Pietro Fiorentini

ASX 176/FO

High Medium Pressure Gas Regulator
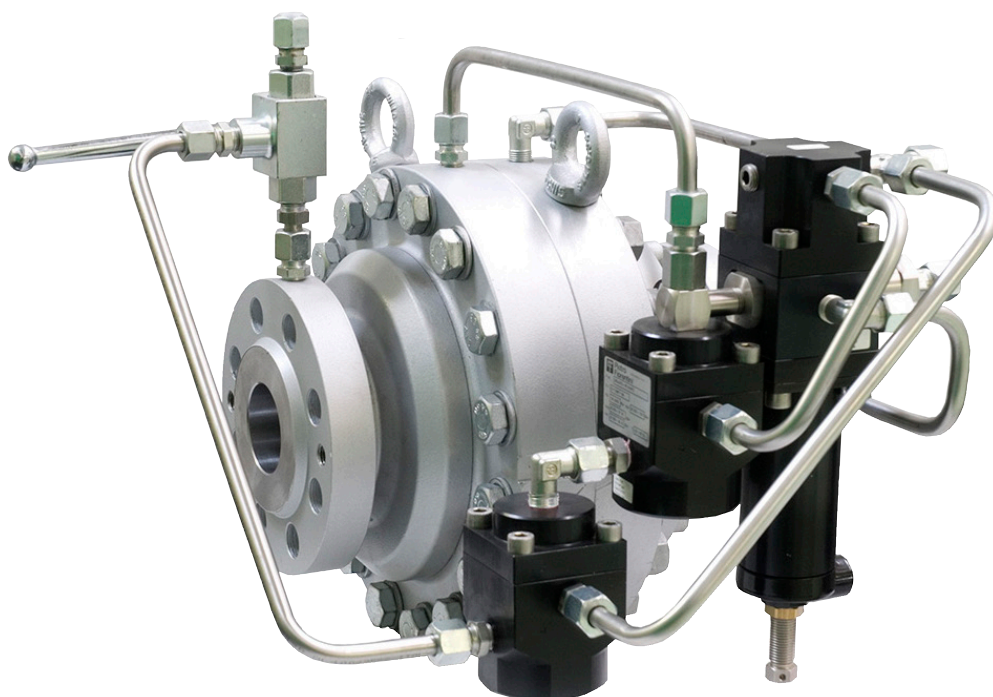
TECHNICAL BROCHURE

www.fiorentini.com

Who we are

We are a global organization specialized in designing and manufacturing technologically advanced solutions for natural gas treatment, transmission 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
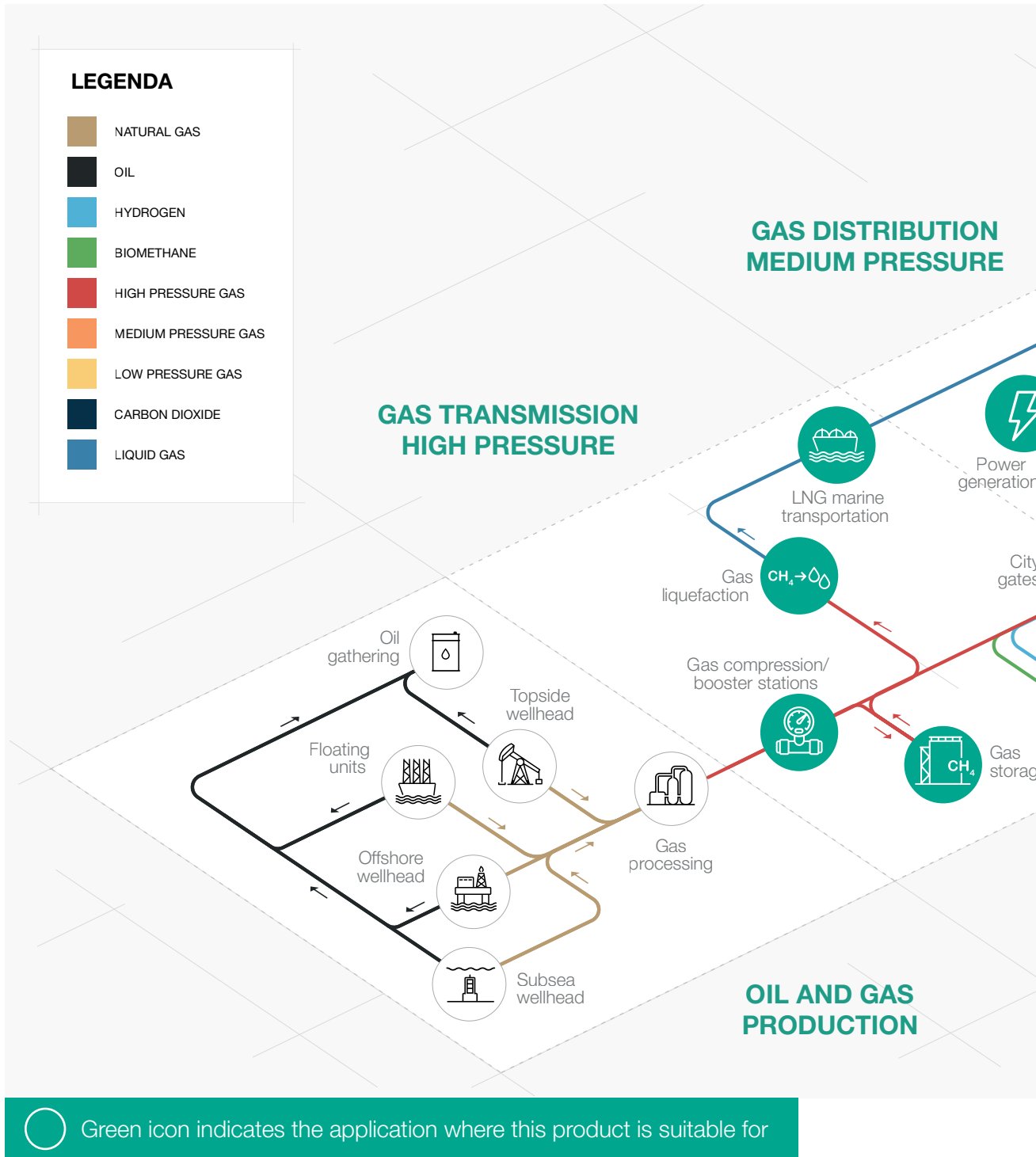
Localised technical support

