Pietro Fiorentini

Aperval 101

Medium - Low Pressure Gas Regulator

www.fiorentini.com

Who we are

We are a global organization that specializes 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 solutions that span the whole natural gas chain.

We are constantly evolving 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 level of professionalism.

Pietro Fiorentini advantages
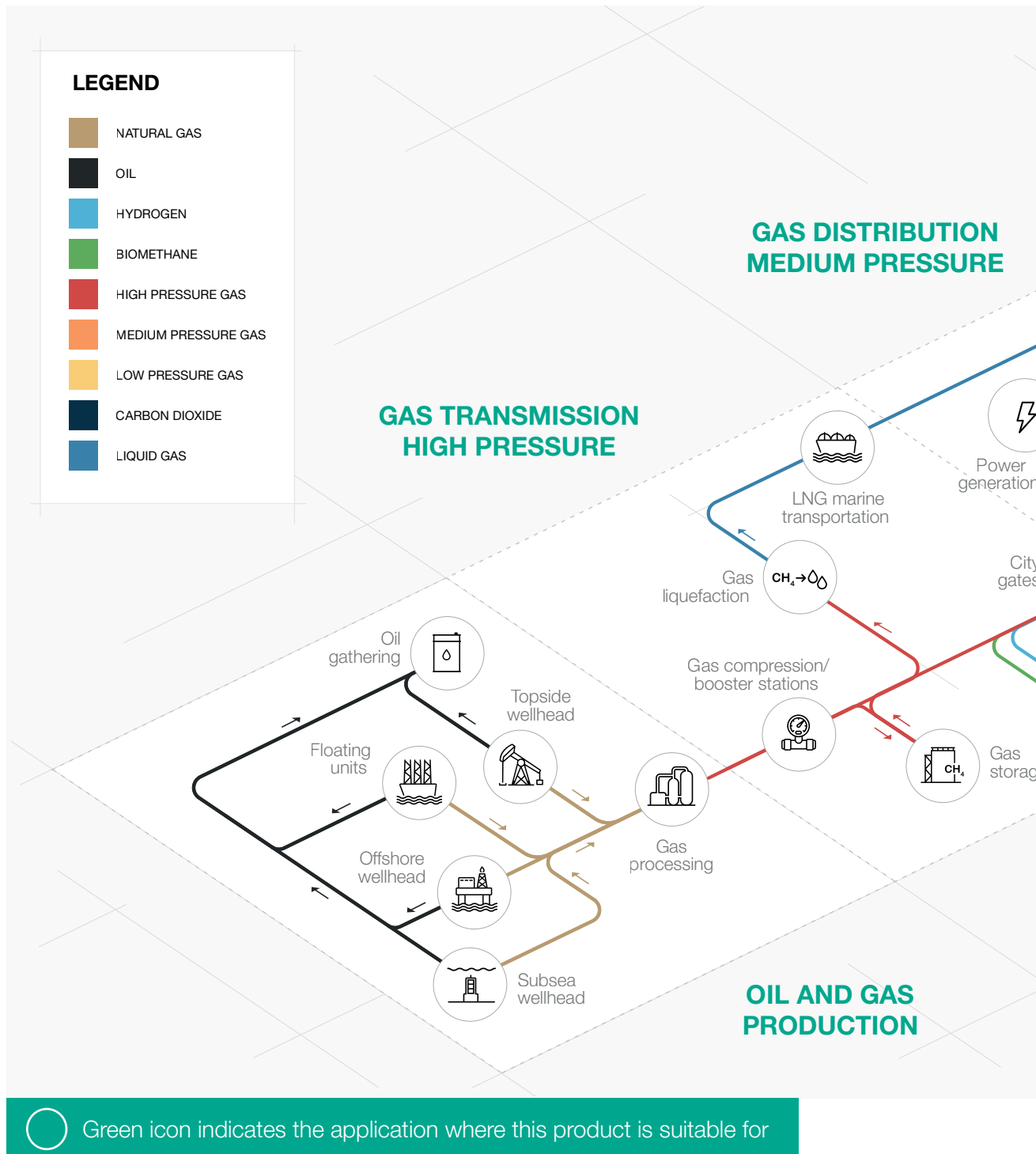
Localised technical support

