MT-208-E

ENGLISH

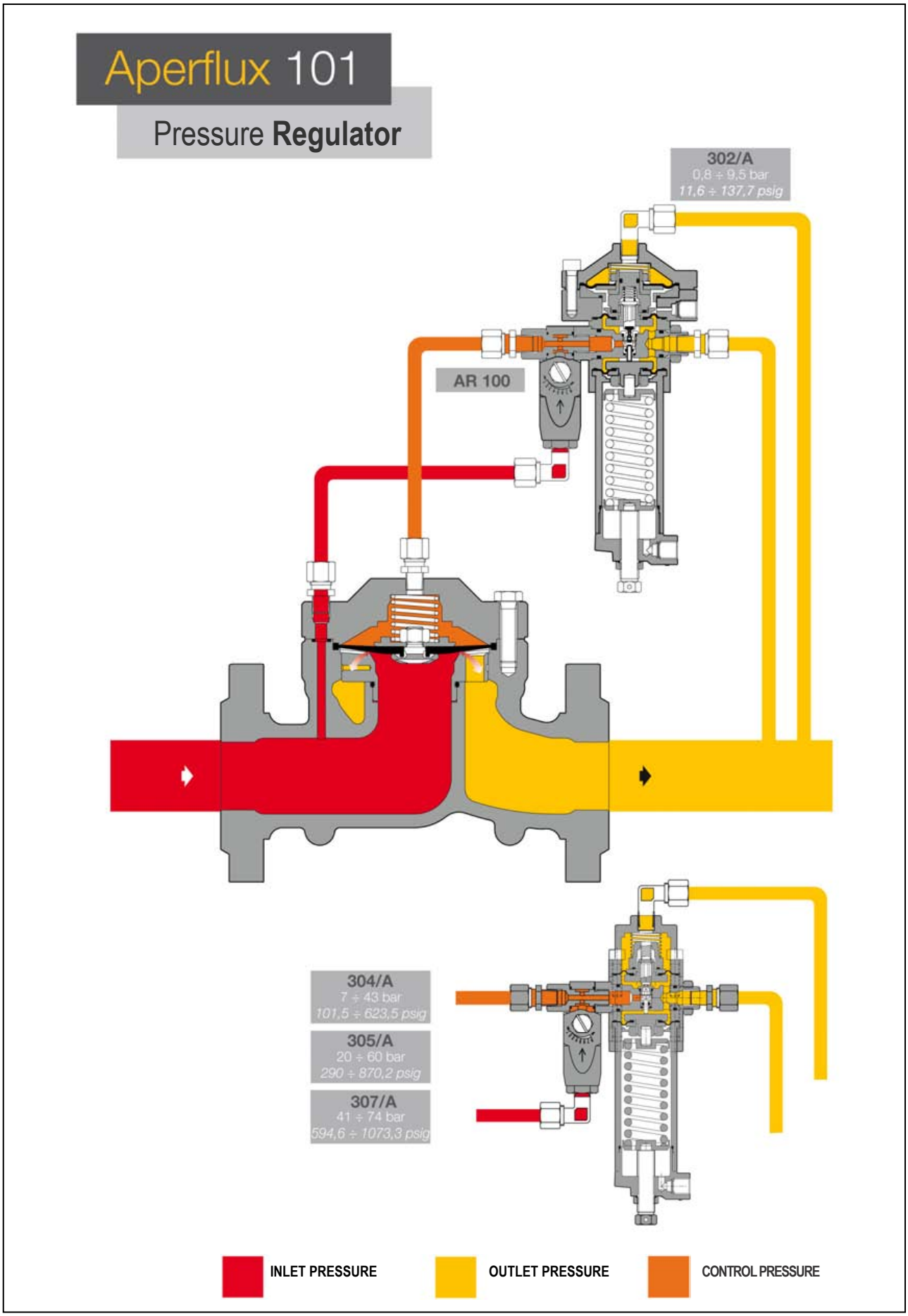
PRESSURE REGULATOR

Aperflux 101

TECHNICAL MANUAL

INSTALLATION, COMMISSIONING
AND MAINTENANCE INSTRUCTIONS

Pietro Fiorentini®


Aperflux 101
Pressure Regulator
302/A
0,8 ÷ 9,5 bar
11,6 ÷ 137,7 psig
AR 100
304/A
7 ÷ 43 bar
101,5 ÷ 623,5 psig
305/A
20 ÷ 60 bar
290 ÷ 870,2 psig
307/A
41 ÷ 74 bar
594,6 ÷ 1073,3 psig
INLET PRESSURE
OUTLET PRESSURE
CONTROL PRESSURE

PRECAUTION

GENERAL PRECAUTION

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).

PRECAUTION 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 required;
- Use the necessary means of **individual protection** (helmet, goggles, etc.);
- Ensure that the area in which they operate is fitted with the means of **collective protection** envisaged and with the necessary **safety indications**.

HANDLING

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

PACKING

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

INSTALLATION

The installation of the pressure regulator has to occur in compliance with the provisions (laws or standards) in force in the place of installation.
Natural gas plants have to show features in compliance with the law provisions and standard requirements in force in the place of installation or at lease in compliance with standards EN 12186 or EN 12279. In detail, it is necessary to meet the provisions of paragraphs 6.2, 7.5.2, 7.7, 9.3 of the standard EN 12186 and 6.2, 7.4, 7.6, 9.3 of the EN 12279 standard. The installation in compliance with such standards minimizes the risk of fire hazard and the formation of potentially explosive atmospheres.
The valve is not equipped with external pressure limitation devices; therefore, it has to be installed making sure that the operating pressure of the assembly on which it is installed does not exceed the maximum allowable pressure (PS).
Therefore, the user, as deemed necessary by the same, shall install on the assembly suitable pressure limitation systems, as well as provide the plant with suitable relief or drain systems in order to discharge the pressure and fluid contained in the plant before proceeding with any inspection and maintenance activity.

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.

- INDEX -

1.0 INTRODUCTION

The scope of this manual is to provide the essential information for the installation, commissioning, disassembly, re-assembly and maintenance of APERFLUX 101 regulators.
It is also appropriate to provide a brief illustration of the main features of the regulator and of its accessories.

1.1 MAIN FEATURES

The **APERFLUX 101** pressure regulator is a regulator for medium and high pressure.
The **APERFLUX 101** is a "fail open" type regulator and therefore opens in the event of:
- rupture of the main diaphragm
- no feed in the pilot circuit

The main specifications of this regulator are:
- Design pressure: up to 85 bar (1232,8 Psi)
- Working temperature range: -20°C + 60 °C (-4 to + 140 °F)
- Ambient temperature: -20°C + 60 °C (-4 to + 140 °F)
- Inlet pressure range **bpu**: 1,8 to 85 bar (26,1 to 1232,8 Psi)
- Regulating range possible **Wd**: 0,8 ÷ 74 bar (11,6 to 1073,3 Psig) (depending on the pilot installed)
- Minimum differential pressure 1 bar (14,5 Psig). Recommended >2 bar (29 Psig)
- Precision class **AC**: up to **1** (depending on the operative conditions)
- Closing pressure class **SG 10** (depending on the operative conditions)

1.2 OPERATION OF THE PRESSURE REGULATOR WITH SERIES 300 PILOT (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 **Pu,** the downstream pressure **Pd** and the remaining dynamic components.

The control pressure **Pc** is obtained by drawing gas at the pressure **Pu** directly upstream from the diaphragm **20**. The gas is filtered by the filter incorporated in the **AR100** flow regulating valve. The pressure **Pc** is governed by the pilot which regulates its value. The 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 **Pd** 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 increasing the opening of the regulator until the downstream pressure reaches the set point again.

On the other hand, when the downstream pressure rises beyond the set point (as a result of a reduction in the demand or with the increase in the upstream pressure), the obturator **17** closes and therefore the pressure **Pc** reaches the value of the upstream pressure **Pu**. 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.

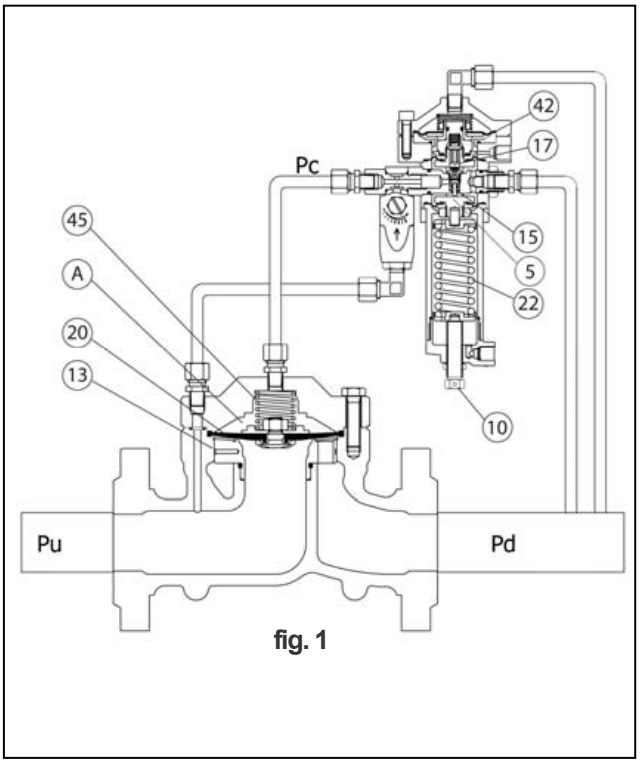


fig. 1

1.3 PILOTS

Pressure Regulators **APERFLUX 101** use following type of pilots:
302/. setting range **Wd**: from 0,8 to 9,5 bar; (11,6 to 137,7 psig)
304/. setting range **Wd**: from 7 to 43 bar; (101,5 to 623,5 psig)
305/. setting range **Wd**: from 20 to 60 bar; (290 to 870,2 psig)
307/. setting range **Wd**: from 41 to 74 bar; (594,6 to 1073,3 psig)
Pilots may be adjusted manually or remotely as shown in table 1:

Table 1: Pilot adjusting instructions	
Pilot type…/A	Manual setting
Pilot type…/D	Electric remote setting control
Pilot type…CS	Setting increased by pneumatic signal remote point

