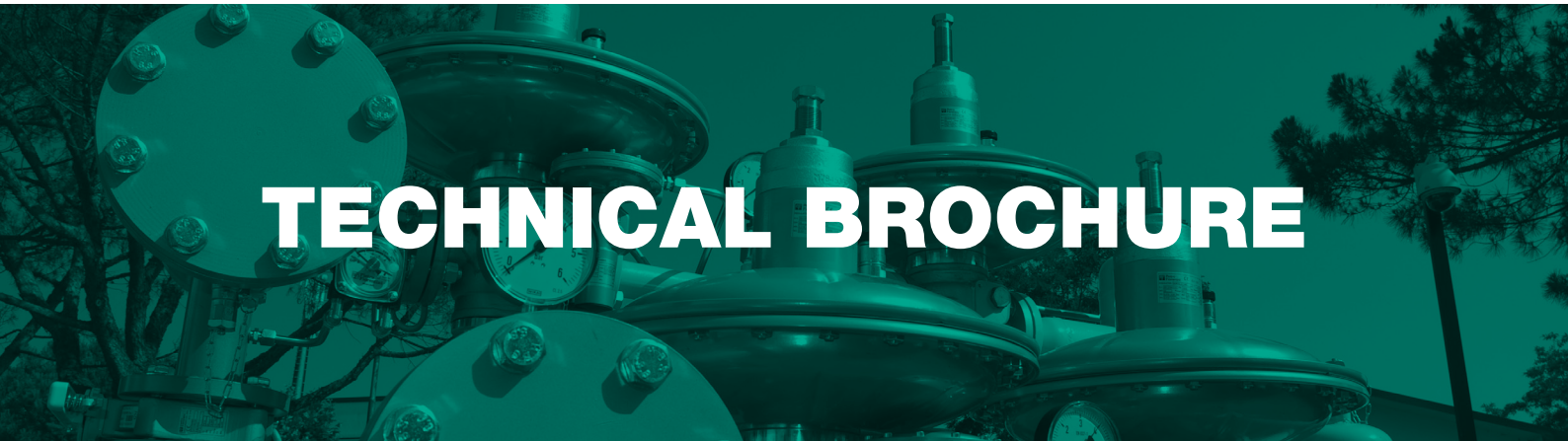
Pietro Fiorentini

Trias

Medium Low Pressure Gas Regulator



TECHNICAL BROCHURE

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The data are not binding. We reserve the right
to make changes without prior notice.

trias_technicalbrochure_ENG_revA

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.

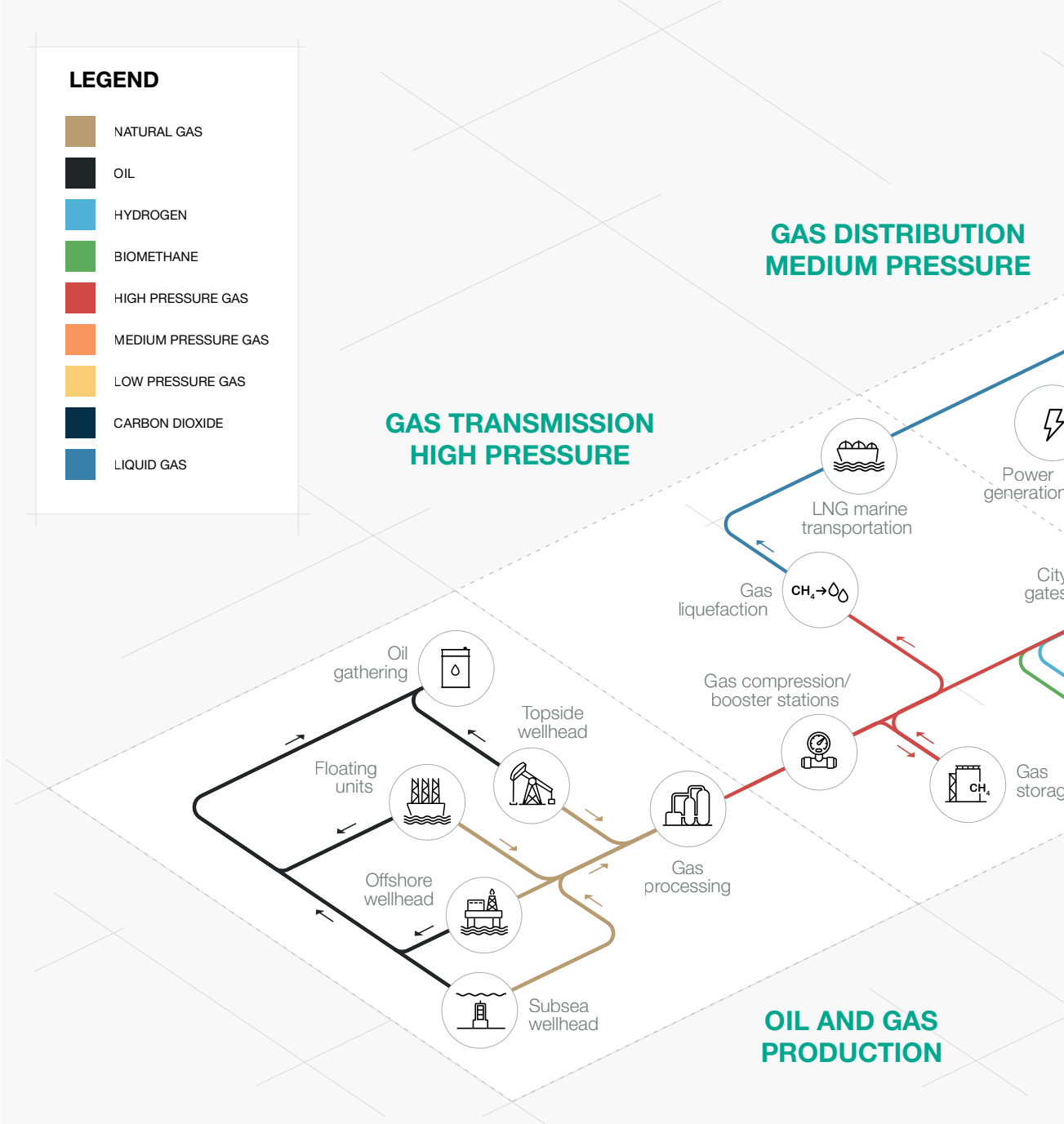
We are constantly evolving to meet our customers' highest expectations in terms of quality and reliability.

