

FEX

Low-pressure gas regulator



TECHNICAL BROCHURE

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Who we are

We are an international company specialising in the design and manufacture of cutting-edge devices and solutions for natural gas processing, transport and distribution systems. We are the ideal partner for operators in the Oil & Gas sector, with a business offer that goes across the whole natural gas chain.

We are in constant evolution to meet our customers' highest expectations in terms of quality and reliability.

Our aim is to be a step ahead of the competition, with customized technologies and an after-sale service program undertaken with the highest grade of professionalism.



Pietro Fiorentini advantages



Localised technical support

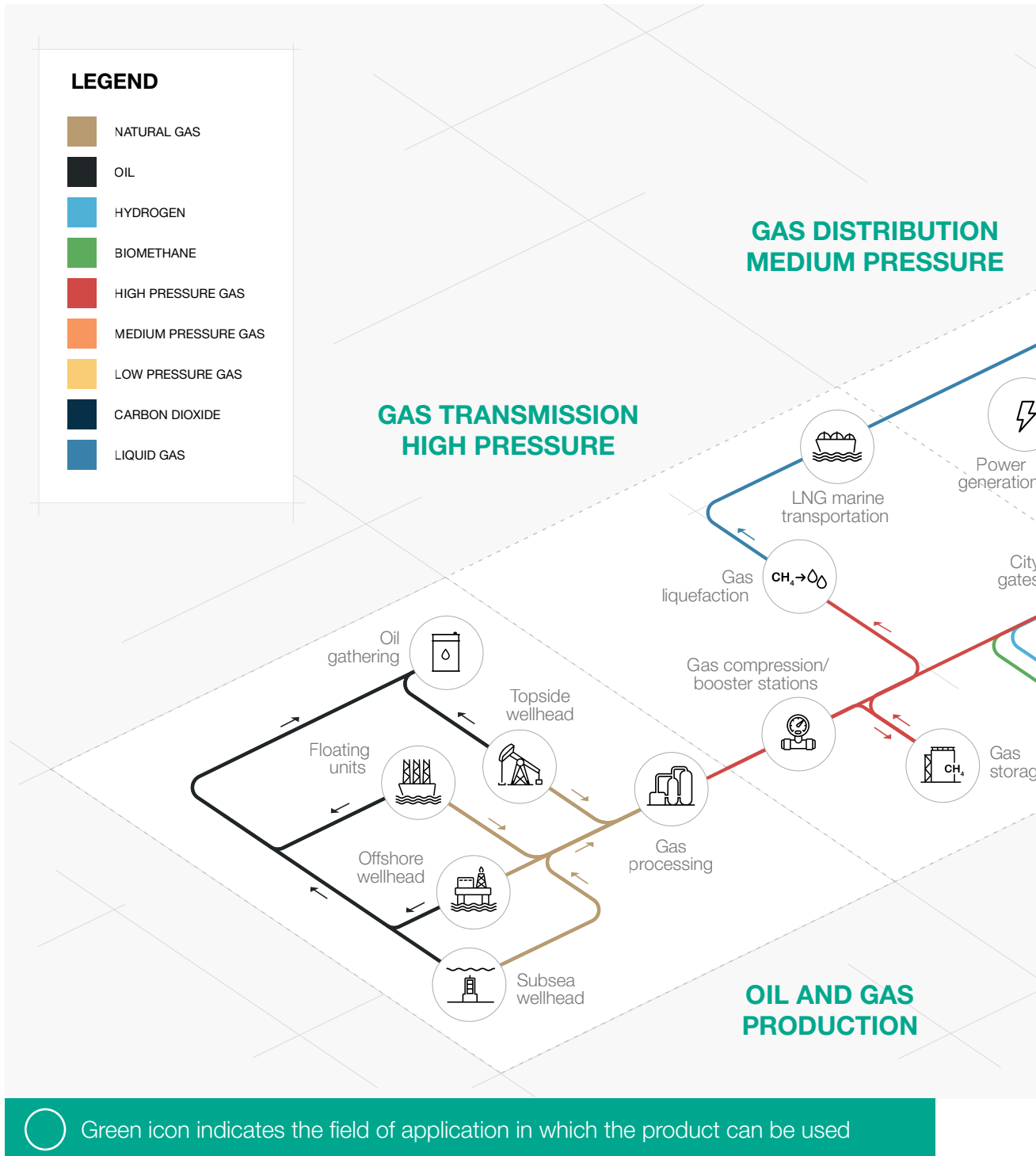


Experience since 1940



We operate in over 100 countries

Application area



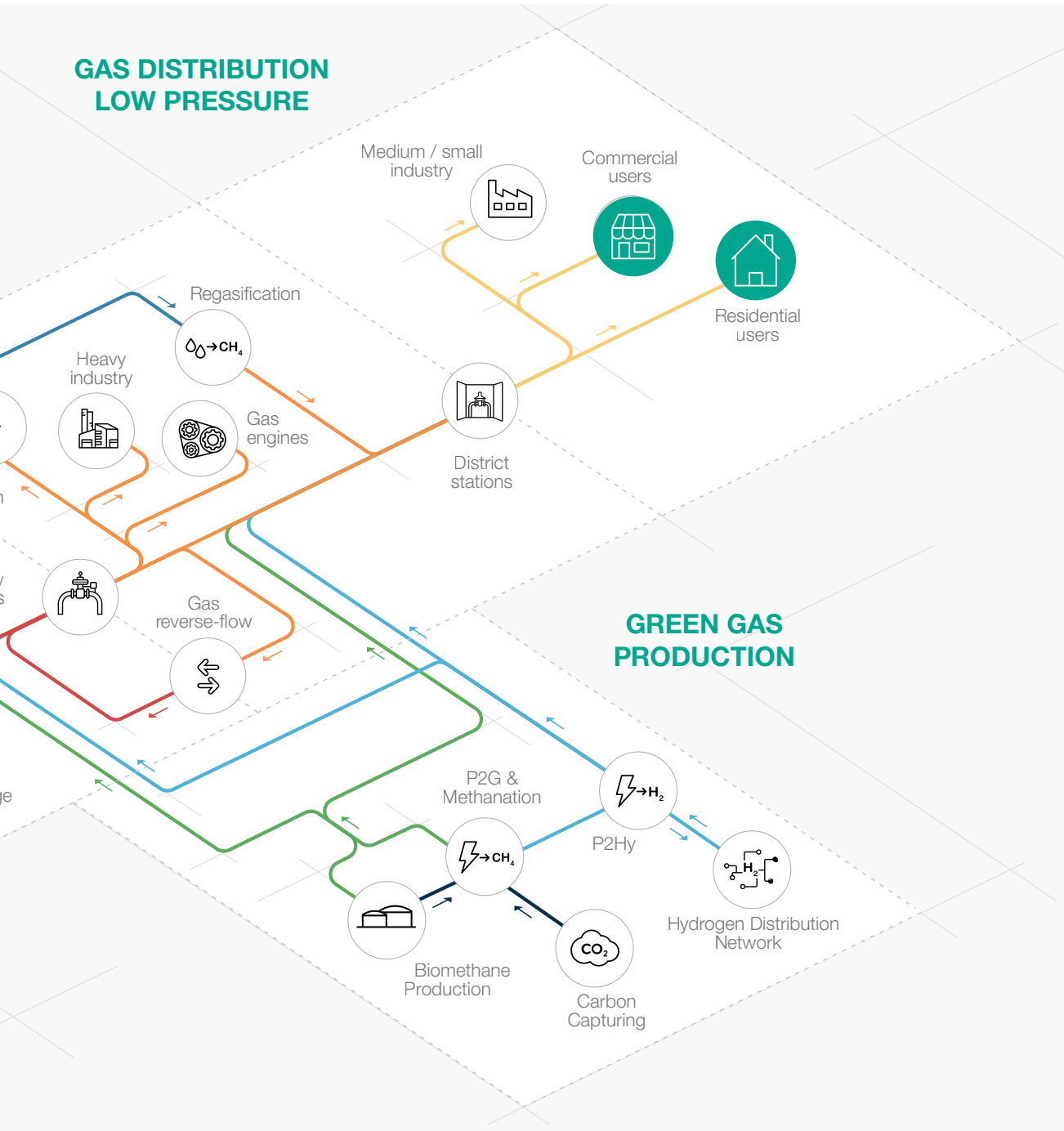


Figure 1 Map of application areas



Introduction

FEX is a two-stage spring loaded direct acting gas pressure regulator by Pietro Fiorentini.

It is particularly suitable for low pressure natural gas distribution networks for residential and commercial users.

It should be used with previously filtered non-corrosive gases including biomethane and natural gas blended with hydrogen.

According to the European Standard EN 334, it is classified as Fail Close since always supplied with an overpressure protection device (slam shut valve).

FEX is Hydrogen Ready for NG-H₂ blending.

