centre at our Arcugnano (VI) 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 tables 17 and 18.

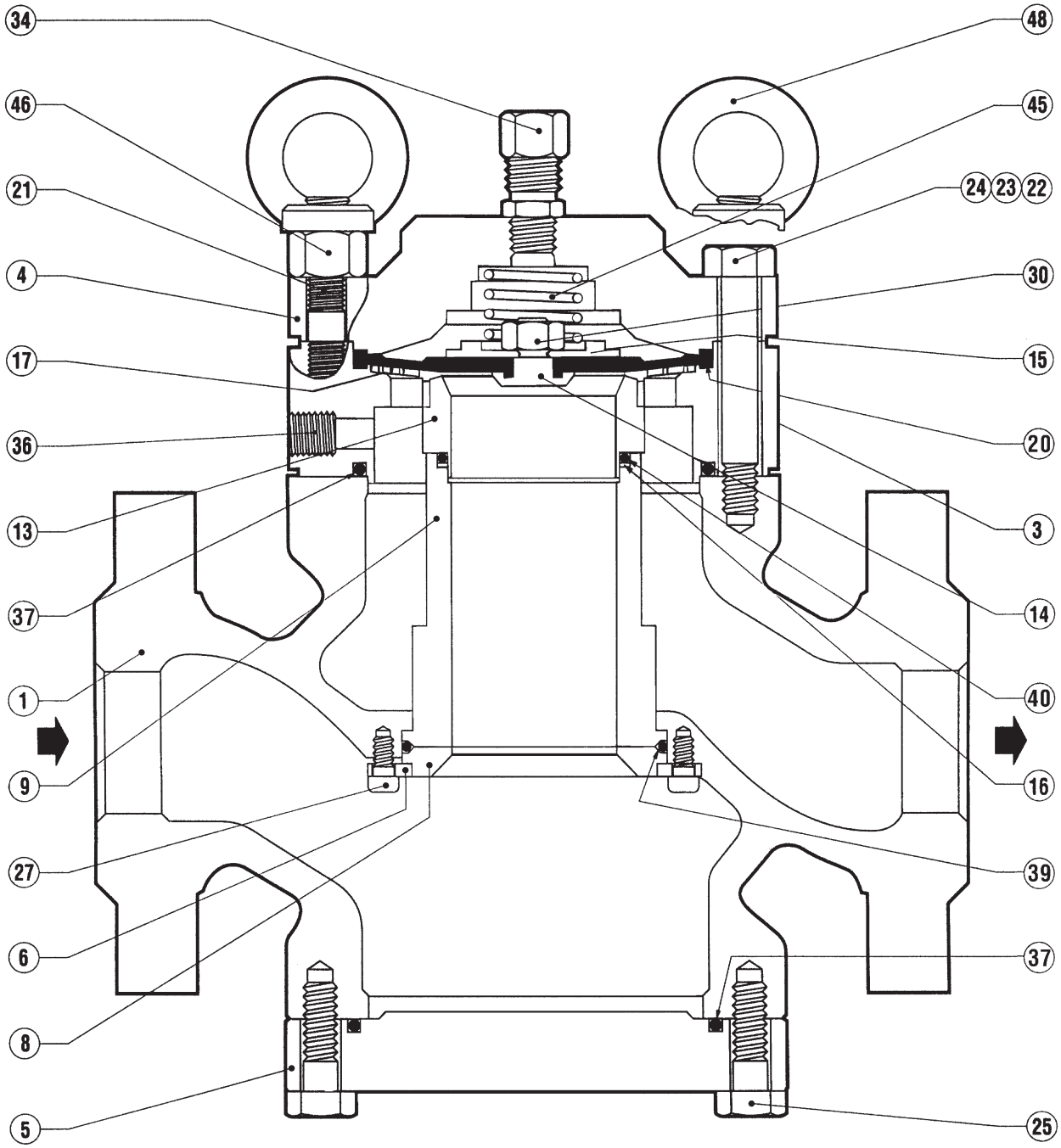
For a proper maintenance the reccomended spare parts are unequivocally identified by labels indicating:

- 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 reccomend 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 re-commissioning of equipment after maintenance, external tightness shall be verified at a proper to assure no external leakage. When equipment is used as safety accessory to PED, 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 APERFLUX 851 REGULATOR MAINTENANCE PROCEDURE



DN: 1" - 2"

Fig. 30

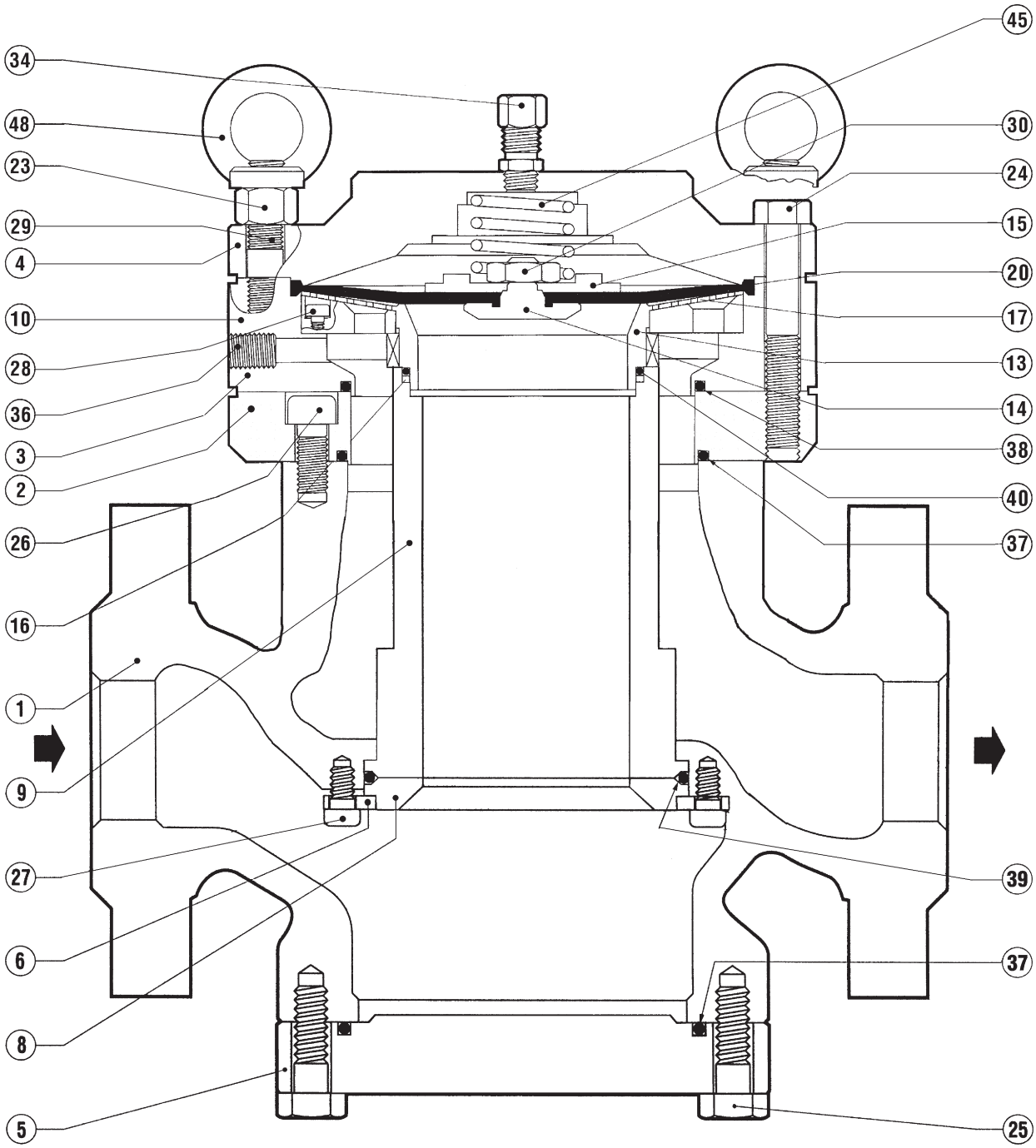


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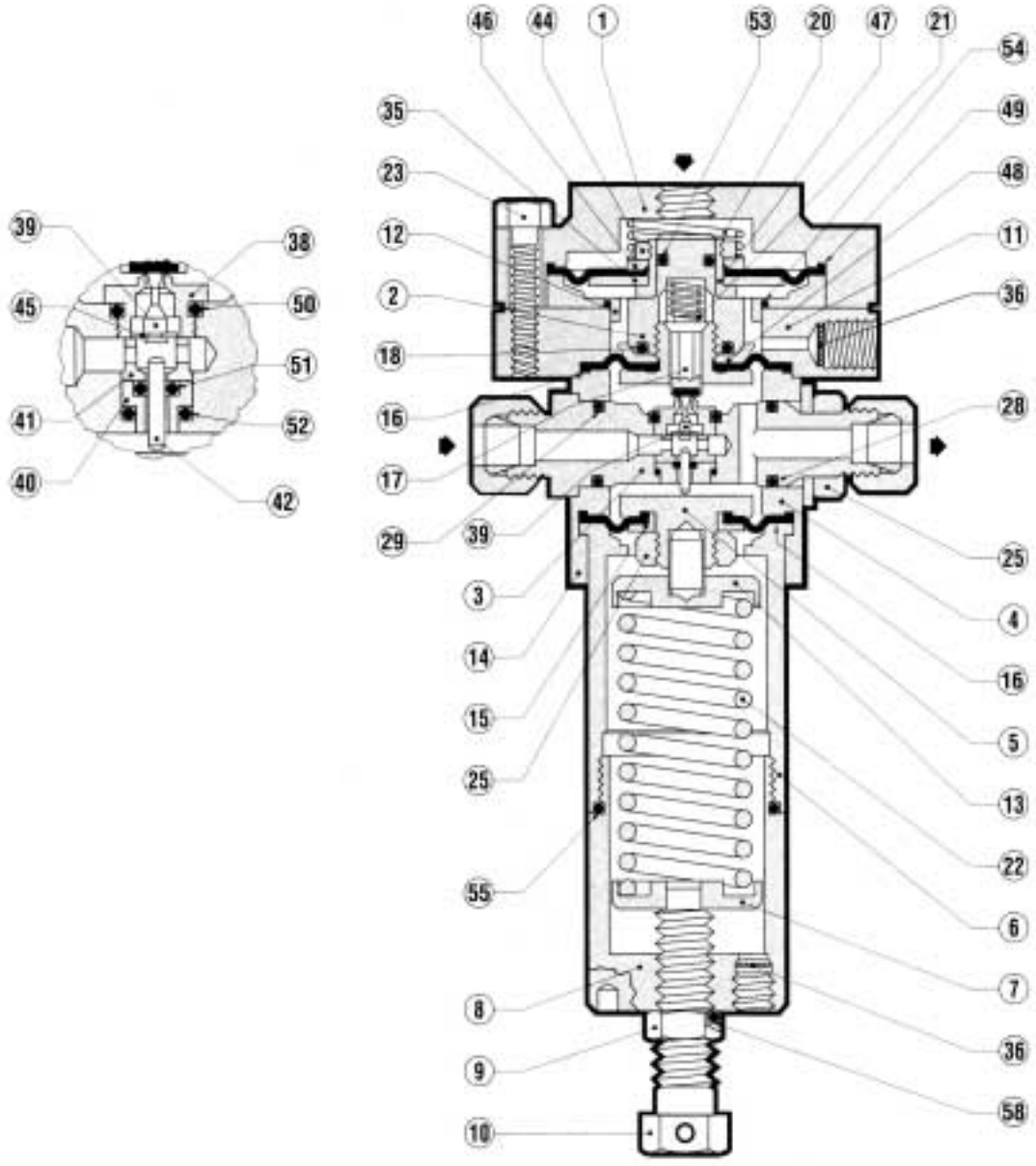
Fig. 31

302/A PILOT



AR73 FLOW REGULATION VALVE

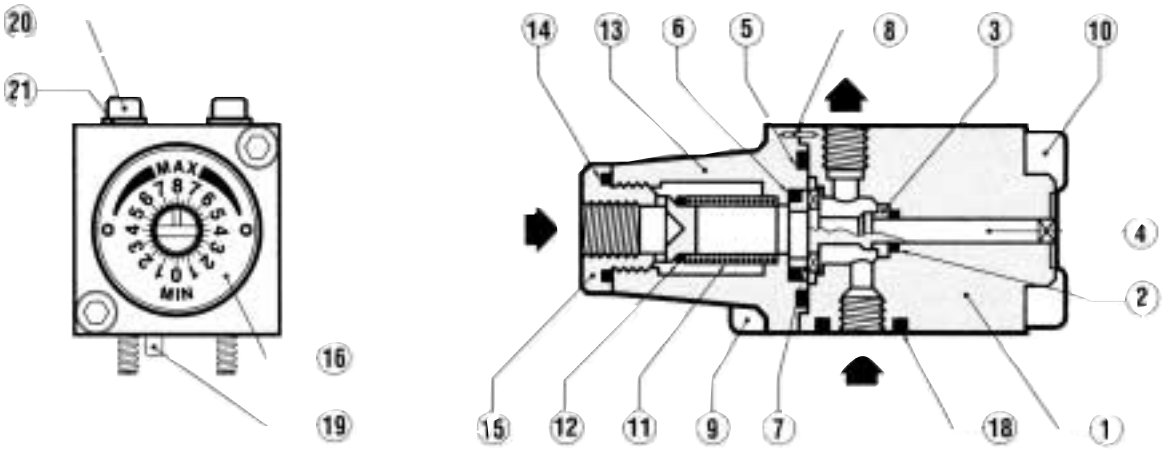


Fig. 32

Procedure for the disassembly, complete replacement of spares parts and reassembly of the "APERFLUX 851" pressure regulator with 302/A pilot + AR73 (PROGRAMMED PREVENTIVE MAINTENANCE)

PRELIMINARY OPERATIONS

A. Put the regulator into conditions of safety;

B. Ensure that the upstream and downstream pressures are 0.

INITIAL OPERATIONS

1) Disconnect all the pilot and regulator feed and sensing line connections, by unscrewing the taper seal connectors.
2) Slacken the fixing nut of the bracket, pos. (14), which fix the pilot to the regulator.
3) Remove the 302/A+AR73 pilot assembly from the regulator.

REGULATOR DISASSEMBLY

4) Slacken the eyebolt, pos. (48), and the remaining fixing screws, pos. (24).
5) Remove the top cover, pos. (4).
6) Remove the spring, pos. (45), along with the diaphragm support assembly.
7) Separate the diaphragm protection plate, pos. (15), from the screw, pos (14), and the diaphragm, pos. (20), slackening the nut, pos. (30).
8) Remove the intermediate flange, pos. (3), along with the diaphragm protection grill, pos. (17).
9) Remove the valve seat, pos. (13).
9a)* Slacken the fixing screws, pos. (26) of the flange, pos. (2), and remove it from the body of the regulator.
10) Slacken the fixing screws, pos. (25), of the bottom blind flange, pos. (5).
11) Remove the bottom blind flange, pos. (5).
12) Slacken the fixing screws, pos. (27), of the lock ring, pos. (6), of the reinforced gasket, pos. (7).
13) Remove the lock ring, pos. (6), the reinforced gasket, pos. (7), and the sleeve, pos. (9).
14) Check and clean the inside of the regulator body.
15) Carefully check that the valve seat is in good condition.
16) **Replace all the parts from the spare parts kit.**

* Only for version 3"÷ 10"

REGULATOR REASSEMBLY

The O-rings and sliding mechanical parts (rods, etc.) must be lubricated lightly before reassembly with a thin layer of silicone grease. Static parts must be greased to make them more tender but mainly so that they will be held in their slots.

17) Reassemble the reinforced gasket, pos. (7), and the lock ring, pos. (6), and fix the screws, pos. (27), of the ring itself.

18) Reassemble the bottom blind flange, pos. (5), and fix the screws, pos. (25).
18a)* Reinstall the flange, pos. (2), on the body of the regulator and fix the screws, pos. (26).
19) Reassemble the valve seat, pos. (13).
20) Reassemble the intermediate flange, pos. (3), along with the diaphragm protection grill, pos. (17).
21) Reassemble the diaphragm support assembly, fixing the nut, pos. (30).
22) Put the diaphragm support assembly, the spring, pos. (45), and the top cover, pos. (4), back on the regulator.
23) Screw in and fix the screws, pos. (23), and the eyebolts, pos. (48).

* Only for version 3"÷ 10"

DISASSEMBLY OF THE PILOT ASSEMBLY

24) Disconnect the connection nipples between the 302/A pilot and the AR73 flow regulator valve, unscrewing the tapered seal connectors.

