

Technical User Manual

Gas Pressure Regulator

Z Serie DN25 - DN150



Main Features

Direct-acting Z-P Serie Gas Pressure Regulators According to 2014/68/EU Directive, EN334 and EN 14382

- **Balanced valve**
- **Rugged construction for durability**
- **Wide pressure regulation range**
- **Full seal at zero flow**
- **Easy maintenance**
- **Optional minimum and/or maximum pressure slam-shut device**
- **Optional silencer internal and/or external**
- **With or Without SSV**
- **With electric position indicator SSV closed by an inductive proximity switch**
- **Combined monitoring system**
- **Bypass system for to activate ssv easily**

Technical Features



Maximum allowable pressure –PS	50 bar
Inlet pressure range –bPu	1 – 50 bar
Outlet pressure range –Wd	0.3 – 16.000 mbar
Allowable temperature –TS ⁽¹⁾	-20 °C to +60 °C
Inlet gas temperature	-20 °C to +60 °C
Accuracy class –AC	up to AC 2.5
Lock-up pressure class –SG	up to SG 5
Nominal size –DN	DN25 1" DN40 1 1/2" DN50 2" DN65 2 1/2" DN80 3" DN100 4" DN150 6"
Connections ⁽³⁾	PN16, PN25 according to ISO 7005 Class 150 or 300 RF according to ASME B16.5 and

⁽¹⁾ Low temperature version -40°C: available on request

⁽³⁾ On request for other connection class

Metarials

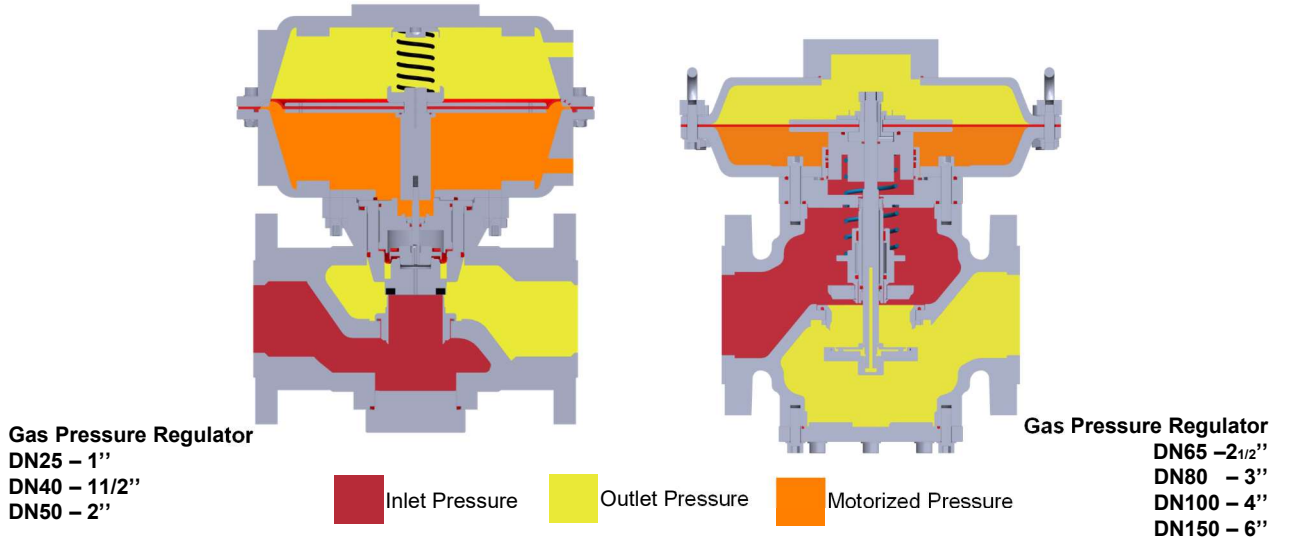
Body ⁽¹⁾	ASTM A 352 LCC
Main Actuator ⁽²⁾	ASTM A 350
Seat ⁽²⁾	Stainless Steel
Internal Parts ⁽²⁾	Stainless steel and brass
Seals	NBR+canvas (powered by hot operation process)
Diaphragm	Synthetic rubber with fabric reinforcement

⁽¹⁾ A 216 WCB: available on request

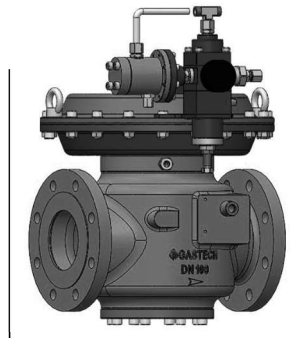
⁽²⁾ Other materials available on request

Gas Pressure Regulator, Z-P Serie

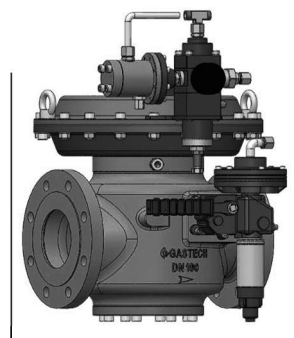
**Desing,
Operational Diagram**



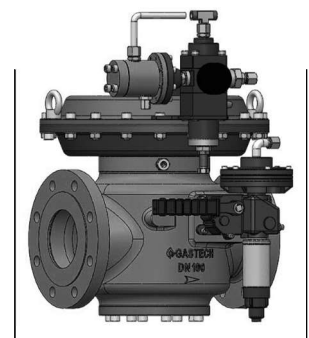
Configurations



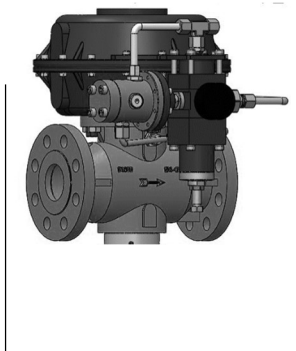
Gas Pressure Regulator
Z65-150



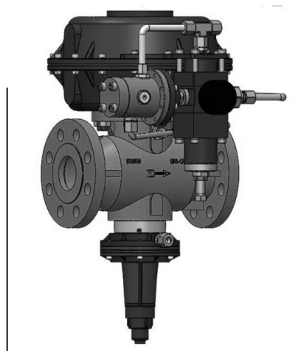
**Gas Pressure Regulator
with Slum Shut Valve**
Z65-150/S Serie



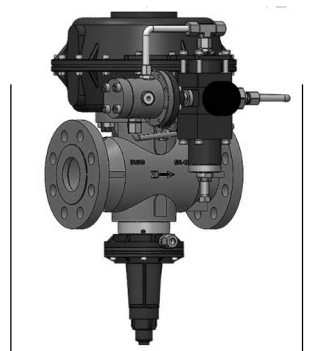
**Gas Pressure Regulator
with Slum Shut Valve + Monitor**
Z65-150M/S Serie



Gas Pressure Regulator
Z25-50



**Gas Pressure Regulator
with Slum Shut Valve**
Z25-50/S Serie



**Gas Pressure Regulator
with Slum Shut Valve + Monitor**
Z25-50M/S Serie

Gas Pressure Regulator, Z Serie

Change & revision history

Date	Page	Reason	Statement

INDEX

Main Features, Technical Features, Materials	1
Desing, Operational Diagram, Configurations	2
Change & revision history.....	3
Index.....	4
Safety and Safe Use.....	5
Summary of symbols, terms and units.....	6
General Description and Operation	7
Environmental conditions, Pipe installation.....	8
Vent Lines for Safety.....	9
General Information for Connection.....	10,11
Connection of the sensing Lines.....	12
Mounting Position.....	12
Dimensions and Weights	13,14
Setting of the outlet pressure	15,16,17,18
Outlet Pressure Range and Setting Springs.....	19
Slum Shut Valve, Technical Features.....	20
Setting Procedure of the Slum Shut Valve	21,22,23

Safety and Safe Use

Warning Notes!