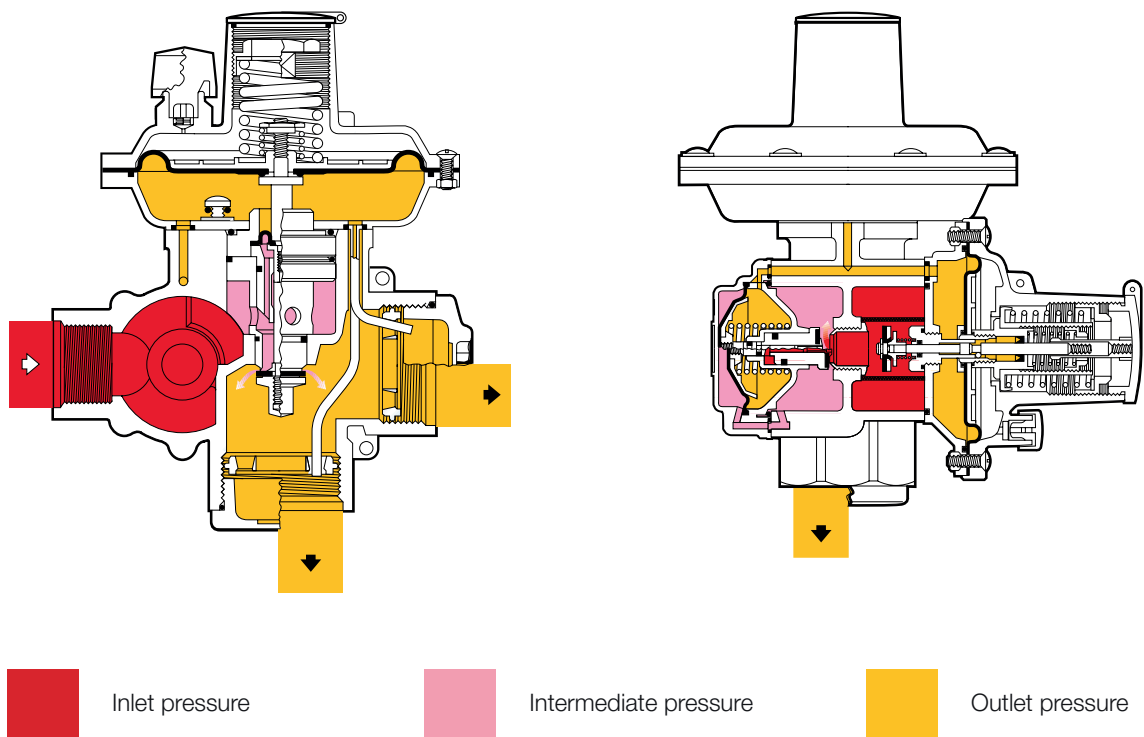


Figure 2 FEX

Features and Calibration ranges

The FEX is a two-stage device for low pressure equipped with integrated slam shut (OPSO and UPSO), and optional fire protection valve.

The balanced 1st stage regulation limits the pressure variation to the 2nd stage, so it is possible to reach high accuracy of the regulated outlet pressure. Therefore, a balanced double stage regulator has a single-size orifice for all pressure and flow conditions.


The FEX can be installed in vertical or horizontal position and has one in-line inlet and two outlets. This reduces greatly space requirements for all types of installations.

The FEX regulator is highly customizable in terms of settings, fittings and accessories.



Figure 3 FEX

FEX competitive advantages

-  Operates with low differential pressure
-  Slam-shut valve for overpressure
Slam-shut valve for underpressure
-  Two-stage regulation with balanced first stage plug
-  High customisation
-  Integrated thermal valve option
-  Built-in filter
-  Suitable for outdoor installations
-  Compatible with biomethane and blended hydrogen up to 20%. Higher mixtures available on request

Features

Features	Values		
Design pressure* (PS ¹ / DP ²)	0.86 MPa 8.6 bar		
Inlet pressure (MAOP / p _{umax} ¹)	0.01 - 0.86 MPa 0.1 - 8.6 bar		
Nominal capacity	50 - 100 m ³ /h 1765 - 3530 ft ³ /h		
	BP version	MP version	
Range of downstream pressure Wds	1.3 - 9.9 kPa 13 - 99 mbar	10 - 35 kPa 100 - 350 mbar	
Range of downstream pressure Wdso	3.2 - 16 kPa 32 - 160 mbar	15.5 - 50 kPa 155 - 500 mbar	
Range of downstream pressure Wdsu	0.6 - 25 kPa 6 - 250 mbar	-	
Accuracy class (AC)	10		
Lock-up over pressure (SG)	20		
	Standard version	Extended temperature version	Arctic version
Ambient temperature* (TS ¹)**	from -20 °C to +60 °C from -4 °F to +140 °F	from -30°C to + 60°C from -22 °F to +140 °F	from -40°C to + 60°C from -40 °F to +140 °F
Inlet gas temperature*,***	from -10°C to + 60°C from +14 °F to +140 °F	from -20°C to + 60°C from -4 °F to +140 °F	from -30 °C to +60 °C from -22 °F to +140 °F
Body connection	Inlet G 1" and outlet G 1" 1/2 according to ISO 228/1, other configurations or connections on request		
Fittings	<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); Flanged Class 150 RF (ASME B16.5) 		

(¹) according to EN334 standard

(²) according to ISO 23555-1 standard

(*) NOTE: Different functional features and/or extended temperature ranges may be available on request. Stated inlet gas temperature range is the maximum for which the equipment's full performance, including accuracy is guaranteed. Product may have a different pressure or temperature ranges according to the version and/or installed accessories.

(**) NOTE: Stated temperature range is the operating range for which the equipment's mechanical resistance and leakage rate are guaranteed. Some body materials, if multiple choices are available, may not be suitable for all the available versions shown.

(***) NOTE: Stated temperature range is the range for which the equipment's full performance, including accuracy and lock-up are guaranteed. Some body materials, if multiple choices are available, may not be suitable for all the available versions shown.

Table 1 Features

Materials and Approvals

Part	Material
Diaphragm and seats	Nitrile rubber for BP version Rubberized fabric for MP version
Sealing rings	Nitrile
Body and cover	Aluminium
Seat	Zamak

NOTE: The materials indicated above refer to the standard models. Different materials can be provided according to specific needs.

Table 2 Materials

Construction Standards and Approvals

The **FEX** regulator is designed in compliance with European standard EN 13611.