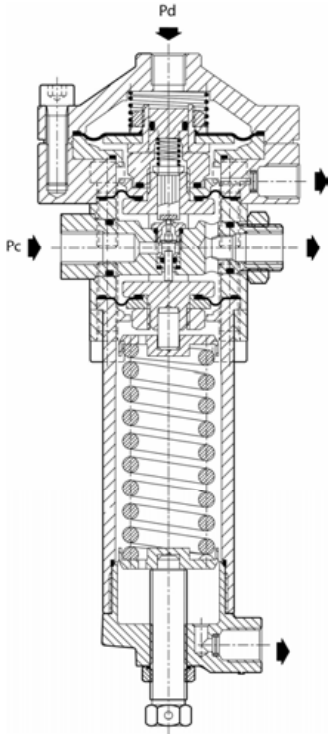


Fig.2
Pilot 302/A

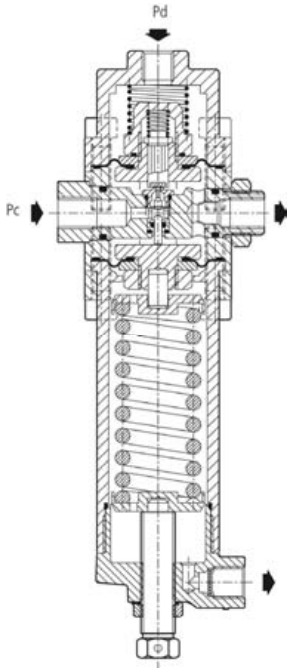


fig. 3
Pilot 304/A

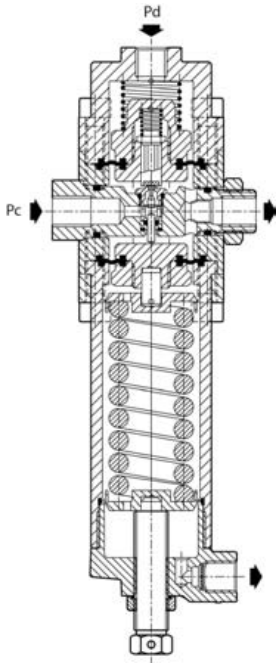


Fig.4
Pilot 307/A

1.4 AR/100 REGULATING VALVE

Pilots series 300 are equipped with regulation valve **AR 100**

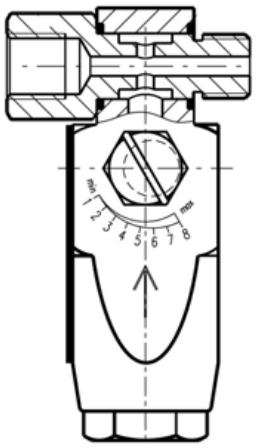


Fig.5

1.5 Tab 2: SETTING SPRINGS

SPRING CHARACTERISTICS					PILOT 302/A
Code	Color	De	Lo	d	Setting range (bar)
2701800	**YELLOW**	35	100	4,5	0,8 ÷ 1,4
2702080	**ORANGE**	35	100	5	1,4 ÷ 2,4
2702290	**RED**	35	100	5,5	2,4 ÷ 4,2
2702460	**WHITE/ORANGE**	35	100	6	4,2÷ 6,2
2702660	**BLACK**	35	100	6,5	6,2 ÷ 9,5

SPRING CHARACTERISTICS					PILOT 304/A
Code	Color	De	Lo	d	Setting range (bar)
2702290	**RED**	35	100	5,5	7 ÷ 10
2702460	**GREEN**	35	100	6	10 ÷ 15
2702660	**BLACK**	35	100	6,5	15 ÷ 22
2702820	**BLUE**	35	100	7	22 ÷ 33
2703045	**BROWN**	35	100	7,5	33 ÷ 43

SPRING CHARACTERISTICS					PILOT 305/A
Code	Color	De	Lo	d	Setting range (bar)
2702820	**BLUE**	35	100	7	20 ÷ 33
2703045	**BROWN**	35	100	7,5	33 ÷ 42
2703224	**GREY**	35	100	8	42 ÷ 60

SPRING CHARACTERISTICS					PILOT 307/A
Code	Color	De	Lo	d	Setting range (bar)
2703224	**GREY**	35	100	8	41 ÷ 74

De = Ø esternal diameter **d =** Ø Wire diameter **Lo =** Length

2.0 INSTALLATION

2.1 GENERAL

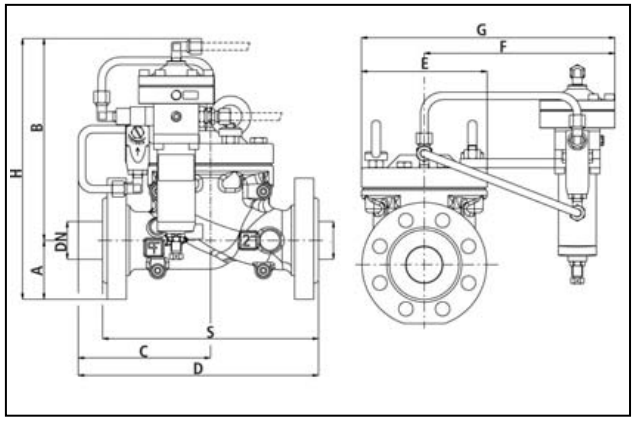
Pressure regulator does not require any supplementary upstream safety accessory for protection against overpressure compared with its design pressure **PS**, when upstream reducing station is sized for a max downstream incidental pressure

MI Pd ≤ 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 usually foresee arrangement is one indicated in fig. 6.



Tab. 3: Overall dimensions in mm

Type	DN	Inches	A	B	C	D ANSI 300	D ANSI 600	E	F	G	H	S ANSI 300	S ANSI 600
APERFLUX 101	50	2”	78	270	175	310	320	167	255	340	348	267	286
APERFLUX 101	80	3”	100	290	185	342	352	235	290	408	390	317	336

Tab. **4**: Weight in KGF (with P302)

DN	Inches	ANSI 300	ANSI 600
50	**2”**	24,5	26,5
80	**3”**	47	51

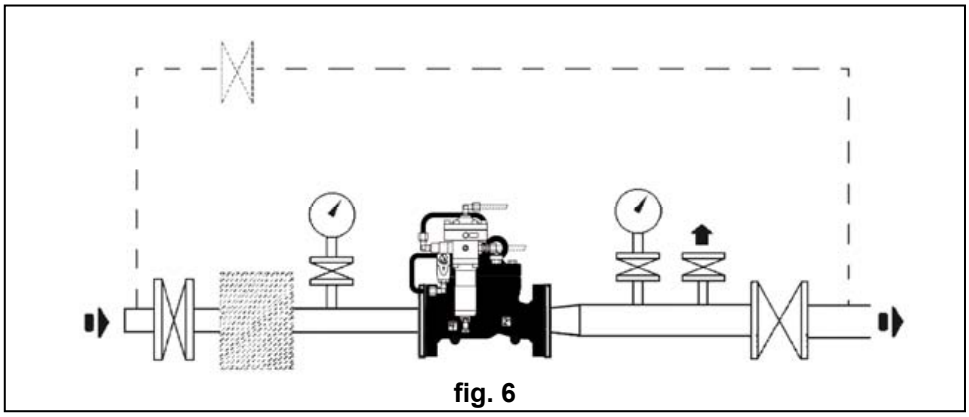


fig. 6

2.2 CONNECTING THE APPARATUSES

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

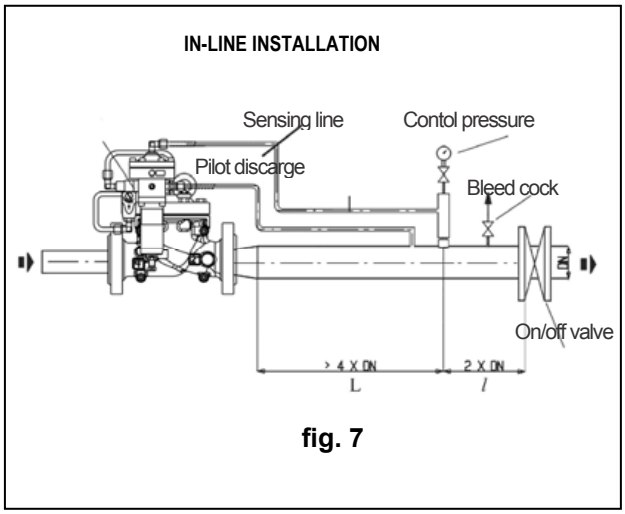


fig. 7

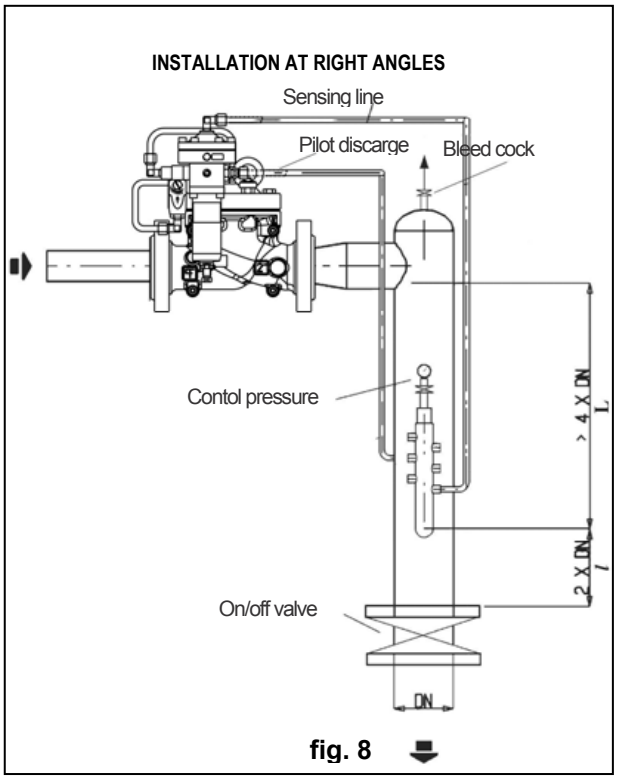


fig. 8

Fig. 9: Detail of multiple Take-off

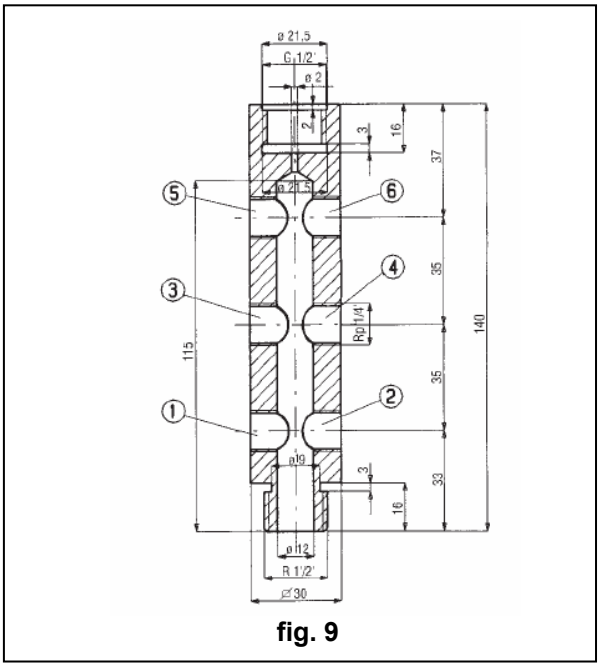


fig. 9

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

The installation of a multiple plug on a plant has its aim in in taking from a single point all the pressure impulse signals that go to the different reduction- safety devices and to their accessories.