Experience since 1940
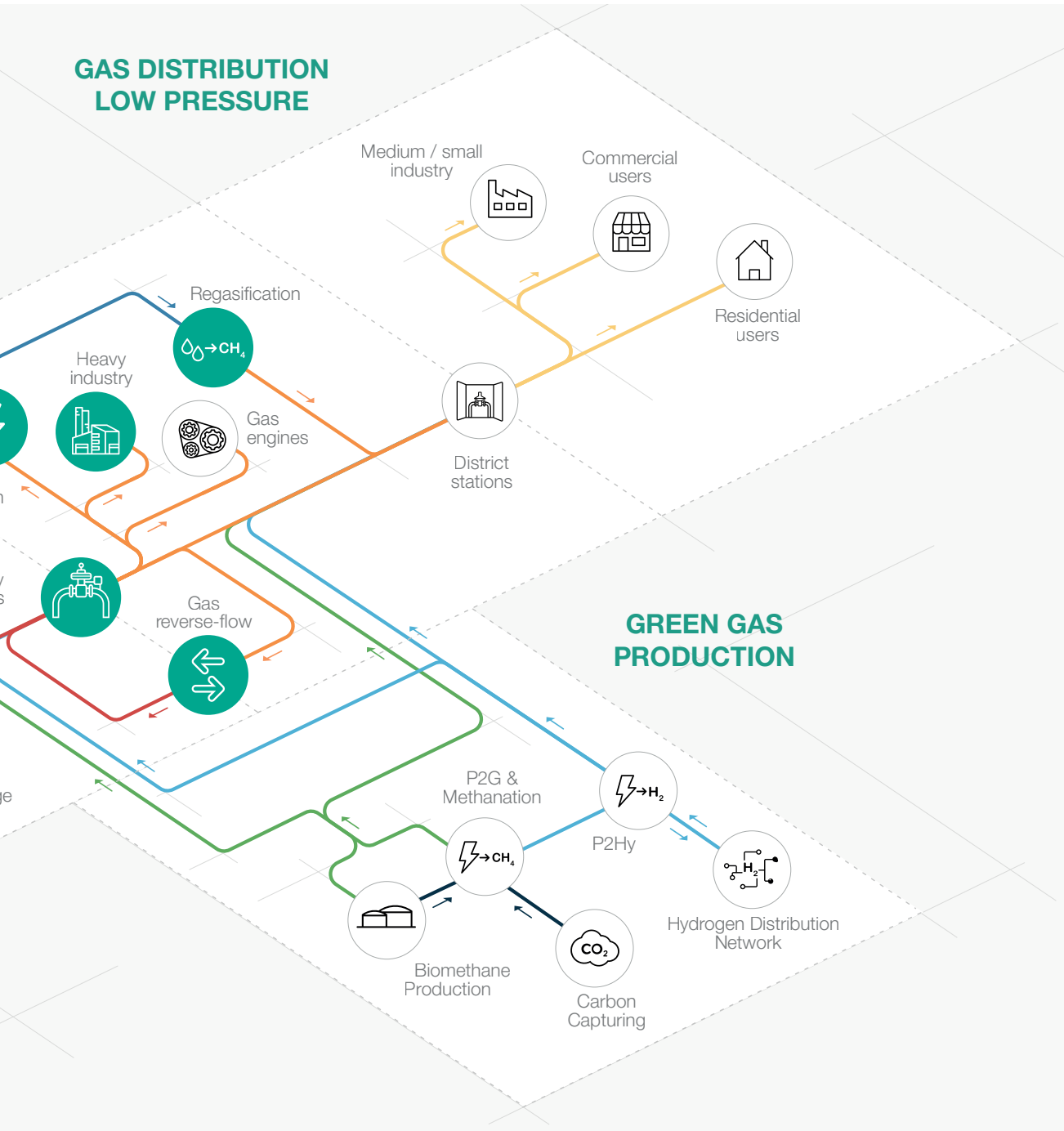
We operate in over 100 countries

Area of Application

LEGENDA

- ▨ NATURAL GAS
- ▨ OIL
- ▨ HYDROGEN
- ▨ BIOMETHANE
- ▨ HIGH PRESSURE GAS
- ▨ MEDIUM PRESSURE GAS
- ▨ LOW PRESSURE GAS
- ▨ CARBON DIOXIDE
- ▨ LIQUID GAS

GAS DISTRIBUTION MEDIUM PRESSURE

GAS TRANSMISSION HIGH PRESSURE

LNG marine transportation

Power generation

Gas liquefaction

City gates

Gas compression/ booster stations

Oil gathering

Topside wellhead

Floating units

Gas storage

Gas processing

Offshore wellhead

Subsea wellhead

OIL AND GAS PRODUCTION

Green icon indicates the application where this product is suitable for

GAS DISTRIBUTION
LOW PRESSURE

Medium / small industry

Commercial users

Residential users

Regasification

Heavy industry

Gas engines

District stations

Gas reverse-flow

GREEN GAS
PRODUCTION

P2G & Methanation

P2Hy

Biomethane Production

Carbon Capturing

Hydrogen Distribution Network

Figure 1 Area of Application Map

Introduction

ASX 176/FO is one of the **pilot-operated gas pressure regulators** designed and manufactured by Pietro Fiorentini.

This device is suitable for use with previously filtered non-corrosive gases, and it is mainly used for high-pressure transmission systems and for medium pressure natural gas distribution networks.