To safely use the equipment, observe the environmental conditions allowed and the data provided on the nameplate of the regulator and any accessories.

To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

Any opening of the valve, replacement of parts or modifications to the original product is the user's responsibility and is done at his own risk.

Caution!

- All activities (mounting, installation and service work, etc.) must be carried out by qualified staff.
- Ensure that the relevant national safety regulations are complied with.
- Any gas pressure regulator that experience a fall or shock must not be put into operation, as this can adversely affect the safety functions even if they do not exhibit any external signs of damage.
- Unsuitable gases or gas components lead to a loss of the safety shutoff function.
- It must not be possible for foreign bodies/particles to enter the gas pressure regulator, as this could have an adverse effect on the safety shutoff function.
- Gases with concentrations of >0.1% for H₂S and NH₃ are only permissible in connection with biogas version.
- Condensation is not permitted in the gas pressure regulator. If not observed, the safety functions are no longer ensured.
- In connection without slum shut valve, the gas pressure regulator must not be used as a safety device. Closing does not take place.
- The Z-P serie gas pressure regulators are designed to withstand gas pressures up to 50 bar in standby mode or working. At a pressure of 50 bar, the Z serie gas pressure regulator remains safely closed or will safely work. If the maximum permissible operating pressure is exceeded, a valve shutdown must be initiated.
- The gas pressure regulator cannot be mounted or replaced while the gas valve is under pressure.
- The impulse pipe (pressure feedback) must be connected to the main outlet gas pipe, downstream from the gas pressure regulator observing a distance of at least 4 x the diameter of the main outlet pipe.
- The upstream and downstream pipes must be cleaned after being laid. Before commissioning, it is essential to ensure that no dirt particles have remained that could enter the gas pressure regulator.
- The slum shut valves supplied by Gastech may only be repaired by Gastech Repair Centers.

Summary of symbols, terms and units

The following table summarizes the symbols and relevant descriptions and unit considered in this chapter and/or used in this document. The symbols are listed in alphabetic order.

Symbol	Terms	Unit
AC	Accuracy class	%
AG	Accuracy group	%
bpu	Inlet pressure range	bar
d	Relative density of natural gas at actual conditions	/
DN	Nominal size	/
DS	Differential strength	/
Δp	Differential pressure	bar
Δp_{min}	Minimum operating differential pressure	bar
IS	Integral strength	/
KG	Flow coefficient	See definition
LpA	Sound pressure level	EN 61672-1
MIPd	Downstream maximum incidental pressure	Bar
p	Component operating pressure	Bar
pb	Atmospheric pressure (absolute pressure)	bar abs
pd	Outlet pressure	Bar
pdmax	Maximum outlet pressure	Bar
pds	Set point	Bar
pf	Lock-up pressure	Bar
pmax	Maximum component operating pressure	Bar
pn	Reference absolute pressure for normal conditions	bar abs
PS	Maximum allowable pressure	Bar
PSD	Specific maximum allowable pressure	Bar
pu	Inlet pressure	Bar
pumax	Maximum inlet pressure	Bar
pumin	Minimum inlet pressure	Bar
SG	Lock-up pressure class	%
SZ	Class of lock-up pressure zone	Lock-up time
TS	Maximum/minimum allowable temperature	°C
V	Gas velocity	m/s
Wd	Set range	Bar
Wds	Specific set range	Bar

General Description and Operation

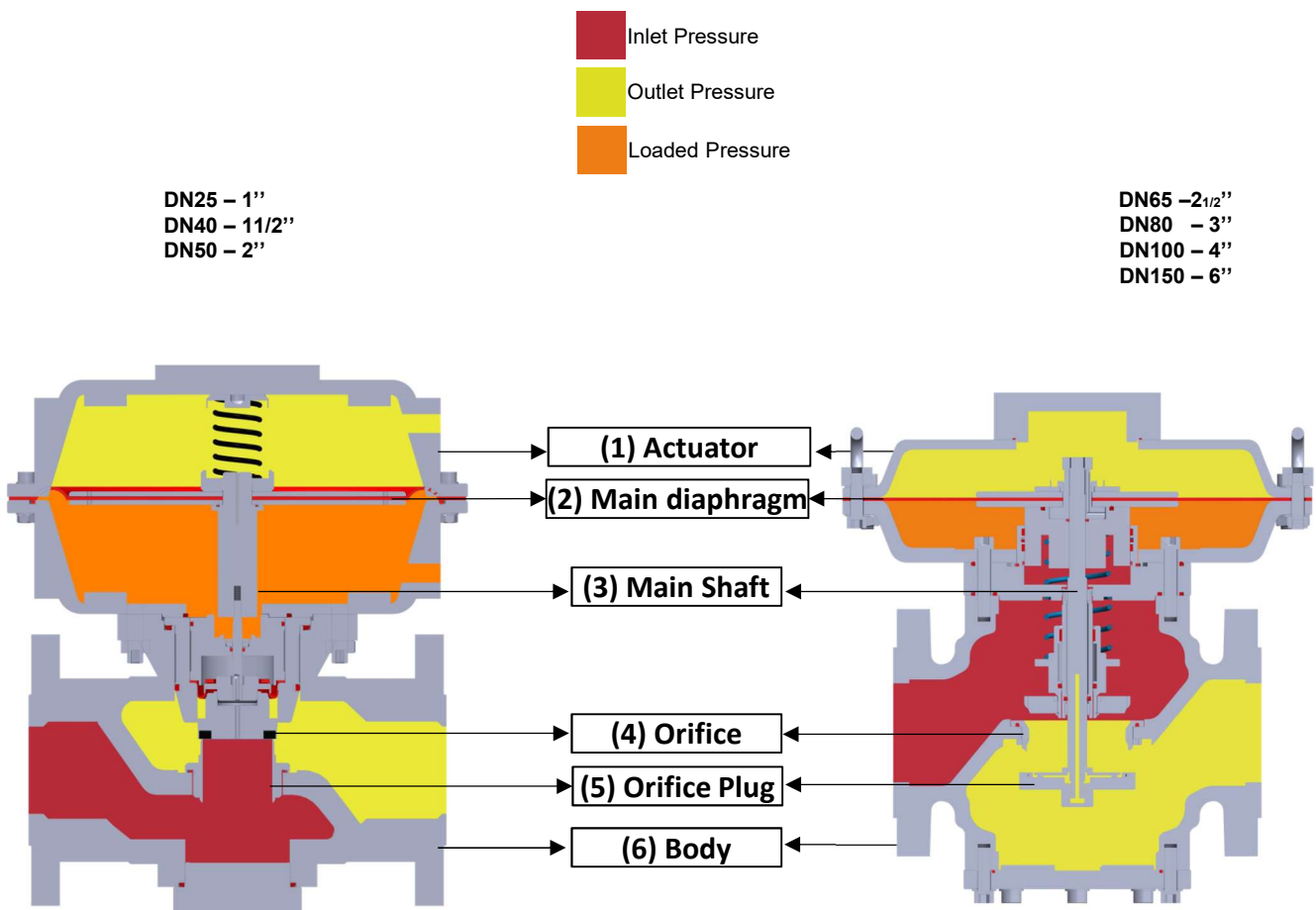
The main diaphragm (2) inside the actuator (1) is connected to the orifice plug (5) with the main shaft (3).