Based on the version/configuration, the FEX regulator complies with:



EN 13611



UNI 8827



EN 16129



EN 88-2



UNI 11655



NF
E29-190-2



Maximum allowable operating pressure

MAOP Maximum Allowable Operating Pressure (p_{umax} according to EN334)					
	Version	Control head			
		FEX BP		FEX MP	
		MPa	bar	MPa	bar
WITHOUT CE MARKING	all versions	0.86	8.6	0.86	8.6

Table 3 MAOP Maximum Allowable Operating Pressure without CE marking

Springs ranges and control heads

Control heads pressure ranges			
	Control head BP	Control head MP	Spring Table web link
Model	kPa mbar	kPa mbar	
FEX	1.3 - 9.9 13 - 99	10 - 35 100 - 350	TT00069

Table 4 Settings table

BP FEX50 / FEX75 / FEX100 VERSION							
Spring item code	Spring colour	d	Lo	De	Spring range (mbar)		
					Min.	Max.	
64470171BI	White	1.8	57	34	13	19	
64470130AR	Orange	1.8	78	34	20	26	
64470131VE	Green	2.2	70	34	27	39	
64470132RO	Red	2.4	67	34	40	59	
64470133BL	Blue	2.4	84	34	60	79	
64470134AZ	Sky blue	3	65	34	80	99	

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

Table 5 BP FEX50 / FEX75 /FEX100 version calibration

MP FEX50 / FEX75 / FEX100 VERSION							
Spring item code	Spring colour	d	Lo	De	Spring range (mbar)		
					Min.	Max.	
64470134AZ	Sky blue	3	65	34	100	119	
64470135GI	Yellow	3.2	63	34	120	209	
64470136GR	Grey	3.5	69	34	210	350	

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

Table 6 MP FEX50 / FEX75 /FEX100 version calibration

General link to the calibration tables: [CLICK HERE](#) or use the QR code:





Accessories

For the pressure regulators:

- Slam shut
- IRV
- Nylon filter
- Fittings
- Thermal safety valve

Slam Shut

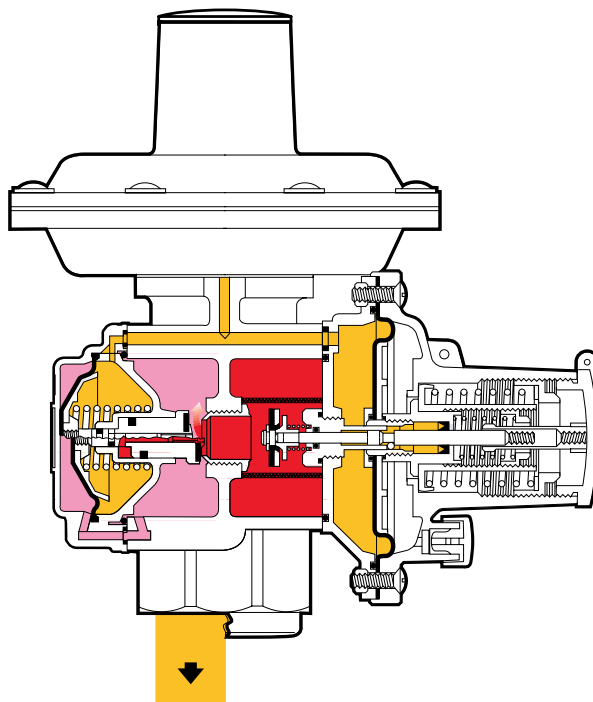
The FEX is always supplied with an incorporated slam shut valve. The main characteristics of this device are:



Slam-shut valve for overpressure
Slam-shut valve for underpressure



Compact dimensions






-  Inlet pressure
-  Intermediate pressure
-  Outlet pressure

Figure 4 FEX with slam-shut

Slam shut types and range					
SSV Type	Model	Operation	Range Wh		Spring Table web link
			kPa	mbar	
FEX	BP	OPSO	3.2 - 16	32 - 160	TT00069
FEX	MP	OPSO	15.5 - 50	155 - 500	TT00069
FEX	BP	UPSO	0.6 - 25	6 - 250	TT00069

Table 8 Settings table

SLAM-SHUT VALVE BP FEX50 / FEX75 / FEX100 FOR OVERPRESSURE									
Spring item code	Spring colour	d	Lo	De	Spring range				
					kPa		mbar		
					Min.	Max.	Min.	Max.	
64470111VE	Green	2	45	34	3.2	5.4	32	54	
64470113AZ	Sky blue	2.3	44	34	5.5	9.9	55	99	
64470114MA	Brown	2.4	51	34	10	16	100	160	

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

Table 7 Slam-shut BP FEX50 / FEX75 / FEX100 for overpressure

SLAM-SHUT VALVE MP FEX50 / FEX75 / FEX100 FOR OVERPRESSURE									
Spring item code	Spring colour	d	Lo	De	Spring range				
					kPa		mbar		
					Min.	Max.	Min.	Max.	
64470115GR	Grey	2.8	42	34	11.5	20.9	115	209	
64470116GI	Yellow	3.2	40	34	21	32.9	210	329	
64470416BI	White	3.1	48	34	33	50	330	500	

