

# Aperval 101

Medium-low pressure gas regulator



Revision B - Edition 01/2024

**USE, MAINTENANCE  
AND WARNING  
MANUAL**



# 1 - INTRODUCTION

## FOREWORD

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## GENERAL REMARKS

All operating, maintenance instructions and recommendations described in this manual must be observed. In order to obtain the best performance and to keep the equipment in efficient condition, the manufacturer recommends that maintenance operations be carried out regularly.

It is of particular importance that the personnel responsible for the equipment be trained in its use, maintenance and application of the safety instructions and procedures indicated in this manual.

Revision: B

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## 1.1 - REVISION HISTORY

Revision index	Date	Revision contents
<b>A</b>	02/2023	First issue
<b>B</b>	01/2023	Chapter 6: updated Fig. 6.8 Chapter 13: updated par. 13.1

Tab. 1.1.

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## 2 - GENERAL INFORMATION

### 2.1 - MANUFACTURER IDENTIFICATION

<b>Manufacturer</b>	PIETRO FIORENTINI S.P.A.
<b>Address</b>	Via Enrico Fermi, 8/10 36057 Arcugnano (VI) - ITALY <b>Tel. +39 0444 968511 Fax +39 0444 960468</b> <b>www.fiorentini.com arcugnano@fiorentini.com</b>

Tab. 2.2.

### 2.2 - IDENTIFICATION OF THE PRODUCT

<b>Equipment</b>	MEDIUM PRESSURE REGULATOR
<b>Model</b>	APERVAL 101

Tab. 2.3.

### 2.3 - REGULATORY FRAMEWORK

PIETRO FIORENTINI S.P.A., with registered offices in Arcugnano (Italy) - Via E. Fermi, 8/10, declares under its sole responsibility that the equipment of the APERVAL 101 series described in this manual is designed, manufactured, tested and checked in compliance with the requirements of EN 334 standard on gas pressure regulators.

The equipment complies with the requirements of Directive 2014/68/EU ("Pressure Equipment Directive" PED). The assessment procedure adopted is in accordance with module H1 as per Annex III of the Directive.

#### **NOTICE!**

**The declaration of conformity in its original version is delivered together with the equipment and this operating and warning manual.**

### 2.4 - WARRANTY

PIETRO FIORENTINI S.P.A. guarantees that the equipment was manufactured using the best materials, with high quality workmanship, and complies with the quality requirements, specifications and performance set out in the order.




The warranty shall be considered null and void and PIETRO FIORENTINI S.P.A. shall not be liable for any damage and/or malfunctions:

- due to any acts or omissions of the purchaser or end-user, or any of their carriers, employees, agents, or any third party or entity;
- in the event that the purchaser, or a third party, makes changes to the equipment supplied by PIETRO FIORENTINI S.P.A. without the prior written approval of the latter;
- in the event of failure by the purchaser to comply with the instructions contained in this manual, as provided by PIETRO FIORENTINI S.P.A.

#### **NOTICE!**

**The warranty conditions are specified in the commercial contract.**

## 2.5 - SYMBOLS USED IN THE MANUAL

Symbol	Definition
	Symbol used to identify important warnings for the safety of the operator and/or equipment.
	Symbol used to identify information of particular importance in the instruction manual. The information may also concern the safety of the personnel involved in using the equipment.
	Obligation to consult the instruction manual/booklet. Indicates a requirement for the personnel to refer to (and understand) the operating and warning instructions of the machine before working with or on it.

Tab. 2.4

### **HAZARD!**

**Alerts to a hazard with a high level of risk, an imminent hazardous situation which, if not prevented, will result in death or severe damage.**

### **WARNING!**

**Alerts to a hazard with a medium level of risk, a potentially hazardous situation which, if not prevented, may result in death or severe damage.**

### **ATTENTION!**

**Alerts to a hazard with a low level of risk, a potentially hazardous situation which, if not prevented, could result in minor or moderate damage.**

### **NOTICE!**

**Alerts to specific warnings, directions or notes of particular concern, that are not related to physical injury, as well as practices for which physical injury is not likely to occur.**

## 2.6 - ADDRESSEES, SUPPLY AND STORAGE OF THE INSTRUCTION MANUAL

The instruction manual is intended for qualified technicians responsible for operating and managing the equipment throughout its service life.

It contains the necessary information to properly use the equipment and keep its functional and qualitative characteristics unchanged over time. All information and warnings for safe, correct use are also provided.

The instruction manual, as well as the declaration of conformity and/or test certificate, is an integral part of the equipment and must always accompany it whenever it is moved or resold. It is up to the user to keep this documentation intact for reference throughout the lifespan of the equipment.

### **WARNING!**

**Removing, rewriting or editing the pages of the manual and their contents is not allowed.**

**Keep the instruction manual near the equipment, in an accessible place known by all qualified technicians involved in using and running it.**

**PIETRO FIORENTINI S.p.A. shall not be held liable for any damage to people, animals and property caused by failure to adhere to the warnings and operating procedures described in this instruction manual.**

## 2.7 - LANGUAGE

The original instruction manual was drawn up in Italian.

Any translations into additional languages are to be made from the original instruction manual.

### **HAZARD!**

**The Manufacturer is not responsible for any incomplete translations. If any inconsistency is found, please refer to the text of the original manual.**

**If inconsistencies are found or the text does not make sense:**

- stop any actions;
- immediately contact the relevant offices of PIETRO FIORENTINI S.p.A.

### **WARNING!**

**PIETRO FIORENTINI S.p.A. shall be held liable for the information provided in the original manual only.**

## 2.8 - APPLIED RATING PLATES

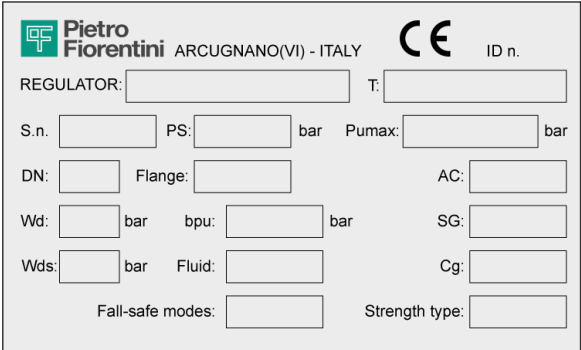
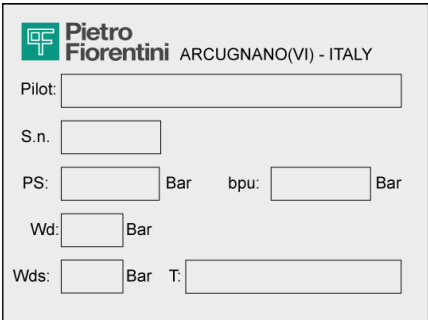
### WARNING!

**Removing nameplates and/or replacing them with other plates is strictly not allowed.  
Should the plates be unintentionally damaged or removed, the customer must notify  
PIETRO FIORENTINI S.p.A.**

The equipment and its accessories are provided with nameplates (Id.1 and Id.2).

The nameplates specify identification details of the equipment and its accessories to be mentioned in case of need to PIETRO FIORENTINI S.p.A.

Tab. 2.5 shows the nameplates applied:

Id.	Type	Image
1	NAMEPLATE REGULATOR (EC version)	
2	NAMEPLATE PILOT	

Tab. 2.5.

## 2.8.1 - GLOSSARY FOR NAMEPLATES

The terms and abbreviations used on nameplates are described in Tab. 2.6:

Term	Description
<b>AC</b>	Accuracy class.
<b>AG max</b>	Accuracy class of pressure boosting slam-shut valves. "OPSO" (Over pressure shut off).
<b>AG min</b>	Accuracy class of safety devices for pressure drop. "UPSO"(Under pressure shut off).
<b>bpu</b>	Range of inlet pressure for which the regulator ensures a given accuracy class.
<b>CE</b>	Marking certifying compliance with applicable European directives.
<b>Cg</b>	Flow rate coefficient.
<b>Class</b>	Alphanumeric designation used for reference purposes related to a combination of mechanical and dimensional characteristics for flanges, in accordance with the relevant parts of EN 1759 series, which includes the word Class followed by a dimensionless whole number.
<b>DN</b>	Nominal size of connections.
<b>Fail safe mode</b>	Regulator reaction mode (Fail open or Fail close).
<b>Flange</b>	Type of flanged connections or type of connection thread.
<b>Fluid</b>	Type of fluid compatible with the equipment.
<b>ID no.</b>	Number of the Notified Body participating in the conformity assessment of the equipment.
<b>Pilot</b>	Pilot family.
<b>PS</b>	Maximum permissible pressure for which the equipment was designed.
<b>Pumax</b>	Maximum inlet pressure at which the regulator can operate continuously under specific conditions.
<b>REGULATOR</b>	Equipment family.
<b>SG</b>	Shut-off pressure class.
<b>Slam-shut device</b>	Slam-shut valve family.
<b>S.n.</b>	Equipment serial number.
<b>Strength type</b>	Strength class: Integral strength or differential strength (DS).
<b>T</b>	Permissible temperature range (min. and max.) for which the equipment was designed.
<b>Tripping unit</b>	Pressure switch family.
<b>Type</b>	Accessory type and family.
<b>Wd</b>	Full setpoint range that can be obtained from the regulator by adjusting and/or replacing certain components (e.g. replacement of valve seat or control element, e.g. spring).
<b>Wdo</b>	Full setpoint range with regard to tripping caused by increased pressure in the pressure switch incorporated in the slam-shut valve. This range can be obtained by adjusting and/or replacing the components (for example, spring or sensitive element).
<b>Wds</b>	Full setpoint range that can be obtained from the regulator by adjusting but not replacing the components.
<b>Wdso</b>	Full setpoint range with regard to tripping caused by increased pressure in the pressure switch incorporated in the slam-shut valve. This range can be obtained by adjusting but not replacing the components.

Term	Description
<b>Wdu</b>	Full setpoint range with regard to tripping caused by decreased pressure in the pressure switch incorporated in the slam-shut valve. This range can be obtained by adjusting and/or replacing the components (for example, spring or sensitive element).
<b>Wdsu</b>	Full setpoint range with regard to tripping caused by decreased pressure in the pressure switch incorporated in the slam-shut valve. This range can be obtained by adjusting but not replacing the components.

Tab. 2.6.



## 2.9 - GLOSSARY OF MEASUREMENT UNITS

Type of measurement	Unit of measurement	Description
<b>Volumetric flow rate</b>	Sm <sup>3</sup> /h	Standard cubic metres per hour
	Scfh	Standard cubic feet per hour
<b>Pressure</b>	bar	Unit of measurement in the CGS system
	psi	Pounds per square inch
	"wc	inch of water column
	Pa	Pascal
<b>Temperature</b>	°C	Degree centigrade
	°F	Fahrenheit degree
	K	Kelvin
<b>Tightening torque</b>	Nm	Newton-metre
	ft-lbs	Foot per pound
<b>Sound pressure</b>	dB	Decibel
<b>Other measures</b>	V	Volt
	W	Watt
	Ω	Ohm

Tab. 2.7.

## 2.10 - QUALIFIED PROFESSIONAL FIGURES

Qualified operators in charge of using and managing the equipment throughout its technical service life:

Professional figure	Definition
<b>Mechanical maintenance technician</b>	<p>Qualified technician able to:</p> <ul style="list-style-type: none"> <li>perform preventive/corrective maintenance operations on all mechanical parts of the equipment subject to maintenance or repair;</li> <li>access all device parts for visual inspection, equipment checks, adjustments and calibrations.</li> </ul> <p>The maintenance mechanical technician is not authorised to operate on live electrical systems (if any).</p>
<b>Electrical maintenance technician</b>	<p>Qualified technician able to:</p> <ul style="list-style-type: none"> <li>perform preventive/corrective maintenance operations on all electrical parts of the device subject to maintenance or repair;</li> <li>read wiring diagrams and check the correct functional cycle;</li> <li>perform adjustments and operate on electrical systems for maintenance, repair and replacement of worn parts.</li> </ul> <p>The electrical maintenance technician can operate in the presence of voltage inside electrical panels, junction boxes, control equipment etc. only if he/she is deemed to be suitable (S.P.).</p> <p>For general requirements, refer to the IEC EN 50110-1:2014 standard.</p>
<b>Worker in charge of transport, handling, unloading and placement on site</b>	<p>Operator qualified to:</p> <ul style="list-style-type: none"> <li>use lifting equipment;</li> <li>handle materials and equipment.</li> </ul> <p>The equipment must be lifted and handled strictly in accordance with the instructions provided by the manufacturer as well as the regulations in force at the place where the equipment is installed.</p>
<b>Installer</b>	<p>Qualified operator able to:</p> <ul style="list-style-type: none"> <li>carry out all the operations necessary to properly install the equipment;</li> <li>perform all the operations necessary for the proper functioning of the equipment and the system in safety.</li> </ul>
<b>User's technician</b>	<p>Technician trained and authorized to use and manage the equipment for the activities for which it was supplied. They must:</p> <ul style="list-style-type: none"> <li>be able to perform all operations required to properly run the equipment and the system, ensuring their own safety and that of any personnel on site;</li> <li>have proven experience in properly using the equipment similar to that described in this instruction manual, and be trained, informed and instructed in this regard.</li> </ul> <p>The technician may carry out maintenance only if authorised/qualified to do so.</p>

Tab. 2.8.

## 3 - SAFETY

### 3.1 - GENERAL SAFETY WARNINGS

#### WARNING!

The equipment described in this instruction manual is:

- a device subjected to pressure in pressurised systems;
- normally installed in systems carrying flammable gases (for example: natural gas).

#### WARNING!

If the gas used is a combustible gas, the installation area of the equipment is defined as a “danger zone” as there are residual risks that potentially explosive atmospheres may be generated.

In “danger zones” and in close proximity thereto:

- there must not be any effective sources of ignition;
- smoking is not allowed.

#### ATTENTION!

Authorised operators must not carry out operations or services on their own initiative that do not fall within their competence.

Never operate the equipment:

- while under the influence of intoxicating substances such as alcohol;
- if you are using drugs that may slow reaction times.

#### NOTICE!

The employer must train and inform operators on how to behave during operations and on the equipment to be used.









Before installation, commissioning or maintenance, operators must:

- take note of the safety regulations applicable to the place of installation they are working in;
- obtain the necessary permits to operate when required;
- wear the personal protective equipment required by the procedures described in this instruction manual;
- ensure that the required collective protective equipment and safety information are available in the area they are operating in.

### 3.2 - PERSONAL PROTECTIVE EQUIPMENT

Tab. 3.9 shows the personal protective equipment (PPE) and its description. An obligation is associated with each symbol. Personal protective equipment means any equipment intended to be worn by the worker in order to protect them against one or several risks that are likely to threaten their safety or health during work.

For the operators in charge, depending on the type of work requested, the most appropriate PPE of the following will be reported and must be used:

Symbol	Meaning
	<b>Obligation to use safety or insulated gloves.</b> Indicates a requirement for the personnel to use safety or insulated gloves.
	<b>Obligation to use safety goggles.</b> Indicates a requirement for personnel to use protective goggles for eye protection.
	<b>Obligation to use safety shoes.</b> Indicates a requirement for the personnel to use accident-prevention safety shoes.
	<b>Obligation to use noise protection equipment.</b> Indicates a requirement for the personnel to use ear muffs or ear plugs to protect their hearing.
	<b>Obligation to wear protective clothing.</b> Indicates a requirement for the personnel to wear specific protective clothing.
	<b>Obligation to use a protective mask.</b> Indicates a requirement for the personnel to use respiratory masks in the event of a chemical risk.
	<b>Obligation to use a protective helmet.</b> Indicates a requirement for the personnel to use protective helmets.
	<b>Obligation to wear high visibility vests.</b> Indicates a requirement for the personnel to use high visibility vests.

Tab. 3.9.

#### **WARNING!**

Each licensed operator is obliged to:

- **take care of his/her own health and safety and that of other people in the workplace who are affected by his/her actions or omissions, in accordance with the training, instructions and equipment provided by the employer;**
- **appropriately use the PPE made available;**
- **immediately report to the employer, the manager or the person in charge any deficiencies in the equipment and devices, as well as any dangerous conditions they may become aware of.**

### **3.3 - RESIDUAL RISKS**

In accordance with the requirements of PED 2014/68/EU, point 1.2 of Annex I, below is an assessment of the risks associated with the equipment and an indication of the principles adopted for their prevention, according to the following classification:

- a) Elimination and/or reduction of the risk.
- b) Application of appropriate protective measures.
- c) information to users about residual risks.

### 3.3.1 - TABLE SHOWING RESIDUAL RISKS DUE TO PRESSURE

Risk and Hazard	Event and Cause	Effect and Consequence	Solution and Prevention
<b>Pressurised gas leakage. Projection of metallic and non-pressurised parts.</b>	<ul style="list-style-type: none"> <li>violent impact;</li> <li>impact (also due to falling, improper handling, etc.).</li> </ul>	<ul style="list-style-type: none"> <li>deformation;</li> <li>breakage of connections and, if pressurised, even burst.</li> </ul>	<p>a. Handling and installation with appropriate devices to avoid localised stress.</p> <p>b. Installation in suitable places and spaces with appropriate guards and packaging.</p> <p>c. Information in the instructions for use and warning.</p>
<b>Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.</b>	<ul style="list-style-type: none"> <li>Use of inappropriate fluids.</li> </ul>	<ul style="list-style-type: none"> <li>corrosion;</li> <li>embrittlement;</li> <li>explosion.</li> </ul>	<p>a. The user must check compliance of the used fluid with the specifications on the data plate.</p>
<b>Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.</b>	<ul style="list-style-type: none"> <li>operation at temperatures below the minimum permissible temperature.</li> </ul>	<ul style="list-style-type: none"> <li>embrittlement;</li> <li>breaking;</li> <li>explosion.</li> </ul>	<p>a. Install in places where the temperature is not below the minimum permissible temperature and/or insulate the equipment adequately.</p> <p>b. The minimum temperature allowed is indicated on the data plate.</p>
<b>Pressurised gas leakage. Projection of metallic and non-pressurised parts. Explosion.</b>	<ul style="list-style-type: none"> <li>overpressure or exceeding of the rated limit values (maximum pressure allowed)</li> </ul>	<ul style="list-style-type: none"> <li>explosion;</li> <li>breaks;</li> <li>cracks;</li> <li>permanent deformation.</li> </ul>	<p>a. The device has appropriate design safety margins.</p> <p>b. The user must check the maximum pressure applicable to the equipment.</p> <p>c. The maximum allowable pressure is highlighted on the appropriate plate on the equipment.</p>
<b>Falling of the equipment.</b>	<ul style="list-style-type: none"> <li>dangerous handling.</li> </ul>	<ul style="list-style-type: none"> <li>deformation;</li> <li>cracking;</li> <li>breaking.</li> </ul>	<p>b. The user must have suitably sized lifting equipment.</p> <p>c. The above requirements are referred to in the equipment use and warning manual.</p>
<b>Pressurised fluid leakage. Projection of metallic and non-metallic pressurised parts.</b>	<ul style="list-style-type: none"> <li>incorrect fixing of the equipment.</li> </ul>	<ul style="list-style-type: none"> <li>deformation;</li> <li>breaking.</li> </ul>	<p>a. The device is equipped with unified type process connections and compression fittings.</p> <p>b. The user must ensure correct fixing to the line.</p> <p>c. Directions in the instructions for use and warning.</p>
<b>Explosion of the device, pressurised fluid leakage. Projection of metallic parts.</b>	<ul style="list-style-type: none"> <li>operation at temperatures above the maximum permissible temperature.</li> </ul>	<ul style="list-style-type: none"> <li>reduction of mechanical resistance and breakage of the device;</li> <li>explosion.</li> </ul>	<p>a. The user must equip the system with suitable safety and control devices.</p> <p>b. The maximum temperature allowed is indicated on the data plate.</p>

Risk and Hazard	Event and Cause	Effect and Consequence	Solution and Prevention
<b>Pressurised gas leakage.</b>	<ul style="list-style-type: none"> <li>device maintenance with the system running.</li> </ul>	<ul style="list-style-type: none"> <li>inappropriate opening of pressurised chambers.</li> </ul>	<p>a. The user must perform any maintenance with the equipment not in operation.</p> <p>b. The above requirements are referred to in the use and warning manual.</p>
<b>Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.</b>	<ul style="list-style-type: none"> <li>external loads bearing on the device.</li> </ul>	<ul style="list-style-type: none"> <li>deformation;</li> <li>cracking and slot formation;</li> <li>if pressurised, also bursting.</li> </ul>	<p>a. With the exclusion of what is set out in the project, the user must verify that no additional concentrated load bears on the device.</p>
<b>Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.</b>	<ul style="list-style-type: none"> <li>electrostatic potential, differential stray currents.</li> </ul>	<ul style="list-style-type: none"> <li>corrosion localised in the device.</li> </ul>	<p>b. The user must equip the device with the necessary protection and earthing devices.</p> <p>c. The above requirements are referred to in the use and warning manual.</p>
<b>Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.</b>	<ul style="list-style-type: none"> <li>humidity;</li> <li>environments with aggressive atmosphere.</li> </ul>	<ul style="list-style-type: none"> <li>deterioration of external surfaces;</li> <li>corrosion.</li> </ul>	<p>a. The user must periodically check the state of conservation of the external surfaces.</p> <p>b. The above requirements are referred to in the use and warning manual.</p>

Tab. 3.10.

### 3.3.2 - TABLE OF RESIDUAL RISKS FOR POTENTIALLY EXPLOSIVE ATMOSPHERES

Tab. 3.11 shows the conditions that can lead the APERVAL 101 pressure regulators to generate a potentially explosive atmosphere.

Considering that the silencer does not have active functional parts, in this analysis it is considered an integral part of the APERVAL 101 regulator.

The table is valid for use with natural gas with a density of no more than 0.8; for different densities, the installation and environmental conditions must also be evaluated.

**! WARNING!**

**If the gas used is a combustible gas, the installation area of the equipment is defined as a “danger zone” as there are residual risks that potentially explosive atmospheres may be generated.**

**There must be no effective sources of ignition in “danger zones” and in close proximity thereto.**

Operating conditions	Atmosphere potentially explosive	Regulatory references	Management measures included in the instructions for use and warning
<b>First start-up</b>	No	<ul style="list-style-type: none"> <li>During the production cycle and before the CE marking according to Directive 2014/68/EU, the external tightness of the equipment is checked at a value of 1.1 PS (in accordance with Standard EN 334).</li> <li>Before commissioning, the external sealing of the system portion on which the equipment is installed is checked at a suitable pressure (in accordance with the provisions of standards EN 12186 and EN 12279).</li> </ul>	The instructions for use indicate the need to meet the requirements in Standards EN 12186 and EN 12279.
<b>Operation in normal conditions</b>	No	<p>The indications in the previous point apply, in addition:</p> <ul style="list-style-type: none"> <li>the equipment is installed outdoors or in an environment with natural ventilation (in accordance with Standards EN 12186 and EN 12279);</li> <li>the installation is subject to surveillance according to current national rules/good practice/the equipment manufacturer's instructions (in accordance with the provisions of Standard EN 12186 and Standard EN 12279).</li> </ul>	<p>The instructions for use indicate that:</p> <ul style="list-style-type: none"> <li>any environment in which the equipment is installed must meet the requirement of Standards EN 12186 and EN 12279;</li> <li>periodic checks and maintenance must be carried out during surveillance in accordance with the national rules in force (if any), and with the specific manufacturer's recommendations.</li> </ul>
<b>Breakage of the control head diaphragm (malfunction)</b>	No	<p>This event must be considered a rare malfunction.</p> <p>All atmospheric pressure chambers delimited on at least one side by a diaphragm must be channelled to a safe area (in accordance with the provisions of Standard EN 12186 and Standard EN 12279).</p>	The instructions for use indicate the need to meet the requirements of Standards EN 12186 and EN 12279.



Operating conditions	Atmosphere potentially explosive	Regulatory references	Management measures included in the instructions for use and warning
<b>Breakage of other non-metallic parts (malfunction)</b>	No	This type of malfunction is not reasonably expected as it involves static seals (to the outside) that cannot generate any external leakage.	-
<b>Decommissioning</b>	No	<ul style="list-style-type: none"> <li>The pressure of the system section in which the equipment is installed must be reduced with appropriate vent lines channelled to a safe area (in accordance with the provisions of Standard EN 12186 and Standard EN 12279).</li> <li>The residual gas must be discharged as indicated above.</li> </ul>	The instructions for use indicate the need to meet the requirements of Standards EN 12186 and EN 12279
<b>Reboot</b>	No	<ul style="list-style-type: none"> <li>After reassembling the regulator, carry out an external leakage test at a convenient pressure value as specified by the manufacturer.</li> <li>Before commissioning, the external sealing of the system portion on which the equipment is installed is checked at a suitable pressure (in accordance with the provisions of standards EN 12186 and EN 12279).</li> </ul>	The instructions for use indicate: <ul style="list-style-type: none"> <li>the minimum conditions for testing internal leakage;</li> <li>the need to meet the requirements of Standards EN 12186 and EN 12279.</li> </ul>

Tab. 3.11.

### 3.4 - OBLIGATIONS AND PROHIBITIONS

The following is a list of obligations and prohibitions to be observed for the safety of the operator.

It is mandatory to:



- carefully read and understand the instructions for use and warning;
- check whether the downstream equipment is suitably sized according to the performance required of the regulator in the actual operating condition;
- before installing the equipment, the data on the nameplates must be checked;
- Avoid violent shocks and impacts that could damage the equipment and, as a result, cause the pressure fluid to escape.

It is forbidden to:

- operate in various capacities on the equipment without the PPE indicated in the work procedures described in these use and warning instructions;
- operate in the presence of open flames or bring open flames close to the work area;
- smoke near the equipment or while working on it;
- use the equipment with parameters other than those indicated on the nameplate;
- use the equipment with fluids other than those indicated on the nameplate and in these use and warning instructions;
- use the equipment outside the operating temperature range specified on the nameplate and in these use and warning instructions;
- service the equipment with the system portion, on which it is installed, running;
- install or use the equipment in environments other than those specified in these instructions for use and warning.

