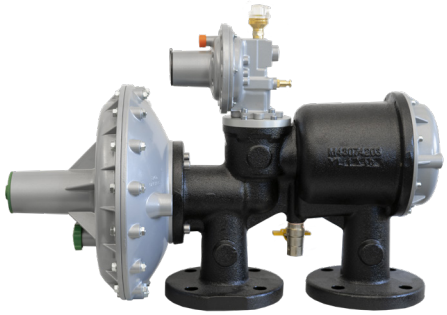
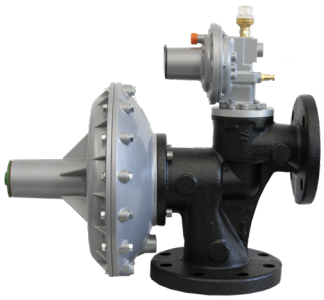
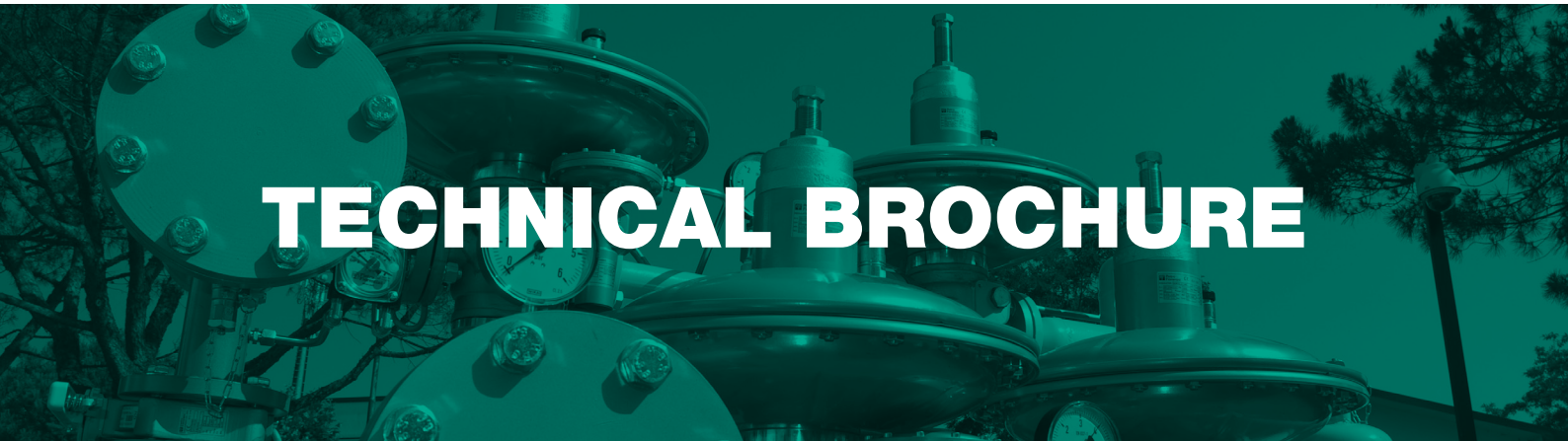
Pietro Fiorentini

Dival **SQD**

Medium - Low Pressure Gas Regulator







TECHNICAL BROCHURE

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sqd_technicalbrochure_ENG_revB

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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 spans the whole natural gas chain.

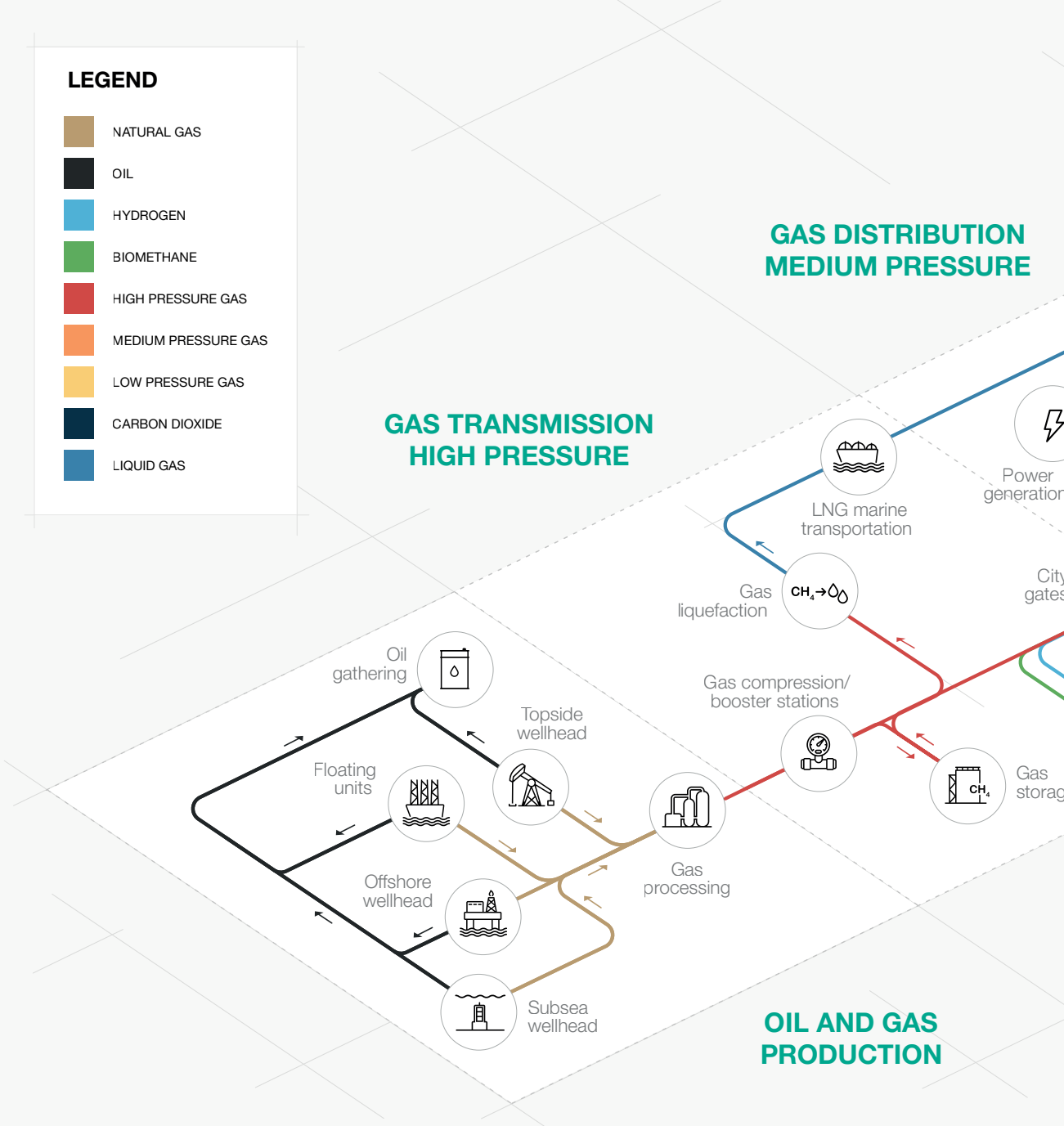
We are in constant evolution to meet our customers' highest expectations in terms of quality and reliability.