According to the European Standard EN 334, it is classified as **Fail Open**.
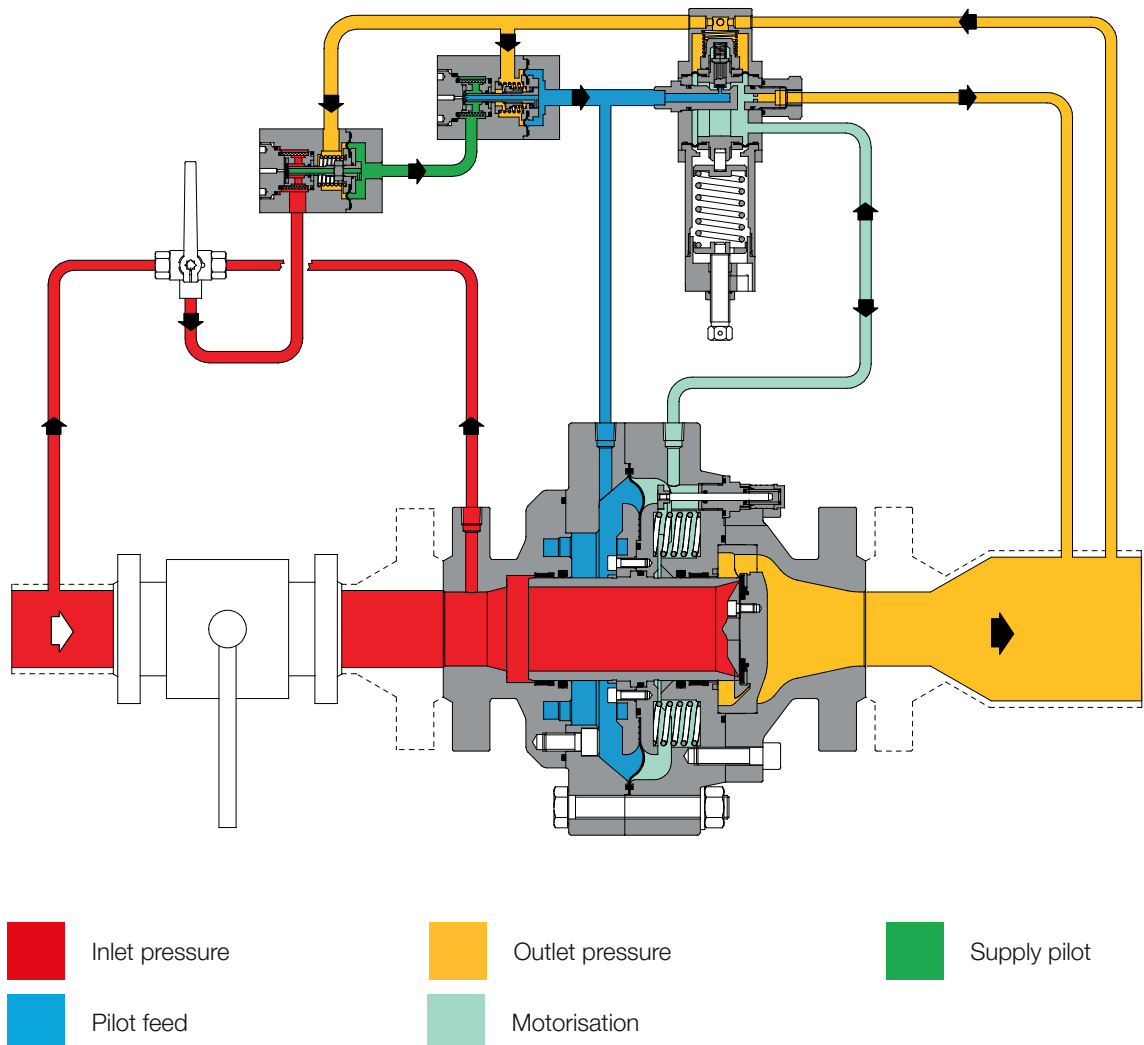

Inlet pressure	**Outlet pressure**	**Supply pilot**	
Pilot feed	**Motorisation**		

Figure 2 ASX 176/FO

Features and Calibration ranges

ASX 176/FO is a **pilot-operated** device for high pressure and medium pressure with a unique **dynamic balancing system** which ensures an **outstanding turn down ratio** combined with an extremely **accurate outlet pressure control.**

ASX 176/FO is a balanced pressure regulator. This means that the controlled outlet pressure is not affected by variations in the inlet pressure and flow during its operation. Therefore a balanced regulator can have a single-size orifice for all pressure and flow conditions.

This regulator is suitable for use with previously filtered, non corrosive gases, in natural gas transmission and distribution networks as well as high load industrial application.

Set point adjustement of the regulator is operated via a pilot unit used to control the motorization pressure to the diaphragm chamber.

It is an axial flow regulator with higher capacity compared to the same size top entry body regulators.

The **body form factor** makes it very **reliable** for applications with high **elemental sulphur** presence in the gas stream.
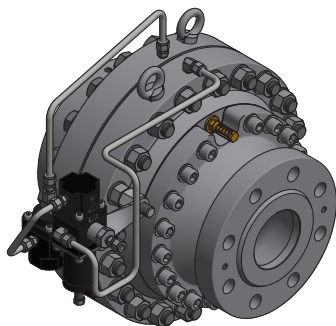
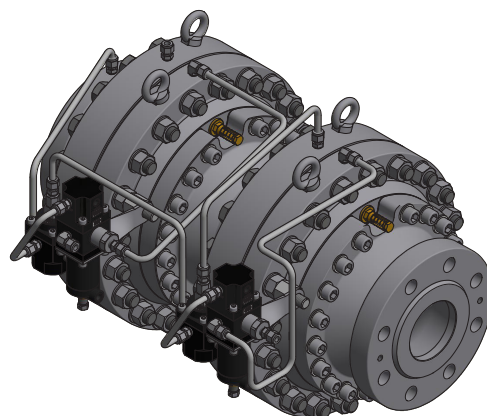**Figure 3** ASX 176/FO   **Figure 4** ASX 176/FO with PM/176

ASX 176/FO competitive advantages

Balanced type

High accuracy

High turn-down ratio

True Fail Open plug and seat regulator

Built-in pilot filter

High capacity

High reliability vs elemental sulphur presence

Biomethane compatible and available with specific versions for full Hydrogen or blending

Features

Features	Values
Design pressure*	up to 10.2 MPa up to 102 barg
Ambient temperature*	from -20 °C to +60 °C from -4 °F to +140 °F
Inlet gas temperature range*	from -20 °C to +60 °C from -4 °F to +140 °F
Inlet pressure range bpu (MAOP)	from 0.3 to 10 MPa from 3 to 100 barg
Range of downstream pressure Wd	from 0.1 to 7.4 MPa from 1 to 74 barg
Available Accessories	LDB/176 Silencer, PM/176 Monitor, SSX/176 Slam shut
Minimum differential pressure	0.2 MPa 2 barg
Accuracy class AC	up to 2.5
Lock-up pressure class SG	up to 10
Nominal dimensions DN	DN 25 / 1"; DN 50 / 2"; DN 80 / 3"; DN 100 / 4"; DN 150 / 6"
Connections*	Class 300, 600 RF or RTJ according to ASME B16.5

(*) REMARK: Different functional features and/or extended temperature ranges available on request. Stated temperature ranges are the maximum for which the equipment's full performance, including accuracy, are fulfilled. Standard product may have a narrower range.

Table 1 Features

Materials and Approvals

Part	Material
Body	Steel ASTM A350 LF2
Plug	ASTM A 350 LF2 Nikel coated on sealing surface
Seat	Polimer / Nitril rubber vulcanized on a metal support
Diaphragm	Rubberized canvas (performed by hot-pressing process)
Sealing ring	Nitrile rubber
Compression fittings	In zinc-plated carbon steel according to DIN 2353; Stainless steel on request
REMARK: 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

ASX 176/FO regulator, is designed according to the European standard EN 334.
The regulator reacts in opening (Fail Open) according to EN 334.

The product is certified according to European Directive 2014/68/EU (PED).
Leakage class: bubble tight, better than VIII according to ANSI/FCI 70-3.

