Pietro Fiorentini®

E

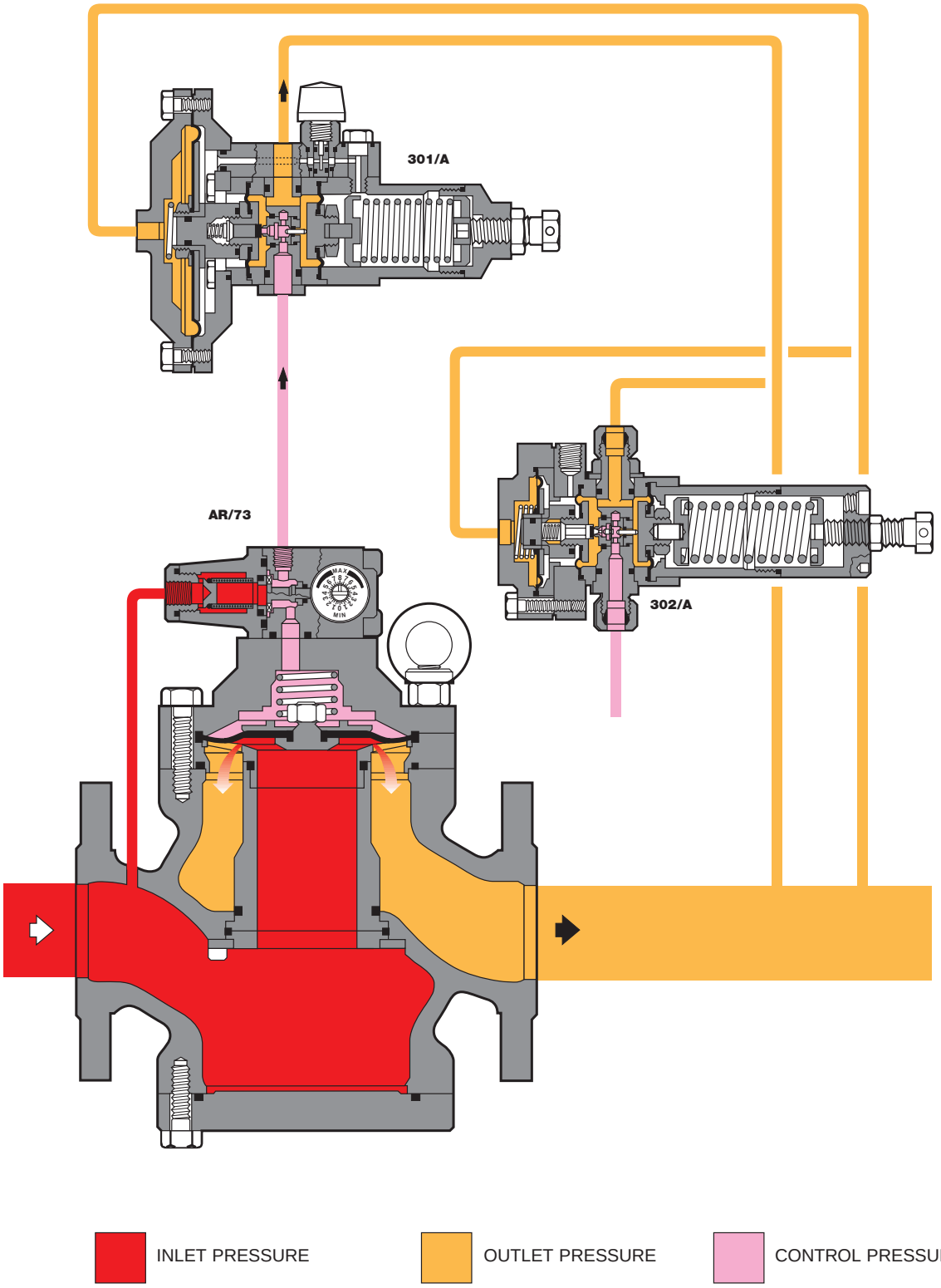
PRESSURE REGULATOR

APERVAL

TECHNICAL MANUAL MT032

INSTALLATION, COMMISSIONING AND MAINTENANCE ISTRUCTIONS

APERVAL



DECLARATION OF CONFORMITY

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

Following conformity assessment procedure has been carried out:

- EC type-examination (module B) by DVGW (ID n° 0085) – report **02/108/4330/855 issued 18th April 2002.** In this report both the versions incorporating the safety shut-off devices serie VB/93 when controlling overpressure and the monitor PM/182, are classified as safety accessories according to clause 2.1.3 of art. 1 of PED.

- Production quality assurance (module D) by BUREAU VERITAS (ID n° 0062) – Attestation d'Approbation du Système Qualité N° **CE-PED-D-FIO001-02-ITA issued 15th May 2002.**

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

Arcugnano 25/9/2002 *The Pietro Fiorentini SpA*

www.mvandc.com | sales@mvandc.com | Phone: 877.566.3837 | Fax: 925.407.2903

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 series Aperval 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/182 (as well as the in-line monitor REVAL 182) being classified as fail close regulators according to the standard EN 334 is categorized as **safety accessory** according PED, therefore it can be used both as pressure accessory and **safety accessory** to PED. The regulator Aperval when incorporating slam shut valve VB/93 with pressure switch 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 97/23/EC of pressure regulator and relevant accessory bearing the CE marking requires installation in the system with minimum requirements according to EN 12286.

INDEX

1.0 INTRODUCTION

The scope of this manual is to provide the essential information for the commissioning, disassembly, re-assembly and maintenance of the APERVAL regulator.
At the same time we consider it appropriate to provide a brief illustration of the main features of the regulator and its accessories.

1.1 MAIN SPECIFICATIONS

The APERVAL pressure regulator is a regulator for medium and low pressures.
The APERVAL is a "fail open" type regulator and therefore opens in the event of:
- rupture of the main diaphragm;
- rupture of the pilot diaphragm/s;
- no feed in the pilot circuit.

The main specifications of this regulator are:
- Design pressure: up to 18.9 bar;
- Working temperature range: -20°C to +60 °C;
- Ambient temperature: -20°C to +60 °C;
- Inlet pressure range bpe: 0.5 to 18.9 bar;
- Regulating range possible Wh: 5 to 9500 mbar (depending on the pilot installed);
- Minimum differential pressure: 0.45 bar;
- Precision class RG= up to 2.5;
- Closing pressure class SG: up to 5.

1.2 OPERATION (FIG. 1)

In the absence of pressure, the main diaphragm 20 is maintained in the closed position by the spring 45 and rests on the seat of the valve with grill 13. The seal is guaranteed by the contact between the valve seat 13 and the diaphragm 20.
In normal working conditions, the following forces act on the diaphragm 20:
- downwards: the load of the spring 45, 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 20; the gas is filtered by the filter 11 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 22 and the thrust on the diaphragm 42 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 5 is created and leads to an increase in the opening of the obturator 17 and therefore a reduction of the control pressure Pc.
As a result, the diaphragm 20 moves upwards increas-ing 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 17 closes and therefore the pressure Pc reaches the value of the upstream pressure Pe. In these conditions, the diaphragm 20 goes to the closed position.
In normal working conditions, the obturator 17 is positioned in such a way that the pressure Pc above the diaphragm 20 is such as to maintain the downstream pressure around the selected value.

Connections to be made by the customer *Ref. No. for the connections*

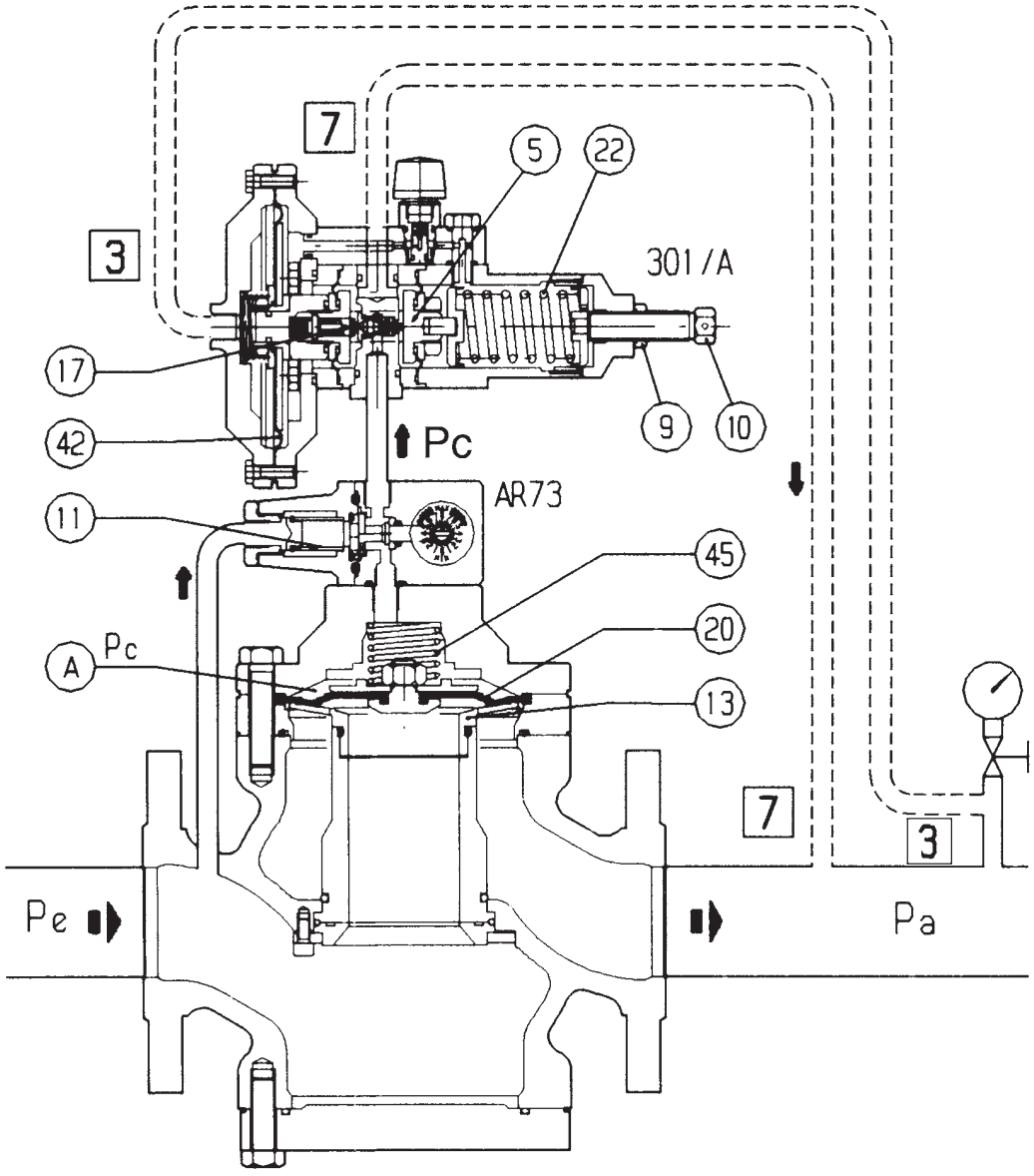
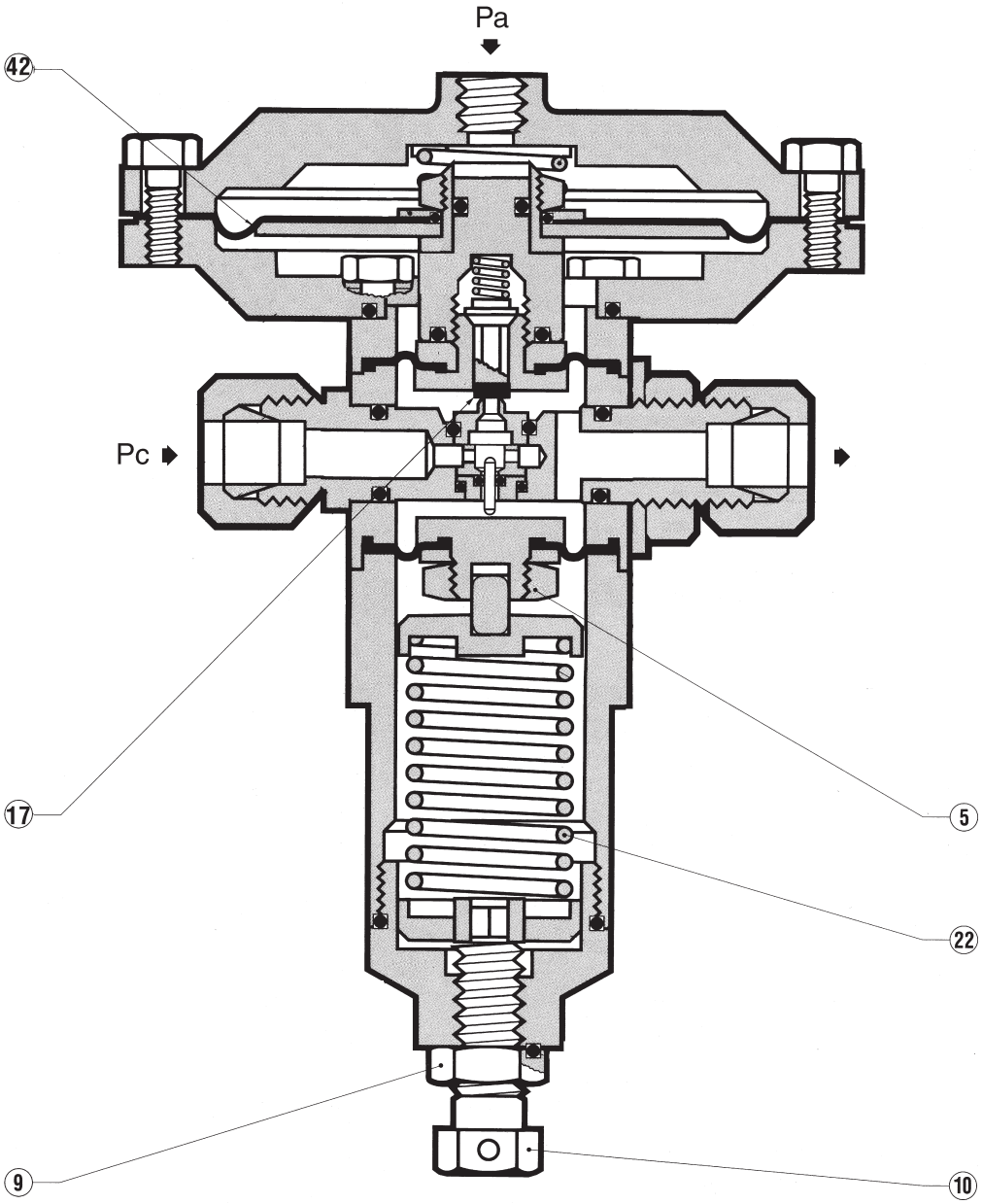


Fig. 1

301/A PILOTS



301/A/TR Versions

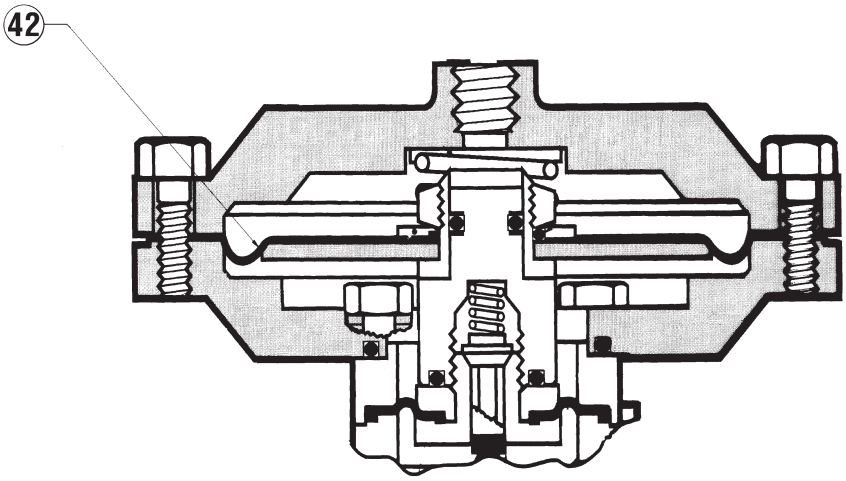


Fig. 2

PILOT 302/A

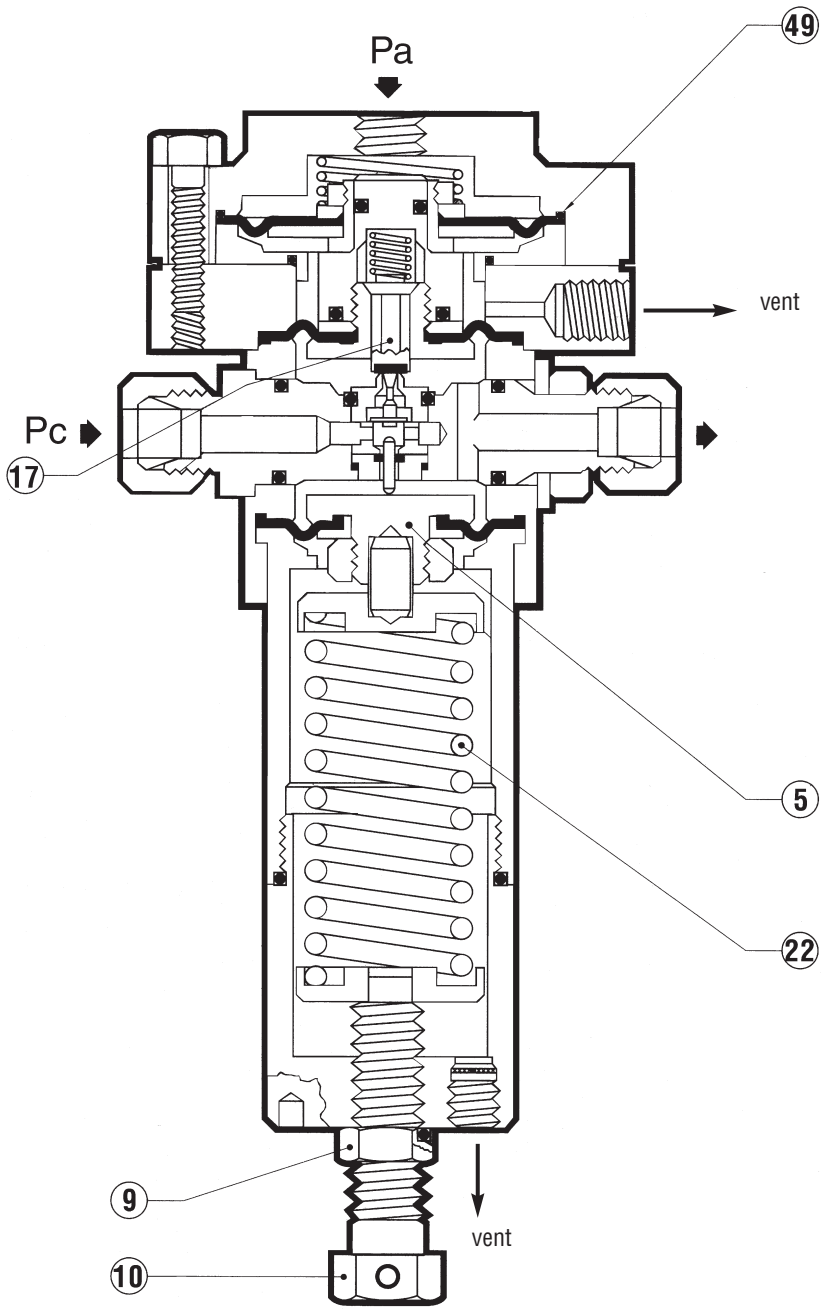


Fig. 2A

1.3 AR73 REGULATING VALVE

The AR73 regulatoring valve is an adjustable flow regulating device. Its function is to adjust and differentiate the regulator's response times so as to optimize its operation.
Small openings of the valve results 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 plate 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.
Table 1 shows the normal works regulation values for the AR73 valve, referred to some working conditions.

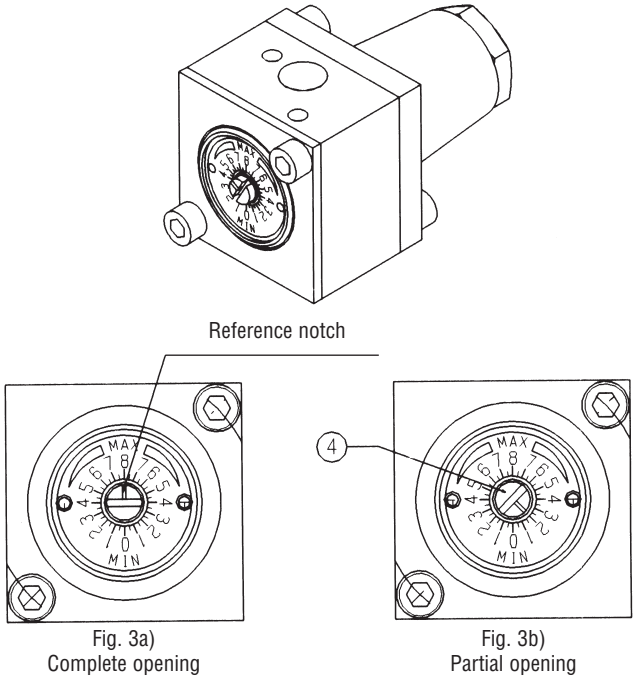


Fig. 3a)
Complete opening

Fig. 3b)
Partial opening

Fig. 3

TAB. 1 AR73 REGULATING VALVE ADJUSTMENT VALUES (Rating No.)

Pa (Bar)		DN 25 Pe (Bar)				DN 40 Pe (Bar)				DN 50 Pe (Bar)				DN 65 Pe (Bar)				DN 80 Pe (Bar)				DN 100 Pe (Bar)			
		Min	5	16	19	Min	5	16	19	Min	5	16	19	Min	5	16	19	Min	5	16	19	Min	5	16	19
0,02	301/A	1.5	3	3	3	0	2	3	3	1	3	3	3	1	2	2	2	3	4	4	4	1	2.5	2.5	2.5
0,1	301/A	3.5	5	5	5	4	5	5	5	3	5	5	5	4	6	7	7	4	5.5	6.5	6.5	4	5	5	5
0,1	301/A/TR	1.5	3	3	3	1	3	3	3	0	2	2	2	2	3	3	3	0	2.5	2.5	2.5	0	3.5	3.5	3.5
0,5	301/A/TR	2	4	4	4	1	5	4	4	1	4	4	4	2	4	5	5	0	4	5	5	0	4.5	4.5	4.5
2	301/A/TR	0	4	4	4	0	3	4	4	0	3	5	5	1	2	4	5	3	3	5	5	1	3	5	5
2	302/A	0	2	2	3	0	3	3	3	0	2	4	4	0	1	3	3	1	3	4	4	1	3	5	5
9	302/A	0		2	2	0		2	2	1		4	4	0		1	1	1		3	3	1		3	3

N.B.: P_e min= P_a + ΔP min (upstream - downstream)

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 de-crease. When the desired setting has been reached, the adjustment screw can be blocked by means of the provided nut 9. The 301/A and 301/A/TR pilots are provided with a damper device (fig. 4) on the line which puts the two chambers at atmospheric pressure into communication.
The purpose of this device is to appropriately "throttle" the ventilation in the chambers towards the atmosphre so as to reduce any pressure oscillation phenomena in the transitory adjustment phases (e.g. variations of the flow demand). Its operation is now described briefly. The two chambers A and B are constantly in communication through the apertures C and D and the annular chambers F (fig. 4a). The ventilation of these chambers towards the atmosphere takes place through the aperture E in the nozzle 68. By turning the nozzle appropriately using a screwdriver, it is possible to choke the opening of this aperture, passing from a maximum value (fig. 4b) to a minimum value (fig. 4d).
The degree of choking can be read from the outside by means of the notches on the connection fitting 67 and the nozzle 68 (fig. 4e). When the notches are aligned or, in any case, within the maximum opening zone shown in the figure, the opening of the aperture E is completely free (fig. 4b).