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

Pietro Fiorentini advantages

- Localised technical support
- Experience since 1940
- We operate in over 100 countries

Area of Application



Green icon indicates the application where this product is suitable for

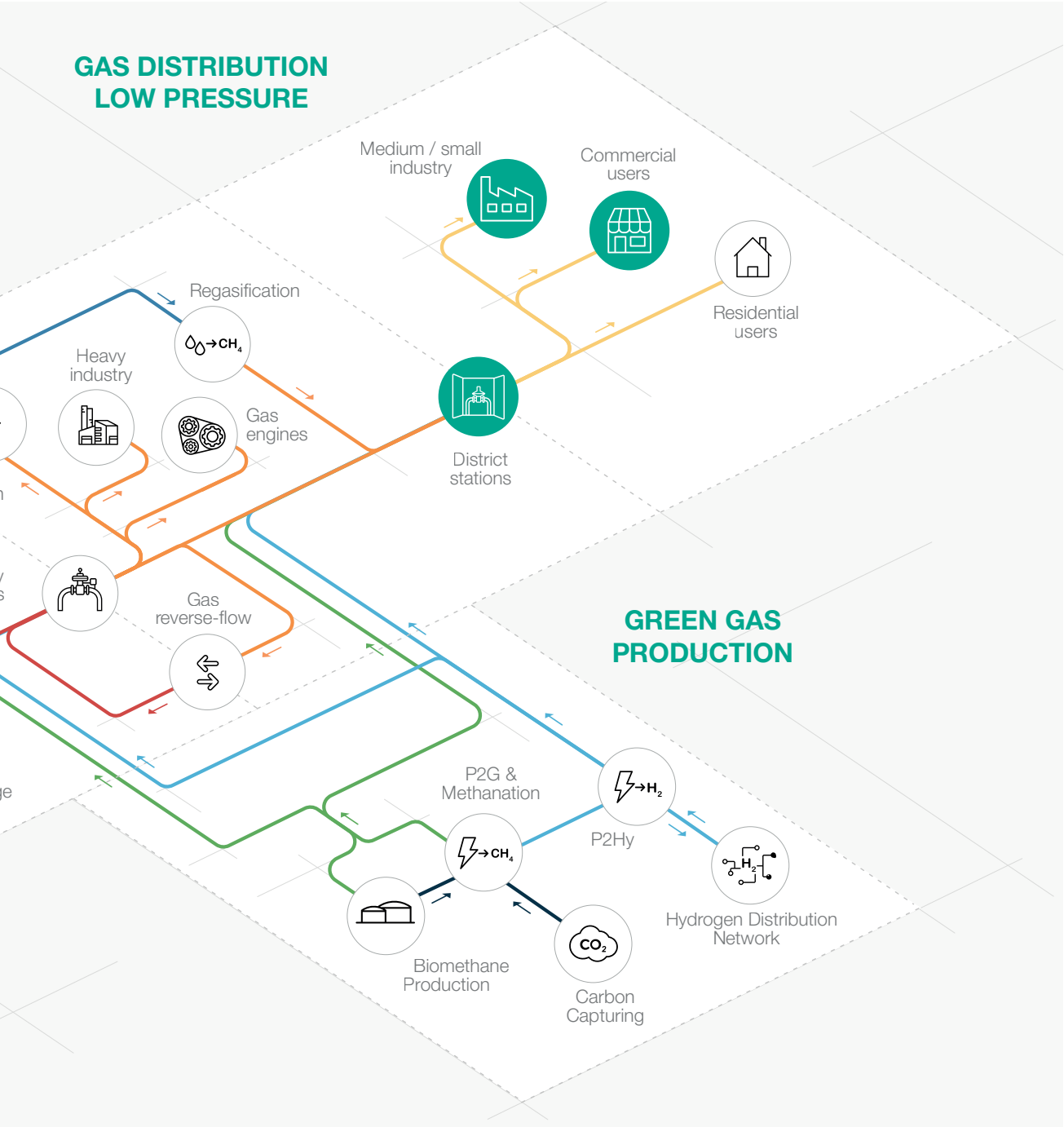


Figure 1 Area of Application Map

Introduction

The **Dival SQD** by Pietro Fiorentini is a **lever-operated** gas pressure regulator controlled by a diaphragm and contrasting regulated spring action.

Mainly used for medium and low pressure natural gas distribution networks, as well as commercial and industrial applications.

It should to be used with previously filtered non-corrosive gases.

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

The Dival SQD are **Hydrogen Ready** for NG-H2 blending.

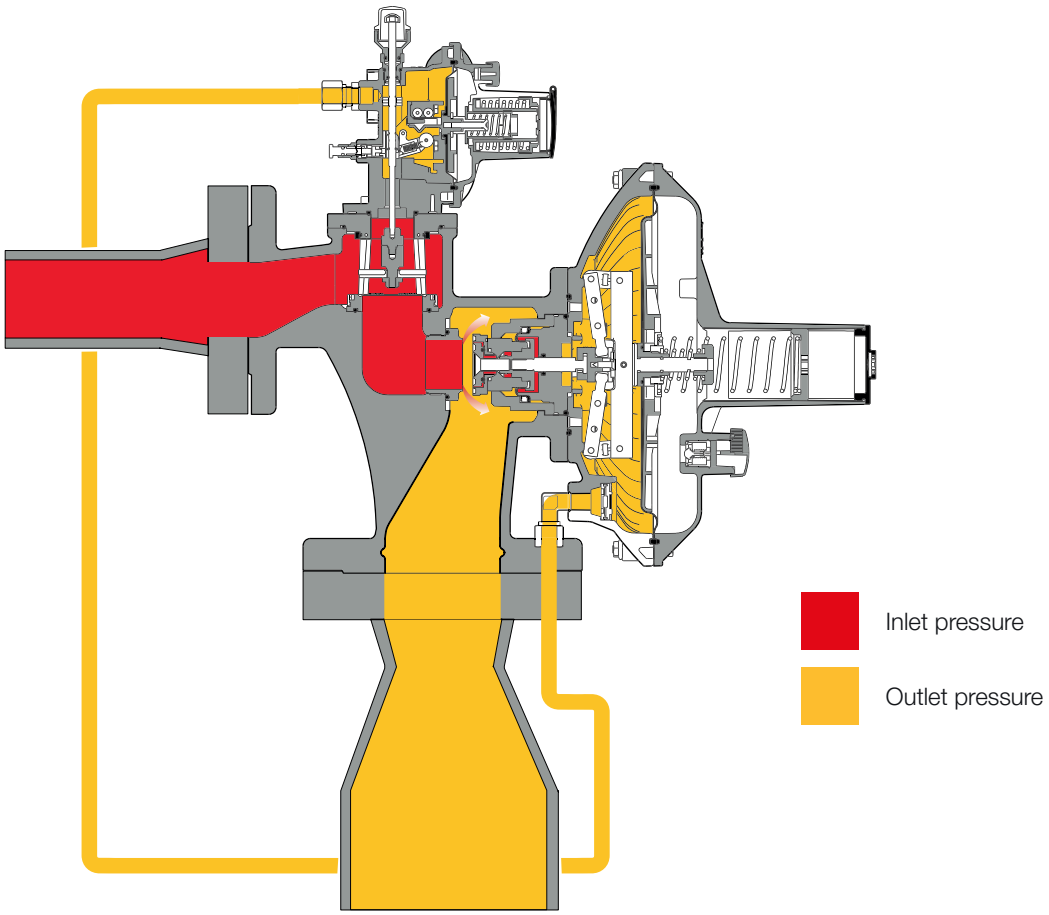


Figure 2 Dival SQD Standard version

Features and Calibration ranges

The **Dival SQD** is a **lever-operated** device for medium and low pressure with a unique **dynamic balancing system** which ensures an **outstanding turndown ratio** combined with an extremely **accurate outlet pressure control.**

A balanced pressure regulator it is a pressure regulator where delivery pressure accuracy is not affected by the fluctuation of the inlet pressure and flow during its operation. Therefore, a balanced pressure regulator can have a single orifice for all pressure and flow operating conditions.

Its innovative concept is represented by its **unique valve body geometry**, thus allowing to deliver a regulator which incorporate both **high capacity** and **low differential pressure drop on cartridge's filter**. The Dival SQD, regulator is classified according to European standard EN 334, as Differential Strength (DS) pressure regulator for versions SQD2 - SQD6, and Integral Strength (IS) for version SQD1.

This regulator is suitable for use with previously filtered, non-corrosive gases and distribution networks as well as high load industrial applications. Therefore, it is particularly suitable for ON/OFF burners applications and in any industrial processes where sudden changes in the gas demand are foreseen.