if outlet pressure exceeds the force of the loaded pressure;

the main diaphragm (2) moves up, moves with the main shaft (3) orifice plug (5) attached to the main diaphragm (2) and closes the orifice (4), stopping the flow.

if the outlet pressure decreases further than the compression force of the loaded pressure;

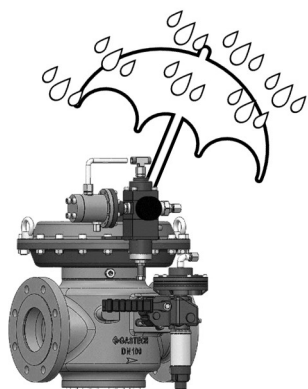
the main diaphragm (2) moves down, moves with the main shaft (3) orifice plug (5) attached to the main diaphragm (2) and opens the orifice (4), starting the flow.



Gas Pressure Regulator, Z-P Serie

Environmental conditions

Gastech guarantees the product under the following storage and transportation conditions. All functions of products that are stored unused for more than 3 years should be checked.



Storage IEC 60721-3-1

Climatic conditions	Class 1K3
Mechanical conditions	Class 1M2
Temperature range	-20...60 °C
Humidity	< 95 % r.h.

Transport IEC 60721-3-2

Climatic conditions	Class 2K2
Mechanical conditions	Class 2M2
Temperature range	-15...60 °C
Humidity	< 95 % r.h.

Pipe installation

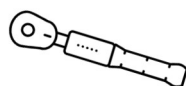
Maximum tightening torque of flange bolts



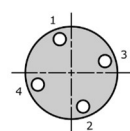
	25 1"	40 1 1/2"	50 2"	65 2 1/2"	80 3"	100 4"	150 6"
PN 16	40	120	120	120	120	120	200
ANSI 150	40	120	120	120	120	200	300

1. Clean flanges
2. Insert gasket between flanges
3. Insert screws, washers and nuts, tighten by hand
4. Tighten screws crosswise in three steps as per the order indicated.

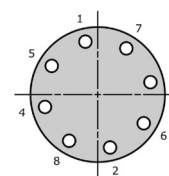
- Step 1: 25% M
- step 2: 50% M
- step 3: 100% M



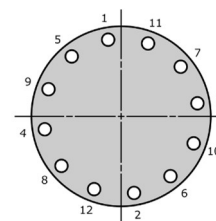
M = max. tightening torque



Circular 4-Bolt



Circular 8-Bolt



Circular 12-Bolt

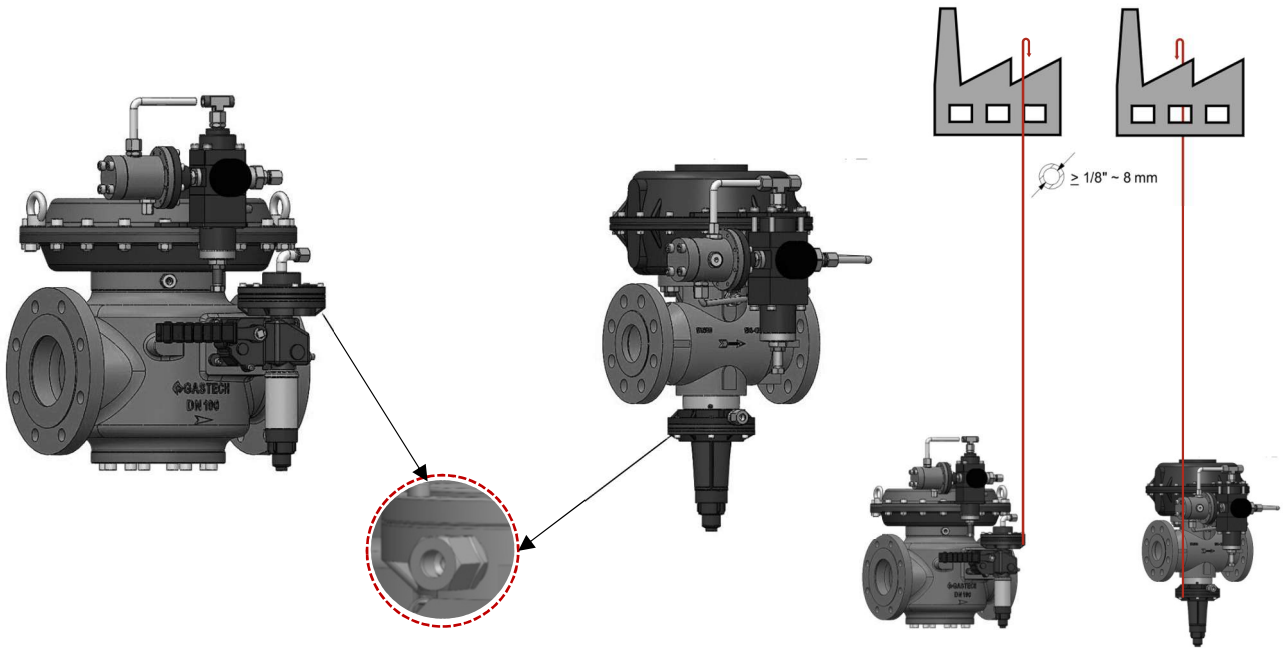


use new sealing gaskets with every maintenance

Gas Pressure Regulator, Z-P Serie

Vent Lines for Safety

The discharge outlets on the regulator must be transported to the outside with a pipe. In indoor use, if the vent lines are not carried outside, gas may leak into the environment when the regulator fails. Creates a risk of fire and explosion.



Make sure the gas is conveyed to a non-hazardous area with the vent line. Natural gas will rise due to lower density than air, GPL will go down due to greater density than air. The density of the gas used should be analyzed and accumulations should be prevented.