In the zone indicated as "choking", the opening starts to be reduced gradually (fig. 4c) and finally reaches the minimum value in correspondence with the minimum opening zone (fig. 4d). In this final condition, the section of the passage is given exclu-sively by the extremely reduced clearance between the fitting 67 and the nozzle 68.
The pilot is normally supplied with the damper set in the choking zone. A test should be carried out however before the start-up, unscrewing the knob 69 and controlling the position of the notches. The setting can be adjusted by turning the nozzle 68 clockwise or anti clockwise indifferently, bearing in mind that with the maximum opening the probability of pumping is maximum while with the minimum opening we get the highest outlet pressure variations during the transitory phases.

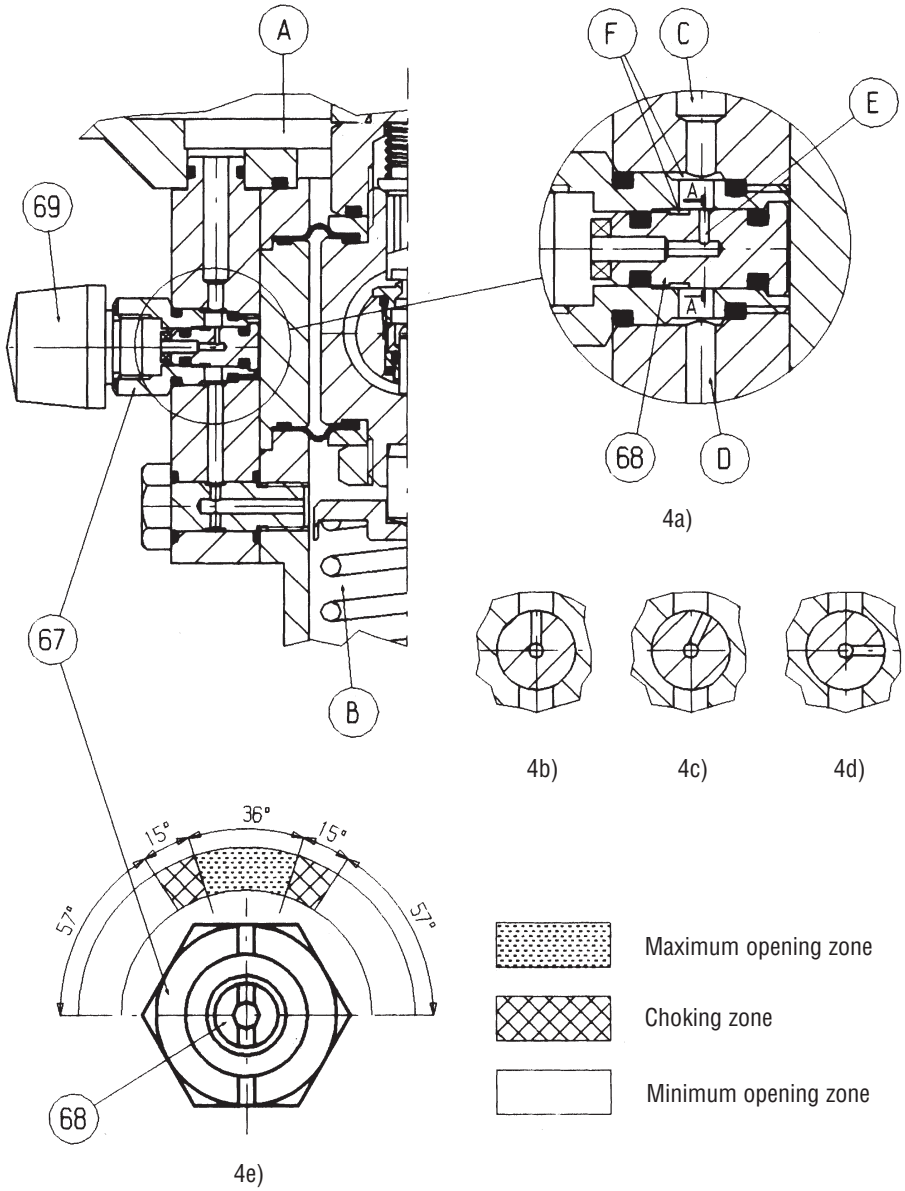


Fig. 4

1.4 SETTING SPRINGS

The Aperval regulator uses the 301/A, 301/A/TR and 302/A pilots. The regulation range of the different pilots is given in the tables below.

Tab. 2 301/A Pilot setting springs

Code	Colour	d	de	Lo	i	it	Setting range in mbar
2700680	BROWN	2.3	35	60	6	8	5 ÷ 13
2700830	RED/BLACK	2.5			5.5	7.5	12 ÷ 30
2700920	WHITE/YELLOW	2.8			5.5	7.5	28 ÷ 55
2701040	WHITE/ORANGE	3			5.5	7.5	40 ÷ 85
2701260	WHITE	3.5			5.5	7,5	69 ÷ 100

Tab. 3 301/A/TR Pilot setting springs

Code	Colour	d	de	Lo	i	it	Setting range in mbar
2701260	WHITE	3.5	35	60	5.5	7.5	100 ÷ 310
2701530	YELLOW	3			5	7	280 ÷ 650
2701790	YELLOW/BLACK	4.5			4.5	6.5	640 ÷ 1040
2702450	RED	6			5	7	800 ÷ 2000

Tab. 4 302/A Pilot setting springs

Code	Colour	d	de	Lo	i	it	Setting range in mbar
2701541	WHITE	4	35	60	7.5	9.5	0.8 ÷ 1.3
2701800	YELLOW	4.5			8	10	1.2 ÷ 2.1
2702080	ORANGE	5			8.5	10.5	2.0 ÷ 3.3
2702290	RED	5.5			8.25	10.25	3.0 ÷ 4.8
2702460	GREEN	6			8.25	10.25	4.5 ÷ 7.0
2702660	BLACK	6.5			8	10	6.0 ÷ 9.5

De = external diameter **d =** wire diameter **i =** active coils **Lo =** Spring length **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:

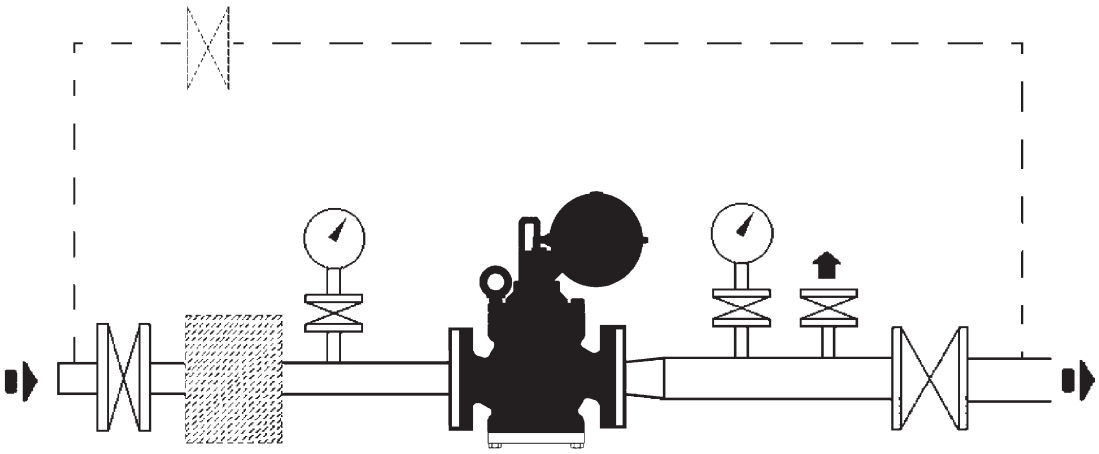
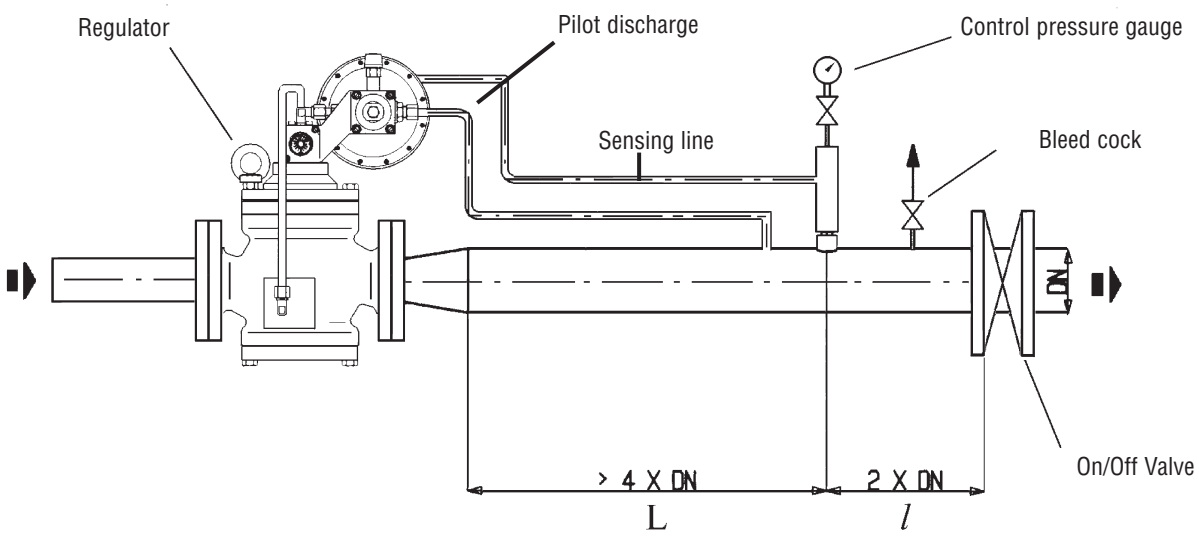


Fig. 5 (Standard regulator)

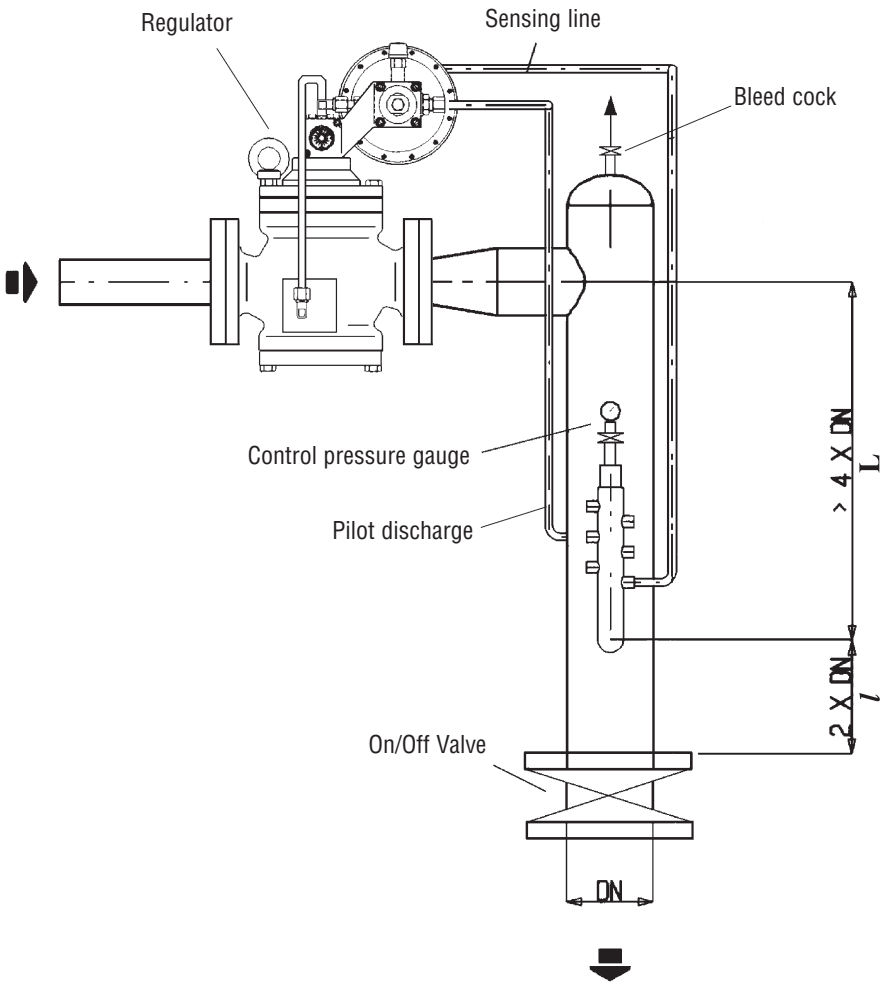
TAB. 5 CONNECTING THE APPARATUSES

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

IN-LINE INSTALLATION

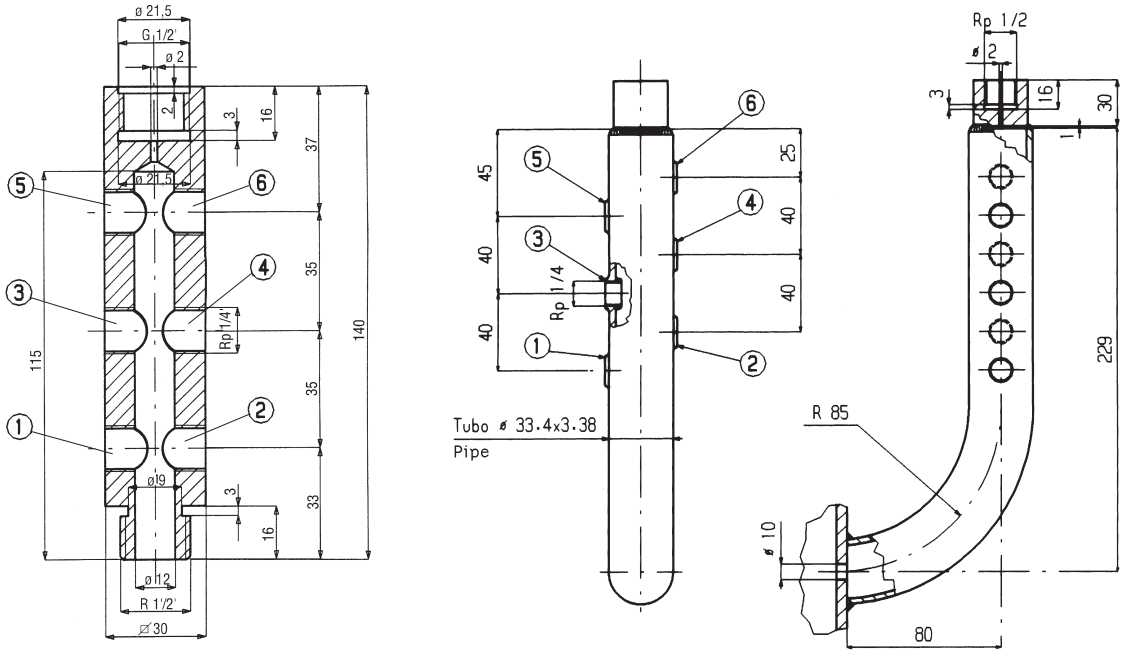


INSTALLATION AT RIGHT ANGLES



TAB. 6 DETAIL OF THE 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**.
For good regulation, it is indispensable 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 piping itself must slope down towards the downstream 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
Vmax = 15 m/s for Pa < 0,5 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 55 (fig. 6).
It is based on the contrast between the thrust on the diaphragm 24 deriving from the pressure of the gas to control and the thrust from the setting spring 20. The weight of the mobile assembly, the static thrust and the residual dynamic thrust on the obturator 4 also contribute to this contrast.
When the thrust deriving from the pressure of the gas exceeds that of the setting spring, the obturator 4 is raised and a certain quantity of gas is released as a result.
As soon as the pressure drops below the set-point, the obturator returns to the closed position. Proceed as indicated below to control and adjust intervention of the relief valve.

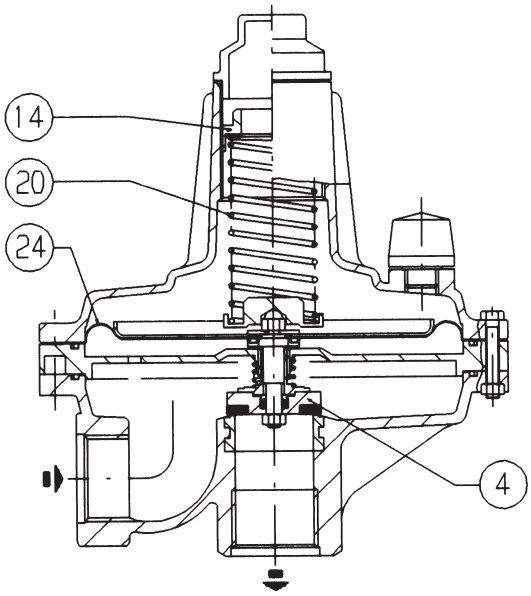


Fig. 6

3.1.1 DIRECT INSTALLATION IN THE LINE (FIG. 7)

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 vent 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 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 necessary by turning the internal adjustment ring 14 appropriately (clockwise to increase and anticlockwise to decrease).

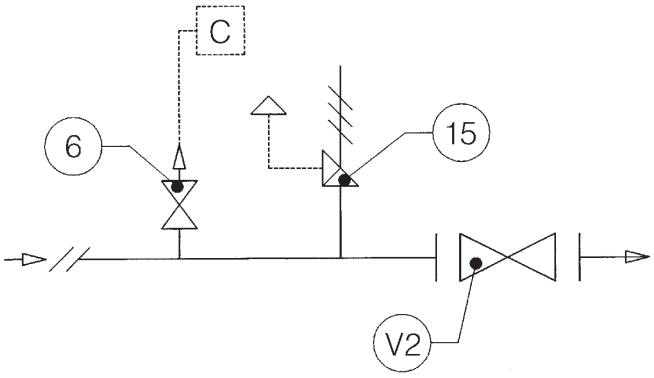


Fig. 7

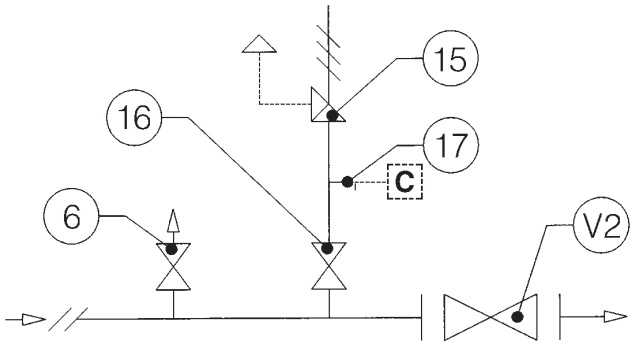


Fig. 8

3.1.2 INSTALLATION WITH ON/OFF VALVE (FIG. 8)

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 it necessary by turning the internal adjustment ring 14 appropriately (clockwise to increase and anticlockwise to decrease).

3.2 ACCELERATOR

In accelerator (fig.9) is installed on the PM/182 incorporated monitor and on the REVAL 182 regulator (use as in-line monitor) to spped up their intervention in the event of failure of the active regulator(recommended 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 ring 1, clockwise to increase the value,anticlockwise to reduce it.
Two models are available:
- V/25 range of intervention Who: 15 ÷ 600 mbar;
- M/A range of intervention starting from 550 mbar.

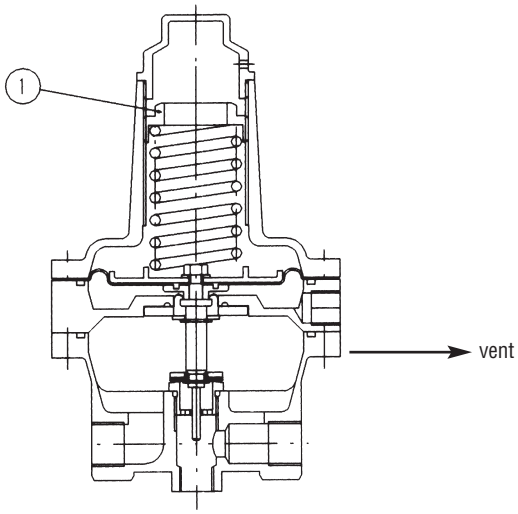


Fig. 9 Accelerator V/25

4.0 MODULARITY

The modular-type design of APERVAL series regulators means that it is also possible to fit either the emergency monitor regulator PM/182 or the slam-shut incorporated with the body itself even after the installation of the regulator, without any modifications.

4.1 INCORPORATED SLAM-SHUT VALVE

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

4.2 VB/93 INCORPORATED SLAM-SHUT

This is a device (fig. 10a) which immediately blocks the gas flow if, following some kind of failure, the downstream pressure reaches the set-point for its intervention or if it is operated manually.
On the Aperval regulator, it is possible the VB/93 slam-shut incorporated both with the service regulator or on the one functioning as in-line monitor.
The main characteristics of this device are:
- design pressure: 18.9 bar for all the components;
- intervention with pressure increase and/or decrease;
- intervention accuracy (AG): ± 1% of the pressure set-point for pressure increases, ± 5% for pressure decreases;
- balanced obturator which permits the device to be rearmed without needing a bypass in any operative situation;
- manual button control.

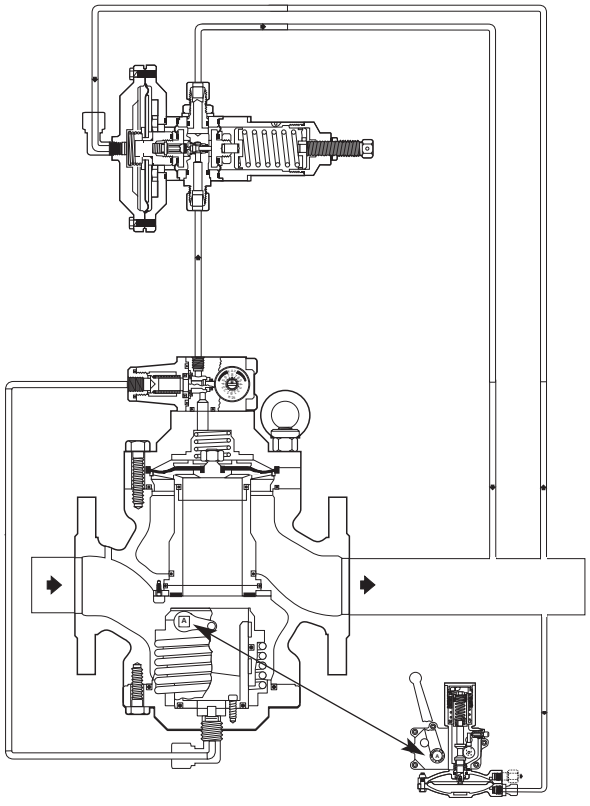


Fig. 10a

4.2.1 VB/93 SLAM-SHUT OPERATION

The slam-shut mechanism comprises:
- a mobile obturator 104 subject to the load of the closing spring 124;
- a seal 107 already used in the Reval 182 regulators;
- a lever assembly 114, 116 and 118 whose rotation provokes movement of the obturator 104;
- a VB 31/32/33 pressure switch device (fig. 10b) whose internal motion determines the open or closed position of the obturator 104.