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 adjustement of the regulator is operated via a spring located in the top chamber.

It allows remarkable savings in the installation assembly, in terms of development fewer connection pipes, bends, flanges and **less man-hours needed for assembly**.

This construction concept allows to have **reduced footprint district station** compared to the conventional one.

Dival SQD competitive advantages

- Compact and simple design
- High accuracy
- High turn-down ratio
- Fail Open plug and seat regulator
- Built-in replaceable cartridge filter
- Token IRV
- Top Entry
- Easy maintenance
- In-build accessories
- Balanced type
- Biomethane compatible and 20% Hydrogen blending compatible. Higher blending available on request

Features

Features	Values
Design pressure* (PS[1] / DP[2])	up to 0.6 MPa up to 6 barg
Ambient temperature* (TS[1])**	from -20 °C to +60 °C from -4 °F to +140 °F
Inlet gas temperature*,***	from -20 °C to +60 °C from -4 °F to +140 °F
Inlet pressure (MAOP / p_{umax} [1])	from (Pd + 0.01) MPa to 0.6 MPa from (Pd + 0.1) bar to 6 barg
Range of downstream pressure (Wd[1])	• SQD1 from 1.3 to 30 kPa SQD2-6 from 1 to 30 kPa • SQD1 from 13 to 300 mbar SQD2-6 from 10 to 300 mbar
Available accessories	LA slam shut, relief valve
Minimum operating differential pressure (Δp_{min} [1])	0.01 MPa 0.1 barg
Accuracy class (AC[1])	up to 10 | up to 1% absolute (depending on working conditions)
Lock-up pressure class (SG[1])	up to 20 (depending on version and set point)
Nominal size (DN[1,2])	SQD1 in and out DN 40 | 1”1/2 SQD2 in and out DN 50 | 2” SQD6 in DN 50 | 2” and DN 80 | 3” out
Connections	Flanged: Class 150 RF according to ASME B16.5 and ASME B16.42 PN16/25 according to ISO 7005-1 and 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.
(**) 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
Body	Cast iron GS 400 – 18 ISO 1083
Cover	Alluminium
Seat	Brass
Diaphragm	Fabric finish rubber
O-ring	Nitrile rubber
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 **Dival SQD** regulators are designed according to the European standard EN 334.
The regulators react in opening (Fail Open) according to EN 334.

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

EN 334

PED-CE

Springs ranges and control heads

Control heads pressure ranges			
	Control head BP	**Control head MP**	**Spring Table web link**
Model	kPa mbar	kPa mbar	
Dival SQD1	1.3 ÷ 10 13 ÷ 100	10 ÷ 30 100 ÷ 300	TT 1500
Dival SQD2	10 ÷ 30 100 ÷ 300	-	TT 1500
Dival SQD6	10 ÷ 30 100 ÷ 300	-	TT 1500

Table 3 Settings table

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

Maximum allowable operating pressure

Dival SQD1

Design pressure (p_s according to EN334)				
Version	Body		Slam shut	
	MPa	barg	MPa	barg
Cast Iron Body 1" 1/2 x 1" 1/2	0.60	6	2.00	20

Table 4 Design pressure of body and slam shut

Design pressure (p_s according to EN334)				
Parts	Control head			
	BP		MP	
	MPa	barg	MPa	barg
Cover	2.00	20	2.00	20
Diaphragm	0.03	0.3	0.06	0.6
Max Diaphragm Δp	0.02	0.2	0.03	0.399

Table 5 Design pressure of control heads

MAOP Maximum Allowable Operating Pressure (p_{umax} according to EN334)					
Version		Control head			
		BP		MP	
		MPa	barg	MPa	barg
WITH / WITHOUT CE MARKING	All versions	0.60	6	0.60	6

Table 6 MAOP Maximum Allowable Operating Pressure with/without CE marking

Dival SQD2 and SQD6

Design pressure (p_s according to EN334)				
Version	Body		Slam shut	
	MPa	barg	MPa	barg
Cast Iron Body 2"x2"	0.60	6	2.00	20

Table 7 Design pressure of body and slam shut

Design pressure (p_s according to EN334)		
Parts	Control head	
	BP	
	MPa	barg
Cover	0.05	0.5
Diaphragm	0.06	0.6
Max Diaphragm Δp	0.03	0.399

Table 8 Design pressure of control heads

MAOP Maximum Allowable Operating Pressure (p_{umax} according to EN334)					
Version		Control head		Body	
		BP			
		MPa	barg	MPa	barg
WITH / WITHOUT CE MARKING	All versions	0.05	0.5	0.60	6

Table 9 MAOP Maximum Allowable Operating Pressure with/without CE marking

Accessories

For the pressure regulators:

- Cartridge filter
- Slam shut

Cartridge Filter

The regulators Dival SQD are designed with built-in high capacity cartridge filter with low pressure drop. The cartridge has 5 microns filtration efficiency.

For Dival SQD1-2 models, the filter body is integral to the pressure regulator, allowing considerable advantages in terms of size and installation. For the Dival SQD6 model the filter is connected with a special flanged coupling.

All filters are characterized by a great accessibility to the filtering cartridge which means easy cartridge replacement without the need to disassemble the body of the filter from the regulator.