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



Green icon indicates the application where this product is suitable for

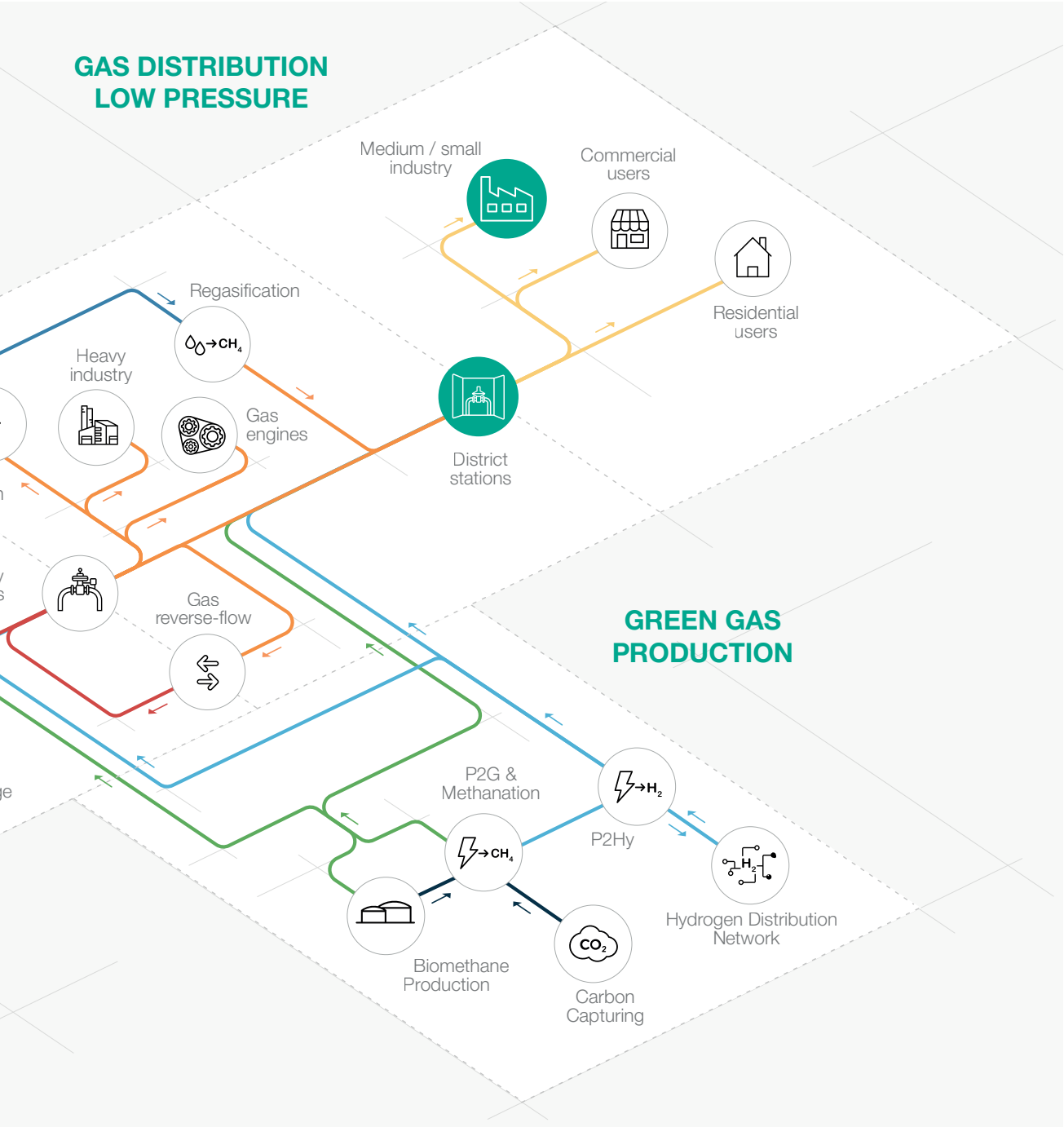


Figure 1 Area of Application Map

Introduction

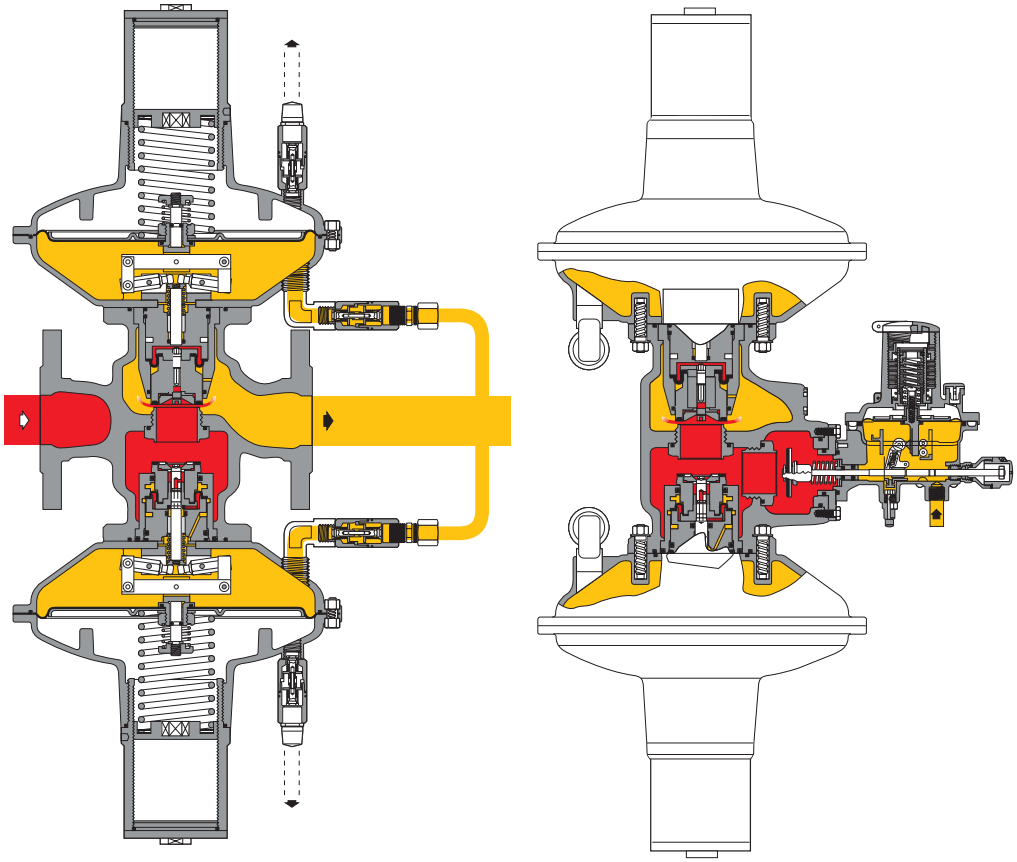
The **Trias** by Pietro Fiorentini is a **lever-operated** gas pressure regulator controlled by a diaphragm and contrasting regulated spring action.

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 Trias is **Hydrogen Ready** for NG-H2 blending.



Inlet pressure

Outlet pressure

Figure 2 Trias BM

Features and Calibration ranges

The **Trias** 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.

This regulator is suitable for use with previously filtered, non-corrosive gases and distribution networks as well as high load industrial applications.

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.

The Trias pressure regulators incorporates the concept of active regulator plus dual overpressure protection devices in the same body.

- **Trias BM:** active regulator plus incorporated monitor and slam shut.
- **Trias BB:** active regulator plus double incorporated slam shuts.