The regulator must be installed in the line with **the arrow on the body pointing in the gas flow direction.** It is indispensable for good regulation that the position of the downstream pressure take-offs and the speed of the gas at the takeoff point respect the values given in fig. 7 and 8 (positioning) and tab.5 (speed). When the regulator is used in gas pressure reduction stations it must be installed at least according to the requirements envisaged in EN 12186 standards. Any possible gas leakage at any point, due to diaphragm or sensor malfunction or breakage, must be channelled according to EN 12186 standards. or EN 12279.

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

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

Tab.5

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

2.3 DOWNSTREAM VOLUME REQUIRED FOR INSTALLATION

In the case of a service regulator of the ON-OFF type (stopping or starting of burners), you should remember that though the **APERFLUX 101** apparatus is classified as being of the fast reaction type, it requires an appropriately dimensioned volume of gas between the apparatus itself and the burner so as to partly absorb the pressure swings caused by fast flow rate variations.

3.0 IN LINE ACCESSORIES

3.1 RELIEF VALVE

The relief valve is a safety device which releases a certain quality of gas to the exterior when the pressure at the control point exceeds the set-point as a result of short-lasting events such as, for example, the very fast closing of the on/off valves and/or overheating of the gas with zero flow rate demand. The release of the gas to the exterior can, for example, delay or block the intervention of the slam-shut valves for transitory reasons deriving from damage to the regulator.
Obviously the quantity of gas released depends on the extent of the overpressure with respect to the set-point.
The different models of relief valves available are all based on the same operating principle which is illustrated below with reference to the valve **VS/AM 65** (fig. 10).
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 quality 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.

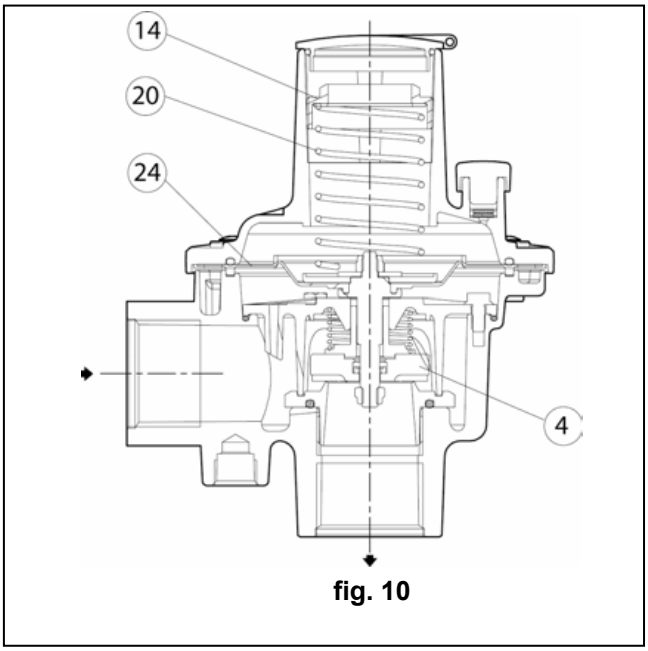


fig. 10

3.1.1 DIRECT INSTALLATION IN THE LINE (fig. 11)

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

1) Ensure that the downstream on/off valve **V2** and the bled cock **6** are closed;

2) To increase pressure in the downstream pipe until the envisaged intervention value in one of the following ways:
   - If allowed by the spring installed on the pilot (see tab.2), increase the setting of the same pilot until the desired value is reached;
   - Connect a stand-by controlled pressure to the atmosphere drain tap **6** and set it to the desired value.

3) Check intervention of the relief valve and ad just it if necessary by turning the internal adjustment ring **14** appropriately (clockwise to increase the set-point, anticlockwise to reduce it)

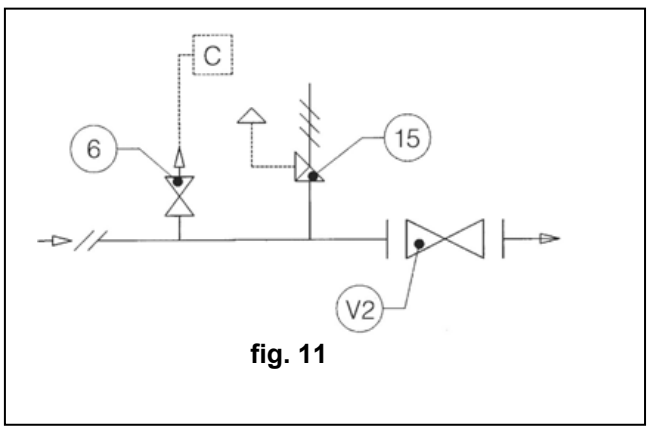


fig. 11

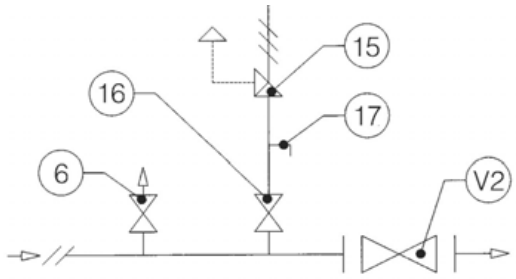


fig. 12

3.1.2 INSTALLATION WITH ON-OFF VALVE (fig. 12)

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

3.2 ACCELERATOR

An accelerator (fig.13) is installed on the REFLUX 819 regulator (use as in-line monitor) to speed up the intervention in the event of failure of the active regulator (recommended when used safety accessory according to Directive 97/23/EC "PED").

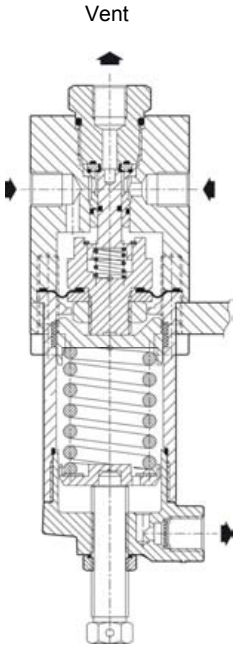


fig. 13

3.3 SB/82 SLAM-SHUT VALVE

The **SB/82** slam-shut device (see fig. 14-15) consists of an obturator A, a releasing lever system, a control head **B** and a resetting system which is controlled manually by the lever **C**. The pressure in the circuit to control acts on the diaphragm in the control head **B**.
This diaphragm, which is integral with a control rod **D**, receives a counter force by means of the minimum pressure springs **17** and the maximum pressure springs **11**, set at the preset values .
The translation movement of this rod provokes the displacement of the lever L which controls the release of the entire mobile system and frees the obturator which is closed by the action of the spring **48**.
To reset the device, operate the lever **C**.
This opens an internal by-pass in the first part of ts stroke. This leads to the filling of the downstream zone and balances the pressure on the obturator. Then, complete resetting of the entire mobile system is obtained in the second part of the stroke of the lever **C**.
Releasing can also be carried out manually by means of the button **101**.

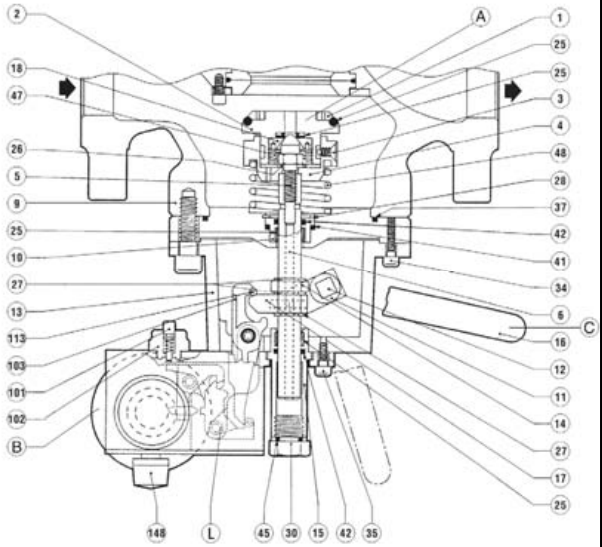


fig. 14

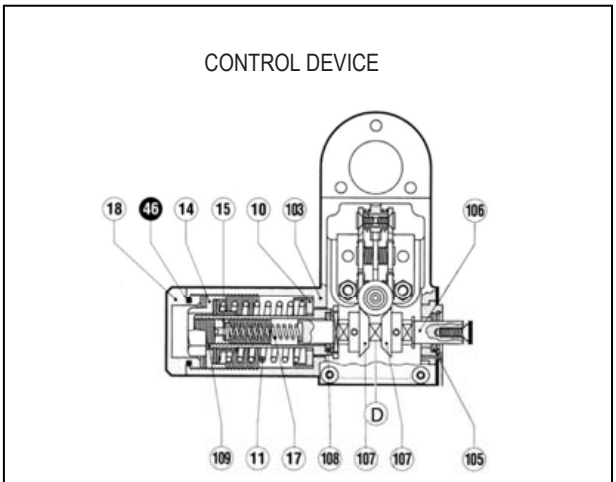


fig. 15

4.0 IN LINE MONITOR

The monitor is an emergency regulator whose function is to come into service instead of the main regulator when failure of the latter causes the downstream pressure to reach the point set for monitor intervention.