Gas Pressure Regulator, Z-P Serie

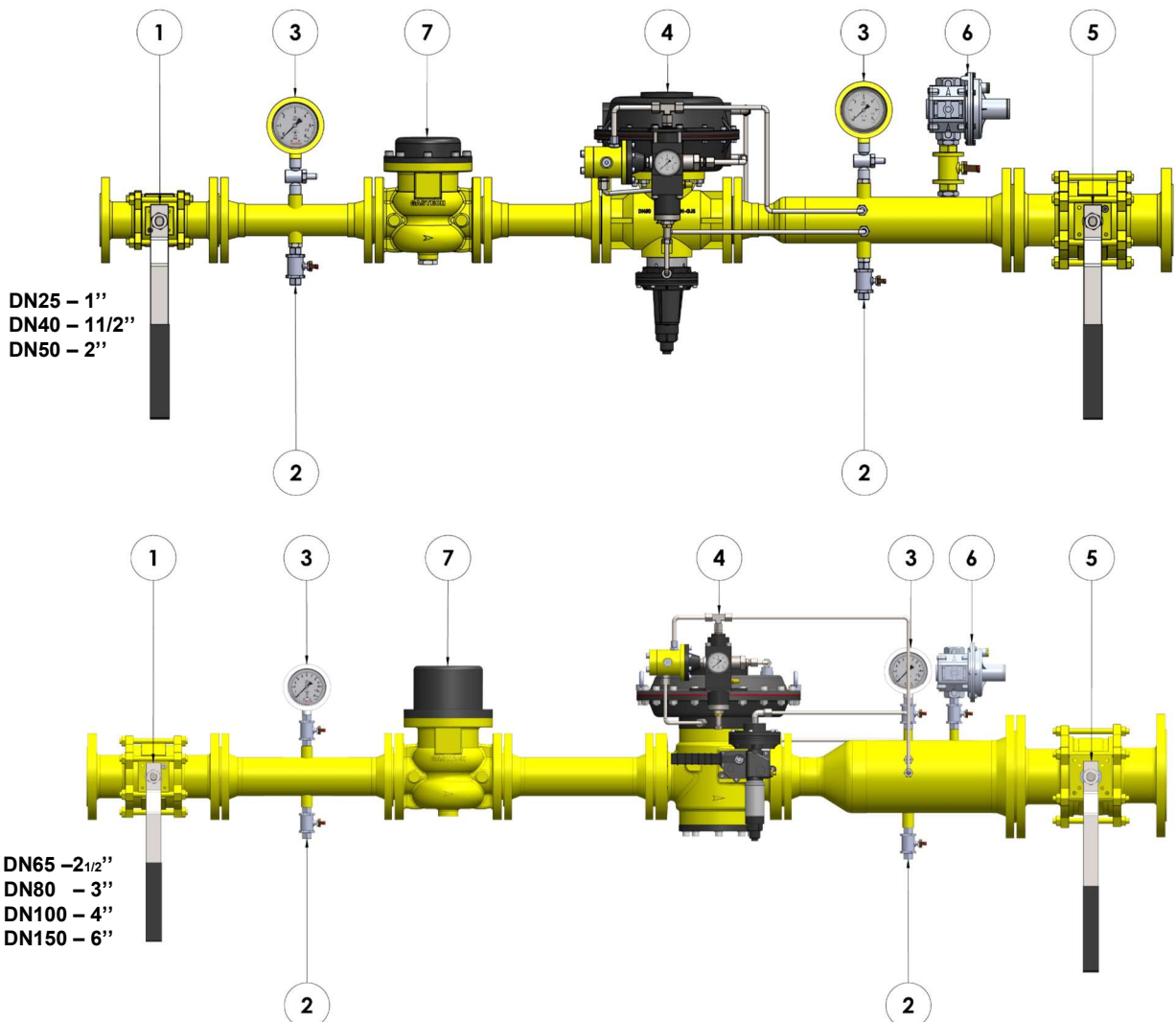
General Information for Connection

The bodies of the regulators have an arrow sign indicating the flow direction. The gas must flow in the same direction as the arrow on the body of regulator. Make sure that the flow direction is correct while the regulator is mounted to the installation. The gas must be filtered and must not contain particles larger than 5 microns.

The simplest installation should include the following equipment;

Pos	Equipment
1	Upstream Main Shut off Valve
2	Manual Relief Valve –for upstream and downstream
3	Pressure Gauge –for upstream and downstream
4	Gas Pressure Regulator
5	Downstream Main Shut off Valve

Standard Position



Gas Pressure Regulator, Z-P Serie

General Information for Connection

For a perfect pressure stabilization, follow the guidelines below;

- The impulse pipe (pressure feedback) must be connected to the main outlet gas pipe, downstream from the gas pressure regulator observing a distance of at least 4 x the diameter of the main outlet pipe.
- Do not install equipment (main ball valve, solenoid valve, gas meter, etc...) on the main pipe at the regulator outlet before the 6x distance after the regulator.
- Gas velocity can never exceed 40m/s in the main outlet pipe, recommended gas velocities are as follows;

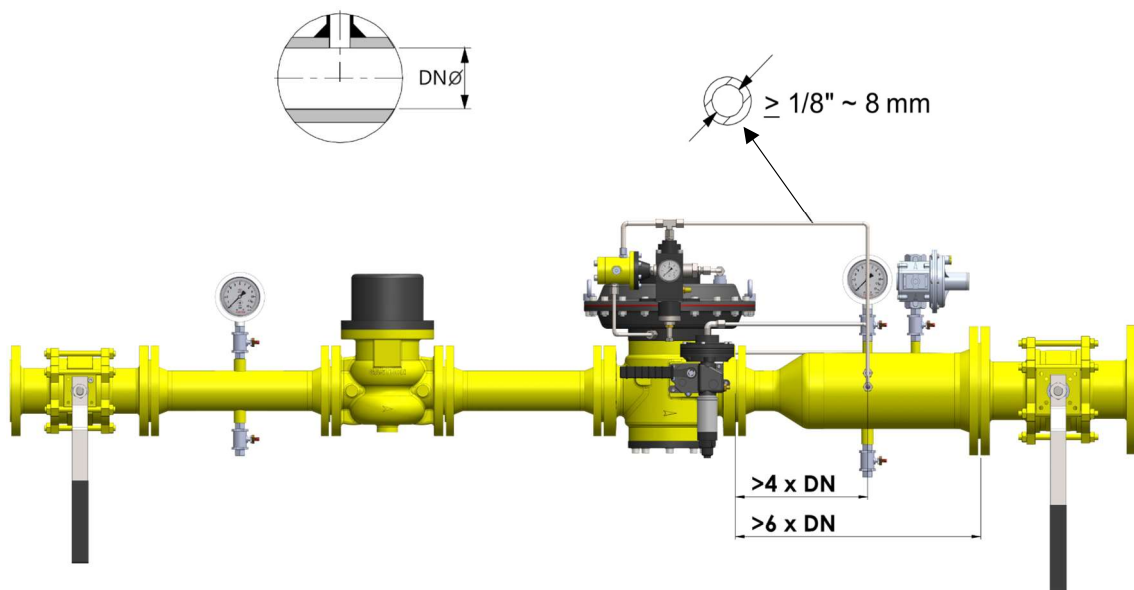
$V_{max} = 30 \text{ m/s}$ for $1,5 < P_d < 4 \text{ bar}$

$V_{max} = 25 \text{ m/s}$ for $0,15 < P_d \leq 1,5 \text{ bar}$

$V_{max} = 15 \text{ m/s}$ for $P_d \leq 0,15 \text{ bar}$

To prevent the impulse connections of the sensing lines from collecting dirt and condensation, the following is required:

- Impulse pipe fittings are always connected to the top or horizontal axis of the pipe.
- The slope of the impulse pipe is always 5-10% towards the main pipe connection.



