

Series FE

Low-pressure gas regulator



Revision 00 - Edition 10/2021

**USE, MAINTENANCE
AND WARNING
MANUAL**

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1 - INTRODUCTION

FOREWORD

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The manufacturer is in no way responsible for the consequences of operations carried out in a manner not in accordance with the manual.

GENERAL CONSIDERATIONS

All the operating, maintenance instructions and recommendations described in this manual must be adhered to in order to:

- obtain the best possible performance from the equipment;
- keep the equipment in efficient conditions.

Training the personnel in charge is essential in order to:

- properly use the equipment;
- correctly apply the safety alerts and procedures recommended.

Revision: 00

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1.1 - REVISION HISTORY

Revision index	Date	Revision contents
00		

Tab. 1.1.

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2 - GENERAL INFORMATION

2.1 - MANUFACTURER IDENTIFICATION

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

Tab. 2.2.

2.2 - IDENTIFICATION OF THE PRODUCT

FE	LOW-PRESSURE GAS REGULATOR
Series	Equipment
Available models	<ul style="list-style-type: none"> • FE6 • FE10 • FE25 • FES

Tab. 2.3.

2.3 - REGULATORY FRAMEWORK

PIETRO FIORENTINI S.P.A. with registered offices in Arcugnano (Italy) - Via E. Fermi, 8/10, declares that the equipment of SERIES FE described in this manual is designed, manufactured, tested and checked in compliance with the requirements of standards: UNI 11655:2016, UNI EN 16129:2013 where applicable.

 **NOTE!**

For specific type approvals, see the appropriate section on the Manufacturer's website: <https://www.fiorentini.com>

 **NOTE!**

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

 **NOTE!**

The warranty conditions are specified in the commercial contract.

2.5 - ADDRESSEES, SUPPLY AND STORAGE OF THE MANUAL

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

It contains the necessary information for the correct use of the equipment in order to maintain its functional and qualitative characteristics over time. All information and warnings for correct use in full safety are also provided.

The 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 modifying the pages of the manual and their contents is not allowed.

Keep the 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 manual.

2.6 - LANGUAGE

The original manual has been drawn up in Italian.

Any translations into additional languages must be made from the original manual.

HAZARD!

The translations into other languages cannot be fully verified. 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 PIETRO FIORENTINI S.p.A. at the addresses specified in paragraph 2.1.**

WARNING!

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

2.7 - 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 manual. The information may also concern the safety of the personnel involved in using the equipment.
	Obligation to refer to the manual. Indicates a requirement for the personnel to refer to (and understand) the instruction manual before working with or on the equipment.

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.

NOTE!

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.

2.8 - NAMEPLATES APPLIED

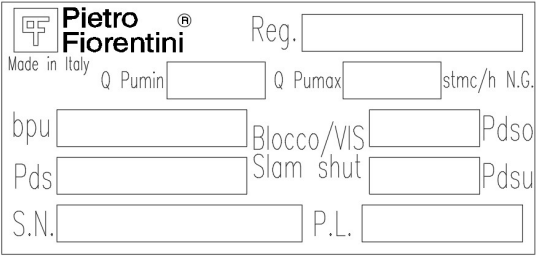

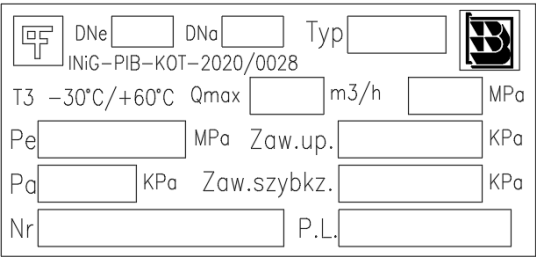


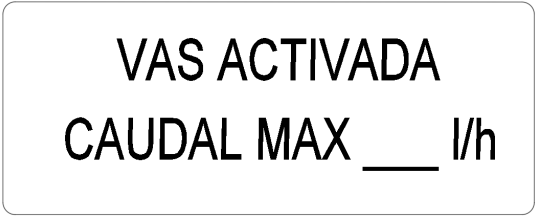
WARNING!




**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 (from Id.1 to Id.10).

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

List of the nameplates applied:

Id.	Type	Image
1	STANDARD LABEL	 <p> Pietro Fiorentini® Reg. <input type="text"/> <small>Made in Italy</small> Q P_{min} <input type="text"/> Q P_{max} <input type="text"/> stmc/h N.G. b_{pu} <input type="text"/> Blocco/VIS <input type="text"/> P_{dso} P_{ds} <input type="text"/> Slam shut <input type="text"/> P_{dsu} S.N. <input type="text"/> P.L. <input type="text"/> </p>
2	LABEL FOR RUSSIA	 <p> Pietro Fiorentini® per.FE25 <small>Сделано в Италии.</small> Q nom 25 stmc/h N.G. С.н. xxxxxxxxxxxxxx b_{pu} 0,5 - 8,6 бар ПЗК макс 37 мбар P_{dso} P_d 20 мбар ПЗК мин // P_{dsu} материал корпуса: zamak ДАТА мм/yyyy </p>
3	LABEL FOR POLAND	 <p> Pietro Fiorentini DNe <input type="text"/> DN_a <input type="text"/> Typ <input type="text"/>  <small>INiG-PIB-KOT-2020/0028</small> T3 -30°C/+60°C Q_{max} <input type="text"/> m³/h <input type="text"/> MPa P_e <input type="text"/> MPa Zaw.up. <input type="text"/> KPa P_a <input type="text"/> KPa Zaw.szybkoz. <input type="text"/> KPa Nr <input type="text"/> P.L. <input type="text"/> </p>
4	SAFETY DIAPHRAGM LABEL	 <p style="text-align: center;">SAFETY DIAPHRAGM</p>
5	LABEL FOR SPAIN VAS ACTIVADA	 <p style="text-align: center;">VAS ACTIVADA CAUDAL MAX ___ l/h</p>

Id.	Type	Image
6	LOW TEMPERATURE LABEL	<p style="text-align: center;"> Low Temperatures Version Environment Temperature °C -40/+60 Gas Temperature °C -20/+60 </p>
7	LABEL FOR TURKEY	<div style="border: 1px solid black; padding: 5px;">  Pietro Fiorentini Pg max/min: ___ - ___ bar Q min/max: ___ - ___ m3/h Pg: ___ mbar As: ___ - ___ mbar QT: ___ KT: ___ ETA/ETÚ: ___ EBA/EBÚ: ___/___ mbar ASA/ASÚ: ___/___ mbar  50YYYYZZFNNNNNNNNN </div> <div style="border: 1px solid black; padding: 2px; width: fit-content; float: right; text-align: center;"> Data: mm/yyyy </div>
8	-30 °C TEMPERATURE LABEL	<p style="text-align: center;"> Environment temperature -30°/+60°C Gas temperature -20°/+60°C </p>
9	LABEL FOR ROMANIA	<p style="text-align: center;"> Year: XXXX FE _____ Functional performances in agreement with EN334 T: -20/+60 °C PS: 8.6 bar DN: _____ Connection: ___ Wds: _____mbar Fluid: N.G. </p>
10	LABEL FOR SPAIN KROMS	<div style="border: 1px solid black; padding: 5px;">  /kromschroeder,s.a.Reg. <input style="width: 100px;" type="text"/> Made in EU Q Pumin <input style="width: 50px;" type="text"/> Q Pumax <input style="width: 50px;" type="text"/> stmc/h Hecho en EU bpu <input style="width: 50px;" type="text"/> Sfiro/Vas <input style="width: 100px;" type="text"/> Relief valve Pd <input style="width: 50px;" type="text"/> Blocco/Vis <input style="width: 100px;" type="text"/> Pds0 <input style="width: 50px;" type="text"/> Slam shut Pdsu S.N. <input style="width: 100px;" type="text"/> P.L. <input style="width: 50px;" type="text"/> </div>

Tab. 2.5.

2.8.1 - GLOSSARY FOR NAMEPLATES

The terms and abbreviations used on the nameplates are described below:

Description	Label terminology					
	Standard	Russia	Poland	Turkey	Romania	Spain Kroms
Inlet pressure range	bpu	bpu	Pe	Pg max/min	-	bpu
Adjusted pressure	pds	Pd	Pa	Pç	-	Pd
Tripping pressure maximum pressure slam-shut device	Slam-shut device VIS Slam Shut pdso	ЛЗК Макс Pdso	Zaw.up.	EBÜ	-	Blocco VIS Slam Shut Pdso Pdsu
Tripping pressure minimum pressure slam-shut device	Slam-shut device VIS Slam Shut pdsu	ЛЗК МИН Pdsu	Zaw. szybkz.	EBA	-	Blocco VIS Slam Shut Pdso Pdsu
Minimum nominal flow rate	Q pumin	-	-	Q min/max	-	Q Pumin
Maximum nominal flow rate	Q pumax	-	Q max	Q min/max	-	Q Pumax
Regulator model	Reg.	per.	Typ	-	FE	Reg.
Regulator production lot	P.L.	ДАТА	P.L.	Data + barcode	Year	P.L.
Regulator serial number	S.N.	С.н.	Nr	barcode	-	S.N.
Regulator nominal flow rate	-	Nom Q	-	-	-	-
Inlet connections	-	-	DNe	-	DN / Connection	-
Outlet connection	-	-	DNa	-	DN / Connection	-
Operating temperature range	-	-	T3	-	T	-
Accuracy class	-	-	-	ÇT	-	-
Closing class	-	-	-	KT	-	-
Maximum pressure slam-shut device Accuracy Group	-	-	-	ETA	-	-
Minimum pressure slam-shut device Accuracy Group	-	-	-	ETÜ	-	-
Regulator head range	-	-	-	As	-	-
Calibration spring range	-	-	-	-	Wds	-
Maximum pressure slam-shut device spring range	-	-	-	EBÜ	-	-
Minimum pressure slam-shut device spring range	-	-	-	EBA	-	-
Design pressure	-	-	-	-	PS	-
Type of fluid	N.G.	-	-	-	Fluid	-
Relief calibration	-	-	-	-	-	Sfiro VAS Relief Valve

Tab. 2.6.

2.9 - GLOSSARY OF MEASUREMENT UNITS

Type of measurement	Unit of measurement	Description
Volumetric flow rate	Stm ³ /h	Standard cubic metres per hour
	Scfh	Standard cubic feet per hour
Pressure	bar	Unit of measurement in the CGS system
	psi	Pounds per square inch
	"wc	Water column inch
	Pa	Pascal
Temperature	°C	Degree centigrade
	°F	Fahrenheit Degree
	K	Kelvin
Tightening torque	Nm	Newton metro
	ft-lbs	Foot per pound
Sound pressure	dB	Decibel
Other measures	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
<p style="text-align: center;">Installer</p>	<p>Qualified operator able to:</p> <ul style="list-style-type: none"> • handle materials and equipment; • carry out all the operations necessary to properly install the equipment; • perform all the operations necessary to safely operate the equipment and system; • be able to perform all the operations necessary to uninstall and subsequently dispose of the equipment in compliance with the regulations in force in the country of installation. <p>The installer is not authorised to use the lifting equipment. The equipment must be lifted and handled strictly in accordance with the instructions provided by the manufacturer and the regulations in force at the place where the equipment is installed.</p>
<p style="text-align: center;">Commissioning technician</p>	<p>Technician trained and authorised to use and manage the equipment for the activities it was supplied for. They must:</p> <ul style="list-style-type: none"> • be able to perform all operations required for the proper functioning of the equipment and the system, and for their safety or that of any personnel present; • access all device parts for visual inspection, checking equipment status, making adjustments and calibrations; • have proven experience in properly using the equipment similar to that described in this manual, and be trained, informed and instructed in this regard. <p>The skilled technician is not authorised to use the lifting equipment.</p>

Tab. 2.8.

3 - SAFETY

3.1 - GENERAL SAFETY INSTRUCTIONS

WARNING!

The equipment described in this 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.

NOTE!

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 that they are working in;
- obtain the necessary permits to operate when required;
- equip themselves with the necessary personal protection required in the procedures described in this manual;
- ensure that the area that they are operating in is equipped with the required collective protections and the necessary safety information.

3.2 - PERSONAL PROTECTIVE EQUIPMENT

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

Tab. 3.9.

WARNING!

Each licensed operator is obliged to:

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

3.3 - RESIDUAL RISKS

 **NOTE!**

The equipment of SERIES FE does not fall within the scope of the PED 2014/68/EU directive.

The risks associated with the equipment are assessed below and the principles adopted for their prevention are indicated, according to the following classification:

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

3.3.1 - TABLE SHOWING RESIDUAL RISKS DUE TO PRESSURE

 **WARNING!**

If there are any functional faults, do not operate. Immediately contact **PIETRO FIORENTINI S.p.A.** for the necessary directions.

Risk and Hazard	Event and Cause	Effect and Consequence	Solution and Prevention
Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.	<ul style="list-style-type: none"> Violent impact. Impact (also due to falling, improper handling, etc.). 	<ul style="list-style-type: none"> Deformation. Broken connections and, if under pressure, even burst. 	<p>a. Handling and installation with appropriate devices to avoid localised stress.</p> <p>b. Installation in suitable places and spaces with appropriate protections, suitable packaging.</p> <p>c. Information/directions contained in this manual.</p>
Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.	<ul style="list-style-type: none"> Use of inappropriate fluids. 	<ul style="list-style-type: none"> Corrosion. Embrittlement. Explosion. 	<p>a. The user must check compliance of the used fluid with what is indicated on the installation sheet.</p>
Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.	<ul style="list-style-type: none"> Operation at temperatures below the minimum permissible temperature. 	<ul style="list-style-type: none"> Embrittlement. Breakage. Explosion. 	<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 allowable temperature is specified in this manual (refer to paragraph 4.5).</p>
Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts. Explosion.	<ul style="list-style-type: none"> Overpressure or exceeding of the rated limit values (maximum pressure allowed). 	<ul style="list-style-type: none"> Explosion. Breaks. Cracks. Permanent deformations. 	<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 design pressure is specified in this manual (refer to paragraph 4.5).</p>
Pressurised fluid leakage. Projection of metallic and non-metallic pressurised parts.	<ul style="list-style-type: none"> Incorrect fixing of the equipment. 	<ul style="list-style-type: none"> Deformation. Breakage. 	<p>a. The device is equipped with unified type process connections and compression fittings.</p> <p>b. The installer must ensure correct fixing to the line.</p> <p>c. Information/directions contained in this manual.</p>
Explosion of the device pressurised fluid leakage. Projection of metallic parts.	<ul style="list-style-type: none"> Operation at temperatures above the maximum permissible temperature. 	<ul style="list-style-type: none"> Reduction of mechanical resistance, breakage of the device. Explosion. 	<p>a. The commissioning technician must equip the system with suitable control and safety devices.</p> <p>b. The maximum allowable temperature is specified in this manual (refer to paragraph 4.5).</p>

Risk and Hazard	Event and Cause	Effect and Consequence	Solution and Prevention
Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.	<ul style="list-style-type: none"> Electrostatic potential differential stray currents. 	<ul style="list-style-type: none"> Corrosion localised in the device. 	a. The commissioning technician must check the equipment for proper earthing.
Pressurised gas leakage. Projection of metallic and non-metallic pressurised parts.	<ul style="list-style-type: none"> Humidity. Environments with aggressive atmosphere. 	<ul style="list-style-type: none"> Deterioration of external surfaces. corrosion. 	a. The user must shut off the line and contact PIETRO FIORENTINI S.p.A.