SMONTAGGIO PILOTA 302/A

25) Slacken the lock nut, pos. (9).
26) Slacken the setting screw, pos. (10), turning it anticlockwise as far as it goes.
27) Remove the pilot plug, pos. (8).
28) Remove the spring support, pos. (7), the spring, pos. (22), and the spring support, pos. (13), from the pilot.
29) Slacken the screws, pos. (24), and remove the sleeve, pos. (6), and the pilot bracket, pos. (14).
30) Slacken the nut, pos. (25), and remove the protection plate, pos. (15) and the bottom diaphragm, pos. (16), from the diaphragm support, pos. (5).
31) Slacken the screws, pos. (23), and remove the pilot top flange, pos. (1), along with the spring, pos. (20).
32) Remove the downstream impulse diaphragm assembly, pos. (44), (46), (49), (47), (35), and the ring, pos. (12).
33) Separate the impulse diaphragm assembly, unscrewig the nut, pos. (44).
34) Unscrew the pilot nut, pos. (2), and remove it along with the spring, pos. (21), and the obturator, pos. (17).
35) Slacken the screws, pos. (24), and remove the bottom flange, pos. (11), the protection plate, pos. (48), and the diaphragm, pos. (16).
36) Slacken the nut, pos. (25), and remove the shaft of the valve seat, pos. (3), from the pilot body, pos. (4).
37) Carefully check that the valve seat is in good condition and, in particular, the modulating piston, pos. (39).
38) **Change all the parts included in the spare parts kit.**

REASSEMBLING THE 302/A PILOT

39) Reassemble the shaft of the valve seat, pos. (3), on the pilot body, pos. (4), with the interposition of the diaphragm support, pos. (5).
40) Screw in and tighten the nut, pos. (25).
41) Reassemble the bottom diaphragm, pos. (16), and the protection plate, pos. (15), on the diaphragm support, pos. (5), and screw in the nut, pos. (25).
42) Insert the pilot obturator, pos. (17), the spring, pos. (21), the diaphragm, pos. (16), and the protection plate, pos. (48).
43) Screw in the pilot nut, pos. (2).
44) Check and centre the diaphragm support, pos. (5).

45) Reassemble the bottom flange, pos. (11), on the pilot body pos. (4) and fix the screws, pos. (24).
46) Reassemble the impulse diaphragm assembly, screwing in the nut, pos. (14).
47) Reassemble the ring, pos. (12), the impulse diaphragm assembly, the spring, pos. (20), and the pilot top flange, pos. (1), and fix the screws, pos. (23).
48) Reassemble the sleeve, pos. (4), and the pilot bracket, pos. (6), on the valve body, pos. (14), and fix by screwing in the screws, pos. (24).
49) Position the spring support, pos. (13), the spring, pos. (22), and the spring support, pos. (7), and fix the pilot plug, pos. (8).

DISASSEMBLING THE AR73 FLOW REGULATOR VALVE

50) Unscrew the filter plug, pos.(13), from the valve sleeve, pos. (15).
51) Slacken the fixing screws, pos. (9), and separate the valve body, pos. (1), from the valve sleeve, pos. (13).
52) **Change all the parts included in the spare parts kit.**

REASSEMBLING THE AR73 FLOW REGULATOR VALVE

53) Refit the valve body, pos. (1), to the valve sleeve, pos. (13), and fix the screws, pos.(9).
54) Screw the filter plug, pos.(15), to the valve sleeve, pos. (13).

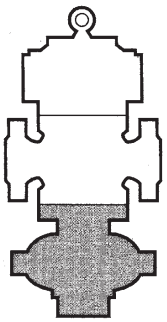
REASSEMBLING THE PILOT ASSEMBLY

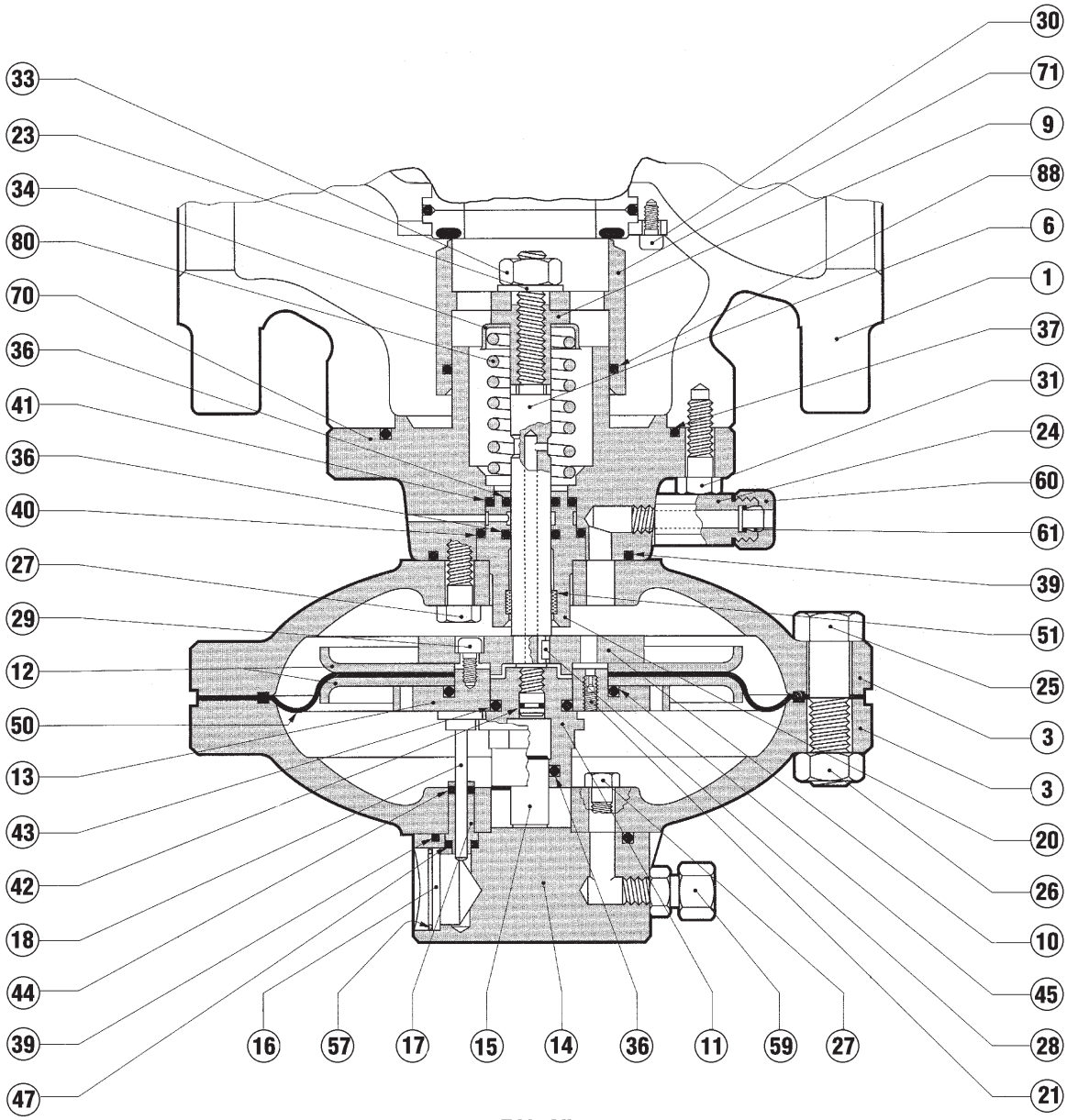
55) Reconnect the connection nipples between the 302/A pilot and the AR73 flow regulator valve, screwing in the taper seal connectors.

FINAL OPERATIONS

56) Fit the 302/A pilot + AR73 assembly onto the regulator.
57) Fix the nut of the bracket fixing the pilot to the regulator.
58) Reconnect all the feed and sensing line connectors, screwing in the taper seal connectors.

7.3 PM/819 MONITOR MAINTENANCE PROCEDURE

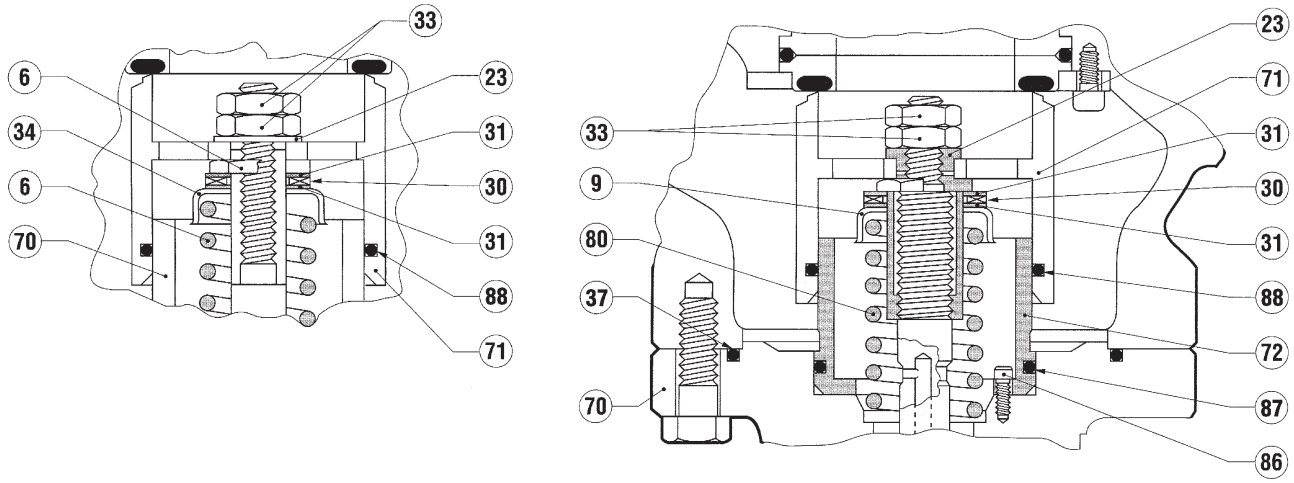




DN: 2”

Fig. 33

VERSIONS

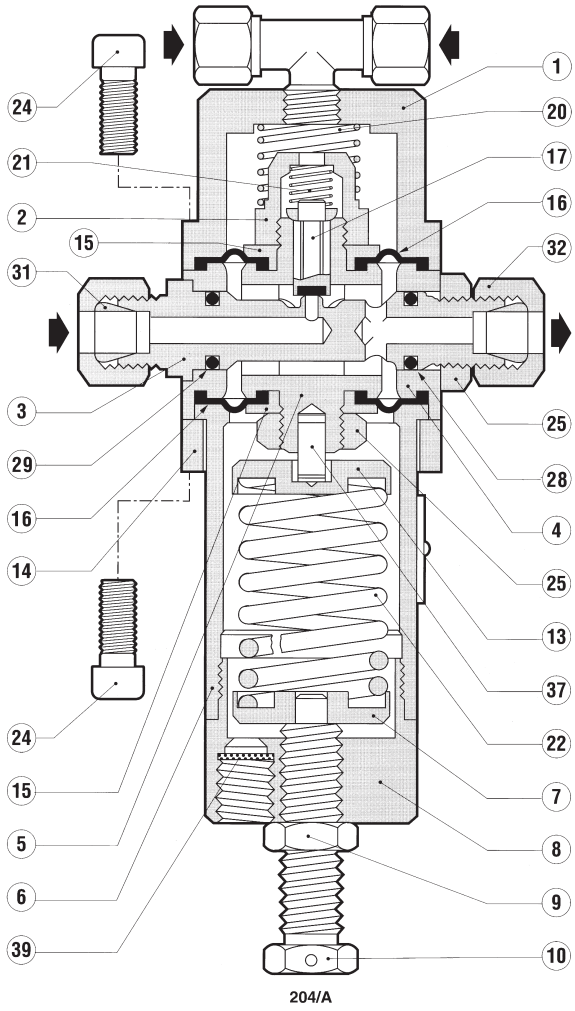


DN: 3" - 4"

DN: 6" ÷ 10"

Fig. 33/A

204/A + R14/A PILOT



204/A

Fig. A

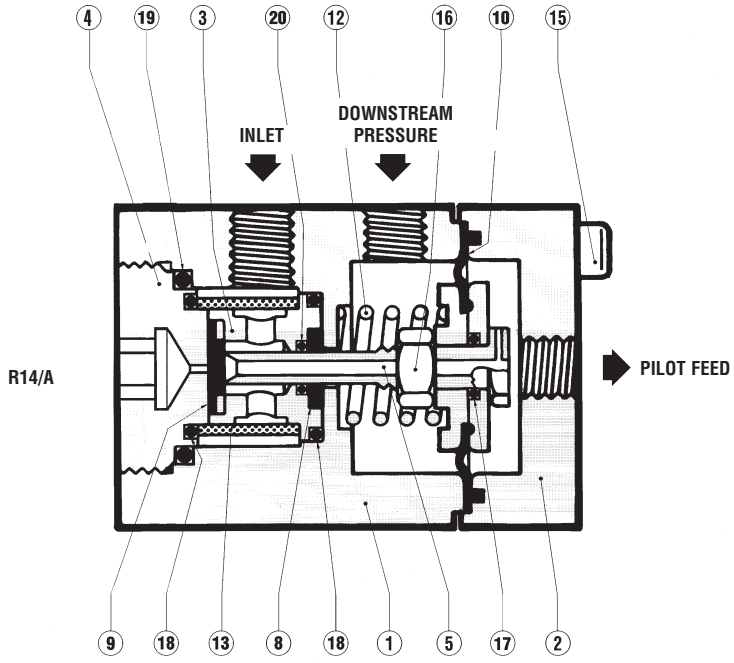


Fig. 34

PM/819 MONITOR (FIG. 33)

1) Disconnect the connection pipes between the regulator and monitor and the respective pilot units, and between the latter and the downstream pressure take-offs.
2) Remove the screws (88) which secure the reduction assembly (90) of the monitor to the body, making sure that the weight of the reduction assembly itself can be sustained. When removing the assembly from the body, the maximum care must be taken so as to avoid denting the sealing edge of the obturator (5).
3) Lay the reduction assembly on one side.
4) Slacken the lock nut, (33) , fixing the obturator, (71) to the rod (6), and remove the obturator, (71) from the obturator guide (70) .
5) Completely slacken the spring, (80) , by unscrewing the lock nut, (9) .
6) Remove the screws (25) and the nuts (26) from the obturator guide (2).
7) Raise the top cover (3) with the flange (14) and the indicator rod guide (17) . To separate the three parts, unscrew the screws (27).
8) Separate the parts (11) and (13) making use of the flat faces on the piston guide (11) and the holes on the disc (13).
9) Raise the assembly composed of the diaphragm (50) and the discs (10), (12) and (13); disassemble the diaphragm (50) by removing the screws (23) .
10) Remove the stem (6) from the side of the cover.
11) Disassemble the bottom cover (3) by removing the screws (27) , and remove the stem guide (20) .

Take the following precautions during reassembly:

- the bottom cover (3) should be fixed to the obturator guide (2) in such a way that the hole of the motorization pressure passage mates with the similar hole on the obturator guide itself;
- when assembling the assembly consisting of the diaphragm (50) and the guard discs, check that the hole with the nozzle on disc (13) is aligned with the hole on disc (10) ; also check that the hole on nozzle (21) is free from dirt and foreign bodies;
- when assembling the assembly composed of the top cover (3) with the flange (14) and the indicator rod ensure that the washer of the indicator rod (18) is correctly fitted between the disc (13) and the piston guide (11) and that it does not obstruct the hole in disc (13); it should all be turned in such a way that the indicator port is completely visible;
- before securing the lock nut (9), check that the spring (54) is properly housed in the special centring beat on the obturator guide (2) .

DISASSEMBLING THE PILOT ASSEMBLY

1) Disconnect the connection nipples between the pilot 204/A and the preregulator R14/A, unscrewing the tapered seal connectors.

DISASSEMBLING THE 204/A PILOT (FIG. 34)

2) Slacken the lock nut (9).
3) Slacken the adjustment screw (10) for its complete stroke by turning it anticlockwise.
4) Remove the pilot plug (8).
5) Remove the spring support (7), the spring (22) and the spring support (13) from the pilot.
6) Slacken the screw (24) and remove the sleeve (6) and the pilot bracket (14).
7) Unscrew the lock nut, (25) and remove the protection disc (5) and the bottom diaphgram (16).
8) Slacken the screws (24) and remove the pilot cover (1) along with the spring (20).
9) Unscrew the pilot nut (2) and remove the spring (21), the pilot obturador (17), the protection disc (15) and the top diapragm (16).
10) Unscrew the lock nut from the valve seat (25).
11) From the pilot body (4) remove the shaft of the valve seat (3) along with the diaphragm support (5).
12) Clean and carefully check that the valve seat (3) is in good condition.
13) **Replace all the components which are part of the spare parts kit.**

REASSEMBLING THE 204/A PILOT

14) On the pilot body (4), reassemble the shaft of the valve seat (3), putting the diaphragm support (5) between them.
15) Screw and tighten the nut (25).
16) Reassemble the bottom diaphragm (16), and the protection disc (15) and screw in the pilot lock nut (25).
17) Insert the pilot obturator (17), the spring (21), the top diaphragm and the protection disc (15).
18) Screw in the pilot nut (18).
19) Check and centre the diaphragm support (5).
20) Reassemble the pilot cover (20) along with the spring (1) and fix the screws (24).
21) Reassemble the sleeve (6) and the pilot bracket (14) on the pilot body (4) and secure it by screwing in the screws (24) mm.
22) Position the spring support (13), the spring (22),and the spring support (7) and fix the pilot plug (8).