Coupling Filter / Regulator Model	
Regulator	**Size filter cartridge**
Dival SQD1	G. 0.5
Dival SQD2	G. 1
Dival SQD6	G. 2

Table 10 Filter's cartridge size table

Slam Shut LA

The Dival SQD pressure regulator offers the possibility of installing an **incorporated LA slam shut valve** and this can be done either during the manufacturing process or be retrofited in the field.

LA is available for all sizes

Retrofitting can be done without modifying the pressure regulator assembly. With the built-in slam shut, the Cg valve coefficients is 5% lower than the corresponding version without.

The main characteristics of this device are:

- OPSO — Overpressure Shut-Off
- UPSO — Underpressure Shut-Off
- Internal by-pass
- Push button for tripping test
- Compact dimensions
- Easy maintenance
- Remote tripping option
- Limit switch option

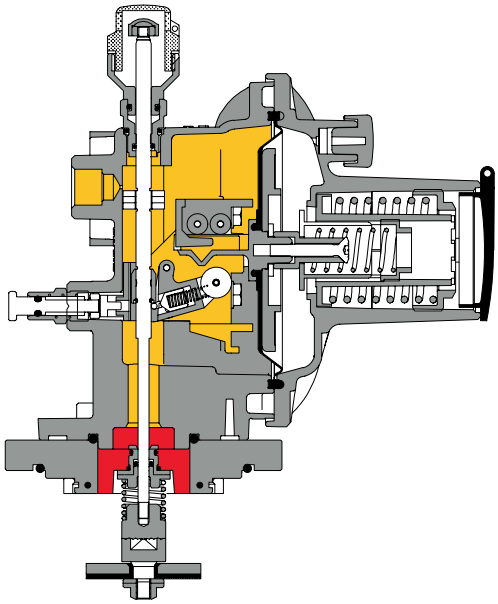


Figure 3 Dival SQD with LA

Pressure switch types and ranges					
SSV Type	**Model**	**Operation**	**Range Wh**		**Spring Table web link**
			KPa	**mbarg**	
LA	BP	OPSO	3 - 18	30 - 180	TT 00214
		UPSO	0.6 - 6	6 - 60	
LA	MP	OPSO	14 - 45	140 - 450	TT 00214
		UPSO	1 - 24	10 - 240	
LA	TR	OPSO	25 - 550	250 - 5500	TT 00214
		UPSO	10 - 350	100 - 3500	

Table 11 Settings table

Weights and Dimensions

Dival SQD1

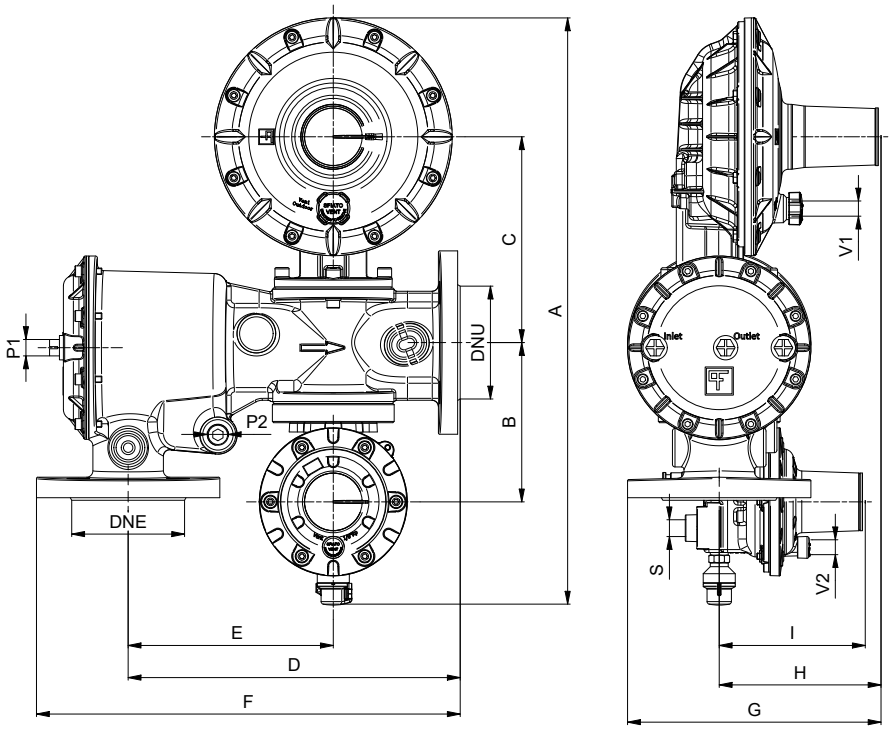


Figure 4 Dival SQD1 dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)		
	[mm]	inches
A	460	18.1”
B	124.5	4.9”
C	160.5	6.3”
D	259	10.2”
E	160	6.3”
F	330.5	13.01”
G	195.5	7.7”
H	124	4.9”
I	114	4.5”
DNE	1"1/2	
DNU	1"1/2	
Weight	Kg	lbs
	12.5	28