Tab. 3.10.

3.3.2 - TABLE OF RESIDUAL RISKS FOR POTENTIALLY EXPLOSIVE ATMOSPHERES

Table 3.11 shows the conditions that can lead the pressure regulators SERIES FE to generate a potentially explosive atmosphere.

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”, where no effective ignition sources must be present, as there are residual risks that potentially explosive atmospheres may be generated.

Operating conditions	Potentially explosive atmosphere	Regulatory References	Management measures included in the use, maintenance and warning manual
First start-up	No	<ul style="list-style-type: none"> During the production cycle, the external sealing of the equipment is checked according to the UNI 11655:2016 standard. Before commissioning, the external sealing of the system portion on which the equipment is installed is checked according to the requirements applicable in the place of installation (when installed in pressure reduction systems, the provisions of 12186:2014 and UNI EN12279:2007 must be adhered to). 	The manual refers to the need to check the external sealing and, when applicable, meet the requirements of the UNI EN 12186:2014 and UNI EN 12279: 2007 standards.
Operation in normal conditions	No	<p>The provisions in the previous point apply and, in addition:</p> <ul style="list-style-type: none"> the equipment is installed outdoors or in an environment with natural ventilation according to the regulations in force in the place of installation, or, when applicable, standards EN 12186:2014 and EN 12279:2007; is monitored according to the national rules in force, good practice and the instructions of the equipment manufacturer. 	<p>The manual reports that:</p> <ul style="list-style-type: none"> any room that the equipment is installed in must meet the ventilation requirement for the place of installation, or, when applicable, the provisions in standards EN 12186:2014 and EN 12279:2007; periodic checks must be carried out during surveillance in accordance with the national rules in force, if any, and with the specific manufacturer's recommendations.
Breakage of diaphragms	No	This event must be considered a rare malfunction.	The manual refers to the need to meet the periodic check requirements in accordance with the regulations in force in the place of installation.
Breakage of other non-metallic parts (malfunction)	No	This type of malfunction is not reasonably expected as it involves static seals (to the outside) that cannot generate any external leakage.	-

Operating conditions	Potentially explosive atmosphere	Regulatory References	Management measures included in the use, maintenance and warning manual
Decommissioning	No	<ul style="list-style-type: none"> • Pressure must be reduced in the system section, where the equipment is installed, inside a suitably ventilated room. • The residual gas must be discharged as indicated above. 	The manual refers to the need to operate in a suitably ventilated environment.
Reboot	No	<ul style="list-style-type: none"> • After reassembling the regulator, carry out an external leakage test at a suitable pressure value, as specified by the Manufacturer. • Before commissioning, the external sealing of the system portion on which the equipment is installed is checked according to the requirements applicable in the place of installation (when installed in pressure reduction systems, the provisions of 12186:2014 and UNI EN12279:2007 must be adhered to). 	<p>The following is referred to in the manual:</p> <ul style="list-style-type: none"> • the minimum conditions for testing the equipment for external leakage; • the need to check external sealing and, when applicable, meet the requirements of the UNI EN 12186:2014 and UNI EN 12279: 2007 standards.

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:



- carefully read and understand the use, maintenance and warning manual;
- 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, strictly refer to the details specified on the nameplates and in the manual;
- Avoid violent shocks and impacts that could damage the equipment and, as a result, cause the pressure fluid to escape.

It is strictly forbidden to:

- operate in various capacities on the equipment without the PPE indicated in the work procedures described in this manual;
- 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 in this manual;
- use the equipment outside the operating temperature range specified in this manual;
- install or use the equipment in environments other than those specified in this manual.

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 beyond the limits allowed 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 headphones 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.

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4 - DESCRIPTION AND OPERATION

4.1 - GENERAL DESCRIPTION

The equipment is a self-operated dual-stage low-pressure regulator suitable for gaseous fluids such as:

- natural gas;
- GPL;
- non-corrosive gases.

The main elements of the equipment are specified in Tab. 4.13.:

Pos.	Description	Pos.	Description
1	Inlet connections: a: in-line b: in a square pattern	7	Outlet connections: a: in-line b: in a square pattern
2	First stage regulation	8	Slam-shut valve for maximum downstream pressure
3	Double stage regulation	9	Relief valve
4	Excess flow lock-up device reset button	10	Double stage regulation valve (3)
5	Reset knob of the slam-shut valve for maximum downstream pressure	11	Excess flow lock-up device
6	Reset knob protection cap (5)	-	-

Tab. 4.13.

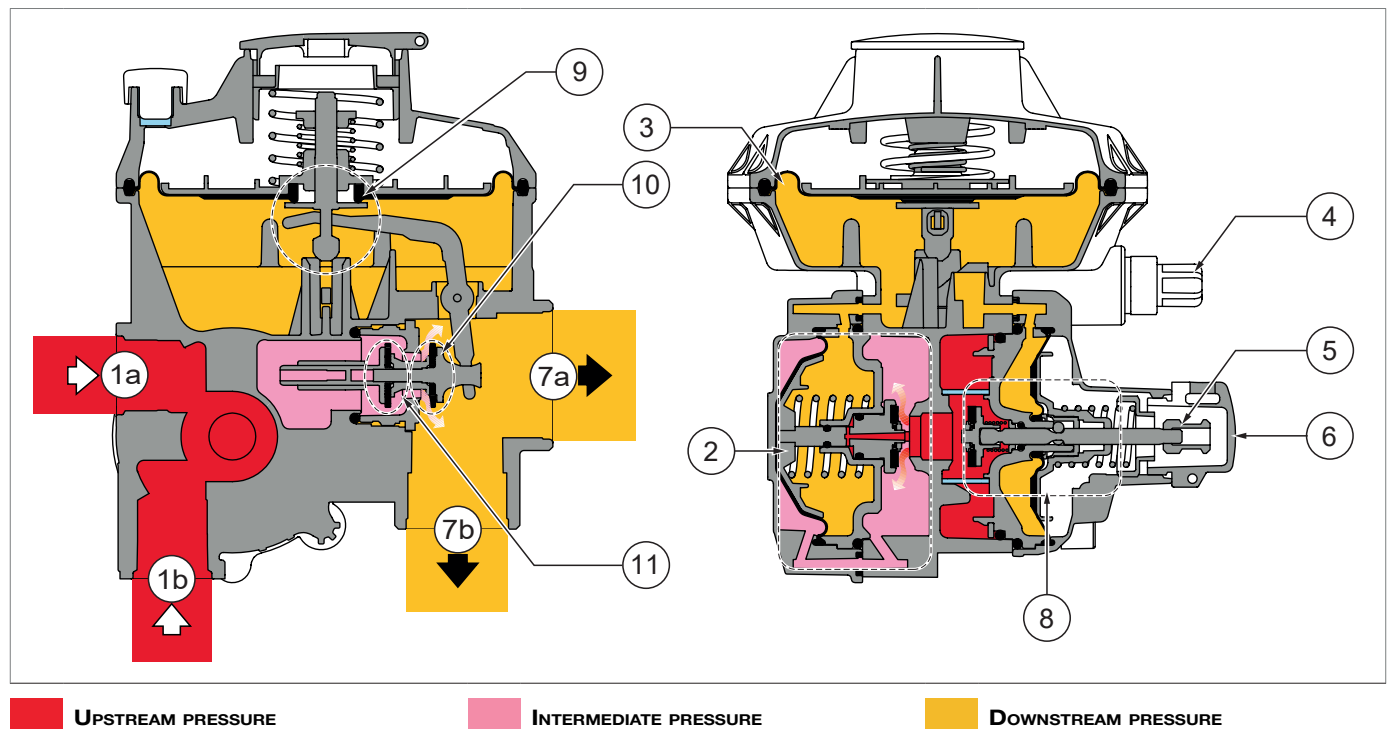


Fig. 4.1. FE (basic version) general description

4.2 - OPERATION

SERIES FE equipment consists of regulators featuring:

- self-operation;
- low pressure suitability;
- a dual regulation stage.

Tab. 4.14. describes the operation of the equipment in a simplified manner:

Step	Description
1	The upstream pressure (A) feeds the regulator.
2	The first regulation stage (B) determines the first pressure reduction.
3	Intermediate pressure is adjusted by the second regulation stage (C) to the value of the downstream pressure (D) required by the user.
4	In the event of faults, the safety devices will trip: <ul style="list-style-type: none"> • relief valve (E); • excess flow lock-up device (F); • slam-shut valve for maximum downstream pressure (G).

Tab. 4.14.

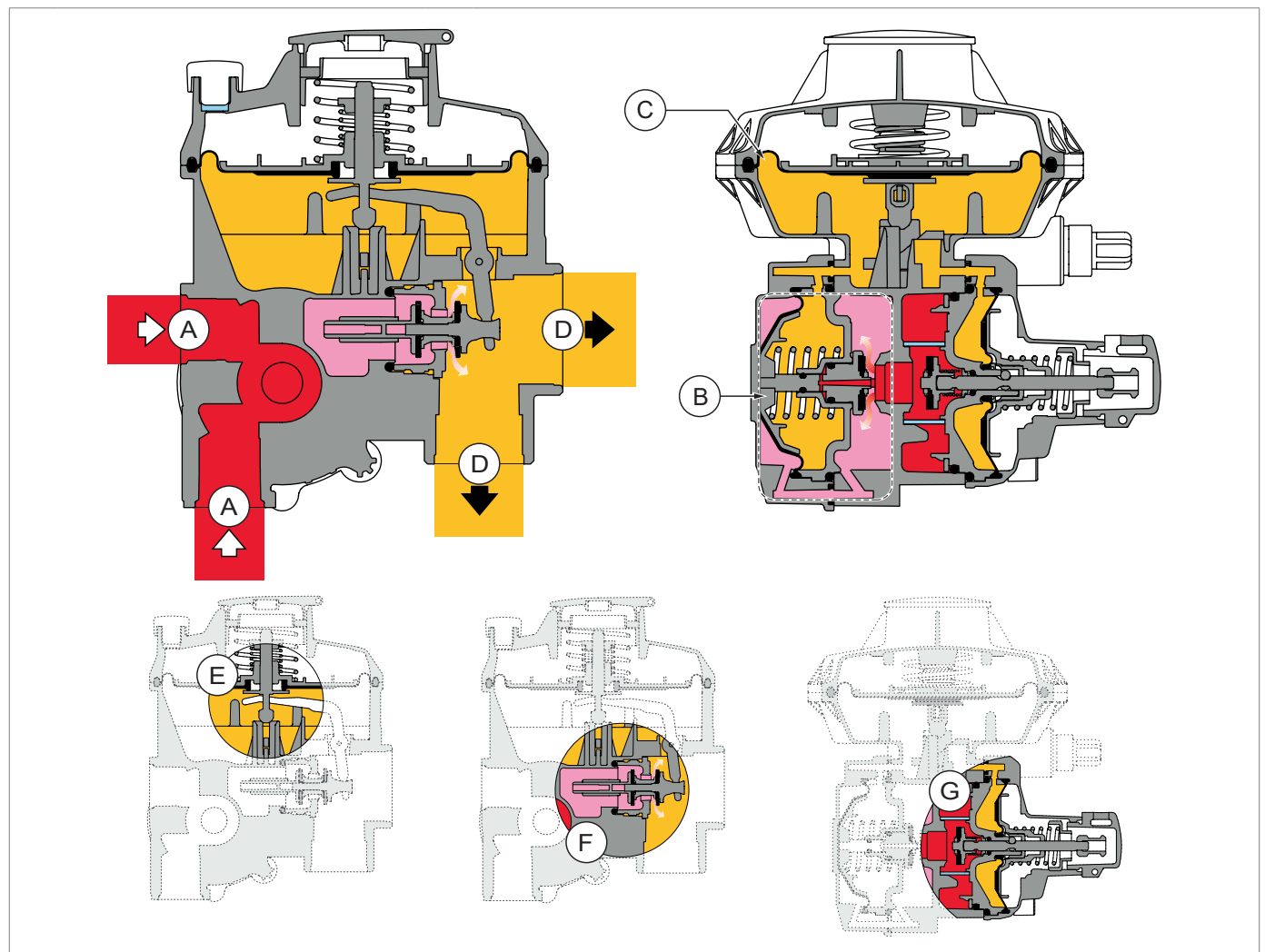


Fig. 4.2. Operation SERIES FE

4.3 - INTENDED USE

4.3.1 - ENVISAGED USE

NOTE!

The equipment of **SERIES FE** is used to adjust the pressure to a pre-set value. It can be installed directly on:

- **user's gas meters.**
- **rising pillars;**
- **burners.**

The equipment in question is intended for:

Operation	Permitted	Unpermitted	Work environment
Adjustment of the downstream pressure for:	Gaseous, and non-aggressive or corrosive fluids filtered beforehand.	<ul style="list-style-type: none"> • Liquids. • Any product other than those permitted. 	Installations for the distribution of natural gas to supply networks for: <ul style="list-style-type: none"> • commercial use; • home use.

Tab. 4.15.

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

Safe work conditions are as follows:

- use within the limits stated on the nameplate and in this manual;
- compliance with the operating and warning instructions as well as commissioning procedures (refer to chapter 8);
- 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 equipment running under all circumstances;
- behaviour resulting from carelessness;
- behaviour resulting from the use of the equipment by unauthorised and unsuitable people (children, disabled);
- 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 UNI EN 12186:2014 and UNI EN 12279:2007 standards, or in installations carrying LPG;
- in commercial premises and industrial plants (after checking by contacting PIETRO FIORENTINI S.p.A.).

NOTE!