The pressure switch device comprises a control head C in which the pressure to be controlled Pa acts on the diaphragm 16, integral with the camshaft 13.
The load of the pressure Pa on the diaphragm is countered by the springs 32 and 31 which respectively determine tripping as a result of pressure increase and decrease.
The device is set by turning the rings 22 and 23. Clockwise rotation of the rings increases the set point while anticlockwise rotation reduces it.
In the event of tripping as a result of pressure increase, when the pressure Pa exceeds the set point, the load on diaphragm 16 of the control head C increases until it overcomes the resistance of the spring 32.
This causes down ward translation of the shaft 13 which, by means of the cam, shifts the feeler 7 to disengage the lever mechanism 114.
Intervention for a pressure decrease takes place as follows.
This provokes the downward displacement of the shaft 13 which shifts the feeler 7 and releases the lever mechanism 114 by means of the cam. If the pressure Pa drops below the set-point, the support of spring 21 stops its stroke on the beat of the body 31 and the spring 12 displaces the support 13 upwards and the shaft 18 as a result.
The cam then shifts the feeler 7 and causes the release of the lever mechanism 114. Intervention of the slam-shut device can also be provoked manually by means of the release button 6.
The connection between the control head C and the Pa control point can be made with the interposition of a device Push (fig. 17) which makes it easy to control the operation of the pressure control device.

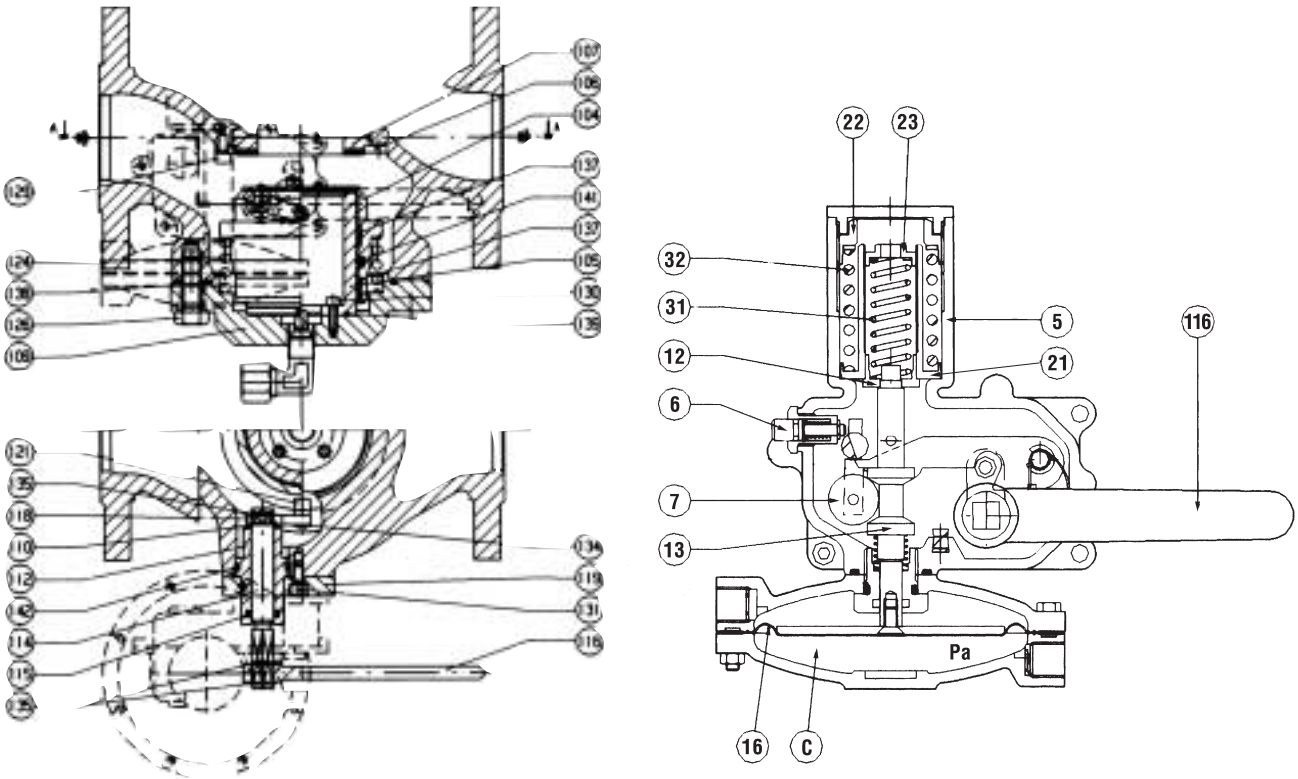


Fig. 10b

4.2.2 TAB. 8 VB/93 SETTING SPRINGS

	Spring characteristics							SETTING RANGE in mbar					
								VB/31		VB/32		VB/33	
	Code	Colour	De	Lo	d	i	it	max	min	max	min	max	min
1	2700565	WHITE	35	50	2.0	5.25	7.25	22 ÷ 43					
2	2700675	YELLOW			2.3	5.25	7.25	33 ÷ 60					
3	2700820	ORANGE			2.5	5.00	7.00	50 ÷ 95					
4	2700910	RED			2.7	6.00	8.00	75 ÷ 155					
5	2701035	GREEN			3.0	5.25	7.25	110 ÷ 190					
6	2701140	BLACK			3.2	4.50	6.50	160 ÷ 280					
7	2701255	BLUE			3.5	4.50	6.50	210 ÷ 360					
8	2701380	GREY			3.7	4.25	6.25			700 ÷ 1500			
9	2701525	BROWN			4.0	4.50	6.50	310 ÷ 560		900 ÷ 2000		2000 ÷ 4100	
10	2701645	PURPLE			4.2	4.00	6.00	510 ÷ 910		1300 ÷ 2800			
11	2701785	WHITE/BLACK			4.5	4.50	6.50					3700 ÷ 8500	
12	2702065	SKY-BLUE			5.0	4.00	6.00	860 ÷ 1200				6200 ÷ 10500	
13	2700338	WHITE	15	40	1.3	8.75	10.75		10 ÷ 25				
14	2700377	YELLOW			1.5	8.50	10.50		20 ÷ 55				
15	2700464	ORANGE			1.7	8.50	10.50		50 ÷ 105				
16	2700513	RED			2.0	8.50	10.50		75 ÷ 145				
17	2700713	GREEN			2.3	8.50	10.50		125 ÷ 275				
18	2700750	BLACK		35	2.5	6.25	8.25		255 ÷ 605		150 ÷ 1550		750 ÷ 3300
19	2700980	BLUE			3.0	6.00	8.00		505 ÷ 905		1000 ÷ 2100		2500 ÷ 4500
20	2701180	BROWN			3.5	5.50	7.50				1800 ÷ 2700		4000 ÷ 5800

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

4.3 MONITOR

The monitor is an emergency regulator which takes over from the active regultor if for any reason the latter permits the downstream pressure to rise up to the value set for its intervention.
When pressure regulator Reval 182 or incorporated monitor PM/182 are used as monitor, to increase response time an accelerator is installed.
Installation of accelerator is recommended for use as safety accessory according to Directive 97/23/EC (PED).
Two alternative solutions are offered for this security device on the Reval 182 regulators: incorporated monitor or in-line monitor.

4.3.1 PM/182 INCORPORATED MONITOR

This emergency device (fig. 11) 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 separate servomotors;
- they work on independent valve seats.

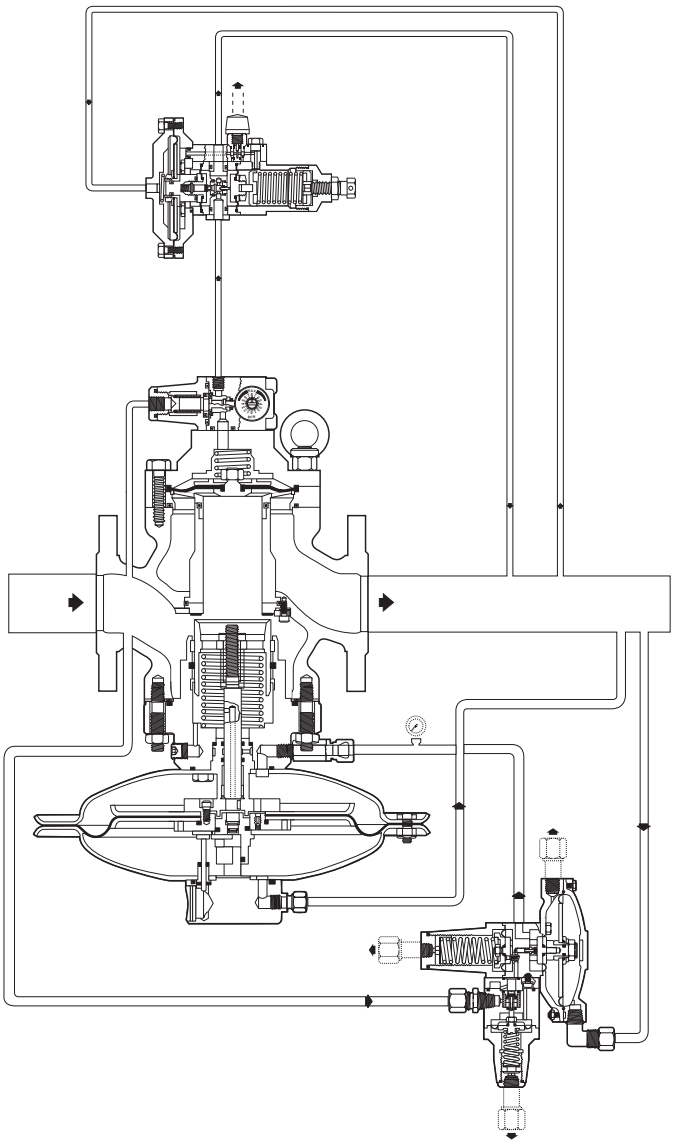


Fig. 11

4.3.2 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:
- Reval 182 regulator (fig. 12);
- Aperval regulator, the same in all ways as the main regulator (fig. 13).

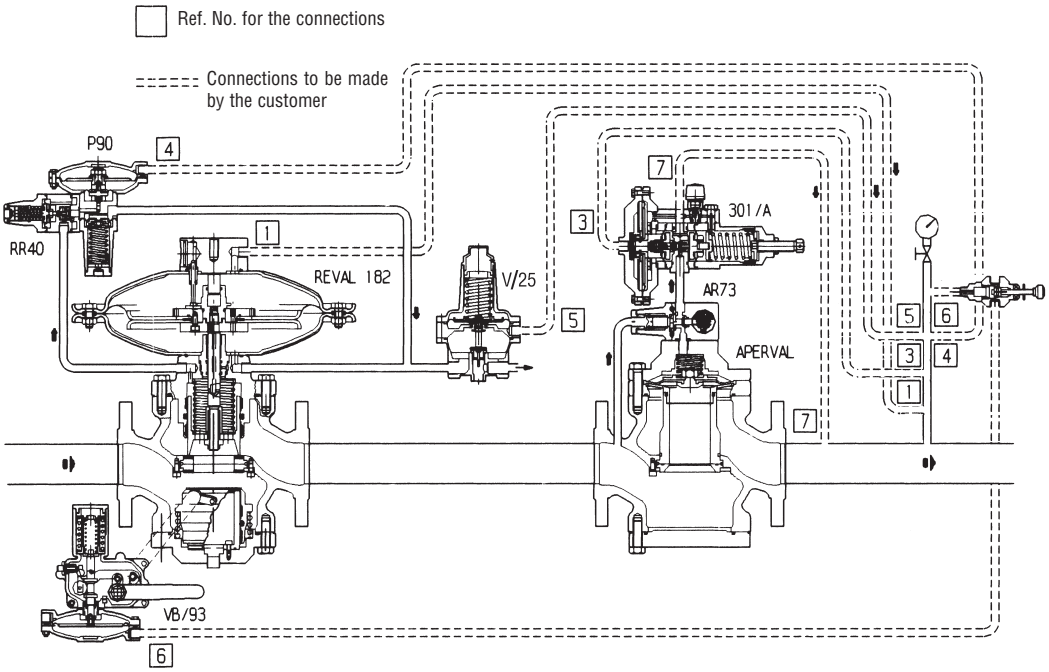


Fig. 12

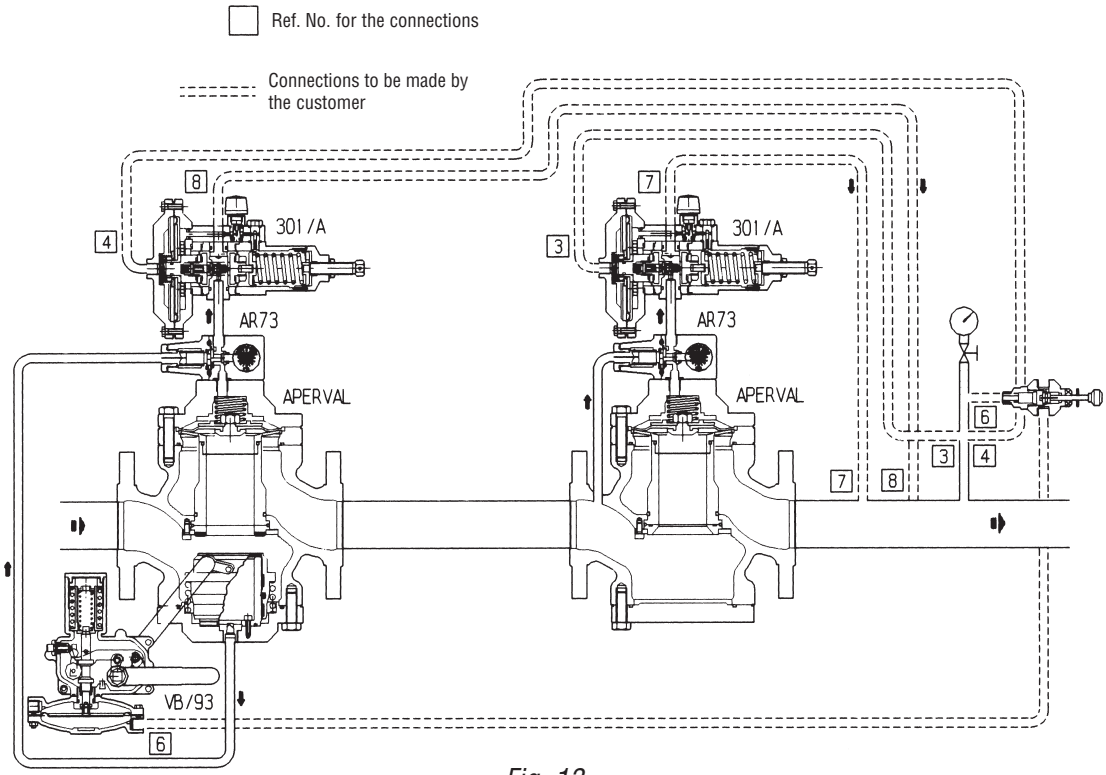


Fig. 13

4.3.3 SETTING SPRINGS

The REVAL 182 regulator and the monitor PM/182 uses the P90, P92 and 204/A pilots. The regulation range of the different pilots is given in the tables below.

Tab. 9 RR40 Setting springs pre-regulator

	Code	Colour	De	Lo	d	i	it	Setting range in mbar
1	2700338	WHITE	15	40	1.3	8.75	10.75	0.11 ÷ 0.22
2	2700375	YELLOW			1.5	5.25	6.75	0.22 ÷ 0.58
3	2700464	ORANGE			1.7	8.5	10.5	0.5 ÷ 0.86
4	2700510	RED		35	2	5.25	7.25	0.85 ÷ 2
5	2700745	GREEN			2.5	5.25	7.25	1.95 ÷ 4.7
6	2700980	BLACK			3	6	8	4.6 ÷ 8.2

N.B.: Recommended pre-regulator set point: Pep= Pa + (0.15 ÷ 0.2) bar

Table 10 P90-92 Pilots setting springs

PILOT P90

	Code	Colour	De	Lo	d	i	it	Setting range in mbar
1	2700400	WHITE	25	55	1.5	7	9	6 ÷ 15
2	2700545	YELLOW			2	7.5	9.5	14 ÷ 50
3	2700790	ORANGE			2.5	8	10	49 ÷ 120
4	2701010	RED			3	7	9	110 ÷ 270
PILOT P92								
1	2701010	RED	25	55	3	7	9	260 ÷ 660
2	2701225	GREEN			3.5	6	8	650 ÷ 1110

Table 11 204/A Pilots setting springs

	Code	Colour	De	Lo	d	i	it	Setting range in mbar
1	2701260	WHITE	35	60	3.5	5.50	7.50	300 ÷ 1200
2	2701530	YELLOW			4	5.00	7.00	700 ÷ 2800
3	2702070	ORANGE			5	5.00	7.00	1500 ÷ 7000
4	2702450	RED			6	5.00	7.00	4000 ÷ 12000

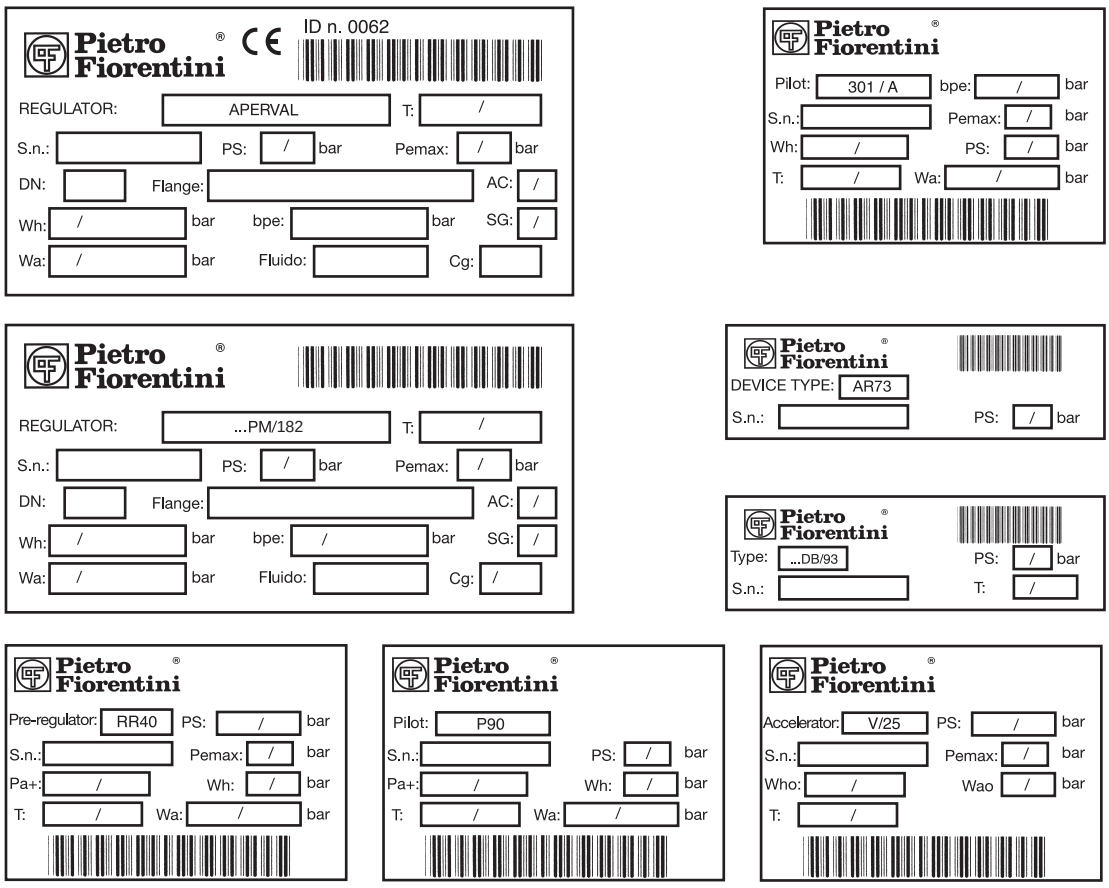
De = Ø external diameter **d** = Ø wire diameter **i** = active coils **Lo** = Length **it** = total coils

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.

APPARATUS SPECIFICATION PLATES



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

CE= According ti Directive PED

Pemax= maximum operating pressure at the inlet of the apparatus

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

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

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

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

5.2 GAS INPUT, CONTROL OF EXTERNAL TIGHTNESS AND SETTING

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

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

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

External tightness is guaranteed if no of bubbles is 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., vibrations during transport)for the settings to be changed,while remaining within the values permitted by the springs used.

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

Tables 12 and 13 give the recommended set-points for the apparetuses 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 with two lines, starting up one line at a time is recommended, starting from theone with the lower set-point, known as the “reserve” line. **The set-points of the apparatuses in this line will obviously deviate from those specified in the tables 12 and 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. 14)

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

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. 15). Reopen valve V1 slowly.
5) Control the damper device of the pilot 3 as il-lustrated in paragraph 1.3.
6) Choke the AR73 valve, referring to the indicative values given in table 1.
7) Adjust the setting by alternately adjusting the 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. 15).
8) Close the bleed cock 6 and check that the downstream pressure, after a period of increase, stabilizes and at a value slightly higher than that of closure of the pilot/regulator combination. Otherwise eliminate the causes of the internal leakage.
9) Using a foam substance, check the tightness of all the joints between the on-off valves V1 and V2.
10) 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. 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.
11) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point 7 so as to readjust the setting, increasing the opening of the AR73 valve, or that of the pilot damper device.
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.

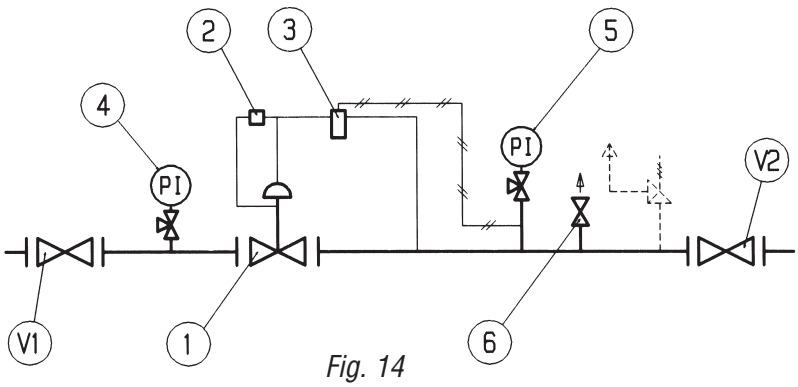


Fig. 14

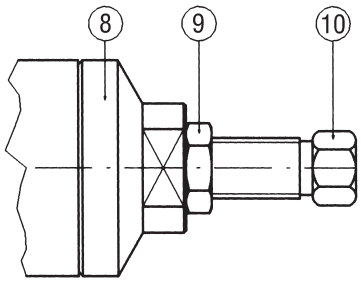


Fig. 15 - 30./... adjustment screw.

5.4 COMMISSIONING THE REGULATOR WITH INCORPORATED VB/93 SLAM-SHUT (FIG. 16)

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

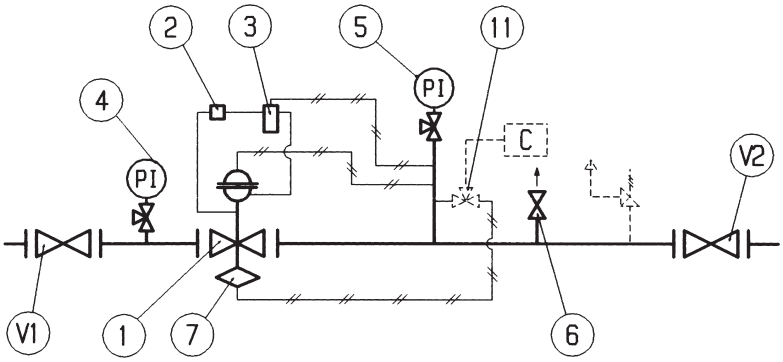


Fig. 16

Control and adjust slam-shut 7 operation as follows:

A) For slam-shut devices connected to the down-line piping by means of the three-way "push" valve 11, proceed as follows (fig. 17):

- connect an auxiliary controlled pressure to C;
- stabilise this pressure at the set-point established for the regulator;
- insert the reference pin 2 in the notching, pressing knob 1 completely;
- reset the slam-shut device by means of the provided lever;
- keep the knob 1 pressed:

• safety devices which intervene for maximum pressure: slowly increase the auxiliary pressure and check the intervention value. If necessary, increase the intervention value by turning the adjustment ring 22 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 ntervention values for pressure increase or decrease by respectively turning the rings 22 or 23 clockwise and vice versa to reduce the intervention values.