DISASSEMBLING THE R14/A PREREGULATOR (Fig.34)

23) By slackening the screws (5), remove the cover (2), from the preregulator body (1).
24) Remove the diaphragm obturator assembly and the spring (12).
25) Separate the diaphragm assembly (10) and ob-turator (5), by unscrewing the lock nut (16).
26) Unscrew the preregulator plug (4).

27) From the preregulator body (1), remove the preregulator plug (4), the reinforced gasket (9), the filter (13), the obturator guide (3) and the guide ring (8).
28) Clean and carefully check that the obturator (5) is in a good state.
29) **Replace all the components which are part of the spare parts kit.**

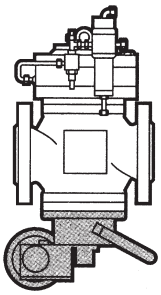
REASSEMBLING THE R14/A PREREGULATOR

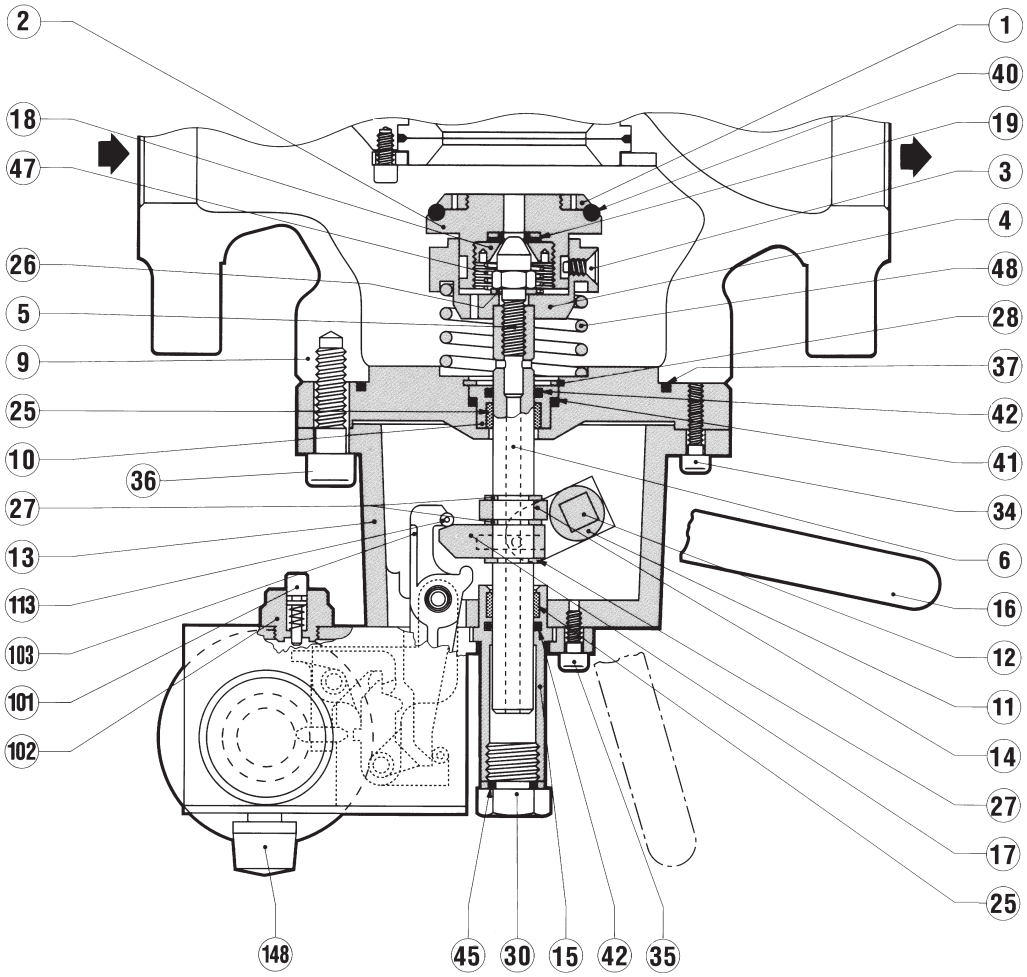
30) Reassemble the filter-shaft guide assembly.
31) Screw in the preregulator plug (4).
32) Reassemble the diaphragm-obturator assembly.
33) Reassemble the spring and the diaphragm-obturator assembly and fix the cover (2), securing the screws (15).

REASSEMBLING THE PILOT ASSEMBLY

34) Reconnect the connection nipples between the pilot 204/A and the preregulator R14/A screwing in the tapered seal connectors.

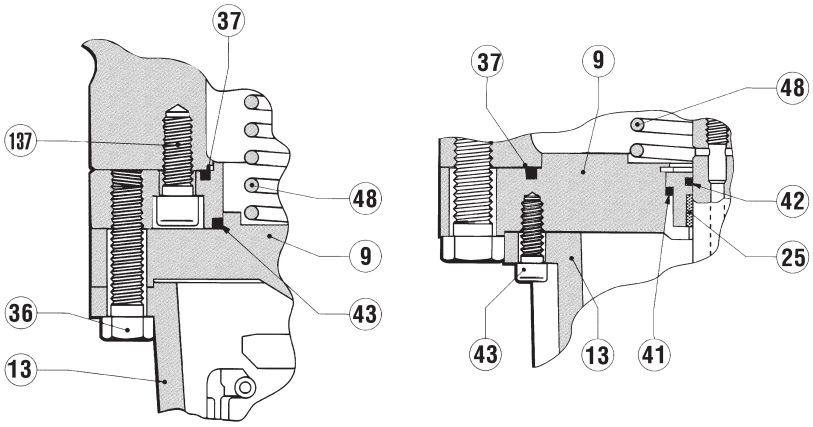
7.4 SLAM-SHUT DEVICE SB/82 MAINTENANCE PROCEDURE





DN: 2”

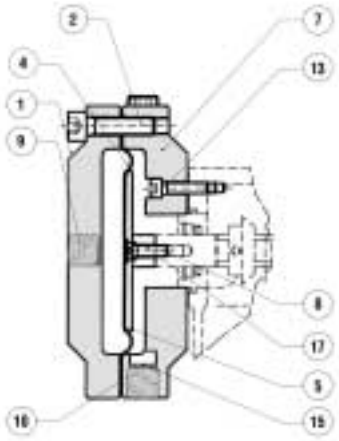
VERSIONS



DN: 1” *DN: 3” - 4”- 6”- 8”*

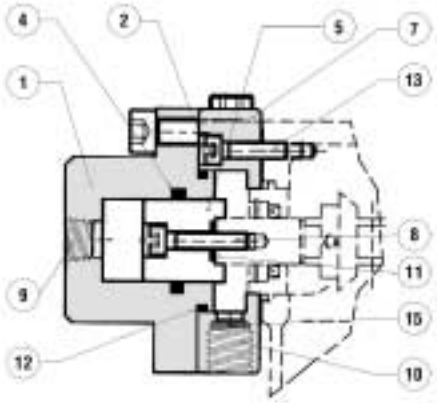
Fig. 35

SLAM-SHUT CONTROL HEADS

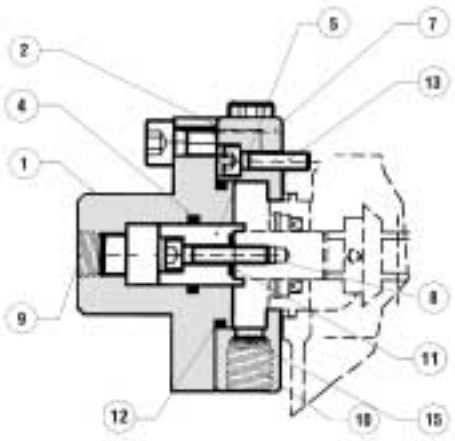


MOD. 102 -106

MOD. 103 -106



MOD. 104 -107



MOD. 105-108 - 109

SB/82 SLAM-SHUT (FIG. 35)

1) Check that the slam-shut is in the closed position.
2) Disconnect the pipe between the downstream pressure take-off and the head of the slam-shut pressure switch.
3) Slacken the fixing screws, pos. (36), so as to partially slacken the spring, pos. (48) ; before removing them completely, ensure that you can support the wright of the slam-shut device adequately.
4) Remove the screws and separate the slam-shut from the body, pos. (9) .
5) Put the slam-shut on its side.
6) Unscrew the screws, pos. (3) , and remove the obturator, pos. (2) , and the spring, pos. (47) .
7) Unscrew the ring, pos. (1) , and the ring, pos. (18) , from the obturator, pos. (2) .
8) Keeping the shaft, pos. (6) firm, slacken the screw, pos. (26) .
9) Remove the ring, pos. (4) , and the spring, pos. (48).
10) Remove the retaining ring, pos. (28) and the shaft guide, pos. (10) .
11) Slacken the screws, pos. (2) , from the pressure switch device, and remove the cover, pos. (1) .

Replace all the components included in the spare parts kit.

RE-ASSEMBLY

12) Fit the cover, pos. (1) , and fix the screws, pos. (2) on the pressure switch device.
13) Put back the shaft guide, pos. (10) and fix it with the retaining ring, pos. (28) .
14) Put back the spring, pos. (48) and the ring, pos. (4) , and fix the screw, pos. (26) .
15) Put back the rings, pos. (1) and pos. (18) on the obturator, pos. (2) .
16) Put back the spring, pos. (47) and the obturator, pos. (2) , fixing the screws, pos. (3) .
17) Put the slam-shut device back on the body, pos. (9) and fix the screws, pos. (36) .
18) Restore the connection between the downsteam pressure take-off and the head of the slam-shut pressure switch.

8.0 FINAL OPERATIONS

8.1 TIGHTNESS AND SETTING CHECK

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 and of the pilot;
   • the tightness of the internal surfaces of the regulator and of the pilot;
   • the tightness of the connection fittings.
2) Open a bleed cock downstream from the regulator to create a small gas flow.
3) Turn the pilot setting screw, pos. (10) , to obtain the desired set-point.
4) Close the bleed cock.

8.2 START UP

1) Very slowly open the downstream on/off valve and, if necessary, adjust the regulator setting by alternately adjusting the AR73 valve and the 30/... pilot.
2) Fix the lock-nut, pos. (9) of the pilot.

Tab. 17 MAINTENANCE WRENCHES APERFLUX 851 PRESSURE REGULATORS WITH 30.../A PILOT AND AR73

A  Combination spanner	B  Adjustable spanner	C  Compass pin wrench
D  Box spanner	E  Hexagon or allen key	F  Hexagonal T key
G  Hexagonal socket T wrench	H  Phillips screwdriver	I  Flat head screwdriver
L  O-Ring extraction tool	M  Circlip pliers	N  Fiorentini special socket
O  Fiorentini special tool		

APERFLUX 851

Type	DN	1"	2"	3"	4"	6"	8"	10"
A	Ch.	14-17-19 24-27	14-17-19 24-27	14-17-19 24-27-32	14-17-19 24-27-32	14-17-19 24-27-30	14-17-19 24-27-32	14-16-17 19-24-27 32-36
B	L.	300						
C	ø	4						
F	Ch.	5-6	5-6	5-6-10	5-6-14	5-6-17	5-6-17	4-5-6-17
I	L.	6,5 x 100						
L	Cod.	7999099						

APERFLUX 851+PM/819

Type	DN	1"	2"	3"	4"	6"	8"	10"
A	Ch.	13-14-15 17-19-24 27-30	13-14-15 17-19-24 27-30	13-14-15 17-19-24 27-30-32	13-14-15 17-19-24 27-30-32	13-14-15 17-19-24 27-30-32-41	13-14-15 17-19-24 27-30-32-41	13-14-15 17-19-24 27-32-46-50
B	L.	300						
C	ø	4						
D	Ch.					27-41	27-41	30-41-55
E	Ch.	3-12	3-12	3-12	3-12	3-12	3-12	3-12
F	Ch.	5-6	5-6	5-6-10	5-6-14	5-6-17	5-6-17	4-5-6-17
G	Ch.	9-17-20	9-17-20	9-17-19-22	9-17-19-22	9-22	9-22	
I	L.	6,5 x 100						
L	Cod.	7999099						

Tab. 18 MAINTENANCE WRENCHES FOR APERFLUX 851 PRESSURE REGULATORS WITH 30.../A PILOT AND AR73

A  Combination spanner	B  Adjustable spanner	C  Compas pin wrench
D  Box spanner	E  Hexagon or allen key	F  Hexagonal tee key
G  Hexagonal socket T wrench	H  Phillips screwdriver	I  Flat head screwdriver
L  O-Ring extraction tool	M  Circlip pliers	N  Fiorentini special socket
O  Fiorentini special tool		

APERFLUX 851+DB/851

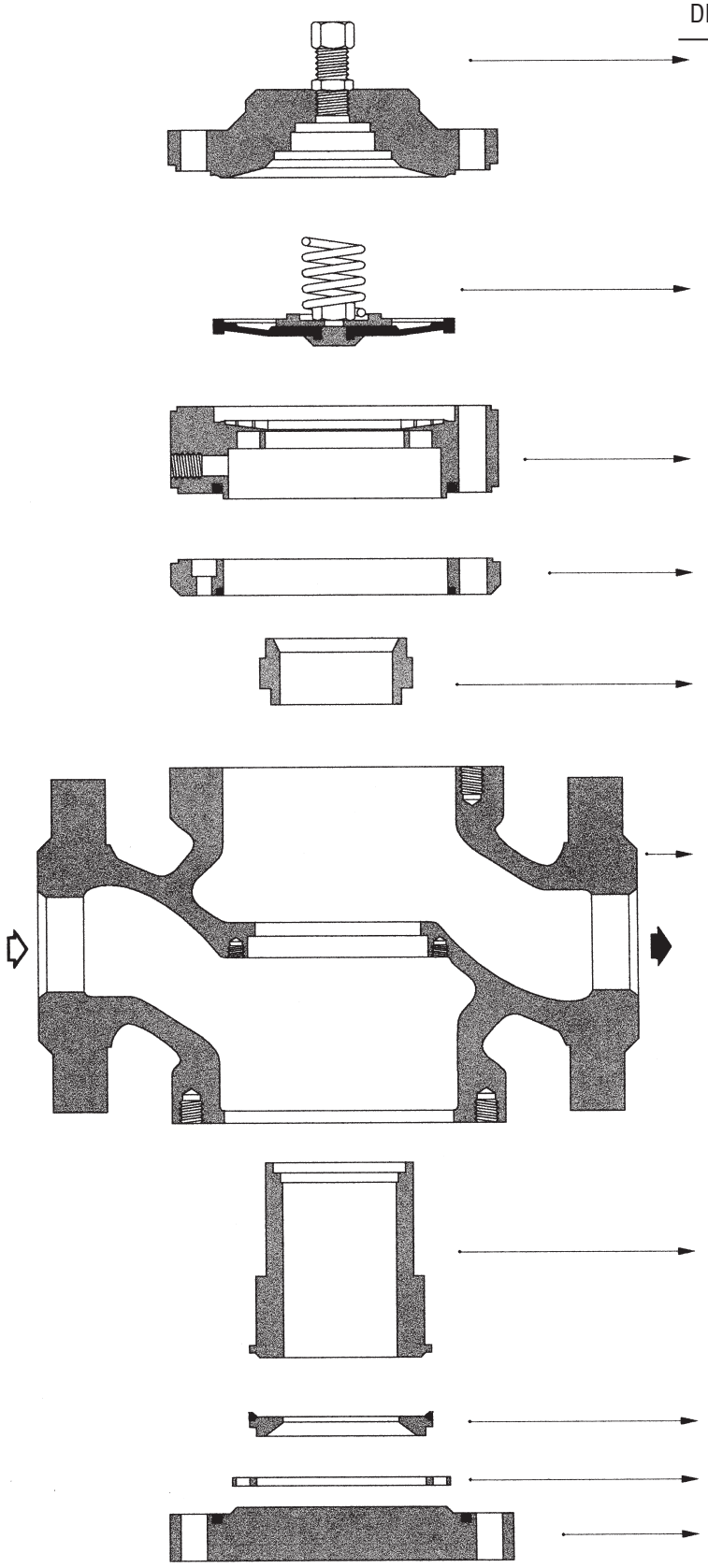
Type	DN	1"	2"	3"	4"	6"	8"	10"
A	Ch.	14-17-19 24-27	14-17-19 24-27	14-17-19 24-27-32	14-17-19 24-27-32	14-17-19 24-27-30	14-17-19 24-27-32	14-16-17 19-24-27 32-36
B	L.	300						
C	ø	4						
F	Ch.	5-6	5-6	5-6-10	5-6-14	5-6-17	5-6-17	4-5-6-17
I	L.	6,5 x 100						
L	Cod.	7999099						
O	Cod.	7999020	7999022	7999023	7999024	7999025	7999027	7999028