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

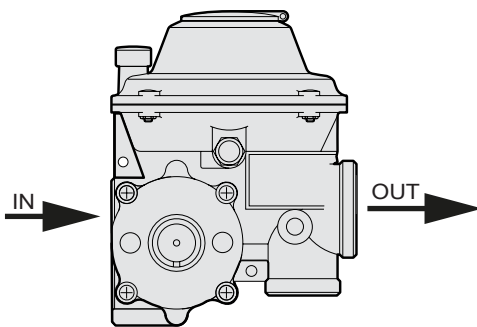
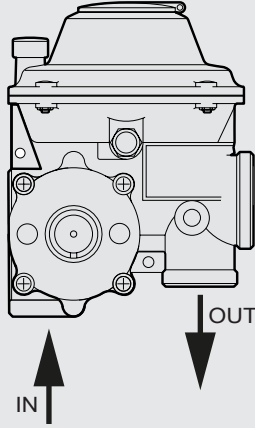
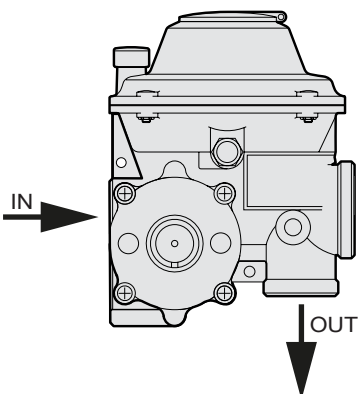
4.4 - MODELS AND CONFIGURATIONS

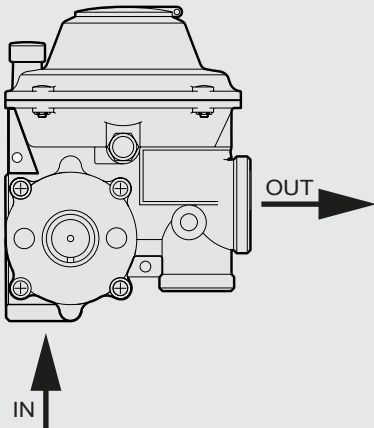
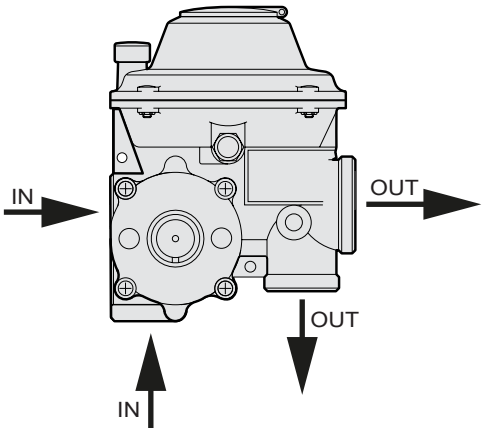
SERIES FE includes 4 standard models based on the nominal flow rate as specified in Tab. 4.16.:

Regulator trade name	Nominal flow rate	Minimum input pressure
FE6	6 m ³ /h	pds + 0.2 bar
FE10	10 m ³ /h	pds + 0.3 bar
FE25	25 m ³ /h	pds + 0.4 bar
FES	50 m ³ /h	pds + 0.8 bar

Tab. 4.16.

Various configurations can be set up based on inlet/outlet connections:

Type	Inlet connection (modular connections on request)	Outlet connection (modular connections on request)	Image
FE L	1 G ½" EN ISO 228/1	1 G 1" EN ISO 228/1	
FE U	1 G ½" EN ISO 228/1	1 G ¾" EN ISO 228/1	
FE S	1 G ½" EN ISO 228/1	1 G ¾" EN ISO 228/1	

Type	Inlet connection (modular connections on request)	Outlet connection (modular connections on request)	Image
FE T	1 G 1/2" EN ISO 228/1	1 G 1" EN ISO 228/1	
FE Q	2 G 1/2" EN ISO 228/1	<ul style="list-style-type: none"> • 1 G 1" EN ISO 228/1 (in-line inlet) • 1 G 3/4" EN ISO 228/1 (in-line inlet) 	

Tab. 4.17.

NOTE!

Mounting positions with the outlet connection facing down are recommended in installations using LPG.

Other versions can be set up according to the safety devices installed:

- » slam-shut valve for maximum downstream pressure (always envisaged);
- » Excess flow lock-up device (optional);
- » relief valve (optional).

Some typical versions are listed below, also by way of example:

! NOTE!

The different versions of the equipment must be:

- contractually established;
- set up at PIETRO FIORENTINI S.p.A. plants only

Type	Description
Version with safety diaphragm	<p>In case of breakage of the working diaphragm, installing a safety diaphragm guarantees:</p> <ul style="list-style-type: none"> • service continuity; • adjusted pressure control; • the ability to identify the working diaphragm through controlled gas leakage into the atmosphere (< 30 l/h gas).
Version with thermal valve	<p>The thermal valve, built into the inlet fitting, ensures that the power supply to the regulator is cut off when the ambient temperature reaches 160 °C.</p> <p>! NOTE!</p> <p>The version with thermal valve requires that specific fittings are requested from the sales offices PIETRO FIORENTINI S.p.A..</p>
Version set up for indoor installation	<p>In the event of complete failure, this version guarantees that gas is dispersed into the atmosphere at a lower than 30 l/h flow rate.</p> <p>! NOTE!</p> <p>Indoor installation is subject to the regulations in force in the country of installation. Regulatory checks are the responsibility of the installer.</p>
Underground version	<p>Special surface guards combined with the use of specific components make this version suitable for installation in underground wells.</p> <p>! ATTENTION!</p> <p>The underground version of the regulator is not suitable for operation if completely covered by earth or other types of debris.</p> <p>! NOTE!</p> <p>For specific installation and checks of the underground version after commissioning, see chapter 7.</p>
Painted version	<p>This version is suitable for:</p> <ul style="list-style-type: none"> • marine environments (against salt corrosion); • highly humid atmospheres.
Low temperature version	<p>This version guarantees correct operation with:</p> <ul style="list-style-type: none"> • Ambient temperature: up to -40 °C and/or • gas temperature up to -20 °C. <p>! NOTE!</p> <p>The low temperature version of the regulator is identified through a specific plate (see paragraph 2.8).</p>

Type	Description
Excess flow, automatic reset version	<p>This version provides to automatically reset the safety device tripped due to excess flow (after resolving the cause that caused tripping).</p> <div style="border: 1px solid black; padding: 5px;"> <p>! NOTE!</p> <p>The safety device is reset through a downstream gas discharge with a controlled flow rate not greater than 15 l/h.</p> </div>

Tab. 4.18.

4.4.1 - SURFACE TREATMENTS

! NOTE!

Surface treatments (special painting, anticorrosive treatments, galvanising,...) are foreseen for specific needs and/or particular environmental conditions.

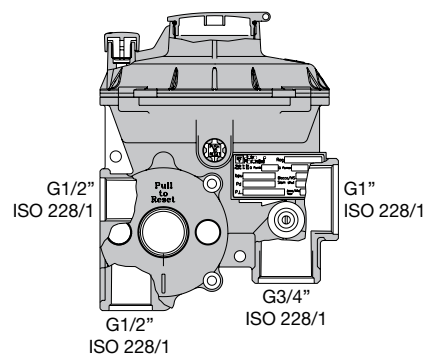
4.5 - TECHNICAL FEATURES/PERFORMANCE

NOTE!

To classify the functional performance of the equipment, refer to standards UNI 11655:2016 and UNI EN 16129:2013.

The main specifications can be found in Tab.4.19:

Technical features	
Design pressure (DP)	8.6 bar
Inlet pressure range	0.1 - 7 bar (on request up to 8.6 bar)
Regulator capacity	6 - 50 m ³ /h
Adjustment range of downstream pressure	Version BP: 13 - 180 mbar Version TR: 181 - 500 mbar
Accuracy class (AC)	10
Lock up over pressure (SG)	20
Operating ambient temperature	<ul style="list-style-type: none"> -20°C + 60°C (standard version) -30°C + 60°C (extended minimum temperature version) * -40°C + 60°C (low temperature version).*
Permissible gas temperature	<ul style="list-style-type: none"> -10°C + 60°C (standard version) -15°C + 60°C (extended minimum temperature version) * -20°C + 60°C (low temperature version) *
Inlet connection	G 1/2" EN ISO 228/1 (modular connections on request)
Outlet connection	<ul style="list-style-type: none"> In-line outlet: G 1" EN ISO 228/1 Outlet in a square pattern: G 3/4" EN ISO 228/1 (modular connections on request)
Modular connections	<ul style="list-style-type: none"> Gas (as per UNI EN ISO 228-1:2003); Flat swivel joint (as per NF E29-533: 2014 and NF E29-536: 2017); NPT (according to ASME B1.20.1, excluding connections with metal/metal sealing); Special accessories (on request).



* Version identified by specific nameplate (refer to paragraph 2.8)

Tab. 4.19.

4.6 - SAFETY DEVICES

To prevent the safety devices from tripping during normal service (when there are no faults at user level):

- do not exceed the maximum capacity values of the gearbox;
- do not feed the gearbox with pressures lower than the minimum values specified;
- do not purge of the downstream line with the gearbox installed.

4.6.1 - SLAM-SHUT VALVE FOR MAXIMUM DOWNSTREAM PRESSURE

NOTE!

If the valve trips, service will be interrupted.

The slam-shut valve for maximum downstream pressure (A) is a safety device that remains open in normal service conditions and automatically and completely closes the gas flow when the maximum downstream pressure exceeds the calibration values.

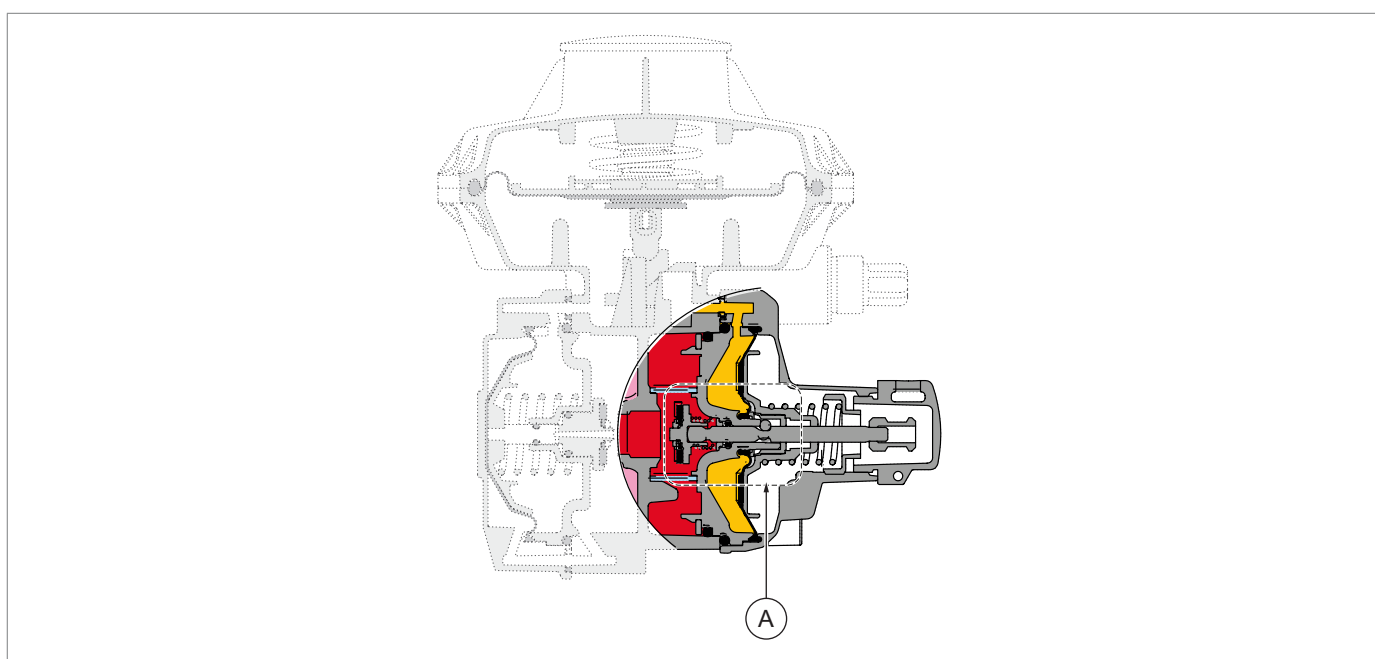


Fig. 4.3. Slam-shut valve for maximum pressure

4.6.2 - EXCESS FLOW LOCK-UP DEVICE

 **NOTE!**

If the device trips, service will be interrupted.

The excess flow lock-up device (A) is a safety device which remains in the open position under normal operating conditions and closes automatically and completely when the pre-set flow limits are exceeded.

The device trips due to the increase in the flow rate between 110% and 150% of the guaranteed flow rate specified on the plate (see paragraph 2.8).

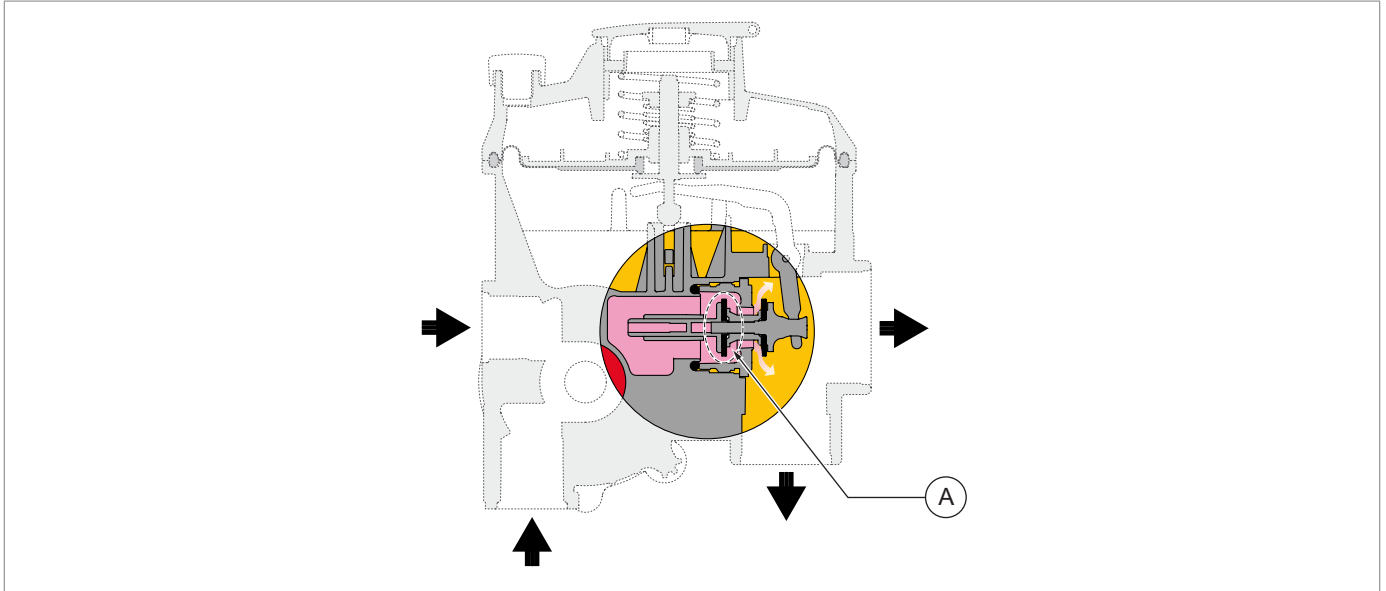


Fig. 4.4. Excess flow lock-up device

4.6.3 - RELIEF VALVE

The relief valve (A) is a safety device that is used to:

- automatically discharge a gas flow into the atmosphere through the exhaust conveyor (B), when the pressure detected downstream exceeds a pre-set value and
- to automatically return to closed position when the downstream pressure drops below the opening/discharge value.

The relief valve trips due to:

- thermal expansion of the downstream gas with no flow;
- temporary defective sealing of the plugs in the first and second regulation stages.

NOTE!

The tripping pressure value of the relief valve is lower than the tripping pressure value of the slam-shut valve for maximum downstream pressure.