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

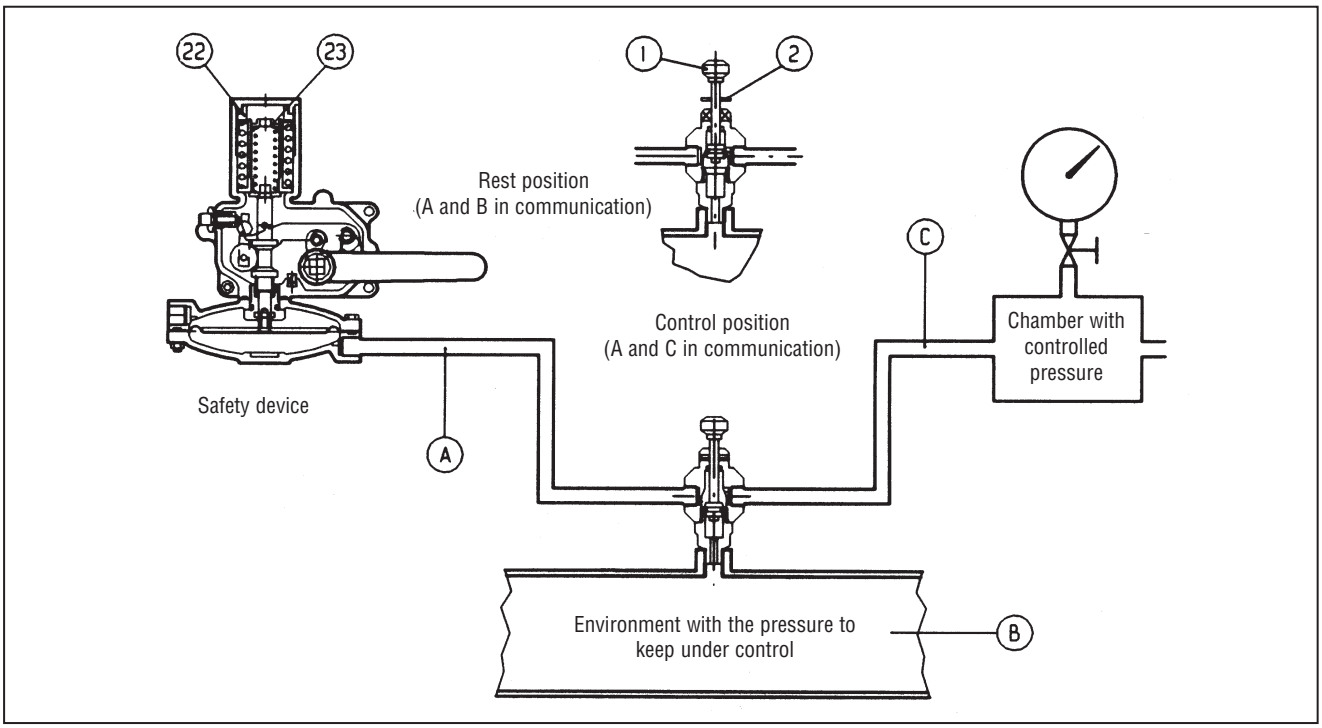


Fig. 17

B) On devices without the "push" valve (fig. 18) we recommend separately connecting the control head to a controlled auxiliary pressure and repeat the operations described above.

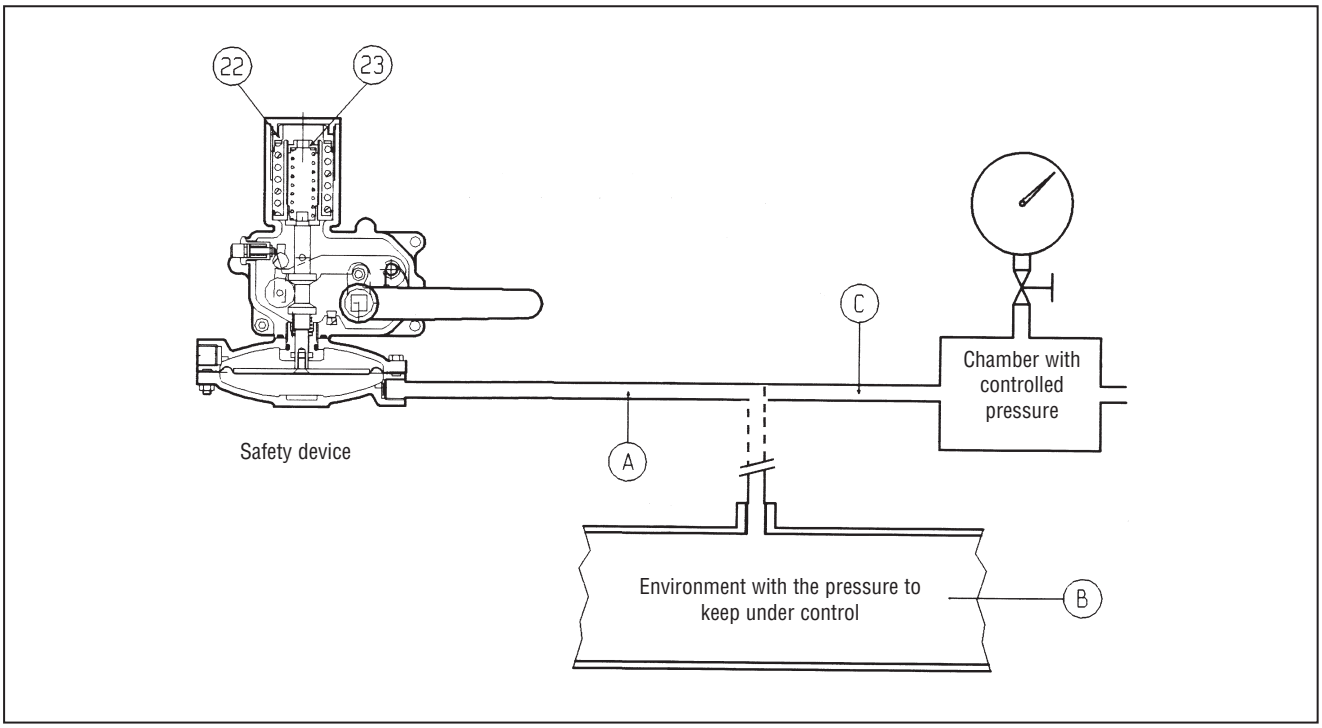


Fig. 18

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 provided lever clockwise.
5) Open the downstream bleed cook 6.
6) Control the damper device of the pilot 3 as illustrated in par. 1.3.
7) Choke the AR73 valve referring to the indicative values shown in table 1.
8) Adjust the setting by alternately adjusting the 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. 15)
9) Close the bleed cock 6 and check that the down-stream pressure, after a period of increase, stabilizes and at a value slightly higher than that of closure of the pilot/regulator combination. Otherwise eliminate the causes of the internal leakage.
10) Using a foam substance, check the tightness of all the joints between the on-off valves V1 and V2.
11) 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.
12) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point 8 so as to readjust the setting, increasing the opening of the AR73 valve, or that of the pilot damper device.
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.
13) It is recommended to check that the flow of the line stops when the slam-shut is tripped manually.

.

TAB. 12	Settings of on-line apparatuses consisting of regulator APERVAL + Slam shut + Relief valve		
Regulator set-point (Pas) mbar	**RELIEF VALVE**	**SLAM-SHUT Max**	**SLAM-SHUT Min**
5<Pas≤12	20 mbar	25 mbar	Slam-shut not available
12<Pas≤15	Pas x 1.5	Pas + 20 mbar	10 mbar
15<Pas≤19			
19<Pas≤24			Pas -10 mbar
24<Pas≤30	Pas x 1.4		
30<Pas≤60	Pas x 1.25	Pas + 30 mbar	
60<Pas≤80			
80<Pas≤110		Pas + 40 mbar	Pas -20 mbar
110<Pas≤200	Pas x 1.15	Pas + 100	Pas -40 mbar
200<Pas≤500		Pas + 150	Pas -60 mbar
500<Pas≤800		Pas + 300	Pas -100 mbar
800<Pas≤1000		Pas + 500	Pas -200 mbar
1000<Pas≤2500			Pas -300 mbar
2500<Pas≤5000		Pas + 1000	
5000<Pas≤6000			Pas -700 mbar
6000<Pas≤7700	Pas x 1.1	Pas + 1500	5,8 bar
7700<Pas≤9000			

5.5 COMMISSIONING THE REGULATOR WITH INCORPORATED PM/ 182 MONITOR AND ACCELERATING VALVE (FIG. 19)

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

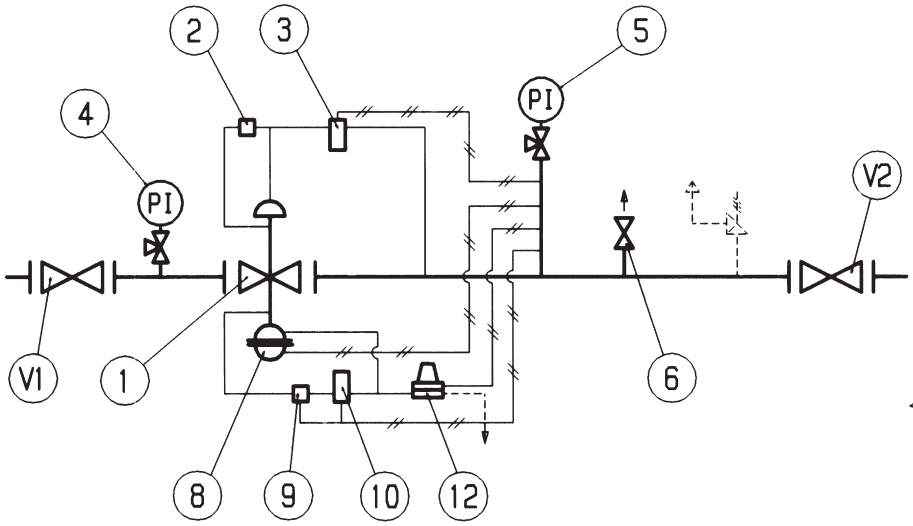


Fig. 19

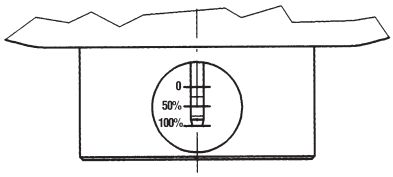


Fig. 20

1) Completely increase the setting of the pilot 3 by turning ring 10 clockwise (fig. 15).
2) Completely increase the setting of the accelerator valve by turning the internal adjustment ring 1 (fig. 9) clockwise.
3) Close the AR73 valve in position 0.
4) Partially open the discharge cock 6.
5) Open the inlet on-off valve V1 very slowly.
6) Chech on the pressure gauge of the regulator 9 that its pressure set-point is within the raccomended range of values Pep= Pa+ (0.15 ÷ 0.2) bar. If it not correspond, adjust the setting using the setting ring on the pre-regulator.
7) Adjust the setting of the pilot of the monitor 10 to the intervention value set for the accelerating valve 12 (see table 13).
8) Lower the setting of the accelerating valve until, using a foam, foam medium gas is seen to come out of the discharge point.
9) 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.
10) Adjust the setting of the pilot of the monitor 10 to the set value.
11) Open the AR73 valve in position 8.
12) Control the damper device of the pilot 3 as illus- trated in par. 1.3) 8.
13) Reduce the setting of pilot 3 to the selected working value of the service regulator.
14) Ascertain that the PM/182 monitor positions itself completely open, controlling the position of the stroke indicator through the port (fig. 20).
15) Choke the AR73 valve referring to the indicative values shown in table 1.
16) Adjust the setting by alternately adjusting the 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. 15).
17) Close the bleed cock 6 and check that the down-line pressure, after a period of increase, stabilizes and at a value slightly higher than that of closure of the pilot/monitor combination. Otherwise eliminate the causes of the internal leakage.

18) Using a foam substance, check the tightness of all the joints between the on-off valves V1 and V2.
19) 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.
20) 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, or that of the pilot damper device.
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 REVAL 182 IN-LINE MONITOR IN LINE WITH VB/93 INCORPORATED SLAM-SHUT AND ACCELERATOR (FIG. 21)

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

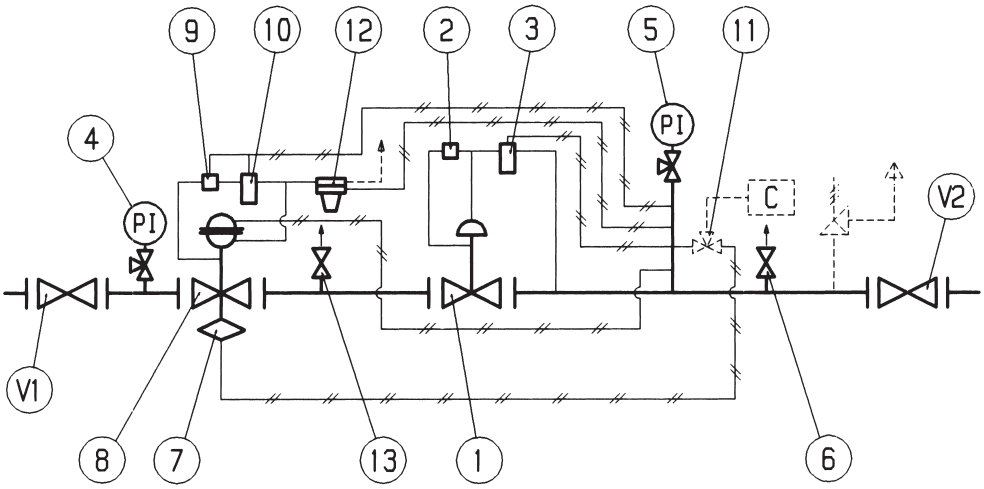


Fig. 21

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. 17):
- connect an auxiliary controlled pressure to path C;
- stabilize this pressure at the regulator set point valve;
- 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 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 22 clockwise, or viceversa 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 22 or 23 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 advisable to connect the control head separately to a controlled auxiliary pressure and repeat the operations described above (fig. 18).

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) Partially open the discharge cock 6.
3) Open the inlet on-off valve V1 very slowly.
4) Completely increase the setting of the pilot 3 by turning the screw 10 clockwise (fig. 15).
5) Close the AR73 valve in position 0.
6) Completely increase the setting of the accelerating valve by turning the internal adjustment ring 1 (fig. 9) clockwise.
7) Open the slam-shut very slowly, turning the pro-vided lever clockwise.
8) Check on the pressure gauge of the pre-regulator 9 that its pressure set-point is within the recommed-ed range of values Pep= Pa + (0.15 ÷ 0.2) bar. If it not corrispond, adjust the setting using the setting ring on the (reregulator).
9) Adjust the setting of the pilot of the monitor 10 to the intervention value set for the acceleratoring valve 12 (see table 13).
10) Lower the setting of the accelerating valve until, using a foam, gas is seen to come out of the discharge point.
11) 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.
12) Adjust the setting of the pilot of the monitor 10 to the set value.
13) Open the AR73 valve in position 8.
14) Control the damper device of the pilot 3 as illus- trated in par. 1.3).
15) Reduce the setting of pilot 3 to the selected working value of the service regulator.
16) Ascertain that the REVAL 182 monitor positions itself completely open, controlling the position of the stroke indicator through the port (fig. 20).
17) Choke the AR73 valve referring to the indicative values shown in table 1.
18) Adjust the setting by alternately adjusting the 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. 15).
19) Close the bleed cock 6 and check that the downstream pressure, after a period of increase, stabilizes at a slightly higher value than that of closure of the pilot/monitor combination. Otherwise eliminate the causes of the internal leakage.
20) Using a foam substance, check the tightness of all the joints between the on-off valves V1 and V2.
21) 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 of the installation.
22) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point 18 so as to readjust the setting, increasing the opening of the AR73 valve, or that of the pilot damper device.
    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.
23) It is recommended to check that the flow in the line stops when the slam-shut is tripped manually is recommended.

5.7 COMMISSIONING THE REGULATOR PLUS APERVAL IN LINE MONITOR WITH INCORPORATED VB/93 SLAM-SHUT (FIG. 22)

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

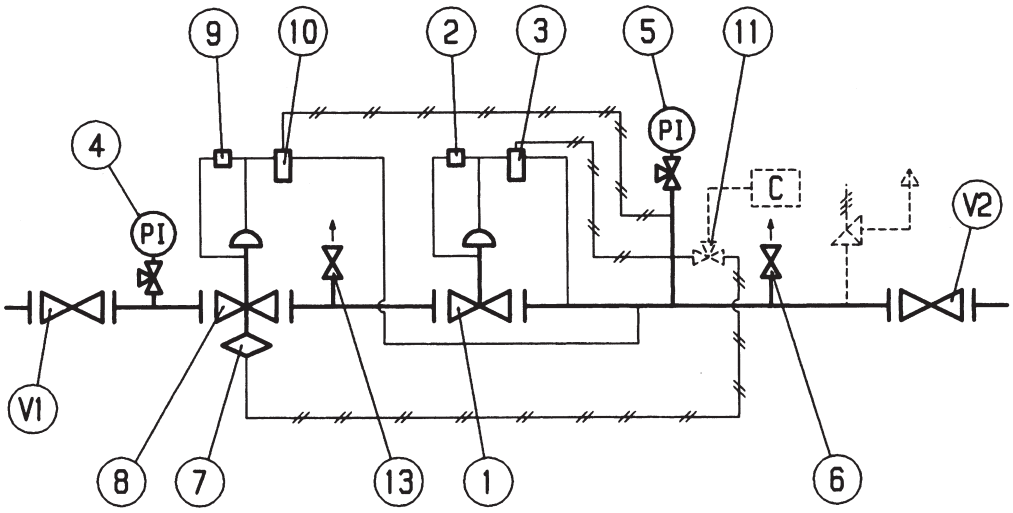


Fig. 22

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. 17):
   - connect an auxiliary controlled pressure to path C;
   - stabilize this pressure at the regulator set point value;
   - insert the reference pin 2 in the notching, 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 tintervention, value by turning the adjustment ring 22 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 22 or 23 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 advisable to connect the control head separately to a controlled auxiliary pressure and repeat the operations described above (fig. 18).

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) Partially open the discharge cock 6.
3) Open the AR73 (9) valve of the monitor in position 8.
4) Close the AR73 (2) valve of the service regulator in position 0.
5) Open the inlet on-off valve V1 very slowly.
6) Completely increase the setting of the pilot 3.
7) Open the slam-shut very slowly, turning the pro-vided lever clockwise.
8) Control the damper device of the pilot 10 as il-lustrated in par. 1.3 and choke the AR73 valve referring to the indicative values shown in table 1.
9) Using the pressure gauge 5, check that the down-stream 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 pres-sure is obtained with the minimum opening possible of the AR73 valve.
10) Open the AR73 (2) valve of the service regulator in position 8.
11) Slowly reduce the pressure of the pilot 3 to the set point of the service regulator.
12) Repeat the operations in point 8 for the pilot 3 and the valve 2.
13) Wait until the downstream pressure settles at the desired value and adjust it as described in point 9.
14) Close the bleed cock 6 and check that the downstream pressure, after a period of increase, stabilizes at a slightly higher value than that of closure of the pilot/monitor 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 value of the installation.
17) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point 9 so as to readjust the setting, increasing the opening of the AR73 valve, or that of the pilot damper device. 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.
18) It is reccommended to check that the flow of the line stops when the slam-shut is tripped manually is recommended.

TAB. 13:	Settings of in-line apparatuses consist+ing of regulator APERVAL + Monitor + Slam-shut + Relief valve				
Regulator set-point (Pas) mbar	Set-point MONITOR	Set-point ACCELERATOR	Set-point RELIEF VALVE	Set-point SLAM-SHUT Max	Set-point SLAM-SHUT Min
5<Pas≤12	Pas + 5 mbar	Pas + 11 mbar	28 mbar	30 mbar	Slam-shut not available
12<Pas≤15					
15<Pas≤19			Pas x 1.8	Pas + 20 mbar	10 mbar
19<Pas≤24					Pas - 10 mbar
24<Pas≤30			Pas x 1.55		
30<Pas≤60			Pas x 1.4	Pas + 30 mbar	
60<Pas≤80					
80<Pas≤110	Pas x 1.15	Pas x 1.25	Pas x 1.3	Pas + 40 mbar	Pas - 20 mbar
110<Pas≤200				Pas x 1.41	Pas - 40 mbar
200<Pas≤400				Pas x 1.41	Pas - 60 mbar
400<Pas≤800	Pas x 1.12			Pas x 1.45	Pas - 100 mbar
800<Pas≤1000					Pas - 200 mbar
1000<Pas≤2500	Pas x 1.05	Pas x 1.12	Pas x 1.16	Pas x 1.4	Pas - 300 mbar
2500<Pas≤5000		Pas x 1.1		Pas x 1.3	
5000<Pas≤6000					Pas - 700 mbar
5000<Pas≤7700				Pas x 1.22	5.8 bar
7700<Pas≤8100		Pas x 1.09	Pas x 1.15		
8100<Pas≤9000				10.5 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 APERVAL REGULATOR (FIG. 23, 28 e 29)

PROBLEM	POSSIBLE CAUSE	APPARATUS	REMEDY
No tightness at Q=0	Valve seat [13]damaged	Regolatore (fig. 23)	Replace
	Diaphragm [20] damaged		Replace
	O-ring [39] damaged		Replace
	O-ring [40] damaged		Replace
	Dirt or foreign bodies in the sealing area		Clean
	Obturator [17] damaged	30./...Pilot (fig. 28)	Replace
	O-ring [54] damaged		Sostituzione
	O-ring [55] damaged		Replace
	O-ring [56] damaged		Replace
Pumping	Opening too small	AR73 (fig. 29)	Increase opening
	Excessive damper opening	30./...Pilot (fig. 28)	Reduce opening

PROBLEM	POSSIBLE CAUSES	APPARATUS	REMEDY
Pa reduction with Q increase	Opening too great	AR73	Reduce opening
Pa pressure increases with Q >0	Diaphragm [20] broken	Regulator (fig. 23)	Replace
	Dirt or foreign bodies in the sealing area		Clean
	Diaphragm [16] broken	30./...Pilot	Replace
	Diaphragm [42] broken		Replace
	Obturator [17] damaged		Replace

6.2 TAB. 15 PM/182 MONITOR (FIG. 25)

PROBLEM	POSSIBLE CAUSE	DEVICE	REMEDY
Pressure increases with Q >0	Diaphragm [25] broken	Pre-regulator RR40	Replace
	Obturator [30] damaged	P...Pilot	Replace
	Obturador [30] blocked in open position		Check and, if necessary, clean
	Diaphragm [23] ruptured		Replace
	Bleed hole blocked		Clean
	Reinforced gasket [7] damaged	Regulator	Replace
	Dirt between the reinforced gasket and the obturator		Clean and check gas filtering
	Obturator blocked		Clean and check the moviments
	Diaphragm fixed incorrectly		Fix
	Downstream sensing line dirty		Clean
	Occlusion of pres. chamber vent nozzle		Clean
	Obturator guide ring [35] damaged		Replace
	Diaphragm broken [42]		Replace

PROBLEM	POSSIBLE CAUSE	DEVICE	REMEDY
Pressure drop	Feed too low	Pre-regulator RR40	Setting modification
	Filter cartridge [104] dirty		Replace
	Occlusion by dirt		Check cartridge [104] filter
	Diaphragm broken [25]		Replace
	Reinforced gasket [30] inflated		Replace
	Diaphragm broken [25]	Pilot P ...	Replace
	Motorisation line to the regulator broken		Repair
	Obturator blocked	Regulator	Clean and verify the moviments
	Diaphragm broken [50]		Replace
	Guide ring [36] damaged		Replace
	Breakage or leakage from vent nozzle calibrated hole screw		Repair
	No pressure upstream		Check cleanliness of line filter cartridges

6.3 TAB. 16 VB/93 SLAM-SHUT (FIG. 24)

PROBLEM	POSSIBLE CAUSE	REMEDY
Slam-shut obturator does not close	Control head diaphragm [16] roptured	Change diaphragm
Leakage from slam-shut obturator	Seal [107] deteriorated	Change seal
	Seal of obturator [104] deteriorated	Change the seat
	O.Ring [93] damaged	Replace
	O.Ring [141] damaged	Replace
Wrong release pressure	Wrong max and/or min. spring setting	Make the setting again by means of the rings [22]and/or [23]
	Friction in the lever mechanism	Change the box containig the whole assembly
Resetting not possible	Persistence of the cause of increase or decrease of the downstream pressure	Decrease or increase the downstream pressure
	Lever mechanism broken or cracked whole assembly.	Change the standard box containing

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 case 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

Before carrying out any operation it is important to ascertain that the regulator has been cut off both upstream and downstream and that the pressure has been discharged in the sections of piping between 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, 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 components relieves us of all responsibility.