⚠ All pipe of sensing line must have pipes with a minimum inside diameter of 8 mm, recommend not to put valve on the impulse line.

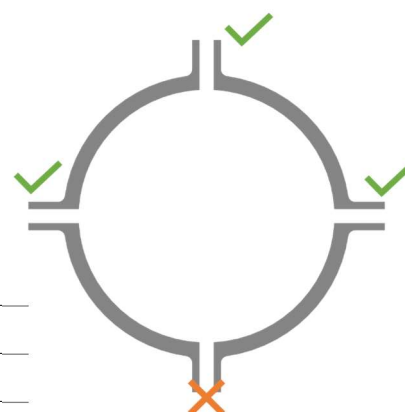
Gas Pressure Regulator, Z-P Serie

General Information for Connection

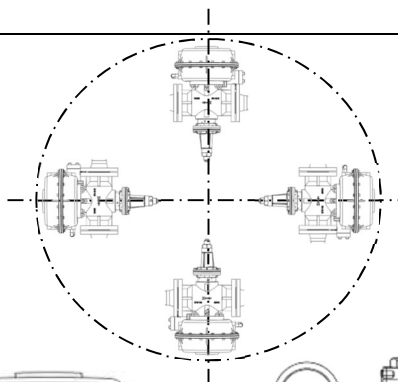
Calculate the gas velocity with the following formula;

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

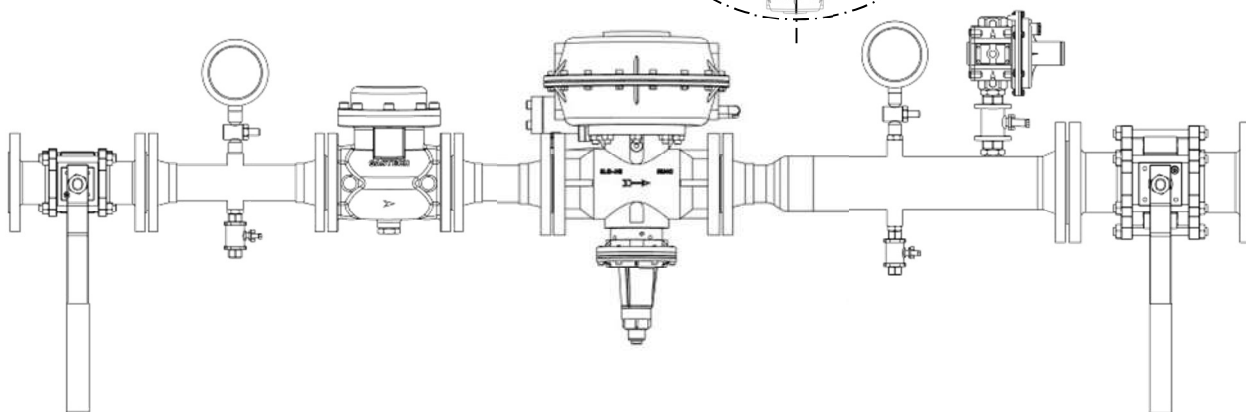
V	Velocity (m/s)
345.92	Numerical constant
Q	Flow rate under standard conditions (Stm ³ /h)
DN	Regulator nominal diameter (mm)
Pd	absolute outlet pressure in (bar)



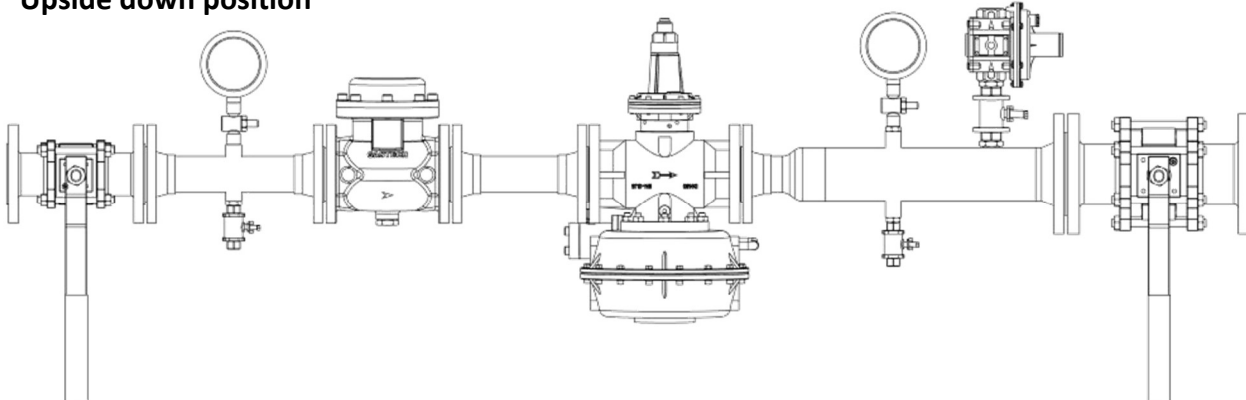
Mounting Position



Standard Position



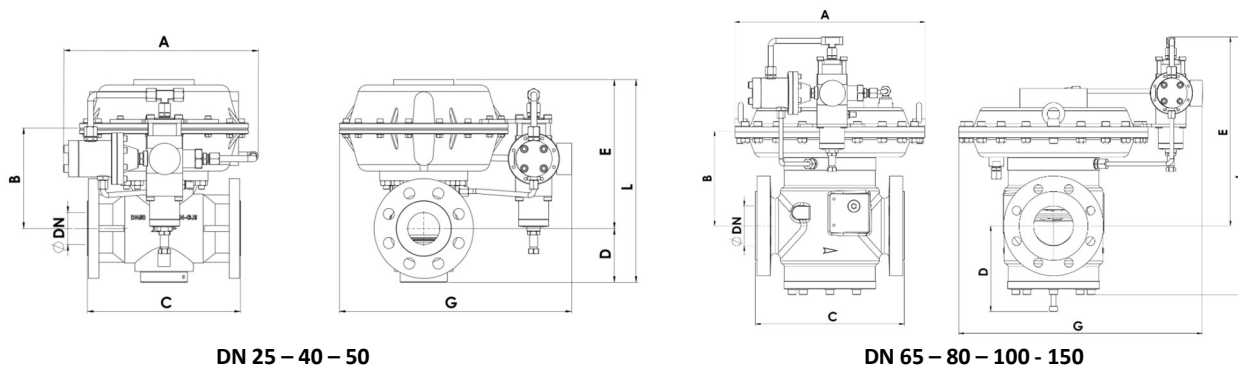
Upside down position




Gas Pressure Regulator, Z-P Serie

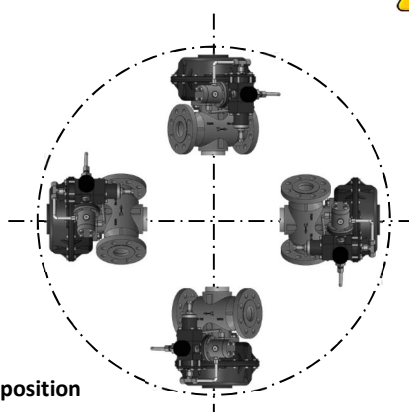
Dimensions and Weights

Z-P Serie -without SSV



DN ⁽¹⁾	A	B	C	D	E	G	L	Wgt kg
25 1"	320	160	222	80	240	385	320	26
40 1 1/2"	320	160	222	80	240	385	320	27
50 2"	320	170	254	90	246	385	340	32
50 2"	385	190	254	90	246	490	340	41
65 2 1/2"	385	190	298	175	380	490	520	82
80 3"	385	190	298	175	380	490	520	83
100 4"	385	190	352	175	380	490	520	103
150 6"	385	280	451	360	780	490	700	165