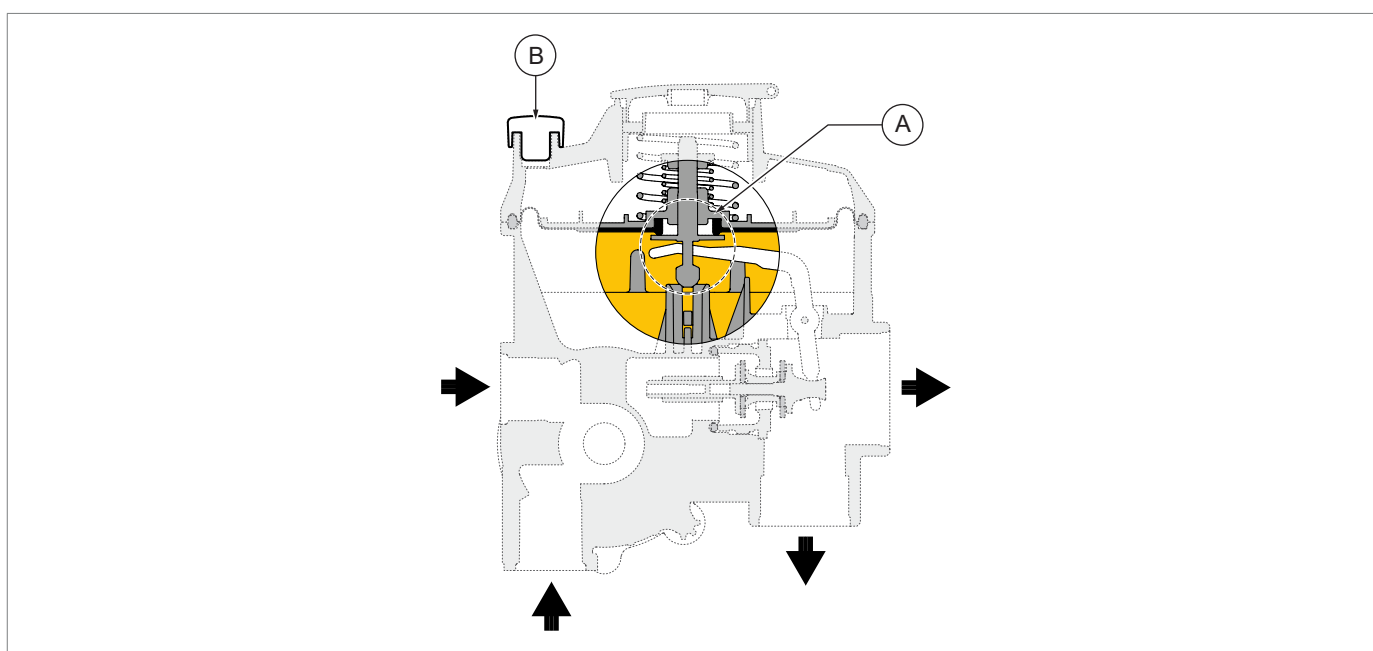


Fig. 4.5. Relief valve

4.6.4 - PRESSURE OUTLET

NOTE!

For an in-field check of the safety devices, a pressure outlet (A) built in the regulator or on the downstream section of the system is required.

Only two types of pressure outlet can be built into the regulator:

- standard (A);
- Peterson model (B).

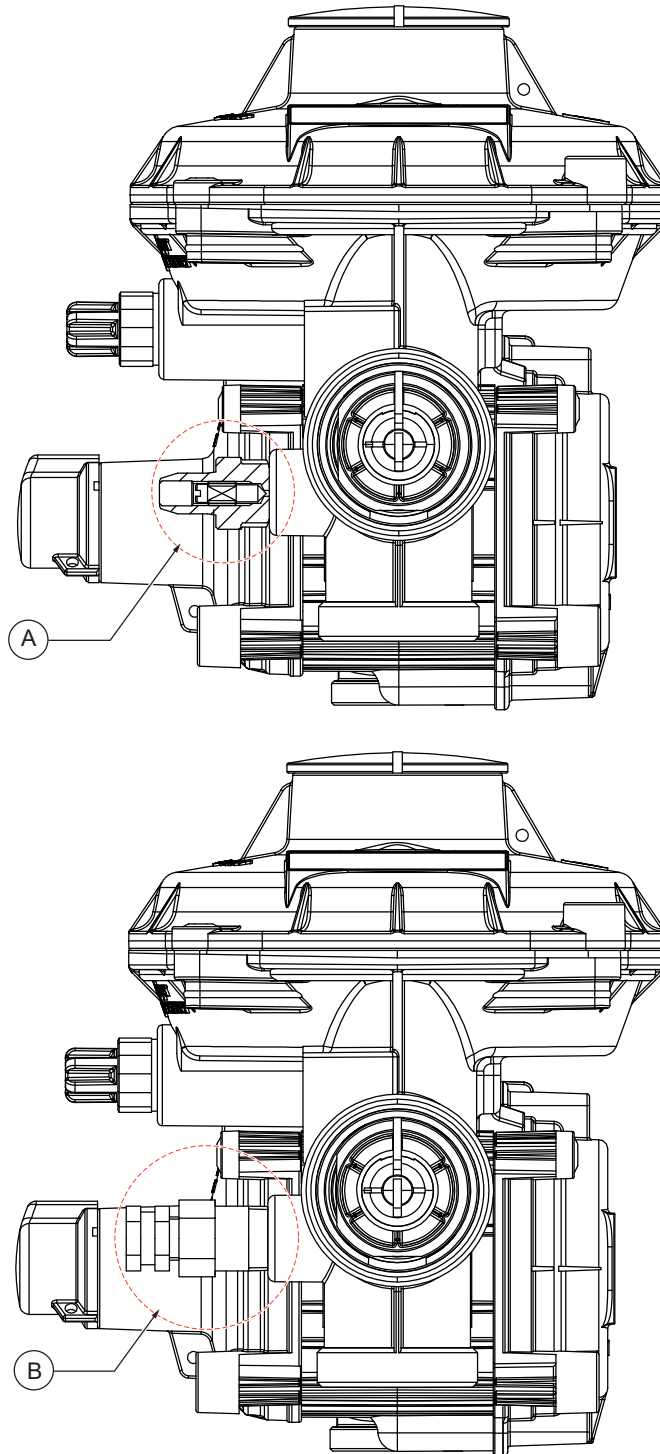


Fig. 4.6. Pressure outlets

4.6.4.1 - PROCEDURE OF USE WITH STANDARD PRESSURE OUTLET

⚠ ATTENTION!

The maximum operating pressure for the standard pressure outlet is 0.5 bar.

To use a standard pressure outlet (A), proceed as follows:

Step	Action
1	Undo the locking screw (B).
2	Fit the rubber tube on the tang (C) making sure that the connection is sealed.
3	Tighten the locking screw (B) making sure there are no leaks from the pressure outlet.

Tab. 4.20.

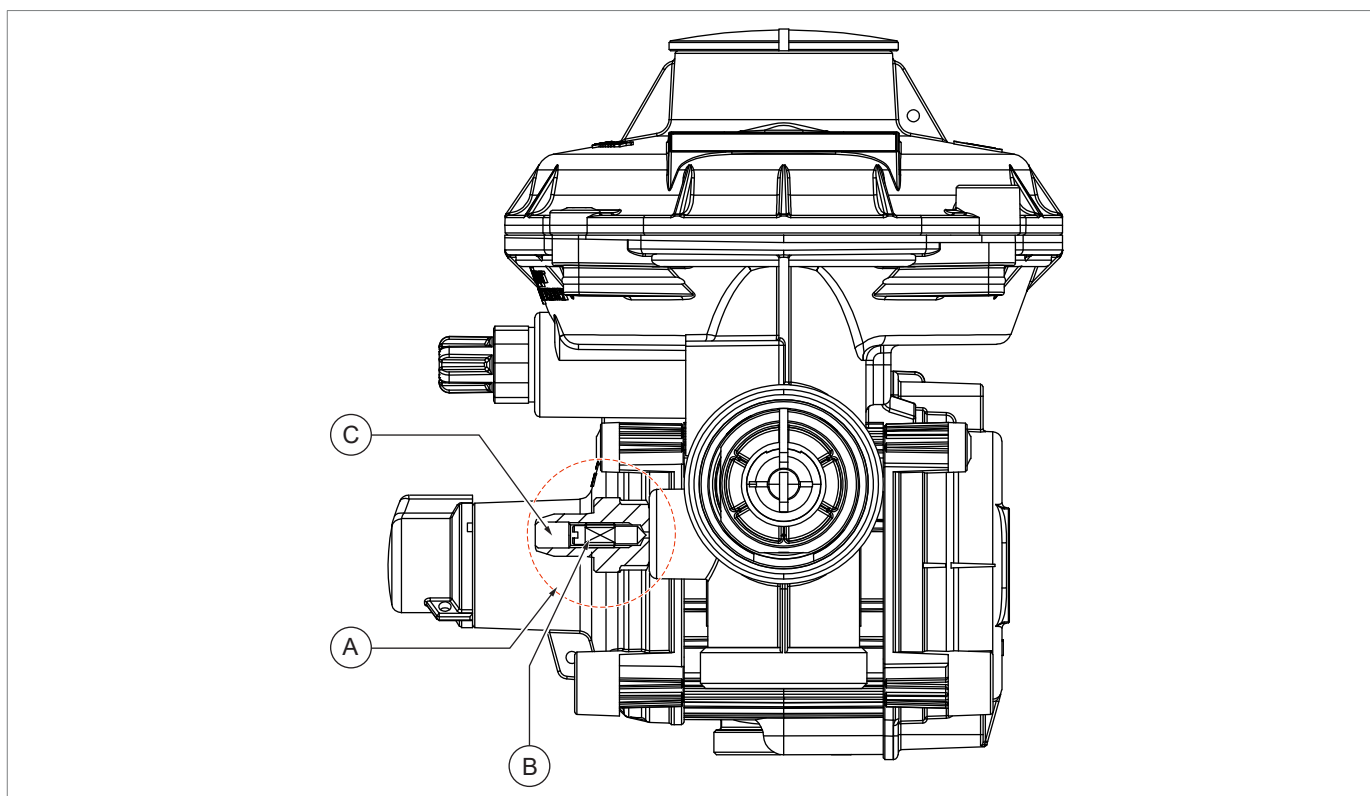


Fig. 4.7. Standard pressure outlet use

4.6.4.2 - PROCEDURE OF USE WITH PETERSON MODEL PRESSURE OUTLET


ATTENTION!

The maximum operating pressure for a Peterson model standard pressure outlet is 10 bar.

NOTE!

The pressure gauge (E) and the ring nut (D) are not included in the standard scope of supply and are supplied only on request.

To use a Peterson model pressure outlet (A), proceed as follows:

Step	Action
1	Remove the closing cap (B).
2	Fit the pin (C) until the connection with the gas chamber of the outlet body is made, then lock it through the ring nut (D).  NOTE! The pin (C) is not present on the regulator but is an accessory of the pressure outlet.
3	Read the pressure measured on the pressure gauge (E).
4	After reading, loosen the ring nut (D) to unlock the pin (C).
5	Remove the pin (C).
6	Put the closing cap (B) back in place.

Tab. 4.21.

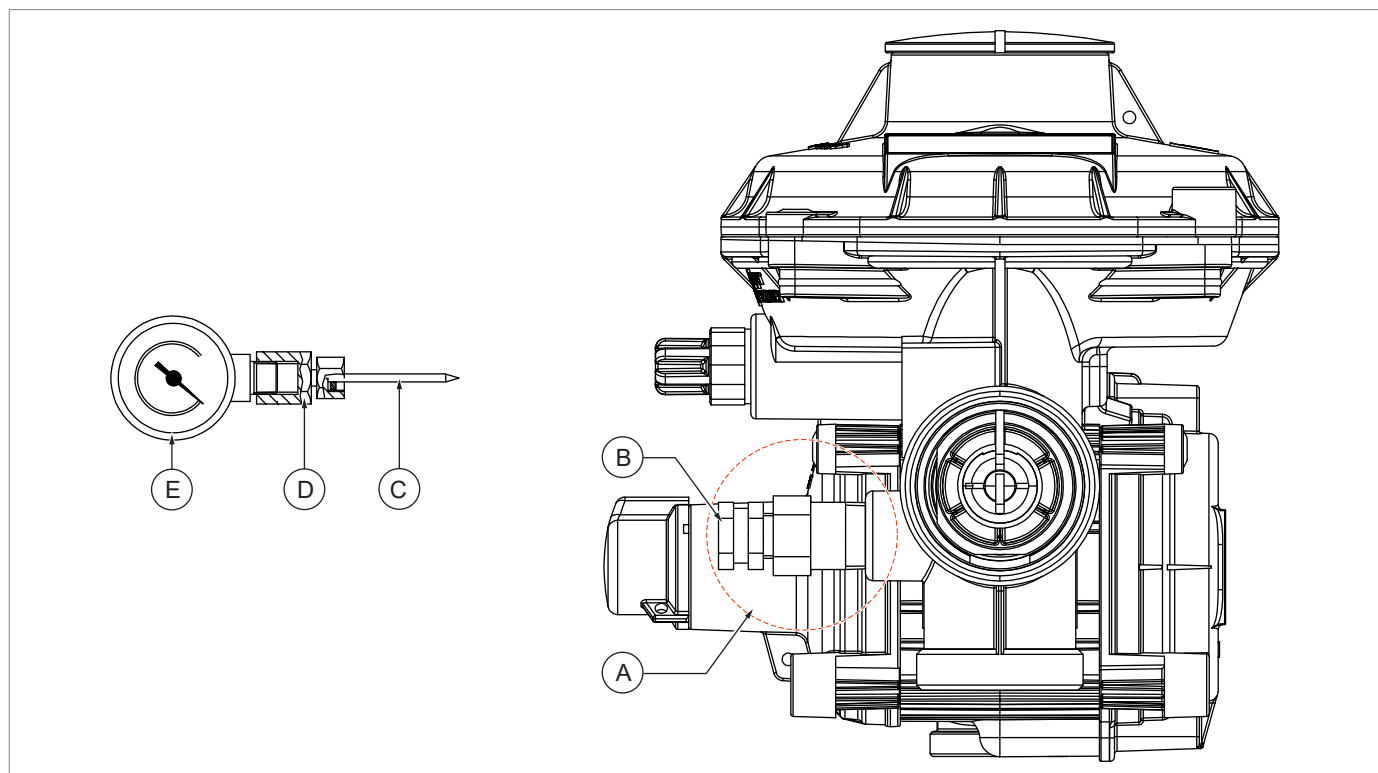


Fig. 4.8. Peterson model pressure outlet use

5 - TRANSPORT AND HANDLING





5.1 - SPECIFIC WARNINGS FOR TRANSPORT AND HANDLING

NOTE!

Transport and handling must be carried out in compliance with the regulations in force in the country of installation by personnel who are:

- qualified (specially trained);
- familiar with accident prevention and workplace safety regulations;
- authorised to use lifting equipment.