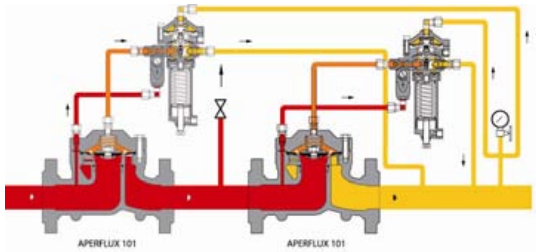


fig. 16

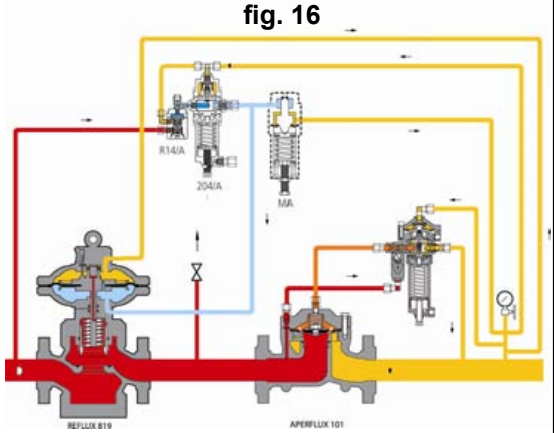


fig. 17

5.0 START UP

5.1 GENERAL

After installation, check that the inlet/outlet on/off valves, any by-pass and the bleed cock are closed.
Before commissioning, you must ensure that the conditions of use comply with the characteristics of the apparatuses.
These characteristics are recalled by the symbols on the specification plates applied to each apparatus (**fig. 18**).
We recommend actuating the opening and closing valves very slowly.
The regulator could be damaged by operations which are too fast.

APPARATUS SPECIFICATION PLATES

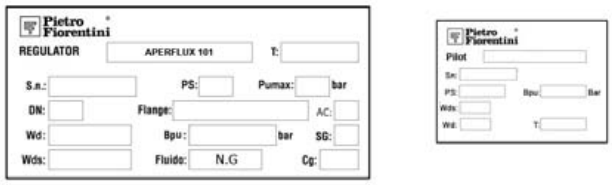


fig. 18

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

CE = According to 97/23/CE PED Directive

Pumax= maximum operating pressure at the inlet of the apparatus.

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

PS= maximum pressure for which the body and its inner metallic partition walls are designed in accordance with the strength requirements in this document.

Wds= setting range of the pressure regulator which can be obtained using the parts and the setting spring fitted at the moment of testing (that is without changing any components of the apparatus).

Wd= setting range of the pressure regulator which can be obtain using the setting springs indicated in the associated tables and also by changing some other part of the apparatus (reinforced gasket, diaphragm, etc.).

Cg and KG = experimental coefficient of critical flow.
AC= regulation class.
SG= closing pressure class.
AG= intervention accuracy.

Wdso= range of intervention for the over pressure of slam-shut which can be obtain using the setting spring fitted at the moment of testing.

Wdo= range of intervention for the over pressure of slam-shut which can be obtain using the setting springs indicated in the tables.

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

Wdu= range of intervention for pressure decrease of slam-shut which can be obtain using the setting springs indicated in the tables.

5.2 GAS INPUT, CONTROL OF EXTERNAL TIGHTNESS AND SETTING

The pressurization of the equipment shall be performed very slowly. Should not any stabilization procedure be carried out, it is recommended to keep gas speed in the feeding piping at a value equal to 5 m/sec during pressurization.
To protect the apparatus from damage, the following operations must never be carried out:

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

External tightness is guaranteed if no bubbles form when a foam medium is applied on the element under pressure.
The regulator and any other apparatuses (slam-shut, monitor) are normally supplied already set for the desired set-point. It is possible for various reasons (e.g., vibration during transport) for the settings to be changed while remaining within the values permitted by the springs used.
We therefore recommend checking the settings using the procedures illustrated below.
Table 6 gives the recommended set-point for the apparatuses in the various installation arrangements. The figures in these tables can be useful both when checking existing set-point and for modifying them should this become necessary later.
In installation consisting of two lines, we suggest commissioning one line at a time, starting from the one with the lover set-point, known as the “reserve” line. The set-point of the apparatuses in the line will obviously deviate from those specified in the table 6.
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.19)

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

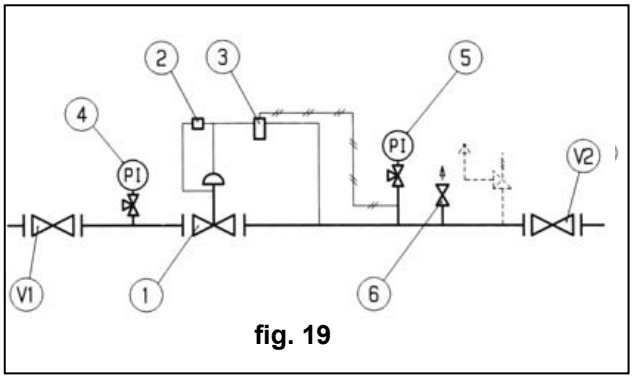


fig. 19

1) Partially open the atmosphere drain tap **6**.
2) Open the AR100 **2** 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 **1**0 anticlockwise (fig. 24). Reopen valve **V1**slowly.
5) Choke the AR100 valve.
6) Adjust the setting by alternately adjusting the AR100 valve and the 30./... pilot so that the value of the set pressure is obtained with the minimum opening possible of the AR100 valve; then block the screw **10** of the pilot with the provided nut **9**.
7) 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.
8) Using a foam substance, check the tightness of all the joints between the on-off valves **V1**and **V2**.
9) Very slowly open the downstream on-off valve **V2** to obtain the complete filling of the pipe. If at the beginning of this operation the pressure in the pipe is much lower than the set point, the opening of this valve should be choked so as not to go beyond the maximum flow rate value for the installation.
10) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point **6** so as to readjust the setting, increasing the opening of the AR100 valve. If on the other hand, there is an excessive reduction of the regulated pressure with an increase in flow, repeat the above operations with a smaller opening of the AR100 valve.

5.4 COMMISSIONING THE REGULATOR APERFLUX 101 WITH APERFLUX 101 IN LINE MONITOR (fig.20)

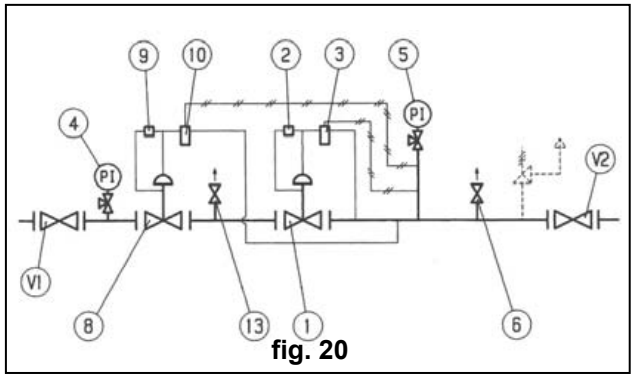


fig. 20

1) Partially open the atmosphere drain tap **6**.
2) Open the AR100 **9** valve of the monitor in position **8**.
3) Close the AR100 **2** valve of the service regulator in position 1.
4) Open the inlet on-off valve **V1** very slowly.
5) Completely increase the setting of the pilot **3**.
6) Check, via pressure gauge **5**, that downstream pressure gets stabilized at the envisaged monitor setting value. Adjust it acting alternatively on regulation bolt of the pilot **10** and on regulation valve AR100 **9**, so that the setting pressure is the pressure reached with the minimal opening possible of the valve AR100.
7) Open valve AR100 **2** of the main regulator in position **8**.
8) Slowly decrease the setting of the pilot **3** until the chosen value for the functioning regulator is reached.
9) Repeat the operations in point **6** for the pilot **3** and the valve **2**.
10) Wait until the downstream pressure settles at the envisaged value and adjust it as descrbed in point **6**.
11) Close the atmosphere drain tap **6** and check that downstream pressure, after an increase - stage, gets stabilized at a value slightly higher than the closure value of the pilot / monitor

system. On the contrary erase the causes generating the internal leak.

12) Using a foam substance, check the tightness of all the joints between the on-off valves **V1**and **V2**.
13) Very slowly open the downstream on-off valve **V2** to obtain the complete filling of the pipe.
14) 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.
15) 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 AR100 valve. If on the other hand, there is an excessive reduction of the regulated pressure with an increase in flow, repeat the above operations with a smaller opening of the AR100 valve.

5.5 COMMISSIONING THE REGULATOR APERFLUX 101 WITH REFLUX 819 IN LINE MONITOR WITH INCORP. SB/82 SLUM-SHUT AND ACCELLERATING VALVE (fig.21)

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

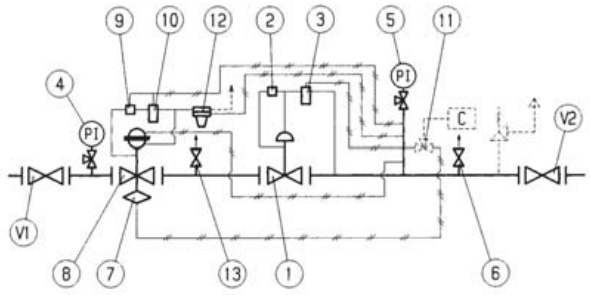


fig. 21

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

A) For slam-shuts connected to the downstream piping by a three-way deviator push valve **11**, proceed as follows (fig. 22):
- connect a controlled auxiliary pressure to **C**
- stabilise this pressure at the set-point established for the regulator
- insert a reference pin **2** in the notch, pressing the knob 1 completely
- reset the slam-shut device by means of the provided lever
- keep the knob **1** pressed and:

  • 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 **14** clockwise, or anticlockwise to reduce the intervention value.

  • Safety devices which intervene for pressure increase and reduction:
  slowly increase the auxiliary pressure and record the intervention value. Restore the pressure to the set-point established for the regulator, and carry out the slam-shut reset operation. Check intervention for pressure reduction by slowly reducing the auxiliary pressure.

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

B) On devices without the "push" valve (fig. 23) we recommend connecting the control head separately to a controlled auxiliary pressure and repeat the operations described above.

ATTENTION

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

N.B.: The intervention test should be repeated at least every 6 monts.