APERFLUX 851+SB/82

Type	DN	1"	2"	3"	4"	6"	8"	10"
A	Ch.	8-13-14 15-17-19 24-27-32	8-13-14 15-17-19 24-27-32	8-13-14 15-17-19 24-27-32	8-13-14 15-17-19 24-27-32	8-13-14 15-17-19 24-27-30-32	8-13-14 15-17-19 24-27-32	8-13-14 15-16-17 19-24-32-36-41
B	L.	300						
C	ø	4						
D	Ch.	9-10-15-24	9-10-15-24	9-10-15-24	9-10-15-24	9-10-15-24	9-10-15-24	27
E	Ch.	2-3-4-8	9-10-15-24	9-10-15-24	9-10-15-24	9-10-15-24	9-10-15-24	27
F	Ch.	2-3-4-8	2-3-4-10	2-3-4	2-3-4	2-3-4	2-3-4	2-3-4
I	L.	6,5 x 100						
L	Cod.	7999099						
M	ø	19 ÷ 60						
N	Cod.	7999019						

9.0 WEIGHT OF THE COMPONENTS

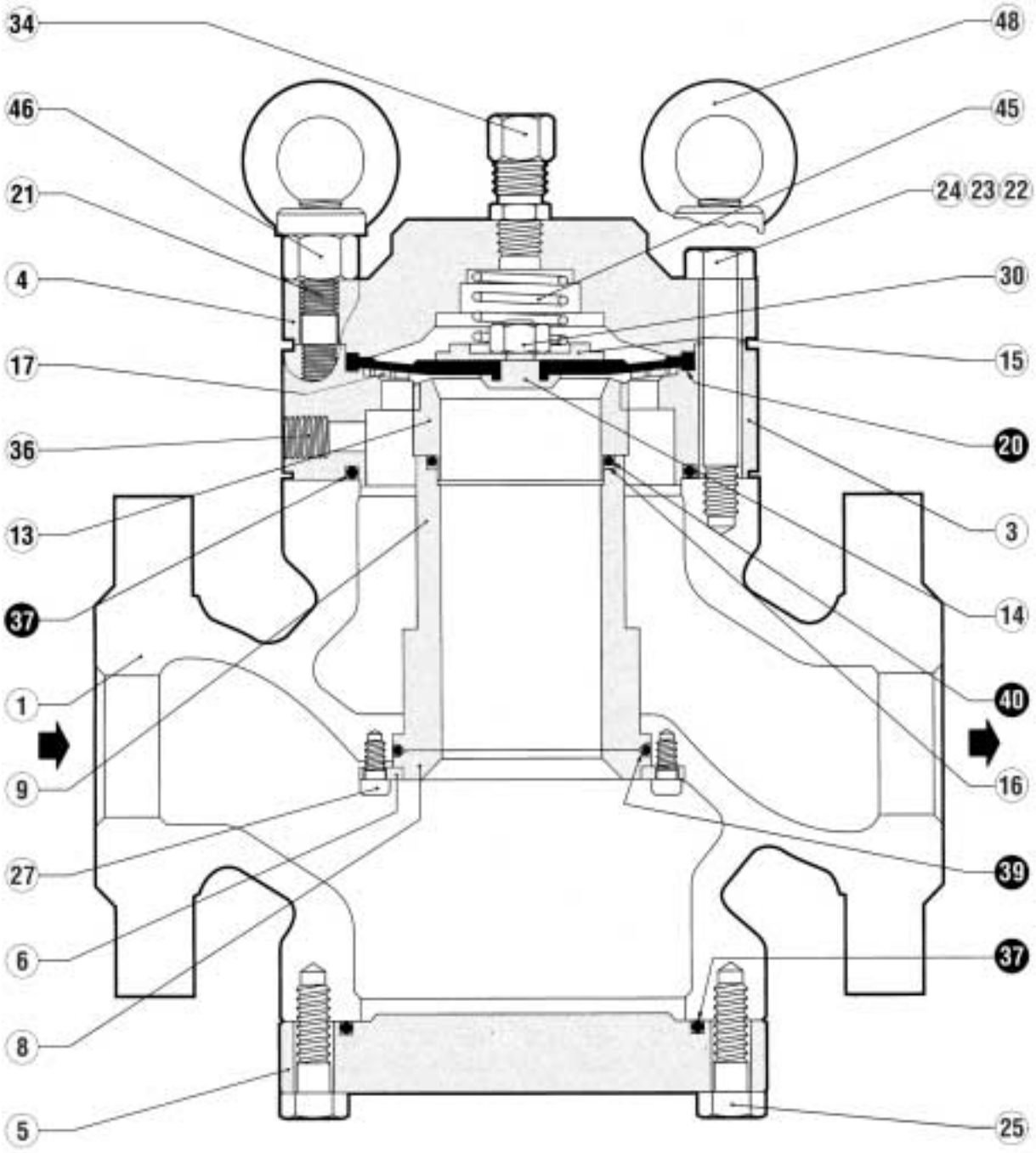
9.1 TAB. 19 WEIGHT OF THE COMPONENTS IN KG.



DN	1”	2”	3”	4”	6”	8”	10”
	2,750	4,200	11	16	36	82	142
	0,300	0,300	0,650	1,200	2,100	2,800	5,300
	2,500	3,950	10,200	16,200	32	52	80
	-	-	6,200	8,500	20,900	48	988
	0,150	0,400	0,760	1	1,700	2,200	2,700
	9,400	20,500	37	66	148	234	385
	0,650	1,700	4,100	6,400	11,900	22,600	32
	0,050	0,200	0,400	0,650	1,900	2,900	2,900
	0,090	0,150	0,250	0,600	0,700	0,800	1,200
	1,300	3	5,700	10,400	19,700	35	78

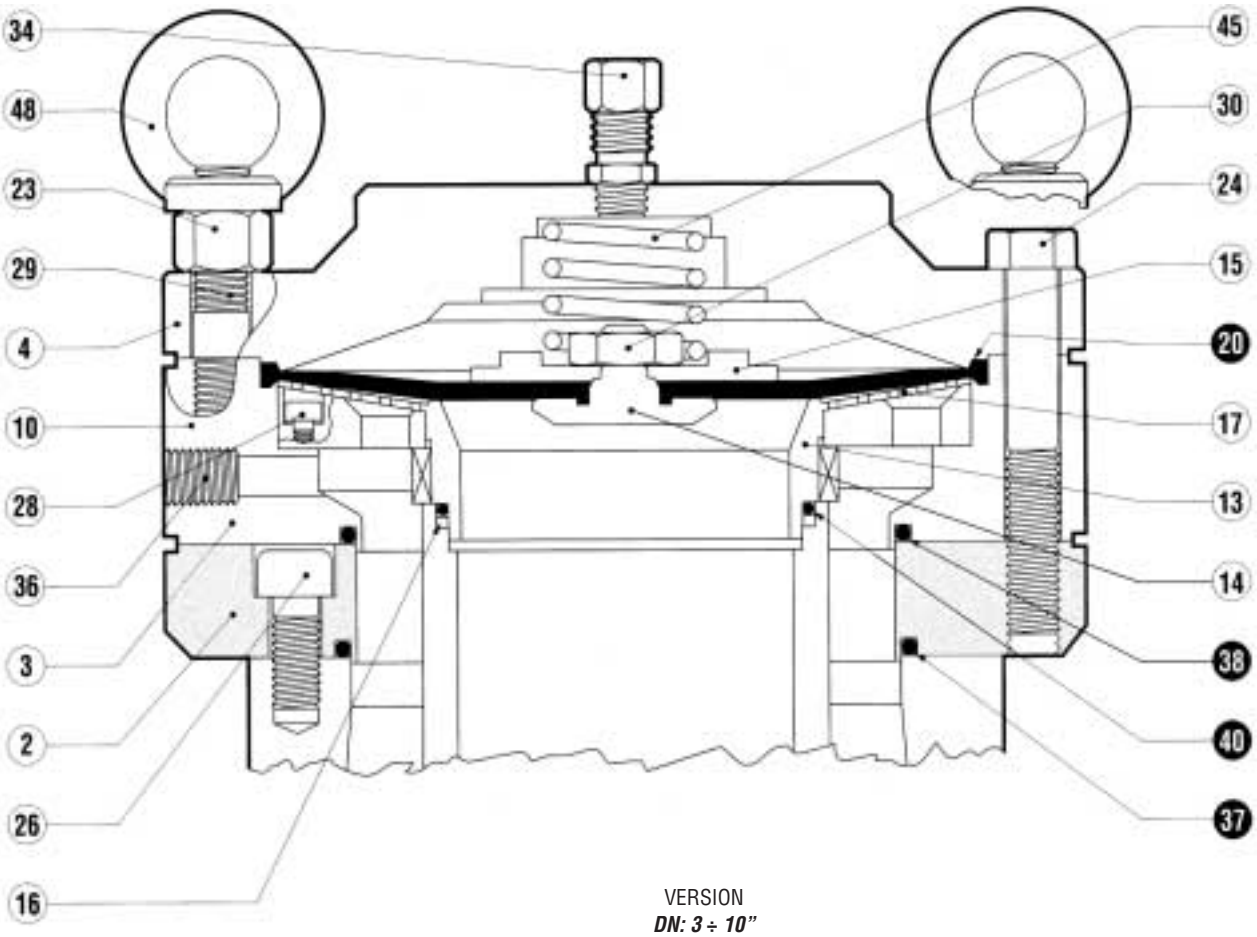
10.0 LIST OF RECOMMENDED SPARES

APERFLUX 851 PRESSURE REGULATOR



DN: 1" - 2"
Fig. A

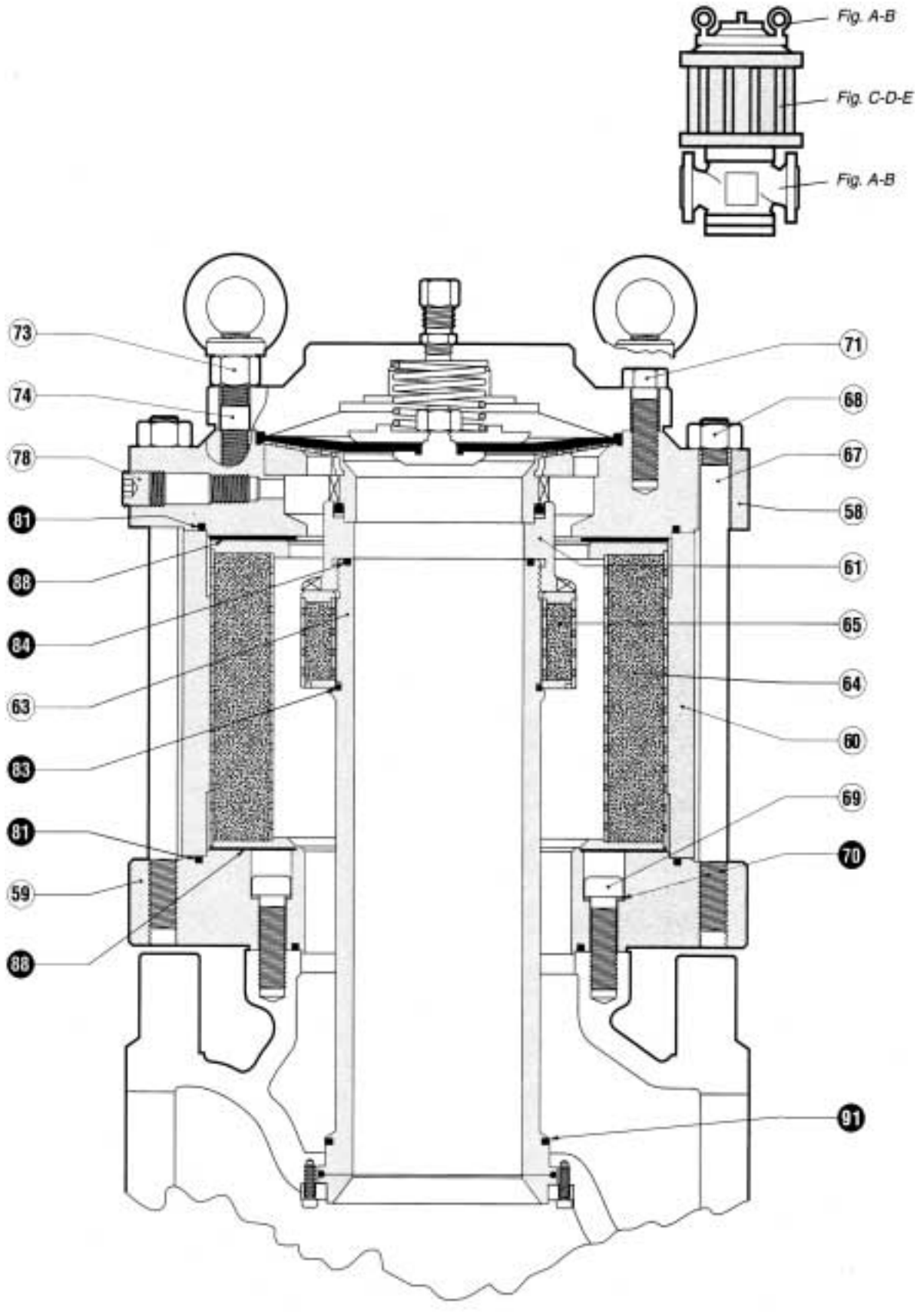
VERSION



VERSION
DN: 3 ÷ 10"
Fig. B

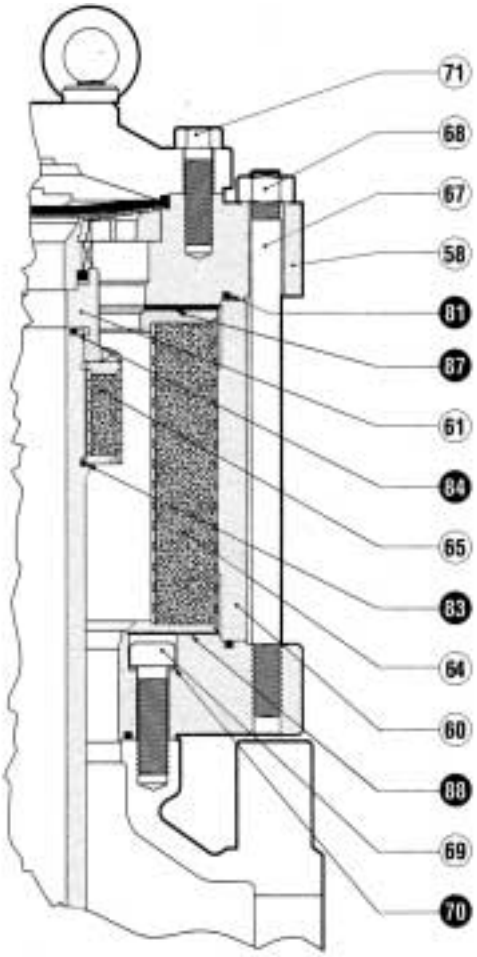
			N. OF PIECES	
		DN	1" - 2"	3" ÷ 10"
	POS.	DESCRIPTION		
APERFLUX 851	**20**	Diaphragm	1	1
	37	O. Ring	2	2
	38	O. Ring	-	1
	39	O. Ring	1	1
	40	O. Ring	1	1