Transport and handling

Operator qualification	<ul style="list-style-type: none"> • Installer.
PPE required	<div style="display: flex; align-items: center;">     </div> <div style="background-color: #f4a460; padding: 5px; margin-top: 5px;"> <p>WARNING!</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"> • the regulations in force in the country of installation; • <u>any information provided by the Safety Manager at the installation facility.</u>
Weights and dimensions of the equipment	<p>For dimensions and weights, refer to paragraph 5.2 "Physical characteristics of the equipment".</p>

Tab. 5.22.

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 must be kept in the packaging until installation.



Upon receiving the equipment:

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

! NOTE!

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. 5.23. describes the types of packaging used:

Ref.	Type of packaging	Image
A	Multiple cardboard box (impact protection)	
B	Single cardboard box	

Tab. 5.23.

5.2 - PHYSICAL CHARACTERISTICS OF THE EQUIPMENT

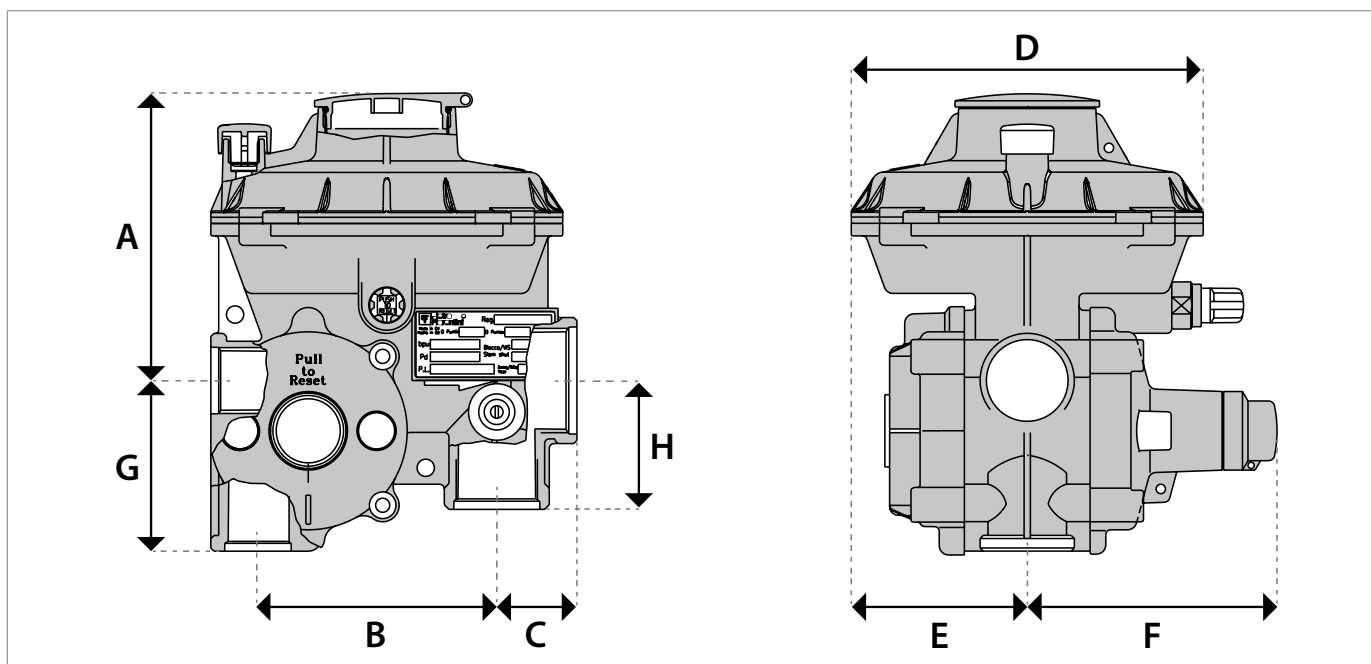


Fig. 5.9. SERIES FE Physical characteristics

Overall dimensions	
Ref.	Dimensions [mm]
A	91
B	76
C	25.5
D	Ø112
E	56
F	79
G	54.3
H	41

Tab. 5.24.

Weight [kgf]	
Zamak regulator (without fittings)	1.35
Aluminium regulator (without fittings)	1.0
Weight increase with fittings	from 0.15 to 0.7

Tab. 5.25.

NOTE!

Refer to the product configurator ("sizing") of the website PIETRO FIORENTINI S.p.A. (www.fiorentini.com) for the dimensions and weight of the equipment.

5.3 - EQUIPMENT ANCHORING AND LIFTING METHOD

 **HAZARD!**

Using lifting equipment (if necessary) for unloading, carrying and handling packages is reserved only for skilled operators who have been properly trained (and are appropriately qualified if required by the regulations in force in the country of installation) and are familiar with:

- accident prevention rules;
- workplace safety provisions;
- lifting equipment features and limits.

 **HAZARD!**

Before handling a load, make sure that its weight does not exceed the load capacity of the lifting equipment (and any other lifting tools) specified on the specific plate.

 **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;
- make sure to have perfect visibility along the route.

5.3.1 - FORKLIFT HANDLING METHOD

HAZARD!

Prohibitions:

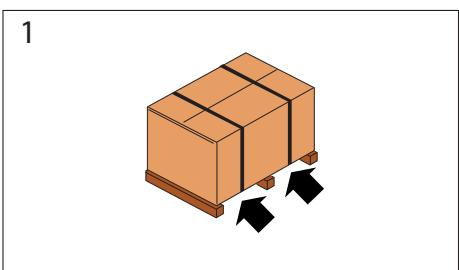
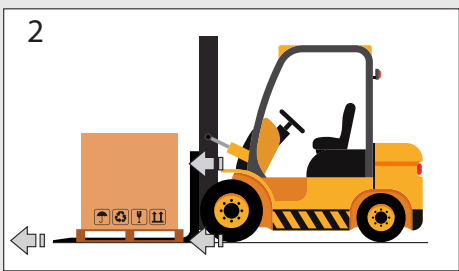
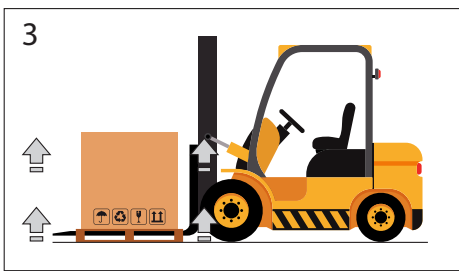
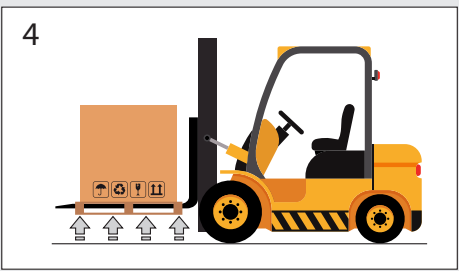
- do not transit under suspended loads;
- do not move the load over the personnel operating in the site/plant area.

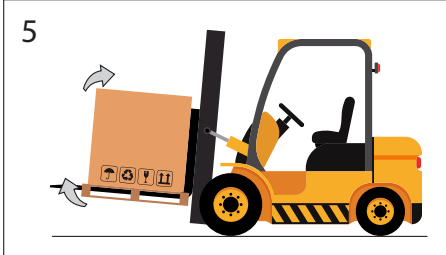
WARNING!

The following is not allowed on forklifts:

- carrying passengers;
- lifting people.


If cardboard boxes (single or multiple) are carried on a pallet, proceed as follows:

Step	Action	Image
1	Place the forks of the forklift under the load surface.	<p>1</p> 
2	Make sure that the forks extend from the front of the load (by at least 5 cm), far enough to eliminate any risk of the transported load from tipping.	<p>2</p> 
3	<p>Raise the forks until they are touching the load.</p> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p>NOTE! Fasten the load to the forks with clamps or similar devices if required.</p> </div>	<p>3</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 at the centre of the lifting forks.	<p>4</p> 

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. ⚠ WARNING! If: <ul style="list-style-type: none"> • obstacles along the path; • particular operating situations; do not offer the operator a perfect view, the assistance of a ground operator is required, placed outside the range of action of the lifting means, with the task of carrying out reports.	-
7	Place the load in the chosen installation area.	-

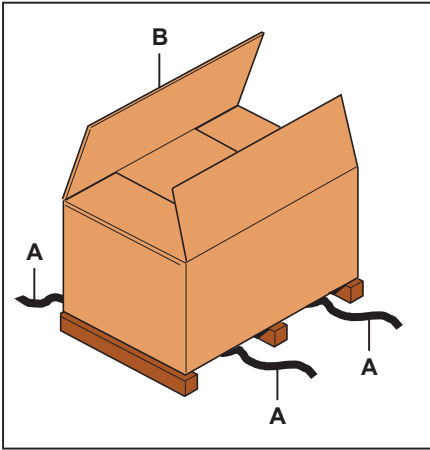
Tab. 5.26.

5.4 - PACKAGING REMOVAL

Packaging removal	
Operator qualification	<ul style="list-style-type: none"> Installer.
PPE required	<div style="display: flex; align-items: center;">  </div> <div style="background-color: #f4a460; padding: 5px; margin-top: 5px;"> ⚠ WARNING! </div> <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"> the regulations in force in the country of installation; <u>any information provided by the Safety Manager at the installation facility.</u>

Tab. 5.27.

To unpack the equipment in a cardboard box, proceed as follows:

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	Move the equipment from the base to the place intended for it. <div style="border: 1px solid blue; padding: 5px; margin-top: 5px;"> NOTE! Have at least 2 operators manually move the packages if required due to their dimensions/weight. </div>	

Tab. 5.28.

NOTE!

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

NOTE!

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

WARNING!

Protect the regulator from blows and impacts, even accidental, until it is installed.

If the equipment needs to be stored for an extended period, the minimum environmental conditions for the intended storage are provided in Tab.5.29. Compliance with these conditions will guarantee the declared performance:

Conditions	Data
Maximum storage period	5 years.
Temperature	Not above 40°C
Humidity	Not above 70%
Radiation and light sources	Away from radiation and light sources according to UNI ISO 2230:2009

Tab. 5.29.

5.5.1 - STORAGE LASTING LONGER THAN THE MAXIMUM TIME ALLOWED

NOTE!

After a storage period exceeding the maximum time allowed (5 years), the equipment must be scrapped.

6 - INSTALLATION

6.1 - INSTALLATION PRE-REQUISITES

6.1.1 - ALLOWED ENVIRONMENTAL CONDITIONS

 **WARNING!**

To safely use the equipment, observe the environmental conditions allowed and to the data provided on the nameplate of the regulator and any accessories (refer to paragraph 2.8 “Nameplates applied”).

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 that the operator has good view when working on the equipment.

6.1.2 - STORAGE LASTING LONGER THAN THE MAXIMUM TIME ALLOWED

 **WARNING!**

Installing the equipment after storage exceeding the maximum admissible time (5 years) is not allowed. After a storage period exceeding the maximum time allowed, the equipment must be scrapped.

6.1.3 - CHECKS BEFORE INSTALLATION

With respect to its **design pressure (DP)**, the equipment does not require any further safety device upstream to protect against any overpressure when, for the upstream reduction station, the maximum incidental downstream pressure is:

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

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

ATTENTION!

If the installation of the equipment requires the field 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 applied.**

Before installation, it must be ensured that:

- the flow direction is observed as shown on the regulator;
- the data shown on the nameplate matches the requirements of the connected combustion equipment;
- at least one shut-off valve is installed upstream;
- at least one shut-off valve is installed downstream;
- the expected dimensions of the installation site are compatible with the equipment size;
- the inlet/outlet pipes do not exert loads on the equipment;
- the inlet and outlet connections of the equipment are clean and have not been damaged;
- the inside of the upstream pipe is clean and free of processing residues such as welding slag, sand, paint residues, water, etc...

Installation

Operator qualification	<ul style="list-style-type: none"> • Installer.
PPE required	<div style="text-align: center;">  </div> <div style="background-color: #f4a460; padding: 5px; text-align: center;">  WARNING! </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"> • the regulations in force in the country of installation; • any information provided by the Safety Manager at the installation facility.

Tab. 6.30.

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 closed.

WARNING!

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

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

WARNING!

Near the equipment, do not:

- use open flames (e.g. for welding operations);
- smoke.

WARNING!

The equipment must be installed away from atmospheric agents and direct sunlight.

WARNING!

The room where the equipment is installed must:

- be properly aerated/ventilated;
- have an ambient temperature of use as indicated in paragraph 4.5 (“Technical characteristics/performance”).

WARNING!

The installer must:

- use the fittings and gaskets supplied with the equipment by PIETRO FIORENTINI S.p.A.
- fix the swivel joints (when provided) according to the tightening torques specified by standards: NF E29-533: 2014 and NF E29-536: 2017.

ATTENTION!

Do not use the equipment as a reference template (available on request).

6.3 - GENERAL INFORMATION ON THE LINE

The device must be installed in the line, with the arrow on its body pointing to the gas flow direction.
In the typical and most frequent installation, the following must be available:

Pos.	Description
1	Pressure regulator.
2	Shut-off valve upstream of the equipment (1).
3	Shut-off valve downstream of the equipment (when required).
4	Gas meter (if any).

Tab. 6.31.

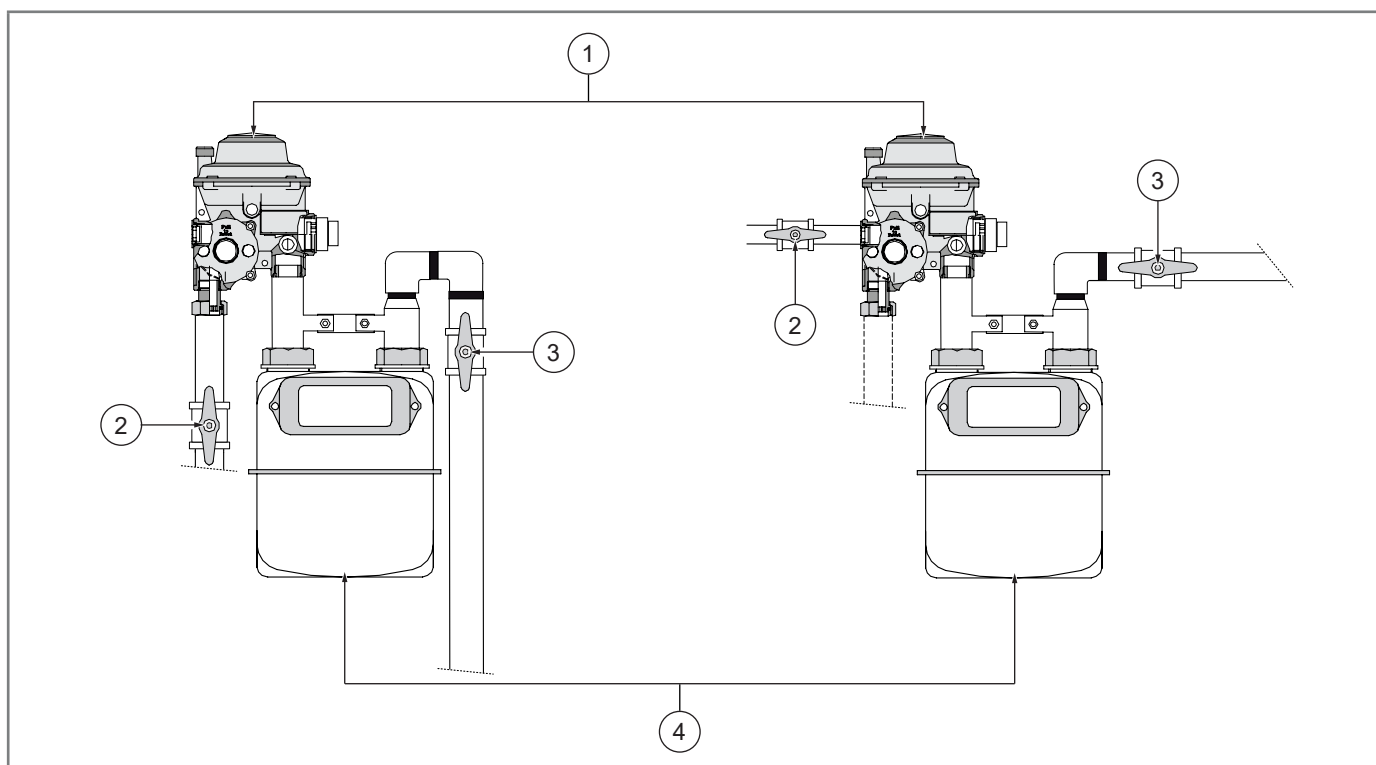


Fig. 6.10. Connection examples

NOTE!