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

1) Ensure that the slam-shut is in the closed position.
2) Open the inlet on-off valve V1 very slowly.
3) Completely increase the setting of the pilot **3** by turning the screw **10** clockwise (fig. 24).
4) Close the AR100 **2** valve in position **1**.
5) Completely increase the setting of the accelerating valve **12** by turning the adjustment screw (fig. 13) clockwise.
6) Open the slam-shut very slowly, turning the provided lever clockwise.
7) Partially open the discharge cock **6**
8) Adjust the setting of the pilot of the monitor **10** to the intervention value set for the accelerating valve **12** (see table 6).
9) Lower the setting of the accelerating valve until, using a foam, gas is seen to come out from the discharge point.
10) Lower the setting of the pilot **10** to the selected working value of the monitor, ensuring that the valve **12** is no longer discharging gas.
11) Adjust the setting of the pilot of monitor **10** to the set value.
12) Open the AR100 **2** valve in position **8**.
13) Reduce the setting of pilot **3** to the selected working value of the service regulator.
14) Ascertain that the REFLUX 819 monitor positions itself completely open, controlling the position of the stroke indicator.
15) Adjust the setting by alternately adjusting the regulating AR100 valve and the 30./... pilot so that the value of the set pressure is obtained with the minimum opening possible of the AR100 valve; then block the screw 10 of the pilot with the provided nut **9** (fig. 24).
16) Close the vent 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.
17) Using a foam substance, check the tightness of all the joints between the on-off valves V1 and V2.
18) Very slowly open the downstream on off valve V2 to obtain the complete filling of the pipe. If at the beginning of this operation the pressure in the pipe is much lower than the set point, the opening of this valve should be choked so as not to go beyond the maximum flow rate value for the installation.

19) If pumping phenomena arise in normal working conditions, it is necessary to repeat the operations in point **15** so as to readjust the setting, increasing the opening of the AR100 valve. If, on the other hand, there is an excessive reduction of the regulated pressure with an increase in flow, repeat the above operations with a smaller opening of the AR100 valve.

20) It is reccomended to check that the flow of the line stops when the slam shut is tripped manually.

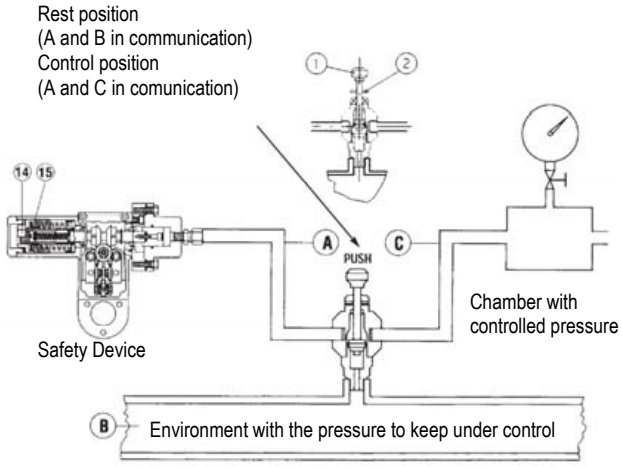


fig. 22

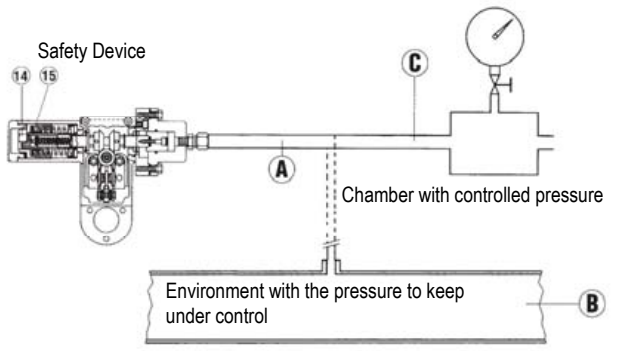


fig. 23

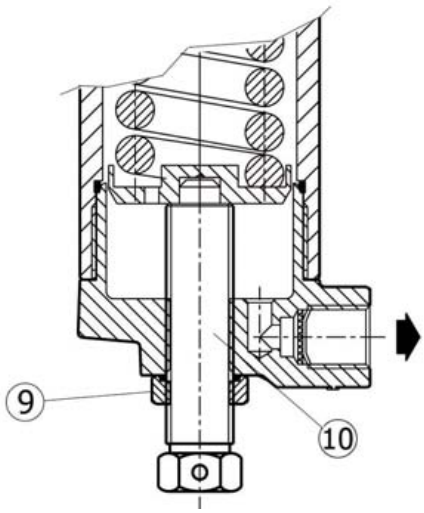


fig. 24

Tab 6	Setting of on-line apparatuses consisting of regulators APERFLUX 101+ Monitor + Slam-shut + Relief valves				
Reg. set-point (Pds) bar	Monitor Set-point	Accelerator Set-point	Relief valve Set point	Slam-shut Max Set point	Slam-shut Min Set point
0.8< Pds ≤2.1	Pds x 1.1	Pds x 1.2	Pds x 1.3	Pds x 1.5	Pds - 0.3 bar
2.1< Pds ≤5	Pds x 1.1	Pds x 1.2	Pds x 1.3	Pds x 1.4	Pds - 0.5 bar
5< Pds ≤25	Pds x 1.05	Pds x 1.1	Pds x 1.15	Pds x 1.3	Pds - 3 bar
25< Pds ≤74	Pds x 1.03	Pds x 1.06	Pds x 1.15	Pds x 1.3	Pds - 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. 7 APERFLUX 101 REGULATOR (fig. 25, 26, 27, 28, 29)

PROBLEM	POSSIBLE CAUSE	APPARATUS	REMEDY
No tightness at Q=0	Valve seat [2] damaged	Regutator (fig.25)	Replace
	Diaphragm [3] damaged		Replace
	O-ring [13] damaged		Replace
	Dirt or foreign bodies in the sealing area		Clean
	Obturator [17] damaged	Pilot 30./…(fig.26,27,28)	Replace
	O-ring [50] damaged		Replace
	O-ring [51] damaged		Replace
	O-ring [52] damaged		Replace
Pumping	Opening too small	AR100 (fig.29)	Increase opening
	Reduced downstream volume		Increase volume
	Incorrectly sensing line position		Change position
Pd reduction with Q increase	Opening too great	AR100 (fig.29)	Decrease opening
Pd pressure increases with Q>0	Diaphragm [3] broken	Regulator (fig.25)	Replace
	Dirt or foreign bodies in the sealing area		Clean
	Diaphragm [16] broken	Pilot 30./…(fig.26,27,28)	Replace
	Diaphragm [49] broken		Replace
	Obturator [17] damaged		Replace
	Filter (5) clogged	AR100 (fig. 29)	Replace

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 table 8

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

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

N.B. The use of non-original components relieves Pietro Fiorentini S.p.A. of all responsibility.

If the maintenance is carried out by your own authorized personnel, we recommend putting reference markings, before the disassembly, on those parts which could have directional or reciprocal positioning problems when reassembling. Finally, we would remind you that O-Rings and sliding mechanical components (rods, etc.) must be lubricated, before the re-assembly, with a fine **layer** of silicone grease.

7.2 APERFLUX 101 REGULATOR MAINTENANCE PROCEDURE

PROGRAMMED PREVENTIVE MAINTENANCE

Procedure for the disassembly, complete replacement of the spare parts and reassembly of the APERFLUX 101 pressure regulator.

PRELIMINARY OPERATION

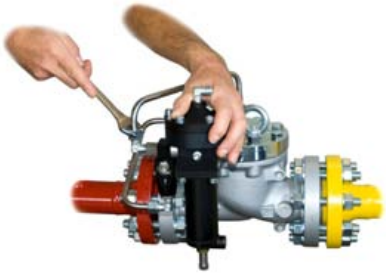
A. Put the regulator in safety conditions
B. Ensure that upstream and downstream pressure are 0

DISASSEMBLING AND RE-ASSEMBLY

7.3 DISASSEMBLING THE REGULATOR UNIT (Fig. 25)

1) Unplug the fitting between the regulators and the outlet pressure plug (impulse plug)

2) Remove the pilot from the regulator



3) Remove the fixing bolts of the high cap (5) from the main body (1)

4) Remove the high cap (5)

5) Take out the diaphragm group and separate the single parts (3 – 9 and 11)

6) Remove the grill from the body (1)

7) Remove the O-Ring (13) from the grill (2)

8) Remove the O-Ring (4) from the body (1)

To re-install the regulator you can carry out the operations described for the dismantling, in the opposite way.
Before re-installing the sustain elements (o-rings, diaphragm, etc…), it is necessary to check their integrity and if that is the case to replace them.
Check the good conditions of the grill.

7.4 DISASSEMBLING UNIT 302/A PILOT

A) Separate the flow regulation valve AR 100 from the pilot

7.4.1 PILOT 302/A (fig.26)

1) Loosen the blocking nut and unscrew completely the pilot regulation bolt

2) Unscrew the cap

3) Remove the cap together with the spring and the spring guide

4) Unscrew and remove the fixing bolts of the muff to the body

5) Separate the muff from the body

6) Unscrew the fixing nut

7) Remove the nut together with the disc and the diaphragm

8) Loosen and remove the fixing bolts of the head cap to the flange

9) Remove the head cap

10) Remove the spring and the diaphragm

11) Remove the ring

12) Loosen and remove the fixing bolts of the flange to the valve body

13) Remove the flange from the valve body

14) Unscrew the diaphragm support

15) Remove the diaphragm support together with the spring and remove the o-rings

16) Remove the obturator together with the spring and the diaphragm

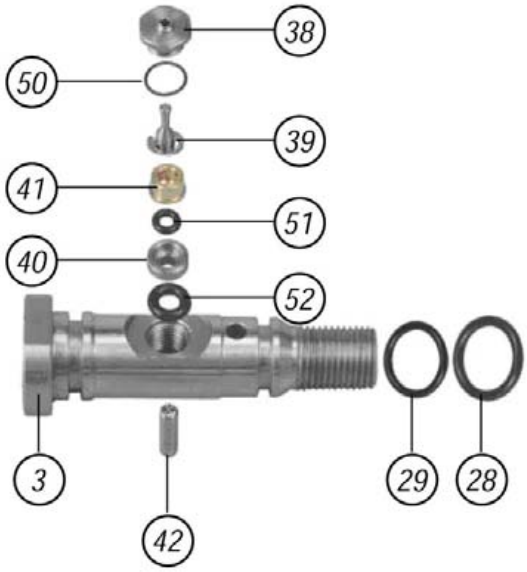
17) Remove the valve seat group fitting

18) Unscrew and remove the fixing nut of the valve seat group to the valve body

19) Separate the valve seat group from the valve body and the diaphragm support

20) Unscrew the valve seat from the valve seat group

21) Remove the valve seat and the inside components



(3) valve seat group, (38) valve seat,(39) modular piston,(40) guide,(41) connector, (42) cylindrical pin.
(28 – 29 – 50 – 51 – 52) O-ring

22) Carefully check the good conditions of the valve seat and particularly of the modular piston

23) Replace all components being part of the Replacement Kit

To reassemble the pilot you can run the other way around the operations described for the disassembling process.