EN 334   PED-CE

Pilot ranges and types

Type	Model	Operation	Range Wh		Spring Table web link
			MPa	barg	
Main pilot	204/A/FO	Manual	0.1 - 3.3	1 - 33	TT 1183
Main pilot	205/A/FO	Manual	2 - 6	20 - 60	TT 1183
Main pilot	207/A/FO	Manual	4.1 - 7.4	41 - 74	TT 1183

Table 3 Settings table

Pilot adjustment	
Pilot type .../A	Manual setting
Pilot type .../D	Electric remote control setting
Pilot type .../CS	Pneumatic remote control setting
Pilot type .../FIO	Smart unit for remote setting, monitoring, flow limitation

Table 4 Pilot adjustment table

General link to the calibration tables: **PRESS HERE** or use the QR code:

Accessories

For the pressure regulators:

- Cg limiter

- Limit switches

- Position transmitter

- Silencer

- Slam shut valve

- Monitor

For the pilot circuit:

- R14/A/S preregulator for the high pressure circuit (differential pressure > 3.5 MPa | 35 barg)

- Heating cable for preheating pilot circuit

- Electrical heater PPH200

- Supplementary filter CF14 or CF14/D

- ATF 15 antifreeze

In-line Monitor

The in-line monitor is generally installed upstream of the active regulator.
Although the function of the monitor regulator is different, the two regulators are virtually identical from the point of view of their mechanical components.
The only difference is that the monitor is set at a higher pressure than the active regulator.

The Cg coefficient of the active regulator is the same, however during the sizing process, the differential pressure drop generated by the fully open in-line monitor shall be considered. As a general practise to incorporate this effect, a 20% reduction of the Active regulator's Cg value can be applied.
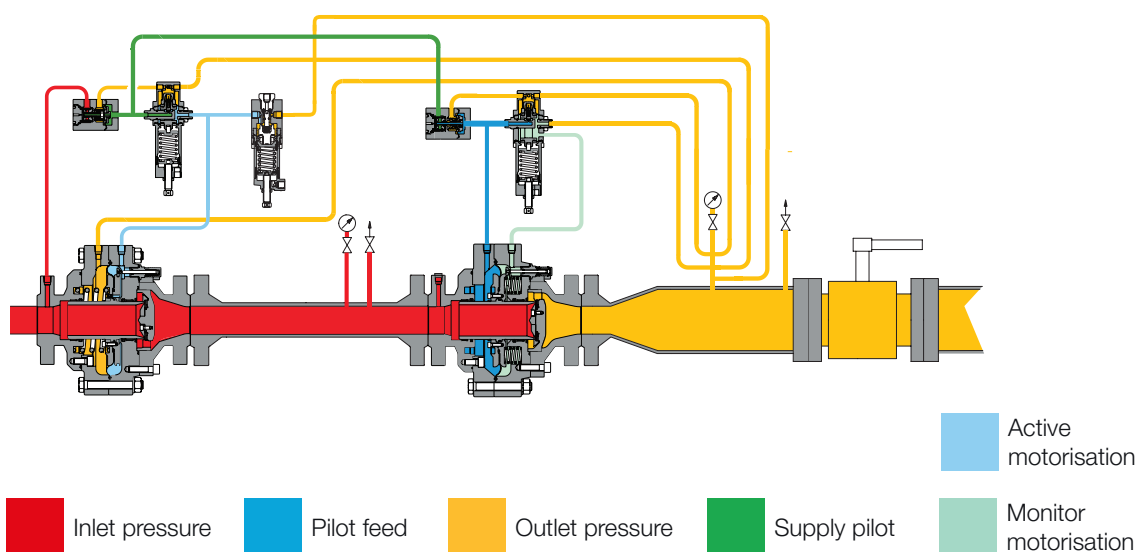

Legend:
- Inlet pressure
- Pilot feed
- Outlet pressure
- Supply pilot
- Active motorisation
- Monitor motorisation

Figure 5 ASX 176/FO with In-line monitor ASX 176

PM/176 monitor

This emergency regulator (monitor) is attached to the body of the main regulator. Both pressure regulators, therefore, use the same valve body, although they have independent actuators, pilots and valve seats.

The monitor is in the fully open position during normal operation of the active regulator and takes over on in the event of its failure.

The functional characteristics of the PM/176 monitor are the same of the basic regulator ASX 176/FO.

The Cg coefficients of regulator having an incorporated monitor is 16% lower than those for standard version.

This solution allows the construction of pressure reduction lines with compact dimensions.

Another great advantage offered by the incorporated monitor regulator is that **it can be installed at any time**, even on an existing regulator, **but it requires changes to the pipework**.

Completely independent

"Fail to close" action

Built-in pilot filter

Visual opening indicator

Limit switch option

Accelerator option

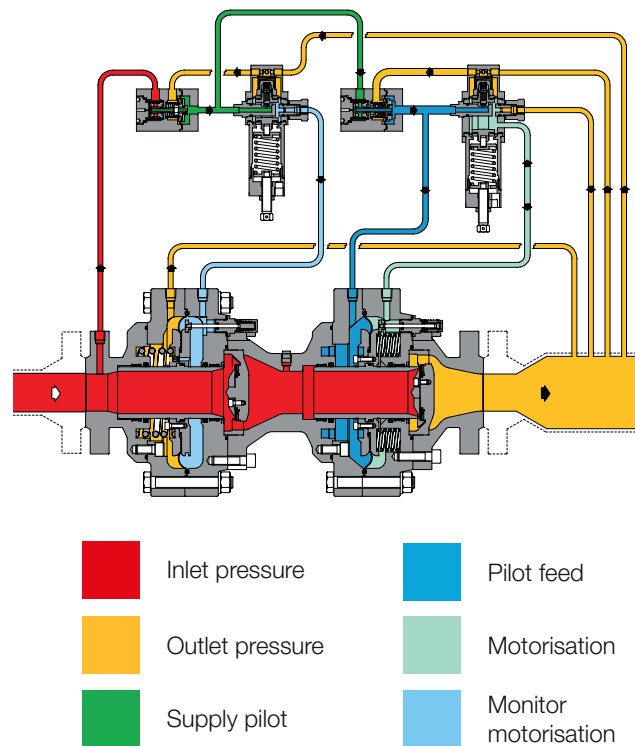| Inlet pressure | Pilot feed |
| Outlet pressure | Motorisation |
| Supply pilot | Monitor motorisation |

Figure 6 ASX 176/FO with PM/176

Type	Model	Operation	Range Wh		Spring Table web link
			MPa	**barg**	
Main pilot	204/A	Manual	0.03 - 4.3	0.3 - 43	TT 433
Main pilot	205/A	Manual	2 - 6	20 - 60	TT 799
Main pilot	207/A	Manual	4.1 - 7.4	41 - 74	TT 1146

Table 5 Setting table

Types of pilot adjustment	
Pilot type .../A	Manual setting
Pilot type .../D	Electric remote control setting
Pilot type .../CS	Pneumatic remote control setting
Pilot type .../FIO	Smart unit for remote setting, monitoring, flow limitation

Table 6 Pilot adjustment table

The monitor regulator can be equipped with an additional pilot called "accelerator" to enable a quick response time during the monitor take over. According to PED the accelerator is required on the monitor when acting as a safety accessory.