APERFLUX 851 PRESSURE REGULATOR + DB/851

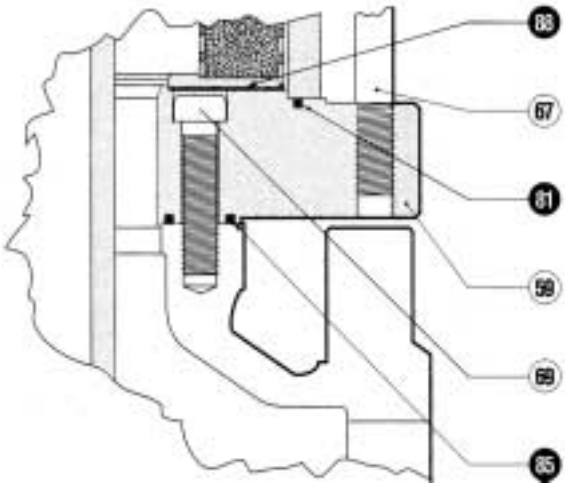


DN: 1" - 2"
Fig. C

VERSIONS



VERSION
DN: 3" ÷ 8"
Fig. D

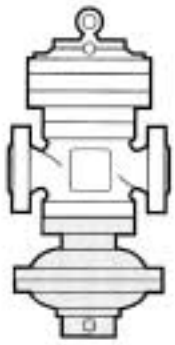


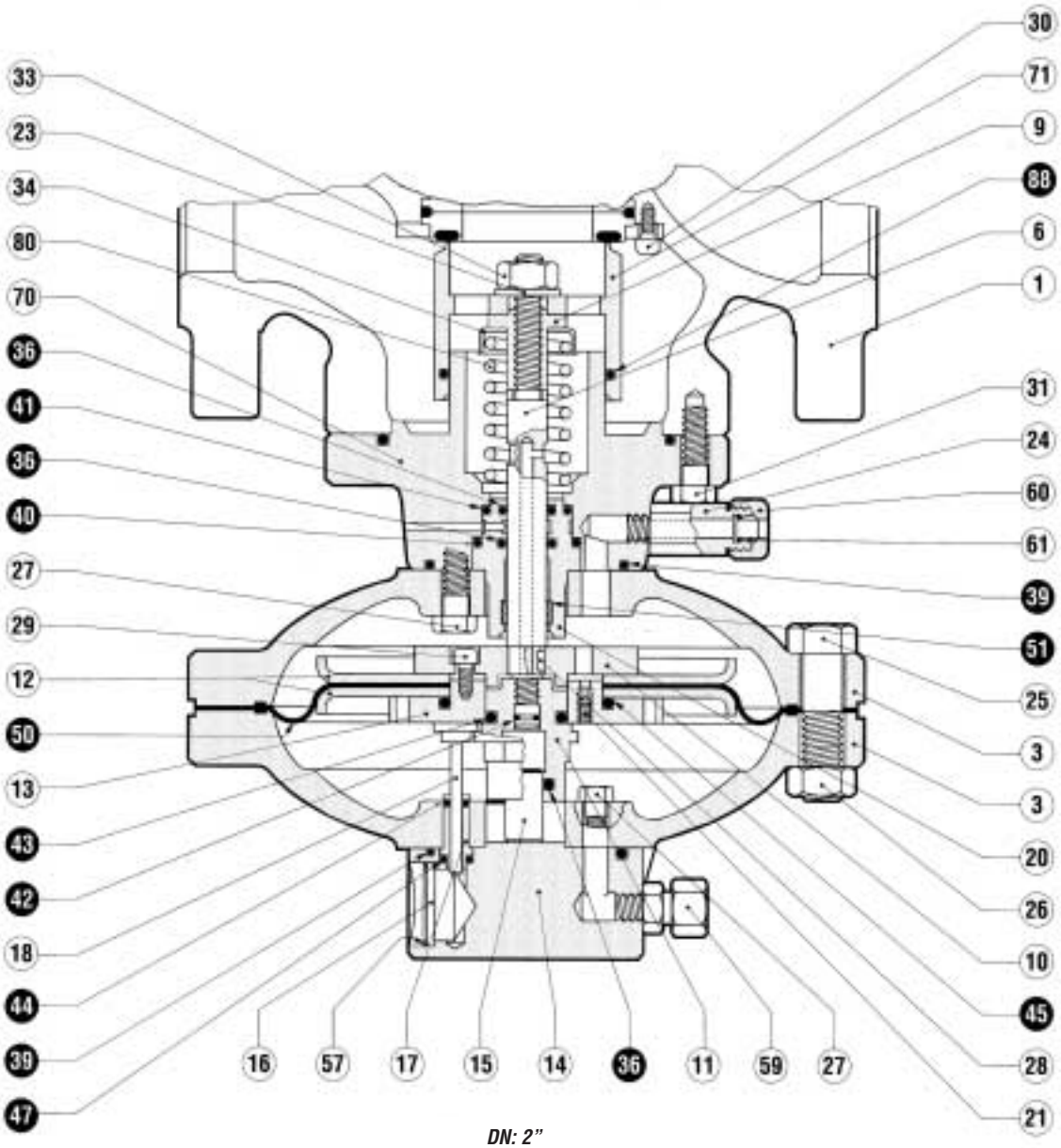
VERSION
DN: 10"
Fig. E

...+ DB/851

POS.	DESCRIPTION	N. OF PIECES									
	DN	1" - 2"		3" - 4"		6"		8"		10"	
		DB 851	DB 886	DB 851	DB 886	DB 851	DB 886	DB 851	DB 886	DB 851	DB 886
70	Copper	8	12	12	4	12	8	16	12	-	-
81	O. Ring	2	2	2	2	2	2	2	2	2	2
83	O. Ring	1	1	1	1	1	1	1	1	1	1
84	O. Ring	1	1	1	1	1	1	1	1	1	1
85	O. Ring	-	-	-	-	-	-	-	-	1	1
87	Gasket	-	-	1	1	1	1	1	1	-	-
88	Gasket	2	2	2	2	1	1	1	1	1	1
91	O. Ring	1	1	1	1	-	-	-	-	-	-

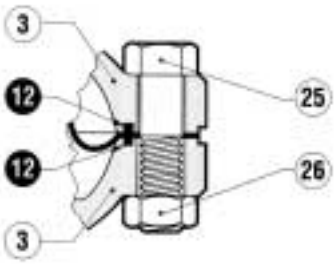
PM/819 MONITOR





DN: 2”

VERSIONS



VERSION
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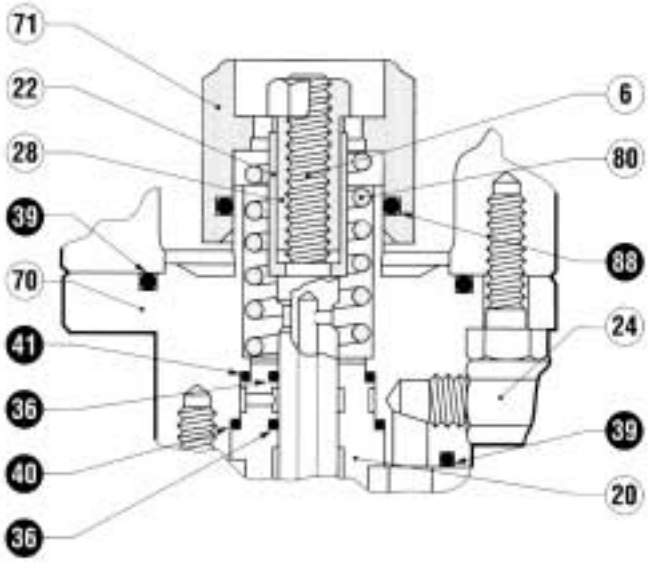
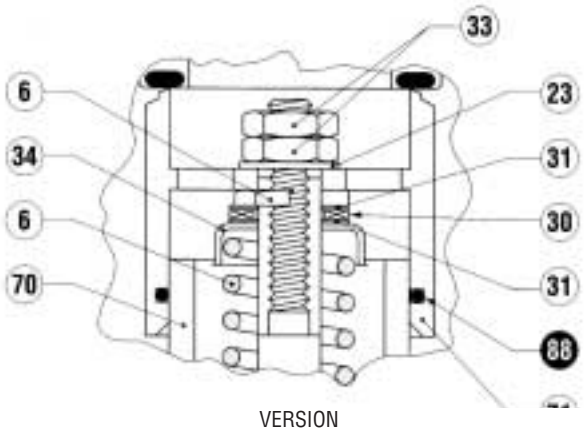
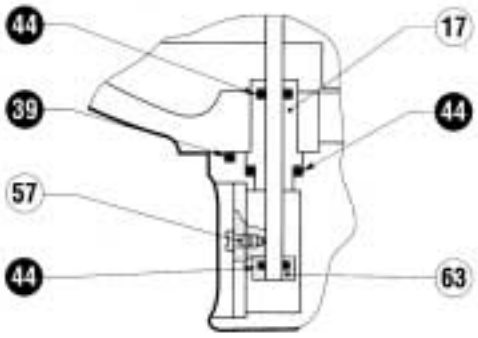


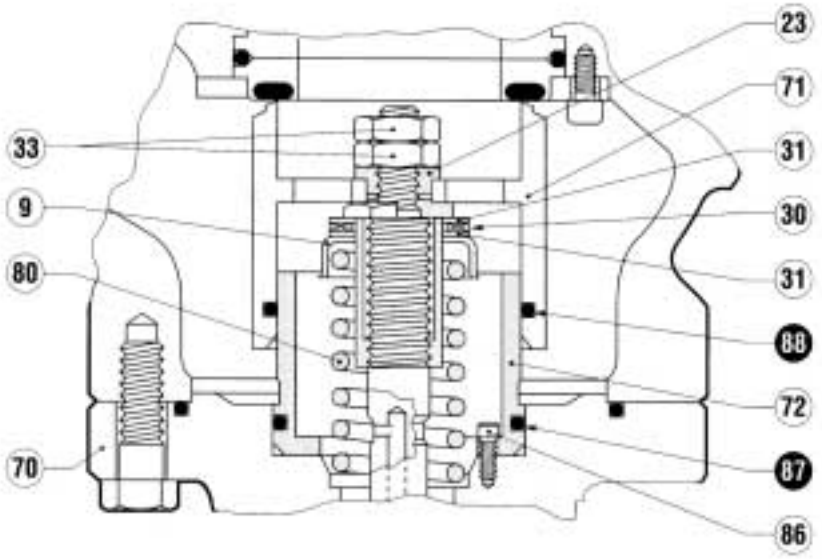
VERSION
DN: 1”



VERSION
DN: 3” - 4”



VERSION
DN: 6” ÷ 10”

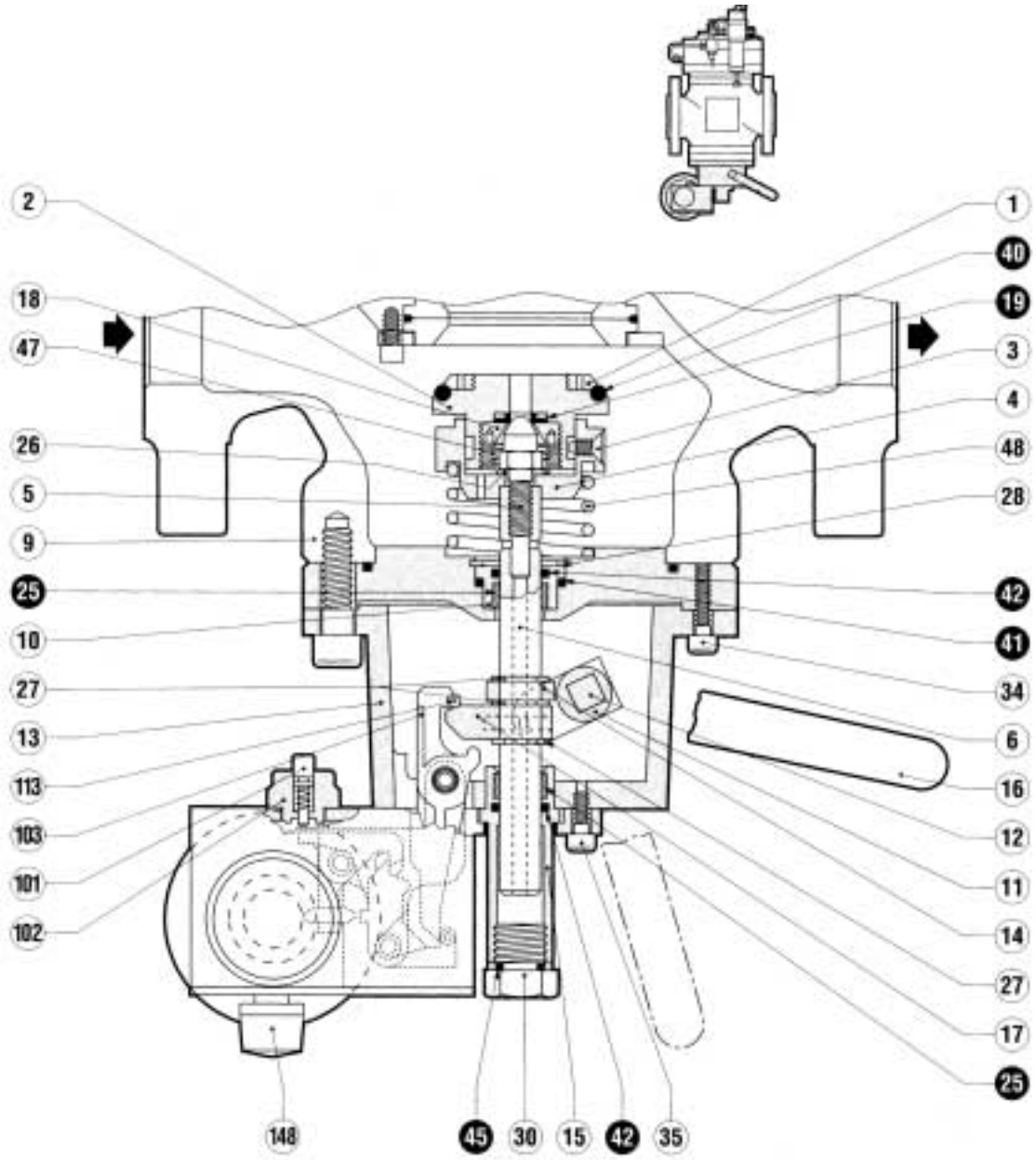


VERSION
DN: 6” ÷ 10”

...+ PM/819

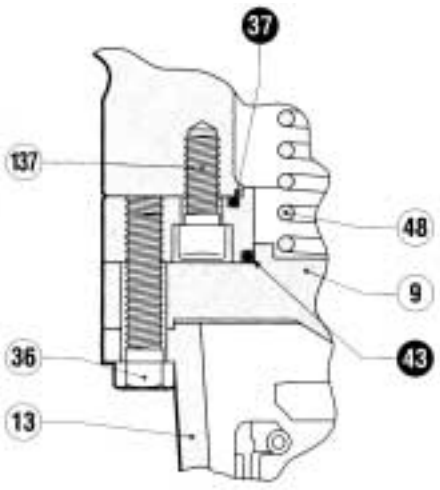
POS.	DESCRIPTION	DN	N. OF PIECES 1" ÷ 4"	6" - 8"	10"
12	O. Ring		-	-	2
36	O. Ring		3	3	3
39	O. Ring		2	2	2
40	O. Ring		1	1	1
41	O. Ring		1	1	1
42	O. Ring		1	1	1
43	O. Ring		1	1	1
44	O. Ring		1	2	2
45	O. Ring		1	1	1
47	O. Ring		1	1	1
50	Diaphragm		1	1	1
51	Guide ring		1	1	1
87	O. Ring		-	1	1
88	O. Ring		1	1	1

... + SB/82 SLAM-SHUT

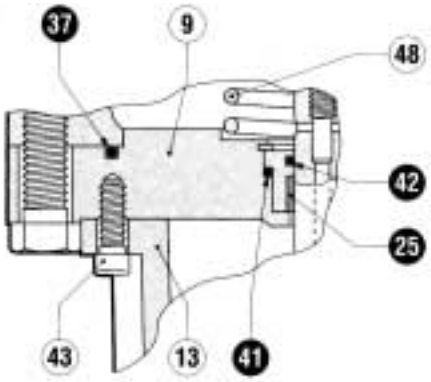


DN: 2”

VERSIONS

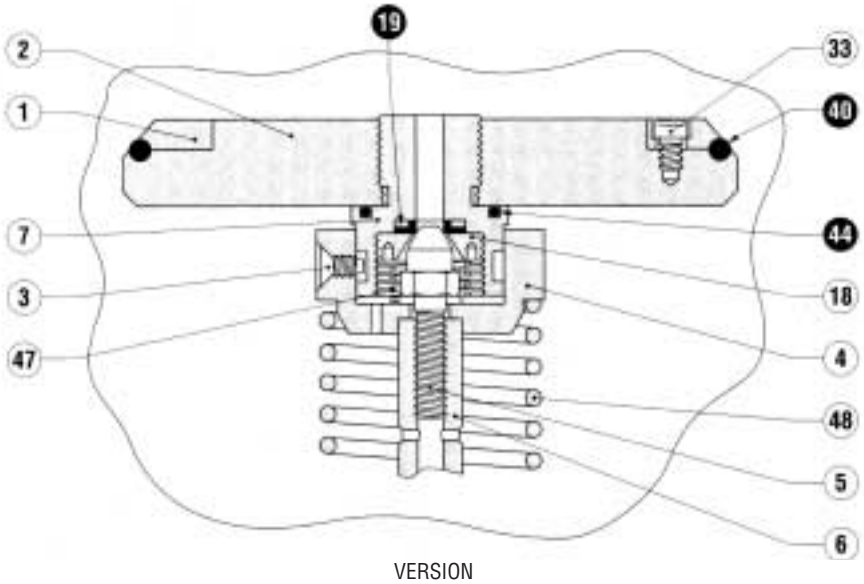


VERSION
DN: 1”