Peculiar Notes

A) In disassembling and reassembling the valve seat group please ensure that the valve seat does not get bruised.

B) In reassembling the mobile group please ensure that the diaphragm support is centered with the valve seat group.

7.5 DISASSEMBLING UNIT 304/A PILOT

NOTE) This procedure is also applicable to unit 305/A and 307/A pilots

A) Separate the flow regulation valve AR 100 from the pilot

7.5.1 PILOT 304/A (fig.27)

1) Loosen the blocking nut and unscrew completely the pilot regulation bolt

2) Unscrew the cap

3) Remove the cap together with the spring and the spring guide

4) Unscrew and remove the fixing bolts of the muff to the body

5) Separate the muff from the body

6) Unscrew the fixing nut

7) Remove the nut together with the disc and the diaphragm

8) Loosen and remove the fixing bolts of the head cap to the flange

9) Remove the head cap together with the spring

10) Unscrew the diaphragm support

11) Remove the obturator support together with the spring and remove the o-ring

12) Remove the obturator together with the spring and the diaphragm

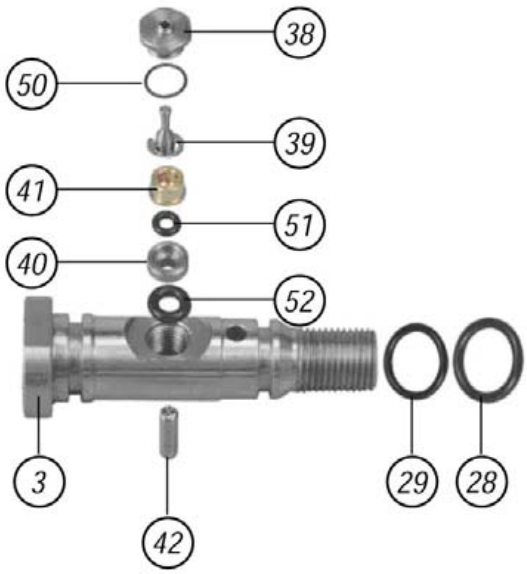
13) Remove the valve seat group fitting

14) Unscrew and remove the fixing nut of the valve seat group to the valve body

15) Separate the valve seat group from the valve body and the diaphragm support

16) Unscrew the valve seat from valve seat group

17) Remove the valve seat and the inside components



(3) valve seat group, (38) valve seat,(39) modular piston,(40) guide,(41) connector, (42) cylindrical pin.
(28 – 29 – 50 – 51 – 52) O-ring

18) Carefully check the good conditions of the valve seat and particularly of the modular piston

19) Replace all components being part of the Replacement Kit

To reassemble the pilot you can run the other way around the operations described for the disassembling process

Peculiar Notes

A) In disassembling and reassembling the valve seat group please ensure that the valve seat does not get bruised.

B) In reassembling the mobile group please ensure that the diaphragm support is centered with the valve seat group.

7.6 DISASSEMBLING AR/100 FLOW REGULATING VALVE (fig.29)

1) Unscrew the cap

2) Remove the cap from the body

3) Remove the filter from the body

4) Unscrew the bolts

5) Remove the bolts from the body

6) Remove the O-rings

7) Replace al components being parts of the Replacement kit.

To reassemble the valve you can run described operations the other way around.