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 recommissioning 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 Procedure for disassembling, completely changing the spare parts, and reassembling the APERVAL pressure regulator with 301/A pilot + AR73 (PREVENTATIVE PROGRAMMED MAINTENANCE)

PRELIMINARY OPERATIONS

A. Put the regulator into conditions of safety;

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

DISASSEMBLY AND RE-ASSEMBLY
Single regulator (fig. 23)

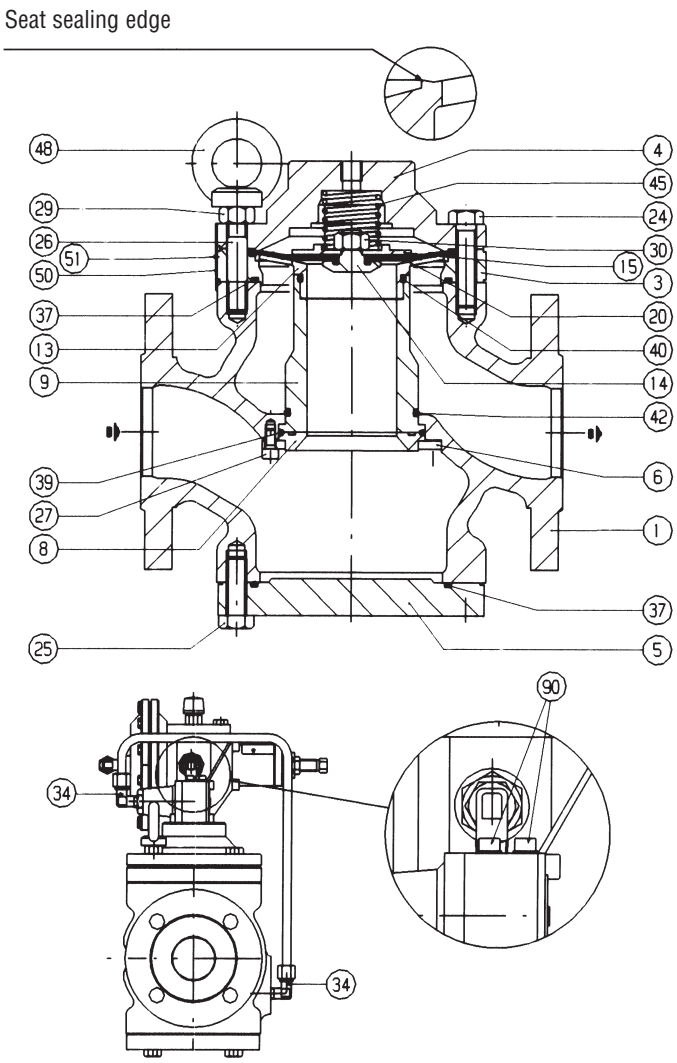
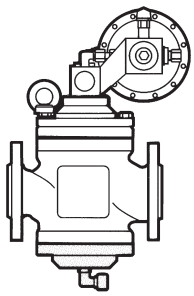


Fig. 23

1) Disconnect the connection pipes between the elbows stream item (34) and between the pilot and the down-line pressure take-offs.
2) Remove the screws item (90) and detach the AR73 + 30./... unit from the regulator cover (4) .
3) Remove the eyebolt (48), the nut (29) and the screws (24) and raise the cover (4) .
4) Remove the diaphragm (20) along with the nut (29), the guard disc (15) and the diaphragm support (14) .
5) Using the flat sides on support (14) , unscrew the nut (30) in order to separate the diaphragm from the other parts.
6) Raise the flange (3) and the seat-grill (13) resting on it, taking a lot of care not to dent the sealing edge of the seat itself.
7) Remove the screws (25) and the blank flange (5) .
8) Remove the screws (27), the retaining ring (6) and the valve seat (8) .
   During this operation it is not necessary to sustain the sleeve (9) manually as the O-ring (42) keeps it in position.
   If you want to remove the sleeve, press it moderately from the top, making sure that it does not fall to the ground.

To reassemble the single monitor, as well as the other components described below, carry out the disassembly operations in the inverse order. Before assembling the sealing elements (O-rings, diaphragms, etc.) check that they are integral and replace them if necessary.
When assembling the diaphragm, check that it is completely inserted into its seat.
The maximum care must be taken when handling the valve seat (13) so as not to damage the sealing edge.

7.3 VB/93 SLAM-SHUT MAINTENANCE PROCEDURE (FIG. 24)



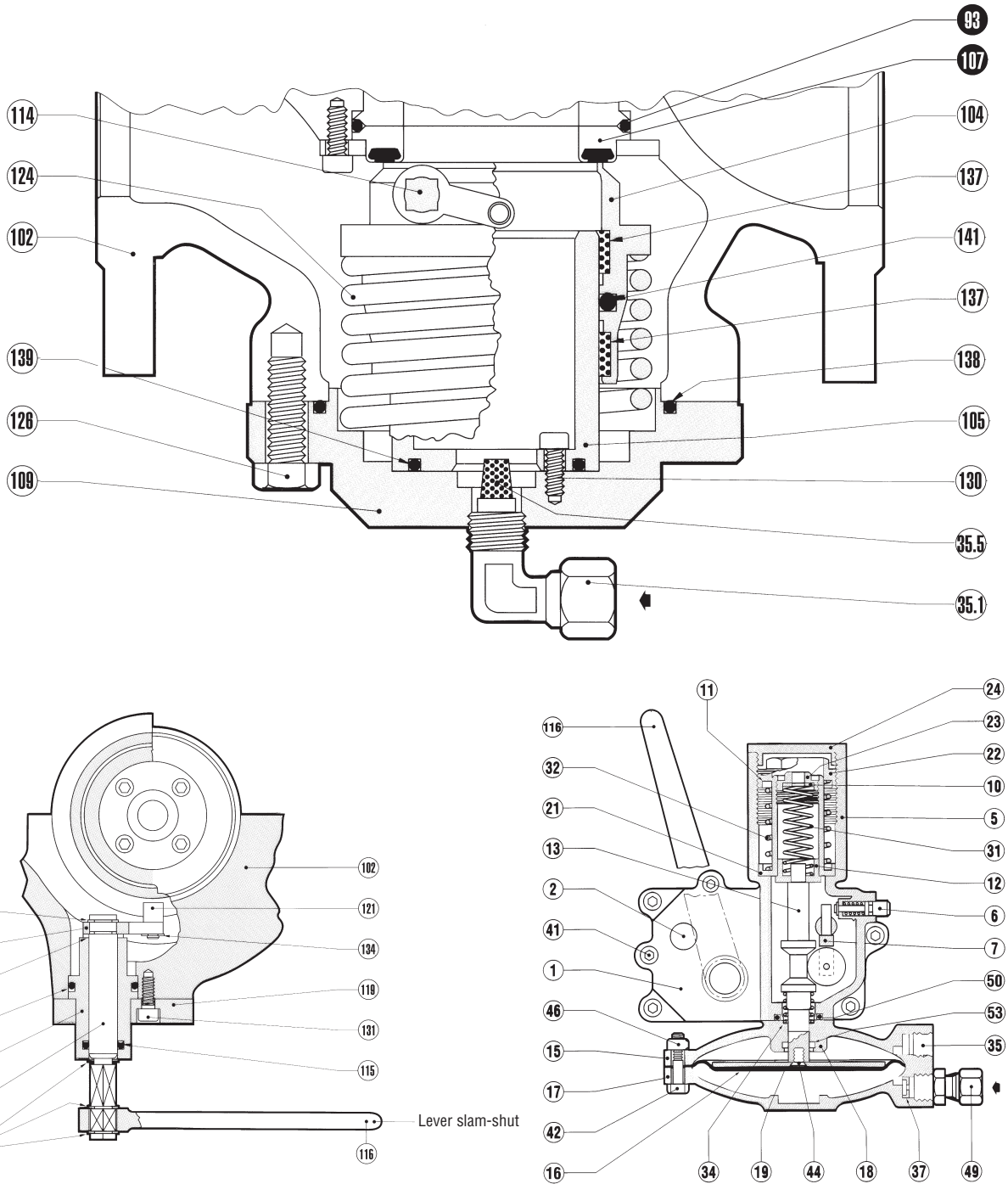


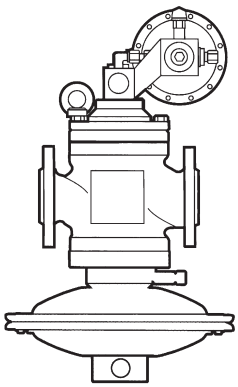
Fig. 24

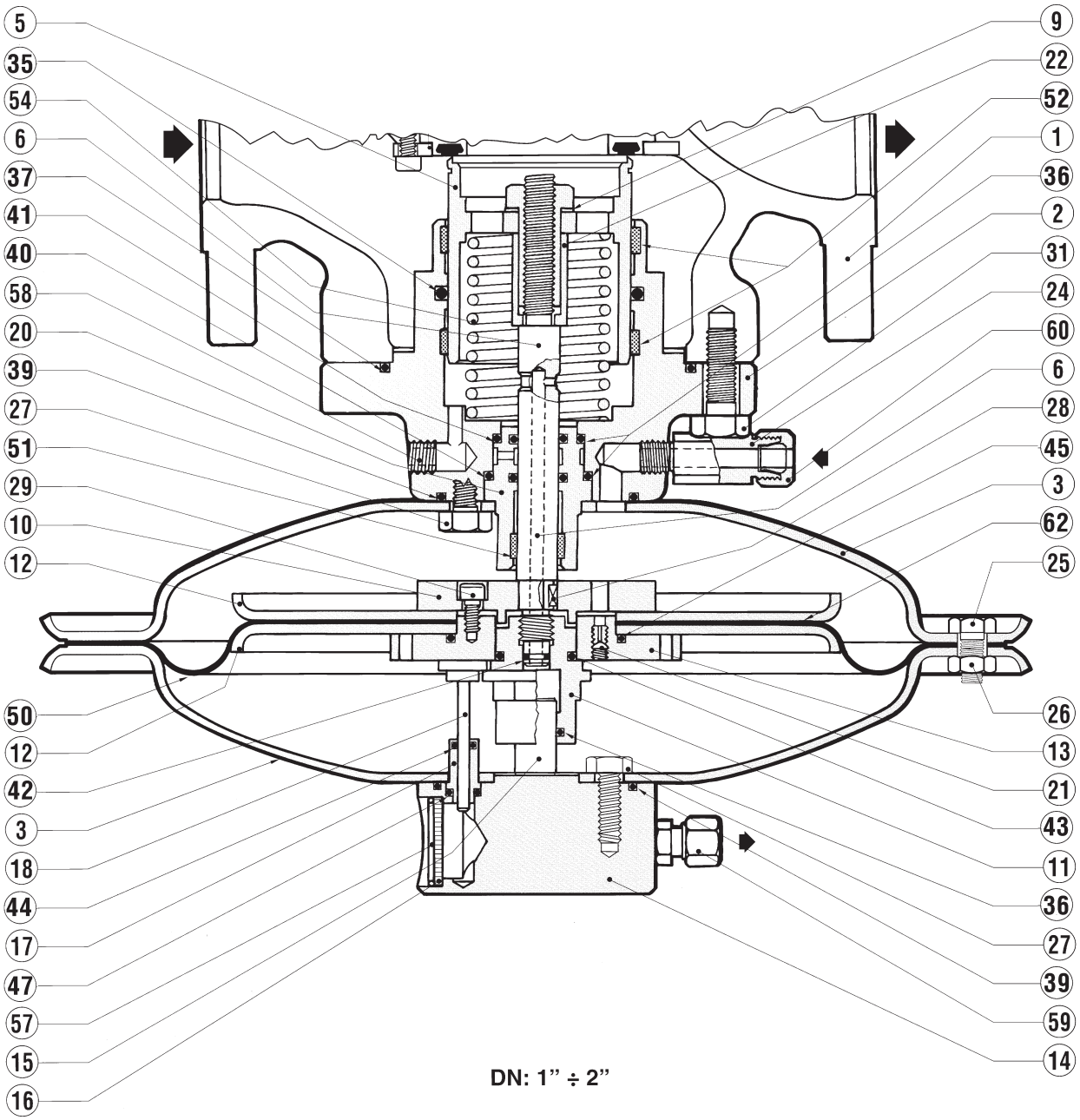
1) Check that the slam-shut is in the closed position.
2) Disconnect the connection pipes between the elbows (35) and the pilot and between the slam-shut head and the downstream pressure take-offs.
3) Using a screwdriver, remove the elastic rings (135) and remove the lever (116).
4) Remove the screws which retain the pressure switch device to the regulator and then remove the device itself from the guide shaft (112).
5) Remove the screws (131) and the small flange (119).
6) Remove the shaft guide (112) from the body; then remove the shaft (114) and lever (118) assembly.
7) Slacken the screws (126) so as to partially unload the spring (124) ; before completely removing them, ensure that the weight of the flange (109) , of the obturator guide (105) and of the obturator (104) can be adequately sustained. When removing this assembly, great care must be taken so as not to damage the sealing edge of the obturator.
8) Remove the screws (130) to separate the flange (109) from the obturator guide (105).
9) Slacken the screws (42) from the pressure switch device, and remove the cover (17) .

Take the following precautions during reassembly:

- install the shaft (114) and lever (118) assembly first;
- when installing the obturator assembly into the body, keep the movement well in line to avoid denting the sealing edge, and take particular care to keep the shaft (114) completely turned anticlockwise;
- fit the small flange (119) and associated components;
- to position the pressure switch device correctly, turn the shaft as far as possible clockwise this time. Then insert the device and secure it to the bodies with the associated screws;
- fit the lever (116) onto the shaft (114). It is important to ensure that when the slam-shut opens it is positioned horizontally and is virtually vertical when the slam-shut is closed.

7.4 PM/182 MONITOR MAINTENANCE PROCEDURE (FIG. 25)





DN: 1" ÷ 2"

Fig. 25

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) With a sharp blow, slacken the lock nut (9) and unscrew it completely to unload the spring (54); then remove the obturator (5) with the spacer (22) from the obturator guide (2).
5) Remove the screws (25) and the nuts (26) from the control head (2).
6) Raise the top cover (3) with the flange (14) and the indicator rod guide (17). To separate the three parts, unscrew the screws (27).
7) Separate the parts (11) and (13) making use of the flat faces on the piston guide (11) and the holes on the disc (13).
8) Raise the assembly composed of the diaphragm (50) and the discs (10), (12) and (13); disassemble the diaphragm (50) by removing the screws (23).
9) Remove the stem (6) from the side of the cover.
10) 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 (18), ensure that the washer of the indicator rod 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 (54) spring is properly housed in the special centring beat on the obturator guide (2);
- take care not to fit the spacer (22) upside-down.

7.5 MANTENANCE PROCEDURE

DB/93 silencer (fig. 26)

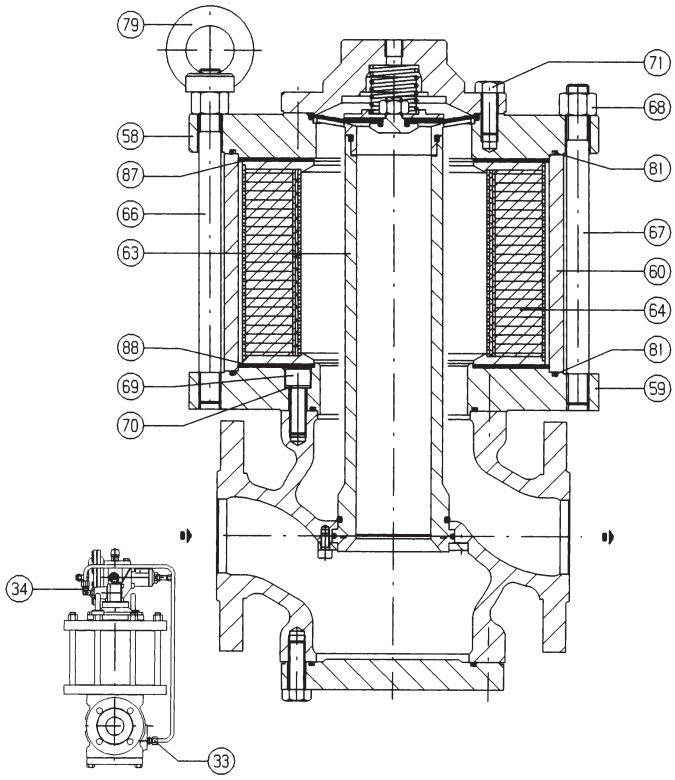


Fig. 26

1) Disconnect the connection pipes between the fittings (33) and (34), and between the pilot and the downstream pressure take-off.
2) Remove the screws (90) (fig. 23) and detach the AR73/ + 30./... assembly from the cover (4) of the regulator.
3) Remove the screws (71) and raise the cover.
4) Repeat the operations from 4 to 8 of page 47.
5) Unscrew the eyebolts (79) and the nuts (68), and raise the flange (58).
6) Remove the basket (64) with the seals (87) and (88).
7) Remove the stay bolts (66) and (67) and the plating (60) .
8) Remove the screws (69) , the washers (70) and then the flange (59) .

It should be remembered that the washers (70) , having been removed, are no longer able to guarantee tightness and must therefore be replaced with new washers.
When reassembling the basket (64) , make sure that its support with the lesser diameter is turned towards the flange (59).

Pilot 3...+ AR73

(fig. 27)

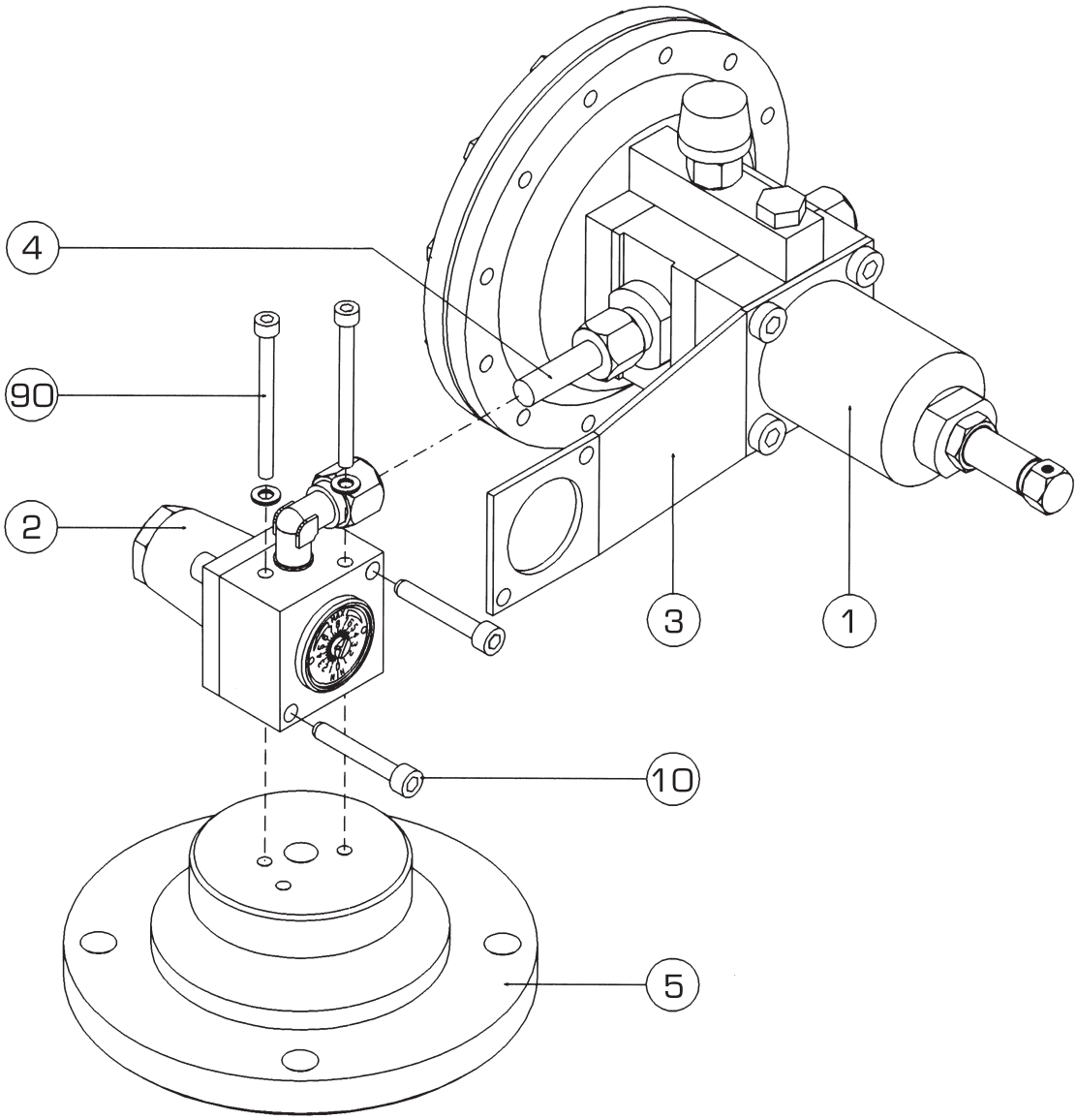
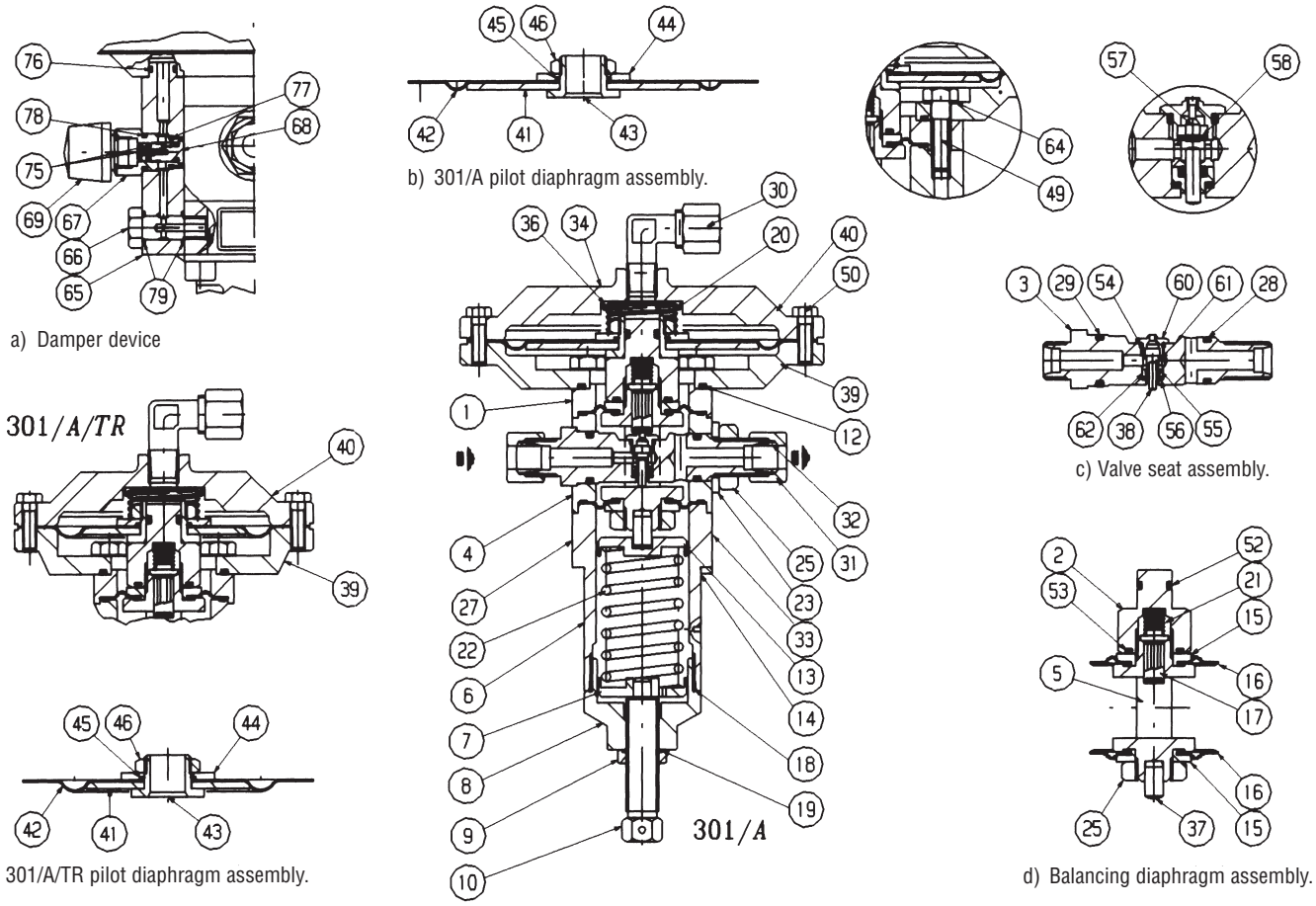


Fig. 27

1) Disconnect the connection pipes between the pilot assembly and the pressure take-offs upstream and downstream.
2) Remove the screws (90) to separate the assembly from the cover (5).
3) Slacken one of the nuts which secure the connection pipe (4) and remove the screws (10). In this way, the pilot (1) with the bracket (3) is separated from the regulating valve (2).