### 3.5 - SAFETY PICTOGRAMS

The following safety pictograms may be shown on the equipment and/or packaging PIETRO FIORENTINI S.p.A.:

Symbol	Definition
	Symbol used to identify an ELECTRICAL HAZARD.
	Symbol used to identify a GENERIC HAZARD.

Tab. 3.12.

#### HAZARD!

**It is absolutely forbidden to remove the safety pictograms on the equipment.**

**The user is required to replace the safety pictograms which, following wear, removal or tampering, are illegible.**

### 3.6 - RISK LEVEL

Depending on the operating conditions, use and configuration required, the equipment may generate noise other than that permitted by current legislation in the country of installation.

For the value of the noise generated by the equipment and further information, contact PIETRO FIORENTINI S.p.A.

#### ATTENTION!

**The obligation to use earmuffs or ear plugs to protect the operator's hearing remains in the event that the noise in the installation environment of the equipment (depending on specific operating conditions) exceeds the value of 85 dBA.**



## 4 - DESCRIPTION AND OPERATION

### 4.1 - GENERAL DESCRIPTION

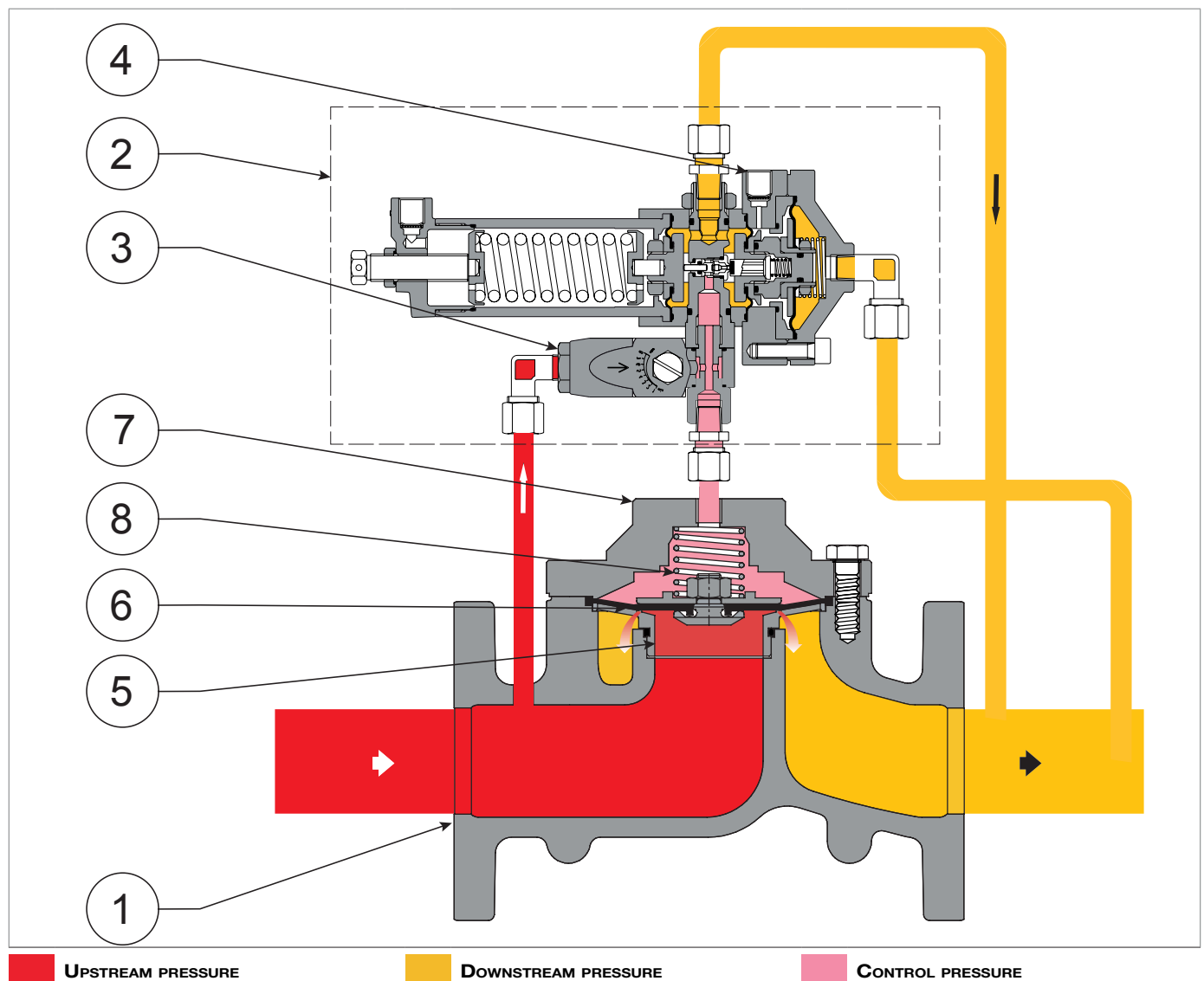
The equipment APERVAL 101 is a piloted pressure regulator for low and medium pressure which reduces the inlet gas pressure, keeping the downstream value stable even when the following varies:

- inlet pressure value;
- the required flow rate within the operating conditions of the equipment.

The main elements of the equipment are:

Pos.	Description	Pos.	Description
1	Main regulator	5	Valve seat
2	Piloting unit	6	Pressure control element
3	AR100 lamination valve	7	Control head
4	300 series pilot	8	Spring

Tab. 4.13.



**UPSTREAM PRESSURE**

**DOWNSTREAM PRESSURE**

**CONTROL PRESSURE**

Fig. 4.1. General description APERVAL 101

### 4.1.1 - REGULATOR REACTION MODES

The APERVAL 101 equipment is a regulator piloted with a “fail open” reaction (on-opening reaction), that is, it opens in the event of:

- breakage of the pilot diaphragm(s);
- breakage of the pilot plug;
- no power supply in the pilot circuit.

### 4.2 - OPERATION

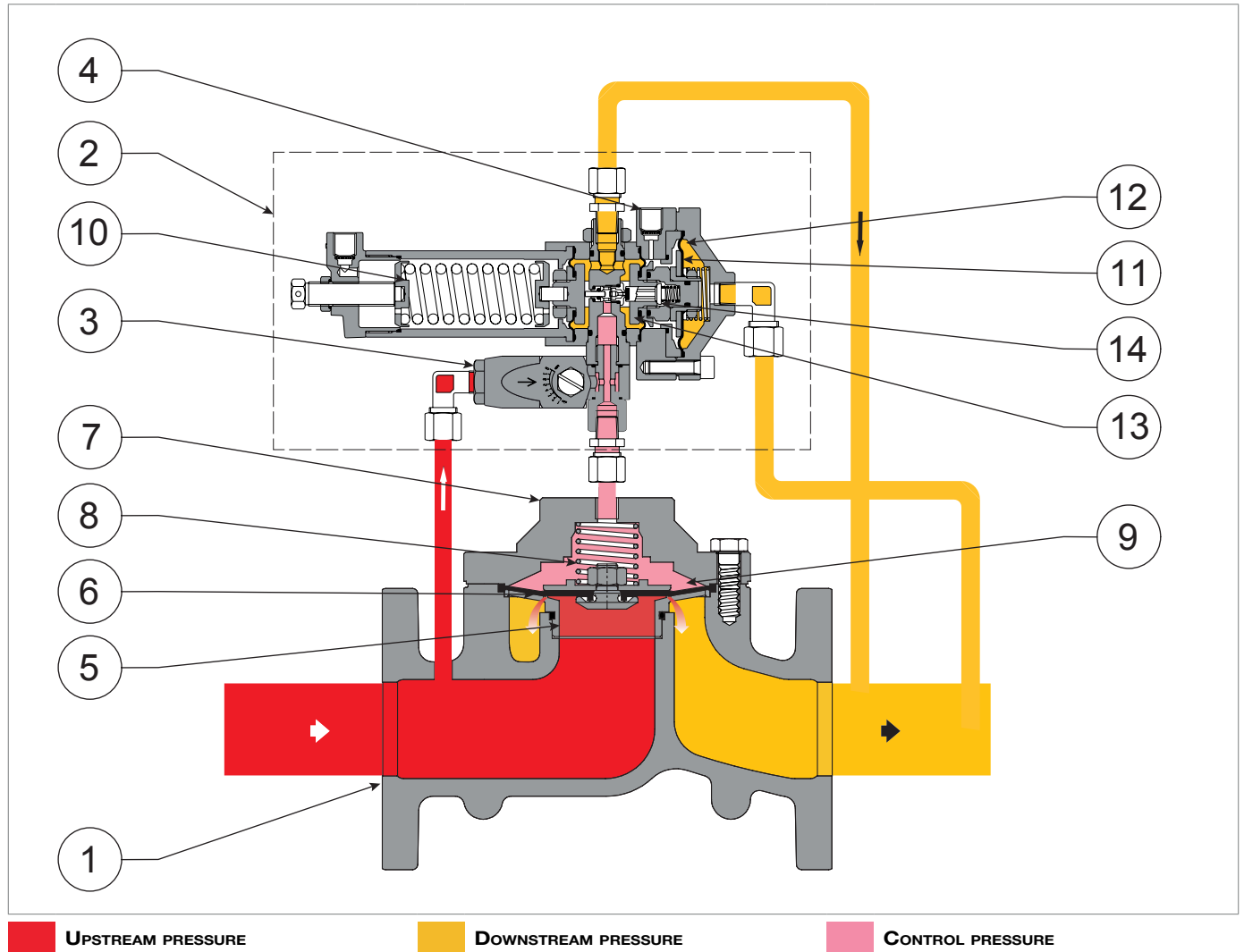


Fig. 4.2. Operation APERVAL 101

In the control head (7), the pressure control element (6), if not pressurised, is kept in the closed position by the spring (8).

Under normal operating conditions, the following forces act on the pressure control element (6):

- on the upper side: spring load (8), thrust resulting from the control pressure ( $C_p$ ) in the control chamber (9) and weight of the mobile unit;
- on the lower side: thrusts deriving from the upstream ( $U_p$ ) and downstream ( $D_p$ ) pressure as well as residual dynamic components.

The gas used to feed the pilot (4) and the control chamber (9) is drawn upstream of the control element (6) at the upstream pressure ( $U_p$ ) and cleaned of solid contaminants by the filter incorporated in the AR100 lamination valve (3).

The control pressure ( $C_p$ ) value is adjusted by the pilot (4) by comparing:

- the load of the setting spring (10) of the pilot;
- the action of the downstream pressure ( $D_p$ ) on the diaphragm (11) in the upper chamber (12).

During normal operation, the plug (14) of the pilot is positioned so that the control pressure ( $C_p$ ) above the pressure control element (6) is such that the downstream pressure ( $D_p$ ) is maintained around the selected value.

If, during operation, the following should occur:

Operating conditions	Operating consequences	Concluding outcome
<p><b>Decrease in downstream pressure (<math>D_p</math>) below the calibration value (<math>D_{ps}</math>) for:</b></p> <ul style="list-style-type: none"> <li>• <b>increase in the requested flow rate</b></li> <li>• <b>decrease in upstream pressure (<math>U_p</math>).</b></li> </ul>	<p>Imbalance of the mobile unit (13) which causes:</p> <ul style="list-style-type: none"> <li>• an increase in plug opening (14);</li> <li>• a decrease in control pressure (<math>C_p</math>).</li> </ul>	<p>The pressure control element (6) goes into the open position and causes an increase in gas flow until the downstream pressure (<math>D_p</math>) is restored to the set value (<math>D_{ps}</math>).</p>
<p><b>Increase in upstream pressure (<math>U_p</math>) above the calibration value (<math>D_{ps}</math>) for:</b></p> <ul style="list-style-type: none"> <li>• <b>decrease in required flow rate</b></li> <li>• <b>increase in upstream pressure (<math>U_p</math>).</b></li> </ul>	<p>Imbalance of the mobile unit (13) which causes:</p> <ul style="list-style-type: none"> <li>• partial closure of the plug (14) and flow of a lower quantity of gas;</li> <li>• the increase in the control pressure (<math>C_p</math>) due to the decrease in the pressure loss generated by the lamination valve AR100 (3).</li> </ul>	<p>The pressure control element (6) goes into the closed position and causes a decrease in gas flow until the pressure is restored to the calibration value (<math>D_{ps}</math>).</p>

Tab. 4.14.

## 4.3 - INTENDED USE

### 4.3.1 - ENVISAGED USE

The equipment in question is intended for:

Operation	Permitted	Unpermitted	Work environment
<b>Adjustment of the downstream pressure for:</b>	Gaseous, and non-corrosive, fluids that have been filtered beforehand.	<ul style="list-style-type: none"> <li>Liquids.</li> <li>Any product other than those permitted.</li> </ul>	Installations to carry and convey natural gas to supply networks for: <ul style="list-style-type: none"> <li>civil use;</li> <li>industrial use.</li> </ul>

Tab. 4.15.

The equipment in question is used as a main regulator and in-line monitor regulator.

It was designed to be used exclusively within the limits specified on the nameplate and according to the instructions and limits of use referred to in this manual.

Safe work parameters are:

- use within the limits stated on the nameplate and in this manual;
- compliance with the user manual procedures;
- routine maintenance to be carried out when and how recommended;
- special maintenance to be carried out if required;
- do not tamper with and/or bypass the safety devices.

### 4.3.2 - REASONABLY FORESEEABLE MISUSE

Incorrect and reasonably foreseeable use means the use of the equipment in a way not foreseen in the phase but which can derive from easily predictable human behaviour:

- corrosive fluids;
- fluids not properly treated upstream;
- liquids;
- instinctive reaction of an operator in the event of a malfunction, accident or breakdown while using the equipment;
- behaviour resulting from pressure to keep the machine running under all circumstances;
- behaviour resulting from carelessness;
- behaviour resulting from the use of the equipment by unauthorised and unsuitable people;
- using the equipment in a manner other than that referred to under "Intended use".

Any use of the equipment other than the intended use must be previously approved in writing by PIETRO FIORENTINI S.p.A. If no written approval is provided, use shall be considered improper.

In the event of "improper use", PIETRO FIORENTINI S.p.A. shall not be held liable for any damage caused to people or property, and any type of warranty on the equipment shall be deemed void.

### 4.3.3 - TYPES OF FLUIDS

The equipment works with combustible gases used:

- in pressure control stations according to EN 12186 or EN 12279;
- in transmission and distribution networks.
- in commercial and industrial plants (after checking by contacting the Manufacturer).

#### NOTICE!

**The equipment may be also used with inert gases, subject to verification by contacting the manufacturer.**



#### 4.4 - TECHNICAL FEATURES/PERFORMANCE

The APERVAL 101 equipment is a medium pressure regulator.

APERVAL 101 is a “top entry” type regulator that can be easily serviced and equipped with on-site accessories. The regulation system is balanced and guarantees a stable outlet pressure even when the inlet pressure varies.

The main specifications for this regulator are:

Technical features	
Maximum allowable pressure	Up to 18.9 bar
Ambient temperature range	-20 °C + 60 °C
Inlet gas temperature range	-10 °C + 60 °C
Inlet pressure range (bpu)	0.5 - 18.9 bar
Possible regulation range (Wd)	0.02 - 9.5 bar
Minimum differential pressure	0.48 bar
Accuracy class (AC)	up to 5 (depending on operating conditions)
Lock up pressure class (SG)	up to 10 (depending on operating conditions)

Tab. 4.16.

Cg, Kg and K1 coefficients			
Nominal diameter [mm]	50	80	100
Size [inches]	2”	3”	4”
Coefficient Cg	2091	4796	7176
Coefficient K1	108	108	108

Tab. 4.17.



## 5 - TRANSPORT AND HANDLING



### 5.1 - SPECIFIC WARNINGS FOR TRANSPORT AND HANDLING

#### NOTICE!

Transport and handling must be carried out by personnel:

- qualified (specially trained);
- who are familiar with accident prevention and workplace safety regulations;
- authorised to use lifting equipment;
- in compliance with the regulations in force in the country of destination of the equipment.

#### Transport with forklift or crane

<b>Operator qualification</b>	Person in charge of transport, handling, unloading and placing on site
<b>PPE required</b>	 <p> <b>WARNING!</b></p> <p>The PPE listed in this table is related to the risk associated with the equipment. For the PPE required to protect against risks associated with the workplace, installation or operating conditions, please refer to:</p> <ul style="list-style-type: none"> <li>• the regulations in force in the country of installation;</li> <li>• <u>any information provided by the Safety Manager at the installation facility.</u></li> </ul>
<b>Lifting equipment</b>	Hoist crane, forklift truck or other suitable equipment.
<b>Weights and dimensions of the equipment</b>	For dimensions and weights, refer to paragraph 5.2 "Physical characteristics of the equipment".

Tab. 5.18.

### 5.1.1 - PACKAGING AND FASTENERS USED FOR TRANSPORT

The transport packaging is designed and manufactured to avoid damage during normal transport, storage and handling. The equipment and spare parts must be kept in their packaging until they are installed.




Upon receiving the equipment:

- make sure that no part has been damaged during transport and/or handling;
- immediately report any damage found to PIETRO FIORENTINI S.p.A..

**! NOTICE!**

**PIETRO FIORENTINI S.p.A. shall not be liable for any damage to people or property caused by accidents due to failure to comply with the instructions provided in this manual.**

Tab. 5.19 shows the types of packaging used:

Ref.	Type of packaging	Image
A	Cardboard box	
B	Wooden box	
C	Pallet	

Tab. 5.19.

## 5.2 - PHYSICAL CHARACTERISTICS OF THE EQUIPMENT

### 5.2.1 - APERVAL 101

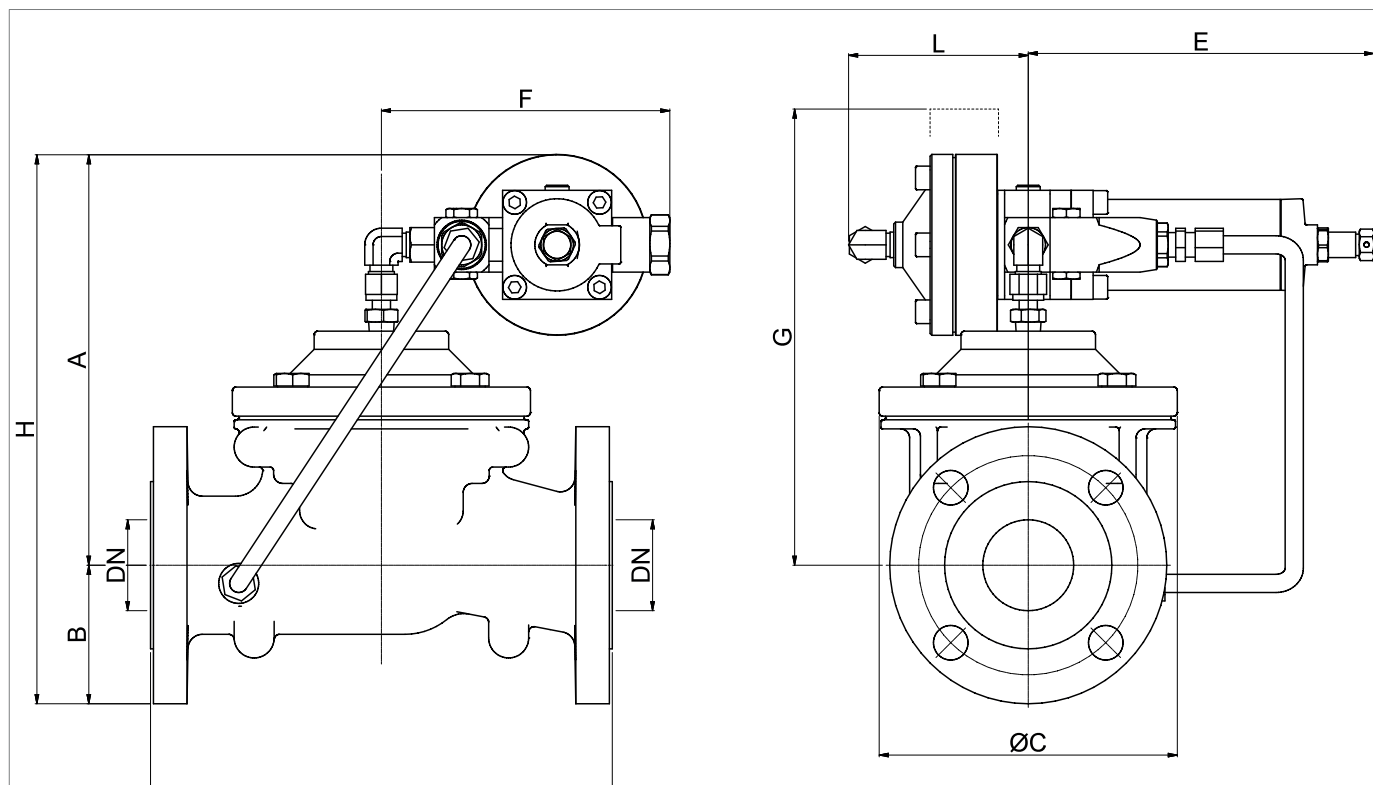


Fig. 5.3. APERVAL 101 physical characteristics

APERVAL 101 overall dimensions			
Nominal diameter [mm]	50	80	100
Size [inches]	2"	3"	4"
S - Ansi 150/PN 16	254	298	352
A	260	675	755
B	79	97	110
C	162	197	290
E	165	165	165
F	170	170	170
G	285	335	405
H	341	386	455
L	105	105	105
Connecting pneumatic pipes	Øe 10 x Øi 8		

Tab. 5.20.

Weight [kgf]			
Ansi 150/PN 16	23	33	66

Tab. 5.21.

### 5.3 - EQUIPMENT ANCHORING AND LIFTING METHOD

 **HAZARD!**

**Before moving the equipment, make sure that the capacity of the lifting equipment is suitable for the load.**

 **WARNING!**

Unloading, transport and handling activities must be carried out by operators qualified and specially trained:

- on accident prevention rules;
- on maximum safety in the workplace;
- on the use of lifting equipment.

 **ATTENTION!**

Before moving the equipment:

- remove any movable or hanging component or firmly secure it to the load;
- protect fragile equipment;
- check that the load is stable.

### 5.3.1 - FORKLIFT HANDLING METHOD

**HAZARD!**

It is forbidden to:

- Do not transit under suspended loads;
- Do not move the load over the personnel operating in the site/plant area.

**WARNING!**

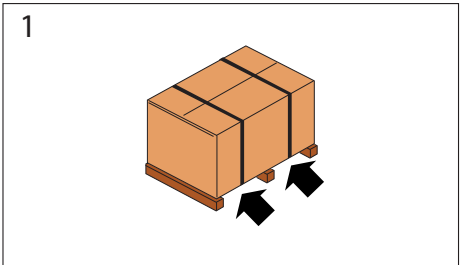
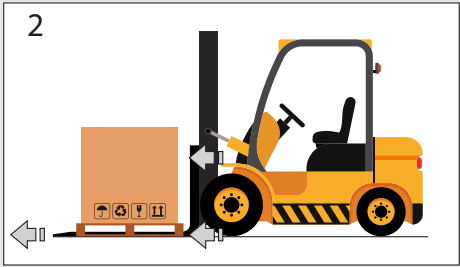


The following is not allowed on forklifts:


- carrying passengers;
- lifting people.

**NOTICE!**

Packaging must always be handled in a vertical position

Proceed as described at Tab. 5.22:

Step	Action	Image
1	Place the forks of the forklift under the load surface.	
2	Make sure that the forks protrude from the front of the load (by at least 5 cm), far enough to eliminate any risk of the transported load tipping.	
3	<p>Raise the forks until they are touching the load.</p> <p><b>NOTICE!</b> Fasten the load to the forks with clamps or similar devices if required.</p>	
4	Slowly lift the load by a few dozen centimetres and check its stability, making sure that the centre of gravity of the load is positioned at the centre of the lifting forks.	

Step	Action	Image
5	Tilt the mast backwards (towards the driver's seat) to help the over-turning moment and to ensure greater load stability during transport.	
6	Adjust transport speed according to the type of floor and load, avoiding sudden manoeuvres. <b>⚠ WARNING!</b> <b>In case of:</b> <ul style="list-style-type: none"> <li>• <b>obstacles along the path;</b></li> <li>• <b>particular operating situations;</b></li> </ul> <b>hinder operator visibility, the assistance of a ground operator is required, standing outside the range of action of the lifting equipment, with the task of signalling.</b>	-
7	Place the load in the chosen installation area.	-

Tab. 5.22.



### 5.3.2 - CRANE HANDLING METHOD

**⚠ WARNING!**

CE-marked chains, ropes and eyebolts must be used. Do not use chains connected to each other by bolts.

Always check that:

- the safety catch of the hook returns to the initial position;
- the ropes are in excellent condition and have adequate sections.

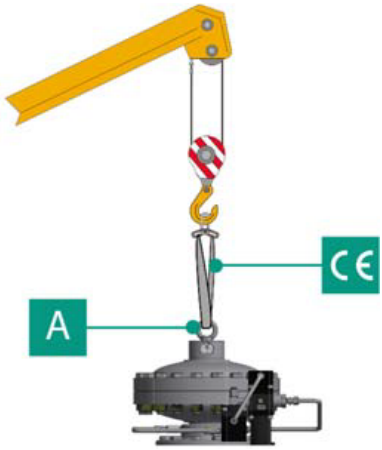
It is forbidden to:

- drag the load on the ground;
- operate near power lines;
- stand within the range of action of the crane.

**⚠ NOTICE!**


**Packaging must be always handled in a vertical position.**

The equipment must be handled using the lifting points provided on the equipment itself. For proper transport, follow the procedure in Tab. 5.23:

Step	Action	Image
1	Attach the lifting rope or chain to the appropriate supports (A). <b>⚠ WARNING!</b> <b>The lifting point is sized for lifting only the equipment, and not other parts of the system connected to it.</b>	
2	Slightly lift the load making sure the ropes or chains are secure. <b>⚠ NOTICE!</b> <b>Check whether the load is properly balanced.</b>	
3	Handle the load avoiding sudden movements.	
4	Place the load in the chosen installation area.	