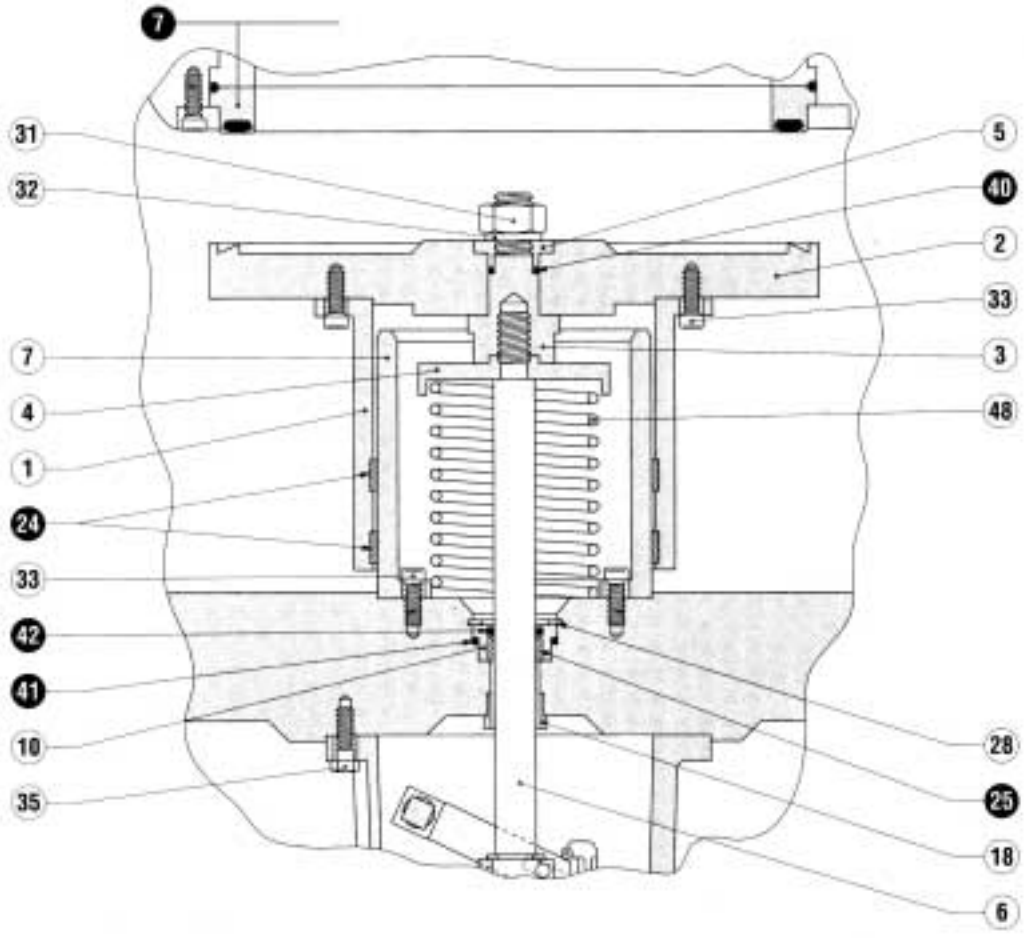


VERSION
DN: 3” - 4” - 6” - 8”

VERSIONS

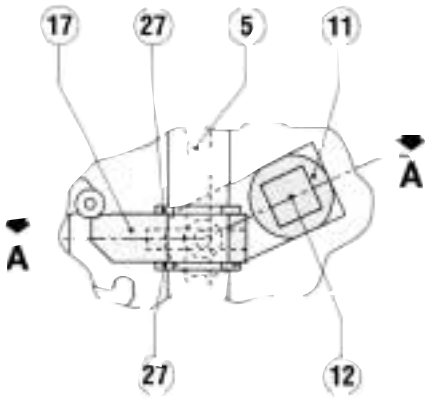


VERSION
DN: 4” - 6” - 8”



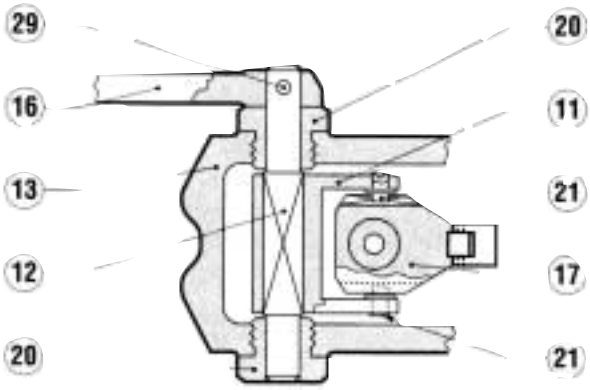
VERSION
DN: 10”

VERSIONS



VERSION
DN: 1" ÷ 4"

SECTION
A - A



VERSION
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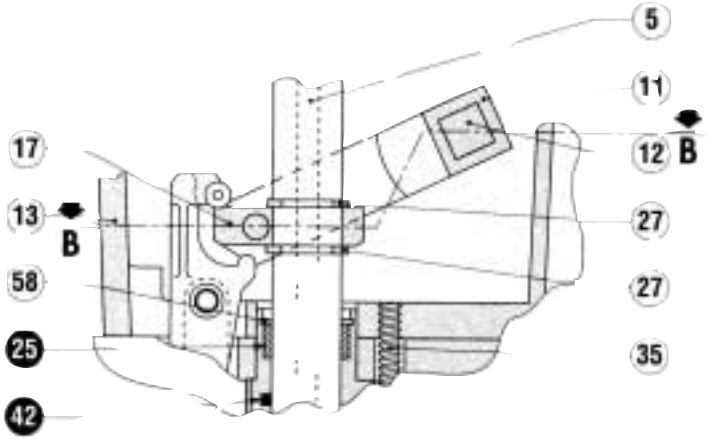
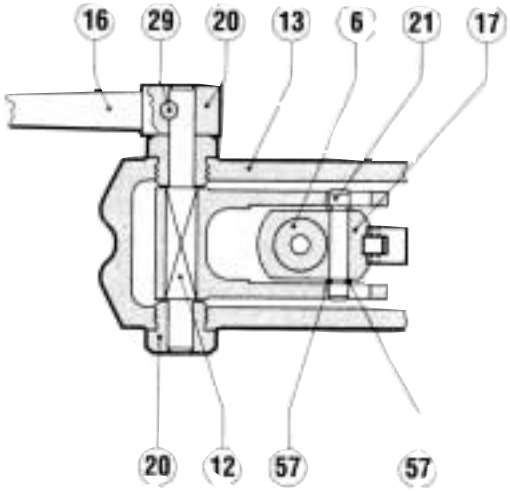


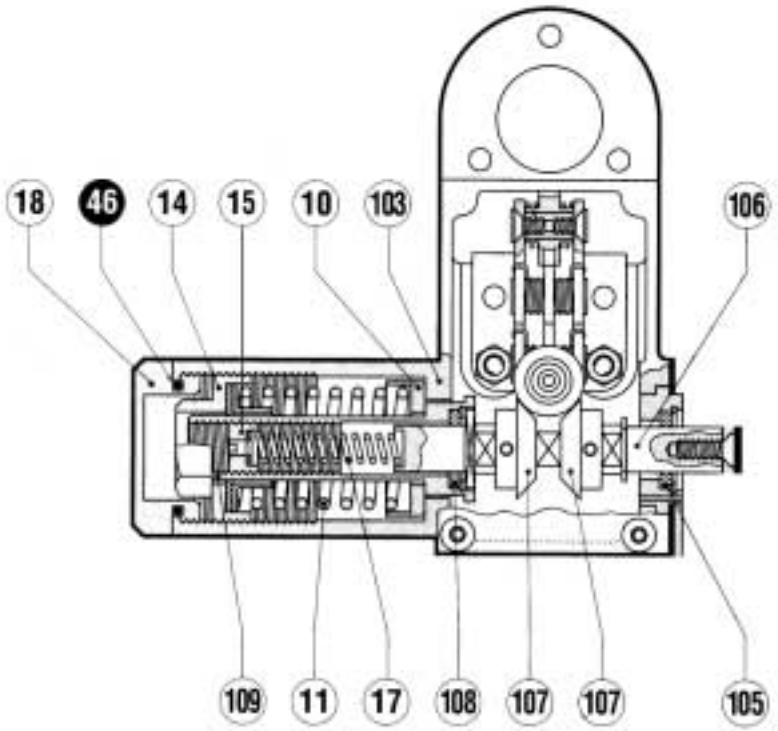
VERSION
DN: 6" - 8" - 10"

SECTION
B - B

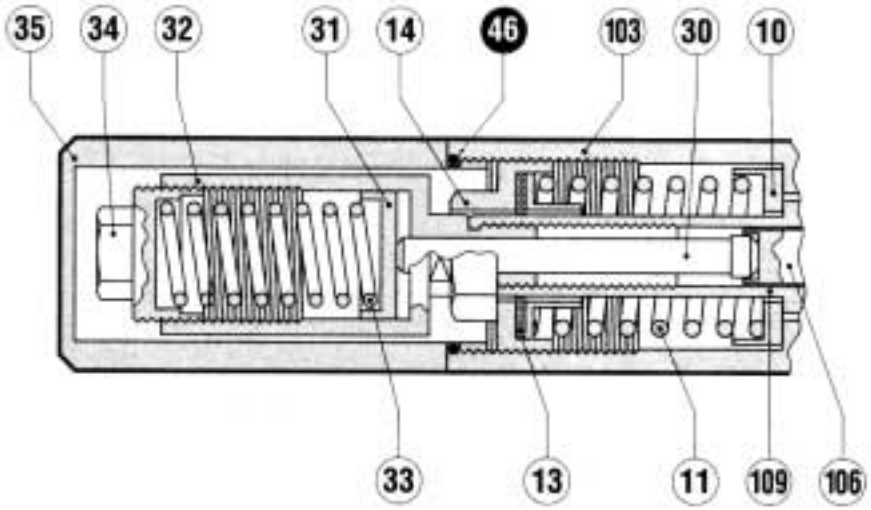


VERSION
DN: 6" - 8" - 10"

CONTROL DEVICE

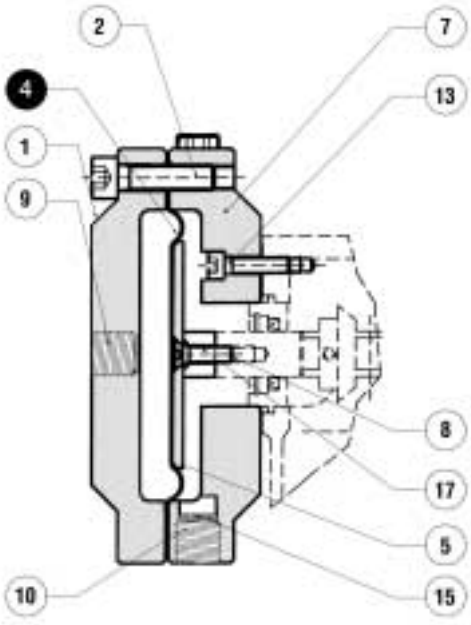


Mod.: 102 - 103 - 104 - 105

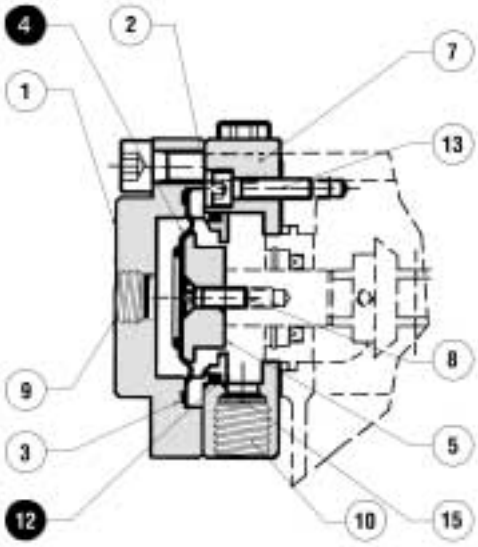


Mod.: 106 - 107 - 108 - 109

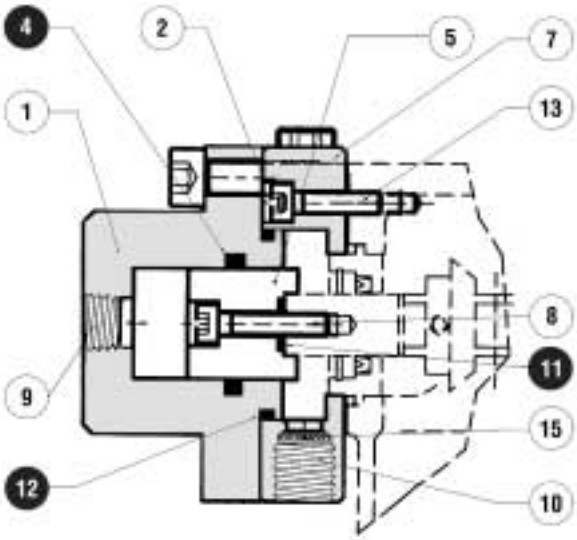
CONTROL HEADS



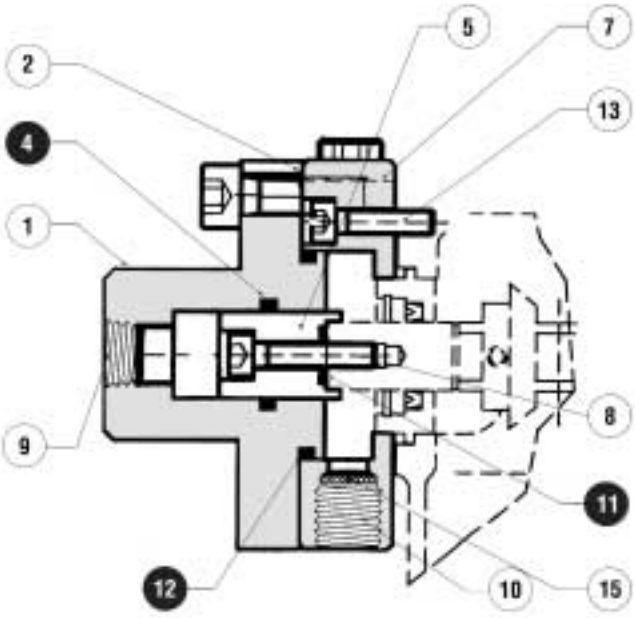
Mod.: 102-106



Mod.: 103-106



Mod.: 104-107



Mod.: 105-108

	POS.	DESCRIPTION	DN	N. OF PIECES			
				1”	2” - 3”	4” ÷ 8”	10”
SB/82 SLAM-SHUT	19	Reinforced gasket		1	1	1	-
	24	Guide ring		-	-	-	2
	25	Guide ring		2	2	2	-
	40	O. Ring		1	1	1	1
	41	O. Ring		1	1	1	1
	42	O. Ring		2	2	2	2
	43	O. Ring		1	-	-	-
	44	O. Ring		-	-	1	-
	45	O. Ring		1	1	1	1