 Int silencer does not affect dimensions
Flange holes on DN25 size are threaded M12x1,75
Flange holes on DN65 size are threaded M16x2,0



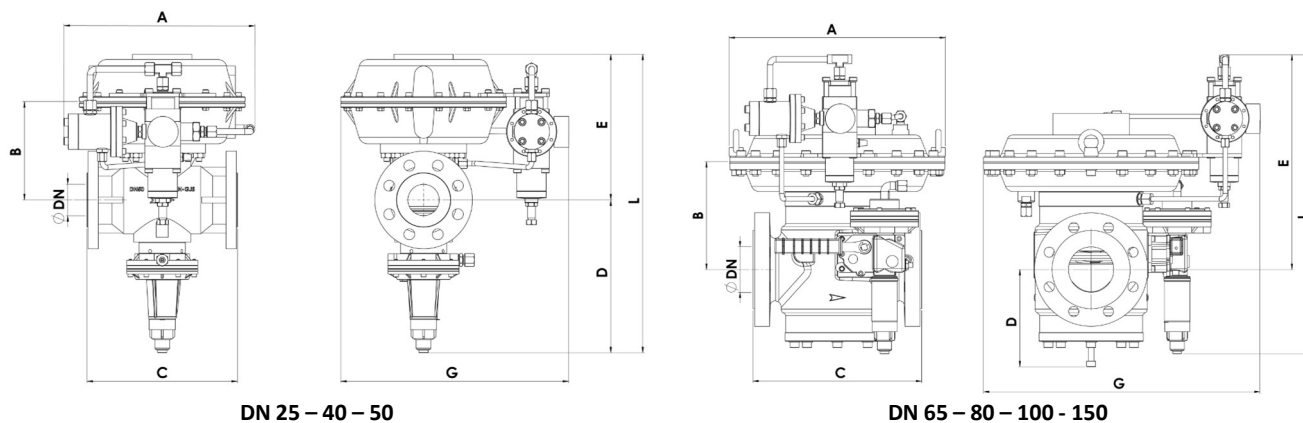
Mounting position



Gas Pressure Regulator, Z-P Serie

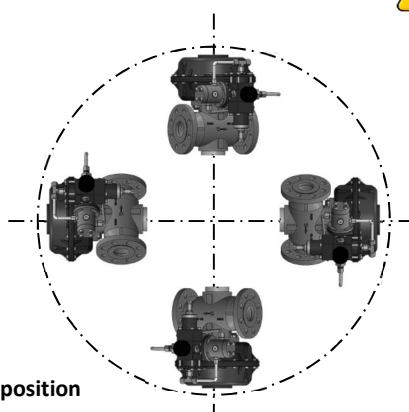
Dimensions and Weights

Z-P Serie -with SSV



DN ⁽¹⁾	A	B	C	D	E	G	L	Wgt kg
25 1"	320	160	222	250	240	385	490	
40 1 1/2"	320	160	222	250	240	385	490	
50 2"	320	170	254	260	246	385	510	
50 2"	385	190	254	260	246	490	510	
65 2 1/2"	385	190	298	175	380	490	530	
80 3"	385	190	298	175	380	490	530	
100 4"	385	190	352	175	380	490	530	
150 6"	385	280	451	350	780	490	610	

! Int silencer does not affect dimensions
 Flange holes on DN25 size are threaded M12x1,75
 Flange holes on DN65 size are threaded M16x2,0