Aperflux101

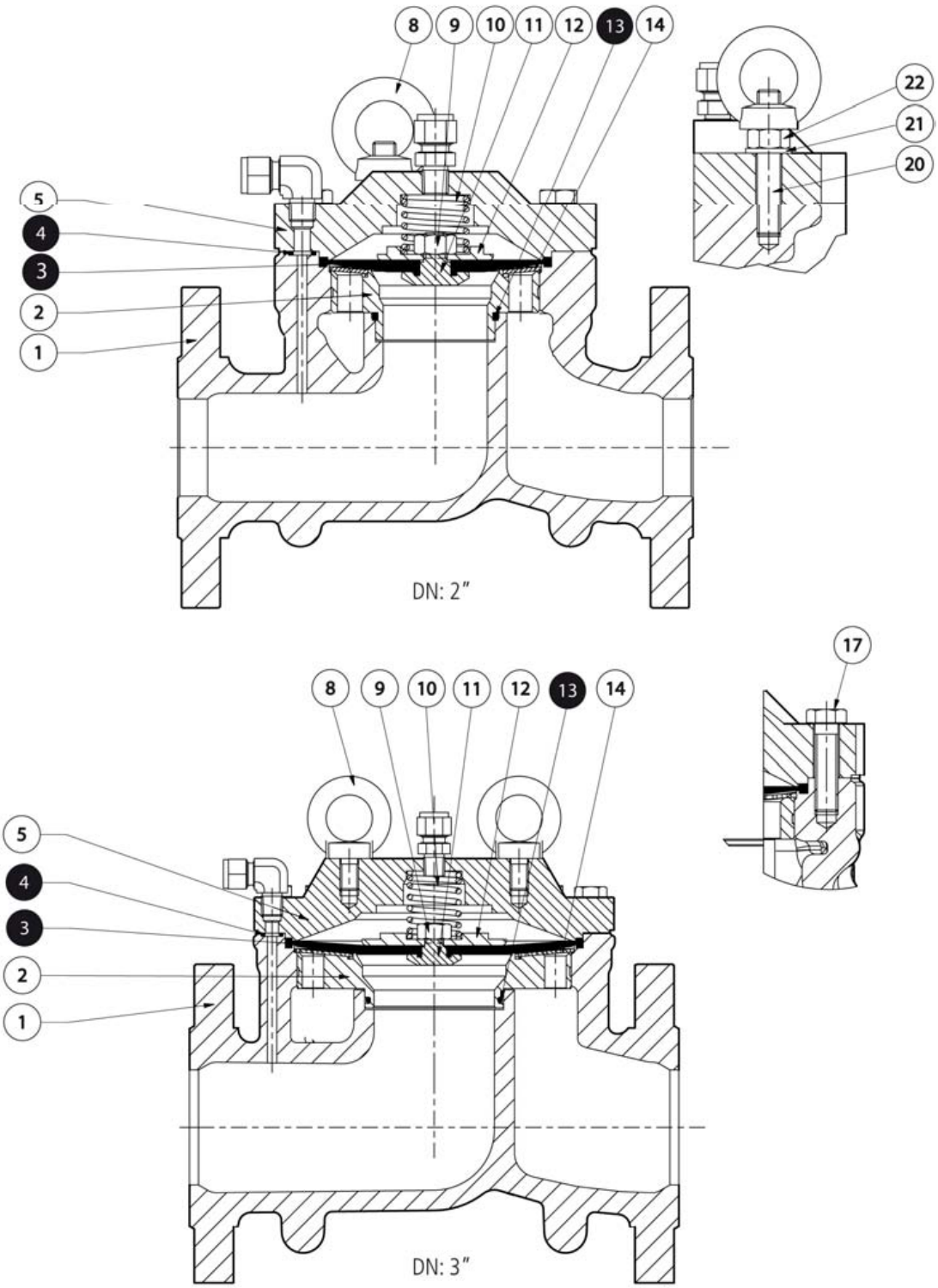


fig. 25

PILOT 302/A

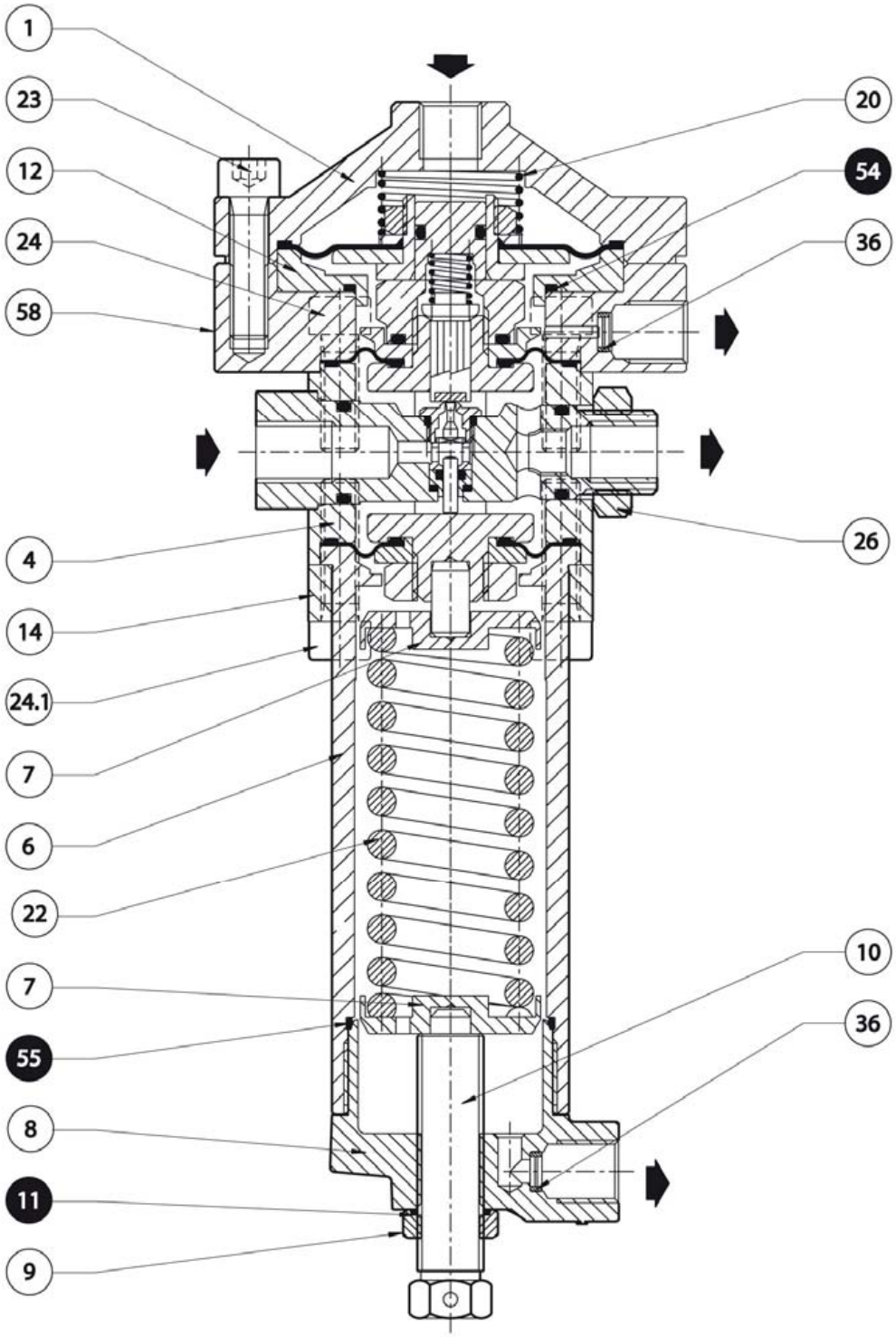
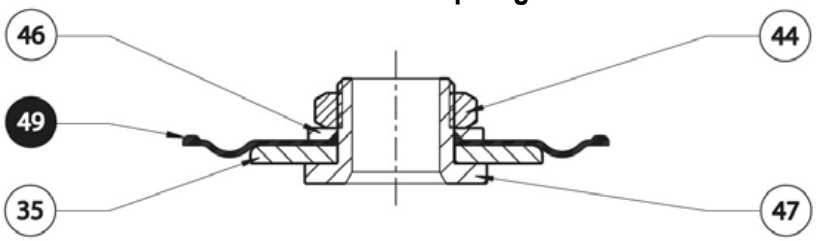
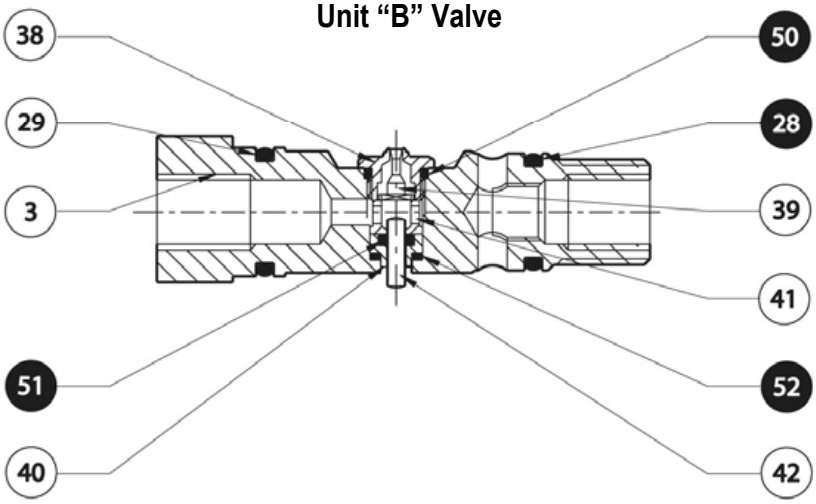


fig. 26

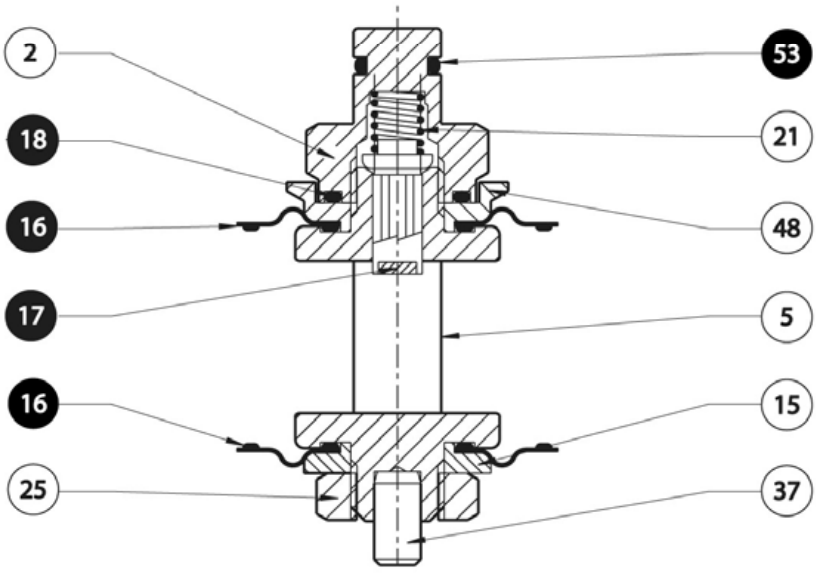
Unit "A" Diaphragm



Unit "B" Valve



Unit "C" Obturator



PILOT 304/A – 305/A

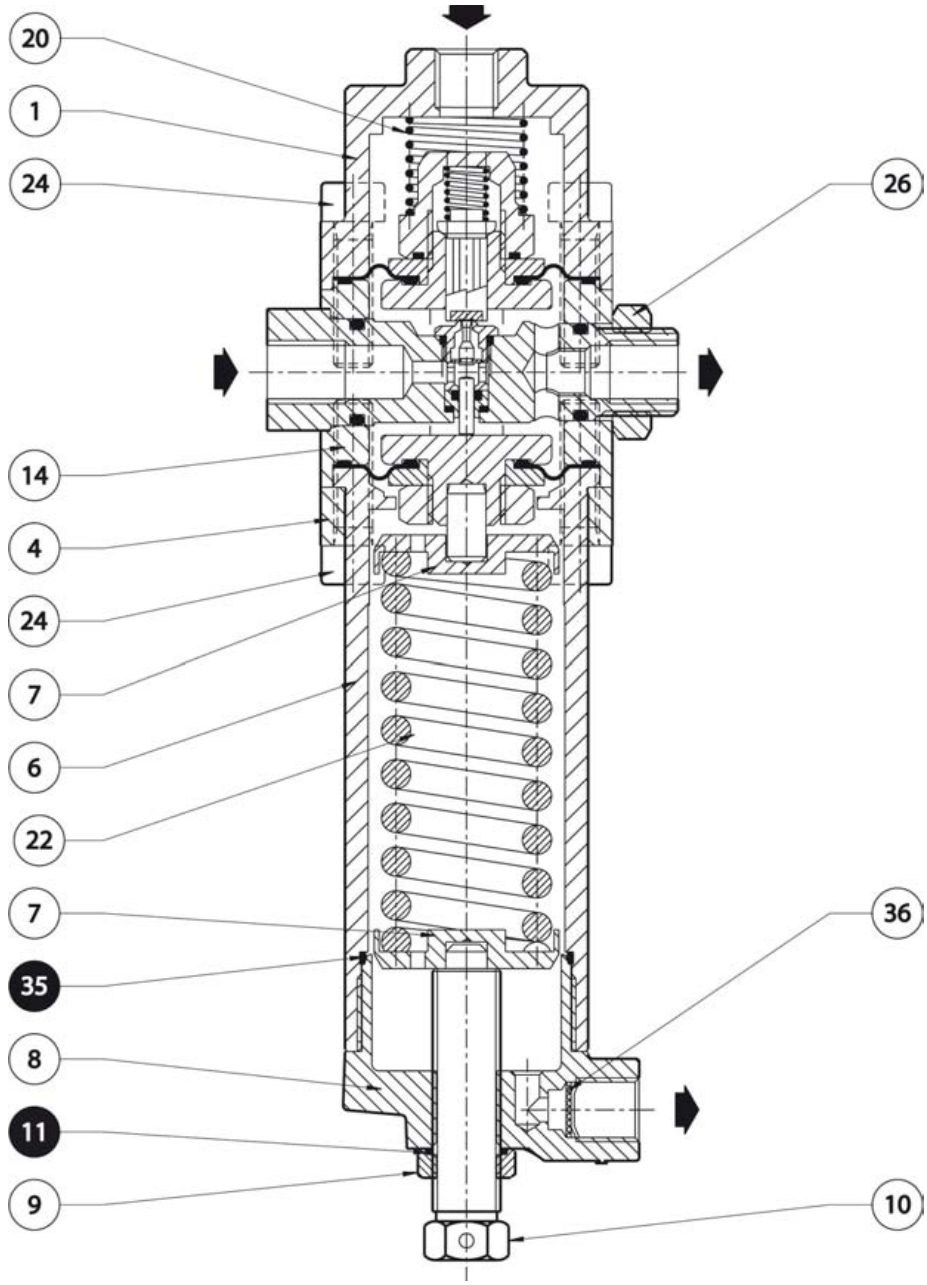
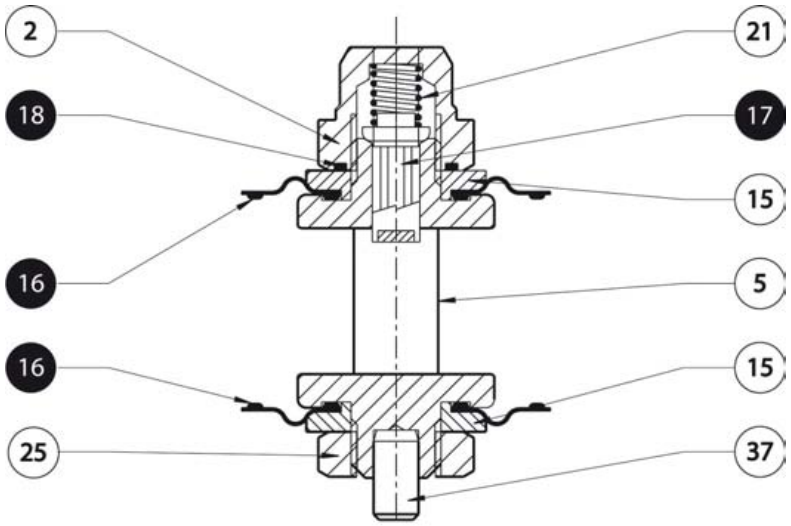
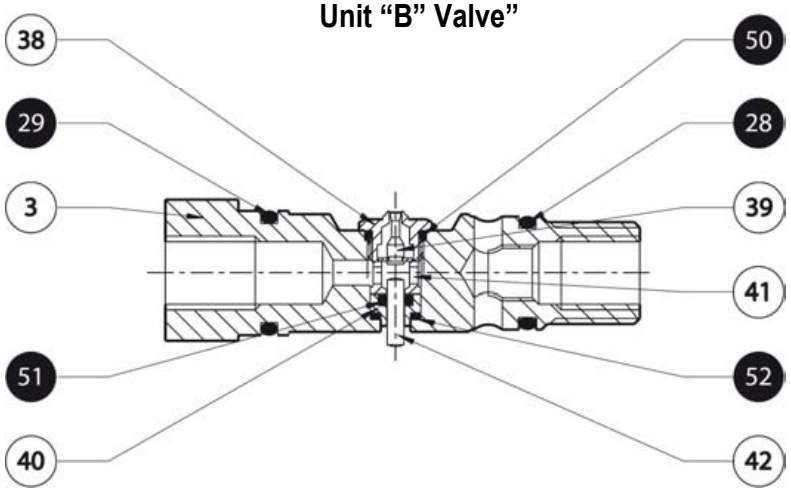


fig. 27

Unit “A” Obturator



Unit “B” Valve”