Trias competitive advantages

- Balanced type
- Operates with low differential pressure
- High accuracy
- Fail Open plug and seat regulator
- Token IRV
- High turndown ratio
- Top Entry
- Easy maintenance
- Compact dimensions
- Biomethane compatible and 20% Hydrogen blending compatible. Higher blending available on request

Features

Features	Values
Design pressure* (PS[1] / DP[2])	up to 1.7 MPa up to 17 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 0.012 to 1.7 MPa from 0.12 to 17 barg
Range of downstream pressure (Wd[1])	from 1.2 to 400 kPa from 12 to 4000 mbarg
Available accessories	none. Pre-defined configurations
Minimum operating differential pressure (Δp_{min}[1])	0.01 MPa 0.1 barg
Accuracy class (AC[1])	up to 5
Lock-up pressure class (SG[1])	up to 20
Nominal size (DN[1,2])	DN 40 | 1” 1/2; DN 50 | 2”
Connections	Class 150 RF according to ASME B16.5 and PN16 according to ISO 7005

([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 ductile iron GS 400 – 18 ISO 1083
Cover	Die cast alluminium
Seat	Brass
Diaphragm	Rubberized canvas
O-rings	Nitrile 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

The **Trias** regulators are designed according to the European standard EN 334.
The regulators react 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 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	Control head TR	Spring Table web link
Modello	DN	kPa mbar	kPa mbar	kPa mbar	
Trias	1" 1/2 - 2"	1.2 ÷ 8.5 12 ÷ 85	8 ÷ 34 80 ÷ 340	30 ÷ 420 300 ÷ 4200	TT 1393

Table 3 Control heads calibration range

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

Maximum allowable operating pressure

Design pressure (p_s according to EN334)				
Version	Body		Slam shut	
	MPa	barg	MPa	barg
PN16 Cast Iron body	1.60	16	2.00	20
#150 Cast Iron body	1.70	17	2.00	20

Table 5 Design pressure of body and slam shut

Design pressure (p_s according to EN334)				
Parts	Control head			
	BP/MP		TR	
	MPa	barg	MPa	barg
Cover	0.80	8	1.70	17
Diaphragm	0.06	0.64	0.80	8
Max Diaphragm Δp	0.04	0.43	0.53	5.32

Table 6 Design pressure of control heads

MAOP Maximum Allowable Operating Pressure (p_{umax} according to EN334)					
Version		Control head			
		BP/MP		TR	
		MPa	barg	MPa	barg
WITH / WITHOUT CE MARKING	PN16 (all body materials) + SSV	2.00	16	2.00	16
	#150 Cast Iron body + SSV	1.70	17	1.70	17

Table 7 MAOP Maximum Allowable Operating Pressure with/without CE marking

Versions

Trias BM

The Trias BM option offer a regulator with an **additional incorporated monitor** regulator. Monitor regulator is an emergency regulator which takes over if, for some reason, the active regulator fails and allows the downstream pressure to increase until it reaches the monitor set-point pressure. This emergency regulator (monitor) is directly assembled to the body of the main regulator.

Both pressure regulators, therefore, use the same valve body but they are controlled by **two independent control mechanism** (control heads, plug and shaft, etc). The operational characteristics of the monitor are the same as the regulator.

Furthermore, as a second level of protection the Trias has a slam shut on board which, in case of both active and monitor fails, close the gas supply within 2 seconds from the overpressure event.