Series 3...pilots

(fig. 28)



a) Damper device

b) 301/A pilot diaphragm assembly.

c) Valve seat assembly.

301/A/TR pilot diaphragm assembly.

d) Balancing diaphragm assembly.

Fig. 28

1) Slacken the nut (9) and unscrew the screw (10) to completely unload the spring (22) .
2) Completely unscrew the plug (8) and remove the spring support (7), the spring (22) and the support (13) from the sleeve.
3) Remove the screw (66) and disassemble the damper assembly (7). To separate the parts, unscrew the fitting (67) and remove the nozzle (68) from it along with the associated O-rings.
4) Remove the screws (24) and the sleeve (6).
5) Remove the screws (50) and the top cover (40).
6) From the head, remove the disc (36) , the spring (20) and the diaphragm assembly. Then disassemble the latter by slackening the nut (46) from the bushing (43).

7) Remove the screws (49), the bottom cover (39) and the spacer (1).
8) From the body (4) remove the shaft and valve seat assembly, taking a lot of care not to damage the valve seat (60). With the pilots 302/A and 301/A/TR it is necessary to ensure that the modulating piston (57) does not protrude from the valve seat (60). This can be obtained, before removal, by lightly pressing the diaphragm support (2) downwards and, during removal, by keeping the valve seat (60) turned vertically upwards. To disassemble this assembly, unscrew the seat (60) and remove the parts (61), (62) and (38).
9) From the body, remove the diaphragm assembly. To disassemble the two diaphragms, insert a lever (pipe, bar, etc.) in the hole of the diaphragm support (5) and unscrew the nut (25) and the support (2). Then remove the obturator (17) and the spring (21).

REASSEMBLY

It is recommended to separately assemble the different assemblies of parts as shown in fig. 28, a, b, c and d, to facilitate pilot reassembly.
Then carry out the operations described for disassembly in the inverse order, starting from the diaphragm assembly. When installing the valve seat assembly, it is indispensable to take the same precautions taken during disassembly. Furthermore, before securing the bottom cover (39) with the screws (49), it is necessary to check that the axis of the hole of the diaphragm support (5) is as parallel as possible to the axis of shaft (3). The check is carried out by raising the edge of the diaphragm (16) from the body.
Before definitively securing the cover (39), insert the damper device in the provided hole in the cover itself.
It should be remembered, finally, that the copper washers (64) must be replaced after every disassembly to guarantee tightness.

AR73 flow regulating valve
(fig. 29-30)

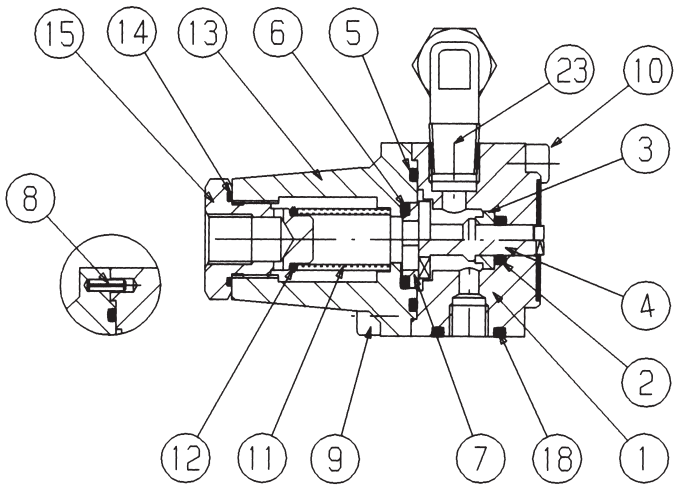


Fig. 29

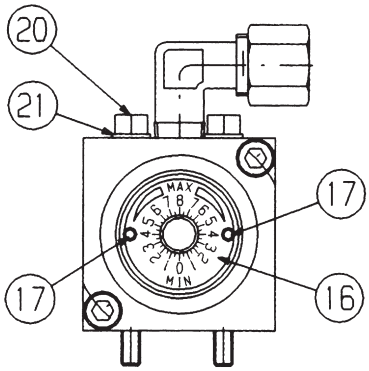


Fig. 30

1) Remove the screws (9) and (10) and separate the body (1) from the sleeve (13).
2) Remove the regulating pin (4) and the bushing (3) from the body.
3) Disassemble the valve seat (7) from the sleeve and, after unscrewing the plug (15), the filter (11).

When reassembling, the reference pin (8) guarantees the correct reciprocal positioning of the sleeve and the body.

REASSEMBLING THE PILOT ASSEMBLY

1) Reconnect the connection nipples between the pilot and the flow regulator valve, screwing in the taper seal connectors.

8.0 FINAL OPERATIONS

1) Fit the pilot assembly onto the regulator.
2) Fix the nut of the bracket fixing the pilot to the regulator.
3) Reconnect all the feed and sensing line connectors, screwing in the taper seal connectors.

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 FOR APERVAL PRESSURE REGULATORS

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		

APERVAL

Type	DN	1"	1"½	2"	2"½	3"	4"
A	Ch.	13-17-18 19-24-27	13-17-18 19-24-27	17-18 19-24-27	17-18 19-24-27	17-18 19-24-27	17-18 19-24-27-32
B	L.	300					
D	Ch.	10-13-15-17	10-13-15-17	10-13-15-17	10-13-15-17	10-13-15-17	10-13-15-17
E	Ch.	4-5	4-5	4-5	4-5	4-5	4-5
F	Ch.	5-6	5-6	5-6	5-6	5-6	5-6-14
I	L.	6,5x100					
L	Cod	7999099					

APERVAL + VB/93

Type	DN	1"	1"½	2"	2"½	3"	4"
A	Ch.	13-17-18 19-22-24-27	13-17-18-19 22-24-27	17-18-19 22-24-27	17-18-19 22-24-27	17-18-19 22-24-27	17-18-19 22-24-27-32
B	L.	300					
D	Ch.	10-13-15-17	10-13-15-17	10-13-15-17	10-13-15-17	10-13-15-17	10-13-15-17
E	Ch.	4-5	4-5	4-5	4-5	4-5	4-5
F	Ch.	5-6	4-5-6	4-5-6	4-5-6	4-5-6	4-5-6-14
I	L.	6,5x100					
L	Cod	7999099					

TAB. 18 MAINTENANCE WRENCHES FOR APERVAL PRESSURE REGULATORS

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		

APERVAL + DB/93

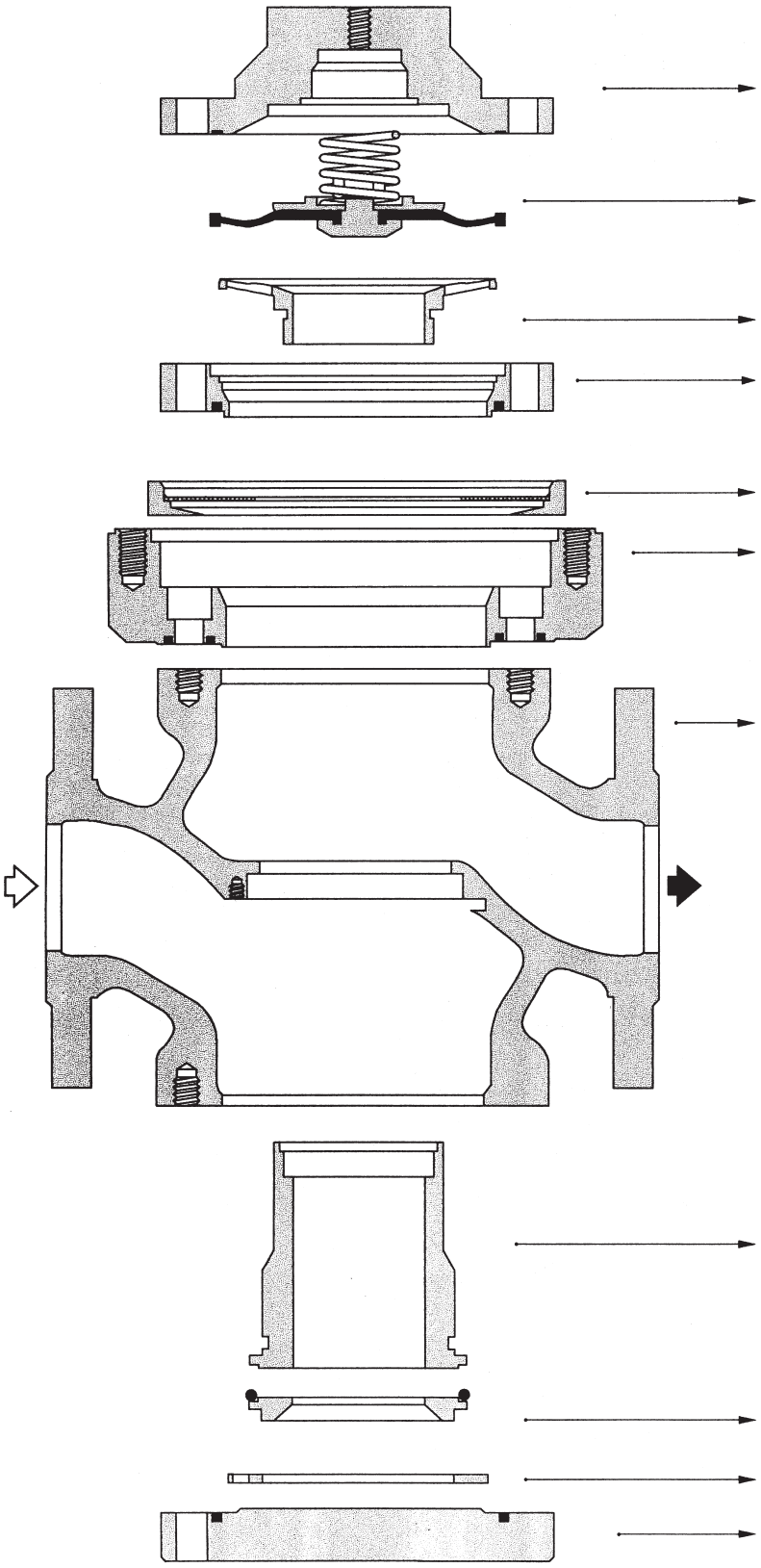
Type	DN	1”	1”½	2”	2”½	3”	4”
A	Ch.	13-17-18-19 21-24-27	13-17-18-19 24-27	17-18-19 24-27	17-18-19 24-27	17-18-19 24-27	17-18-19-24 27-30-32
B	L.	300					
D	Ch.	10-13-15-17	10-13-15-17	10-13-15-17	10-13-15-17	10-13-15-17	10-13-15-17
E	Ch.	4-5	4-5	4-5	4-5	4-5	4-5
F	Ch.	5-6-8	5-6-8	5-6-10	5-6-10	5-6-10	5-6-14
I	L.	6,5x100					
L	Cod	7999099					

APERVAL + PM/182

Type	DN	1”	1”½	2”	2”½	3”	4”
A	Ch.	13-17-18-19 24-27-30	13-17-18-19 24-27-30	17-18-19 24-27-30	17-18-19-22 24-27-30	17-18-19-22 24-27-30	17-18-19-22 24-27-30-32
B	L.	300					
C	ø			4			
D	Ch.	10-13-15-17-20	10-13-15-17-20	10-13-15-17-19	10-13-15-17-18	10-13-15-17-18	10-13-15-17-18
E	Ch.	4-5-8	4-5-8	4-5-8	4-5-8	4-5-8	4-5-8
F	Ch.	5-6	5-6	5-6	5-6	5-6	5-6-14
I	L.	6,5x100					
L	Cod	7999099					

9.0 WEIGHT OF THE COMPONENTS

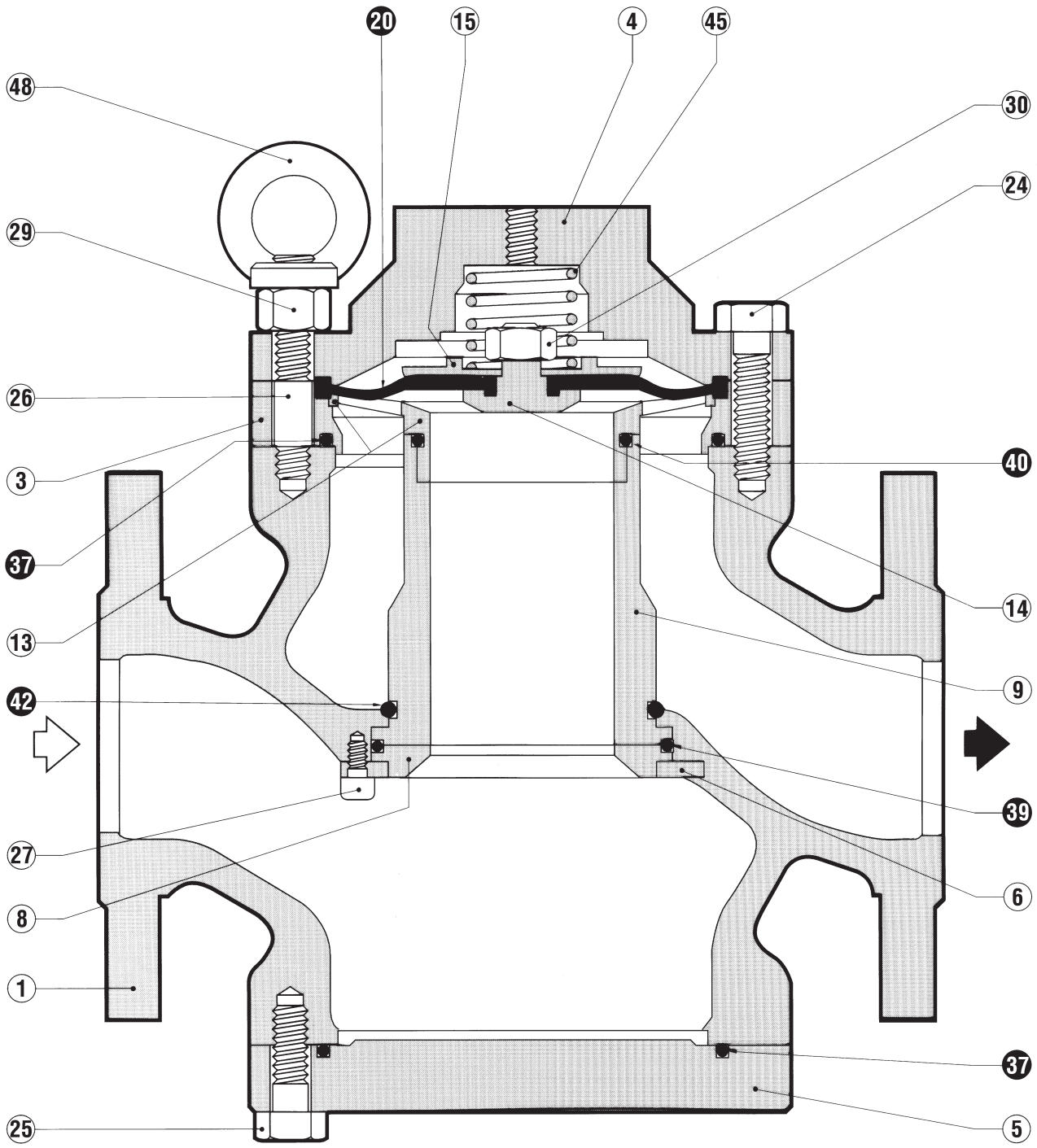
9.1 TAB. 19 WEIGHT OF THE COMPONENTS IN KG.



DN	1”	1” ½	2”	2” ½	3”	4”
	1,500	3,200	3,300	3,800	5,600	16,200
	0,450	0,500	0,650	0,600	0,750	0,800
	0,150	0,230	0,270	0,300	0,500	1,300
	0,820	1,400	1,500	2	2,600	-
	-	-	-	-	-	1,600
	-	-	-	-	-	17
	8,900	13,800	18	21	31	47
	0,600	1,200	1,500	2,300	3	6,500
	0,100	0,170	0,200	0,300	0,400	0,600
	0,100	0,140	0,150	0,250	0,300	0,500
	1,400	2,400	3	3,800	6	10

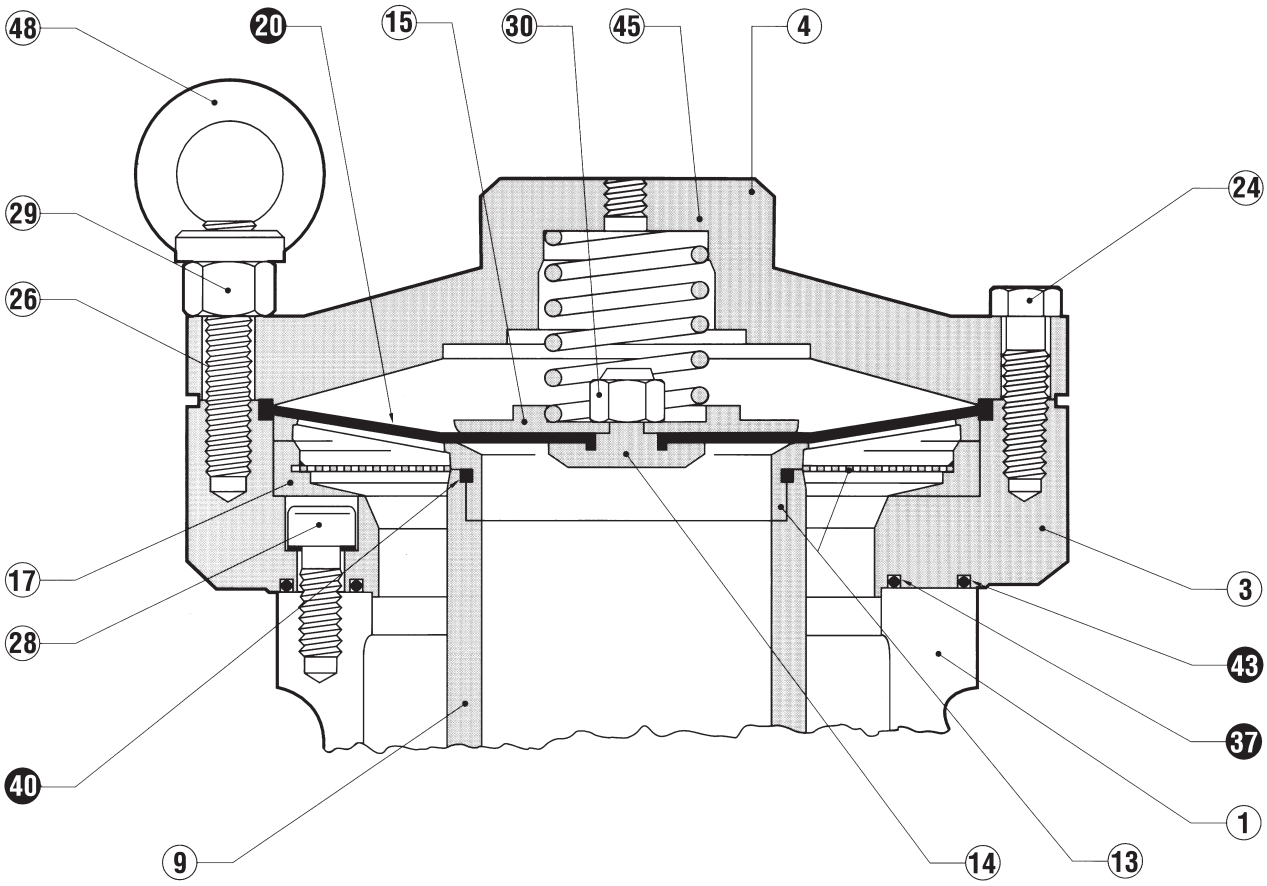
10.0 LIST OF RECOMMENDED SPARES

APERVAL PRESSSURE REGULATOR



DN 1" ÷ 3"
Fig. A

VERSION



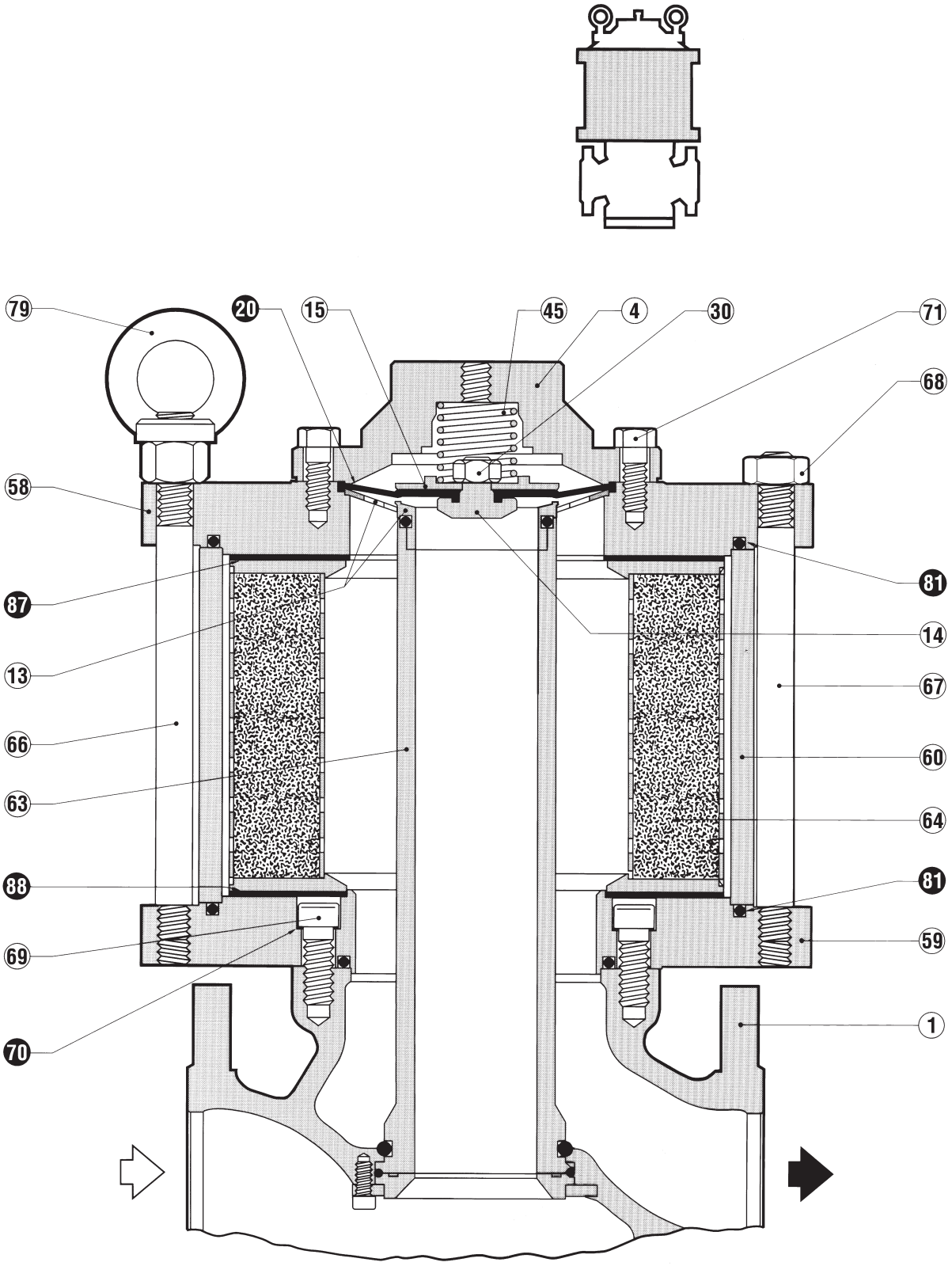
DN 4”