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.

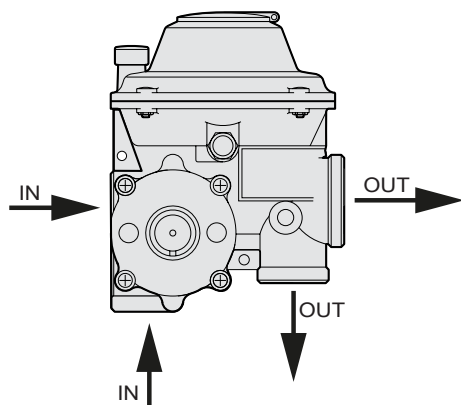
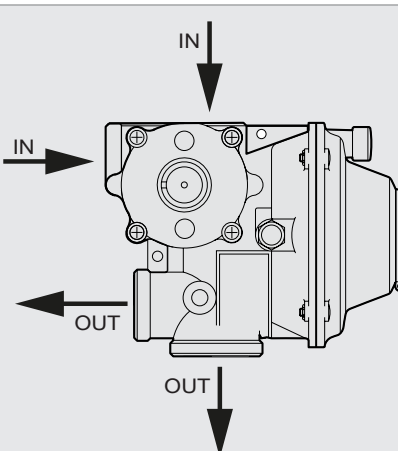
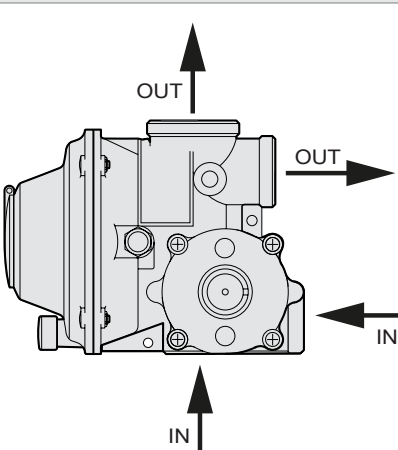
Equipment vents must be ducted in accordance with UNI EN 12186:2014 or UNI EN 12279:2007 or the standards in force at the place of installation of the equipment.

6.4 - INSTALLATION PROCEDURES

NOTE!

- With natural gas or other non-corrosive gases that are not subject to recondensation, the equipment can be installed in any flow direction.
- Mounting positions with outlet flow facing upwards should be avoided in installations using LPG.

For information about how to mount the regulator in keeping with the available models and configurations (see paragraph 4.4. of the manual), refer to Tab. 6.32.:

Ref.	Flow direction	Image
A	Horizontal flow	
B	Vertical flow (from top to bottom)	
C	Reversed vertical flow (from bottom to top)	

Tab. 6.32.

To install the equipment, proceed as specified in Tab. 6.33.:

Step	Action
1	Apply the checks in paragraph 6.1.3 (“Checks before installation”).
2	Remove any type of packaging/equipment protection (if any).
3	<p>Connect making sure that:</p> <ul style="list-style-type: none"> the inlet and outlet pipes do not exert excessive bending or traction forces on the regulator body as a result of not being aligned. If necessary, clamp the inlet/outlet pipes for proper alignment; the connections and/or terminals of the inlet and outlet pipes are suitable for and compatible with the fittings on the regulator. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NOTE!</p> <ul style="list-style-type: none"> If there are swivel connectors, use the gaskets supplied by PIETRO FIORENTINI S.p.A. In case of direct assembly in the regulator body, use only cylindrical GAS connections (ref. UNI EN ISO 228-1). </div>

Tab. 6.33.

NOTE!

The warranty shall be deemed null and void and PIETRO FIORENTINI S.p.A. shall not be held liable for any damage and/or malfunctions if the fittings used during installation are not those supplied.

6.4.1 - POST-INSTALLATION INSTRUCTIONS

WARNING!

Make sure all connections are properly tightened to prevent any leakage during commissioning.

WARNING!

Protect the regulator from blows and impacts, even accidental.



6.5 - EQUIPMENT ADJUSTMENTS

NOTE!

All regulators are calibrated to the values requested by the customer directly at PIETRO FIORENTINI S.p.A. factory.

No further adjustments are required.

The calibration values are specified on the nameplate (refer to paragraph 2.8).

Adjustment	
Operator qualification	<ul style="list-style-type: none"> Installer.
PPE required	<div style="display: flex; align-items: center;">  </div> <div style="background-color: #f4a460; padding: 5px; margin-top: 5px;">  WARNING! </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"> the regulations in force in the country of installation; <u>any information provided by the Safety Manager at the installation facility.</u>

Tab. 6.34.

If it is necessary to change the calibration values, proceed as indicated in Tab. 6.35. to increase or decrease the operating pressure:

Step	Action	Necessary equipment
1	Remove the upper cap (A) of the regulator.	-
2	Turn the ring nut (B) clockwise <ul style="list-style-type: none"> to increase the downstream pressure; anticlockwise to decrease the downstream pressure. 	27 mm tubular socket wrench
3	Put the upper cap (A) of the regulator back in place.	-
4	Remove the cap of the slam-shut device (C).	-
5	Turn the ring nut (D): <ul style="list-style-type: none"> clockwise to increase the slam-shut valve tripping pressure; anti-clockwise to decrease the slam-shut valve tripping pressure. 	13 mm tubular socket wrench
6	Put the cap of the slam-shut device (C) back in place.	-

Tab. 6.35.

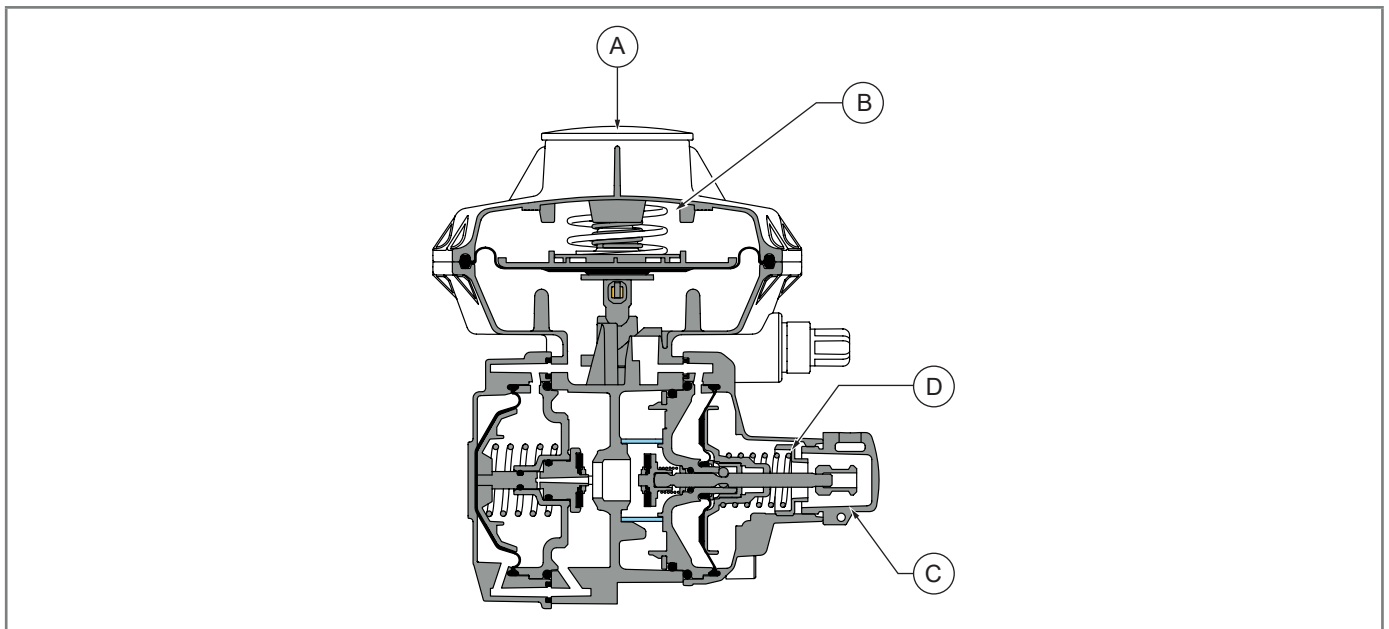


Fig. 6.11. Operating pressure regulation

NOTE!

Minimum calibration variations of $\pm 10\%$ with respect to the value shown on the nameplate (see paragraph 2.8 "Identification plates applied") can be performed only by adhering to the spring ranges specified in the tables in chapter 10 ("Calibration tables").

NOTE!

The relief valve pressure does not need to be adjusted.

WARNING!

Contact PIETRO FIORENTINI S.p.A. for any further need.
Do not make any unauthorised changes to the equipment without the approval of PIETRO FIORENTINI S.p.A.

7 - COMMISSIONING

7.1 - GENERAL WARNINGS

7.1.1 - 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 of explosive mixtures (gas/air) forming inside the piping, if the line is not subjected to inerting.

WARNING!







During commissioning, unauthorised personnel must be removed.

NOTE!

Commissioning must be carried out by authorised and qualified personnel.

Before commissioning the equipment, it is necessary to check that all shut-off valves (inlet, outlet, bypass if any) are closed.

Commissioning

Operator qualification	<ul style="list-style-type: none"> Commissioning technician.
PPE required	<div data-bbox="414 1167 758 1234" style="display: flex; justify-content: space-around;">      </div> <div data-bbox="414 1245 1476 1473" style="background-color: #f9a825; padding: 5px;"> <p> WARNING!</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"> the regulations in force in the country of installation; any information provided by the Safety Manager at the installation facility. </div>

Tab. 7.36.

7.2 - PRELIMINARY PROCEDURES FOR COMMISSIONING

HAZARD!

Before commissioning the equipment, it must be ensured that any risk of explosion or ignition source has been eliminated.

WARNING!

Before commissioning, it must be ensured that:

- the conditions of use comply with the characteristics of the equipment;
- during pressurisation, the equipment has no leaks.

ATTENTION!

To protect the equipment from damage, the following operations must never be carried out:

- pressurisation through a valve located downstream of the equipment;
- depressurisation through a valve located upstream of the equipment.

7.3 - CALIBRATION OF SAFETY DEVICES

NOTE!

The equipment is regulated at PIETRO FIORENTINI S.p.A. production plants

WARNING!

Do not tamper with or make any unauthorised changes to the equipment without the approval of PIETRO FIORENTINI S.p.A.

7.4 - COMMISSIONING THE REGULATOR

NOTE!

Commissioning must be carried out by authorised and qualified personnel.

Commissioning occurs by directly injecting gas into the pipes at a limited speed (maximum permitted value 5 m/s).

7.4.1 - COMMISSIONING THE REGULATOR WITH MANUAL RESET

To commission the regulator (A), with and without excess flow shut-off device, proceed as indicated in Tab. 7.37.:

Step	Action
1	Slowly open the shut-off valve upstream of the regulator (A) to feed it.
2	Unscrew the protection cap (B) of the reset knob (C).
3	Engage the knob (C) in the cap (B) through the special built-in hook.
4	Slowly pull the knob (C) with the cap (B) until the slam-shut device engages (the knob must not remain inside the lid (E) of the slam-shut valve). NOTE! The greater the resistance encountered when pulling the knob (C), the higher the pressure upstream of the gearbox (A).
5	Press the reset button (D) of the excess flow lock-up device, keeping the knob (C) pulled, by about 2/3". NOTE! Keep the knob (C) pulled until the downstream pressure is stable.
6	Put the protection cap (B) back in place.
7	Check that the slam-shut valve for maximum downstream pressure remains triggered. NOTE! The slam-shut valve for maximum downstream pressure is triggered if the knob (C) is visible in the transparent area of the protection cap (B).

Tab. 7.37.