Table 12 Weights and dimensions

Dival SQD2

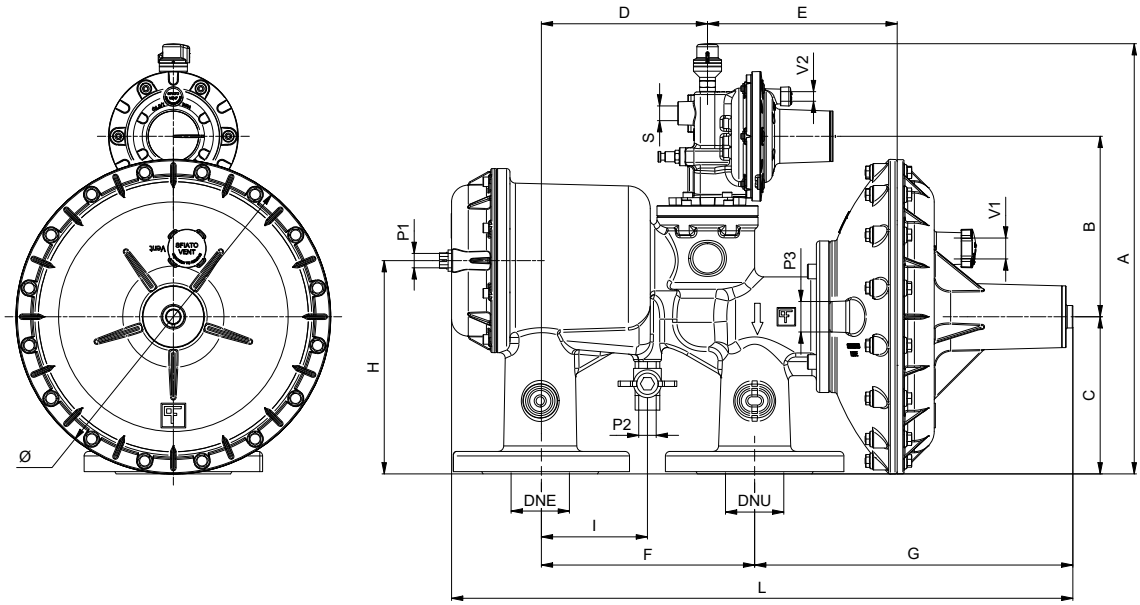


Figure 5 Dival SQD2 dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)		
	[mm]	inches
A	384	15.1”
B	161	6.3”
C	140	5.5”
D	149	5.9”
E	169	6.7”
F	191	7.52”
G	283.5	11.2”
H	190	7.5”
I	95.5	3.8”
L	553.5	21.8”
ø	280	11.0”
DNE	2"	
DNU	2"	
Weight	Kg	lbs
	20.34	45