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

Table 9 Slam-shut MP FEX50 / FEX75 / FEX100 for overpressure

SLAM-SHUT VALVE BP FEX50 / FEX75 / FEX100 FOR UNDERPRESSURE									
Spring item code	Spring colour	d	Lo	De	Spring range				
					kPa		mbar		
					Min.	Max.	Min.	Max.	
64470024BI	White	1.3	45	15	4	7.9	40	79	
64470031RO	Red	1.7	40	15	8	13.9	80	139	
64470038GI	Yellow	2	40	15	14	25	140	250	

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

Table 10 Slam-shut BP FEX50 / FEX75 / FEX100 for underpressure



IRV

The FEX has an integrated token relief valve that discharges a small volume of gas into the atmosphere when the regulator exceeds the relief valve set point. It prevents slam shut valve (with manual reset) to trigger in case of abnormal non-hazardous overpressure conditions. The token IRV can be activated or deactivated in the field, if necessary. The most common conditions are:

- thermal expansion due to the day/night temperature variation
- quick on/off appliance
- small internal leakage

RELIEF VALVE BP FEX50 / FEX75 / FEX100								
Spring item code	Spring colour	d	Lo	De	Spring range			
					kPa		mbar	
					Min.	Max.	Min.	Max.
64470027VER	Green	1.2	30	15.4	1	1.5	10	15
64470030NER	Black	1.2	35	15	1.6	3.4	16	34

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

Table 11 Relief valve calibration BP FEX50 / FEX75 / FEX100;
*the spring ranges refer to the differential between the regulator calibration and relief activation.

RELIEF VALVE MP FEX50 / FEX75 / FEX100								
Spring item code	Spring colour	d	Lo	De	Spring range			
					kPa		mbar	
					Min.	Max.	Min.	Max.
64470024BI	White	1.3	45	15	3.5	7	35	70
64470040GR	Grey	1.5	44	15	7.1	11	71	110

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

Table 12 Relief valve calibration MP FEX50 / FEX75 / FEX100;
*the spring ranges refer to the differential between the regulator calibration and relief activation.

Nylon filter

The FEX is equipped with a nylon mesh 100 microns | 140 mesh (FEX standard version) and 300 microns | 50 mesh (FEX arctic version) to prevent foreign particles, such as weld slag or PE shavings, to get stuck between the orifice and seat/disk thus preventing lockup for new installations.

The purpose of the nylon mesh is to provide protection to the FEX and its accessories thus protecting the customers downstream piping system.



Figure 5 Nylon filter

Thermal safety valve

The thermal valve is a safety device that shuts the inlet gas flow in case of excessive ambient temperature, e.g., due to fire.

The valve is rated to stop the gas flow for up to 90 minutes at 1472 °F | 800 °C. The valve mechanism is composed of a seat, plug, spring, and a block of thermoplastic material. The block holds the valve open under normal conditions, and when the temperature exceeds a certain limit, it softens releasing the plug and stopping the flow. There are two sizes depending on the flow rate and pressure drop: TVD1 (typically for FE) and TVD2 (typically for FEX).

Temperature limits:

212 °F +/- 18 °F | 100 °C +/- 10 °C

320 °F +/- 18 °F | 160°C +/- 10 °C

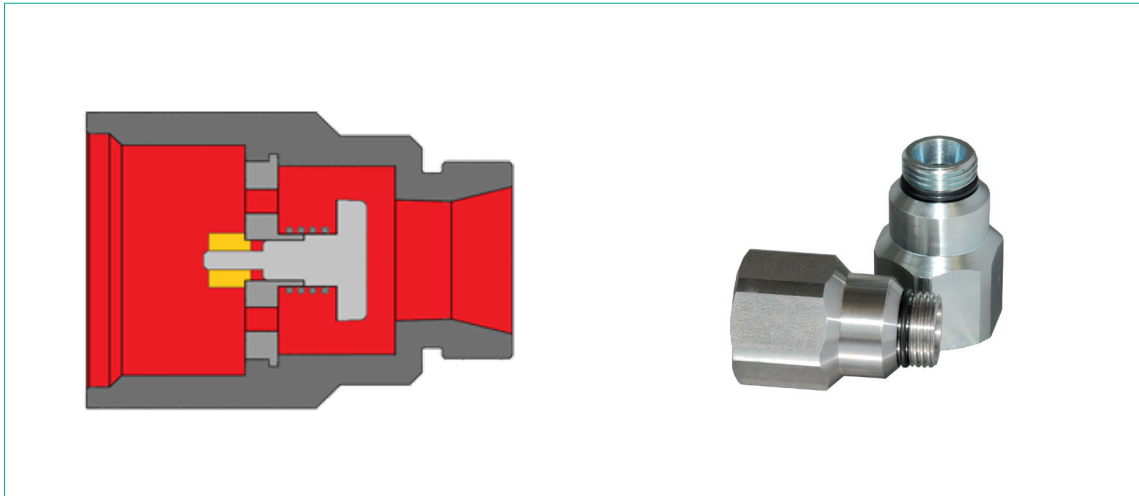


Figure 6 Thermal safety valve

Fire protection valve TVD1 (typically for FE) pressure drop

Inlet pressure		Flow rate											
		1 m ³ /h 35 scfh		5 m ³ /h 175 scfh		9.9 m ³ /h 350 scfh		14.9 m ³ /h 525 scfh		24.8 m ³ /h 875 scfh		42.8 m ³ /h 1500 scfh	
kPa	mbar	kPa	mbar	kPa	mbar	kPa	mbar	kPa	mbar	kPa	mbar	kPa	mbar
6.9	69.0	0	0	0.3	3.0	1.0	1.0	3.73	37.3	5.5	55.0	-	-
13.8	138.0	0	0	0.25	2.5	0.87	8.7	3.48	34.8	5.0	50.0	-	-
34.5	345.0	0	0	0.2	2.0	0.75	7.5	3.23	32.3	4.5	45.0	12.0	120
69.0	690.0	0	0	0.15	1.5	0.62	6.2	2.49	24.9	3.5	35.0	8.0	80
≥ 276	≥ 2760	0	0	0.1	1.0	0.5	5.0	1.49	14.9	2.0	20.0	4.0	40

Table 13 Fire protection valve TVD1 (typically for FE) pressure drop table

Fire protection valve TVD2 (typically for FEX) pressure drop

Inlet pressure		Flow rate											
		5 m ³ /h 175 scfh		9.9 m ³ /h 350 scfh		20 m ³ /h 700 scfh		50 m ³ /h 1750 scfh		75 m ³ /h 2600 scfh		100 m ³ /h 3500 scfh	
kPa	mbar	kPa	mbar	kPa	mbar	kPa	mbar	kPa	mbar	kPa	mbar	kPa	mbar
6.9	69.0	0.2	2.0	0.3	3.0	0.5	5.0	1.74	17.4	3.5	35	-	-
13.8	138.0	0.1	1.0	0.15	1.5	0.45	4.5	1.49	14.9	3.0	30.0	-	-
34.5	345.0	0.05	0.5	0.25	2.5	0.37	3.7	1.24	12.4	2.5	25.0	5.0	50.0
69.0	690.0	0	0	0.15	1.5	0.2	2.0	1.0	10.0	1.2	12.0	4.0	40.0
≥ 276	≥ 2760	0	0	0.1	1.0	0.15	1.5	0.5	5.0	0.9	9.0	1.0	10.0

Table 14 Fire protection valve TVD2 (typically for FEX) pressure drop table

Fittings

FEX connections are customizable by fitting: one side is connected to the regulator body, the other to the piping. Fittings are selected depending on the regulator configuration, piping connection type and size, and end to end allowance. The fitting material can be brass or steel, according to the applicable standard.

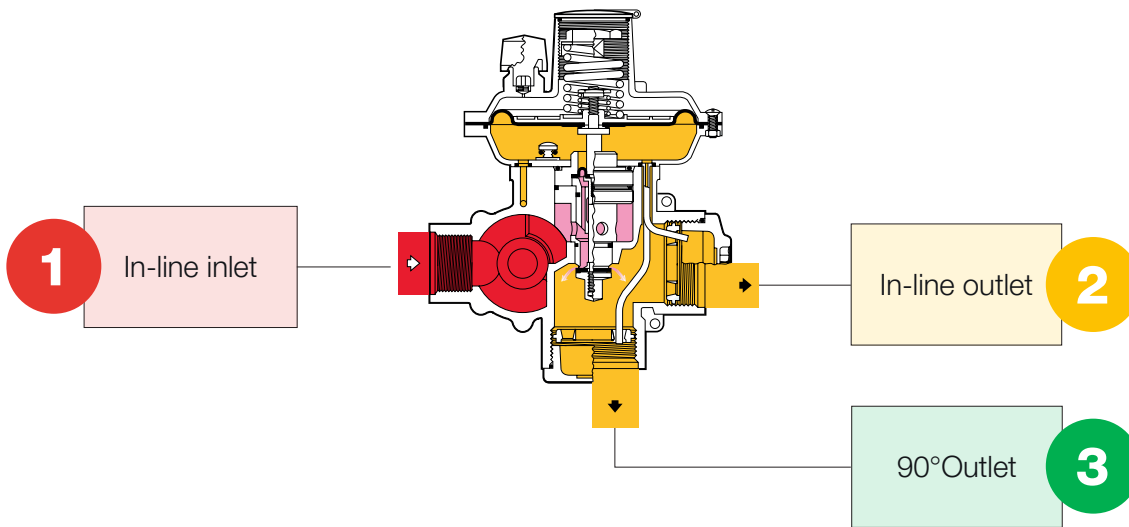


Figure 7 Fittings

Configuration	Piping connection type	Piping connection size	End to end (E-E) allowance
<ul style="list-style-type: none"> L: 1 & 2 S: 1 & 3 	<ul style="list-style-type: none"> Gas (UNI EN ISO 228 1:2003) Flat swivel joint (NF E29 533:2014 and NF E29 536: 2017) NPT (ASME B1.20.1, excluding connections with metal/metal sealing) Flanged Class 150 RF (ASME B16.5) Other on request 	<ul style="list-style-type: none"> 3/4" (Only fo in-line inlet) 1" 1" 1/4 1" 1/2 2" DN25 DN40 	<ul style="list-style-type: none"> PF standard On request
<p>Notes: (*) Fitting piping connection size of the FEX100 outlet must be $\geq 1" 1/2$ in order to guarantee the regulator performance</p>			