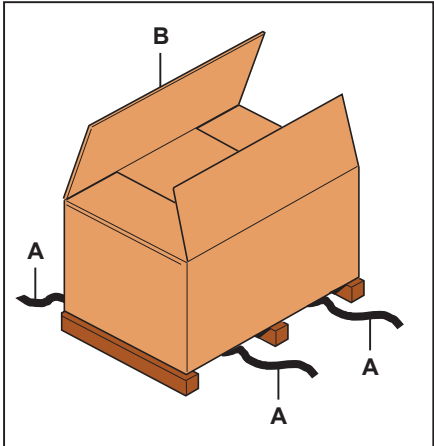
Tab. 5.23.

## 5.4 - PACKAGING REMOVAL

Packaging removal	
Operator qualification	<ul style="list-style-type: none"> <li>Person in charge of transport, handling, unloading and placing on site;</li> <li>Installer.</li> </ul>
PPE required	 <p><b>WARNING!</b></p> <p>The PPE listed in this table is related to the risk associated with the equipment. For the PPE necessary to protect against risks associated with the workplace or operating conditions, please refer to:</p> <ul style="list-style-type: none"> <li>the regulations in force in the country of installation;</li> <li>any information provided by the Safety Manager at the installation facility.</li> </ul>

Tab. 5.24.

To unpack the equipment in a cardboard box, proceed as described in Tab. 5.25:

Step	Action	Image
1	Remove the straps (A).	
2	Remove the packaging cardboard (B).	
3	Remove the fasteners that secure the equipment to the base (if any).	
4	<p>Move the equipment from the base to the place intended for it.</p> <p><b>NOTICE!</b></p> <p>Have at least 2 operators manually move the equipment, if required due to its dimensions/weight.</p>	

Tab. 5.25.

### **NOTICE!**

After removing all packaging materials, check for any anomalies.

If there are anomalies:

- do not install the equipment;
- contact PIETRO FIORENTINI S.p.A. and specify the details provided on the equipment nameplate.


### 5.4.1 - PACKAGING DISPOSAL

### **NOTICE!**

Sort the various materials making up the packaging and dispose of them in compliance with the regulations in force in the country of installation.

## 5.5 - STORAGE AND ENVIRONMENTAL CONDITIONS

If the equipment needs to be stored for an extended period, the minimum environmental conditions for the intended storage are provided. Only by complying with these requirements can the declared performance be guaranteed:


Conditions	Data
Maximum storage period	Maximum 3 years. <div style="border: 1px solid blue; padding: 5px;">  <b>NOTICE!</b>  <b>For installations in later periods, see paragraph “pre-installation warnings after prolonged storage.”</b> </div>
Temperature	Not above 25°C
Humidity	Not above 70%
Radiation	Away from radiation sources according to UNI ISO 2230:2009

Tab. 5.26.

### 5.5.1 - PRE-INSTALLATION WARNINGS AFTER PROLONGED STORAGE

For installations that have been stored for longer than 3 years, the condition of all rubber parts must be checked and, if found to be damaged, they must be replaced in order to ensure the correct functioning of the equipment.

For the replacement of the rubber parts of the equipment, please refer to “9 - Maintenance and functional checks”.

<div style="border: 1px solid blue; padding: 5px;">  <b>NOTICE!</b>  <b>PIETRO FIORENTINI S.p.A. recommends checking the condition of rubber parts in case of downtime or storage longer than 3 years.</b> </div>
--



## 6 - INSTALLATION

### 6.1 - INSTALLATION PRE-REQUISITES

#### 6.1.1 - ALLOWED ENVIRONMENTAL CONDITIONS

##### **WARNING!**

**To safely use the equipment, in full respect of the allowed environmental conditions, follow the data shown on the regulator plate and on any accessories (refer to paragraph “2.8 - Applied rating plates”).**

The installation site must be suitable for the safe use of the equipment.

The installation area of the equipment must be properly lit to ensure proper operator visibility during working on the equipment.

##### **NOTICE!**

**The equipment must operate in places that are properly lit by artificial lighting suitable for the protection of the operator (in compliance with UNI EN 12464-1:2011 and UNI EN 12464-2:2014). If maintenance work is to be performed in areas and/or parts that are poorly lit, it is mandatory to:**

- use all the light sources of the installation plant;
- be equipped with a lighting system handheld or connected to the power supply network, compliant with Directive 2014/34/EU (ATEX) for use in environments at risk of explosion;
- adhere to the temperature specified on the equipment nameplate.

### 6.1.2 - CHECKS BEFORE INSTALLATION

The equipment does not require any further upstream safety device for protection against any overpressure with respect to its **PS admissible pressure** when, for the upstream reduction station, the maximum incidental downstream pressure is:

$$\text{MIPd} \leq 1.1 \text{ PS}$$

**MIPd** = Maximum incidental downstream pressure value (for further information, see UNI EN 12186:2014).

#### **ATTENTION!**

**If the installation of the equipment requires the application of compression fittings, these must be installed in accordance with the instructions of the Manufacturer of the fittings themselves.**



**The choice of fittings must be compatible with:**

- **the use specified for the equipment;**
- **the plant specifications when required.**

Before installation, it must be ensured that:

- the expected dimensions of the installation site are compatible with those of the equipment;
- there are no impediments for the workers in charge of maintenance;
- the upstream and downstream pipes are at the same level and can bear the weight of the equipment;
- the inlet and outlet connections of the pipes are aligned on the flanges;
- the inlet and outlet connections of the equipment are clean and flawless;
- the inside of the upstream pipe is clean and free of processing residues such as welding slag, sand, paint residues, water, etc...

#### Installation

<b>Operator qualification</b>	Installer
<b>PPE required</b>	 <p> <b>WARNING!</b></p> <p><b>The PPE listed in this table is related to the risk associated with the equipment. For the PPE required to protect against risks associated with the workplace, installation or operating conditions, please refer to:</b></p> <ul style="list-style-type: none"> <li>• <b>the regulations in force in the country of installation;</b></li> <li>• <b>any information provided by the Safety Manager at the installation facility.</b></li> </ul>
<b>Equipment required</b>	Please refer to the chapter "7 - Attrezzature per la messa in servizio/manutenzione".

Tab. 6.27.

## 6.2 - SPECIFIC SAFETY INSTRUCTIONS FOR THE INSTALLATION STEP

 **WARNING!**

Before proceeding with installation, make sure that the upstream and downstream valves installed on the line are shut off.

 **WARNING!**

Installation may also take place in areas where there is a risk of explosion, which implies that all necessary prevention and protection measures have to be taken.

For these measures, please refer to the regulations in force at the place of installation.

### 6.3 - GENERAL INFORMATION ON CONNECTIONS

The equipment must be installed in-line with an arrow on the body pointing to the gas flow direction. In line installation as well as in square installation, they must be present (see Fig. 6.4 and Fig. 6.5):

Pos.	Description
1	1 <b>shut-off valve upstream</b> of the equipment.
2	2 <b>vent valves</b> one upstream and one downstream of the equipment.
3	2 <b>pressure gauges</b> one upstream and one downstream of the equipment.
4	1 <b>pressure regulator</b> .
5	1 <b>downstream shut-off valve</b> .

Tab. 6.28.

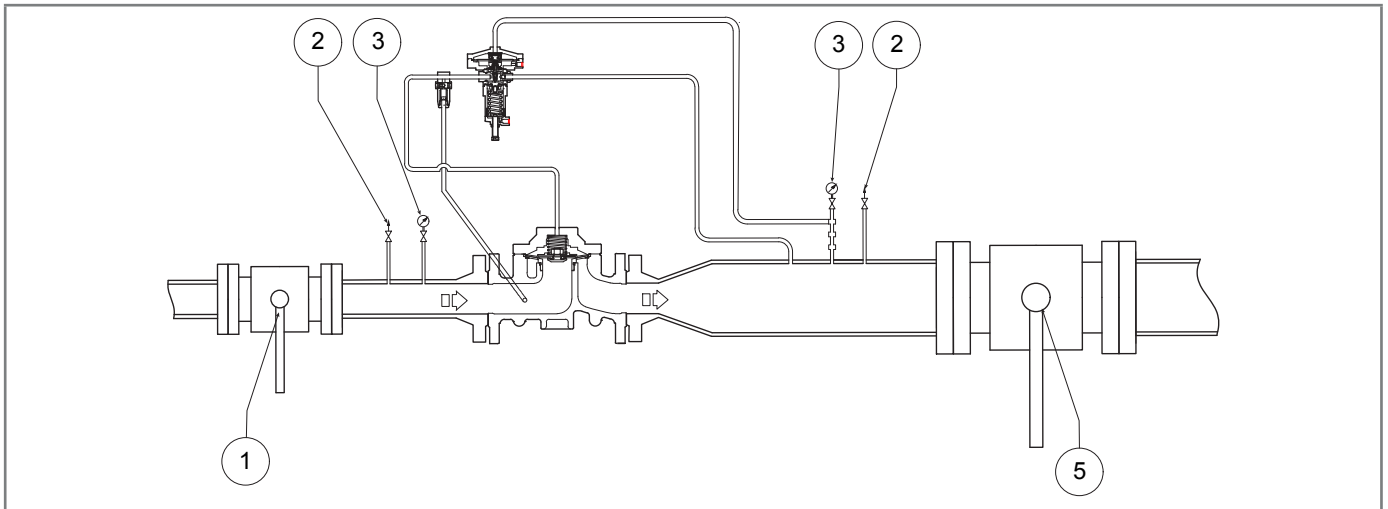


Fig. 6.4. In-line installation

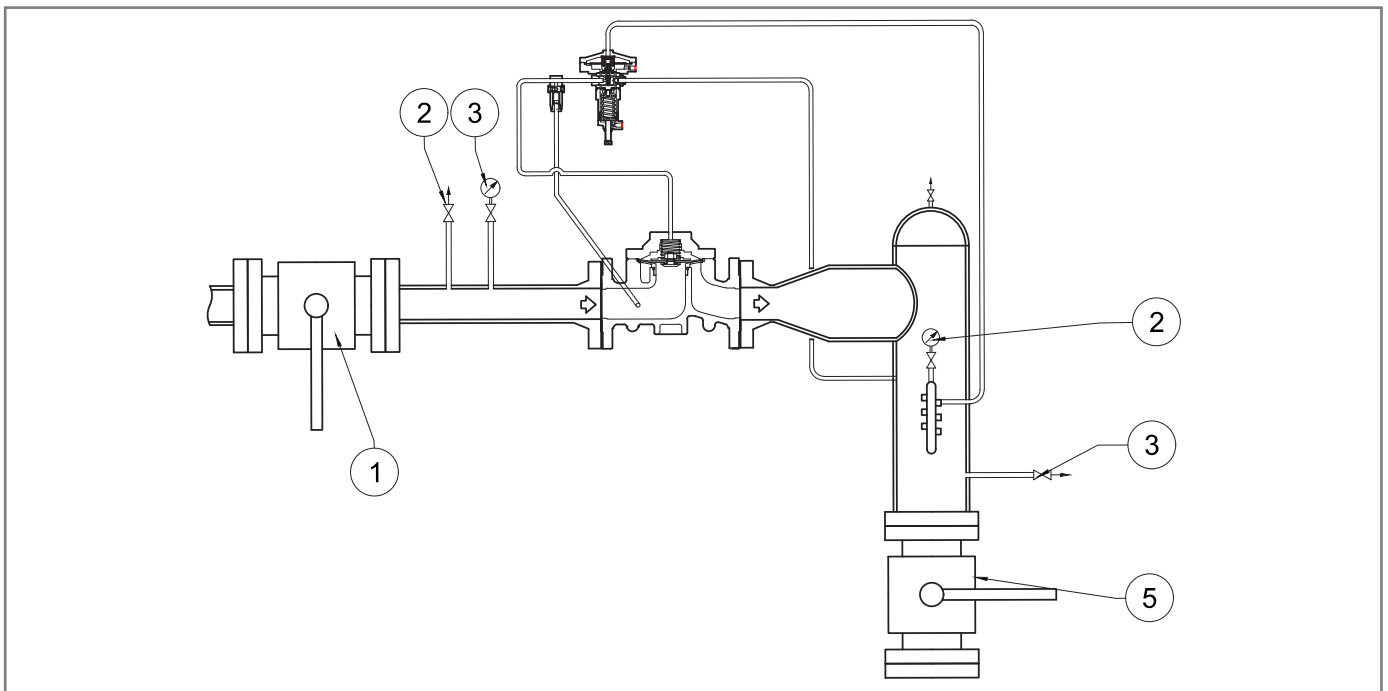


Fig. 6.5. Installation in a square pattern



**! NOTICE!**

When used in gas pressure reduction stations, the device must be installed at least according to the requirements of standards UNI EN 12186:2014 or UNI EN 12279:2007.

Equipment vents must be ducted in accordance with UNI EN 12186:2014 or UNI EN 12279:2007 or the standards in force at the place of installation of the equipment.

## 6.4 - REGULATOR INSTALLATION POSITIONS

Fig. 6.6 and Fig. 6.7 illustrate typical regulator arrangements:

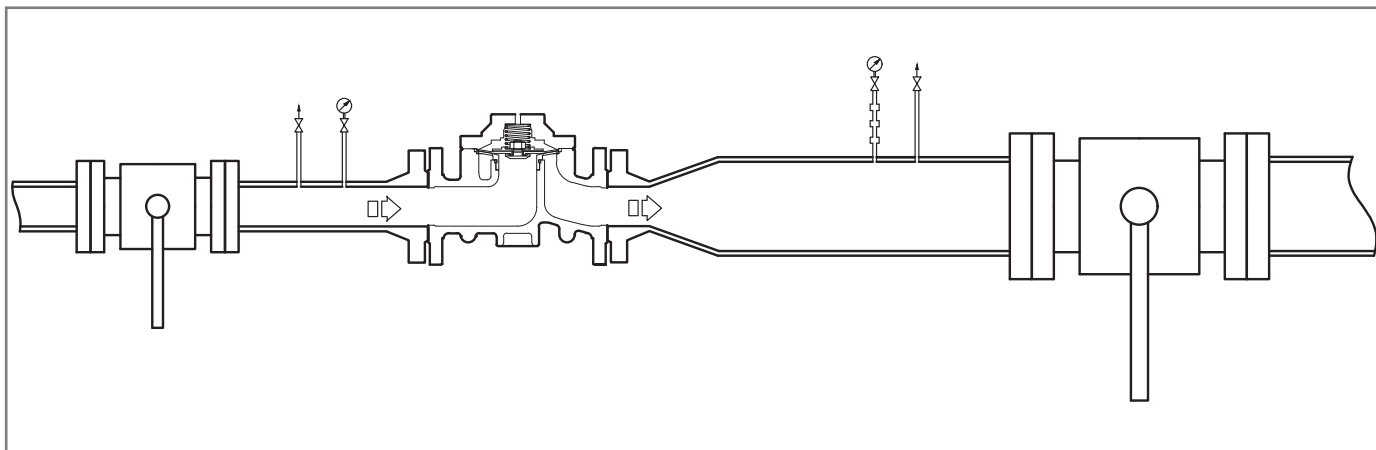


Fig. 6.6. Standard position

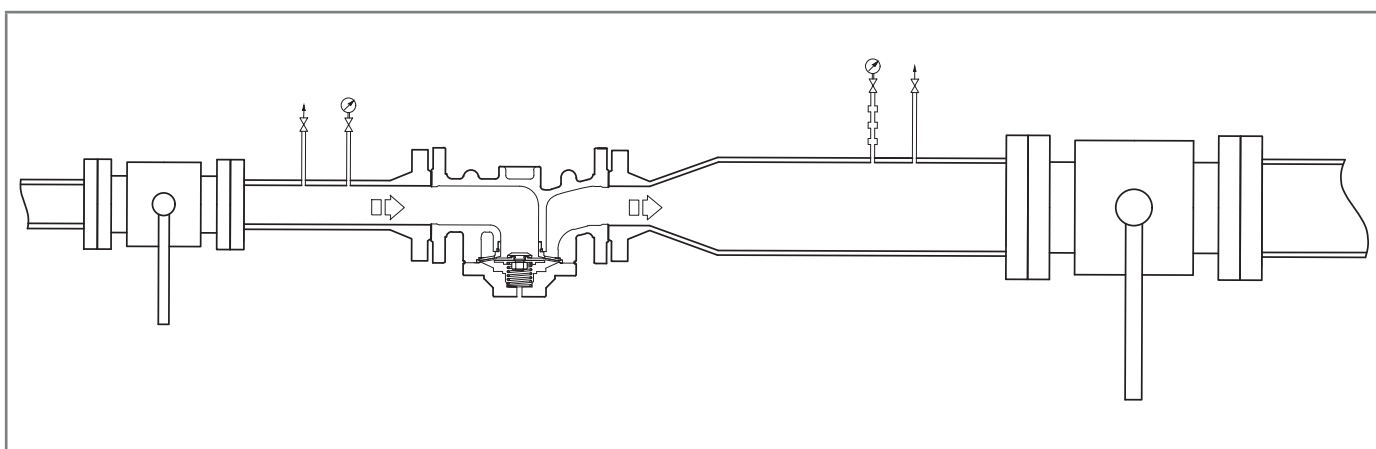


Fig. 6.7. Inverted position

## 6.5 - INSTALLATION PROCEDURES

### 6.5.1 - EQUIPMENT INSTALLATION PROCEDURE

Step	Action
1	Place the equipment in the section of the line designated for it.
2	Place the gaskets between the line flange and the regulator flange.
3	Insert the bolts into the appropriate holes of the connecting flanges.
4	Screw the bolts following the technical rules for tightening flanges.

Tab. 6.29.

#### NOTICE!

For installation after maintenance, replace the seals.

### 6.5.2 - CONNECTION OF THE SENSING LINES TO THE DOWNSTREAM PIPING

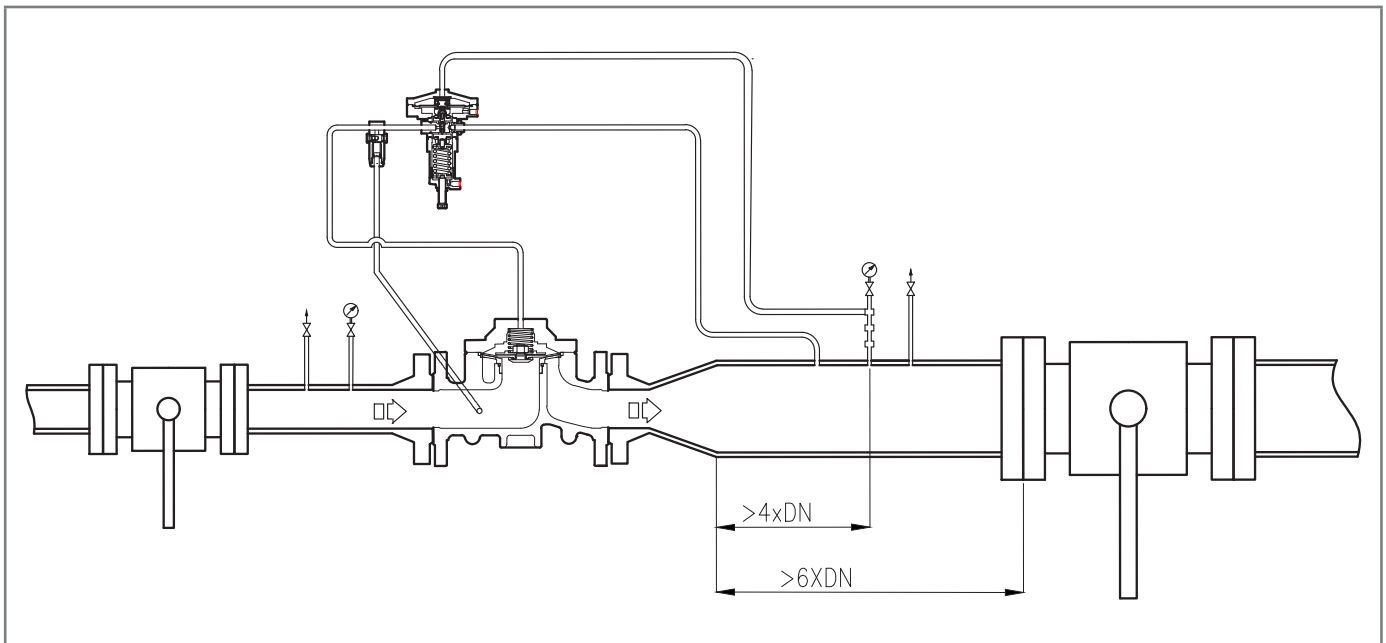


Fig. 6.8. Connection of sensing lines to the downstream piping

For proper adjustment, it is essential that:

- the downstream shut-off valve is placed at a distance of at least 6 times the nominal diameter of the pipe downstream of the regulator;
- the downstream sensing lines are placed on a straight section of pipe (with uniform diameter) having a length equal to at least 4 times the rated diameter of the pipe itself;

#### ATTENTION!

**The pilot drain must not be connected to the multi-socket switch.**

For optimum performance, the velocity of the pressurised fluid at the intake point should not exceed the following values:

$$V_{\max} = 30 \text{ m/s for } P_a > 5 \text{ bar}$$

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

As a limitation of use, the velocity of the pressurised fluid at the intake point does not exceed the following values:

$$V_{\max} = 40 \text{ m/s for } P_a > 5 \text{ bar}$$

To calculate the flow rate, use the following formula:

$$V = 345,92 \times \frac{Q}{DN^2} \times \frac{1 - 0,002 \times Pd}{1 + Pd}$$

**V** = gas velocity in m/sec

**Q** = gas flow rate Sm<sup>3</sup>/h

**DN** = nominal diameter of the regulator in mm

**Dp** = regulator outlet pressure in barg

**NOTICE!**

**All on-site pneumatic connections must have pipes with a minimum internal diameter of 8 mm**

To prevent the sensing line pipes from collecting impurities and condensation, it is necessary that:

- the pipe connections are always welded on the upper part or at maximum 90 degrees on the axis of the pipe (refer to Fig. 6.9);
- the hole in the piping has no burrs or internal protrusions;
- the slope of the pipe is always 5-10% towards the downstream pipe connection.

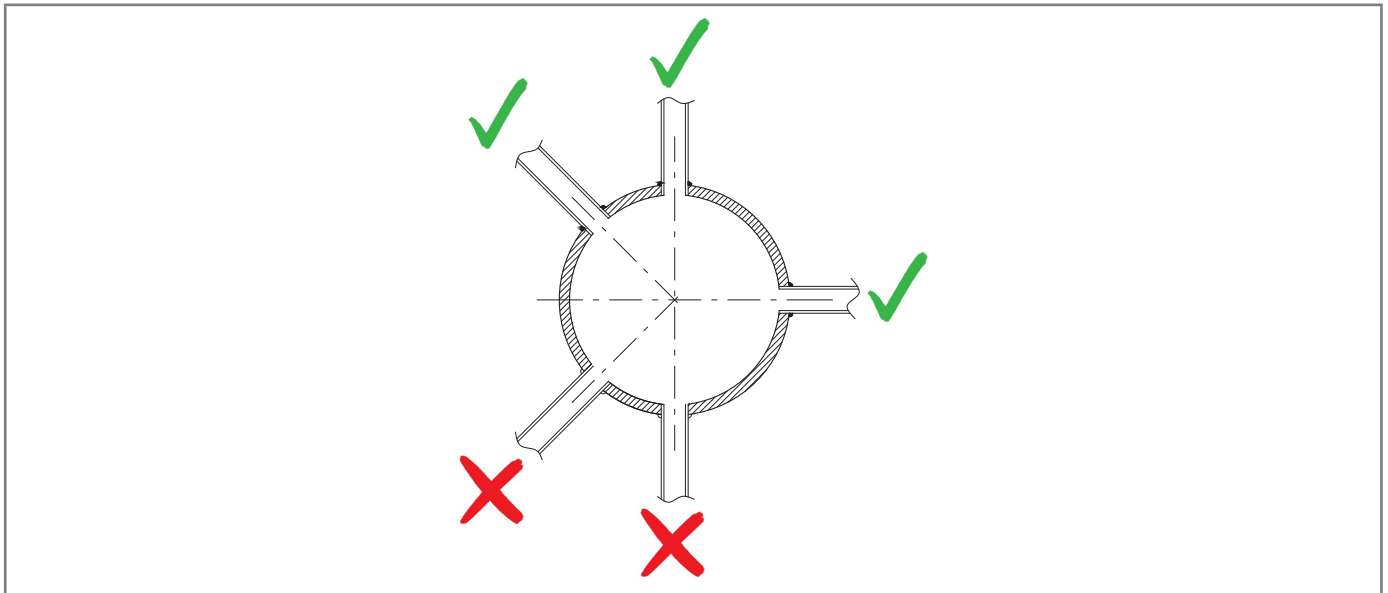


Fig. 6.9. Welded pipe connections

If there is a sensing line, provide equipment connections as shown below:

- 1 and 2 free sockets;
- 3 and 4 pilot sensing lines;
- 5 and 6 free sockets.