Fig. B

APERVAL POS.	DESCRIPTION	N. OF PIECES DN 1” ÷ 3”	N. OF PIECES DN 4”
20	Diaphragm	1	1
37	O. Ring	2	2
39	O. Ring	1	1
40	O. Ring	1	1
42	O. Ring	1	1
43	O. Ring	-	1

The eyebolts assembly position 48 is only indicative.

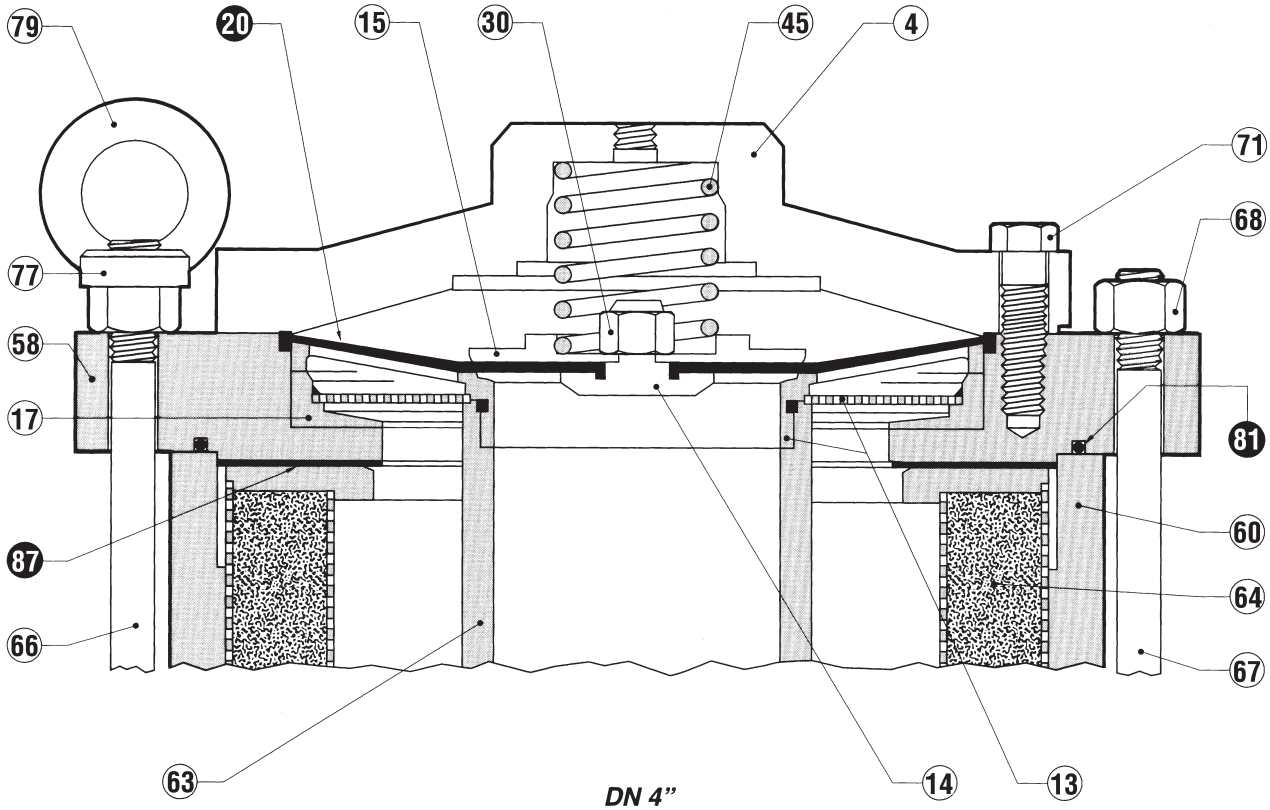
...+ DB/93 SILENCER



DN: 1" ÷ 3"

Fig. C

VERSION



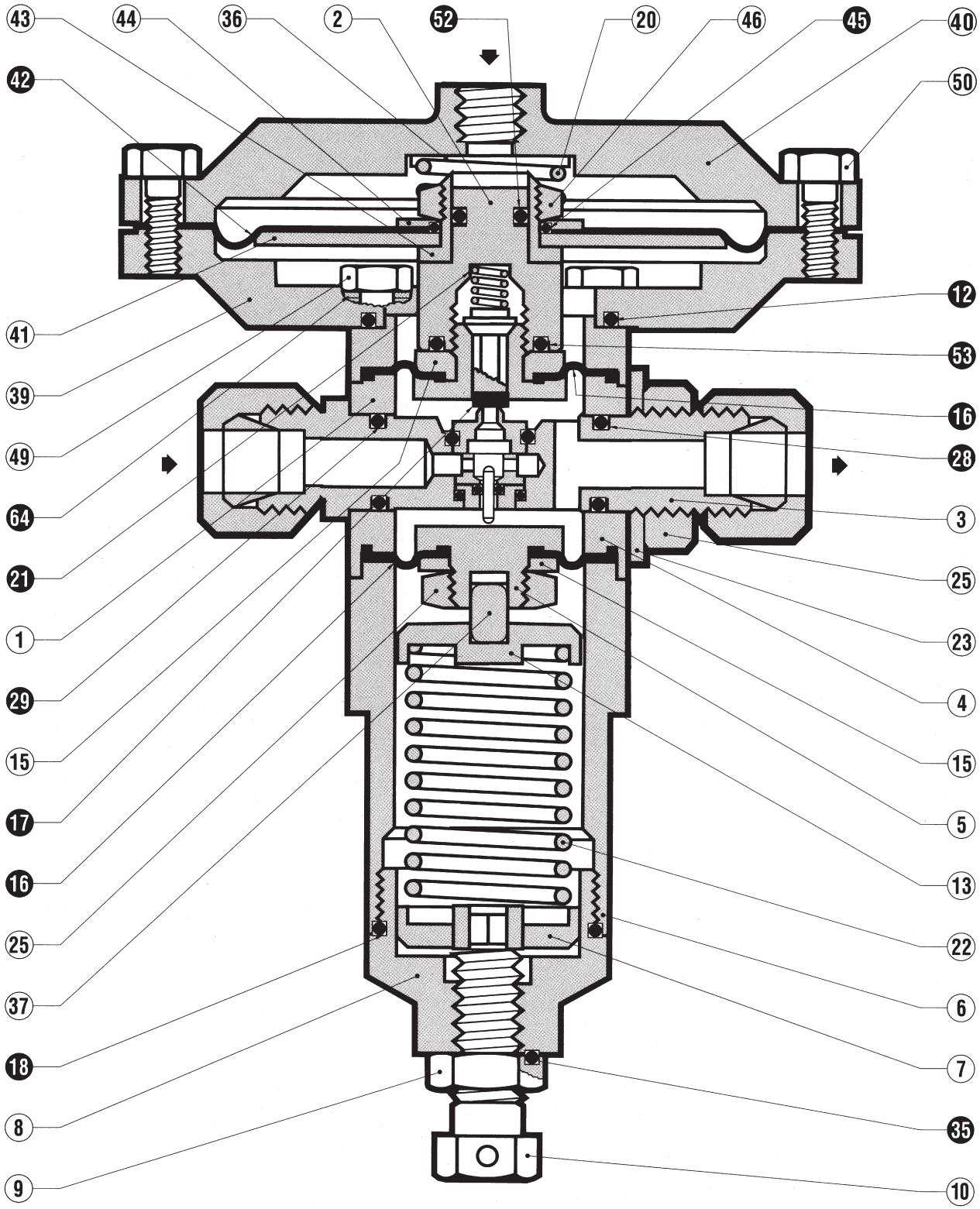
DN 4”

Fig. D

POS.	DESCRIPTION	N. OF PIECES DN 1” ÷ 3”	N. OF PIECES DN 4”
70	Copper	4	-
81	O. Ring	2	2
87	Gasket	1	1
88	Gasket	1	1

...+ DB/93

PILOTS



301/A

Fig. A

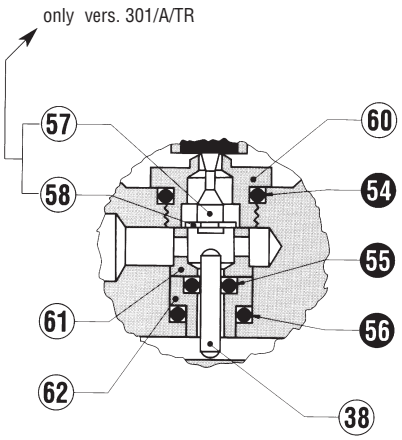


Fig. B

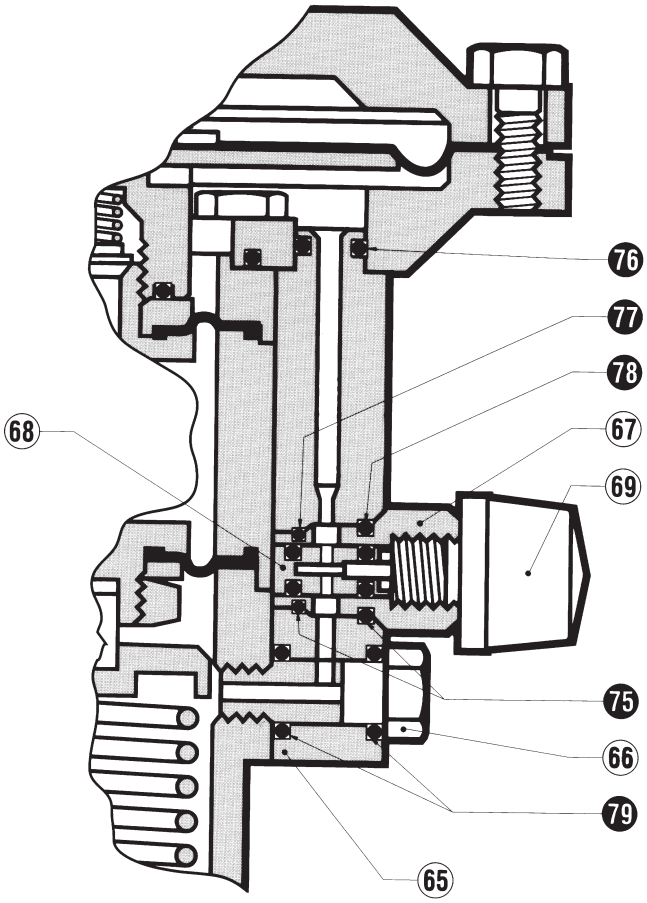


Fig. C

VERSION
301/A/TR

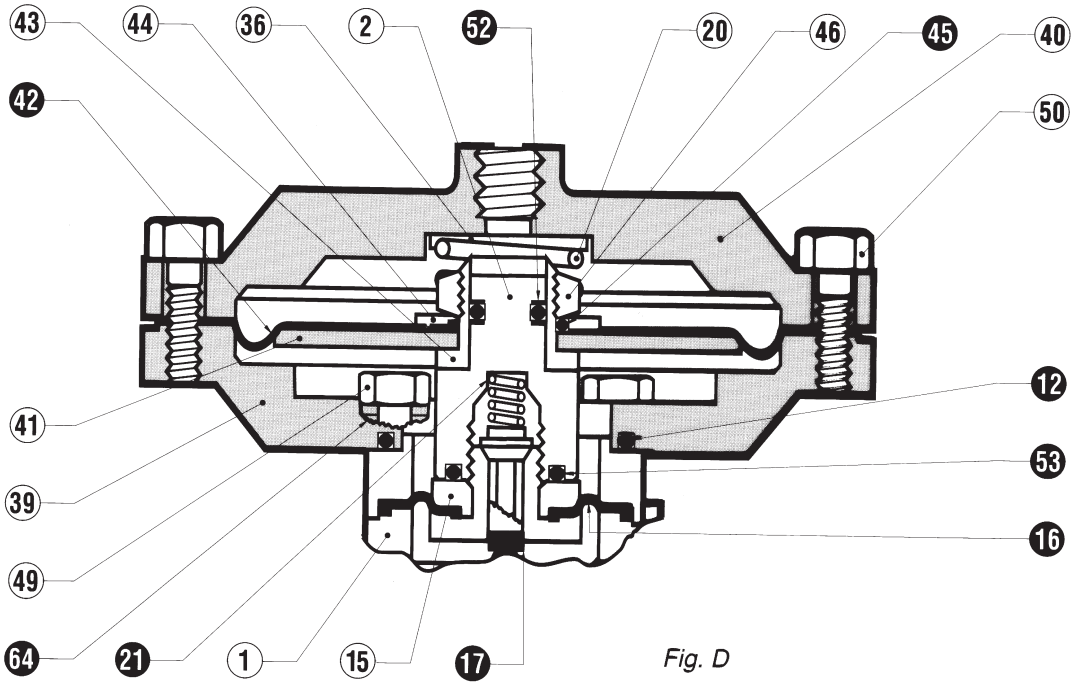
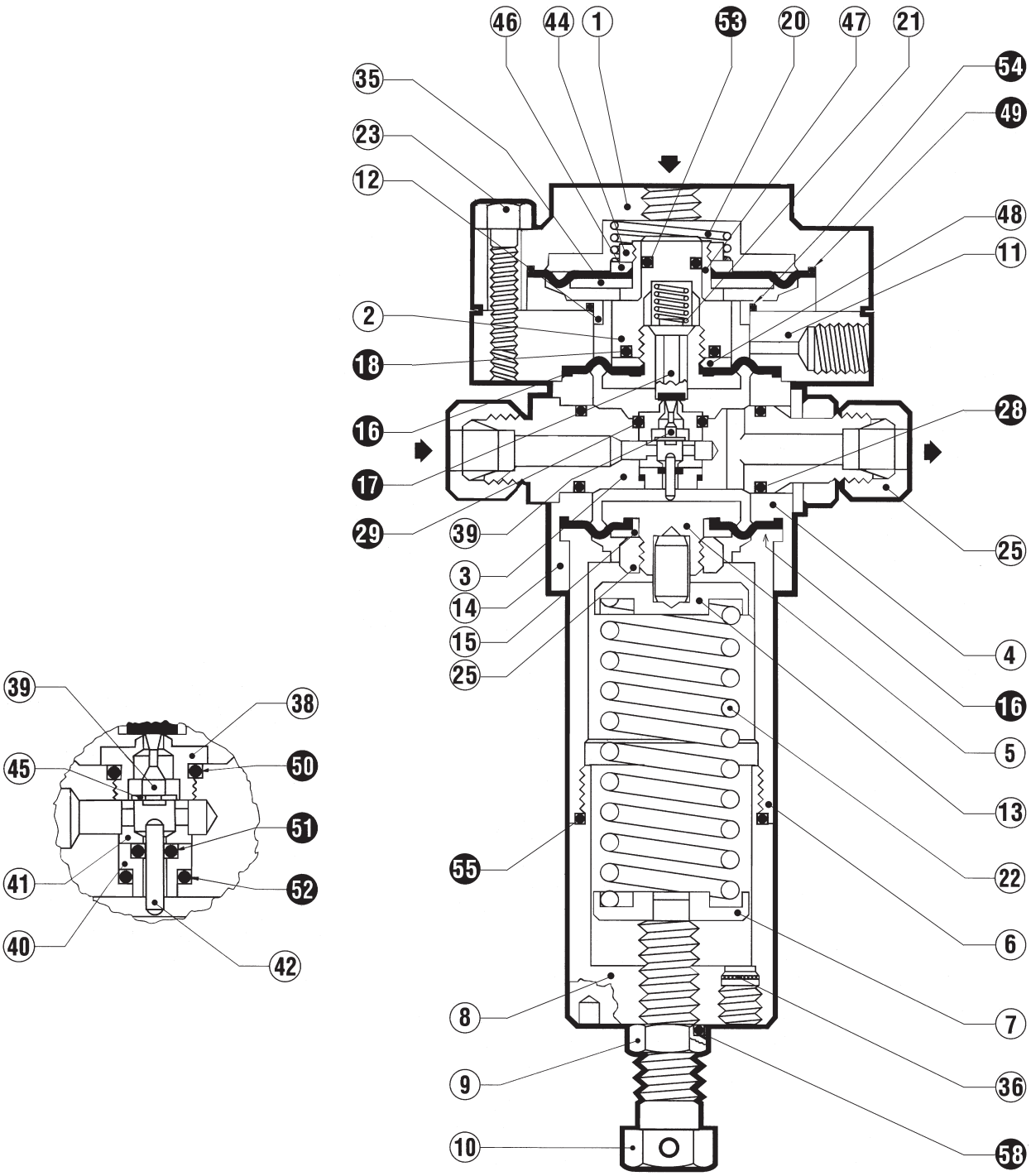


Fig. D



302/A

PILOTS

POS.	DESCRIPTION	N. OF PIECES Pilot 301/A	Pilot 301/A/TR	Pilot 302/A
12	O. Ring	1	1	
16	Diaphragm	1	1	2
17	PLug	1	1	1
18	O. Ring	1	1	1
28	O. Ring	1	1	1
29	O. Ring	1	1	1
35	O. Ring	1	1	
42	Diaphragm	1	1	
45	O. Ring	1	1	
49	Diaphragm			1
50	O. Ring			1
51	O. Ring			1
52	O. Ring	1	1	1
53	O. Ring	1	1	1
54	O. Ring	1	1	1
55	O. Ring	1	1	1
56	O. Ring	1	1	
58	O. Ring			1
64	Copper	4	4	
75	O. Ring	2	2	
76	O. Ring	1	1	
77	O. Ring	1	1	
78	O. Ring	1	1	
79	O. Ring	2	2	

FLOW REGULATING VALVE AR73

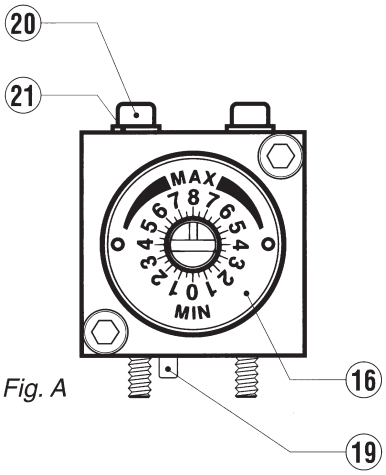


Fig. A

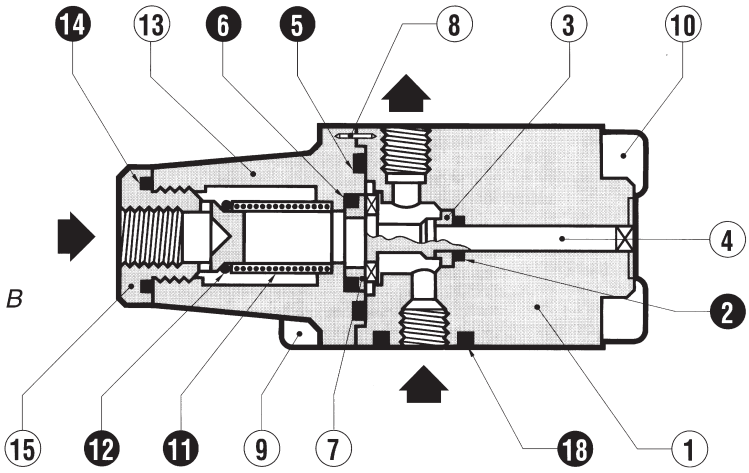
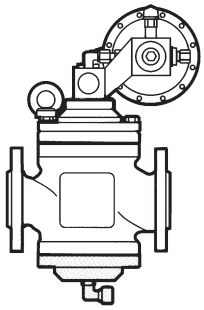
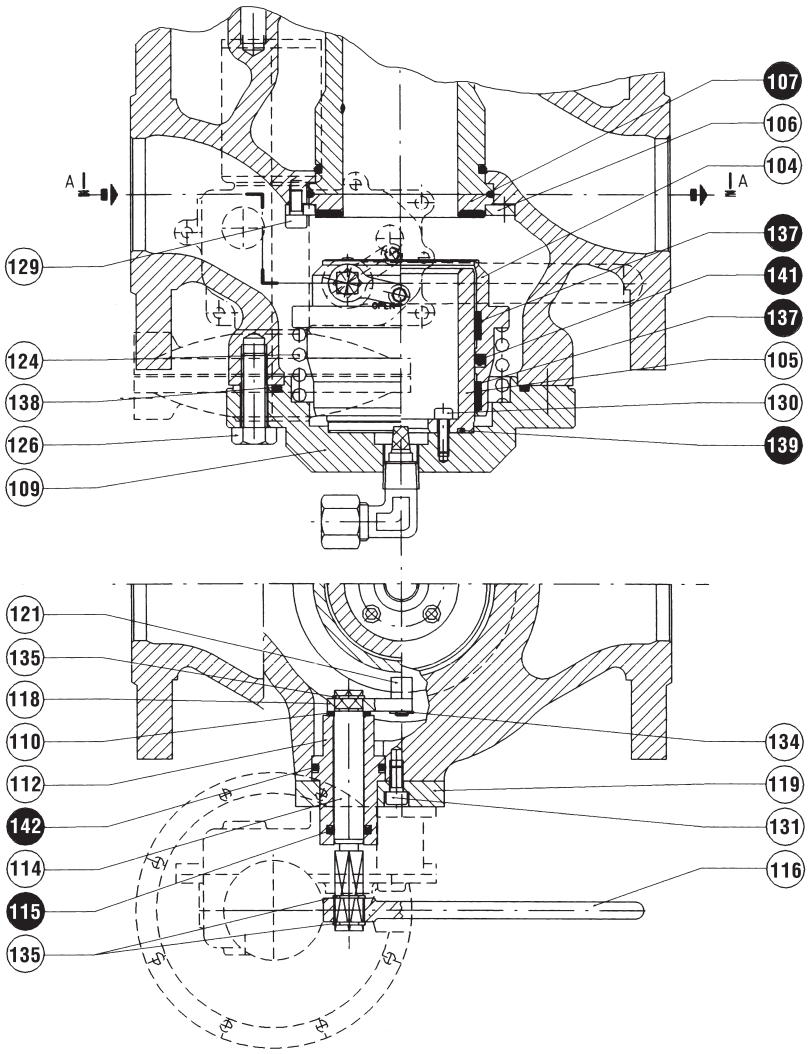