Experience since 1940
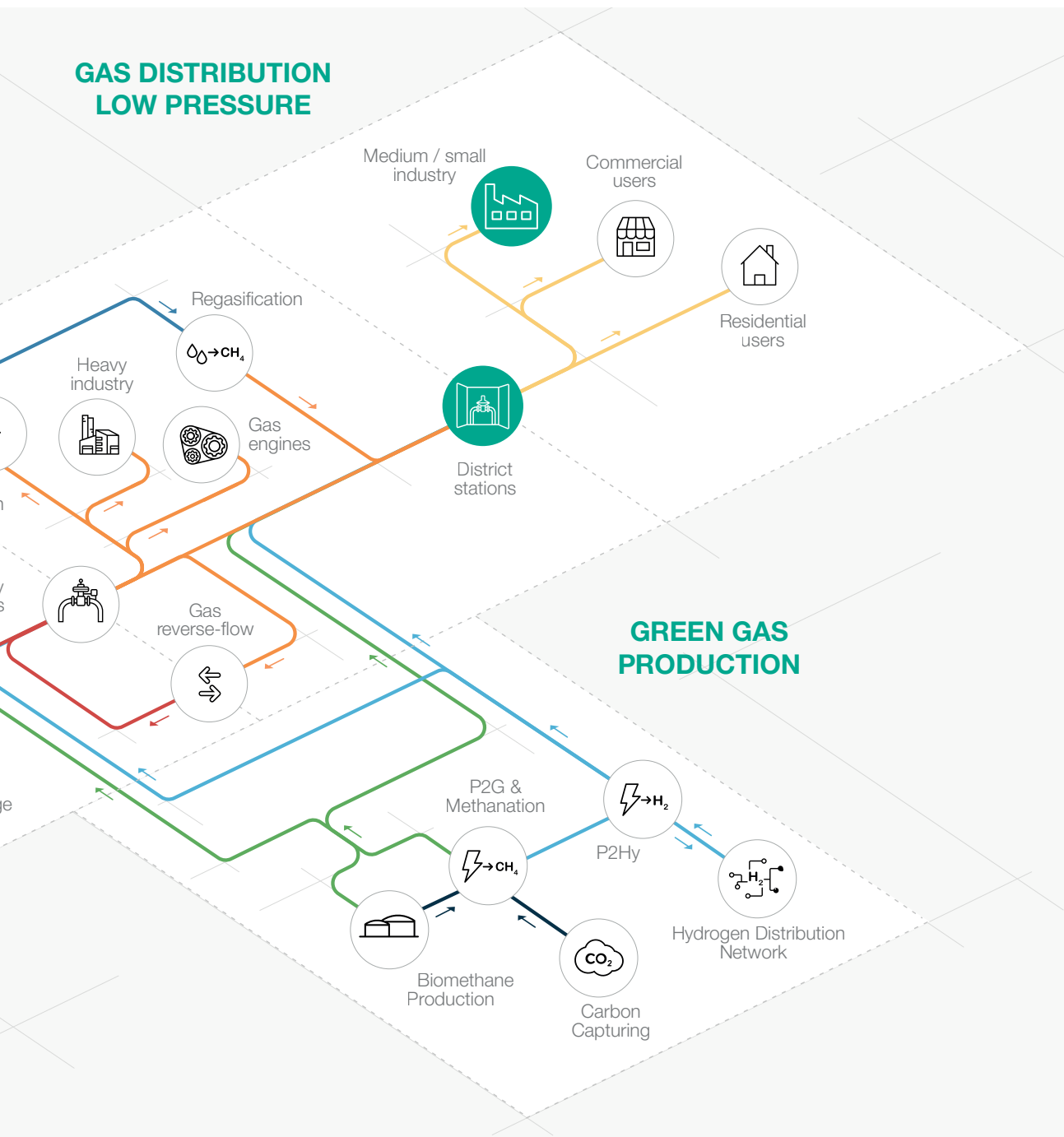
Operating in over 100 countries

Area of Application

LEGEND

- 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

$CH_4 \rightarrow$

City gates

Oil gathering

Topside wellhead

Gas compression/ booster stations

Floating units

Gas storage

CH_4

Offshore wellhead

Gas processing

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

$\text{\large\Circle}\Circle \rightarrow CH_4$

Heavy industry

Gas engines

District stations

Gas reverse-flow

GREEN GAS PRODUCTION

P2G & Methanation

$\rightarrow H_2$

P2Hy

$\rightarrow CH_4$

Hydrogen Distribution Network

Biomethane Production

CO_2

Carbon Capturing

Figure 1 Area of Application Map

Introduction

Aperval 101 is one of the **pilot-operated gas pressure regulators** produced by Pietro Fiorentini.