Table 15 Fittings



Versions






		Models	
		FEX	FEX NO SLAM-SHUT
Image			
Description		Standard version	Version without overpressure and underspressure slam-shut devices
Available versions	ZK Zamak version		
	AI Aluminium version	✓	✓
	UPSO Downstream underpressure slam-shut device	✓	
	OPSO Downstream overpressure slam-shut device	✓	
	 Relief valve	✓	✓
	 Customisable connections by fitting	✓	✓
	 Outdoor installation not protected		

Table 16 Available versions of the FEX regulator

Weights and dimensions

FEX

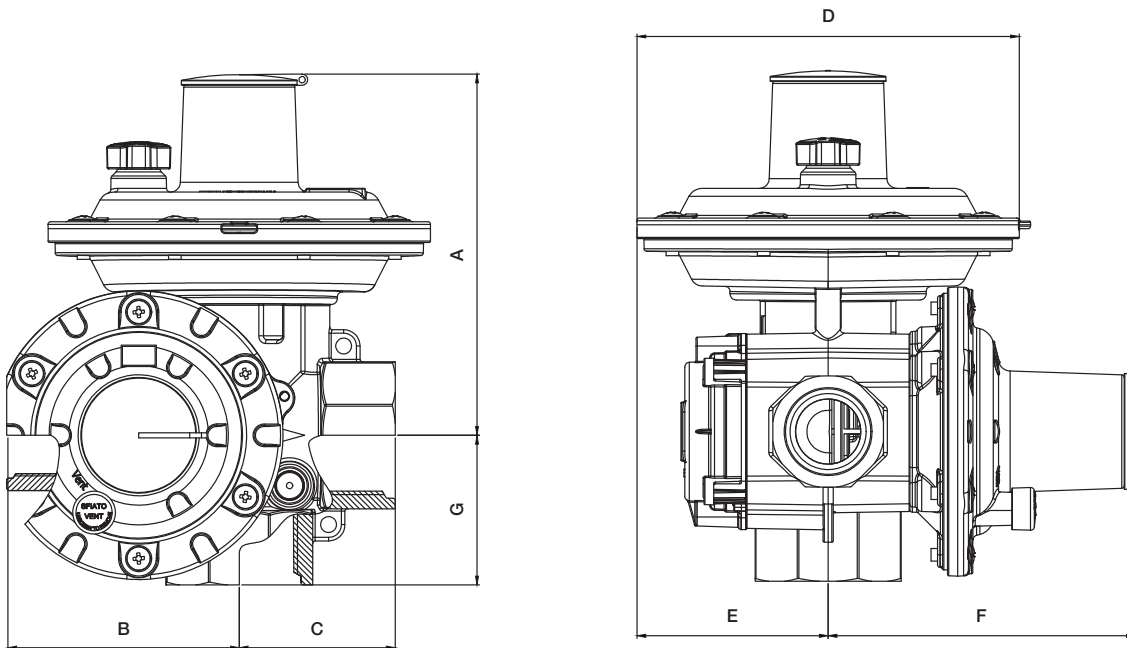


Figure 8 FEX Dimensions

Weights and Dimensions (for other connections, please contact your closest Pietro Fiorentini representative)		
	[mm]	inches
A	144	5.7"
B	92	3.6"
C	62	2.4"
D	Ø152	Ø6.0"
E	76	3.0"
F	122	4.8"
G	60	2.4"
Weight		
	Kg	pounds
	2.1	4.6