**! NOTICE!**

**If there is a multiple sensing line, it is not recommended to place shut-off valves on sensing lines. In any case, follow the regulations in force in the place of installation and use of the equipment.**

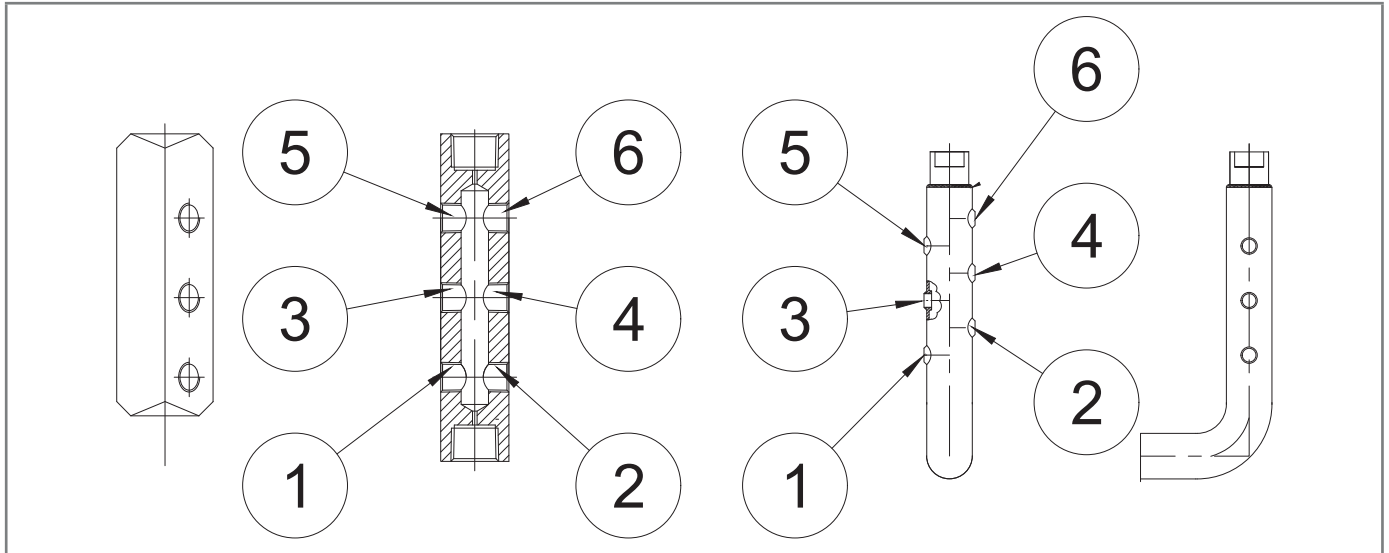


Fig. 6.10. Equipment connections


## 6.6 - POST-INSTALLATION AND PRE-COMMISSIONING CHECKS

When the equipment is operating, make sure that all connections are:

- properly secured/tightened to prevent any leakage during commissioning;
- connected correctly.



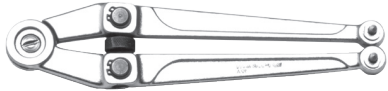



## 7 - COMMISSIONING/MAINTENANCE EQUIPMENT






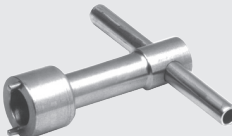


### 7.1 - LIST OF EQUIPMENT

Use of commissioning/maintenance equipment	
<b>Operator qualification</b>	<ul style="list-style-type: none"> <li>• Mechanical maintenance technician;</li> <li>• Electrical maintenance technician;</li> <li>• Installer;</li> <li>• Name of the user.</li> </ul>
<b>PPE required</b>	<div style="display: flex; align-items: center;">  </div> <div style="background-color: #f4a460; padding: 5px; margin-top: 5px;"> <p><b>⚠ WARNING!</b></p> </div> <p>The PPE listed in this table is related to the risk associated with the equipment. For the PPE required to protect against risks associated with the workplace, installation or operating conditions, please refer to:</p> <ul style="list-style-type: none"> <li>• the regulations in force in the country of installation;</li> <li>• any information provided by the Safety Manager at the installation facility.</li> </ul>

Tab. 7.30.

The types of equipment required to commission and service the equipment are described in Tab. 7.31:

Ref.	Equipment type	Image
<b>A</b>	Combination wrench	
<b>B</b>	Adjustable wrench	
<b>C</b>	Roller compass spanner	
<b>D</b>	Double ended bi-hex tubular socket wrench	
<b>E</b>	Bent male hex key	
<b>F</b>	Male T-handle hex wrench	

Ref.	Equipment type	Image
<b>G</b>	T-handle hex socket wrench	
<b>H</b>	Phillips screwdriver	
<b>I</b>	Slotted screwdriver	
<b>L</b>	O-ring extraction tool	
<b>M</b>	Circlip pliers	
<b>N</b>	Fiorentini special key	
<b>O</b>	Fiorentini special key	
<b>P</b>	Fiorentini special tool	

Tab. 7.31.

## 7.2 - EQUIPMENT NEEDED FOR THE DIFFERENT CONFIGURATIONS

Tab. 7.33 is distinguished by:

Term	Description
<b>K./Wr.</b>	Key, with reference to the equipment indicated in Tab. 7.31
<b>Code</b>	Code, referring to the equipment.
<b>DN</b>	Indicates the Nominal Diameter of the reference configuration.
<b>L.</b>	Length, referred to the equipment.
<b>Ref.</b>	Reference to the equipment.
<b>Type</b>	Type (size) or code of the equipment.

Tab. 7.32.

APERVAL 101				
Equipment		Size [inches]		
Ref.	Type	2"	3"	4"
<b>A</b>	K./Wr.	10-16-17-18-19-22-24-27-30	10-16-17-18-19-22-24-27-30	10-16-17-18-19-22-24-27-41
<b>B</b>	L.	300		
<b>C</b>	Ø	4		
<b>E</b>	K./Wr.	2.5-8	2.5-8	2.5-8
<b>F</b>	K./Wr.	4-5-8	4-5-8	4-5-8
<b>G</b>	K./Wr.		10-17-19-22	10-17-19-22
<b>I</b>	L.	65 x 100		
<b>L</b>	Code	7999099		

Tab. 7.33.





## 8 - COMMISSIONING

### 8.1 - GENERAL WARNINGS

#### 8.1.1 - SAFETY REQUIREMENTS FOR COMMISSIONING

##### HAZARD!

During commissioning the risks associated with any discharges to the atmosphere of flammable or noxious gases must be evaluated.

##### HAZARD!

In case of installation on distribution networks for natural gas, consider the risk associated with explosive mixtures (gas/air) being formed inside the piping, if the line is not subjected to inerting.

##### WARNING!

During commissioning, any unauthorised personnel must keep away.  
The no entry area has to be marked with signs and/or boundaries.

##### NOTICE!

Commissioning has to be carried out by authorised and qualified personnel.

The equipment is supplied with the pilot unit already calibrated.

Even if the built-in monitor PM/182 or the built-in blocking valve SA are fitted to the equipment, any pilots or pressure switches present will already be calibrated.



##### NOTICE!

It is possible that for various reasons (e.g. vibrations during transport) the calibration of the equipment's accessories may vary, although within the values indicated on the identification plates.

Before commissioning the equipment, it is necessary to check that:

- all shut-off valves (inlet, outlet, any bypass) are closed;
- the gas is at a temperature within the limits specified on the data plate.

#### Commissioning

<b>Operator qualification</b>	<ul style="list-style-type: none"> <li>• Installer;</li> <li>• Qualified technician.</li> </ul>
<b>PPE required</b>	<div style="display: flex; align-items: center;">  </div> <p> <b>WARNING!</b></p> <p>The PPE listed in this table is related to the risk associated with the equipment. For the PPE required to protect against risks associated with the workplace, installation or operating conditions, please refer to:</p> <ul style="list-style-type: none"> <li>• the regulations in force in the country of installation;</li> <li>• <u>any information provided by the Safety Manager at the installation facility.</u></li> </ul>
<b>Equipment required</b>	Please refer to the chapter "7 - Commissioning/maintenance equipment".

Tab. 8.34.

## 8.2 - PRELIMINARY PROCEDURES FOR COMMISSIONING

### HAZARD!

Before commissioning the equipment, it must be ensured that any source of explosion has been eliminated if there is such a danger.

### WARNING!

Before commissioning, you need to make sure that the characteristics of the equipment are suitable for the conditions of use.


### ATTENTION!

To protect the equipment from damage, never:

- pressurise the equipment through a valve located downstream of it;
- depressurise the equipment through a valve located upstream of it.

Commissioning can be carried out using two different procedures:

### Commissioning types

<b>Injection of an inert fluid</b>	Pressurising the equipment by injecting an inert fluid (e.g. nitrogen) to avoid potentially explosive mixtures for services with combustible gases. <div style="background-color: #f4a460; padding: 5px;"><b> WARNING!</b></div> <b>During pressurisation, always check that the equipment has no leaks.</b>
<b>Direct injection</b>	Direct injection of gas into pipes, keeping the gas velocity in the pipes as low as possible (maximum permitted value of 5 m/s).

Tab. 8.35.

### **8.3 - PROPER COMMISSIONING CHECK**

Completely sprinkle the equipment with a foaming solution in order to check the tightness of the regulator's external surfaces and of the connections made during installation (or equivalent control system).

### **8.4 - CALIBRATION OF ANY ACCESSORIES**

#### **! NOTICE!**

**To properly calibrate the equipment and accessories present, refer to the accuracy class indicated on the nameplates (see section "2.8 - Applied rating plates").**

**8.5 - REGULATOR COMMISSIONING PROCEDURE**

In the application consisting of two pressure adjusting lines, it is advisable to commission one line at a time, starting with the line with the lowest set point.

The set point value is mentioned on the test certificate enclosed with each piece of equipment.

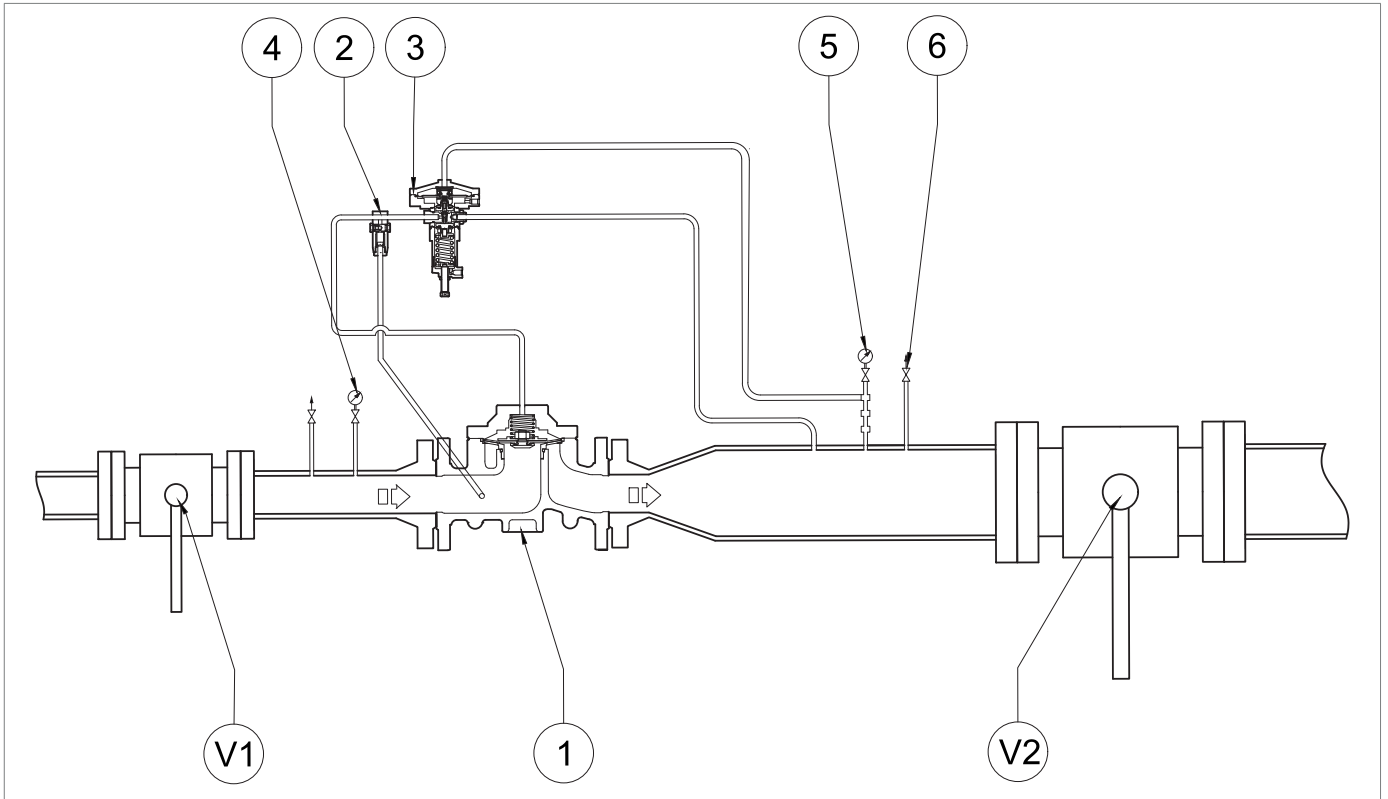


Fig. 8.11. Commissioning the regulator

Step	Action
1	Partially open the bleed cock (6).
2	Completely unscrew the fixing nut and adjusting screw (Fig. 8.12, ref. 10) of the pilot (3) to relieve the spring.
3	<p>Check that the value of the AR100 lamination valve (2) is between 3 and 5.</p> <p><b>! NOTICE!</b></p> <p><b>If necessary, turn the screw of the AR100 lamination valve (2) to the required value.</b></p>
4	<p>Open the inlet shut-off valve (V1) very slowly.</p> <p><b>! NOTICE!</b></p> <p><b>Check the pressure by referring to the pressure gauge (4) located upstream.</b></p>
5	<p>Turn the pilot adjustment screw (3) clockwise to load the calibration spring until the regulator (1) trips.</p> <p><b>! NOTICE!</b></p> <p><b>Check the pressure referring to the pressure gauge (5) located upstream.</b></p>
6	Close the bleed cock (6).
7	<p>Check that the downstream pressure, after an increase phase, does not exceed the shut-off pressure value (refer to the SG value on the nameplate, see par. 2.8).</p> <p><b>! NOTICE!</b></p> <p><b>If the downstream pressure exceeds the closing pressure value, refer to chapter 10 "Troubleshooting" to clear the causes of the malfunctions.</b></p>
8	<p>Check the tightness of all the fittings between the shut-off valves (V1, V2).</p> <p><b>! NOTICE!</b></p> <p><b>Check for sealing with a foaming substance.</b></p>
9	<p>Open the downstream shut-off valve (V2) very slowly until the piping has been filled completely.</p> <p><b>! NOTICE!</b></p> <p><b>If at the beginning of this operation, the pressure in the downstream pipeline is much lower than the calibration pressure, shutter the opening of this valve so as not to exceed the maximum flow rate of the system.</b></p>
10	<p><b>! NOTICE!</b></p> <p><b>Should pumping phenomena or an excessive decrease in downstream pressure (Dp) occur, please refer to Chapter 10 'Troubleshooting' to remove the cause of the malfunction.</b></p>
11	Tighten the adjusting screw and fixing nut (Fig. 8.12, ref. 10) of the pilot (3).

Tab. 8.36.

## 8.5.1 - DEVICE CALIBRATION

### 8.5.1.1 - 300 SERIES PILOT CALIBRATION

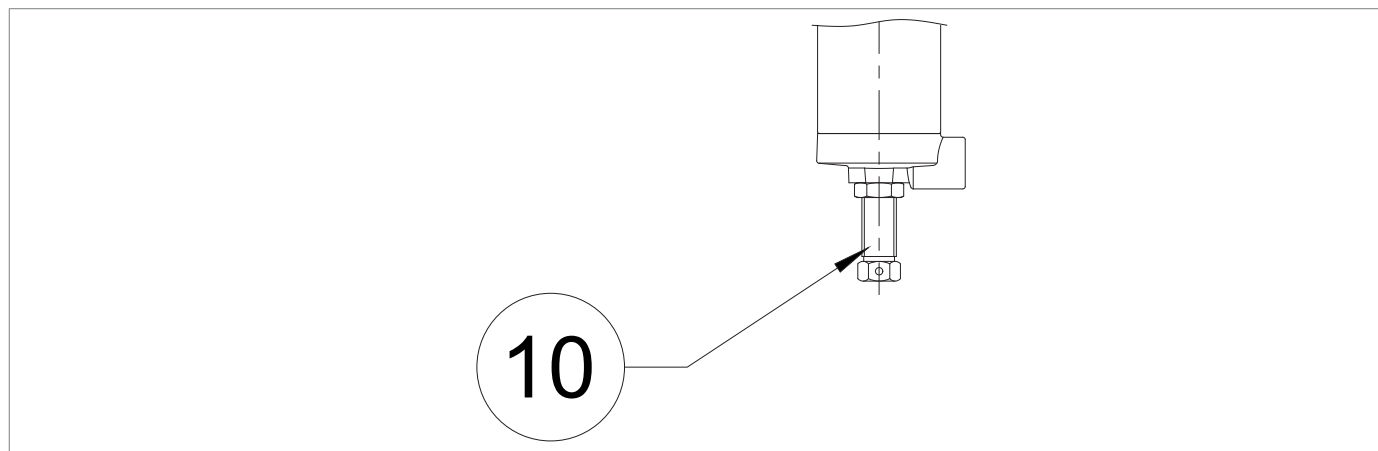


Fig. 8.12. 300 series pilot calibration

Turn the adjusting screw (10):

- anti-clockwise to decrease the adjusted pressure;
- clockwise to increase the adjusted pressure.

## 9 - MAINTENANCE AND FUNCTIONAL CHECKS

### 9.1 - GENERAL WARNINGS

#### HAZARD!

- Maintenance work must be carried out by qualified personnel trained on safety in the workplace and authorised to carry out equipment-related activities.
- Repair or maintenance work not provided for in this manual may be carried out only if approved by PIETRO FIORENTINI S.p.A.. PIETRO FIORENTINI S.p.A. shall not be held liable for damage to persons or property resulting from operations other than those described herein or carried out in ways other than as indicated.

#### WARNING!

Before conducting any work, make sure that the line on which the equipment is installed:

- has been shut off downstream and upstream;
- has been discharged.

#### WARNING!

In case of doubt, do not perform any work. Contact PIETRO FIORENTINI S.p.A. for the necessary clarifications.

The management and/or use of the equipment includes interventions that are necessary as a result of normal use such as:

- inspection and checks;
- functional checks;
- routine maintenance;
- special maintenance.

#### NOTICE!

Maintenance work is strictly related to:

- the quality of the conveyed gas (impurities, humidity, gasoline, corrosive substances);
- the effectiveness of filtration;
- the equipment conditions of use.

To properly run the equipment, one should:

- follow the service frequency referred to in the manual for functional checks and routine maintenance.
- not exceed the time interval between one service and the next. The time interval is to be understood as the maximum acceptable; it can, however, be shortened;
- promptly check the causes of any anomalies such as excessive noise, leakage of fluids or similar and remedy them. The timely removal of any causes of anomaly and/or malfunction prevents further damage to the equipment and ensures operator safety;

Before beginning disassembly of the equipment, make sure that:

- the spare parts and parts used in replacements have adequate requirements to ensure the original performance of the equipment. Use recommended original spare parts;
- the operator must have the necessary equipment (see chapter “7 - Commissioning/maintenance equipment”).


 **NOTICE!**

**The recommended spare parts are unambiguously identified with tags indicating:**

- **the assembly drawing number of the equipment where they are installed (see Chapter “12 - Recommended spare parts”);**
- **The position specified in the assembly drawing of the equipment.**

The equipment maintenance operations are divided, from an operational point of view, into three main categories:



### Commissioning and maintenance operations

<b>Periodic checks and inspections</b>	All those checks that the operator must carry out on a regular basis to ensure that the equipment is in proper working order.
<b>Routine maintenance</b>	All those operations that the operator must preventively carry out to ensure proper operation of the device over time. Routine maintenance includes: <ul style="list-style-type: none"> <li>• inspection;</li> <li>• control;</li> <li>• adjustment;</li> <li>• cleaning;</li> <li>• lubrication;</li> <li>• replacement;</li> </ul> of all spare parts.
<b>Special maintenance</b>	All those operations to be carried out by the operator when the equipment requires them. <div style="background-color: red; color: white; padding: 5px; margin: 5px 0;"> <b>HAZARD!</b></div> <p><b>Special maintenance:</b></p> <ul style="list-style-type: none"> <li>• <b>requires extensive and specialised knowledge of the machines, operations required, risks involved and correct procedures to operate safely;</b></li> <li>• <b>must be provided by qualified, trained and authorised technicians.</b></li> </ul>

Tab. 9.37



## 9.2 - PERIODICALLY CHECKING AND INSPECTING THE EQUIPMENT FOR PROPER OPERATION

Periodic checks and inspections	
<b>Operator qualification</b>	Mechanical maintenance technician
<b>PPE required</b>	 <div style="background-color: orange; padding: 5px; margin-top: 10px;">  <b>WARNING!</b> </div> <p>The PPE listed in this table is related to the risk associated with the equipment. For the PPE required to protect against risks associated with the workplace, installation or operating conditions, please refer to:</p> <ul style="list-style-type: none"> <li>• the regulations in force in the country of installation;</li> <li>• <u>any information provided by the Safety Manager at the installation facility.</u></li> </ul>

Tab. 9.38

Tab. 9.39 lists the checks and inspections, i.e. the operations that do not require any manual service on the equipment. Some items thereof can be replaced remotely using suitable remote control tools:

Activity description	Equipment/accessories involved	Evaluation criterion	Minimum frequency
<b>Significant performance check*</b>	Pressure regulators	<ul style="list-style-type: none"> <li>• No fluctuations in the adjusted pressure.</li> <li>• Significant pressure values within pre-set limits.</li> </ul>	Monthly
	Gas flow slam-shut type safety devices (external position indicator)	<ul style="list-style-type: none"> <li>• Fully open position.</li> </ul>	
	Stand-by monitor (external position indicator)	<ul style="list-style-type: none"> <li>• Fully open position.</li> </ul>	
<b>Visual inspection of the equipment outside condition</b>	All	<ul style="list-style-type: none"> <li>• No visible damage.</li> <li>• External surface protection as per UNI 9571-1:2012.</li> </ul>	Half-yearly

Tab. 9.39

\* These checks may be carried out remotely if there is a remote control system capable of analysing the significant performance of the equipment and of sending alerts/alarms when pre-set thresholds are reached.

## 9.3 - ROUTINE MAINTENANCE

### 9.3.1 - GENERAL SAFETY WARNINGS

 **HAZARD!**

- Put the equipment in a safe condition (close the downstream and then the upstream shut-off valve, drain the equipment completely and lastly drain the line);
- Ensure that the pressure upstream and downstream of the equipment is “0”.

 **NOTICE!**

**Before installing new sealing elements (o-rings, diaphragm, etc.), they must be checked for integrity.**

### 9.3.2 - REPLACEMENT FREQUENCY FOR COMPONENTS SUBJECT TO WEAR

**NOTICE!**

The following provisions shall apply to equipment components only.

The non-metallic parts of the equipment concerned are divided into the following two categories:

**Preventive maintenance work**

<b>Category 1</b>	Covers parts subject to wear and/or abrasion, where: <ul style="list-style-type: none"> <li>wear and tear means the normal degradation of a part after prolonged use under normal operating conditions;</li> <li>abrasion is the mechanical action on the surface of the affected part resulting from the passage of gas under normal operating conditions.</li> </ul>
<b>Category 2</b>	takes into account parts subject to aging only, including parts that also require lubrication and/or cleaning.

Tab. 9.40

**NOTICE!**







Check, within the minimum frequency specified in “Tab. 9.41”, the available components for wear/abrasion/aging.

Category	Part description	Evaluation criterion	Minimum replacement frequency
1	Valve seat sealing rings and non-metallic plugs	Pressure regulators	6 years
		Safety devices	
		Pressure safety system equipment	
1	Non-metallic parts with internal sealing function of valve seats and accessories of individual equipment	Pilots	6 years
		Pre-regulators	
		Accelerators	
		Any others	
1	Non-metallic parts with a sealing function between parts, at least one of which is in motion under normal working/operating conditions	Pressure regulators	6 years
		Gas flow slam-shut type safety devices	
		Relief devices with discharge to atmosphere	
1	Non-metallic parts with sealing function involved in disassembly operations during maintenance	Equipment subject to maintenance	6 years
2	Non-metallic parts providing feedback (sensing elements) of the controlled pressure of safety equipment	Safety equipment and/or accessories	6 years
2	Non-metallic parts with sealing and performance functions (diaphragms) of equipment	Pressure regulators and accessories	6 years
		Gas flow slam-shut type safety devices	6 years
		Relief device with discharge to atmosphere	6 years

Category	Part description	Evaluation criterion	Minimum replacement frequency
2	Non-metallic parts of equipment with an internal sealing function: under normal operating conditions during maintenance	Relief valves	6 years
		Regulation lines disconnection equipment	If there are proven leaks
2	Non-metallic parts with a static sealing function only	Various equipment	If there are proven leaks
2	Lubricating parts	Shut-off valves	Yearly
		Other equipment	Yearly
2	Filter elements	Filters	As needed

Tab. 9.41

## 9.4 - ROUTINE MAINTENANCE PROCEDURES

Routine maintenance	
<b>Operator qualification</b>	Mechanical maintenance technician
<b>PPE required</b>	<div style="display: flex; justify-content: space-around; align-items: center;">      </div> <div style="background-color: #f4a460; padding: 5px; margin-top: 5px;">  <b>WARNING!</b> </div> <p>The PPE listed in this table is related to the risk associated with the equipment. For the PPE required to protect against risks associated with the workplace, installation or operating conditions, please refer to:</p> <ul style="list-style-type: none"> <li>the regulations in force in the country of installation;</li> <li><u>any information provided by the Safety Manager at the installation facility.</u></li> </ul>
<b>Equipment required</b>	Please refer to the chapter “7 - Commissioning/maintenance equipment”.