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

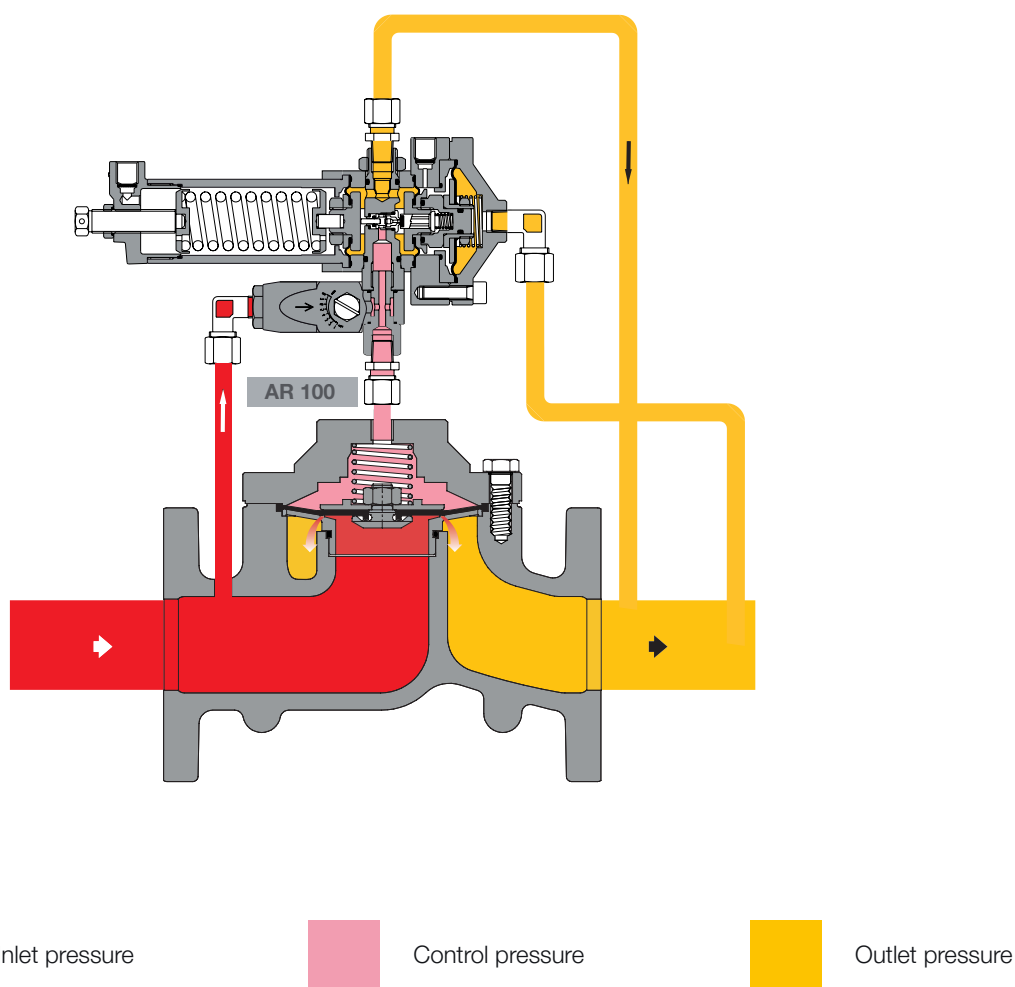It is classified as **Fail Open** according to the European Standard EN 334.

AR 100

■ Inlet pressure	■ Control pressure	■ Outlet pressure

Figure 2 Aperval 101

Features and Calibration ranges

Aperval 101 is a **pilot-operated** device for medium pressure and low pressure with a unique **dynamic balancing system** which ensures an **outstanding turn down ratio** combined with an extremely **accurate outlet pressure control.**

Aperval 101 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 medium / small load industrial application.