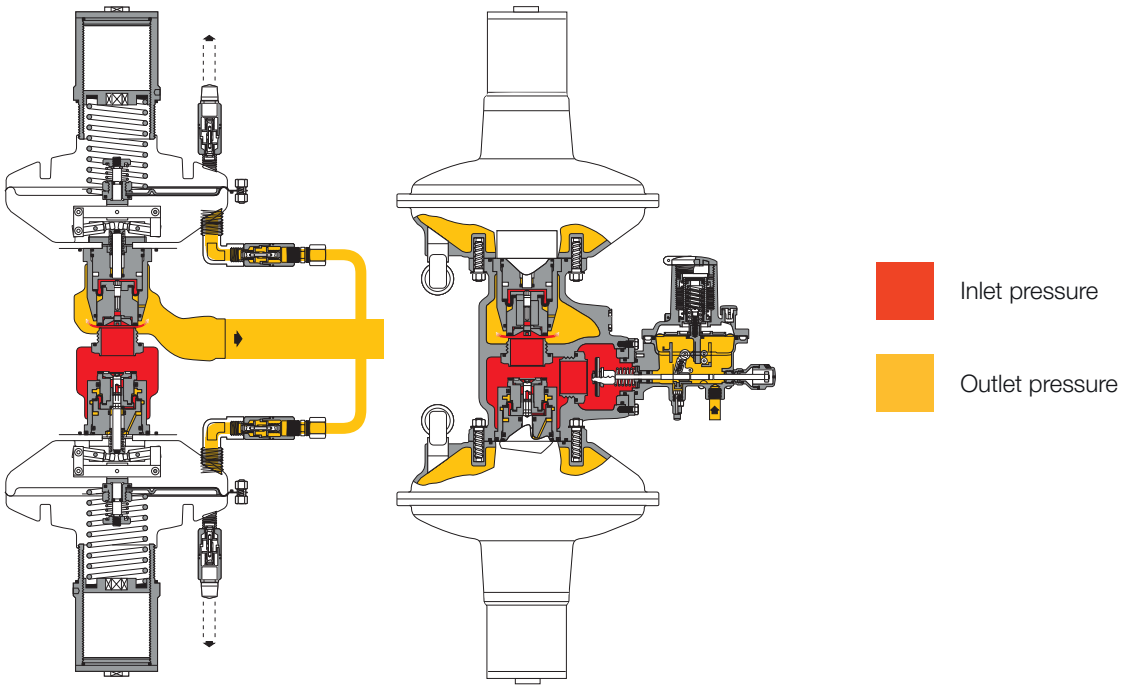


Figure 3 Trias BM with monitor and slam shut

Trias BB

The Trias BB option offer a regulator with a **dual slam shut** for an additional safety layer built in the same body.

Both slam shuts use the same valve body but they are controlled by **two independent control mechanism** (pressure switch, plug and shaft, etc). In case the first slam shut fails, the secondary, usually set slightly higher than the first close the gas supply within 2 seconds from the overpressure event.

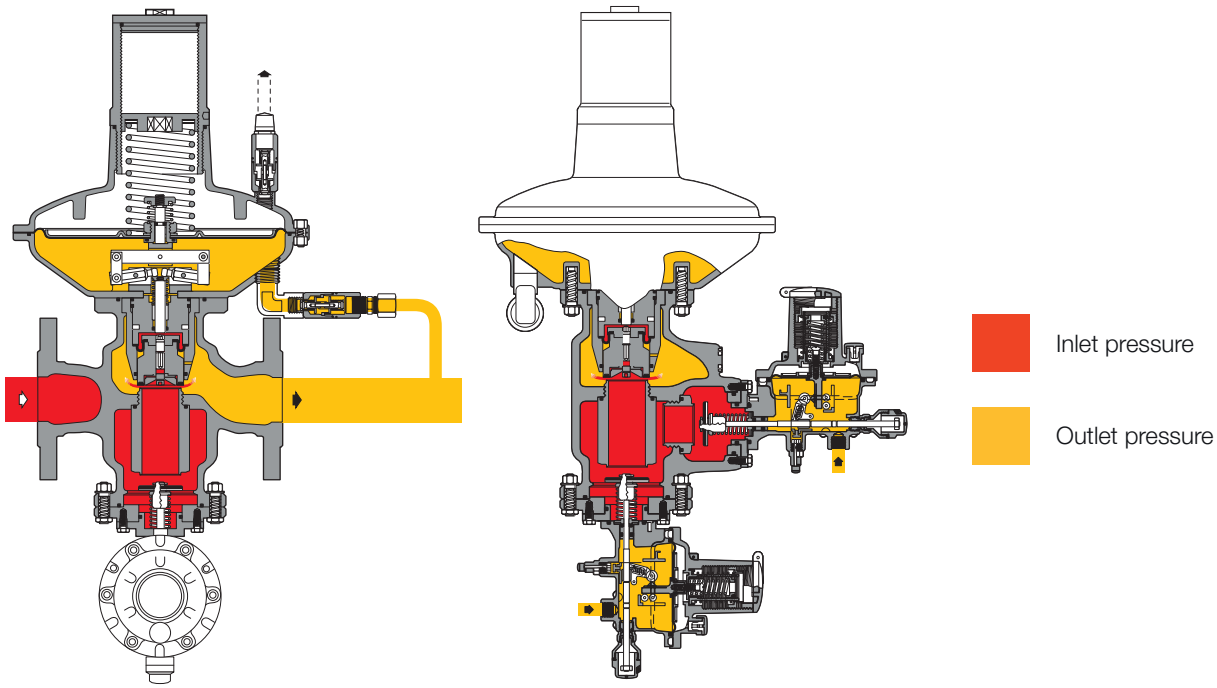


Figure 4 Trias BB with double slam shut

Slam Shut LA

Both Trias versions BM | BB have an **incorporated LA slam shut valve** which is installed during the manufacturing process.