PILOT 307/A

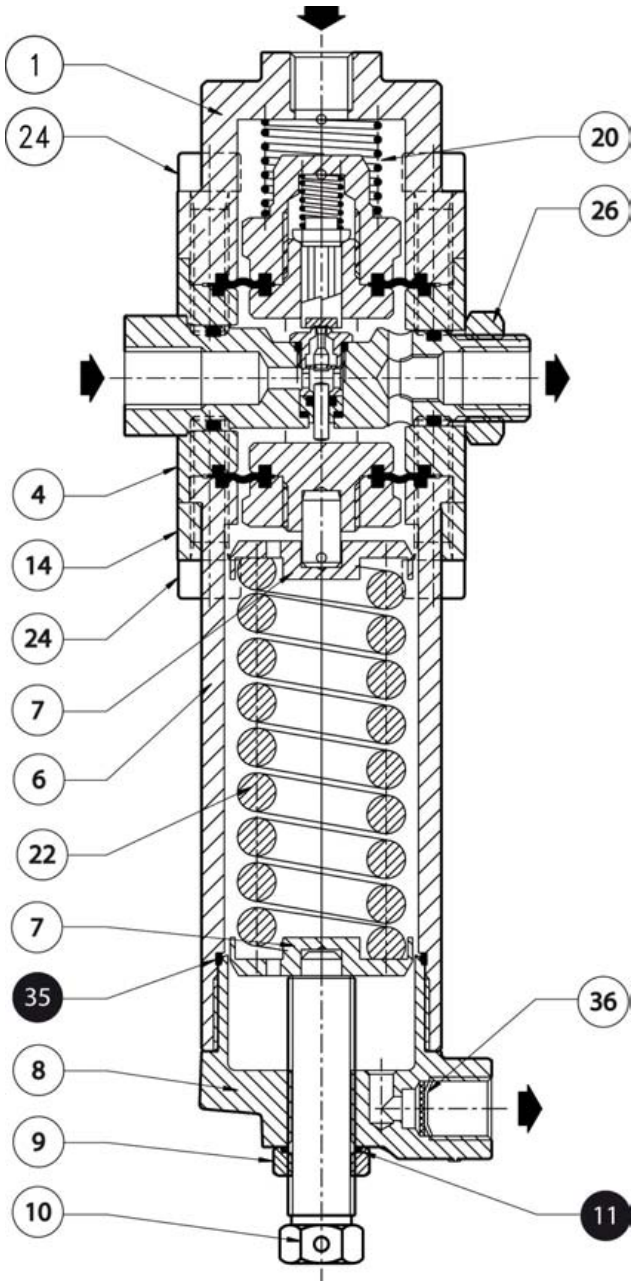
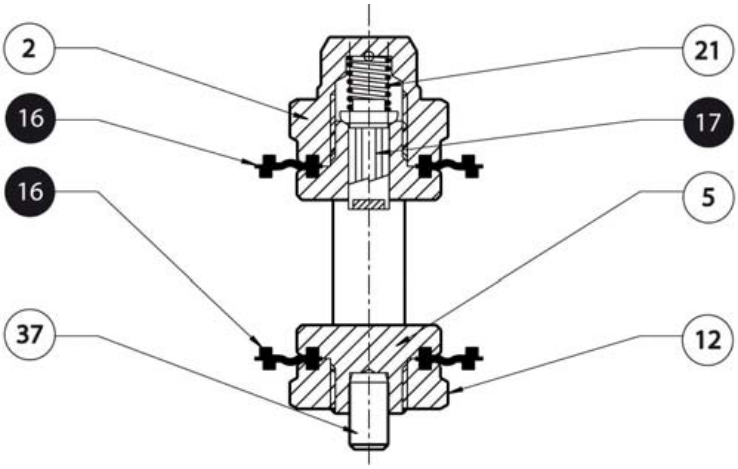
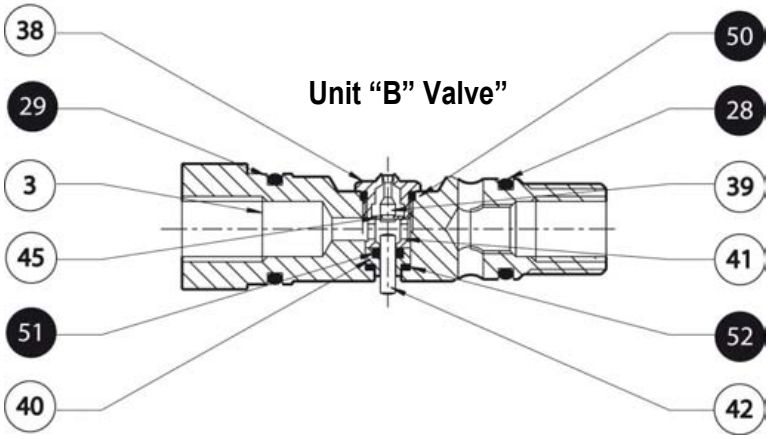


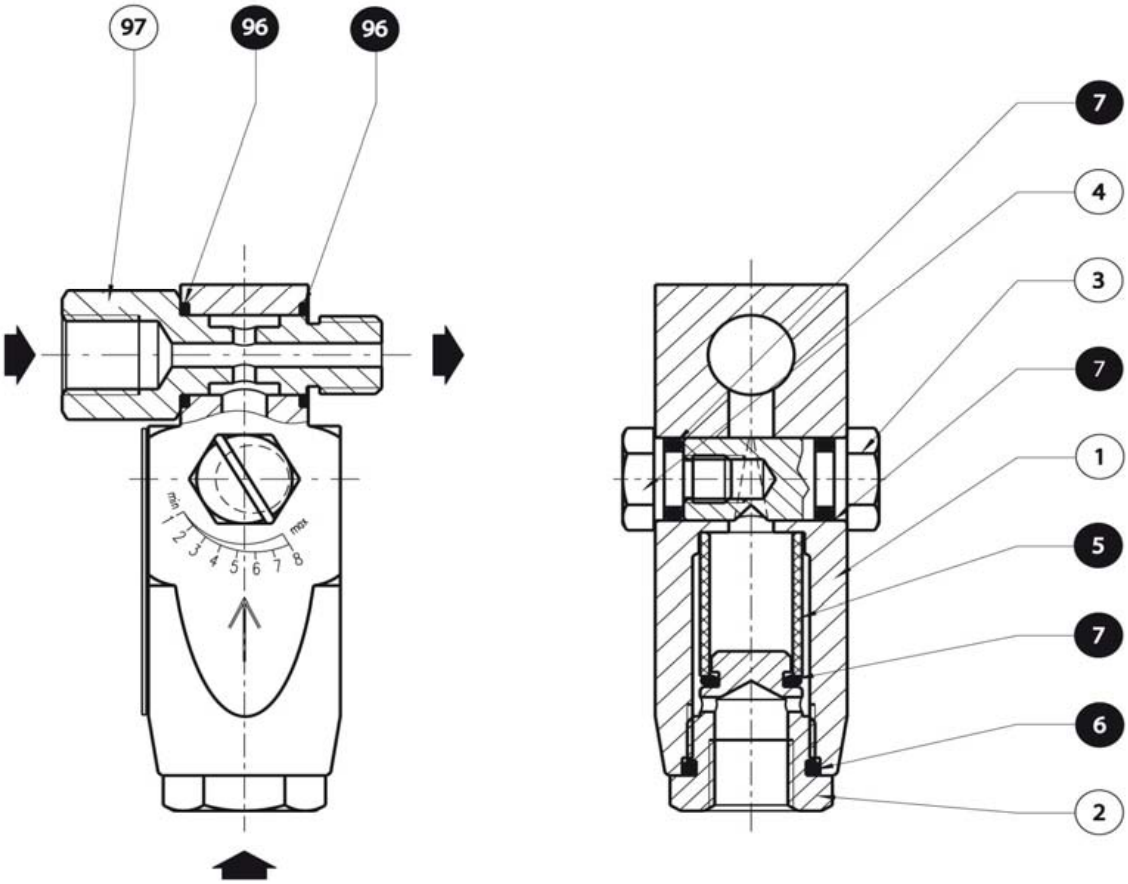
fig. 28

Unit “A” Obturator



Unit “B” Valve”





AR/100

fig. 29

8.0 FINAL OPERATION

8.1 CHECKING THE TIGHTNESS AND SETTING

1) Very slowly open the on/off valve upstream from the regulator and, using a foam solution or the like, check:
   - the tightness of the external surfaces of the regulator and of the pilot
   - the tightness of the internal surfaces of the regulator and of the pilot
2) Check the tightness of the regulator.
3) Open a bleed cock the atmosphere downstream from the regulator to create a small gas flow.
4) Fix the pilot regulation bolt until the desired set-point value is reached.
5) Close the bleed cock to the atmosphere.

8.2 START UP

1) Very slowly open the downstream on/off valve and, if necessary, adjust the regulator setting by adjusting the the pilot screw.

Tab. 8 MAINTENANCE WRENCHES FOR APERFLUX 101 PRESSURE REGULATOR

		
Combination spanner	**Adiustable spanner**	**Box Spanner**
15-17-18-19-20-22-24-27-30	L. 300	12 -27
		
Hexagon Key	**Flat head screwdriver**	**Hexagonal T Key**
6	1,2 x 6,5 x 150	6
O-ring Extraction Tool		

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MT208-E January 2010