It is a **truly top entry design** which allows an **easy maintenance** of parts directly in the field **without removing the body from the pipework.**
Set point adjustment of the regulator is achieved via a pilot, loading and unloading the pressure in the Aperval 101 upper diaphragm chamber.

Figure 3 Aperval 101

Aperval 101 competitive advantages

Compact and simple design

Easy maintenance

1:500 High turn-down ratio

Balanced type

Low noise

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

Top Entry

Features

Features	Values
Design pressure* (PS[1] / DP[2])	up to 1.89 MPa up to 18.9 barg
Ambient temperature* (TS[1])	from -20 °C to +60 °C from -4 °F to +140 °F
Inlet gas temperature*	from -10 °C to +60 °C from 14 °F to +140 °F
Inlet pressure (MAOP / p_{umax}[1])	from 0.05 to 1.89 MPa from 0.5 to 18.9 barg
Range of downstream pressure (Wd[1])	from 2 to 950 kPa from 0.02 to 9.5 barg
Available accessories	none
Minimum operating differential pressure (Δp_{min}[1])	48 kPa 0.48 barg
Accuracy class (AC[1])	up to 2.5
Lock-up pressure class (SG[1])	up to 5
Nominal size (DN[1,2])	DN 50 | 2"; DN 80 | 3"; DN 100 | 4"
Connections	Class 125 FF, 125 RF and 150 RF according to ASME B16.1, and PN 16 according to ISO 7005-2

([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.

Table 1 Features

Materials and Approvals

Part	Material
Body	Spheroidal cast iron GS 400- 18 ISO 1083 Cast steel ASTM A216 WBC
Cover	Rolled or forged carbon steel
Seat	Technopolymer
Diaphragm	Vulcanized rubber
Compression fittings	According to DIN 2353 in zinc-plated carbon steel.

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

Aperval 101 regulator is designed according to the European standard EN 334.
The regulator reacts in opening (Fail Open) according to EN 334.

Leakage class: bubble tight, better than VIII according to ANSI/FCI 70-3.

EN 334

Pilot ranges and types

Type	Model	Operation	Range Wh		Spring Table web link
			kPa	mbarg	
Main pilot	301/.	Manual	0.5 - 10	5 - 100	TT 1037
Main pilot	301/.TR	Manual	10 - 200	100 - 2000	TT 1037

Type	Model	Operation	Range Wh		Spring Table web link
			kPa	barg	
Main pilot	302/.	Manual	80 - 950	0.8 - 9.5	TT 653
Main pilot	HP 100 AP	Manual	30 - 80	0.3 - 0.8	TT 00104
Main pilot	HP 100 AP TR	Manual	80 - 450	0.8 - 4.5	TT 00104

Table 3 Settings Table

Pilot adjustment	
Pilot type .../A	Manual setting
Pilot type .../D	Electric remote setting control
Pilot type .../CS	Pneumatic remote setting control
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:

The pilot system comes complete with an adjustable AR100 restrictor. The flow rate of the pilot system is controlled by the bleed rate through the AR100 restrictor which influences the response time of the regulator.

Pressure drop through the adjustable AR100 restrictor shall be about 20 kPa (0.2 barg) at the minimum opening flow of the regulator and about 100 kPa (1 barg) at the maximum opening flow of the regulator.

Accessories

For the pressure regulators:

- Cg limiter

For the pilot circuit:

- Supplementary filter CF14 or CF14/D

Weights and Dimensions
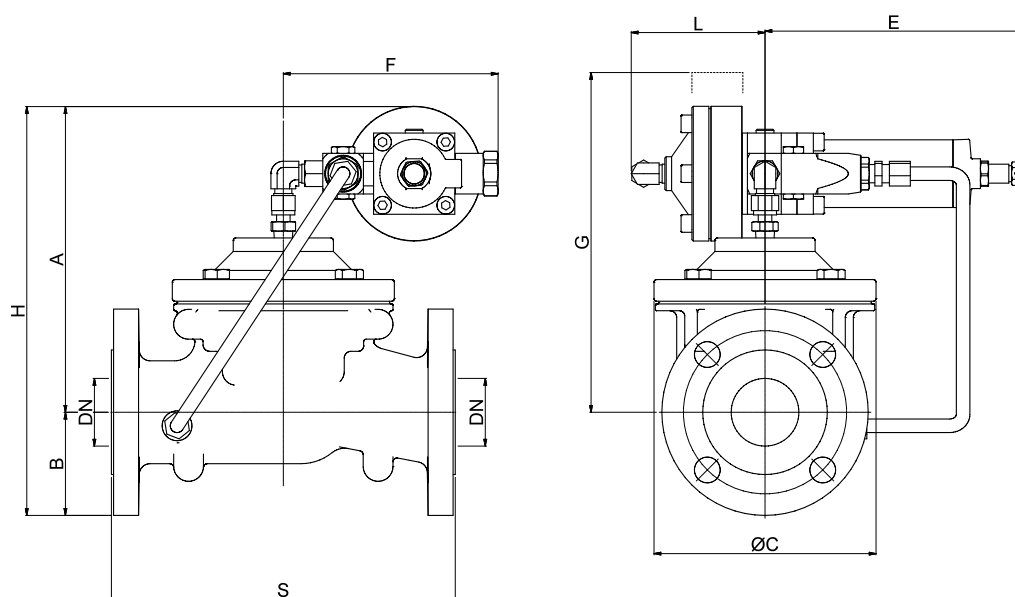
Aperval 101 + pilots 300 series

Figure 4 Aperval 101 + pilots 300 series dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)						
DN - sizes	50		80		100	
inches	2"		3"		4"	
	[mm]	inches	[mm]	inches	[mm]	inches
S	254	10.0"	298	11.7"	352	13.9"
A	260	10.2"	675	26.6"	755	29.7"
B (ANSI 150)	79	3.1"	97	3.8"	110	4.3"
B (PN 16)	79	3.1"	97	3.8"	105	4.1"
Ø C	162	6.4"	197	7.8"	290	11.4"
E	165	6.5"	165	6.5"	165	6.5"
F	170	6.7"	170	6.7"	170	6.7"
G	285	11.2"	335	13.2"	405	15.9"
H	341	13.4"	386	15.2"	455	17.9"
L	105	4.1"	105	4.1"	105	4.1"
Tubing Connections	Øe 10 x Øi 8 (on request imperial sizing)					
Weight	Kg	lbs	Kg	lbs	Kg	lbs
125 FF - 150 FF with pilot	22	48.5	30	66.1	62	136.7
PN 16 with pilot 301	23	50.7	33	72.8	66	145.5

Table 5 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	50	80	100
Inches	2"	3"	4"
Cg	2091	4796	7176
K1	108	108	108

Table 6 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 7)
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 7 Correction factor Fc

Flow rate conversion

Stm^3/h x 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 8 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
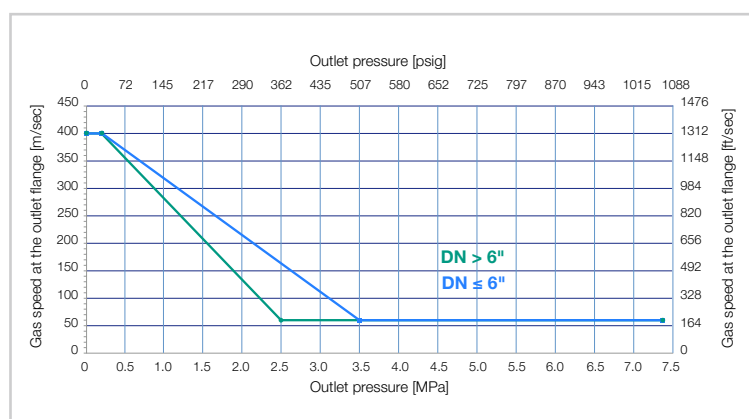
Sizing of regulators is usually made based on valve Cg value (table 7).

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

Q = flow rate in Stm^3/h
P_u = inlet pressure in bar (abs)
P_d = 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)

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

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

$$Q = 0.526 \times Cg \times P_u$$

- **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)

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

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

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

NOTE: The sin value is understood to be DEG.

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