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

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 8 Settings table

Weights and Dimensions

Trias BM

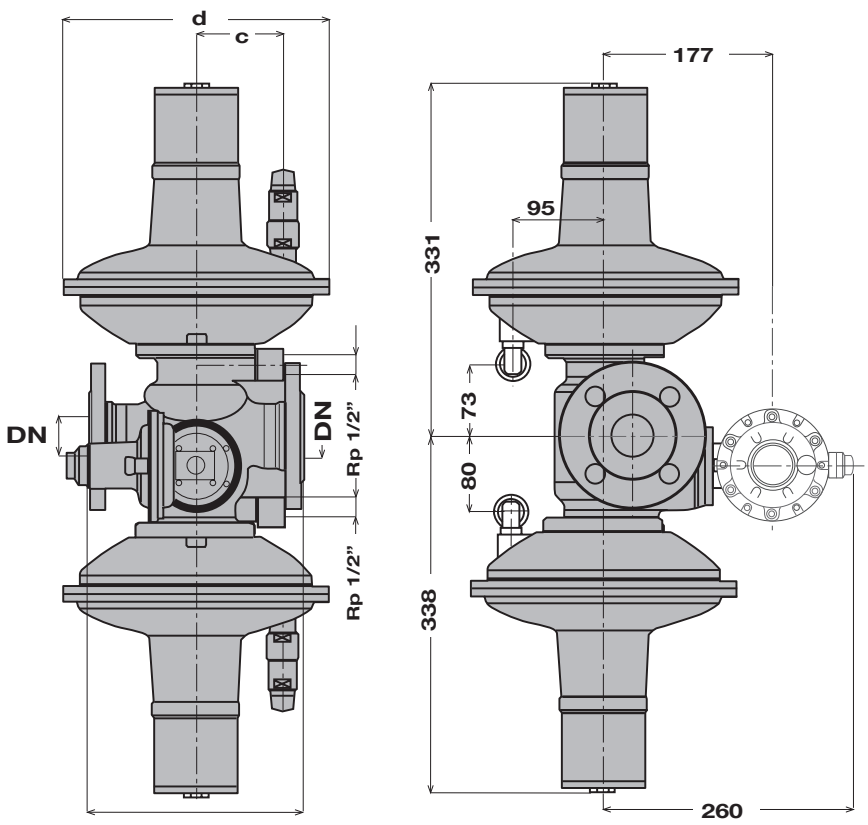


Figure 5 Trias BM dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)					
Size (DN) - [mm]		**40**		**50**	
Size (DN) - inches		**1” 1/2**		**2”**	
		[mm]	inches	[mm]	inches
S		222	8.7”	254	10.0”
BP/MP	d	275	10.8”	275	10.8”
	c	90	3.5”	90	3.5”
TR	d	195	7.7”	195	7.7”
	c	60	2.4”	60	2.4”
Tubing Connections		Øe 10 x Øi 8 (on request imperial sizing)			
Weight		Kg	lbs	Kg	lbs
		27	59.5	30	66.1