Type	Model	Operation	Range Wh		Spring Table web link
			MPa	**barg**	
Accelerator	M/A	Manual	0.03 - 2	0.3 - 20	TT 354
Accelerator	M/A1	Manual	2 - 6.3	20 - 63	TT 892
Accelerator	M/A2	Manual	4 - 7.5	40 - 75	TT 892

Table 7 Accelerator adjustment table

General link to the calibration tables: **PRESS HERE** or use the QR code:

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LDB/176 silencer

Whenever certain noise limit is desired, an additional silencer allows to considerably reduce the noise level (dBA).

ASX 176/FO pressure regulator can be supplied with an **incorporated silencer** in either the standard version or version with incorporated slam shut or monitor regulator.

The high efficiency noise absorption takes place at the point where the noise is generated, thus preventing its propagation.

With the built-in silencer, the Cg valve coefficient is 10% lower than the corresponding version without.

Given the modular arrangement of the regulator, the silencer may be retrofitted to both standard ASX 176/FO version as well as those with incorporated slam shut or monitor, **without any need to modify the main piping**.

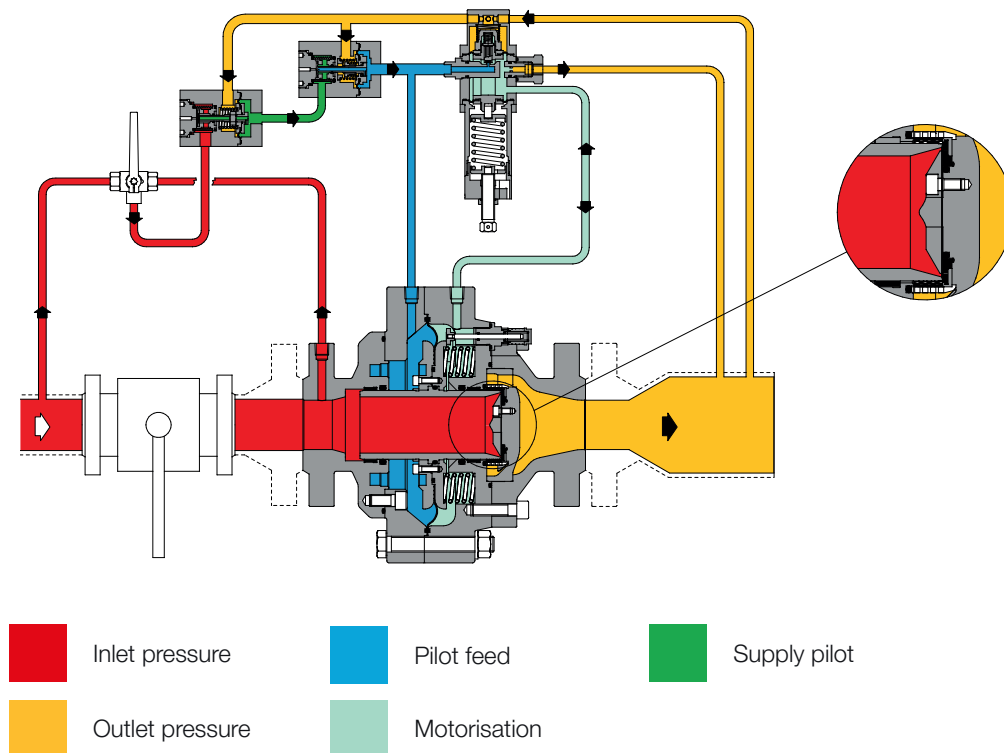Pressure reduction and control operate in the same manner as in the standard version.

■ Inlet pressure	■ Pilot feed	■ Supply pilot
■ Outlet pressure	■ Motorisation	

Figure 7 ASX 176/FO with Silencer LDB/176

The charts below represent the silencer effectiveness based on some common reference conditions for 2", 4"and 6". For actual calculations at specific desired conditions please refer to the online sizing tool or contact your closest Pietro Fiorentini representative.

Legend:
- Pd 0.4 MPa | 4 barg NO Silencer
- Pd 0.4 MPa | 4 barg LDB/176
- Pd 2 MPa | 20 barg NO SILENCER
- Pd 2 MPa | 20 barg LDB/176
- Pd 4 MPa | 40 barg NO Silencer
- Pd 4 MPa | 40 barg LDB/176
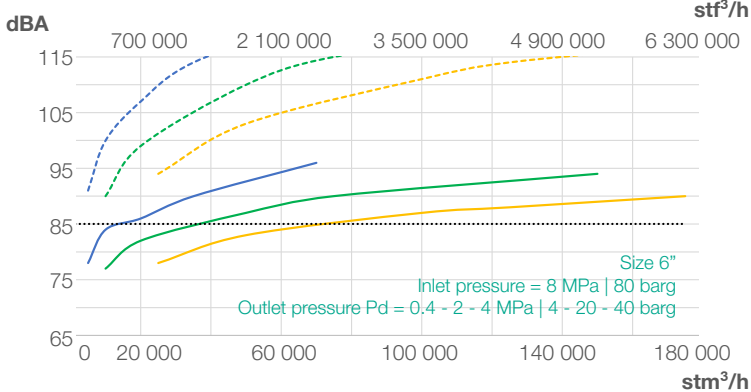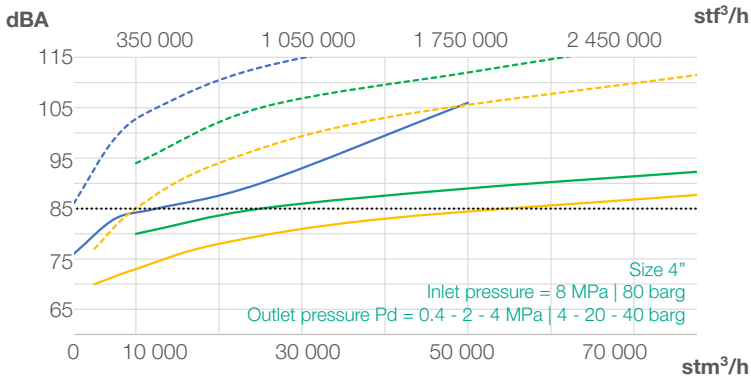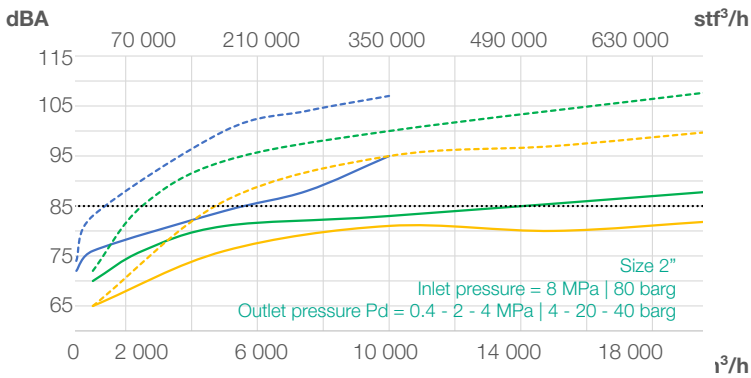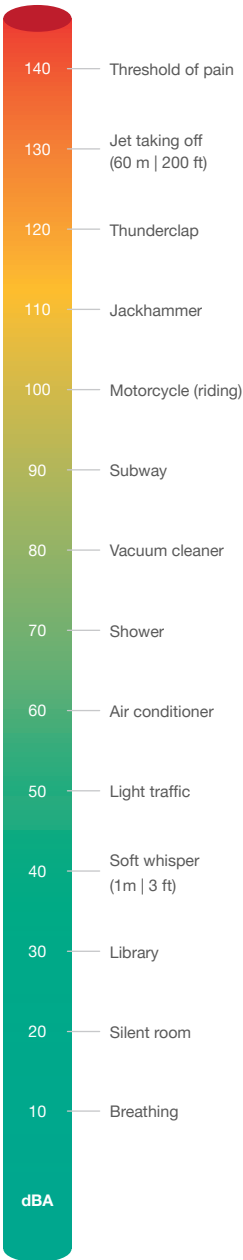- Recommended noise limit (85 dBA at 1 mt | 3 feet)