SETTING

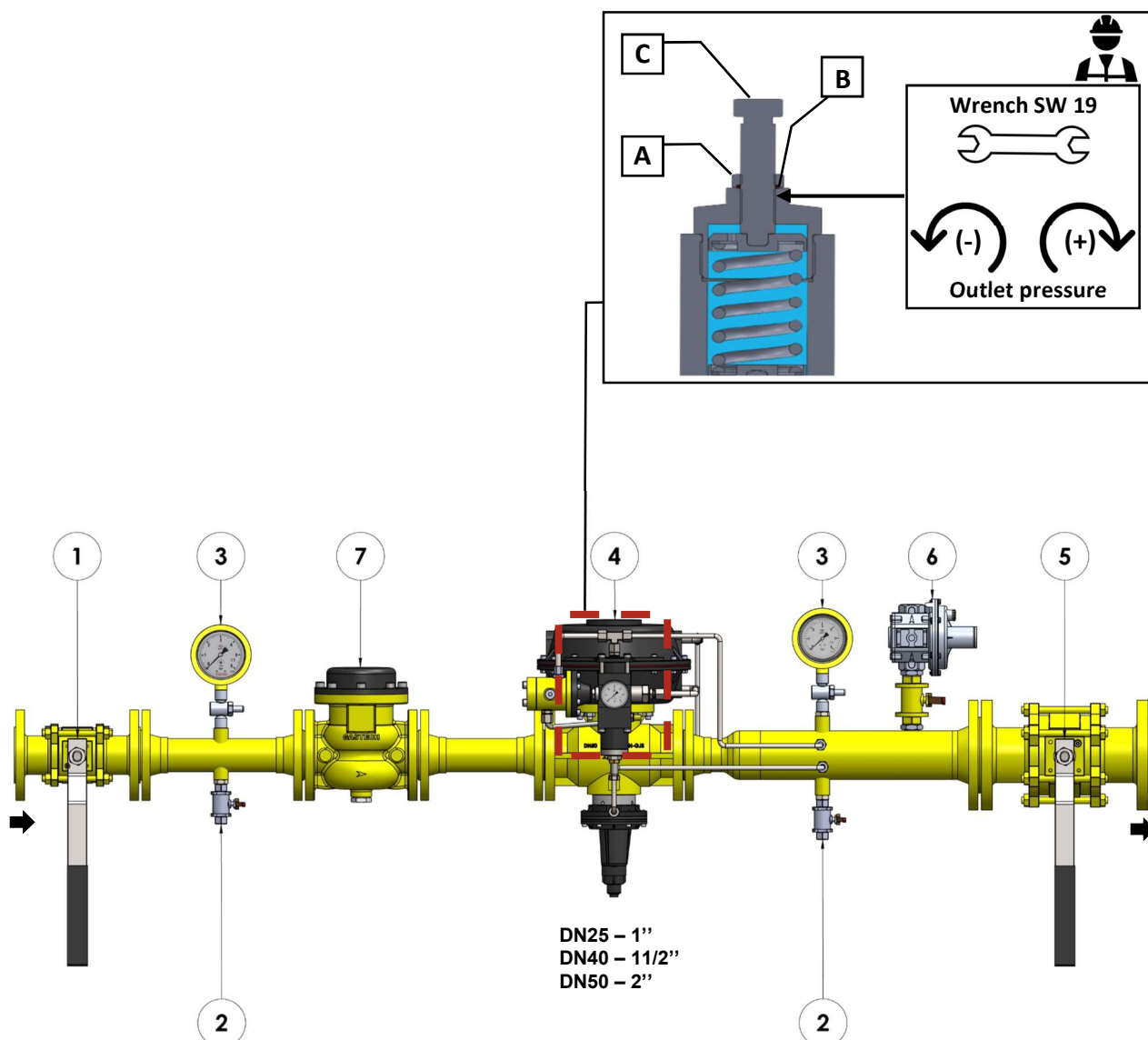
Gas Pressure Regulator, Z-P Serie

Setting of the outlet pressure for DN25 – DN40 – DN50

⚠ Make sure that all safety precautions (staff, environment, system) are taken before following the instructions below.

Operation

Pos	Practice
1	Remove the nut (A)
2	Turn the adjusting screw C using an open-ended wrench SW 19 mm.
3	Turning clockwise: the preload of the setpoint spring is increased and the outlet pressure is increased (+).
4	Turning counter-clockwise: the setpoint spring is released and the outlet pressure reduced (-).
5	After the setting: screw - fix on the nut (A) again.



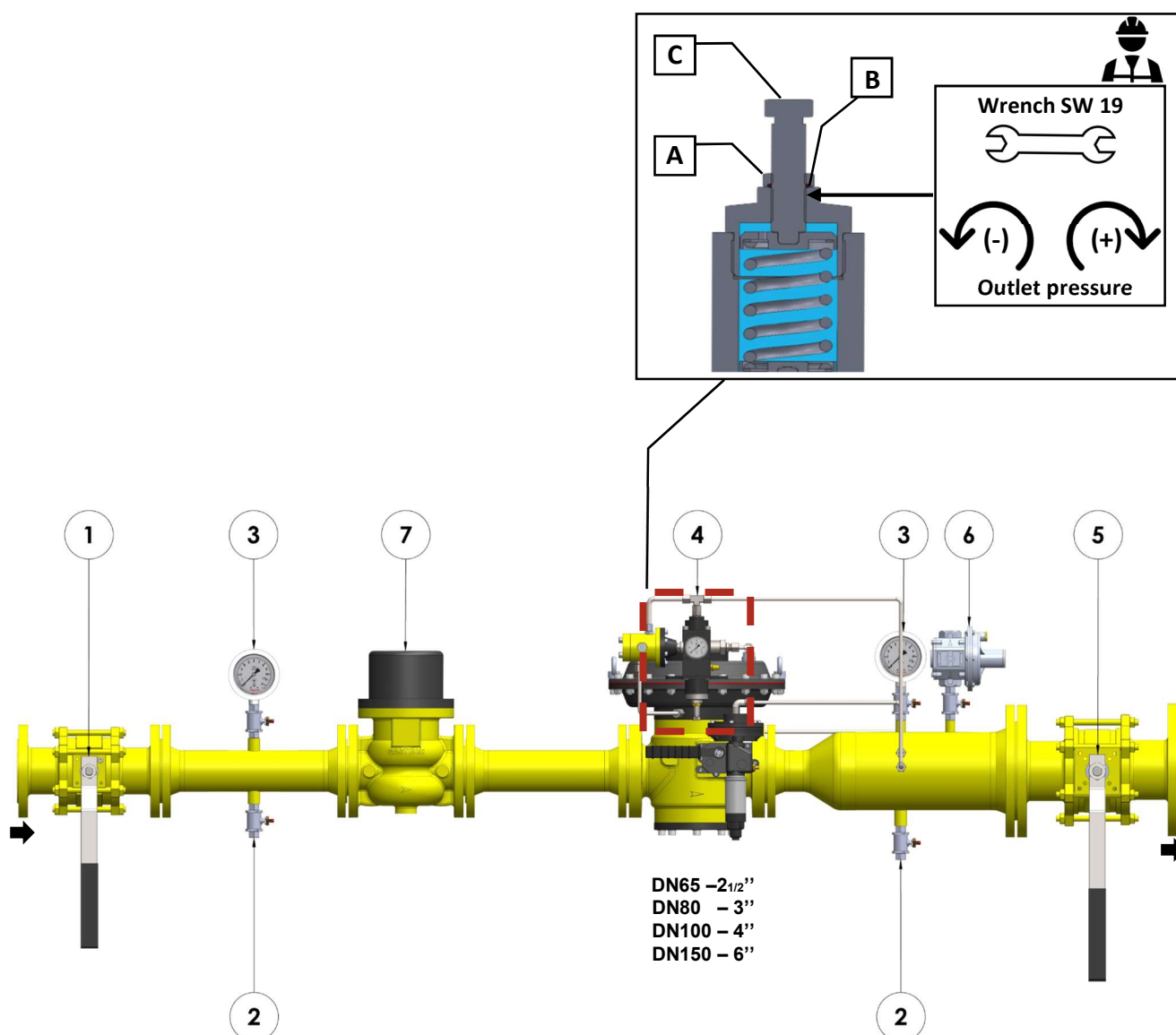
Gas Pressure Regulator, Z-P Serie

Setting of the outlet pressure for DN65 – DN80 – DN100 – DN150

⚠ Make sure that all safety precautions (staff, environment, system) are taken before following the instructions below.

Operation







Pos	Practice
1	Remove the nut (A)
2	Turn the adjusting screw C using an open-ended wrench SW 19 mm.
3	Turning clockwise: the preload of the setpoint spring is increased and the outlet pressure is increased (+).
4	Turning counter-clockwise: the setpoint spring is released and the outlet pressure reduced (-).
5	After the setting: screw - fix on the nut (A) again.



Setting of the outlet pressure

 Make sure that all safety precautions (staff, environment, system) are taken before following the instructions below.