Table 9 Weights and dimensions

Trias BB

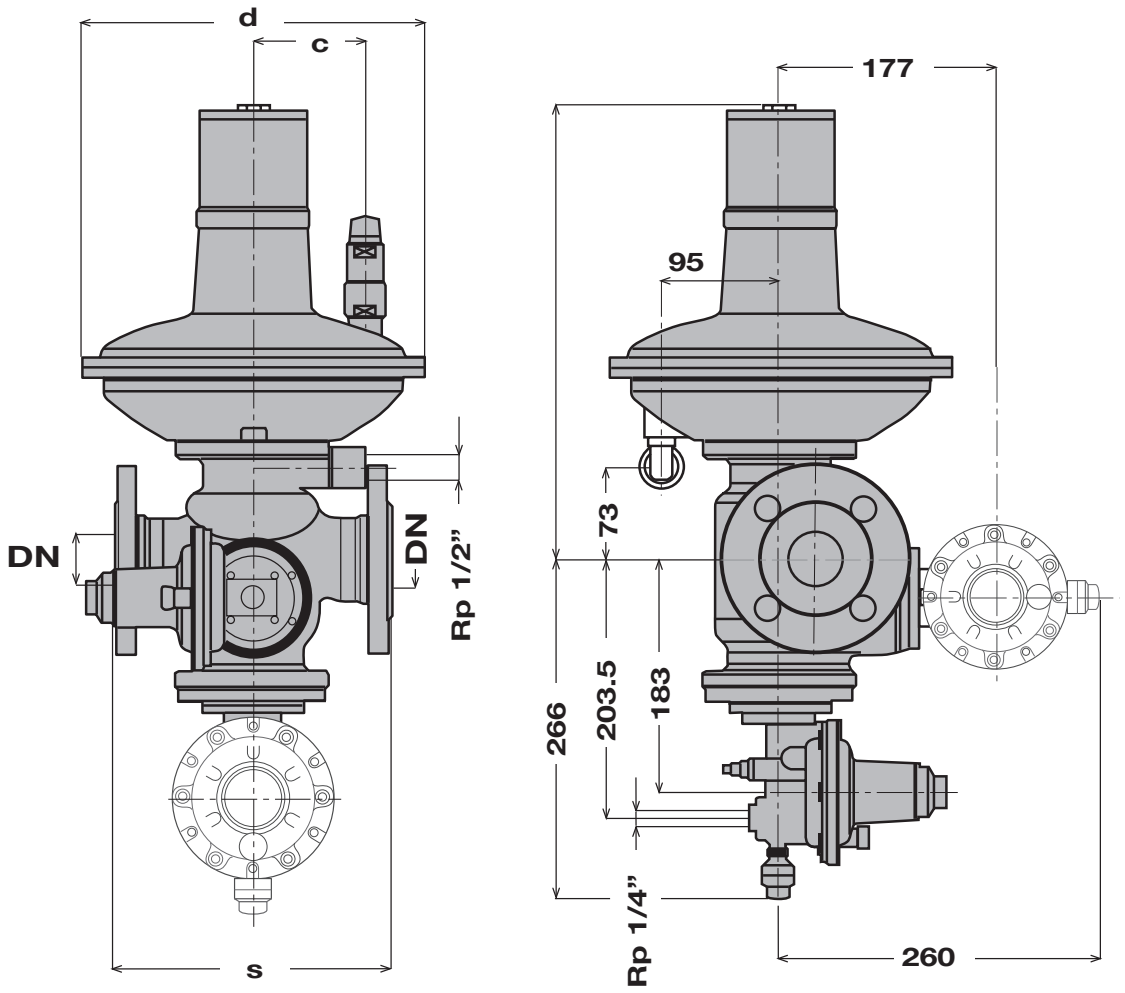


Figure 6 Trias BB dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)					
Size (DN) - [mm]		**40**		**50**	
Size (DN) - inches		**1” 1/2**		**2”**	
		[mm]	inches	[mm]	inches
S		222	8.7”	254	10.0”
BP/MP	d	275	10.8”	275	10.8”
	c	90	3.5”	90	3.5”
TR	d	195	7.7”	195	7.7”
	c	60	2.4”	60	2.4”
Tubing Connections		Øe 10 x Øi 8 (on request imperial sizing)			
Weight		Kg	lbs	Kg	lbs
		20	44.1	33	72.8

Table 10 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	BP	MP	TR	BP	MP	TR
Nominal size	40			50		
Inches	1” 1/2			2”		
Cg Trias BB	562	562	562	590	590	590
Cg Trias BM	556	556	556	576	576	576
K1	93.5	93.5	93.5	93.5	93.5	93.5

Table 11 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 12)
T = gas temperature (°C)

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

S = relative density (refer to Table 12)
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 12 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 13 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

Trias BP - DN 1”1/2

From 2 kPa [20 mbarg] to 8.5 kPa [85 mbarg]

Trias BP - (accuracy 10% ; AC10 according to EN334)											
Inlet pressure		**Outlet pressure**									
		2 kPa / 20 mbarg		2.5 kPa / 25 mbarg		4 kPa / 40 mbarg		6 kPa / 60 mbarg		8.5 kPa / 85 mbarg	
MPa	barg	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh
0.05	0.5	300	10600	301	10700	306	10900	314	11100	315	11200
0.10	1.0	549	19400	549	19400	549	19400	529	18700	499	17700
0.20	2.0	618	21900	629	22300	662	23400	721	25500	783	27700
0.30	3.0	618	21900	629	22300	661	23400	728	25800	819	29000
0.50	5.0	646	22900	652	23100	670	23700	807	28500	995	35200
1.00	10.0	644	22800	649	23000	667	23600	803	28400	990	35000
1.50	15.0	641	22700	647	22900	664	23500	800	28300	986	34900
Cg = 562 K1= 91.5											

Table 14 Trias BP flow rate with outlet pressure from 2 kPa [20 mbarg] to 8.5 kPa [85 mbarg]

Trias BP - DN 2”

From 2 kPa [20 mbarg] to 8.5 kPa [85 mbarg]

Trias BP - (accuracy 10% ; AC10 according to EN334)											
Inlet pressure		**Outlet pressure**									
		2 kPa / 20 mbarg		2.5 kPa / 25 mbarg		4 kPa / 40 mbarg		6 kPa / 60 mbarg		8.5 kPa / 85 mbarg	
MPa	barg	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh
0.05	0.5	350	12400	355	12600	370	13100	388	13800	389	13800
0.10	1.0	599	21200	599	21200	599	21200	599	21200	603	21300
0.20	2.0	998	35300	1006	35600	1031	36500	1067	37700	1108	39200
0.30	3.0	996	35200	1005	35500	1030	36400	1066	37700	1118	39500
0.50	5.0	994	35100	1003	35500	1028	36300	1064	37600	1116	39500
1.00	10.0	990	35000	998	35300	1023	36200	1059	37400	1111	39300
1.50	15.0	986	34900	994	35100	1019	36000	1055	37300	1107	39100
Cg = 590 K1= 91.5											

Table 15 Trias BP flow rate with outlet pressure from 2 kPa [20 mbarg] to 8.5 kPa [85 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.