dBA scale:
- 140 — Threshold of pain
- 130 — Jet taking off (60 m | 200 ft)
- 120 — Thunderclap
- 110 — Jackhammer
- 100 — Motorcycle (riding)
- 90 — Subway
- 80 — Vacuum cleaner
- 70 — Shower
- 60 — Air conditioner
- 50 — Light traffic
- 40 — Soft whisper (1m | 3 ft)
- 30 — Library
- 20 — Silent room
- 10 — Breathing
- dBA

Size 2"
Inlet pressure = 8 MPa | 80 barg
Outlet pressure Pd = 0.4 - 2 - 4 MPa | 4 - 20 - 40 barg

Size 4"
Inlet pressure = 8 MPa | 80 barg
Outlet pressure Pd = 0.4 - 2 - 4 MPa | 4 - 20 - 40 barg

Size 6"
Inlet pressure = 8 MPa | 80 barg
Outlet pressure Pd = 0.4 - 2 - 4 MPa | 4 - 20 - 40 barg

Chart 1 ASX 176/FO's silencer efficiency charts

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SSX/176 slam shut

ASX 176/FO pressure regulator offers the possibility of installing an **SSX/176 incorporated slam shut valve**, depending on the regulator size, and this can be done either during the manufacturing process or be retrofitted in the field.

Retrofitting can be done without modifying the pressure regulator assembly, **but it requires modification to the main piping**.

With the built-in slam shut, the Cg valve coefficients is 20% lower than the corresponding version without.

The main characteristics of this device are:

OPSO   Over Pressure Shut-Off   Compact dimensions

UPSO   Under Pressure Shut-Off   Remote tripping option

Internal by-pass   Limit switch option

Push botton for tripping test

🟥	Inlet pressure
🟧	Motorization SSV
🟨	Outlet pressure
🟦	Pilot feed
🟩	Motorisation active
🟩	Supply pilot
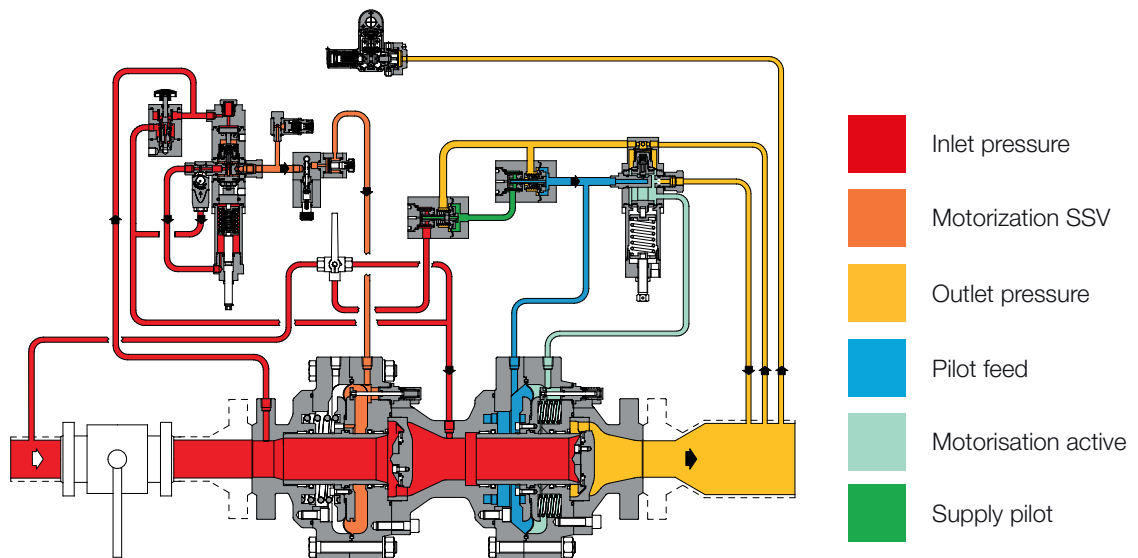
Figure 8 ASX 176/FO with SSX/176

Pressure switch types and ranges					
SSV Type	Model	Operation	Range Wh		Spring Table web link
			MPa	barg	
SSX/176	103M	OPSO	0.2 - 2.2	2 - 22	TT 1331
		UPSO	0.02 - 0.8	0.2 - 8	
SSX/176	104M	OPSO	1.5 - 4.5	15 - 45	TT 1331
		UPSO	0.16 - 1.8	1.6 - 18	
SSX/176	105M	OPSO	3 - 9	30 - 90	TT 1331
		UPSO	0.3 -4.4	3 - 44	

Table 8 Setting table

General link to the calibration tables: **PRESS HERE** or use the QR code:

Weights and Dimensions

ASX 176/FO with or without LDB/176 silencer

Figure 9 ASX 176/FO dimensions

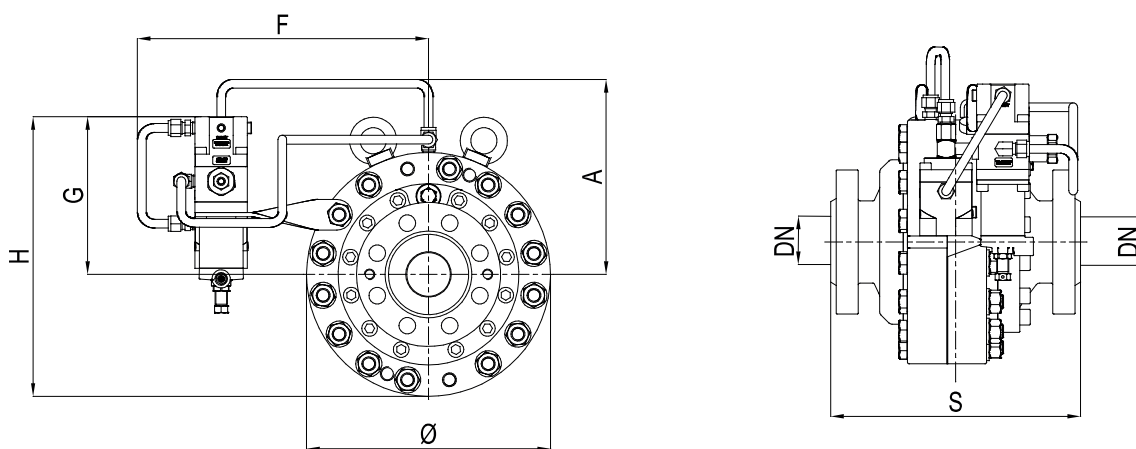| Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)					
	[mm] | inches	[mm] | inches	[mm] | inches	[mm] | inches	[mm] | inches
Size (DN)	25 | 1"	50 | 2"	80 | 3"	100 | 4"	150 | 6"
S - ANSI 300	197 | 7.76"	267 | 10.51"	317 | 12.48"	368 | 14.49"	473 | 18.62"
S - ANSI 600	210 | 8.27"	286 | 11.26"	336 | 13.23"	394 | 15.51"	508 | 20"
Ø	279 | 10.98"	279 | 10.98"	359 | 14.13"	440 | 17.32"	550 | 21.65"
A	180 | 7.09"	180 | 7.09"	223 | 8.78"	263 | 10.35"	318 | 12.52"
F	335 | 13.19"	335 | 13.19"	375 | 14.76"	409 | 16.10"	465 | 18.31"
G	181 | 7.13"	181 | 7.13"	186 | 7.32"	203 | 7.99"	201 | 7.91"
H	321 | 12.64"	321 | 12.64"	365 | 14.37"	425 | 16.73"	476 | 18.74"
Tubing connections	Øe 10 x Øi 8 (on request imperial sizing)				

Weight	Kg | lbs	Kg | lbs	Kg | lbs	Kg | lbs	Kg | lbs
ANSI 300	55 | 121	72 | 159	123 | 271	214 | 472	333 | 734
ANSI 600	55 | 121	74 | 163	126 | 278	225 | 496	365 | 805

Table 9 Weights and dimensions

ASX 176/FO + PM/176 with or without LDB/176 silencer

Figure 10 ASX 176/FO + PM/176 dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)					
	[mm] | inches	[mm] | inches	[mm] | inches	[mm] | inches	[mm] | inches
Size (DN)	25 | 1"	50 | 2"	80 | 3"	100 | 4"	150 | 6"
S - ANSI 300	372 | 14.65"	516 | 20.31"	581 | 22.87"	694 | 27.32"	901 | 35.47"
S - ANSI 600	385 | 15.16"	535 | 21.06"	600 | 23.62"	720 | 28.34"	936 | 36.85"
Ø	279 | 10.98"	279 | 10.98"	359 | 14.13"	440 | 17.32"	550 | 21.65"
A	180 | 7.09"	180 | 7.09"	223 | 8.78"	263 | 10.35"	318 | 12.52"
F	335 | 13.19"	335 | 13.19"	375 | 14.76"	409 | 16.10"	465 | 18.31"
G	181 | 7.13"	181 | 7.13"	186 | 7.32"	203 | 7.99"	201 | 7.91"
H	321 | 12.64"	321 | 12.64"	365 | 14.37"	425 | 16.73"	476 | 18.74"
Tubing connections	Øe 10 x Øi 8 (on request imperial sizing)				

Weight	Kg | lbs	Kg | lbs	Kg | lbs	Kg | lbs	Kg | lbs
ANSI 300	110 | 242	137 | 302	239 | 527	425 | 937	656 | 1446
ANSI 600	110 | 242	139 | 306	242 | 534	445 | 981	730 | 1609

Table 10 Weights and dimensions

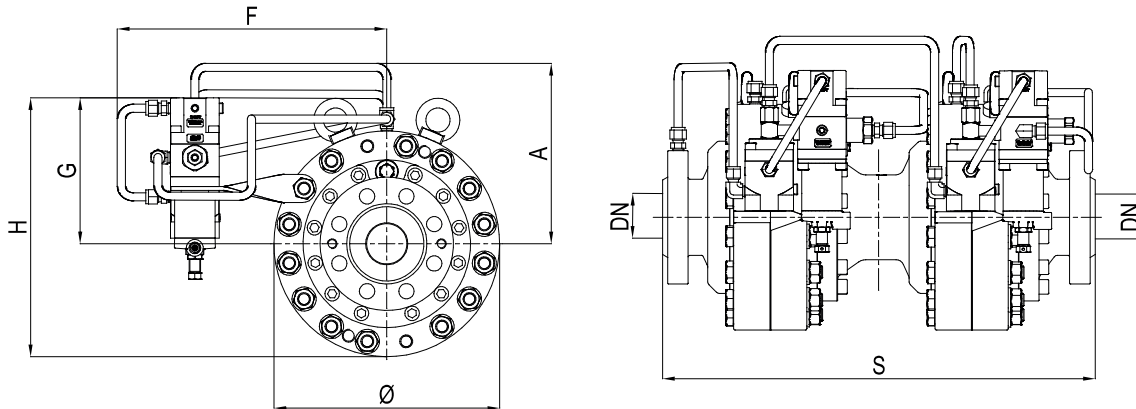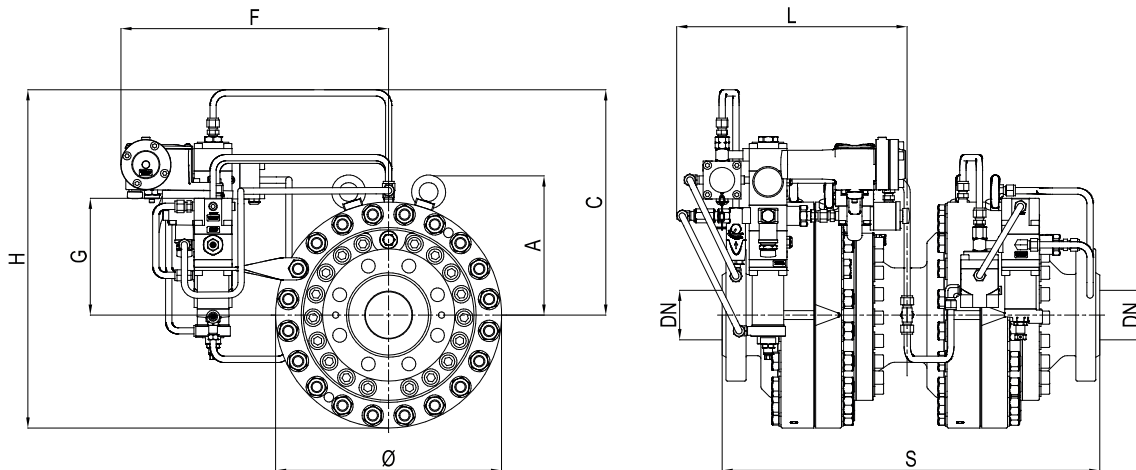# ASX 176/FO + SSX/176 with or without LDB/176 silencer