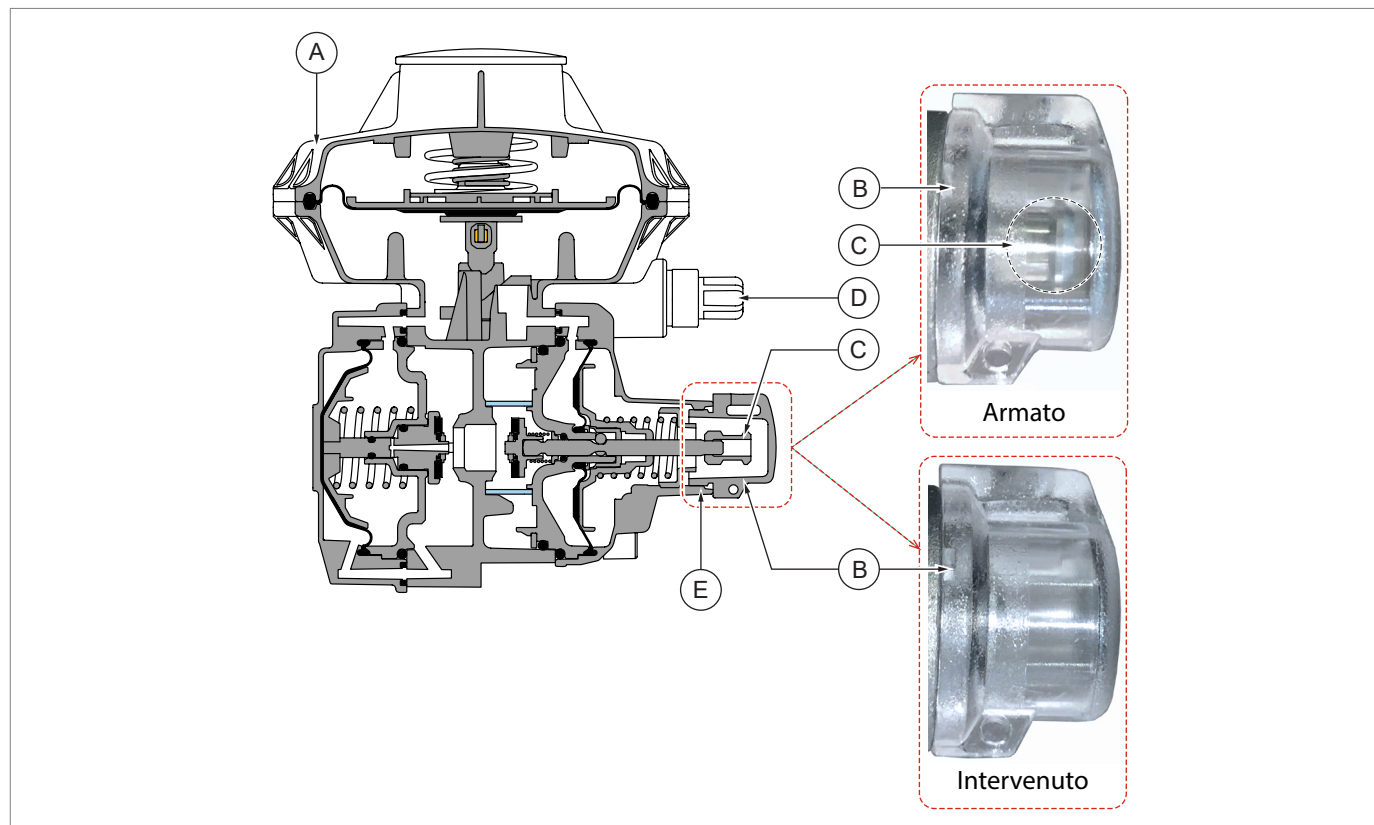


Fig. 7.12. Commissioning with manual reset

7.4.2 - COMMISSIONING THE REGULATOR WITH AUTOMATIC RESET

To commission the regulator (A) with automatic reset, proceed as indicated in Tab. 7.38.:

Step	Action
1	Slowly open the shut-off valve upstream of the regulator (A) to feed it.
2	Unscrew the protection cap (B) of the reset knob (C).
3	Engage the knob (C) with the cap (B) through the special built-in hook.
4	Slowly pull the knob (C) with the cap (B) until the slam-shut device engages (the knob must not remain inside the lid (D) of the slam-shut valve). NOTE! The greater the resistance encountered when pulling the knob (C), the higher the pressure upstream of the gearbox (A).
5	Release the reset knob (C).
6	Put the protection cap (B) back in place.
7	Wait for the lock-up device to automatically reset due to excess flow. The reset time is proportional to the volume downstream of the gearbox. NOTE! Should the device not reset, make sure there are no leaks downstream of the regulator.
8	Once reset (Step 7), check that the slam-shut valve for maximum downstream pressure remains triggered. NOTE! The slam-shut valve for maximum downstream pressure is triggered if the knob (C) is visible in the transparent area of the protection cap (B).

Tab. 7.38.

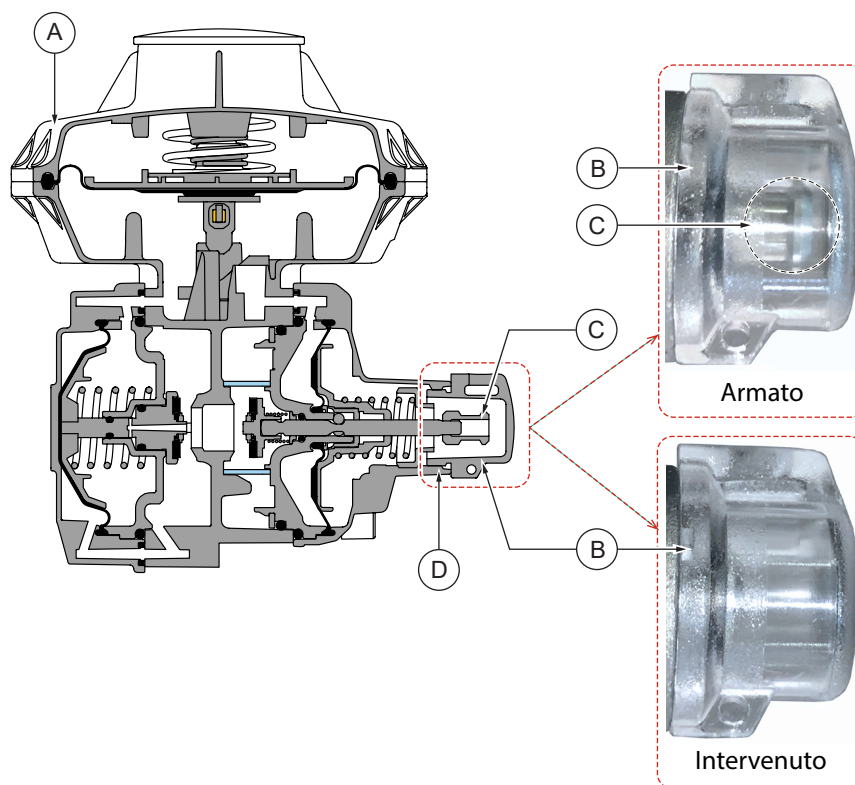


Fig. 7.13. Commissioning with automatic reset

7.5 - PROPER COMMISSIONING CHECK

Check the connections made during the installation of the equipment (refer to chapter 6 "Installation") for proper sealing through a foaming solution (or equivalent control system).

7.6 - RESET OF SAFETY DEVICES AFTER COMMISSIONING

HAZARD!

Before resetting the safety devices, eliminate the causes that caused them to trip.

ATTENTION!

- The maximum pressure slam-shut device is not reset if overpressure has not been eliminated in the network, downstream of the gearbox.
- The excess flow lock-up device will not reset if the fault has not been eliminated on the network.

NOTE!

While resetting the safety devices, the relief valve can temporarily trip.

7.7 - DRUM ASSEMBLY (UNDERGROUND VERSION OF THE REGULATOR)

! NOTE!

The drum must only be assembled for the underground version of the regulator.

7.7.1 - DRUM ASSEMBLED TO THE SLAM-SHUT VALVE LID

! NOTE!

The drum must always be in a horizontal position with the camera facing the ground.

After commissioning the equipment (see paragraph 7.4), proceed as indicated in Tab. 7.39.:

Step	Action
1	Unscrew the butterfly screw (1) anticlockwise, making sure that the O-ring (2) remains in its seat.
2	Fit the drum (3) to the brass fitting (5) so that the rubber tube (4) of the regulator vent is in a vertical position inside the drum itself.
3	Turn the butterfly screw (1) clockwise, tightening it fully to ensure locking and sealing of the system.
4	Make sure the drum (3) is in a horizontal position.

Tab. 7.39.

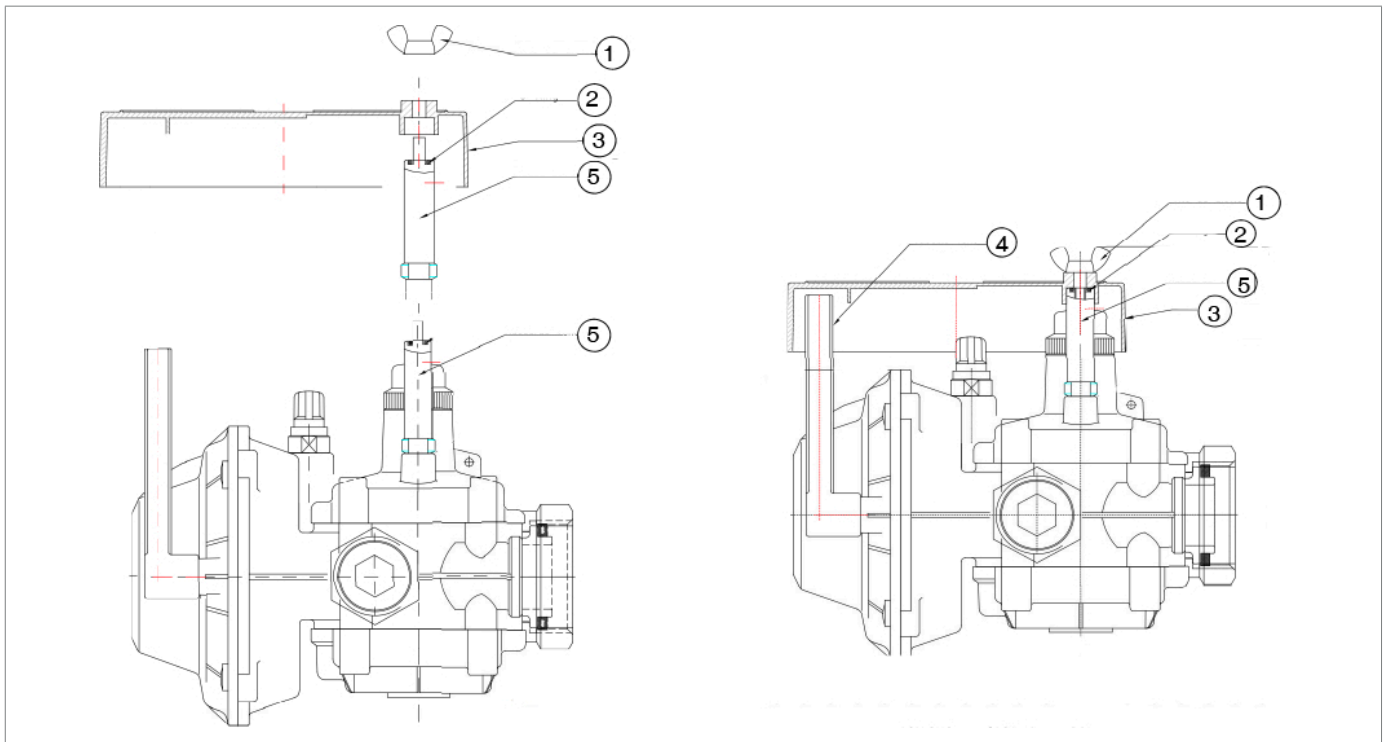


Fig. 7.14. Drum assembled to the slam-shut valve lid (regulator underground version)

7.7.1.1 - REGULATOR RESET

To reset the underground version of the regulator with drum fixed on the slam-shut valve lid, proceed as indicated in Tab. 7.40.:

Step	Action
1	Undo the butterfly screw (1) counterclockwise.
2	Remove the drum (3) from the brass fitting (5).
3	Commission the equipment (see paragraph 7.4).
4	Check for the O-ring (2) on the brass fitting (5).
5	Fit the drum (3) to the brass fitting (5) so that the rubber tube (4) of the regulator vent is in a vertical position inside the drum itself.
6	Turn the butterfly screw (1) clockwise, tightening it fully to ensure locking and sealing of the system.
7	Make sure the drum (3) is in a horizontal position.

Tab. 7.40.

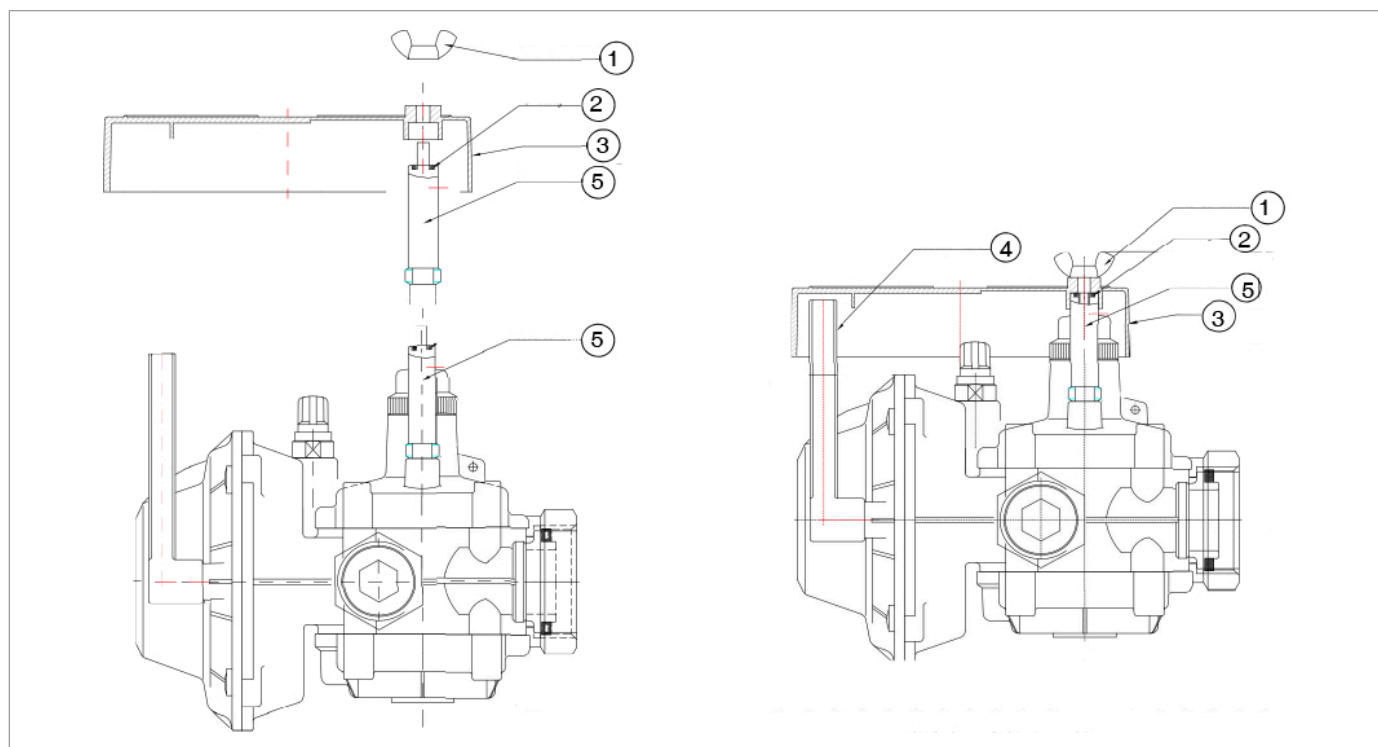


Fig. 7.15. Resetting of the underground regulator with drum fixed on the slam-shut valve lid

7.7.2 - DRUM FIXED ON THE SECOND STAGE CONTROL HEAD



The drum must always be in a horizontal position with the camera facing the ground.

After commissioning the equipment (see paragraph 7.4), proceed as indicated in Tab. 7.41.:

Step	Action
1	Unscrew the butterfly screw (1) anticlockwise, making sure that the O-ring (2) remains in its seat.
2	Screw the brass fitting (5) onto the regulator lid.
3	Fit the drum (3) to the brass fitting (5) so that the rubber tube (4) of the regulator vent is in a vertical position inside the drum itself.
4	Turn the butterfly screw (1) clockwise, tightening it fully to ensure locking and sealing of the system.
5	Make sure the drum (3) is in a horizontal position.

Tab. 7.41.