Trias MP - DN 1”1/2

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

Trias 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	304	10800	320	11300	299	10600	279	9900	258	9200
0.10	1.0	499	17700	529	18700	512	18100	494	17500	477	16900
0.20	2.0	794	28100	818	28900	812	28700	806	28500	801	28300
0.30	3.0	875	30900	897	31700	926	32700	956	33800	985	34800
0.50	5.0	995	35200	895	31700	924	32700	954	33700	983	34800
1.00	10.0	990	35000	891	31500	920	32500	950	33600	979	34600
1.50	15.0	986	34900	888	31400	917	32400	946	33500	975	34500

Cg = 562 K1= 91.5

Table 16 Trias MP flow rate with outlet pressure from 11 kPa [110 mbarg] to 30 kPa [300 mbarg]

Trias MP - DN 2”

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

Trias 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	361	12800	350	12400	335	11900	320	11300	306	10900
0.10	1.0	611	21600	599	21200	585	20700	570	20200	555	19600
0.20	2.0	1136	40200	998	35300	1056	37300	1115	39400	1174	41500
0.30	3.0	1174	41500	1196	42300	1225	43300	1255	44400	1284	45400
0.50	5.0	1171	41400	1194	42200	1223	43200	1252	44300	1282	45300
1.00	10.0	1166	41200	1287	45500	1346	47600	1404	49600	1462	51700
1.50	15.0	1162	41100	1282	45300	1340	47400	1398	49400	1456	51500

Cg = 590 K1= 91.5

Table 17 Trias 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.

Trias TR - DN 1”1/2

From 50 kPa [500 mbarg] to 0.4 MPa [4 barg]

Trias TR - (accuracy 10% ; AC10 according to EN334)

Inlet pressure		Outlet pressure									
		50 kPa / 500 mbarg		0.1 MPa / 1 barg		0.2 kPa / 2 barg		0.3 kPa / 3 barg		0.4 MPa / 4 barg	
MPa	barg	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh
0.05	0.5	-	-	-	-	-	-	-	-	-	-
0.10	1.0	420	14900	-	-	-	-	-	-	-	-
0.20	2.0	898	31800	799	28300	-	-	-	-	-	-
0.30	3.0	997	35300	1197	42300	899	31800	-	-	-	-
0.50	5.0	1194	42200	1493	52800	1694	59900	1497	52900	1199	42400
1.00	10.0	1189	42000	1487	52600	1984	70100	2483	87700	2783	98300
1.50	15.0	1184	41900	1481	52300	1976	69800	2472	87300	2969	104900

Cg = 562 K1= 91.5

Table 18 Trias TR flow rate with outlet pressure from 50 kPa [500 mbarg] to 400 kPa [4000 mbarg]

Trias TR - DN 2”

From 50 kPa [500 mbarg] to 0.4 MPa [4 barg]

Trias TR - (accuracy 10% ; AC10 according to EN334)

Inlet pressure		Outlet pressure									
		50 kPa / 500 mbarg		0.1 MPa / 1 barg		0.2 kPa / 2 barg		0.3 kPa / 3 barg		0.4 MPa / 4 barg	
MPa	barg	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh	Stm³/h	Scfh
0.05	0.5	-	-	-	-	-	-	-	-	-	-
0.10	1.0	550	19500	-	-	-	-	-	-	-	-
0.20	2.0	998	35300	899	31800	-	-	-	-	-	-
0.30	3.0	1296	45800	1397	49400	1099	38900	-	-	-	-
0.50	5.0	1393	49200	1792	63300	1894	66900	1896	67000	1399	49400
1.00	10.0	1387	49000	1982	70000	3175	112200	3476	122800	2982	105300
1.50	15.0	1381	48800	1974	69800	3161	111700	3461	122300	3464	122400

Cg = 590 K1= 91.5

Table 19 Trias TR flow rate with outlet pressure from 50 kPa [500 mbarg] to 400 kPa [4000 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.

Customer Centricity

Customer centricity is a way of running your business — implementing a perfect customer experience at each stage of the pipeline. Pietro Fiorentini is one of the main Italian international company with high focus on product and service quality.

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

Support

Pietro Fiorentini's top priority is to provide support to the client in all phases of project development, during installation, start up and operation. Pietro Fiorentini has developed a highly standardized Intervention-Management-System (IMS), which helps to facilitate the entire process and putting the customer at the forefront of every decision in our process while manufacturing or developing a product to help improve the product and service. With our IMS business model many services are available remotely, avoiding long waiting times, improving service, and avoiding unnecessary expenses.

Training

Pietro Fiorentini offers training services available for both experienced operators and new customers. The training is offered for all levels of our customers which can include one or all of the following: sizing of equipment, application, installation, operation, maintenance and is prepared according to the level of use and the customer's need.

Customer Relation Management (CRM)

The service and care of our customers are one of the main missions and vision of Pietro Fiorentini. For this reason, Pietro Fiorentini has enhanced the customer relation management system. This enables us to track every opportunity and request from our customers into one single information point and allows us to coordinate information allowing us to give the customer improved service.

Sustainability

Here at Pietro Fiorentini, we believe in a world capable of improvement through technology 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. We have 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 understand how and why we operate now.

Pietro Fiorentini

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The data are not binding. We reserve the right
to make changes without prior notice.

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