Tab. 9.42

**9.4.1 - TIGHTENING TORQUES APERVAL 101**

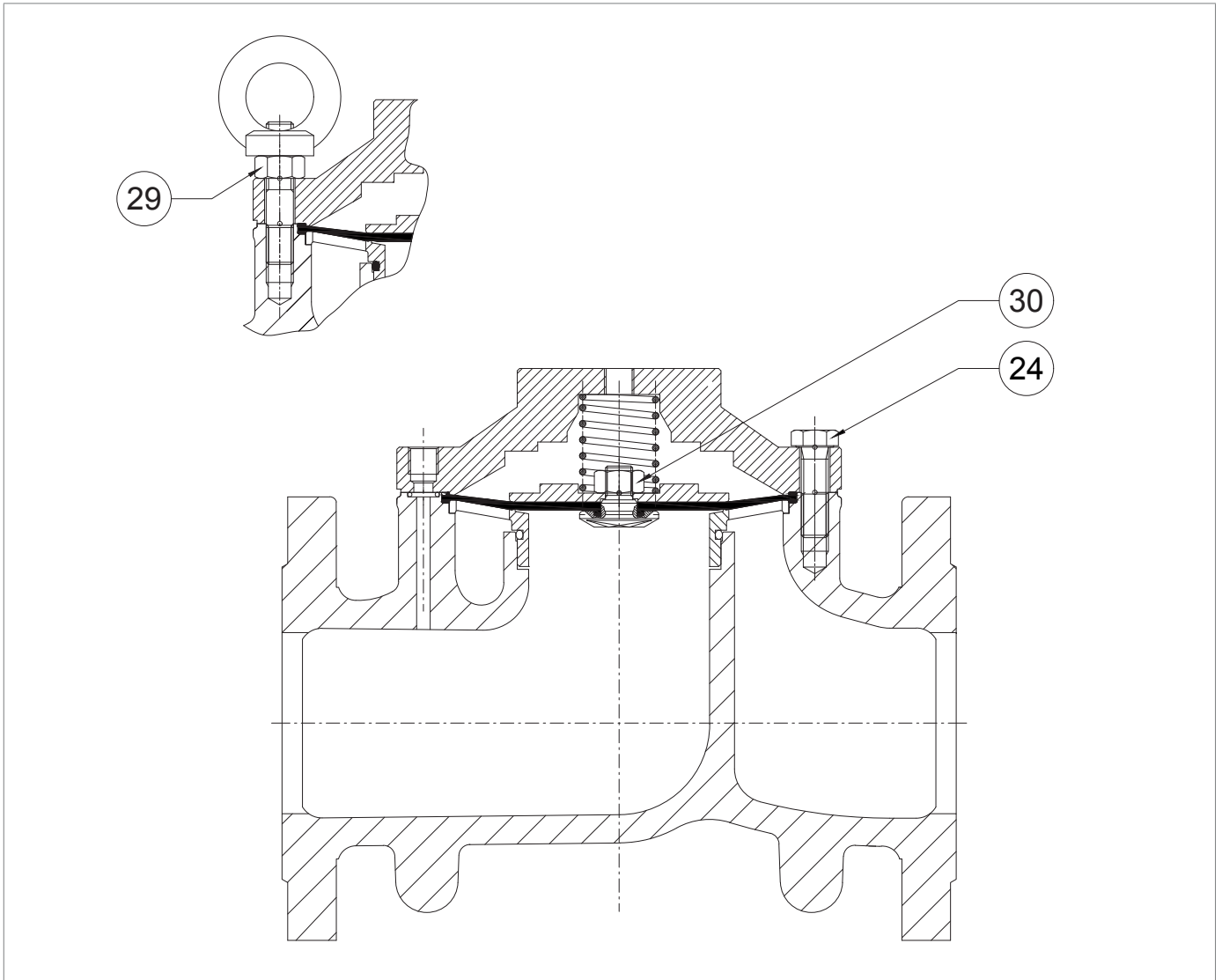


Fig. 9.13. Tightening torques APERVAL 101

**APERVAL 101 2"**

Pos.	Description	Torque (nm)	Torque (ft - lb)
24	Screw M12X35 UNI 5739	80	59
30	Nut M12X1.25 UNI 5588	50	36

*Tab. 9.43.*
**APERVAL 101 3"**

Pos.	Description	Torque (nm)	Torque (ft - lb)
24	Screw M12X40 UNI 5739	80	59
29	Nut M12 UNI 5588	80	59
30	Nut M12X1.25 UNI 5588	50	36

*Tab. 9.44.*
**APERVAL 101 4"**

Pos.	Description	Torque (nm)	Torque (ft - lb)
24	Screw M12X45 UNI 5737	80	59
29	Nut M12 UNI 5588	80	59
30	Nut M16 UNI 5588	80	59

*Tab. 9.45.*

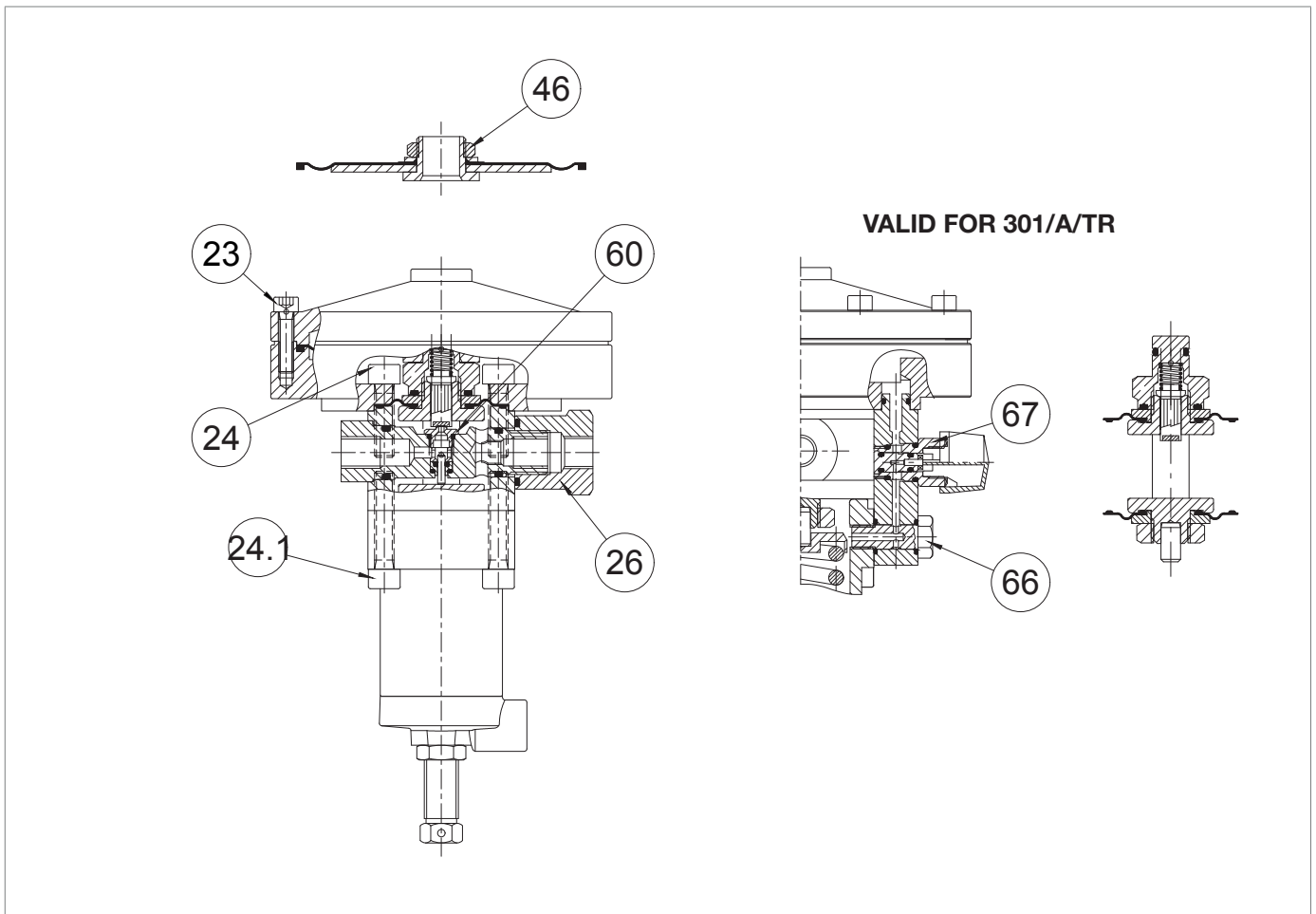
**9.4.1.1 - TIGHTENING TORQUES FOR PILOTS SERIES 300**


Fig. 9.14. Tightening torques for pilot 301/A and 301/A/TR

PILOT 301/A; 301/A/TR			
Pos.	Description	Torque (nm)	Torque (ft - lb)
2	Nut M16X1	20	14
23	Screw M6X25 UNI 5931 AISI	7	5
24	Screw M8X30 UNI 5931 AISI	20	14
24.1	Screw M8X40 UNI 5931 AISI	20	14
25	Nut M16X1.5	20	14
26	Nut M18X1.5	20	14
46	Nut M20X1	8	5
66	Screw G 1/8	20	14

Tab. 9.46



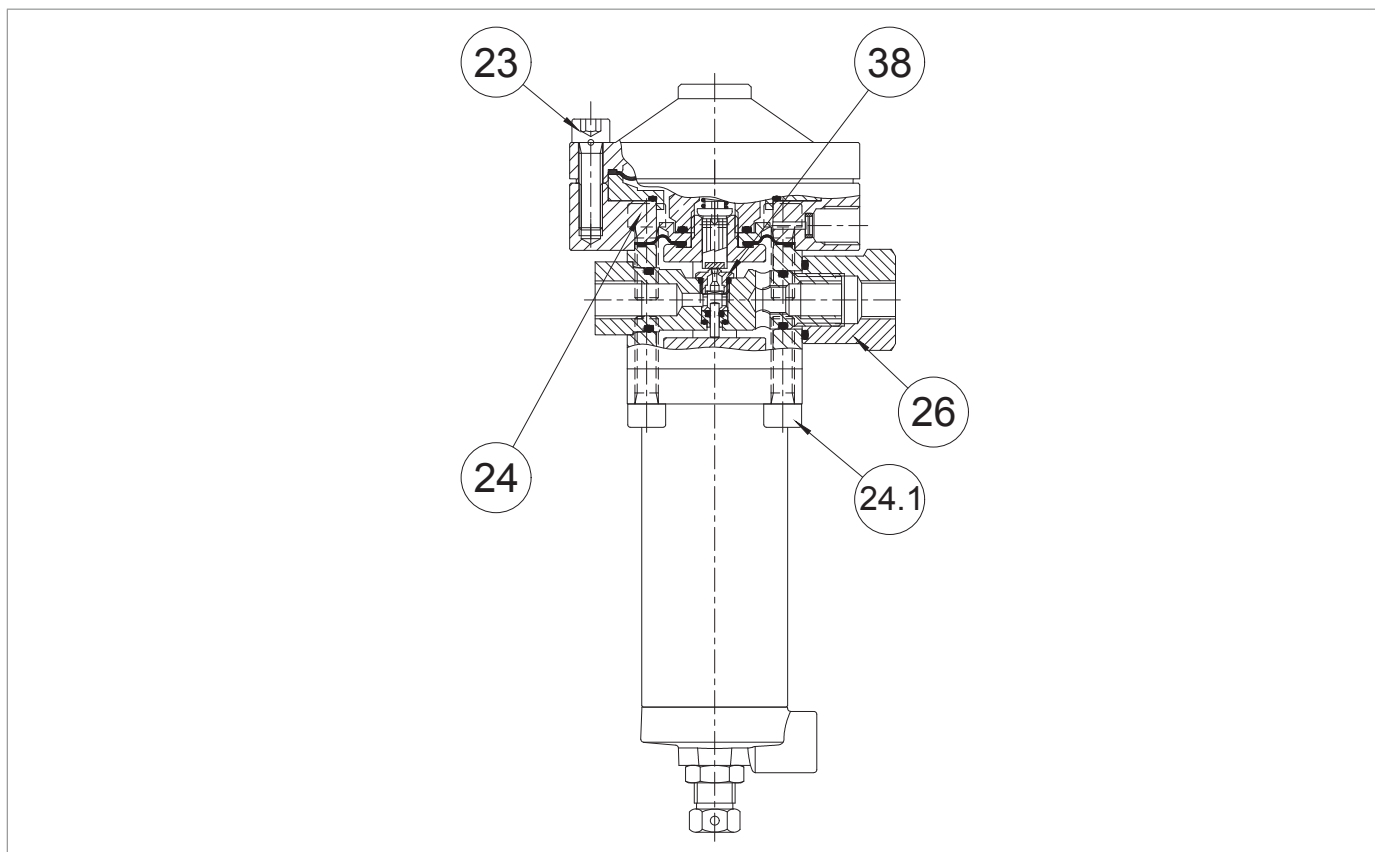


Fig. 9.15. Tightening torques for pilots 302/A

PILOT 302/A			
Pos.	Description	Torque (nm)	Torque (ft - lb)
2	Nut M16X1	20	14
23	Screw M8X30 UNI 5931 AISI	20	14
24	Screw M8X25 UNI 5931 AISI	20	14
24.1	Screw M8X30 UNI 5931 AISI	20	14
25	Nut M16X1.5	20	14
26	Nut M18X1.5	20	14
44	Nut M20X1	8	5

Tab. 9.47

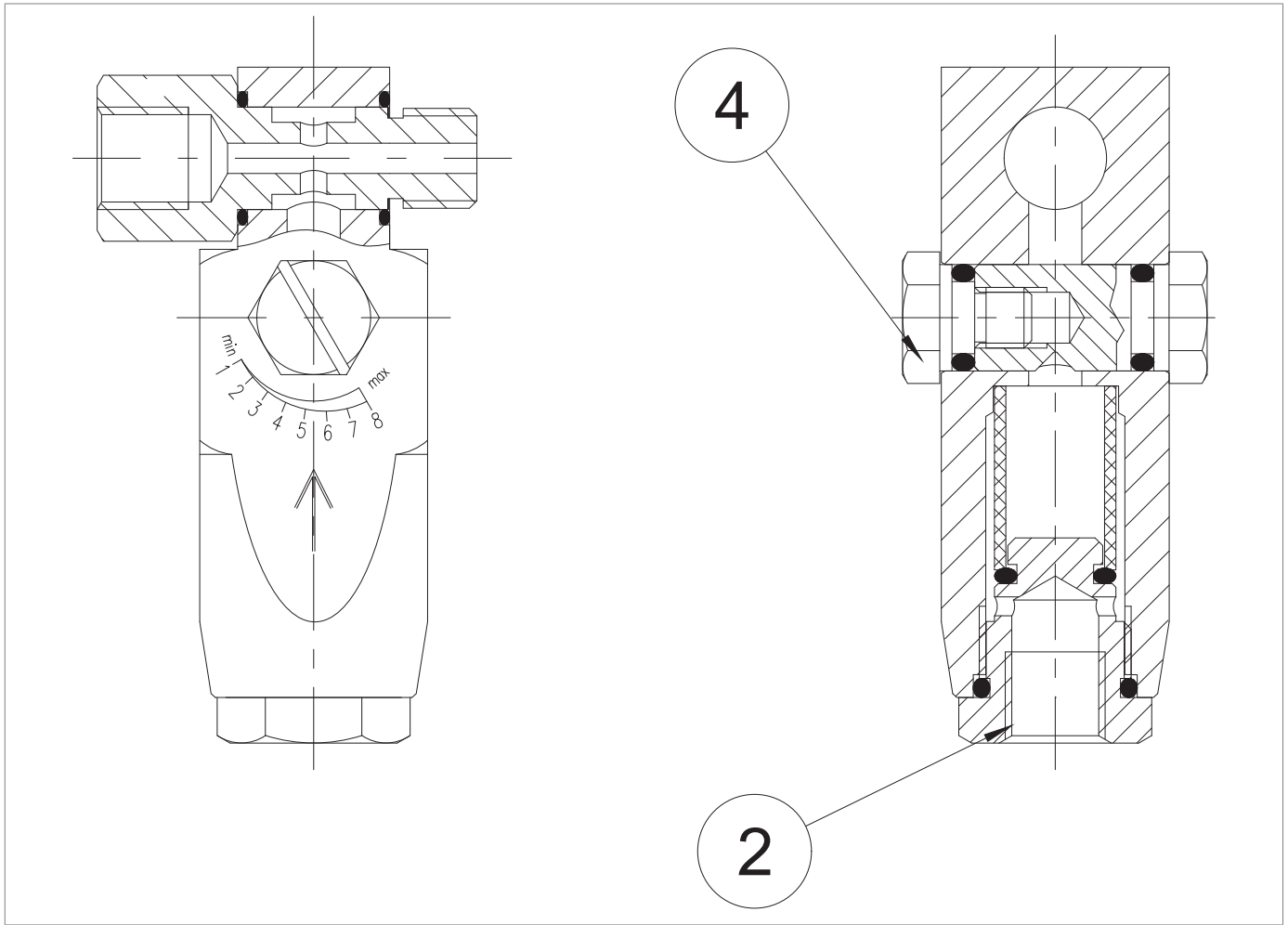
**9.4.1.2 - TIGHTENING TORQUES FOR LAMINATION VALVE AR100**


Fig. 9.16. Tightening torques for lamination valve AR100

<b>LAMINATION VALVE AR100</b>			
<b>Pos.</b>	<b>Description</b>	<b>Torque (nm)</b>	<b>Torque (ft - lb)</b>
2	Cap M20X1.5	20	14
4	Screw M8 AISI	4	2

Tab. 9.48

## 9.4.2 - REPLACING ELEMENTS SUBJECT TO WEAR AND ABRASION

### 9.4.2.1 - INITIAL OPERATIONS

#### **! ATTENTION!**

Before carrying out any work, it is important to ensure that the line on which the regulator is installed has been shut off upstream and downstream, and discharged.

#### **! ATTENTION!**

During assembly, make sure to tighten the screws as per the tables (tightening torques), according to the size for which maintenance is being carried out.

Proceed as follows:

Step	Action
1	Unscrew the conical seal fittings to disconnect all power outlets and sensing lines for the pilot and regulator.
2	Loosen the nut securing the pilot support bracket to the regulator.
3	Remove the following from the regulator: <ul style="list-style-type: none"> <li>the installed series 300 pilot;</li> <li>the AR100 lamination valve.</li> </ul>
	<b>! NOTICE!</b> For procedures for replacing pilot unit parts, please refer to paragraphs “9.4.3 - Regulator Maintenance Procedure APERVAL 101”

Tab. 9.49

### 9.4.2.2 - CROSS DIAGRAM FOR TIGHTENING SCREWS

When indicated by the maintenance procedure, refer to the following diagram to tighten the screws:

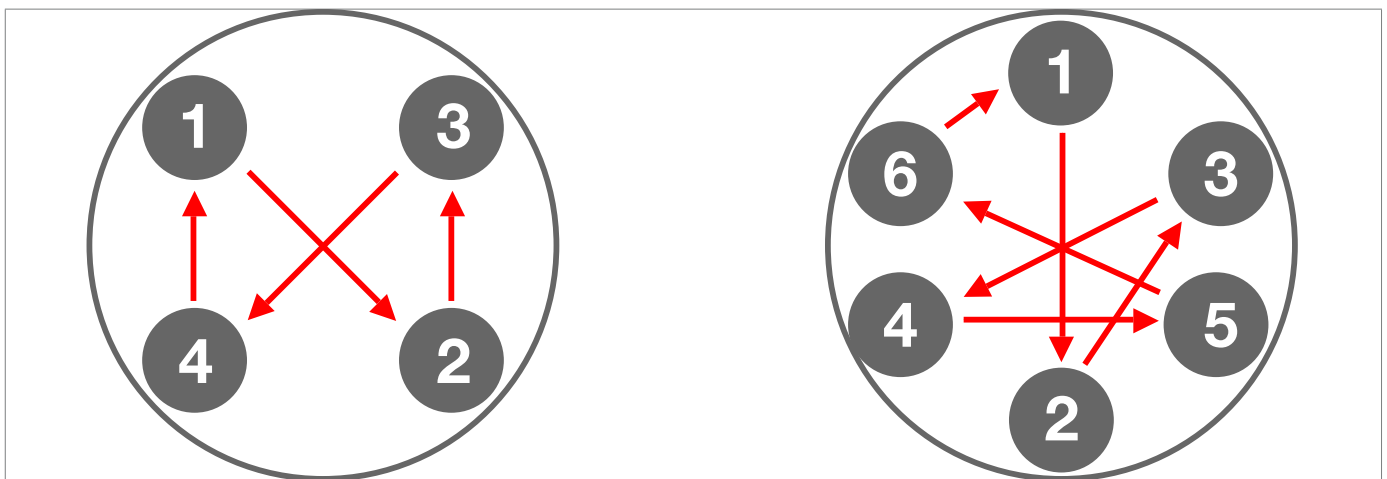


Fig. 9.17. Cross diagram

**9.4.3 - REGULATOR MAINTENANCE PROCEDURE APERVAL 101**

**9.4.3.1 - APERVAL 101 2" - 3"**

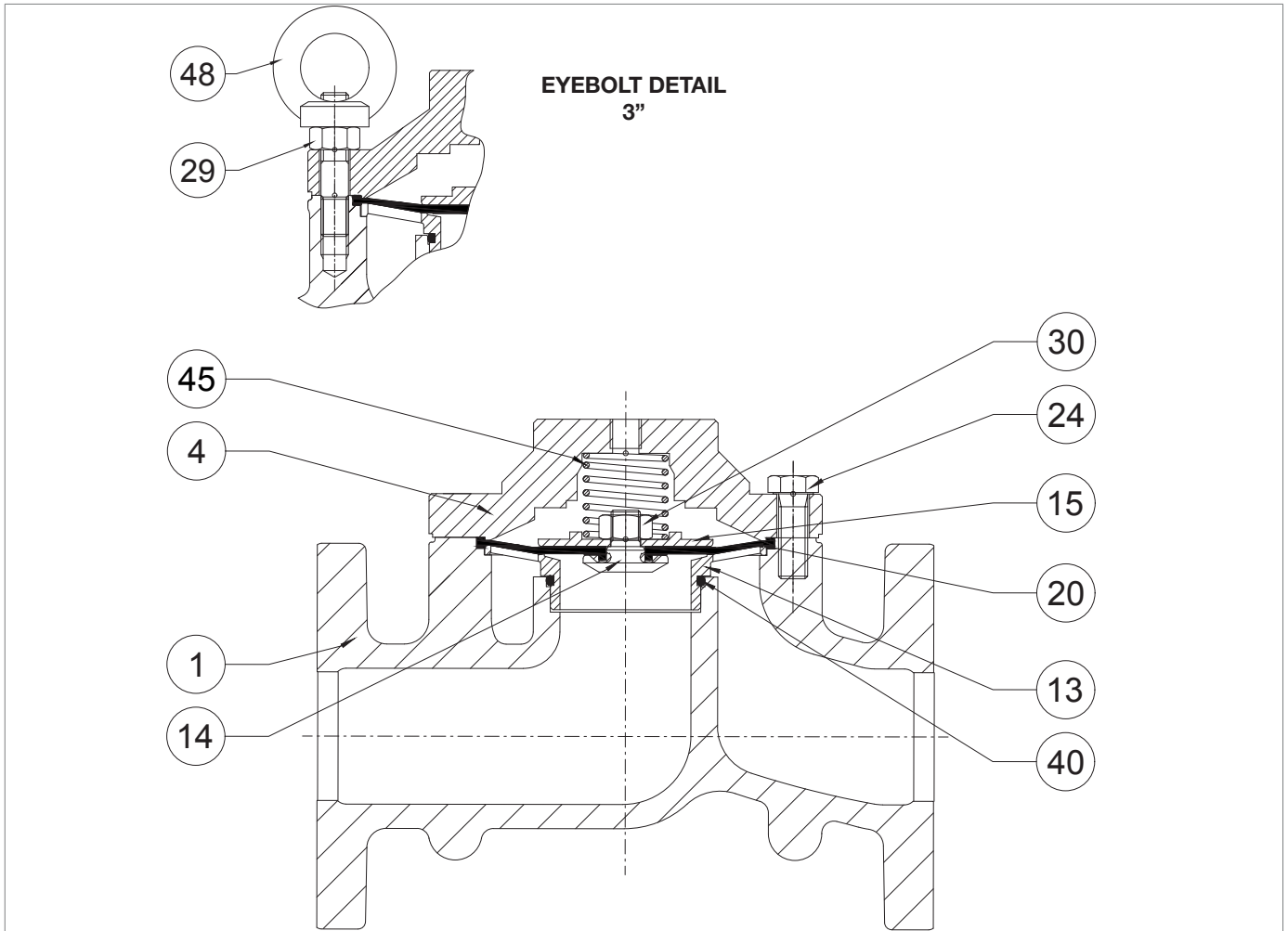
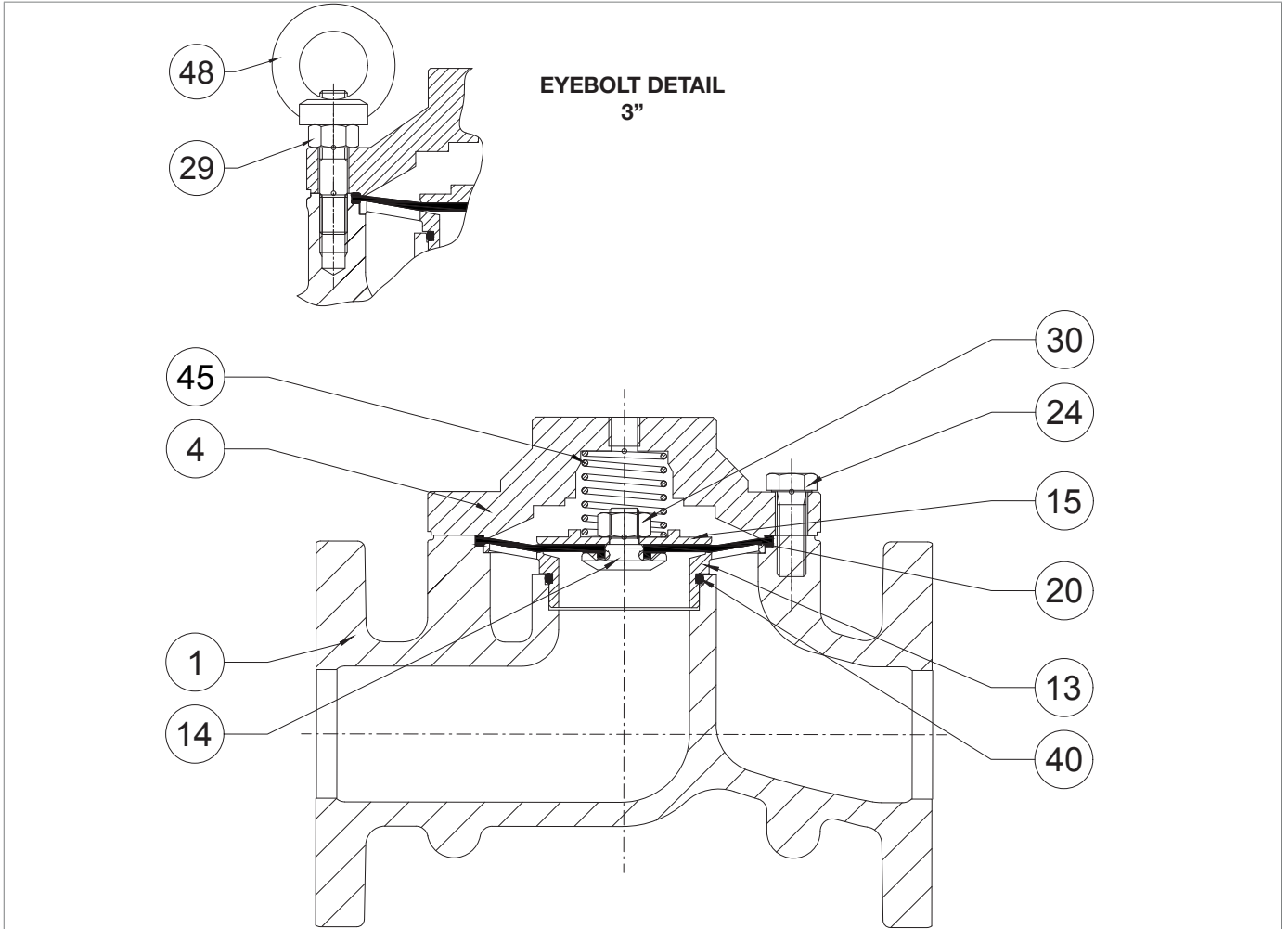