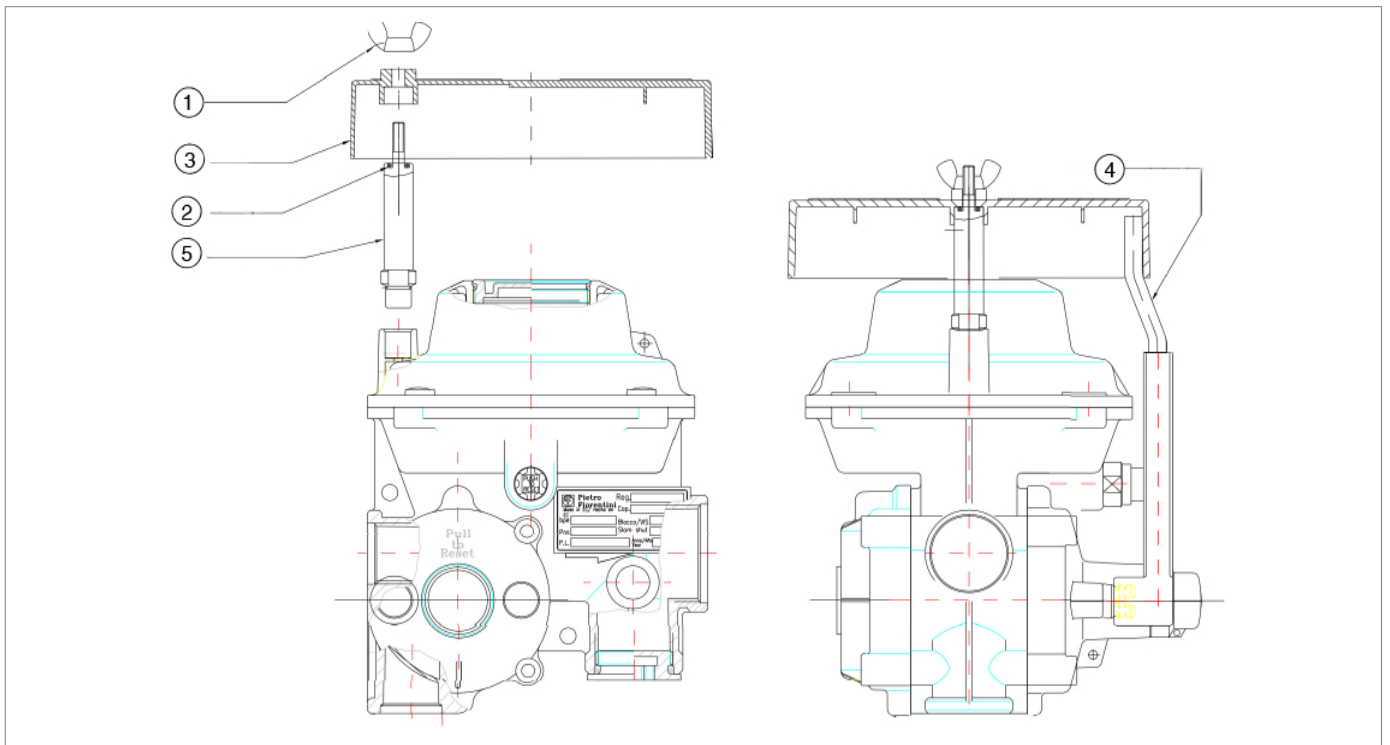


Fig. 7.16. Drum fixed on the second stage control head (underground regulator)

8 - FUNCTIONAL CHECKS

8.1 - GENERAL WARNINGS

 **NOTE!**

The equipment does not need any periodic checks and maintenance procedures.

 **HAZARD!**

PIETRO FIORENTINI S.p.A. shall not be held liable for any damage to people and property due to services provided without its approval.

 **WARNING!**

If you have doubts or there are any functional faults, do not operate. Contact PIETRO FIORENTINI S.p.A. for the necessary clarifications.

In the event of equipment faults, proceed as follows:

Step	Action
1	Close the shut-off valve downstream of the equipment.
2	Close the shut-off valve upstream of the equipment.
3	Ensure that the pressure upstream and downstream of the equipment is "0".
4	Contact PIETRO FIORENTINI S.p.A.



Tab. 8.42.

8.2 - PERIODICALLY CHECKING AND INSPECTING THE EQUIPMENT FOR PROPER OPERATION

HAZARD!

Checks and inspections must be carried out only by qualified technicians.

Periodic checks and inspections

Operator qualification	<ul style="list-style-type: none"> Commissioning technician.
PPE required	<div style="display: flex; align-items: center;">  </div> <div style="background-color: #f96; padding: 5px; margin-top: 5px;">  WARNING! </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"> the regulations in force in the country of installation; any information provided by the Safety Manager at the installation facility.

Tab. 8.43.

8.2.1 - FUNCTIONAL CHECKS OF SAFETY DEVICES



To check the safety devices for proper operation, it is necessary:

- that the system has a shut-off valve downstream of the regulator;
- that the system is set up with a pressure outlet downstream of the regulator or that the regulator is equipped with a built-in pressure outlet (see paragraph 4.6.4);
- that an external pressure source with pressure control is available;
- that the external pressure source is connected to a pressure gauge and to a tap with a 4 mm maximum flow section.

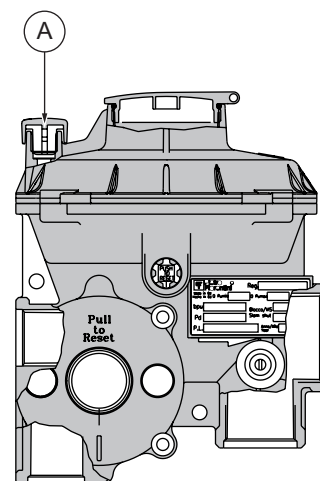
NOTE!

Gas dispersions in the environment must be reduced to the bare minimum.

To check the safety devices, proceed as described in Tab. 8.44.:

Step	Action
1	Close the valve downstream of the regulator.
2	Prepare the external pressure source with a pressure gauge to monitor the pressure. <div style="border: 1px solid blue; padding: 5px; margin-top: 5px;">  NOTE! The maximum pressure introduced downstream of the regulator must not exceed: <ul style="list-style-type: none"> 300 mbar for the BP version; 1 bar for the TR version. </div>
3	Connect the external pressure source to the pressure outlet downstream of the system or, if any, to the pressure outlet on the regulator. <div style="border: 1px solid blue; padding: 5px; margin-top: 5px;">  NOTE! To use the pressure outlet on the regulator, see paragraph 4.6.4. </div>
4a	Pds (adjusted pressure) check: <ol style="list-style-type: none"> open the tap of the external pressure source; check that the pds value is $\pm 10\%$ with respect to the value indicated on the nameplate applied.
4b	Internal sealing check: <ol style="list-style-type: none"> close the tap of the external pressure source; check that the downstream pressure value is stable over time (wait for about 2 minutes).

Step	Action
4c	<p>Checking the slam-shut device for tripping due to maximum downstream pressure:</p> <ol style="list-style-type: none"> open the external pressure source by increasing the pressure by approximately: <ul style="list-style-type: none"> 2 mbar/s for the BP version; 5 mbar/s for the TR version; until the slam-shut device trips due to maximum pressure when the reset knob clicks; check that the tripping value of the slam-shut device is $\pm 15\%$ with respect to the value indicated on the nameplate applied (pdso). <div data-bbox="225 651 839 707" style="border: 1px solid blue; padding: 5px;"> <p>NOTE!</p> <p>If the pressure increase is difficult due to the opening of the relief valve, it is possible to partially plug the discharge conveyor (A) on the second stage lid with a finger to allow the pressure to increase downstream of the gearbox.</p> </div>
5	Reset the slam-shut device for maximum downstream pressure by pulling the reset knob.
6	Disconnect the external pressure source outlet.
7	Close the downstream pressure outlet (Step 3) checking that there are no leaks.
8	Open the shut-off valve closed at Step 1 .



Tab. 8.44.

8.3 - TIGHTENING TORQUES

 **NOTE!**

For the tightening torques of the swivel joints, refer to standards: NF E29-533: 2014 and NF E29-536: 2017.

9 - UNINSTALLATION AND DISPOSAL

9.1 - 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.

9.2 - QUALIFICATION OF THE OPERATORS IN CHARGE

Commissioning

Operator qualification	<ul style="list-style-type: none"> Installer.
PPE required	 <p> WARNING!</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"> the regulations in force in the country of installation; any information provided by the Safety Manager at the installation facility.



Tab. 9.45.

9.3 - UNINSTALLATION

ATTENTION!

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

To properly uninstall the equipment, proceed as specified in Tab. 9.46.:

Step	Action
1	Close the valves upstream and downstream of the regulator.
2	Depressurise the downstream system. <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;">  NOTE! If there is no pressure outlet downstream, loosen the outlet connection from the regulator, creating a slight leak towards the outside. </div>
3	Unscrew the inlet and outlet fittings of the regulator. <div style="background-color: yellow; padding: 5px; margin-top: 10px;">  ATTENTION! Although the system is depressurised (Step 2), there may be a small gas discharge while the inlet fittings are disassembled. </div>

Tab. 9.46.

9.4 - INFORMATION REQUIRED IN CASE OF NEW INSTALLATION

! NOTE!

Should the equipment be reused after uninstallation, refer to chapters: “Installation” and “Commissioning”.

9.5 - DISPOSAL INFORMATION

! NOTE!

- Proper disposal prevents damage to humans and the environment and promotes the reuse of precious raw materials.
- Bear in mind that the regulations 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 regulations in force in the country of installation.

The equipment was manufactured with materials that can be recycled by specialised companies. For proper disposal of the equipment, proceed as specified in Tab. 9.47.:

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 Step 2 to a specialised company.

Tab. 9.47.

The equipment in any configuration consists of the following materials:

Material	Present in	Disposal/recycling indications
Nitrile rubber (TR rubberised canvas)	<ul style="list-style-type: none"> • Diaphragm • O-rings 	It must be dismantled and disposed of separately.
Plastic	<ul style="list-style-type: none"> • Caps • Discs 	It must be dismantled and disposed of separately.
Steel	<ul style="list-style-type: none"> • Springs 	Disassemble and collect separately. It must be recycled through the specific collection centres.
Zamak metal alloy	<ul style="list-style-type: none"> • Equipment body • Lids • Seat 	Disassemble and collect separately. It must be recycled through the specific collection centres.
Aluminium alloy (on request)	<ul style="list-style-type: none"> • Equipment body • Lids 	Disassemble and collect separately. It must be recycled through the specific collection centres.

Tab. 9.48.

! NOTE!

The above materials refer to standard versions. Different materials can be provided for specific needs.

10 - CALIBRATION TABLES

10.1 - CALIBRATION TABLES

NOTE!

When the value indicated on the regulator plate is equal to the minimum or maximum value of a spring referred to in the tables (Tab.10.49., Tab.10.50., Tab.10.51., Tab.10.53., Tab.10.54. And Tab.10.55 .), the spring installed in the regulator is the one featuring the minimum range value equal to the calibration value specified on the data plate.

BP FE6-10-25 EXECUTION							
Pos.	Spring item code	Spring colour	d	Lo	De	Spring range (mbar)	
						Min.	Max.
1	64470358BL	Blue	1.6	41	34	13	17
2	64470359AR	Orange	1.7	41	34	17	22
3	64470360VE	Green	1.8	40	34	22	28
4	64470361RO	Red	2	38	34	28	38
5	64470362AZ	Sky blue	2.1	39	34	38	52
6	64470363BI	White	2.3	38	34	52	75
7	64470368MA	Brown	2.4	37	34	75	100
8	64470364GR	Grey	2.6	35	34	100	140
9	64470365NE	Black	2.8	35	34	140	180

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

Tab. 10.49.

BP FES EXECUTION							
Pos.	Spring item code	Spring colour	d	Lo	De	Spring range (mbar)	
						Min.	Max.
1	64470410ZB	White	1.3	46	34	13	16
2	64470187RO	Red	1.4	38	34	16	19
3	64470358BL	Blue	1.6	41	34	19	23
4	64470359AR	Orange	1.7	41	34	23	28
5	64470360VE	Green	1.8	40	34	28	34
6	64470361RO	Red	2	38	34	34	44
7	64470362AZ	Sky blue	2.1	39	34	44	55
8	64470363BI	White	2.3	38	34	55	75
9	64470368MA	Brown	2.4	37	34	75	100
10	64470364GR	Grey	2.6	35	34	100	140
11	64470365NE	Black	2.8	35	34	140	180

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

Tab. 10.50.

SLAM-SHUT VALVE BP FE6-10-25-S

Pos.	Spring item code	Spring colour	d	Lo	De	Spring range (mbar)	
						Min.	Max.
1	6447038700	-	1	30	18	25	34
2	64470120BLU	Blue	1.1	29	18	35	50
3	64470121GI	Yellow	1.3	30	18	51	79
4	64470122VE	Green	1.3	36.5	18	80	109
5	64470123ROS	Red	1.5	31.5	18	110	159
6	64470124AZ	Sky blue	1.6	34	18	160	219
7	64470020MAR	Brown	1.7	35	18	220	300

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

Tab. 10.51.

RELIEF VALVE BP FE6-10-25-S

Pos.	Spring item code	Spring colour	d	Lo	De	Spring range (mbar)	
						Min.	Max.
1	64470389BI	White	8	37	15	7	7
2	64470213BL	Blue	0.9	37	15	8	10
3	64470029GIA	Yellow	1	35	15	11	19
4	64470027VER	Green	1.2	30	15.4	20	49
5	64470162ROS	Red	1.4	30	15.5	50	75
6	64470024BI	White	1.3	45	15	76	120

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

Tab. 10.52.

TR FE6-10-25 EXECUTION

Pos.	Spring item code	Spring colour	d	Lo	De	Spring range (mbar)	
						Min.	Max.
1	64470368MA	Brown	2.4	37	34	180	220
2	64470364GR	Grey	2.6	35	34	220	300
3	64470365NE	Black	2.8	35	34	300	400
4	64470366VI	Purple	3	38	34	400	500

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

Tab. 10.53.

TR FES EXECUTION

Pos.	Spring item code	Spring colour	d	Lo	De	Spring range (mbar)	
						Min.	Max.
1	64470368MA	Brown	2.4	37	34	180	220
2	64470364GR	Grey	2.6	35	34	220	300
3	64470365NE	Black	2.8	35	34	300	400
4	64470366VI	Purple	3	38	34	400	500

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

Tab. 10.54.

SLAM-SHUT VALVE TR FE6-10-25-S							
Pos.	Spring item code	Spring colour	d	Lo	De	Spring range (mbar)	
						Min.	Max.
1	64470169GR	Grey	2	3	20	300	499
2	64470168BI	White	2.2	28	20.2	500	800

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

Tab. 10.55.

RELIEF VALVE TR FE6-10-25-S							
Pos.	Spring item code	Spring colour	d	Lo	De	Spring range (mbar)	
						Min.	Max.
1	64470029GIA	Yellow	1	35	15	75	149
2	64470027VER	Green	1.2	30	15.4	150	250

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

Tab. 10.56.