Fig. B

	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

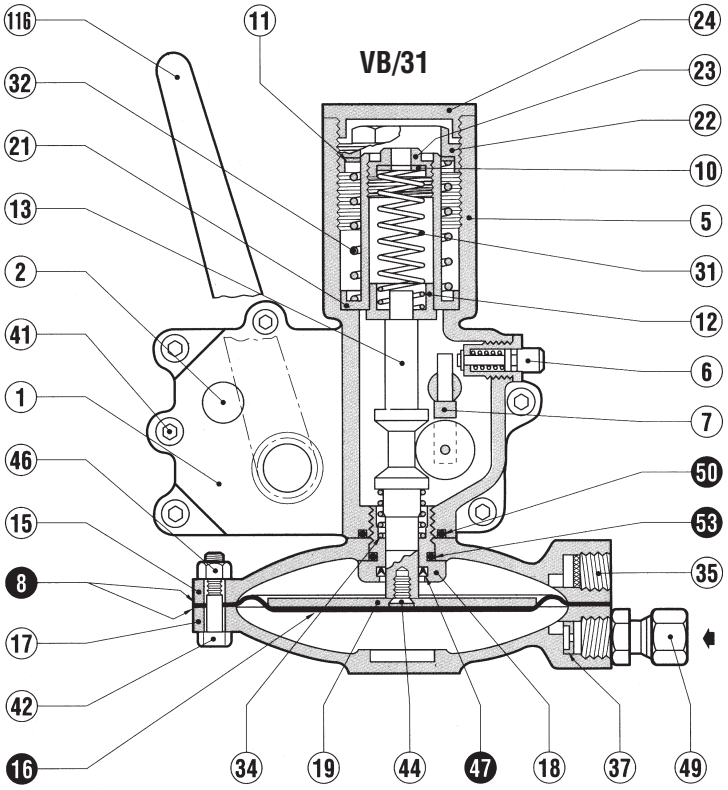
+VB/93 SLAM-SHUT



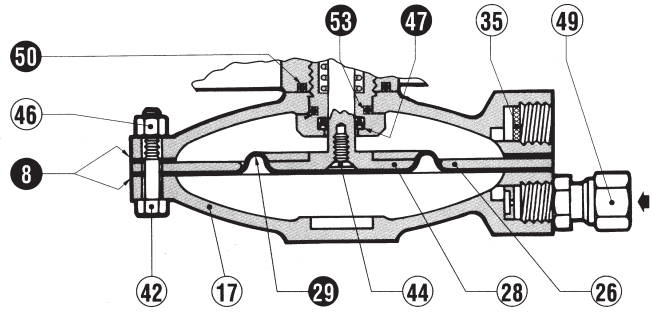


	POS.	DESCRIPTION	N. OF PIECES DN 2" ÷ 4"
...+ VB/93	**107**	Gasket	1
	115	Sealing U - Ring	1
	137	Guide ring	2
	139	O. Ring	1
	141	O. Ring	1
	142	O. Ring	1

CONTROL DEVICE

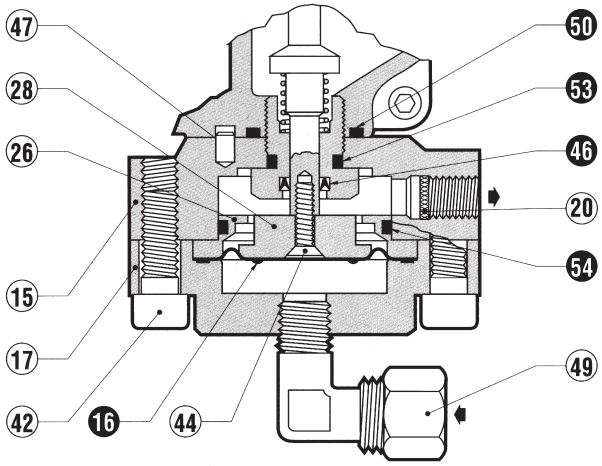


	POS.	DESCRIPTION	DN	N. OF PIECES 1" ÷ 4"
VB/31	8	Gasket		2
	16	Diaphragm		1
	47	Sealing U		1
	50	O. Ring		1
	53	O. Ring		1



VB/32

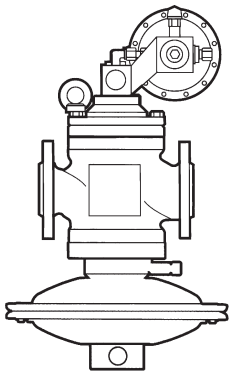
	POS.	DESCRIPTION	DN	N. OF PIECES 1" ÷ 4"
VB/32	8	Gasket		2
	29	Diaphragm		1
	47	Sealing U		1
	50	O. Ring		1
	53	O. Ring		1

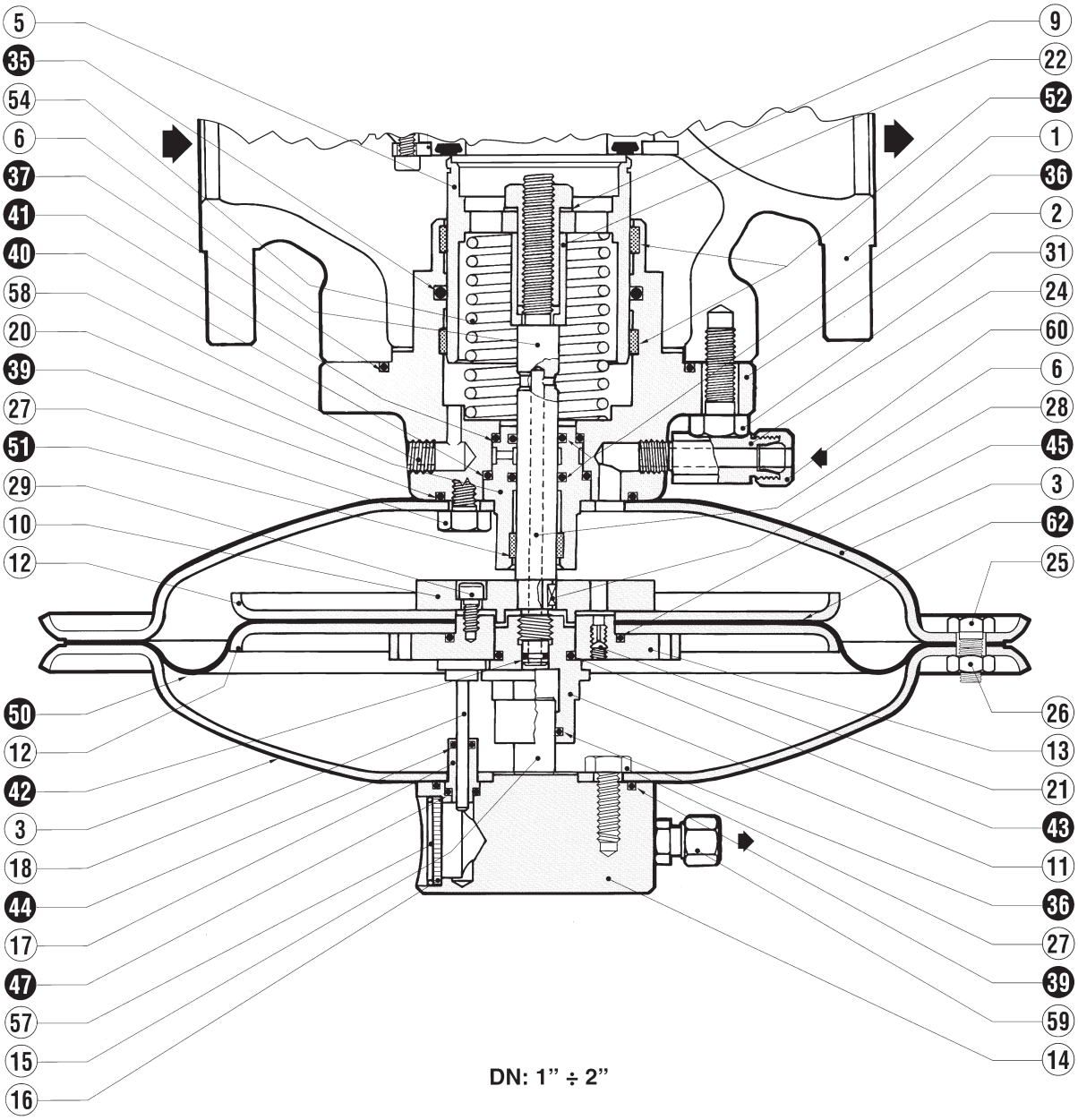


VB/33

	POS.	DESCRIPTION	DN	N. OF PIECES 1" ÷ 4"
VB/33	16	Diaphragm		1
	46	Sealing U		1
	50	O. Ring		1
	53	O. Ring		1

PM/182 MONITOR



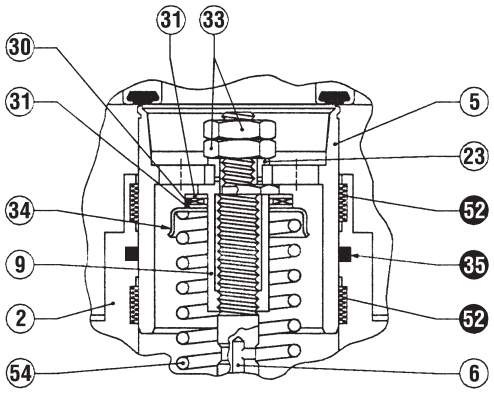


DN: 1” ÷ 2”

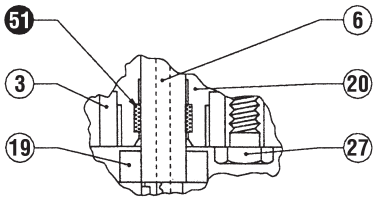
VERSION

MONITOR PM/182

POS.	DESCRIPTION	N. OF PIECES DN 1" ÷ 4"
35	O. Ring	1
36	O. Ring	3
39	O. Ring	2
40	O. Ring	1
41	O. Ring	1
42	O. Ring	1
43	O. Ring	1
44	O. Ring	1
45	O. Ring	1
47	O. Ring	1
50	Diaphragm	1
51	Guide ring	1
52	Guide ring	2
62	Rubber gasket	2

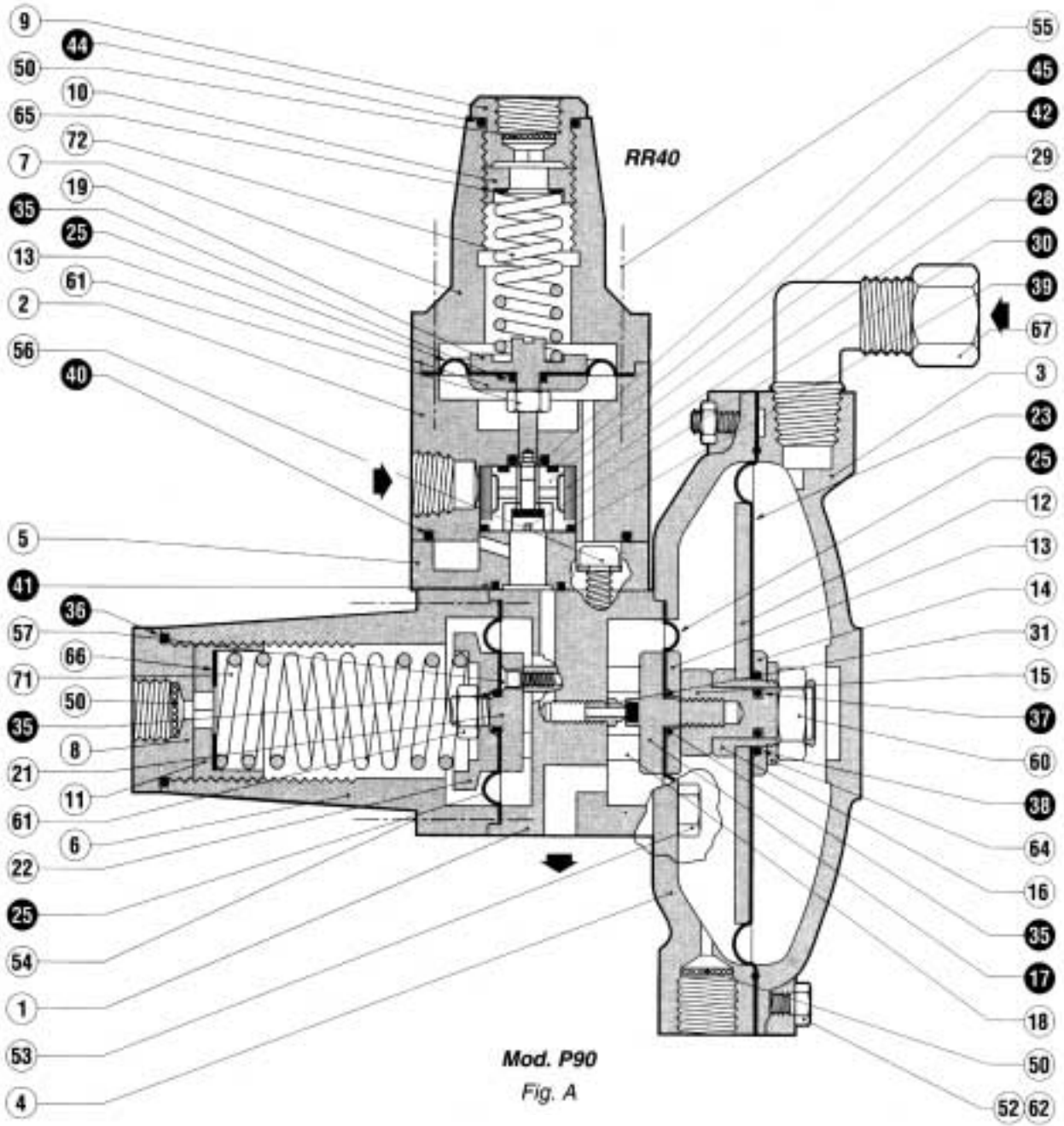


DN: 2" ½ ÷ 4"



DN: 2" ½ ÷ 4"

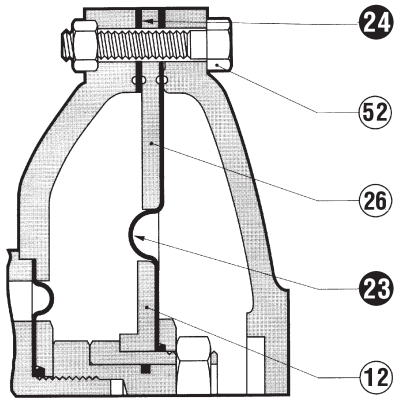
Mod P90/P92 VERSION PILOT + RR40 PRE-REGULATOR



Mod. P90

Fig. A

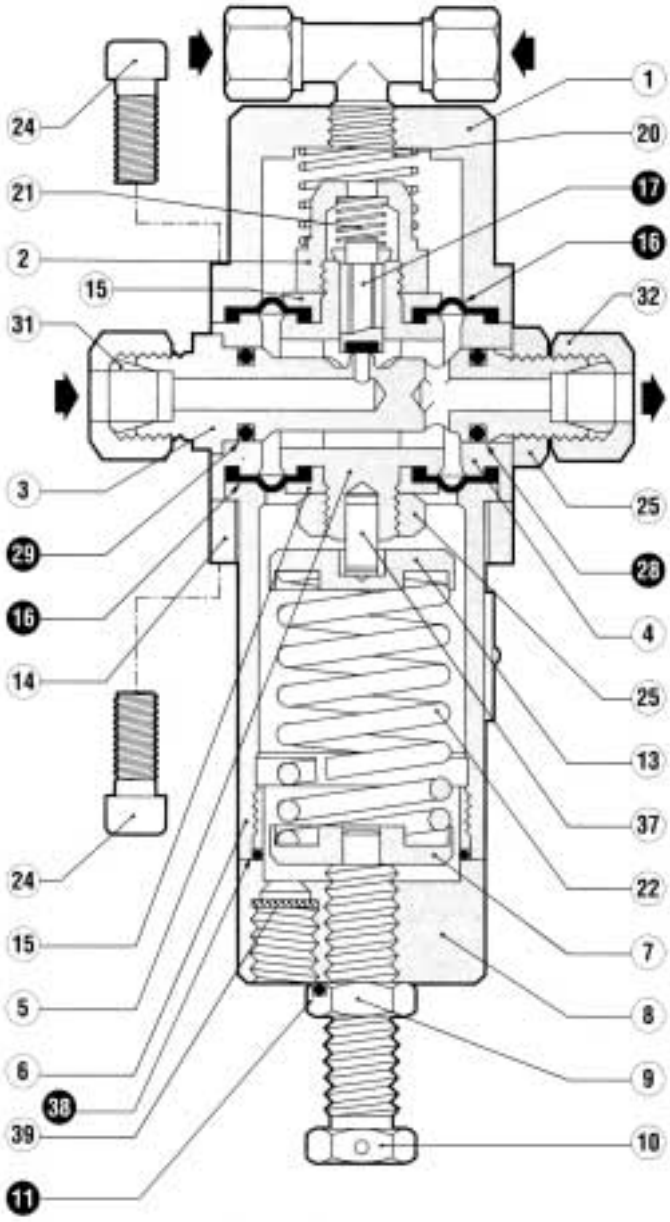
VERSION



Mod. P92

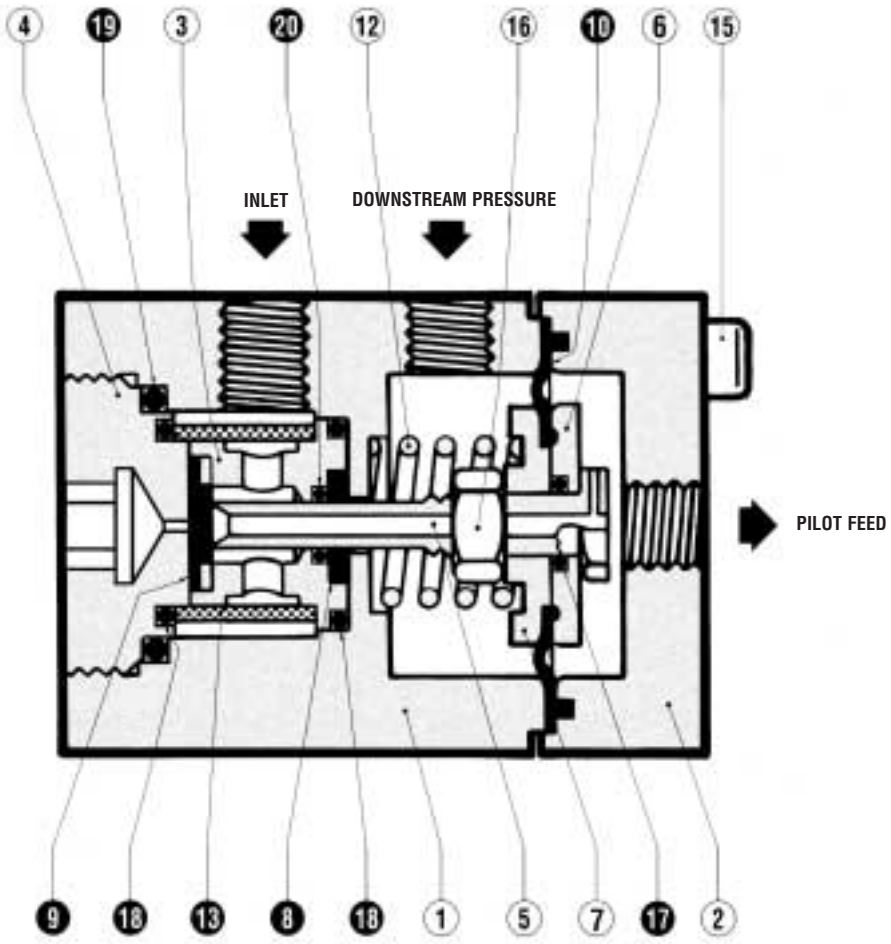
	POS.	DESCRIPTION	N. OF PIECES P90	N. OF PIECES P92
PILOTS	17	Obturator	1	1
	23	Diaphragm	1	1
	24	Gasket	-	1
	25	Gasket	3	3
	28	Filter	1	1
	30	Obturator	1	1
	35	O. Ring	3	3
	36	O. Ring	1	1
	37	O. Ring	1	1
	38	O. Ring	1	1
	39	O. Ring	1	1
	40	O. Ring	1	1
	41	O. Ring	1	1
	42	O. Ring	1	1
	44	O. Ring	1	1
	45	O. Ring	1	1

PILOT 204/A



POS.	DESCRIPTION	N. OF PIECES
11	O. Ring	1
16	Diaphragm	2
17	Obturator	1
28	O. Ring	1
29	O. Ring	1
38	O. Ring	1

R14/A PRE-REGULATOR



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 REGULATOR

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

PER PILOTA

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

NOTE

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

Pietro Fiorentini s.p.a.

OFFICES:

I-20124 MILANO Italy - Via Rosellini, 1 - Phone +39.02.6961421 (10 linee a.r.) - Fax +39.02.6880457
E-mail: sales@fiorentini.com

I-36057 ARCUGNANO (VI) Italy - Via E. Fermi, 8/10 - Phone +39.0444.968511 (10 linee a.r.) - Fax +39.0444.960468
E-mail: arcugnano@fiorentini.com

I-80049 SOMMA VESUVIANA (NA) Italy - Via Cupa Fasano, 80 - Phone +39.081.8991965 - Fax +39.081.8991915
E-mail: napoli@fiorentini.com

SPARE PARTS AND AFTER-SALES SERVICE:

I-36057 ARCUGNANO (VI) Italy - Via E. Fermi, 8/10 - Phone +39.0444.968511 (10 linee a.r.) - Fax +39.0444.968513 - E-mail: service@fiorentini.com

Pietro Fiorentini

Edigraf - srl - edizione 12/02

IMPAGINAZIONE E STAMPA
A CURA DI

Edigraf

MONTECCHIO MAGGIORE (VI)
DECEMBER 2002

Redazione a cura di: Pietro Bottari