Fig. 9.18. Regulator APERVAL 101 2" - 3"

Step	Action
1	<b>ONLY VALID FOR 3"</b> Unscrew and remove the nuts (48).
2	<b>ONLY VALID FOR 3"</b> Unscrew and remove the nut (29).
3	Unscrew and remove the fixing screws (24).
4	Remove the upper lid (4).
5	Remove the spring (45).
6	Take out the diaphragm unit (14, 15, 20, 30).
7	Unscrew and remove the nut (30). <b>NOTICE!</b> <b>During this phase, keep the screw (14) still.</b>
8	Remove the diaphragm protection disc (15).
9	Remove and replace the diaphragm (20) from the screw (14), taking care to lubricate the lanyard with synthetic grease.
10	Assemble the diaphragm unit, placing the diaphragm (20) in the screw (14). <b>NOTICE!</b> <b>Carefully place the diaphragm O-ring (20) into the screw slot (14).</b>
11	Fit the diaphragm protection disc (15).
12	Insert and fix the nut (30) according to the following tightening torques: <ul style="list-style-type: none"> <li>• 2": Tab. 9.43</li> <li>• 3": Tab. 9.44</li> </ul> <b>NOTICE!</b> <b>During this phase, keep the screw (14) still.</b>
13	Remove the grid (13). <b>NOTICE!</b> <b>Take care not to damage the grid seat profile (13).</b>
14	Remove the O-ring (40) from the grid (13) and replace it, taking care to lubricate it with synthetic grease. <b>NOTICE!</b> <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution</b>
15	Fit the grid (13).
16	Put the diaphragm unit (14, 15, 20, 30) in place. <b>NOTICE!</b> <b>Take care to lubricate the retaining slots with synthetic grease.</b>
17	Fit the spring (45).
18	Fit the upper cover (4).
19	Insert and fix the screws (24) according to the following tightening torques: <ul style="list-style-type: none"> <li>• 2": Tab. 9.43</li> <li>• 3": Tab. 9.44</li> </ul> <b>NOTICE!</b> <b>Tighten the screws as shown in the diagram at "9.4.2.2 - Cross diagram for tightening screws".</b>



*Regulator APERVAL 101 2" - 3"*

Step	Action
20	<b>ONLY VALID FOR 3"</b> Insert and fix the nut (29) according to the following tightening torques: <ul style="list-style-type: none"><li>• 3": Tab. 9.44</li></ul>
21	<b>ONLY VALID FOR 3"</b> Insert the eyebolts (48).

Tab. 9.50

 **WARNING!**

**Ensure that all parts have been fitted correctly.**

9.4.3.2 - APERVAL 101 4"

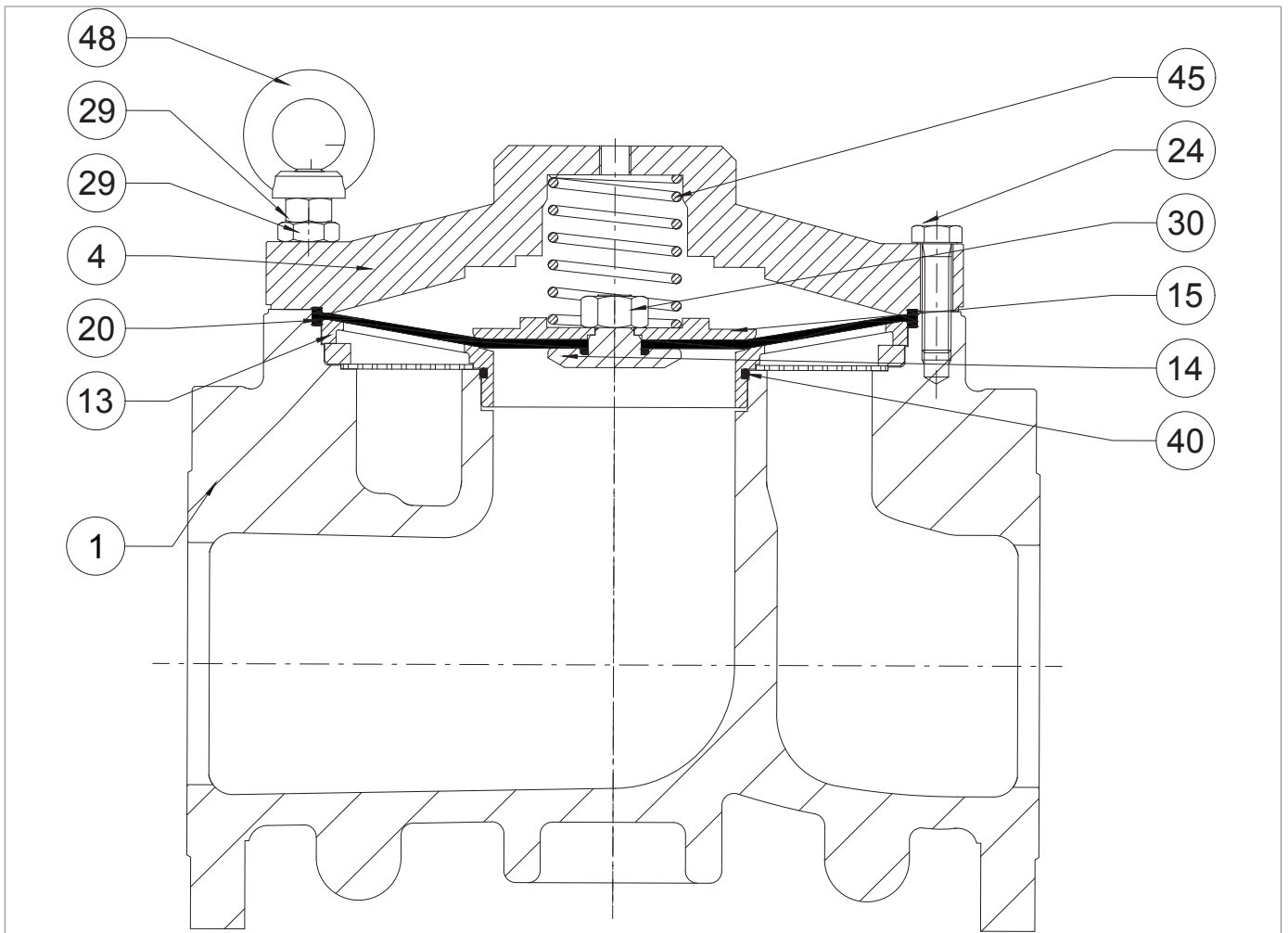


Fig. 9.19. Regulator APERVAL 101 4"



Step	Action
1	Unscrew and remove the nuts (48).
2	Unscrew and remove the nuts (29).
3	Undo and remove the screws (24).
4	Remove the upper lid (4).
5	Remove the spring (45).
6	Take out the diaphragm unit (14, 15, 20, 30).
7	Unscrew and remove the nut (30).
8	Remove the diaphragm protection disc (15).
9	Remove the diaphragm (20) and remove it from the screw (14). <b>NOTICE!</b> <b>Lubricate the lanyard with synthetic grease.</b>
10	Fit the diaphragm protection disc (15).
11	Insert and fix the nut (30) according to the following tightening torques: • 4": Tab. 9.45 <b>NOTICE!</b> <b>During this phase, keep the screw (14) still.</b>
12	Remove the grid (13).
13	Remove the O-ring (40) from the grid (13) and replace it, taking care to lubricate it with synthetic grease. <b>NOTICE!</b> <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b>
14	Fit the grid (13).
15	Put the diaphragm unit (14, 15, 20, 30) in place and lubricate the retaining slots with synthetic grease.
16	Fit the spring (45).
17	Fit the upper cover (4).
18	Insert and fix the screws (24) according to the following tightening torques: • 4": Tab. 9.45 <b>NOTICE!</b> <b>Tighten the screws as shown in the diagram at "9.4.2.2 - Cross diagram for tightening screws".</b>
19	Insert and fix the nuts (29) according to the following tightening torques: • 4": Tab. 9.45
20	Insert the eyebolts (48).

Tab. 9.51

**WARNING!**

**Ensure that all parts have been fitted correctly.**

**9.4.4 - MAINTENANCE OF THE 300 SERIES PILOT + AR100 LAMINATION VALVE**

**9.4.4.1 - 300 SERIES PILOT DISCONNECTION**

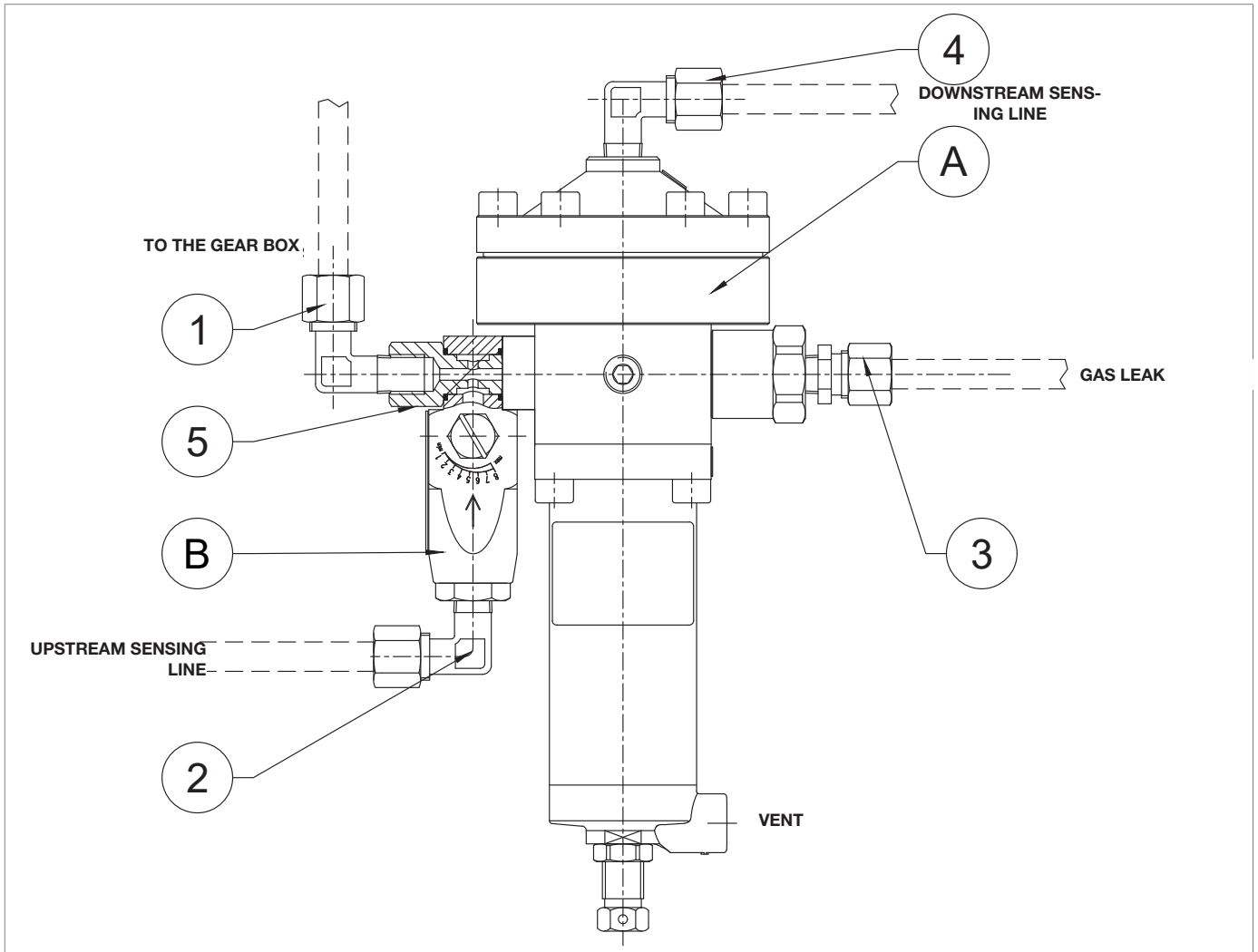


Fig. 9.20. 300/A series pilot

To disconnect the pilot, proceed as in Tab. 9.52 (Fig. 9.20):

Step	Action
<b>1</b>	Disconnect the sensing lines between the 300/A pilot and the regulator by adjusting the fittings (2, 3, 4).
<b>2</b>	Unscrew and remove the union (1) to remove the pilot from the regulator.
<b>3</b>	Unscrew and remove the screw (5) to separate the AR100 lamination valve from the pilot.

Tab. 9.52

9.4.4.2 - PILOT 301/A AND 301/A/TR

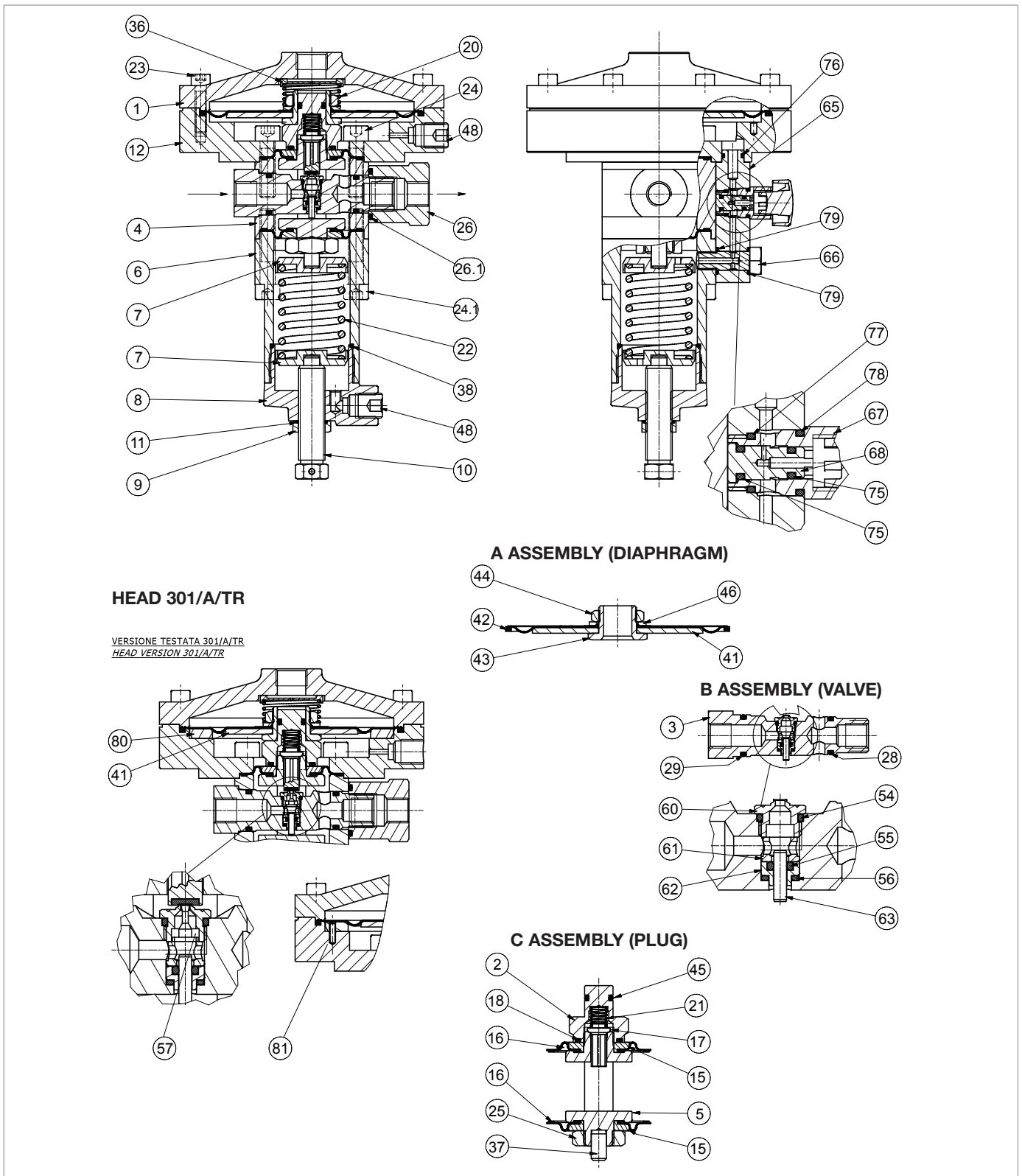




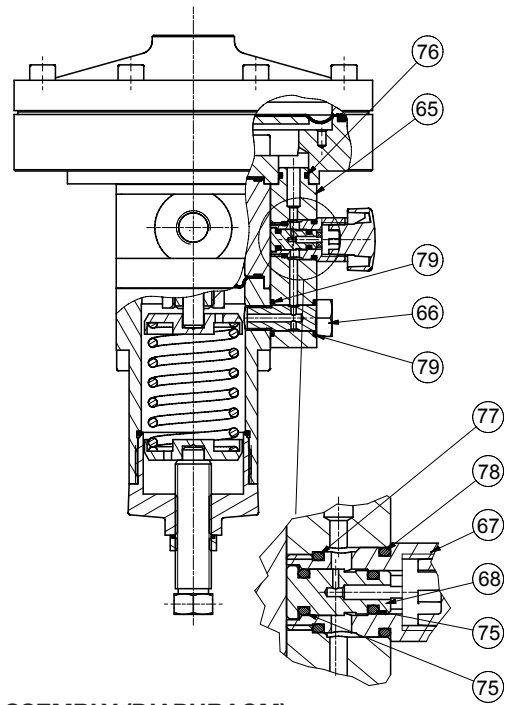
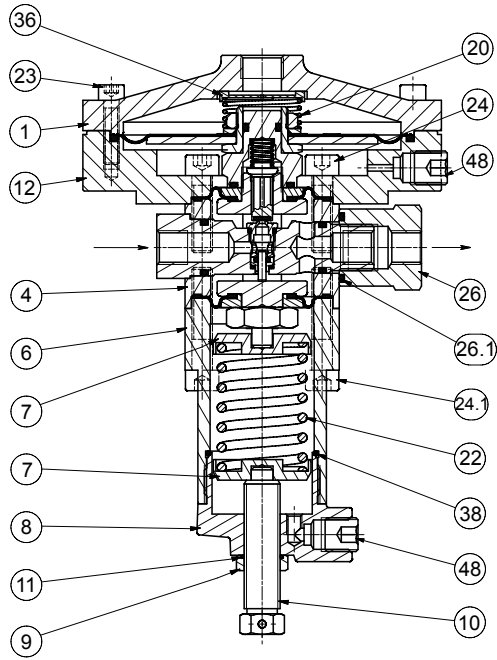


Fig. 9.21. Pilot 301/A and 301/A/TR

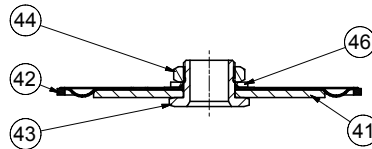
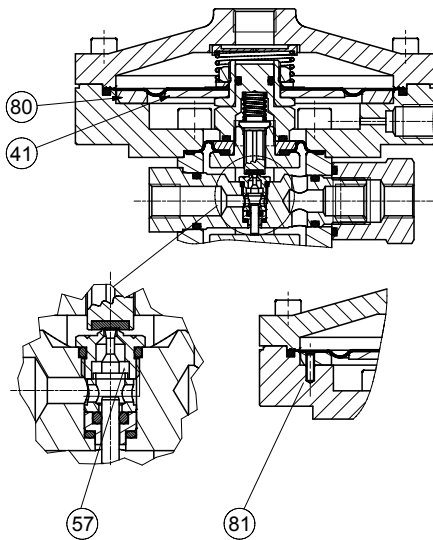
Step	Action
1	Unscrew the nut (9).
2	Completely relieve the spring (22) by turning the adjusting screw (10) anticlockwise.
3	Remove the adjusting screw (10) together with the cap (9).
4	Remove the cap (8).
5	Remove the O-ring (38) from the cap (8) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 5px; margin-top: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
6	Remove the spring (22) and the spring supports (7).
7	Undo and remove the screws of the lower section (24.1).
8	Remove the sleeve (6).
9	Undo and remove the screws of the upper section (23).
10	Remove the pilot cover (1).
11	Remove the spring (20) together with the shock absorber nozzle (36).
12	Remove assembly "A" (diaphragm).
13	Unscrew the nut (44).
14	Remove the nut (46).
15	Remove and replace the diaphragm (42) from its support (43), taking care to lubricate the lanyards with synthetic grease.
16	Fix the nut (46) according to the following tightening torque: <ul style="list-style-type: none"> <li>• Pilot 302: Tab. 9.47</li> </ul>
17	Tighten assembly 'A' (diaphragm) with nut (44).
18	Unscrew and remove the nut (26).
19	Remove the O-ring (26.1) from the nut (26) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 5px; margin-top: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
20	Remove assembly "B" (valve).
21	Unscrew the valve seat (60). <div style="border: 1px solid black; padding: 5px; margin-top: 5px;">  <b>NOTICE!</b>  <b>Take care not to damage the surfaces</b> </div>
22	Remove the O-ring (54) from the valve seat (60) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 5px; margin-top: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
23	<b>VALID FOR 301/A/TR</b> Remove the piston (57).
24	Remove the bushing (61)
25	Remove the balancing piston (63).
26	Take out the piston guide (62).



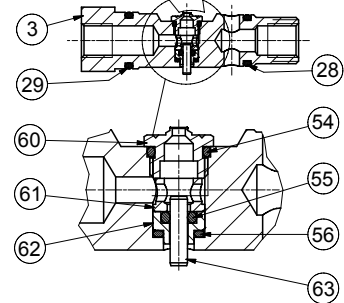
**A ASSEMBLY (DIAPHRAGM)**

**HEAD 301/A/TR**

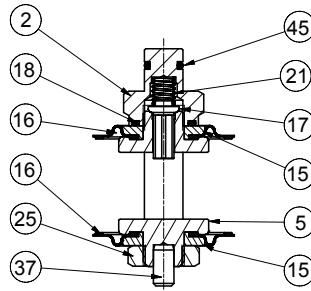
*VERSIONE TESTATA 301/A/TR  
HEAD VERSION 301/A/TR*








**B ASSEMBLY (VALVE)**

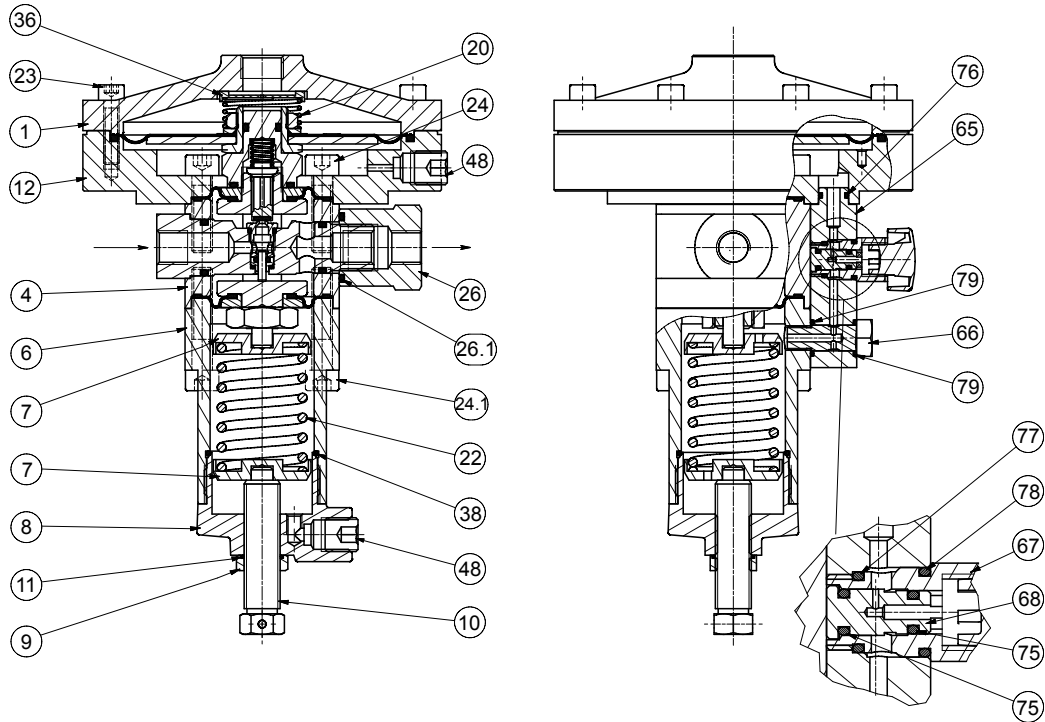


**C ASSEMBLY (PLUG)**

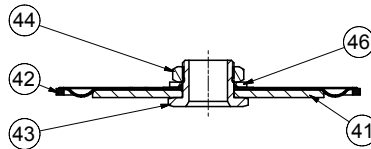


*Pilot 301/A and 301/A/TR*

Step	Action
27	Remove the O-ring (55) from the piston guide (62) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
28	Remove the O-ring (56) from the valve seat (3) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
29	Remove the O-rings (28, 29) from the valve seat (3) and replace them, taking care to lubricate them with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-rings, clean the retaining slots with a cleaning solution.</b> </div>
30	Fit the piston guide (62) and balancing piston (63).
31	Insert the bush (61) into the pilot seat (3) so that the wider stop rests on the O-ring (55).
32	<b>VALID FOR 301/A/TR</b> Insert piston (57).
33	Insert and fix the valve seat (60). <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Take care not to damage the valve seat profile (60) and the O-ring (54).</b> </div>
34	Unscrew and remove the screws (24)
35	<b>a- VALID FOR 301/A</b> Remove the flange (12).  <b>b- VALID FOR 301/A/TR</b> Remove the flange (12) together with the ring (80).
36	Remove assembly “C” (plug) from the valve body (4).
37	Remove the O-ring (45) from the pilot nut (2) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
38	Unscrew and remove the pilot nut (2).
39	Remove the O-rings (18) from the pilot nut (2) and replace them, taking care to lubricate them with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-rings, clean the retaining slots with a cleaning solution.</b> </div>
40	Remove the spring (21).
41	Remove and replace the plug (17).
42	Remove the upper protection disc (15).