MOD. 102-103-104-105-106-107-108-109

	POS.	DESCRIPTION	N. OF PIECES
CONTROL DEVICE	46	O. Ring	1

MOD. 102-106

	POS.	DESCRIPTION	N. OF PIECES
CONTROL HEADS	4	Membrana	1

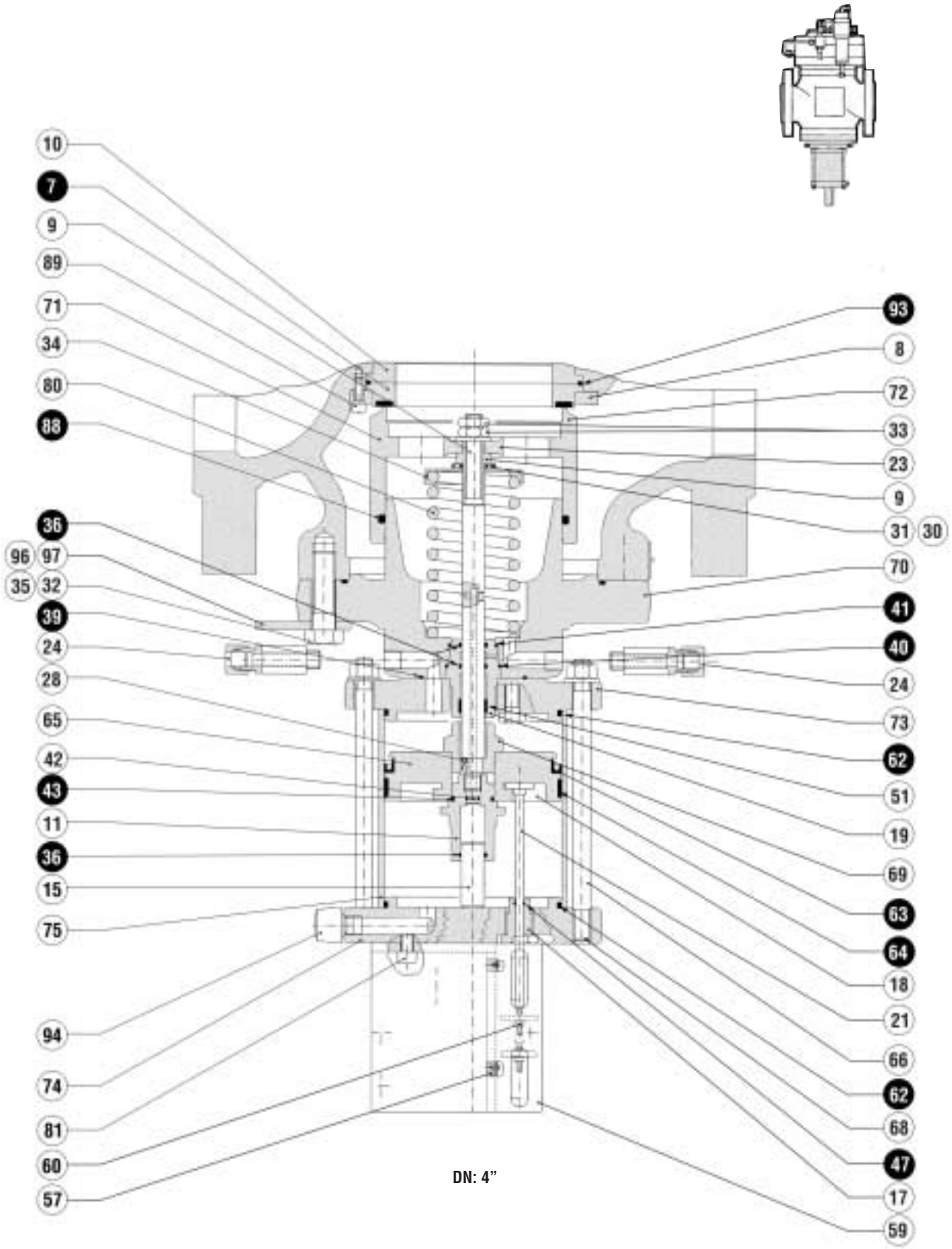
MOD. 103

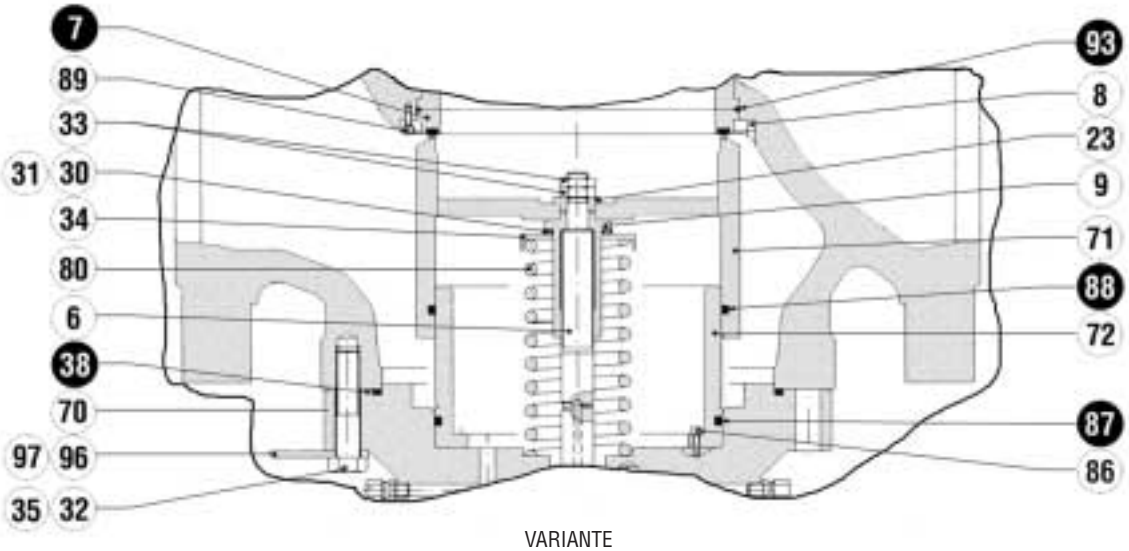
	POS.	DESCRIPTION	N. OF PIECES
CONTROL HEADS	4	Diaphragm	1
	12	O.Ring	1

MOD. 104 - 105 - 107 - 108 - 109

	POS.	DESCRIPTION	N. OF PIECES
CONTROL HEADS	4	O.Ring	1
	11	O.Ring	1
	12	O.Ring	1

HB 97 SLAM-SHUT DEVICE



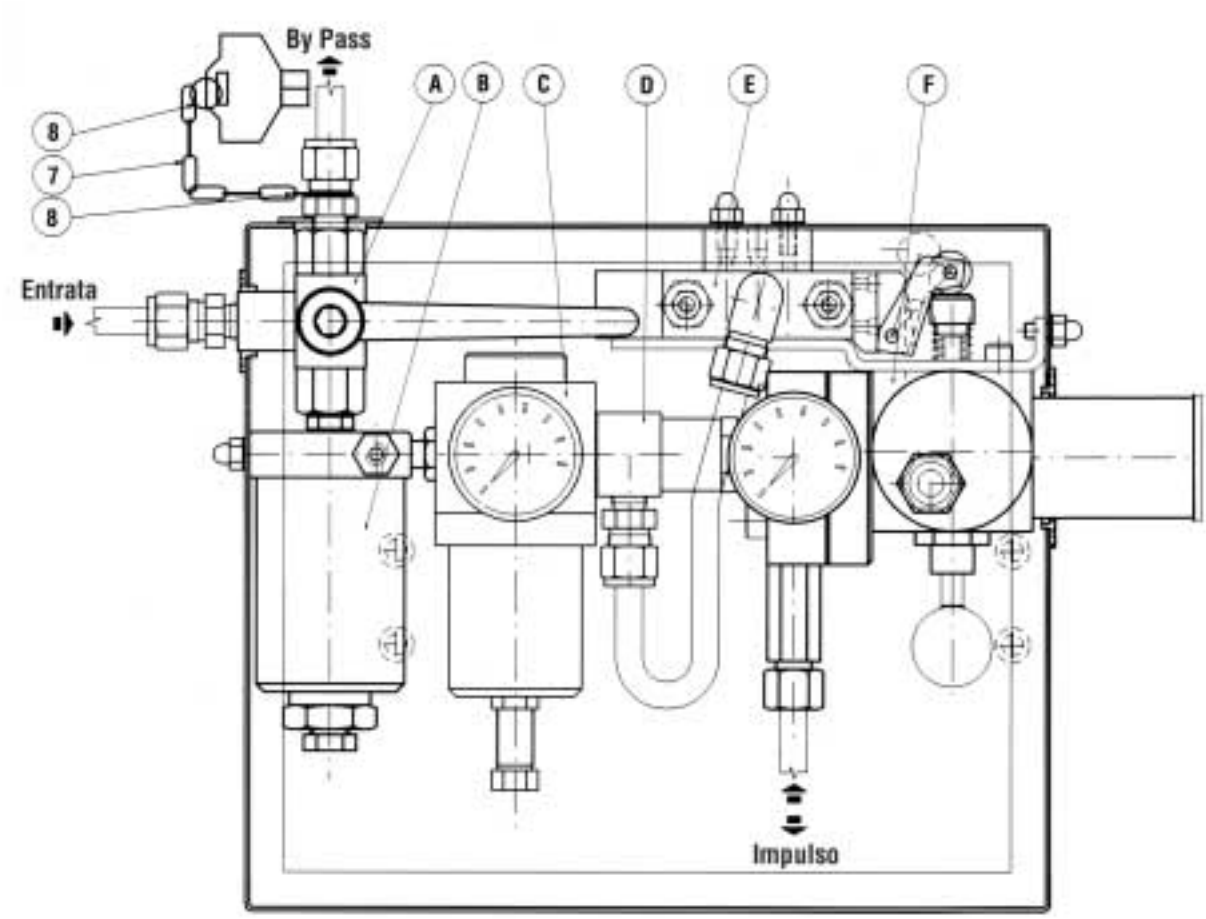


VARIANTE

DN: 6" - 8" - 10"

			N. OF PIECES			
	POS.	DESCRIPTION	DN 4"	6"	8"	10"
HB/97 SLAM-SHUT VALVE	7	Reinforced gasket	1	1	1	1
	36	O. Ring	3	3	3	3
	39	O. Ring	1	1	1	1
	40	O. Ring	1	1	1	1
	41	O. Ring	1	1	1	1
	42	O. Ring	1	1	1	1
	43	O. Ring	1	1	1	1
	47	O. Ring	1	1	1	1
	51	Guide ring	1	1	1	1
	62	O. Ring	2	2	2	2
	63	GACO ring	1	1	1	1
	64	Guide ring	1	1	1	1
	87	O. Ring	-	1	1	1
	88	O. Ring	1	1	1	1
	93	O. Ring	1	1	1	1

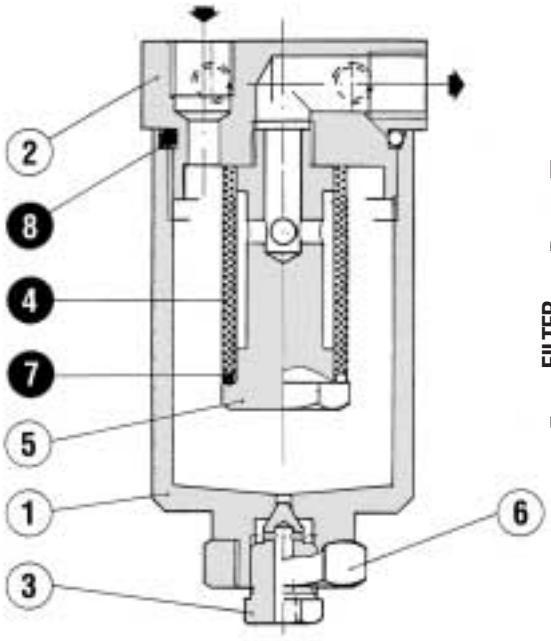
LINE OFF DEVICE



PART. A Three-ways valve
PART. B Filter
PART. C Pressure regulator
PART. D Relief valve
PART. E Slide valve
PART. F Control device

PART. B

FILTER

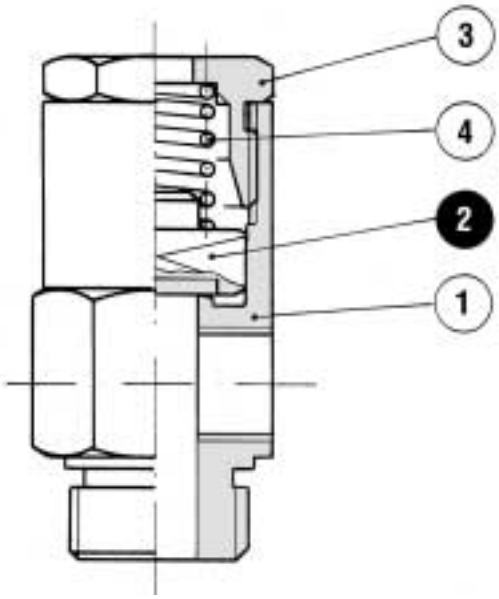


PART. B

	POS.	DESCRIPTION	N. OF PIECES
FILTER	4	Filter cartridge	1
	7	O. Ring	1
	8	O. Ring	1

PART. D

RELIEF VALVE

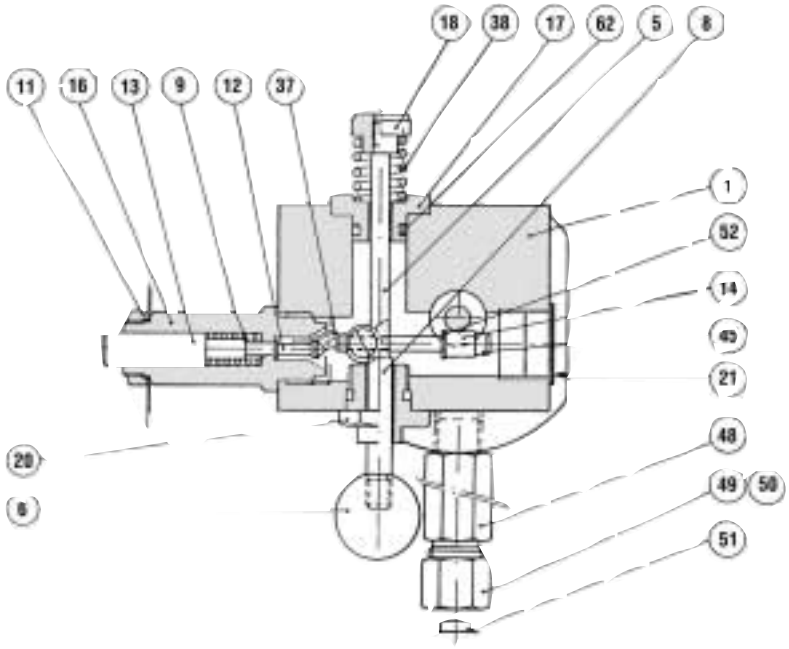


PART. D

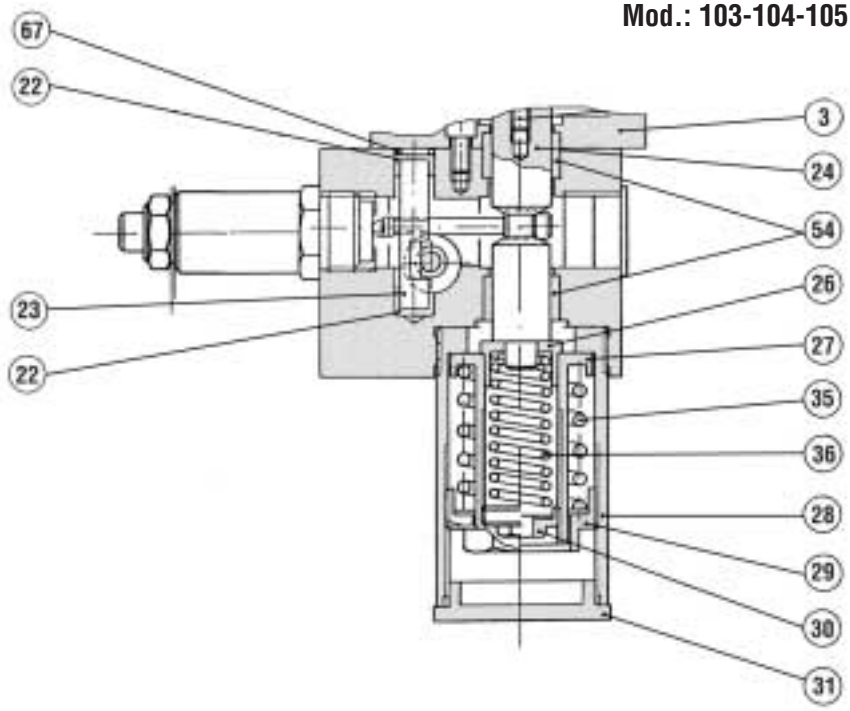
	POS.	DESCRIPTION	N. OF PIECES
RELIEF VALVE	2	Plug	1