Table 17 Weights and dimensions



FEX NO SLAM-SHUT

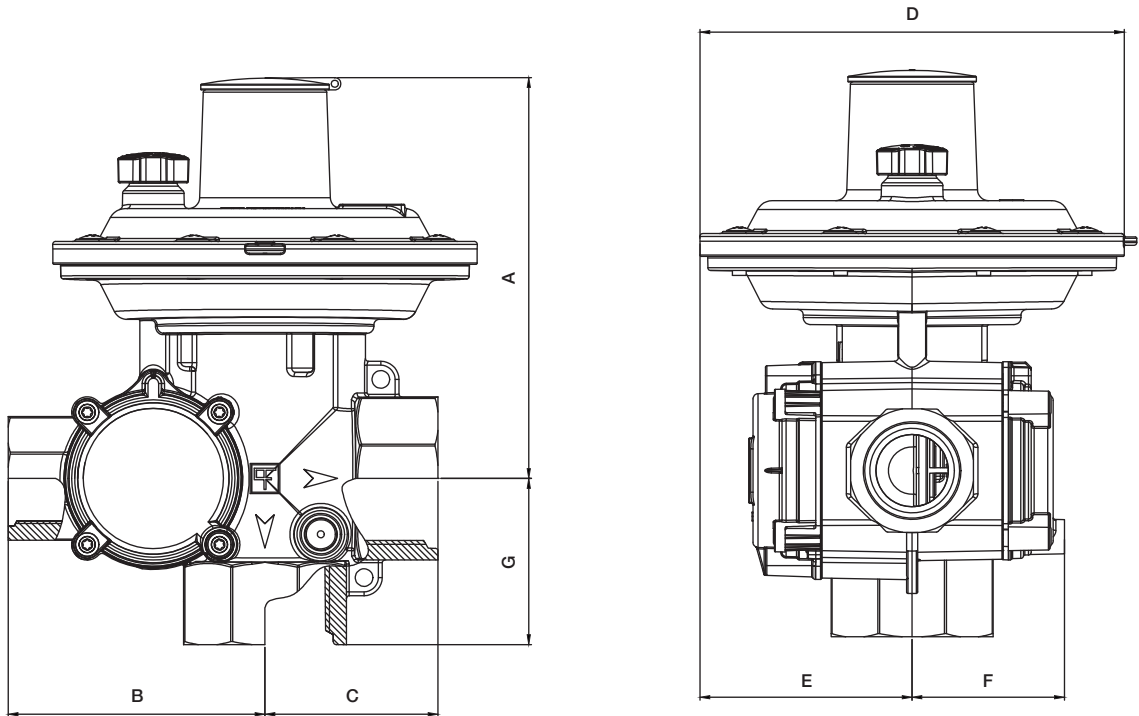


Figure 9 FEX NO SLAM-SHUT Dimensions

Weights and Dimensions (for other connections, please contact your closest Pietro Fiorentini representative)		
	[mm]	inches
A	144	5.7"
B	92	3.6"
C	62	2.4"
D	Ø152	Ø6.0"
E	76	3.0"
F	55	2.2"
G	60	2.4"
Weight		
	Kg	pounds
	1.6	3.5

Table 18 Weights and dimensions

Customer Centricity

Pietro Fiorentini is one of the main Italian international companies with high focus on product and service quality.

The main strategy is to create a stable long-term oriented relationship, putting the customer's needs first. Lean management and thinking and customer centricity are used to improve and maintain the highest level of customer experience.



Support

One of Pietro Fiorentini's top priorities is to provide support to the client in all phases of project development, during installation, commissioning and operation. Pietro Fiorentini has developed a highly standardized intervention management system, which helps to facilitate the entire process and effectively archive all the interventions carried out, drawing on valuable information to improve the product and service. Many services are available remotely, avoiding long waiting times or expensive interventions.



Training

Pietro Fiorentini offers training services available for both experienced operators and new users. The training is composed of the theoretical and the practical parts, and is designed, selected and prepared according to the level of use and the customer's need.



Customer Relation Management (CRM)

The centrality of customer is one of the main missions and vision of Pietro Fiorentini. For this reason, Pietro Fiorentini has enhanced the customer relation management system. This enables to track every opportunity and request from Customer in one single point and make free the information flow.



Sustainability

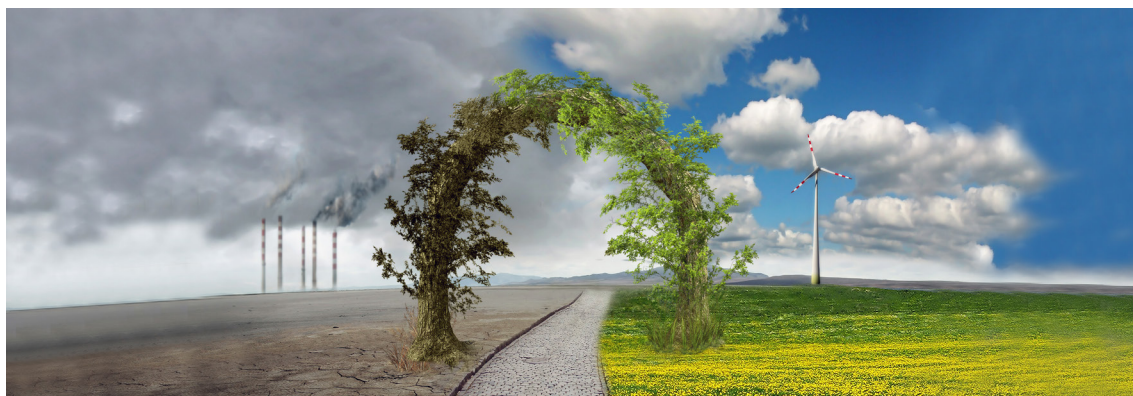
Here at Pietro Fiorentini, we believe in a world capable of improvement through technologies and solutions that can shape a more sustainable future. That is why respect for people, society and the environment form the cornerstones of our strategy.



Our commitment to the world of tomorrow

While in the past we limited ourselves to providing products, systems and services for the oil & gas sector, today we want to broaden our horizons and create technologies and solutions for a digital and sustainable world, with a particular focus on renewable energy projects to help make the most of our planet's resources and create a future in which the younger generations can grow and prosper.

The time has come to put the why we operate before the what and how we do it.





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