Figure 11 ASX 176/FO + SSX/176 dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)					
	[mm] | inches	[mm] | inches	[mm] | inches	[mm] | inches	[mm] | inches
Size (DN)	25 | 1"	50 | 2"	80 | 3"	100 | 4"	150 | 6"
S - ANSI 300	372 | 14.65"	516 | 20.31"	581 | 22.87"	694 | 27.32"	901 | 35.47"
S - ANSI 600	385 | 15.16"	535 | 21.06"	600 | 23.62"	720 | 28.34"	936 | 36.85"
Ø	279 | 10.98"	279 | 10.98"	359 | 14.13"	440 | 17.32"	550 | 21.65"
A	180 | 7.09"	180 | 7.09"	223 | 8.78"	263 | 10.35"	318 | 12.52"
C	346 | 13.62"	346 | 13.62"	352 | 13.85"	369 | 14.52"	388 | 15.27"
F	348 | 13.70"	348 | 13.70"	389 | 15.31"	425 | 16.73"	460 | 18.11"
G	181 | 7.13"	181 | 7.13"	186 | 7.32"	203 | 7.99"	201 | 7.91"
H	489 | 19.25"	489 | 19.25"	532 | 20.94"	590 | 23.22"	653 | 25.70"
L	284 | 11.18"	308 | 12.12"	365 | 14.37"	443 | 17.44"	523 | 20.59"
Tubing connections	Øe 10 x Øi 8 (on request imperial sizing)				

Weight	Kg | lbs	Kg | lbs	Kg | lbs	Kg | lbs	Kg | lbs
ANSI 300	115 | 253	142 | 313	244 | 537	429 | 945	661 | 1457
ANSI 600	115 | 253	144 | 317	246 | 542	449 | 990	735 | 1620

Table 11 Weights and dimensions

Sizing and Cg

In general, the choice of a regulator is made based on the calculation of the flow rate determined by the use of formulae using the flow rate coefficients (Cg) and the form factor (K1) as indicated by the EN 334 standard.

Flow rate coefficient					
Nominal size	25	50	80	100	150
Inches	1"	2"	3"	4"	6"
Cg	630	2300	5000	8800	19000
K1	145	145	145	145	145

Table 12 Flow rate coefficient

For sizing **PRESS HERE** or use the QR code:

Note: In case you do not have the proper credentials to access, feel free to contact your closest Pietro Fiorentini representative.

In general, the online sizing considers multiple variables as the regulator is installed in a system, enabling a better and multiperspective approach to the sizing.

For different gases, and for natural gas with a different relative density other than 0.61 (compared to air), the correction coefficients from the following formula shall be applied:

$$F_c = \sqrt{\frac{175{,}8}{S \times (273{,}16 + T)}}$$

S = relative density (refer to table 13)
T = gas temperature (°C)

Correction Factor Fc

Gas Type	Relative Density S	Correction Factor Fc
Air	1.00	0.78
Propane	1.53	0.63
Butane	2.00	0.55
Nitrogen	0.97	0.79
Oxygen	1.14	0.73
Carbon Dioxide	1.52	0.63

Note: the table shows the Fc correction factors valid for Gas, calculated at a temperature of 15°C and at the declared relative density.

Table 13 Correction Factor Fc

Flow rate conversion

$Stm^3/h \times 0.94795 = Nm^3/h$

Nm^3/h reference conditions T= 0 °C; P= 1 barg
Stm^3/h reference conditions T= 15 °C; P= 1 barg

Table 14 Flow rate conversion

CAUTION:

In order to get optimal performance, to avoid premature erosion phenomena and to limit noise emissions, it is recommended to check that the gas speed at the outlet flange does not exceed the values of the graph below. The gas speed at the outlet flange may be calculated by means of the following formula:

$$V = 345.92 \times \frac{Q}{DN^2} \times \frac{1 - 0.002 \times Pd}{1 + Pd}$$

V = gas speed in m/s
Q = gas flow rate in Stm^3/h
DN = nominal size of regular in mm
Pd = outlet pressure in barg
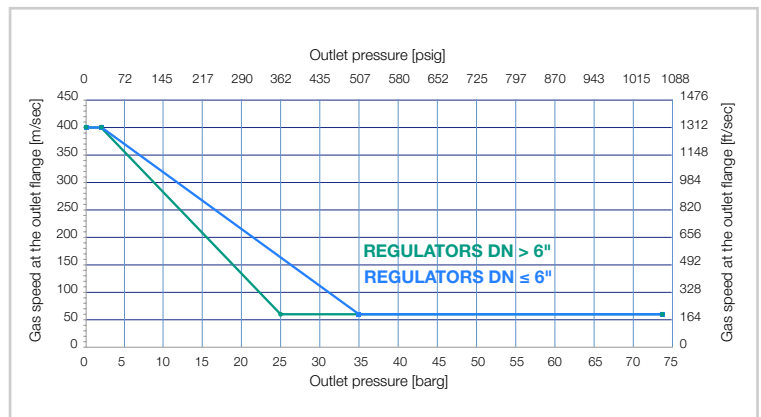
Sizing of regulators is usually made based on valve Cg value (table 12).

Flow rates at fully open position and various operating conditions are related by the following formulae where:

Q = flow rate in Stm^3/h
Pu = inlet pressure in bar (abs)
Pd = outlet pressure in bar (abs).

- **A** > when the Cg value of the regulator is known, as well as Pu and Pd, the flow rate can be calculated as follows:

- **A-1** in sub critical conditions: (Pu < 2 x Pd)

$$Q = 0.526 \times Cg \times Pu \times \sin\left(K1 \times \sqrt{\frac{Pu - Pd}{Pu}}\right)$$

- **A-2** in critical conditions: (Pu ≥ 2 x Pd)

$$Q = 0.526 \times Cg \times Pu$$

- **B** > vice versa, when the values of Pu, Pd and Q are known, the Cg value, and hence the regulator size, may be calculated using:

- **B-1** in sub-critical conditions: (Pu < 2xPd)

$$Cg = \frac{Q}{0.526 \times Pu \times \sin\left(K1 \times \sqrt{\frac{Pu - Pd}{Pu}}\right)}$$

- **B-2** in critical conditions (Pu ≥ 2 x Pd)

$$Cg = \frac{Q}{0.526 \times Pu}$$

NOTE: The sin val is understood to be DEG.

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