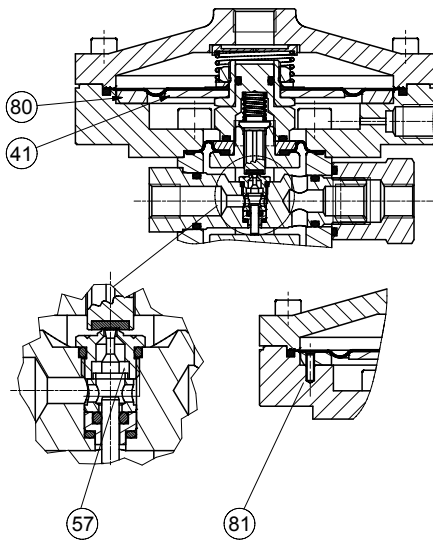


**A ASSEMBLY (DIAPHRAGM)**

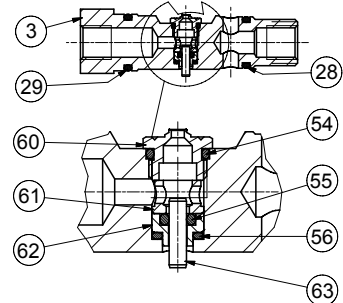


**HEAD 301/A/TR**

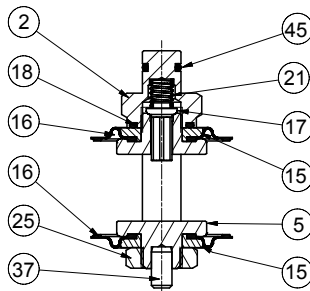
*VERSIONE TESTATA 301/A/TR  
HEAD VERSION 301/A/TR*



**B ASSEMBLY (VALVE)**









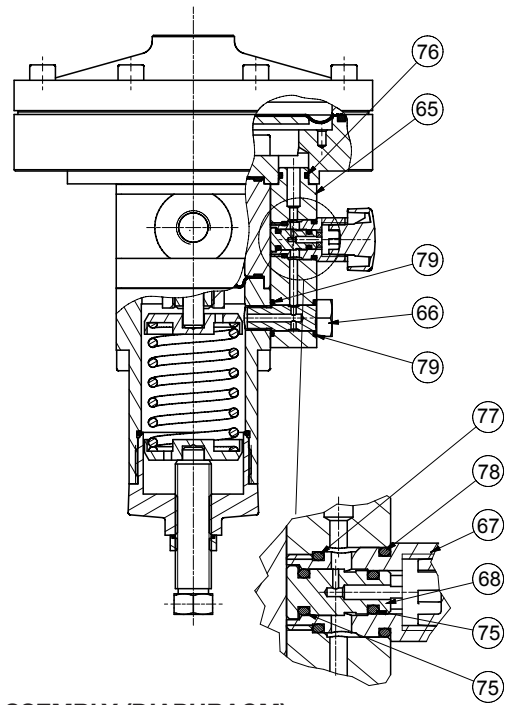
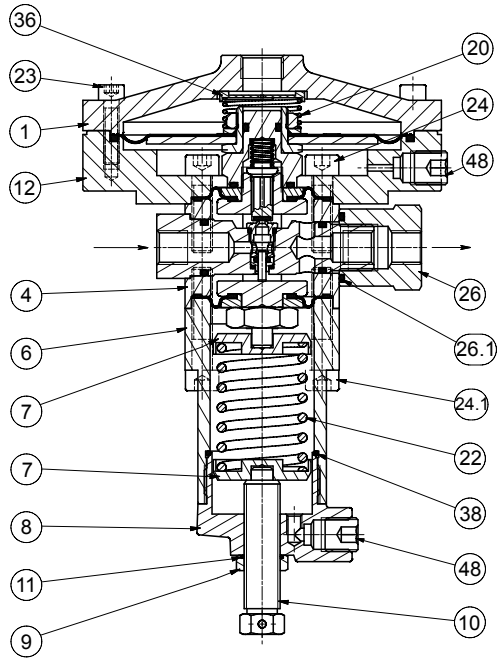
**C ASSEMBLY (PLUG)**



*Pilot 301/A and 301/A/TR*



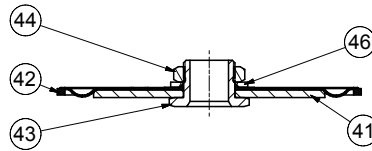
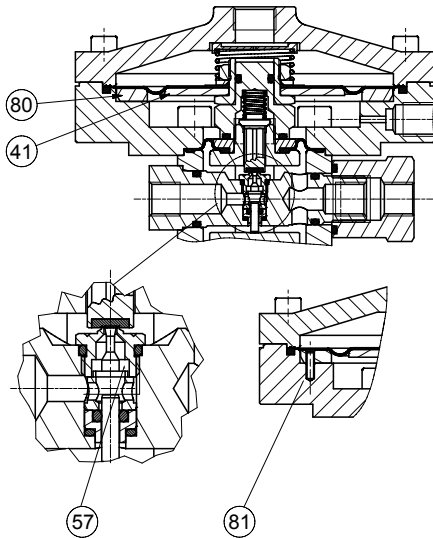
Step	Action
43	Remove and replace the upper diaphragm (16), taking care to lubricate the lanyards with synthetic grease. <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement diaphragm, clean the retaining slots with a cleaning solution.</b> </div>
44	Unscrew and remove the nut (25).
45	Remove the lower protection disc (15).
46	Remove and replace the lower diaphragm (16), taking care to lubricate the lanyards with synthetic grease. <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement diaphragm, clean the retaining slots with a cleaning solution.</b> </div>
47	Fit the lower protection disc (15).
48	Fix the nut (25) according to the following tightening torque: <ul style="list-style-type: none"> <li>Pilot 301 and 301/A/TR: Tab. 9.46</li> </ul>
49	Fit the plug (17) and the spring (21).
50	Fit the upper protection disc (15).
51	Fix the nut (2) according to the following tightening torque: <ul style="list-style-type: none"> <li>Pilot 301 and 301/A/TR: Tab. 9.46</li> </ul>
52	Insert assembly "C" (plug) from the top downwards into the valve body (4). <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b> <ul style="list-style-type: none"> <li><b>Take care not to damage the diaphragms (16) during this step</b></li> <li><b>The marking on the lower section of the headframe must be parallel to the axis of the hole for inserting the seat (3) into the valve body (4).</b></li> </ul> </div>
53	Undo and remove the screw (66).
54	Remove the damping device (65).
55	Remove and replace the O-rings (76, 79) from the damping device (65), lubricating them with synthetic grease. <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-rings, clean the retaining slots with a cleaning solution.</b> </div>
56	Unscrew and remove the screw (67) together with the piston (68).
57	Pull the piston (68) out of the screw (67).
58	Remove the O-rings (75) from the piston (68) and replace them, taking care to lubricate them with synthetic grease. <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-rings, clean the retaining slots with a cleaning solution.</b> </div>
59	Remove the O-rings (77, 78) from the screw (67) and replace them, taking care to lubricate them with synthetic grease. <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-rings, clean the retaining slots with a cleaning solution.</b> </div>
60	Insert the piston (68) into the screw (67)
61	Insert and secure the screw (67) in the damping device (65).



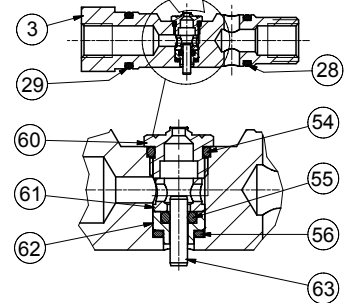
**A ASSEMBLY (DIAPHRAGM)**

**HEAD 301/A/TR**

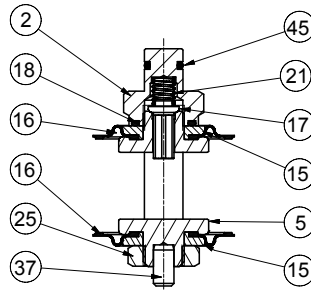
*VERSIONE TESTATA 301/A/TR  
HEAD VERSION 301/A/TR*








**B ASSEMBLY (VALVE)**



**C ASSEMBLY (PLUG)**



*Pilot 301/A and 301/A/TR*

Step	Action
62	Insert assembly "B" (valve) into the valve body (4). <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Take care not to damage the O-rings (28, 29) and the valve seat (3).</b> </div>
63	Fix the nut (26) according to the following tightening torque: <ul style="list-style-type: none"> <li>Pilot 301 and 301/A/TR: Tab. 9.46</li> </ul>
64	<b>a- VALID FOR 301/A</b> Insert the flange (12).  <b>b- VALID FOR 301/A/TR</b> Insert the flange (12) together with the ring (80). <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>The bore of the damping device (65) must be perpendicular to the valve seat (3).</b> </div>
65	Insert and fix the screws (24) according to the following tightening torque: <ul style="list-style-type: none"> <li>Pilot 301 and 301/A/TR: Tab. 9.46</li> </ul>
66	Fit the ring (12).
67	Fit assembly "A" (diaphragm).
68	Position the spring (20) together with the shock absorber nozzle (36). <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>The smallest bore of the shock absorber nozzle (36) must point upwards.</b> </div>
69	Fit the lid (1).
70	Insert and fix the screws (23) according to the following tightening torque: <ul style="list-style-type: none"> <li>Pilot 301 and 301/A/TR: Tab. 9.46</li> </ul>
71	Fit the sleeve (6). <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>The bore of the damping device (65) must be perpendicular to the valve seat (3).</b> </div>
72	Insert and fix the screws (24.1) according to the following tightening torque: <ul style="list-style-type: none"> <li>Pilot 301 and 301/A/TR: Tab. 9.46</li> </ul>
73	Position the damping device (65) on the pilot.
74	Insert and fix the screw (66) according to the following tightening torque: <ul style="list-style-type: none"> <li>Pilot 301 and 301/A/TR: Tab. 9.77</li> </ul>
75	Fit the spring (22) and the spring supports (7).
76	Insert and fix the cap (8).
77	Remove the O-ring (11) from the nut (9) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
78	Fit the adjusting screw (10) together with the cap (9).

Tab. 9.53

 **WARNING!**

**Ensure that all parts have been fitted correctly.**

9.4.4.3 - PILOT 302/A

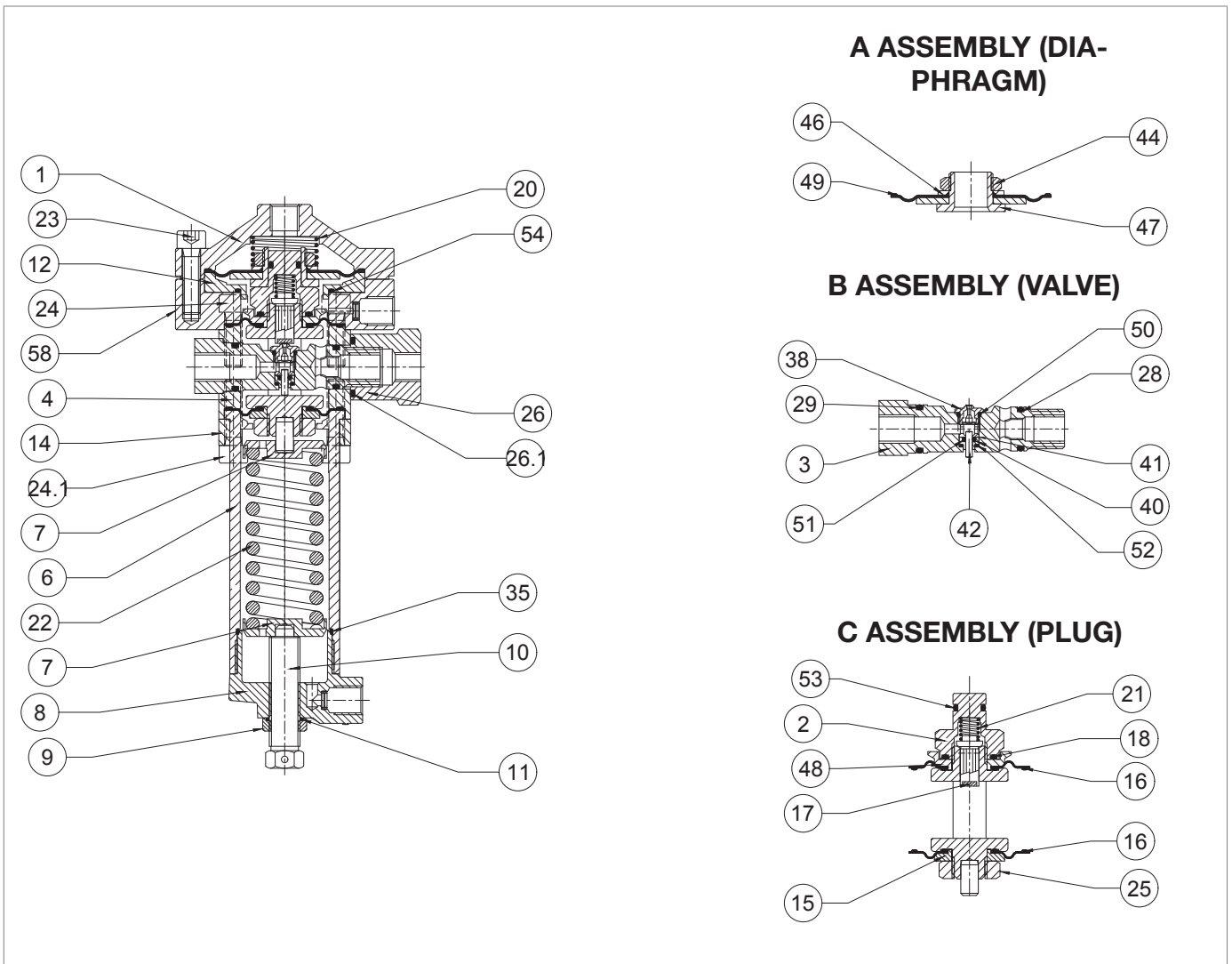




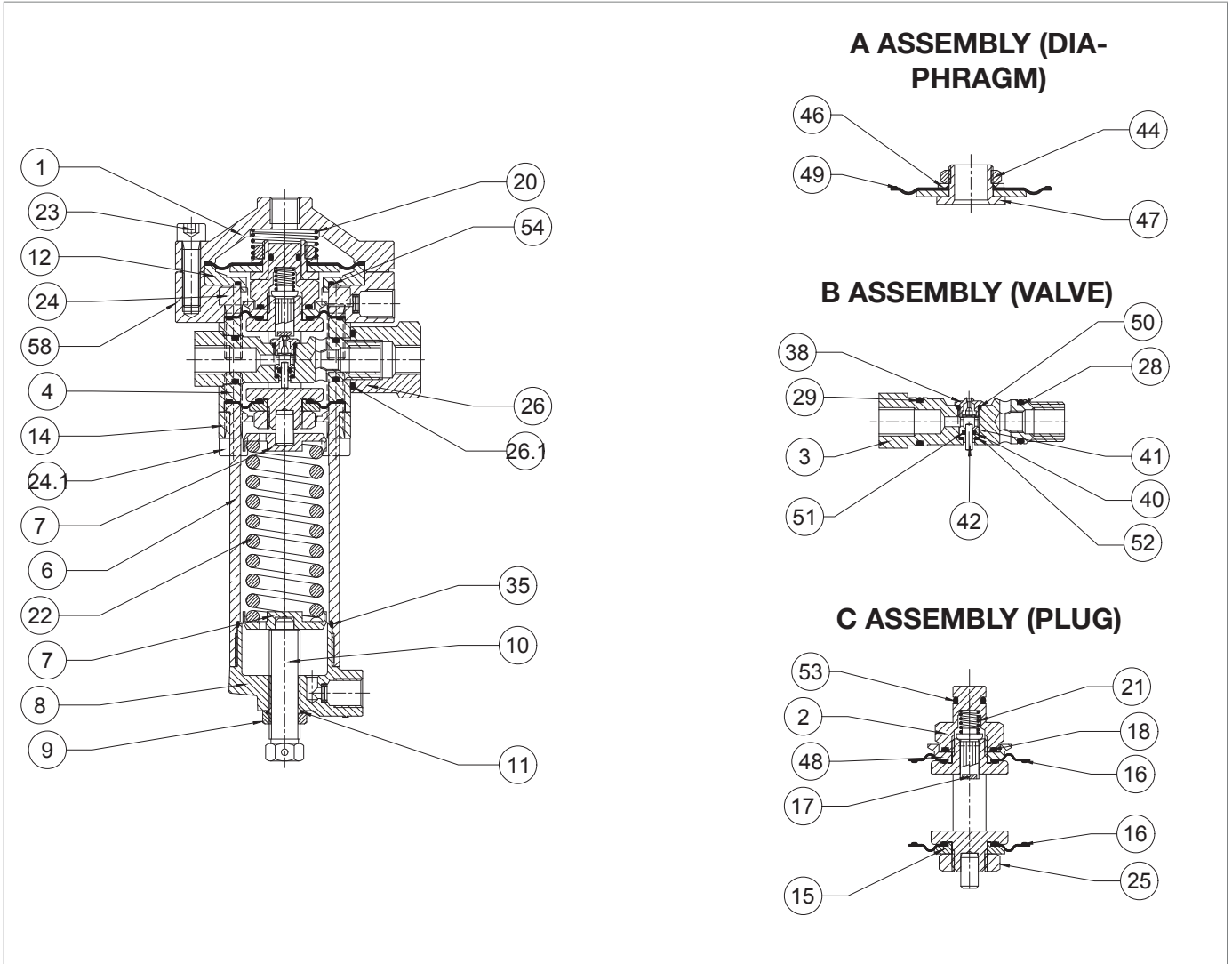









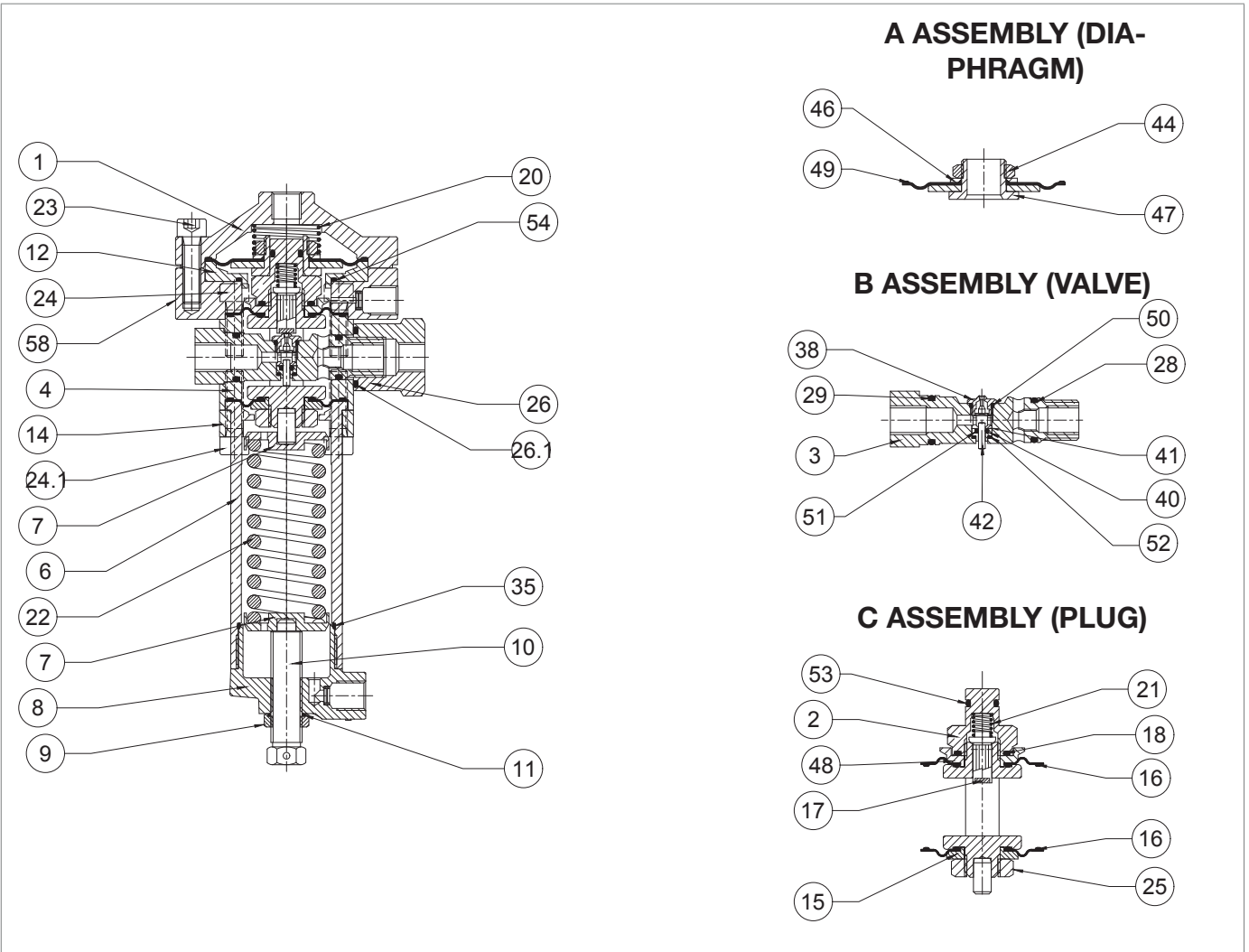
Fig. 9.22. Pilot 302/A

Step	Action
1	Loosen the nut (9).
2	Completely release the spring (22) by turning the adjusting screw (10).
3	Remove the adjusting screw (10) together with the cap (9).
4	Remove the cap (8).
	Remove the O-ring (35) from the cap (8) and replace it, taking care to lubricate it with synthetic grease.
5	 <b>NOTICE!</b> <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b>
6	Remove the spring (22) and the spring supports (7).
7	Undo and remove the screws of the lower section (24.1).
8	Remove the spacer (14) from the sleeve (6).
9	Remove the sleeve (6).
10	Undo and remove the screws of the upper section (23).
11	Remove the pilot cover (1).
12	Remove the spring (20).
13	Remove assembly "A" (diaphragm).
14	Unscrew the nut (44).
15	Remove the ring (46).
16	Remove and replace the diaphragm (49) from its support (47), taking care to lubricate the lanyards with synthetic grease.
17	Fit the ring (46).
18	Tighten assembly "A" (diaphragm) with the nut (44) according to the following tightening torque.
19	Unscrew and remove the nut (26).
	Remove the O-ring (26.1) from the nut (26) and replace it, taking care to lubricate it with synthetic grease.
20	 <b>NOTICE!</b> <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b>
21	Remove the ring (12).
	Remove the O-ring (54) from the nut (12) and replace it, taking care to lubricate it with synthetic grease.
22	 <b>NOTICE!</b> <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b>
23	Remove assembly "B" (valve).
	Unscrew the valve seat (38).
24	 <b>NOTICE!</b> <b>Take care not to damage the surfaces</b>







Pilot 302/A

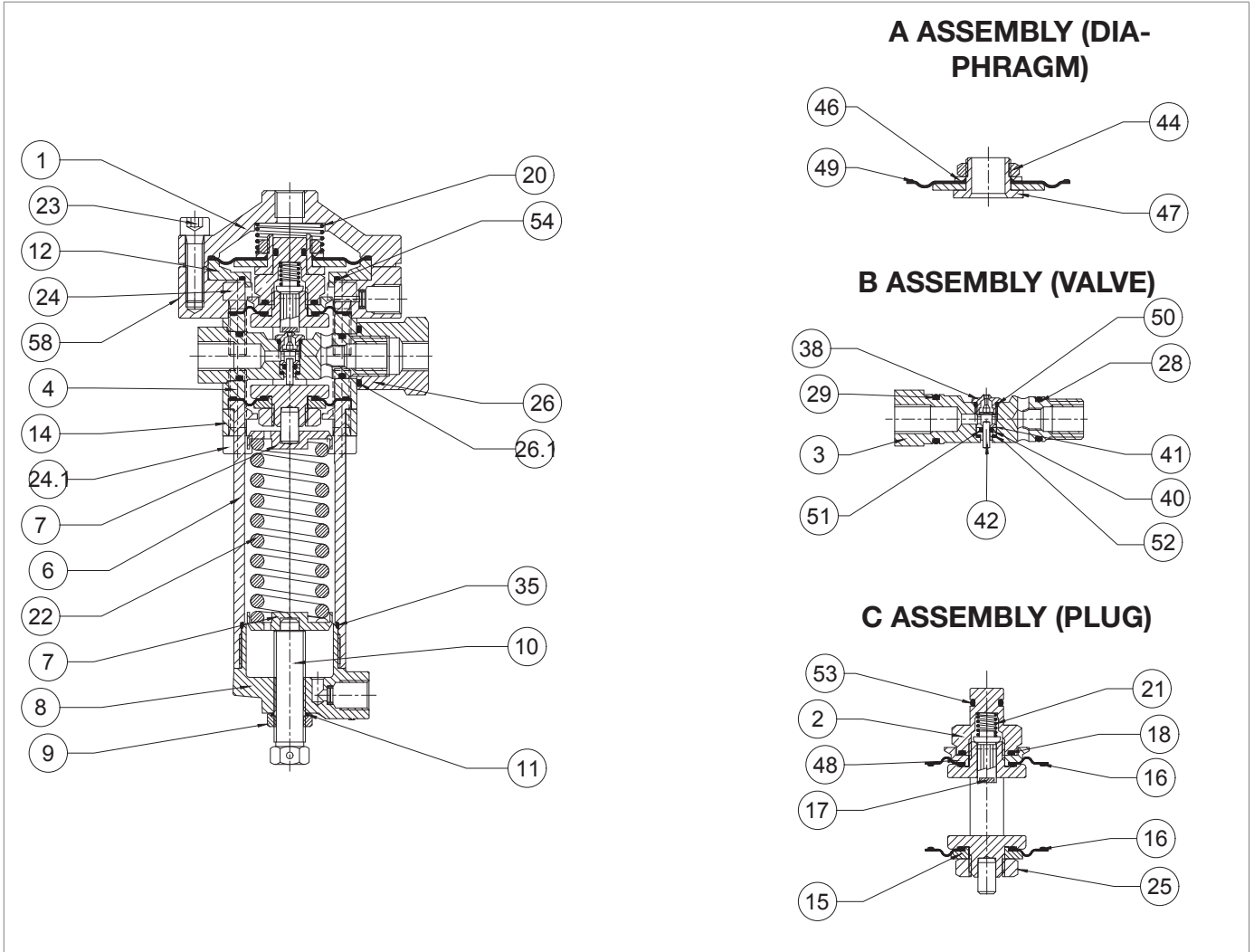
Step	Action
25	Remove the O-ring (50) from the valve seat (38) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
26	Remove the bush (41)
27	Remove the balancing piston (42).
28	Take out the piston guide (40).
29	Remove the O-ring (51) from the piston guide (40) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
30	Remove the O-ring (52) from the valve seat (3) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
31	Remove the O-rings (28, 29) from the valve seat (3) and replace them, taking care to lubricate them with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
32	Fit the piston guide (40) and balancing piston (42).
33	Insert the bush (41) into the pilot seat (3) so that the wider stop rests on the O-ring (51).
34	Insert and fix the valve seat (38). <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Take care not to damage the valve seat profile (38) and the O-ring (50).</b> </div>
35	Remove the screws (24) together with the flange (58).
36	Remove assembly "C" (plug) from the valve body (4).
37	Remove the O-ring (53) from the pilot nut (2) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
38	Unscrew and remove the pilot nut (2).
39	Remove the O-rings (18) from the pilot nut (2) and replace them, taking care to lubricate them with synthetic grease. <div style="border: 1px solid black; padding: 2px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b> </div>
40	Remove the spring (21).
41	Remove and replace the plug (17).