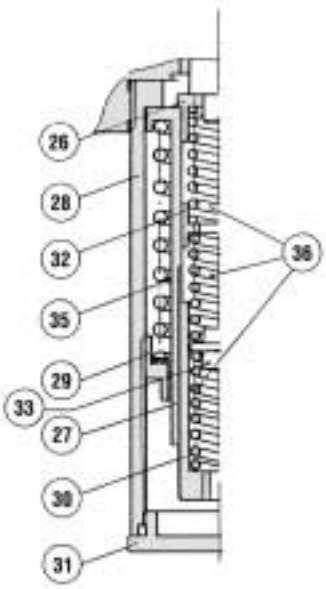
Part. F

CONTROL DEVICE

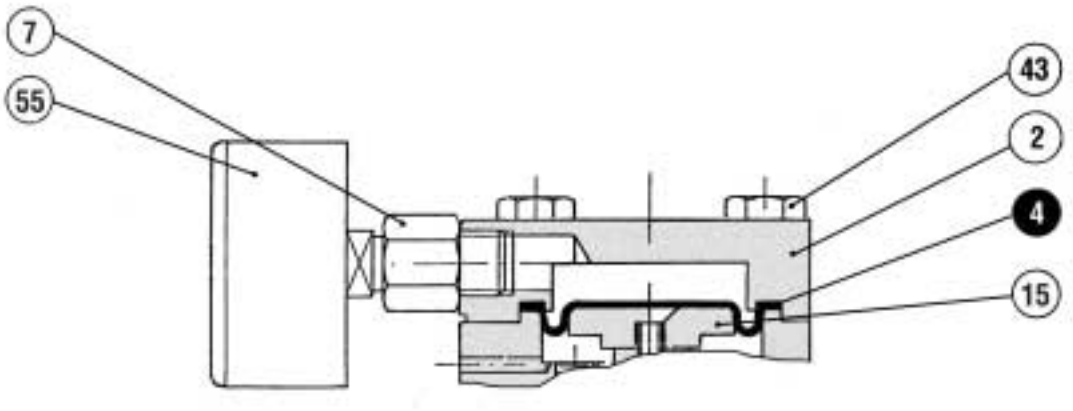


Mod.: 103-104-105





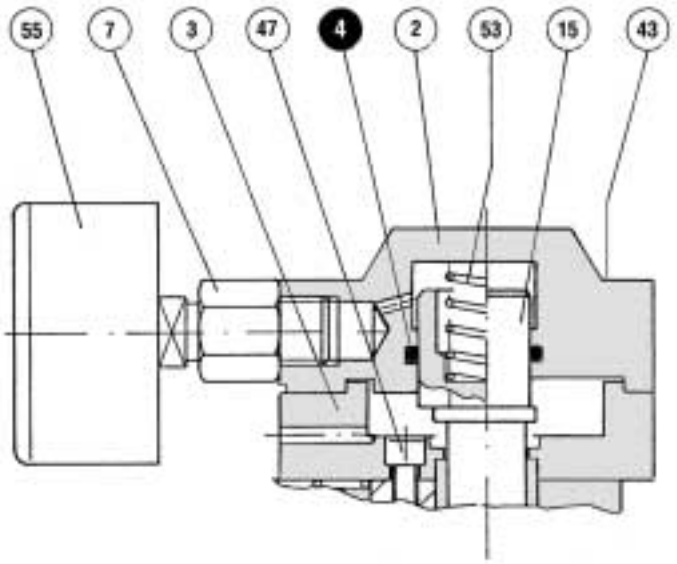
Mod.: 105/92



Mod.: 103

MOD. 103

	POS.	DESCRIPTION	N. OF PIECES
CONTROL HEAD	4	Diaphgram	1



Mod.: 104-105

MOD. 103-105

	POS.	DESCRIPTION	N. OF PIECES
CONTROL HEADS	4	O. Ring	1

PILOTS MOD. 302/A-304/A + AR73 FLOW REGULATION VALVE

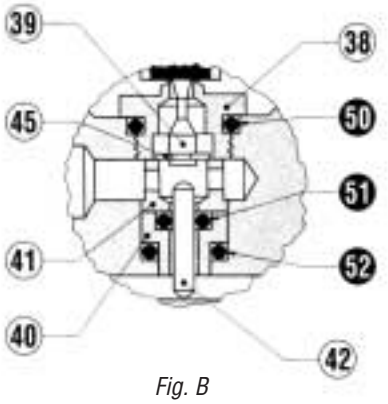
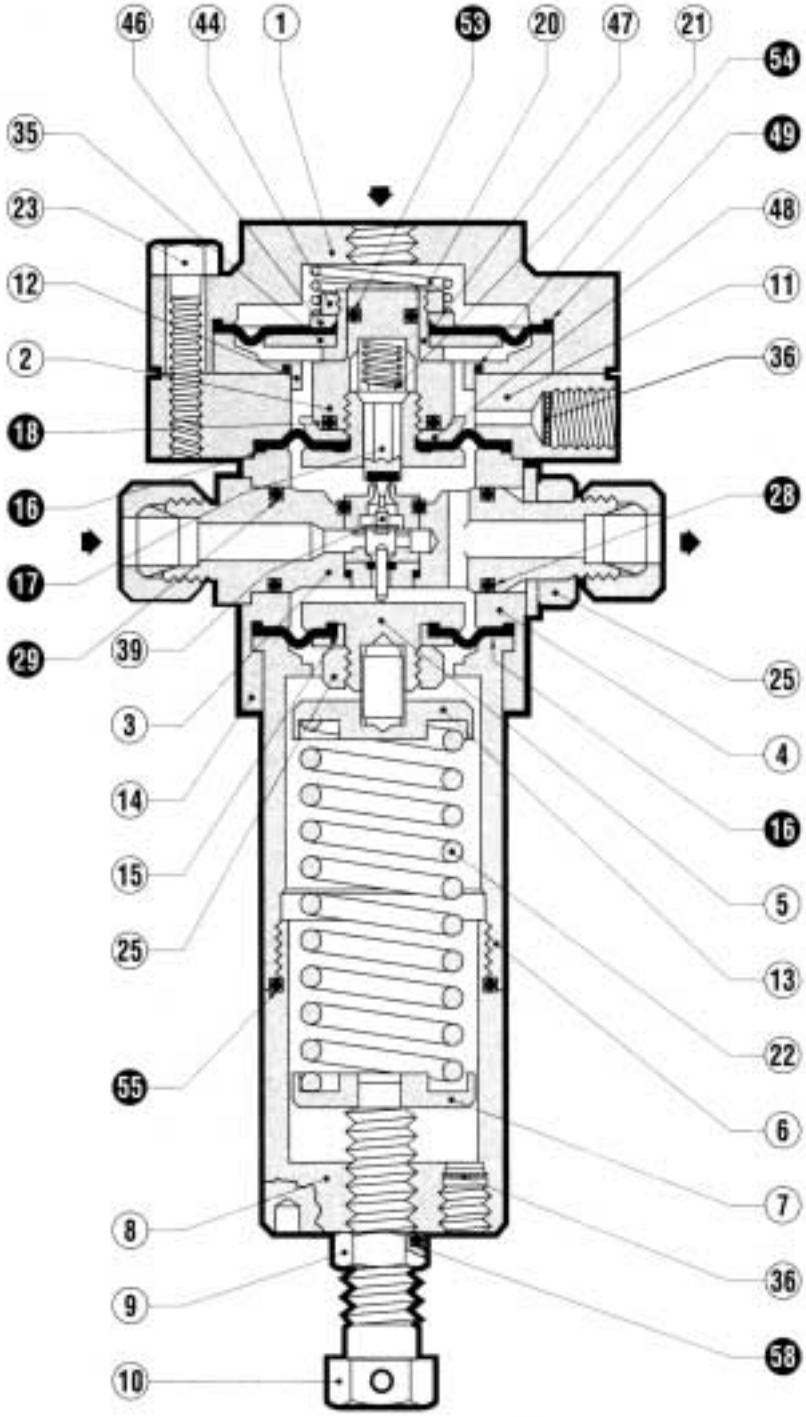
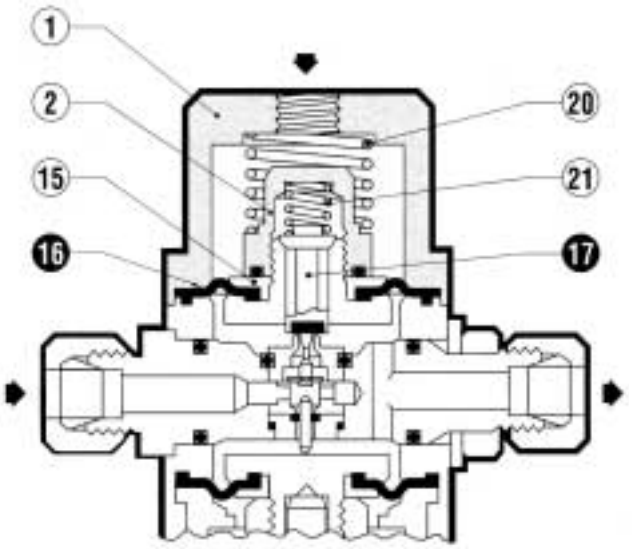


Fig. B



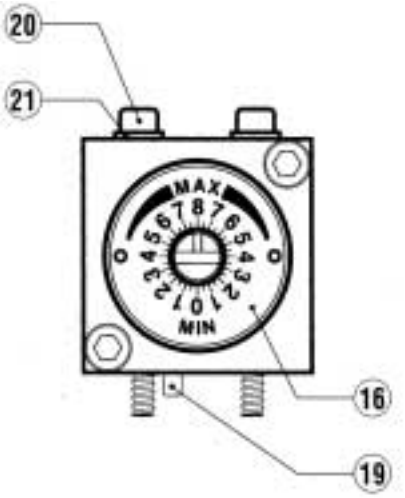
302/A

Fig. A



	POS.	DESCRIPTION	N. OF PIECES 302/A Pilot	304/A Pilot
PILOT	16	Diaphragm	2	2
	17	Obturator	1	1
	18	O. Ring	1	1
	28	O. Ring	1	1
	29	O. Ring	1	1
	49	Diaphragm	1	-
	50	O. Ring	1	1
	51	O. Ring	1	1
	52	O. Ring	1	1
	53	O. Ring	1	-
	54	O. Ring	1	-
	55	O. Ring	1	1
	58	O. Ring	1	1

AR73 FLOW REGULATION VALVE



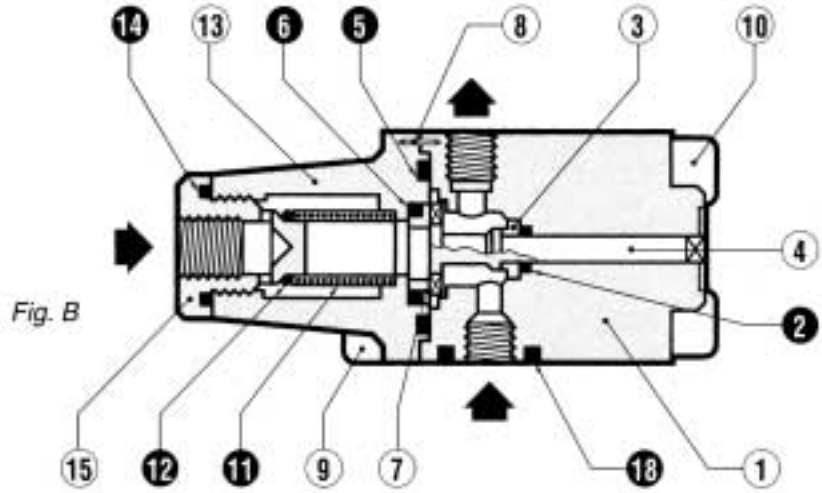
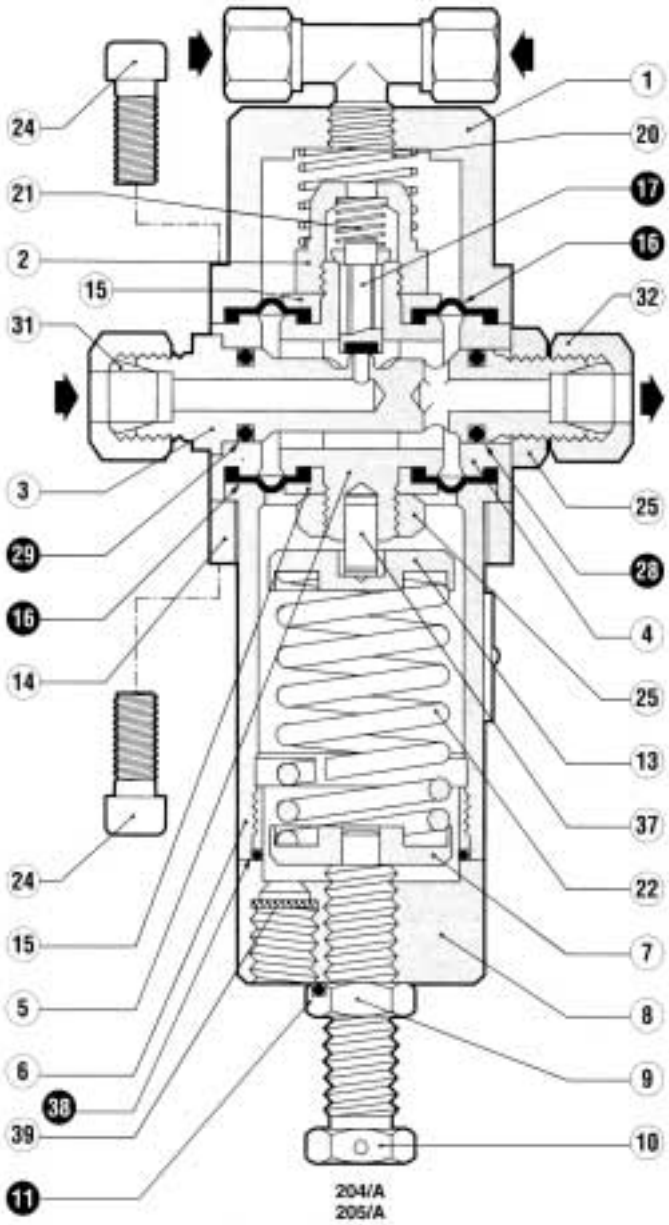


Fig. B

	POS.	DESCRIPTION	N. OF PIECES
AR73	2	O. Ring	1
	5	Diaphragm	1
	6	O. Ring	1
	11	Filter	1
	12	O. Ring	1
	14	O. Ring	1
	18	O. Ring	1

204/A PILOT



204/A
205/A

Fig. A

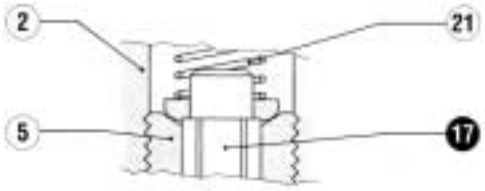
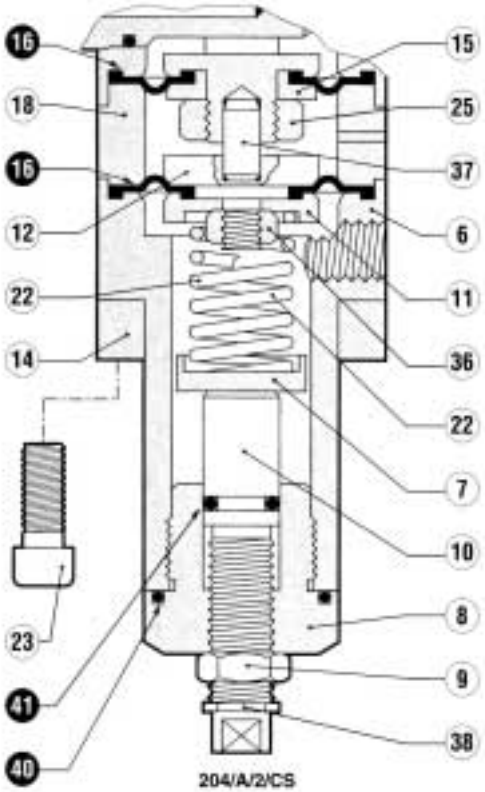


Fig. B

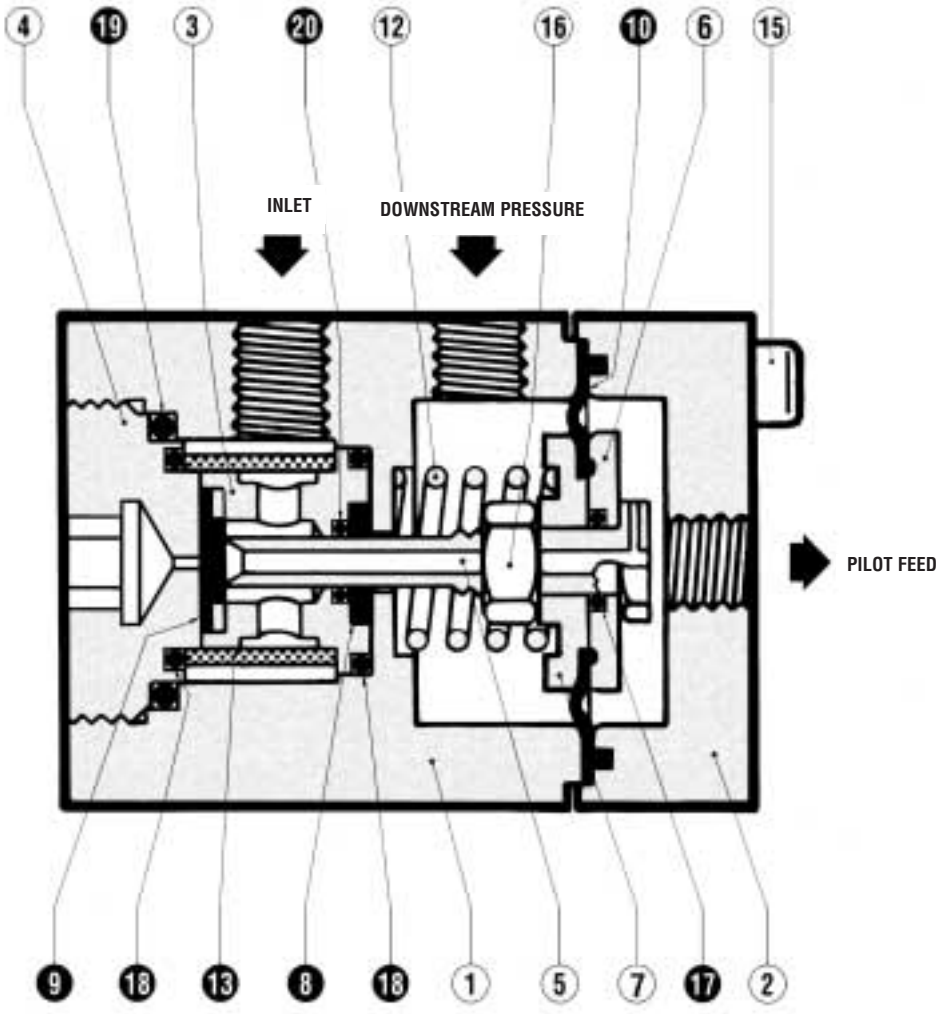


204/A/2/CS

Fig. C

POS.	DESCRIPTION	N. OF PIECES				
		204/A	205/A	204/A/2/CS	204/A/1/CS	204/A/MO
11	O. Ring	1	1	1	1	1
16	Diaphragm	2	2	3	3	2
17	Obturator	1	1	1	1	1
18	O. Ring	-	-	-	-	1
28	O. Ring	1	1	1	1	1
29	O. Ring	1	1	1	1	1
38	O. Ring	1	1	1	1	1
40	O. Ring	-	-	1	-	-
41	O. Ring	-	-	1	-	-

R14/A PREREGULATOR



POS.	DESCRIPTION	N. OF PIECES
8	Guide ring	1
9	Reinforced gasket	1
10	Diaphragm	1
13	Filter	1
17	O. Ring	1
18	O. Ring	2
19	O. Ring	1
20	O. Ring	1

WHEN ORDERING SPARE PARTS, PLEASE SPECIFY:

FOR REGULATORS

Type of regulator
Dne (nominal input diameter)
Pe (inlet pressure)
Pa (outlet pressure)
Works no. (Serial no.)
Year of manufacture
Type of fluid used
Slam-shut (if assembled)
Type of control head
The no. of the part (position no.)
Quantity desired

FOR PILOTS

Type of pilot
Pe (inlet pressure)
Operating Pressure
Works no. (Serial no.)
Year of manufacture
Type of fluid used
The no. of the part (position no.)
Quantity desired

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