Table 13 Weights and dimensions

Dival SQD6

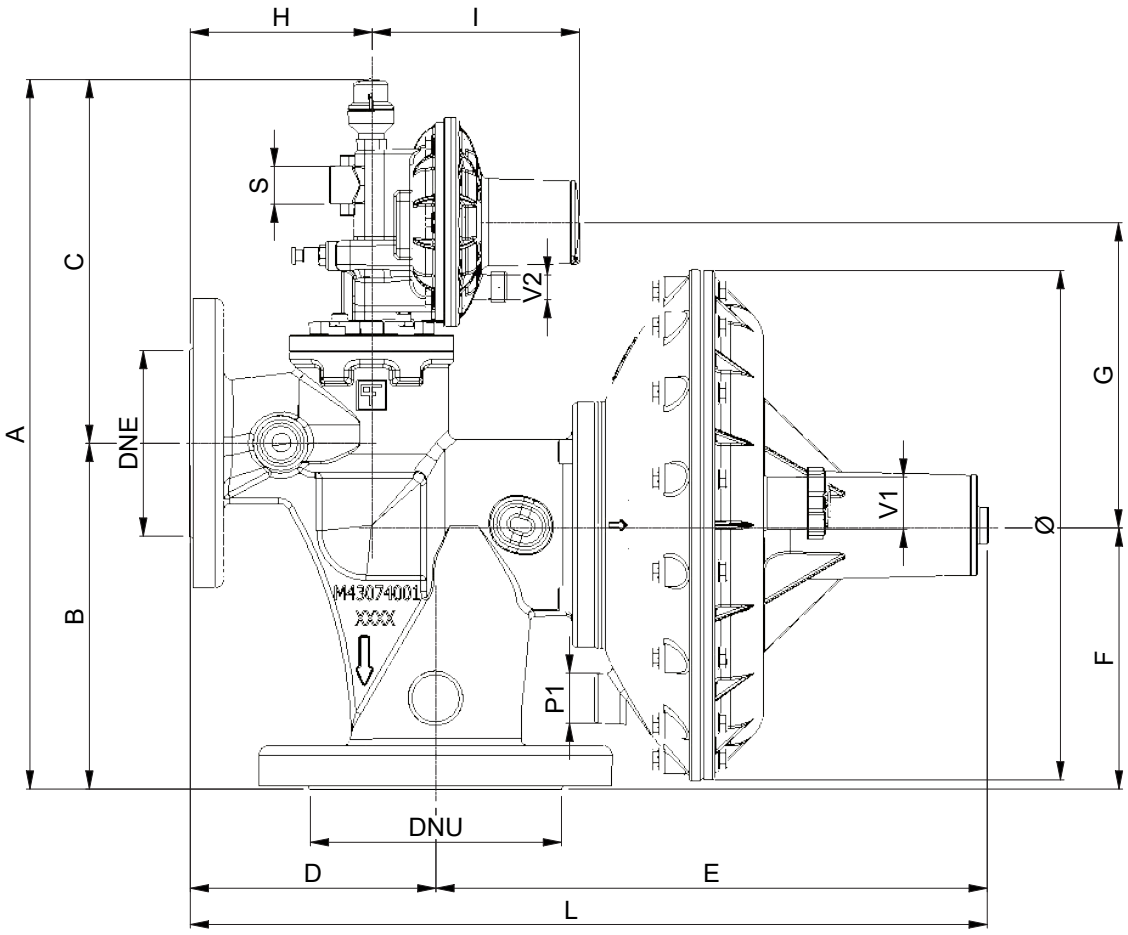


Figure 6 Dival SQD6 dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)		
	[mm]	inches
A	390	15.4”
B	190	7.5”
C	200	7.9”
D	135	5.3”
E	303	11.9”
F	143.5	5.65”
G	168	6.6”
H	100	3.9”
I	114	4.5”
L	438	17.2”
ø	280	11.0”
DNE	2"	
DNU	3"	
Weight	Kg	lbs
	17.75	39.2

Table 14 Weights and dimensions

Dival SQD6 + filter

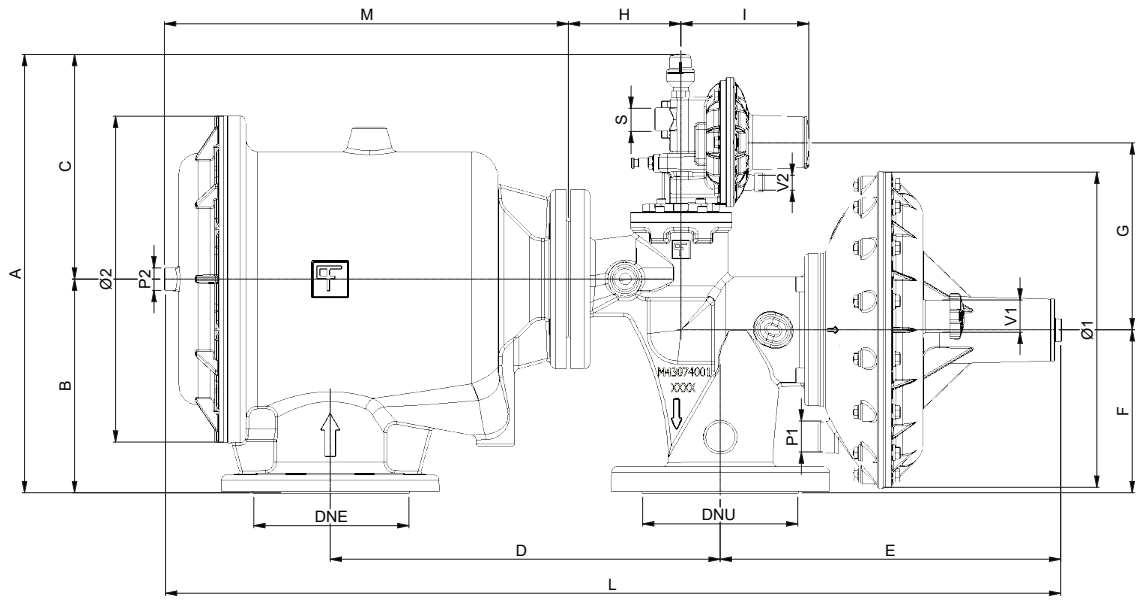


Figure 7 Dival SQD6 + filter dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)		
	[mm]	inches
A	390	15.4”
B	190	7.5”
C	200	7.9”
D	349	13.7”
E	303	11.9”
F	143.5	5.65”
G	168	6.6”
H	100	3.9”
I	114	4.5”
L	800	31.5”
M	361.5	14.2”
ø1	280	11.0”
ø2	290	11.4”
DNE	3"	
DNU	3"	
Weight	Kg	lbs
	43	95

Table 15 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. Sizing is available through the on-line Pietro Fiorentini sizing program.

Flow rate coefficient			
Nominal size	Dival SQD1	Dival SQD2	Dival SQD6
Cg	213	396	930
K1	95	98	98

Table 16 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 on-line 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 17)
T = gas temperature (°C)

$$F_c = \sqrt{\frac{316.44}{S \times (459.67 + T)}}$$

S = relative density (refer to Table 17)
T = gas temperature (°F)

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 17 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 | T= 32 °F; P= 14.5 psig
Stm^3/h reference conditions:
T= 15 °C; P= 1 barg | T= 59 °F; P= 14.5 psig

Table 18 Flow rate conversion

CAUTION:

In order to get optimal performance, to avoid premature wear on the regulators components, and to limit noise emissions, it is recommended to check the gas speed and its compliance with local practice and regulations. The gas speed at the outlet flange of the regulator which be calculated by 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

$$V = 0.0498 \times \frac{Q}{DN^2} \times \frac{14.504 - 0.002 \times Pd}{14.504 + Pd}$$

V = gas speed in ft/s
Q = gas flow rate in Scfh
DN = nominal size of regular in inches
Pd = outlet pressure in psi

Flow capacity tables

Dival SQD1 BP - DN 1”1/2 [40 mm]

From 2 kPa [20 mbarg] to 10 kPa [100 mbarg]