Pilot 302/A



Step	Action
42	Remove the protective disc (48).
43	Remove and replace the upper diaphragm (16), taking care to lubricate the lanyards with synthetic grease. <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement diaphragm, clean the retaining slots with a cleaning solution.</b> </div>
44	Unscrew and remove the nut (25).
45	Remove the protective disc (15).
46	Remove and replace the lower diaphragm (16), taking care to lubricate the lanyards with synthetic grease. <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement diaphragm, clean the retaining slots with a cleaning solution.</b> </div>
47	Fit the protection disc (15).
48	Fix the nut (25) according to the following tightening torque: <ul style="list-style-type: none"> <li>• Pilot 302: Tab. 9.47</li> </ul>
49	Fit the plug (17) and the spring (21).
50	Fit the protection disc (48).
51	Fix the nut (2) according to the following tightening torque: <ul style="list-style-type: none"> <li>• Pilot 302: Tab. 9.47</li> </ul>
52	Insert assembly “C” (plug) from the top downwards into the valve body (4). <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b>  <ul style="list-style-type: none"> <li>• <b>Take care not to damage the diaphragms (16) during this step</b></li> <li>• <b>The marking on the lower section of the headframe must be parallel to the axis of the hole for inserting the seat (3) into the valve body (4).</b></li> </ul> </div>
53	Insert assembly “B” (valve) into the valve body (4). <div style="border: 1px solid black; padding: 5px;">  <b>NOTICE!</b>  <b>Take care not to damage the O-rings (28, 29) and the valve seat (3).</b> </div>
54	Screw in the nut (26) according to the following tightening torque: <ul style="list-style-type: none"> <li>• Pilot 302: Tab. 9.47</li> </ul>
55	Insert the flange (58).
56	Insert and fix the screws (24) according to the following tightening torque: <ul style="list-style-type: none"> <li>• Pilot 302: Tab. 9.47</li> </ul>
57	Fit the ring (12).
58	Fit assembly “A” (diaphragm).
59	Fit the spring (20).
60	Fit the cover (1).
61	Insert and fix the screws (23) according to the following tightening torque: <ul style="list-style-type: none"> <li>• Pilot 302: Tab. 9.47</li> </ul>
62	Position the sleeve (6) and spacer (14).



Pilot 302/A

Step	Action
63	Insert and fix the screws (24.1) according to the following tightening torque: <ul style="list-style-type: none"> <li>• Pilot 302: Tab. 9.47</li> </ul>
64	Fit the spring (22) and the spring supports (7).
65	Unscrew the cap (8).
66	Remove the O-ring (11) from the nut (9) and replace it, taking care to lubricate it with synthetic grease. <div style="border: 1px solid blue; padding: 5px; margin-top: 5px;"> <p><b>! NOTICE!</b>  <b>Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.</b></p> </div>
67	Fit the adjusting screw (10) together with the cap (9).

Tab. 9.54

 **WARNING!**

**Ensure that all parts have been fitted correctly.**

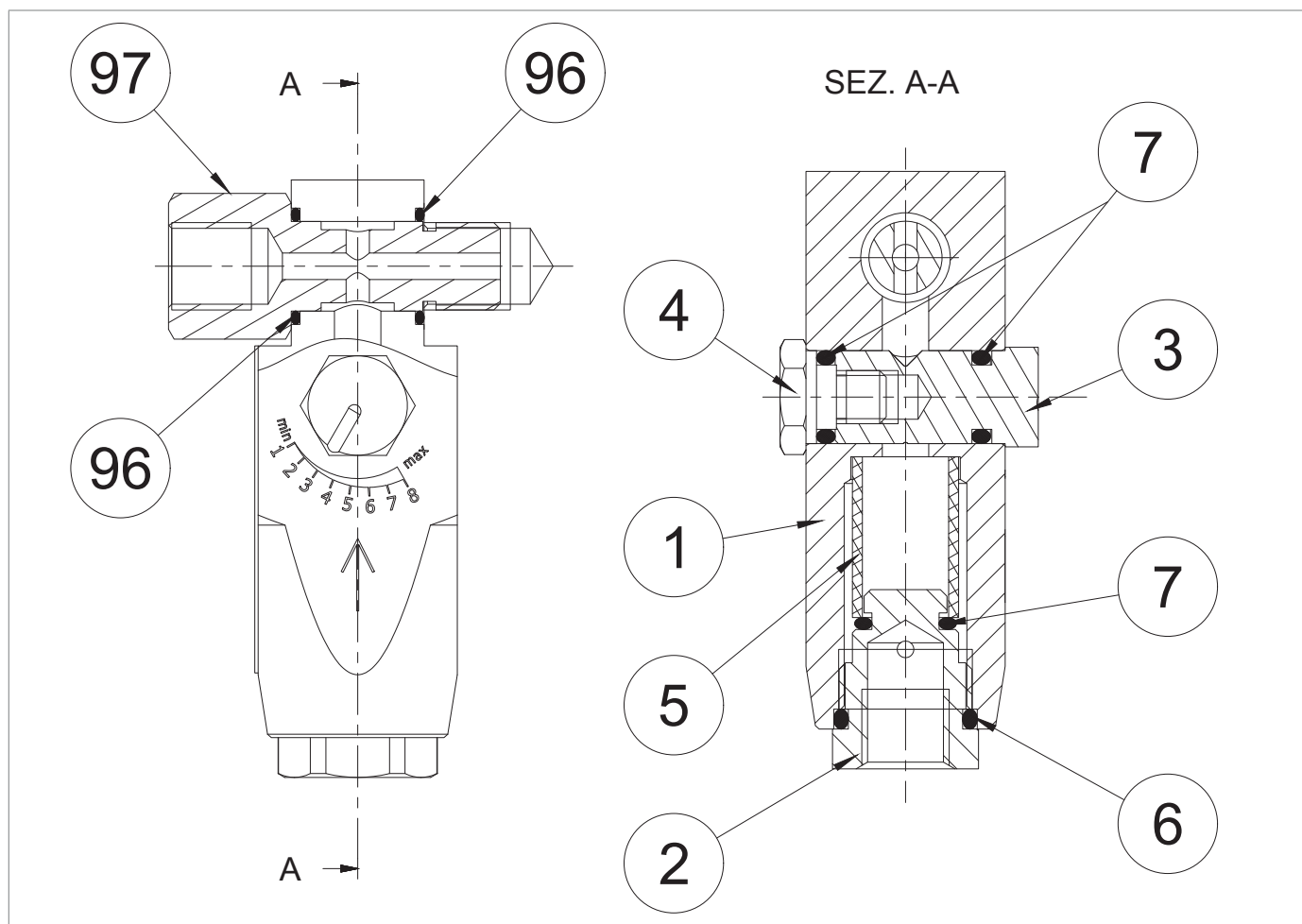
**9.4.4.4 - AR100 LAMINATION VALVE**


Fig. 9.23. AR100 lamination valve

Step	Action
1	Undo and remove the locking screw (97).
2	Remove the O-rings (96) from the AR100 lamination valve body (1) and replace them, taking care to lubricate them with synthetic grease.
3	Undo and remove the locking screw (4).
4	Remove the O-ring (7) from the shut-off screw (4) and replace it, taking care to lubricate it with synthetic grease.
5	Remove the adjusting screw (3).
6	Remove the O-ring (7) from the adjusting screw (3) and replace it, taking care to lubricate it with synthetic grease.

**NOTICE!**




**Before inserting the replacement O-rings, clean the retaining slots with a cleaning solution.**

**NOTICE!**

**Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.**

**NOTICE!**

**Before inserting the replacement O-ring, clean the retaining slots with a cleaning solution.**

Step	Action
7	Unscrew and remove the cap (2).
8	Remove the O-rings (6, 7) from the cap (2) and replace them, taking care to lubricate them with synthetic grease. <div style="border: 1px solid black; padding: 5px; margin-top: 5px;">  <b>NOTICE!</b>  <b>Before inserting the replacement O-rings, clean the retaining slots with a cleaning solution.</b> </div>
9	Remove and replace the filter (5).
10	Fit and fix the cap (2) according to the following tightening torque: <ul style="list-style-type: none"> <li>• AR100: Tab. 9.48</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;">  <b>NOTICE!</b>  <b>Take care not to damage the O-rings (6, 7).</b> </div>
11	Insert the adjusting screw (3), taking care not to damage the O-ring (7).
12	Fit and fix the shut-off screw (4) according to the following tightening torque: <ul style="list-style-type: none"> <li>• AR100: Tab. 9.48</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;">  <b>NOTICE!</b>  <b>Take care not to damage the O-ring (7).</b> </div>
13	Insert the locking screw (97) with the valve ports in line with the AR100 lamination valve (1) body.

Tab. 9.55

 **WARNING!**

**Ensure that all parts have been fitted correctly.**

9.4.4.5 - 300/A SERIES PILOT RECONNECTION

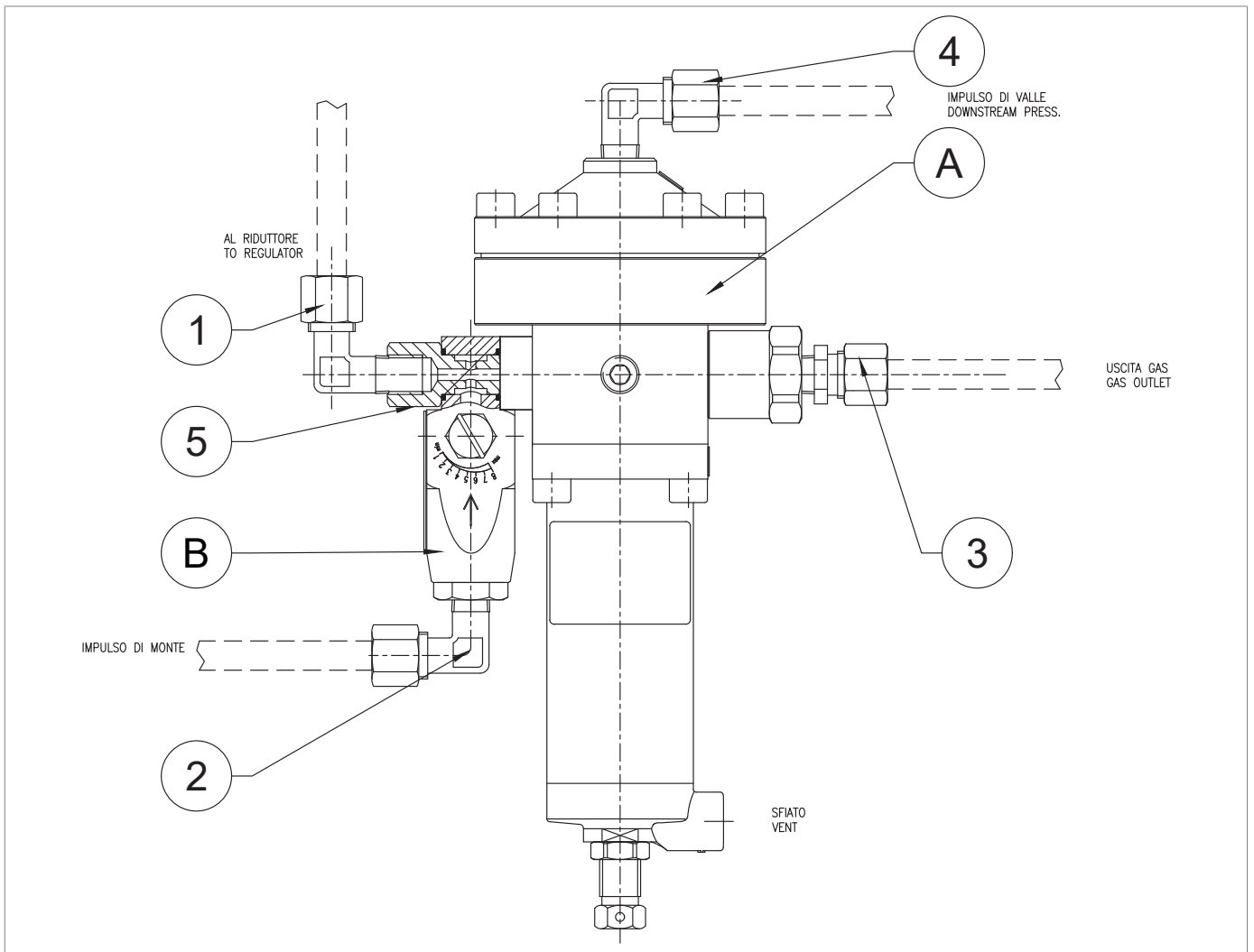


Fig. 9.24. 300/A series pilot

To reconnect the pilot, proceed as indicated in Tab. 9.56 (Fig. 9.24):

Step	Action
<b>1</b>	Insert and secure the screw (5) into the AR100 lamination valve to connect it to the pilot.
<b>2</b>	Attach the fitting (1) to connect the pilot to the regulator.
<b>3</b>	Connect the sensing lines between the 300/A pilot and the regulator by adjusting the fittings (2, 3, 4).

Tab. 9.56





## 10 - TROUBLESHOOTING

Below is a list of the cases (causes and services) that may occur over time in the form of malfunctions of various kinds. These situations depend on the conditions of the gas as well as on the natural ageing and wear of the materials.

### 10.1 - GENERAL WARNINGS

#### **HAZARD!**

**Maintenance work must be carried out by qualified personnel:**

- trained on workplace safety also based on the regulations in force in the place of installation of the work equipment;
- qualified and authorised to carry out activities related to the equipment.

#### **WARNING!**







**PIETRO FIORENTINI S.p.A. shall not be held liable for any damage to people and property due to services:**

- other than those described;
- performed according to methods other than those specified;
- carried out by unsuitable personnel.

#### **NOTICE!**

**If an operating fault occurs and qualified personnel are not available for the specific intervention, call the Assistance Centre authorised by PIETRO FIORENTINI S.p.A.**

## 10.2 - OPERATOR QUALIFICATION SPECIFICATION

Commissioning	
<b>Operator qualification</b>	<ul style="list-style-type: none"> <li>• Mechanical maintenance technician;</li> <li>• Electrical maintenance technician;</li> <li>• Installer;</li> <li>• Name of the user.</li> </ul>
<b>PPE required</b>	<div style="display: flex; align-items: center; gap: 10px;">      </div> <div style="background-color: #f4a460; padding: 5px; margin-top: 5px;">  <b>WARNING!</b> </div> <p>The PPE listed in this table is related to the risk associated with the equipment. For the PPE required to protect against risks associated with the workplace, installation or operating conditions, please refer to:</p> <ul style="list-style-type: none"> <li>• <b>the regulations in force in the country of installation;</b></li> <li>• <b>any information provided by the Safety Manager at the installation facility.</b></li> </ul>
<b>Equipment required</b>	Refer to chapter 7 “Equipment for commissioning/maintenance”.

Tab. 10.57.

## 10.3 - TROUBLESHOOTING PROCEDURES

For proper troubleshooting, proceed as follows:

- close the downstream and upstream shut-off valves;
- refer to the troubleshooting tables listed below.

## 10.4 - TROUBLESHOOTING TABLES

### NOTICE!

Refer to chapter 9 “Maintenance and functional checks” for the pictures of the **APERVAL 101** regulator and its accessories.

### 10.4.1 - TROUBLESHOOTING APERVAL 101 REGULATOR

Failure	Device	Possible causes	Service
<b>Operation faults</b>	LAMINATION VALVE AR100	Unsuitable feed pressure to the regulator	Adjust the flow rate of the AR100 lamination valve
	SERIE 300 PILOTS	Diaphragm holder (16) friction	Centre the hole, assembly and shaft movement
		Balancing pin friction	Lubricate O-ring (51)
		Worn diaphragms (16)	Replace
		Diaphragm (49) worn (for 302/A pilot only)	Replace
		Spring (22) collapsed or out of level	Refit and replace if needed
	REGULATOR	Dirty or worn diaphragm (20)	Clean and replace if needed
		Diaphragm (20) out of level	Refit
		Unsuitable spring (45)	Replace
	<b>Pumping</b>	LAMINATION VALVE AR100	Unsuitable feed pressure to the regulator
SERIE 300 PILOTS		Operating frictions	Check the pilot
<b>No sealing at zero flow</b>	SERIE 300 PILOTS	Dirty or worn plug (17)	Clean and replace if needed
		O-ring (50) not sealing	Clean and replace if needed
		O-ring (51) not sealing	Clean and replace if needed
		O-ring (52) not sealing	Clean and replace if needed
		Upper diaphragm (16) worn (excluding 302/A pilot)	Replace
		O-ring (18) not sealing (for pilots 304/A-305/A only)	Clean and replace if needed
	REGULATOR	Dirty or worn diaphragm (20)	Clean and replace if needed
		Diaphragm (20) out of level	Replace
		No sealing O-ring (40)	Clean and replace if needed
		O-ring (41) not sealing	Clean and replace if needed
		Damaged grille (13)	Replace

Failure	Device	Possible causes	Service
<b>Downstream pressure increases</b>	LAMINATION VALVE AR100	Filter cartridge (11) clogging	Replace
	SERIE 300 PILOTS	Plug (17) worn	Replace
		Diaphragm (49) worn (for 302/A pilot only)	Replace
		Worn diaphragms (16)	Replace
	REGULATOR	Diaphragm (20) worn	Replace
LAMINATION VALVE AR100	Incorrect adjustment	Adjust the flow rate of the AR100 lamination valve	
<b>Downstream pressure decreases</b>	SERIE 300 PILOTS	Ice formation on the valve seat	Increase pilot circuit gas inlet temperature
		Clogging due to valve seat soiling	Clean and check
	REGULATOR	Breakage within the sealing edge of the control element (20)	Replace

Tab. 10.58

## 11 - UNINSTALLATION AND DISPOSAL

### 11.1 - GENERAL SAFETY WARNINGS

#### HAZARD!



Make sure that there are no potentially explosive ignition sources in the work area set up to uninstall and/or dispose of the equipment.

#### WARNING!

Before proceeding with uninstallation and disposal, make the equipment safe by disconnecting it from any power supply.

### 11.2 - QUALIFICATION OF THE OPERATORS IN CHARGE

#### Commissioning

Operator qualification	Installer
PPE required	 <p> <b>WARNING!</b></p> <p>The PPE listed in this table is related to the risk associated with the equipment. For the PPE required to protect against risks associated with the workplace, installation or operating conditions, please refer to:</p> <ul style="list-style-type: none"> <li>• the regulations in force in the country of installation;</li> <li>• any information provided by the Safety Manager at the installation facility.</li> </ul>
Equipment required	Refer to chapter 7 "Equipment for commissioning/maintenance".

Tab. 11.59.

### 11.3 - UNINSTALLATION

#### ATTENTION!

Before uninstalling the equipment, completely drain the fluid in the reduction line and inside the equipment.

#### NOTICE!

To uninstall the equipment, refer to the installation steps (see the "Installation" chapter) and proceed in reverse order.

### 11.4 - INFORMATION REQUIRED IN CASE OF RE-INSTALLATION

#### NOTICE!

Should the equipment be reused after uninstallation, refer to chapter:

- "Installation";
- "Commissioning".

## 11.5 - DISPOSAL INFORMATION

### NOTICE!

**Bear in mind that the laws in force in the country of installation must be complied with. Illegal or improper disposal involves the application of the penalties provided for by the legislation in force in the country of installation.**

### NOTICE!

**Proper disposal prevents damage to humans and the environment and promotes the reuse of precious raw materials.**

The equipment was manufactured with materials that can be recycled by specialised companies. For proper disposal of the equipment, proceed as specified in table 11.60:

Step	Action
1	Set up a large work area free from obstacles where to safely dismantle the equipment.
2	Sort the various components by type of material for easier recycling through separate collection.
3	Send the materials obtained in <b>Step 2</b> to a specialised company.

*Tab. 11.60.*

The equipment in any configuration consists of the following materials:

Material	Disposal/recycling indications
<b>Plastic</b>	It must be dismantled and disposed of separately.
<b>Lubricants/Oils</b>	They must be collected and delivered to the appropriate specialised and authorised collection and disposal centres.
<b>Iron</b>	Disassemble and collect separately. It must be recycled through the specific collection centres.
<b>Steel</b>	Disassemble and collect separately. It must be recycled through the specific collection centres.
<b>Aluminium</b>	Disassemble and collect separately. It must be recycled through the specific collection centres.
<b>Pneumatic/electric components</b>	They must be dismantled in order to be reused if they are still in good condition or, if possible, overhauled and recycled.

*Tab. 11.61.*

### NOTICE!

**Refer to chapter 9 “Maintenance and functional checks” to better identify the composition of the equipment and its parts.**

## 12 - RECOMMENDED SPARE PARTS

### 12.1 - GENERAL WARNINGS

 **NOTICE!**

If spare parts not marked are used, PIETRO FIORENTINI S.p.A. their declared performance cannot be guaranteed.

It is recommended to use original spare parts PIETRO FIORENTINI S.p.A.

PIETRO FIORENTINI S.p.A. shall not be held liable for any damage caused by using non-original parts.

### 12.2 - HOW TO REQUEST SPARE PARTS

 **NOTICE!**

For specific information, please refer to the sales network of PIETRO FIORENTINI S.p.A.





## 13 - CALIBRATION TABLES

### 13.1 - 300 SERIES PILOT CALIBRATION TABLES

301 A							
Pos.	Spring item code	Spring colour	d	Lo	De	Min.	Max
1	2700680	Brown	2.3	60	35	0.005	0.019
2	2700830	Red/Black	2.5			0.02	0.045
3	2700920	White/yellow	2.8			0.046	0.078
4	2701040	White/orange	3			0.079	0.1

**d** = Wire Diameter (mm)    **Lo** = Spring Length (mm)    **De** = External Diameter (mm)

Tab. 13.62.

301/A/TR							
Pos.	Spring item code	Spring colour	d	Lo	De	Min.	Max
1	2701040	White/orange	3	60	35	0.1	0.19
2	2701260	White	3.5			0.191	0.42
3	2701530	Yellow	4			0.421	0.78
4	2701790	Yellow/Black	4.5			0.781	1.2
5	2702070	Orange	5			1.201	2

**d** = Wire Diameter (mm)    **Lo** = Spring Length (mm)    **De** = External Diameter (mm)

Tab. 13.63.

302/A							
Pos.	Spring item code	Spring colour	d	Lo	De	Min.	Max
1	2701800	Yellow	4.5	100	35	0.8	1.1
2	2702080	Orange	5			1.201	2.2
3	2702290	Red	5.5			2.201	3.5
4	2702460	Green	6			3.501	5.6
5	2702660	Black	6.5			5.601	7.3
6	2702820	Blue	7			7.3	9.5

**d** = Wire Diameter (mm)    **Lo** = Spring Length (mm)    **De** = External Diameter (mm)

Tab. 13.64.

TM0048ENG