Dival SQD1 BP - (accuracy 10% ; AC10 according to EN334)											
Inlet pressure		**Outlet pressure**									
		2 kPa / 20 mbarg		2.5 kPa / 25 mbarg		5 kPa / 50 mbarg		7.5 kPa / 75 mbarg		10 kPa / 100 mbarg	
MPa	barg	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh
0.05	0.5	79	2800	82	2900	80	2900	88	3200	96	3400
0.10	1.0	185	6600	185	6600	150	5300	160	5700	171	6100
0.20	2.0	130	4600	191	6800	323	11500	321	11400	319	11300
0.30	3.0	144	5100	187	6700	319	11300	376	13300	433	15300
0.40	4.0	162	5800	175	6200	274	9700	336	11900	399	14100
0.50	5.0	162	5800	175	6200	274	9700	336	11900	399	14100
0.60	6.0	164	5800	166	5900	256	9100	317	11200	378	13400
Cg = 213 K1= 95											

Table 19 Dival SQD1 BP flow rate with outlet pressure from 2 kPa [20 mbarg] to 10 kPa [100 mbarg]

Dival SQD1 MP - DN 1”1/2 [40 mm]

From 11 kPa [110 mbarg] to 30 kPa [300 mbarg]

Dival SQD1 MP - (accuracy 10% ; AC10 according to EN334)											
Inlet pressure		**Outlet pressure**									
		11 kPa / 110 mbarg		15 kPa / 150 mbarg		20 kPa / 200 mbarg		25 kPa / 250 mbarg		30 kPa / 300 mbarg	
MPa	barg	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh
0.05	0.5	73	2600	76	2700	81	2900	77	2800	74	2700
0.10	1.0	149	5300	152	5400	156	5600	157	5600	158	5600
0.20	2.0	296	10500	290	10300	282	10000	288	10200	294	10400
0.30	3.0	419	14800	418	14800	417	14800	415	14700	414	14700
0.40	4.0	441	15600	498	17600	570	20200	547	19400	525	18600
0.50	5.0	418	14800	484	17100	567	20100	605	21400	642	22700
0.60	6.0	395	14000	471	16700	565	20000	662	23400	759	26900
Cg = 213 K1= 95											

Table 20 Dival SQD1 MP flow rate with outlet pressure from 11 kPa [110 mbarg] to 30 kPa [300 mbarg]

Note: Recommended max flow rate are considering multiple factors such as: extend the regulator’s life, mitigate the erosion/vibrations for high velocity and to minimize the noise emission.
Remark: all capacity stated are considering a stand alone regulator. In case of incorporated accessories a reduction of flow shall be considered.

Dival SQD2 - DN 2” [50 mm]

From 2 kPa [20 mbarg] to 30 kPa [300 mbarg]

Dival SQD2 - (accuracy 10% ; AC10 according to EN334)											
Inlet pressure		**Outlet pressure**									
		2 kPa / 20 mbarg		5 kPa / 50 mbarg		10 kPa / 100 mbarg		20 kPa / 200 mbarg		30 kPa / 300 mbarg	
MPa	barg	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh
0.05	0.5	105	3800	135	4800	135	4800	130	4600	153	5500
0.10	1.0	84	3000	206	7300	235	8300	250	8900	320	11300
0.20	2.0	648	22900	454	16100	444	15700	463	16400	601	21300
0.30	3.0	508	18000	812	28700	688	24300	668	23600	778	27500
0.40	4.0	557	19700	976	34500	921	32600	876	31000	1051	37200
0.50	5.0	629	22300	1228	43400	1159	41000	1164	41200	1253	44300
0.60	6.0	700	24800	1480	52300	1396	49300	1451	51300	1455	51400
Cg = 396 K1= 98											

Table 21 Dival SQD2 flow rate with outlet pressure from 2 kPa [20 mbarg] to 30 kPa [300 mbarg]

Dival SQD6 - DN 2”x3” [50x80 mm]

From 2 kPa [20 mbarg] to 30 kPa [300 mbarg]

Dival SQD6 - (accuracy 10% ; AC10 according to EN334)											
Inlet pressure		**Outlet pressure**									
		2 kPa / 20 mbarg		5 kPa / 50 mbarg		10 kPa / 100 mbarg		20 kPa / 200 mbarg		30 kPa / 300 mbarg	
MPa	barg	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh
0.05	0.5	312	11100	280	9900	292	10400	285	10100	272	9700
0.10	1.0	604	21400	439	15600	459	16300	519	18400	609	21600
0.20	2.0	636	22500	988	34900	898	31800	963	34100	1173	41500
0.30	3.0	602	21300	1585	56000	1395	49300	1393	49200	1652	58400
0.40	4.0	567	20100	2182	77100	1892	66900	1822	64400	2131	75300
0.50	5.0	515	18200	1975	69800	2536	89600	2253	79600	2651	93700
0.60	6.0	462	16400	1769	62500	3180	112300	2683	94800	3170	112000
Cg = 930 K1= 98											

Table 22 Dival SQD6 flow rate with outlet pressure from 2 kPa [20 mbarg] to 30 kPa [300 mbarg]

Note: Recommended max flow rate are considering multiple factors such as: extend the regulator’s life, mitigate the erosion/vibrations for high velocity and to minimize the noise emission.
Remark: all capacity stated are considering a stand alone regulator. In case of incorporated accessories a reduction of flow shall be considered.

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