With All Details

Pos	Practice
1	Open the manual vent valve on the outlet side to 30% (2).
	 Remember the gas will discharge, check the safety requirements again
2	Make sure the main outlet valve is closed (5)
3	Open the main inlet valve (1) slowly and observe the outlet pressure gauge (3)
	 Check the inlet pressure on the inlet manometer. Check that the inlet pressure is at the system design value. If the inlet pressure is lower or higher than the design pressure, contact your gas supplier.
	 In the first pressurization, the outlet pressure may increase by 30-60%, since the outlet vent valve is open, the high pressure will be discharged and the regulator reflex will recover after a while.
	 Check the pressure gauge (3) on the outlet pressure side, if the outlet pressure rises unreasonably, close the inlet main valve (1).
4	Close the manual vent valve on the outlet side (2).
	 Check the outlet pressure gauge (3), the outlet pressure should not rise more than 10% from the outlet pressure (on the label Pd Value).
	If the outlet pressure is not at the required value;
5	Open the manual vent valve on the outlet side to 30% (2).
6	Remove the nut A.
7	Turn the adjusting screw C using an open-ended wrench SW 19 mm.
	Turning clockwise: the preload of the setpoint spring is increased and the outlet
7a	pressure is increased (+).
	Turning counter-clockwise: the setpoint spring is released and the outlet pressure
7b	reduced (-).
8	After the setting: screw on the fix nut A again.
9	Close the manual vent valve on the outlet side (2).
	 Check the outlet pressure gauge (3), the outlet pressure should not rise more than 10% from the calibrated outlet pressure
	Close all valves (1)(2)(5), check leakage control with inlet and outlet manometers (3) and foaming liquid
9	
10	If there is a leak, fix it and repeat step 9.
11	Return to step 1
12	Open the main outlet valve slowly and ensure gas supply to the system

Gas Pressure Regulator, Z-P Serie

Outlet Pressure Range and Setting Springs

The spring setting ranges for all diameter regulator are shown in the tables below

Pressure Range (mbar)	Actuator (ø)	Color	Diameter (mm)	Order Code
15 – 30	GT239A	Green	1.8	2.13.0415
25 – 100	GT239A	Pink	2.0	2.13.0416
90 – 250	GT239A	Red	2.5	2.13.0417
230 – 330	GT238A	Purple	3.0	2.13.0418
300 – 1100	GT238A	Orange	3.5	2.13.0419
1000 – 2500	GT238A	Grey	4.0	2.13.0420
1500 – 6000	GT238A	Yellow	5.0	2.13.0421
4000 – 6000	GT238A	Blue	6.0	2.13.0422
6000 – 16000	GT238A	Black	7.0	2.13.0423

Shut Off Range and Setting Springs

Over- Shut off setting ranges for the all diameters are shown in the tables below

Pressure Range (mbar)	Actuator (ø)	Color	Diameter (mm)	Order Code
30 – 125	120 BP-MP	Red	2.2	2.13.0713
65 – 280	120 BP-MP	Blue	2.5	2.13.0280
80 – 370	120 BP-MP	Yellow	2.7	2.13.0714
280 – 490	120 BP-MP	Black	3.2	2.13.0066
480 – 1000	120 AP	Purple	3.5	2.13.0682
750 – 1250	120 AP	Silver	3.7	2.13.0683
1000 – 1750	120 AP	Pink	4.0	2.13.0744
1500 – 2500	120 AAP	White	4.5	2.13.0319
2000 – 5500	120 AAP	Orange	5.0	2.13.0324

Over- Shut off setting ranges for the all diameters are shown in the tables below

Pressure Range (mbar)	Actuator (ø)	Color	Diameter (mm)	Order Code
15 – 35	120 BP-MP	Red	1.2	2.13.0715
25 – 40	120 BP-MP	Blue	1.5	2.13.0283
30 – 100	120 BP-MP	Yellow	2.0	2.13.0716
60 – 240	120 BP-MP	Black	2.3	2.13.0069
70 – 450	120 BP-MP	Purple	2.5	2.13.0746
350 – 900	120 AP-AAP	Silver	2.8	2.13.0320
700 – 3200	120 AP-AAP	Pink	3.5	2.13.0745



Minimum difference between regulator and SSV settings (ΔP_w):
 BP-MP Model: 15% with a minimum difference of 10 mbar for UPSO, 20 mbar for OPSO
 AP-AAP Model : 20% with a minimum difference of 40 mbar for UPSO, 40 mbar for OPSO

Gas Pressure Regulator, Z-P Serie

Slum Shut Valve

The Z-P Serie of regulators can be fitted with safety shut-off valve for overpressure (OPSO) or combined under-and-over pressure (UPS0/OPSO) protection. Shutoff gas flow when the outlet pressure of the regulator increases or/and decreases. The Slum shut valve trip pressure can easily be adjusted independently of the regulator set point. Built internal bypass, for balancing pressure before relatching the safety shut-off valve, is operated by pulling the valve stem. Possibility of application of devices for remote signal and remote control.

Technical Features

Type	IS			
Operation class	A			
Response time	< 2 s			
Allowable temperature –TS ⁽¹⁾	-20 °C to +60 °C			
Accuracy –AG ⁽²⁾	50 mbar	AG 30		
	50 – 150 mbar	AG 10		
	150 – 5.500 mbar	AG 5		
	1.0 – 16 bar	AG 5		
Set Range OPSO ⁽³⁾	BP 20 -300mbar	MP 50 - 500mbar	AP 0.3 – 5.5bar	HP 1 – 16 bar
Set Range OPSO ⁽³⁾	BP 10 -280mbar	MP 20 - 350mbar	AP 0.2 – 3.2bar	HP 0.8 – 14 bar

⁽¹⁾ Low temperature version -40°C: available on request


⁽²⁾ Depending on working conditions

⁽³⁾ change differant springs Refer to page

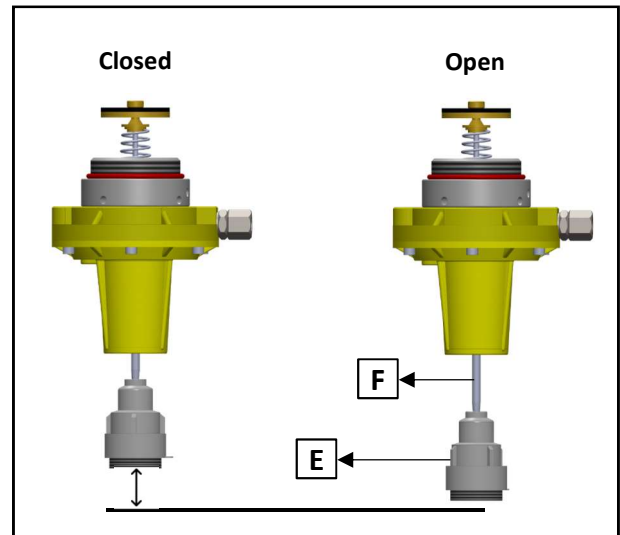
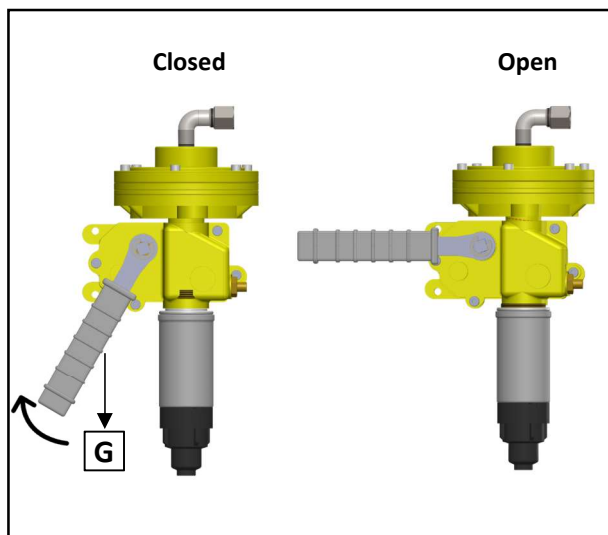
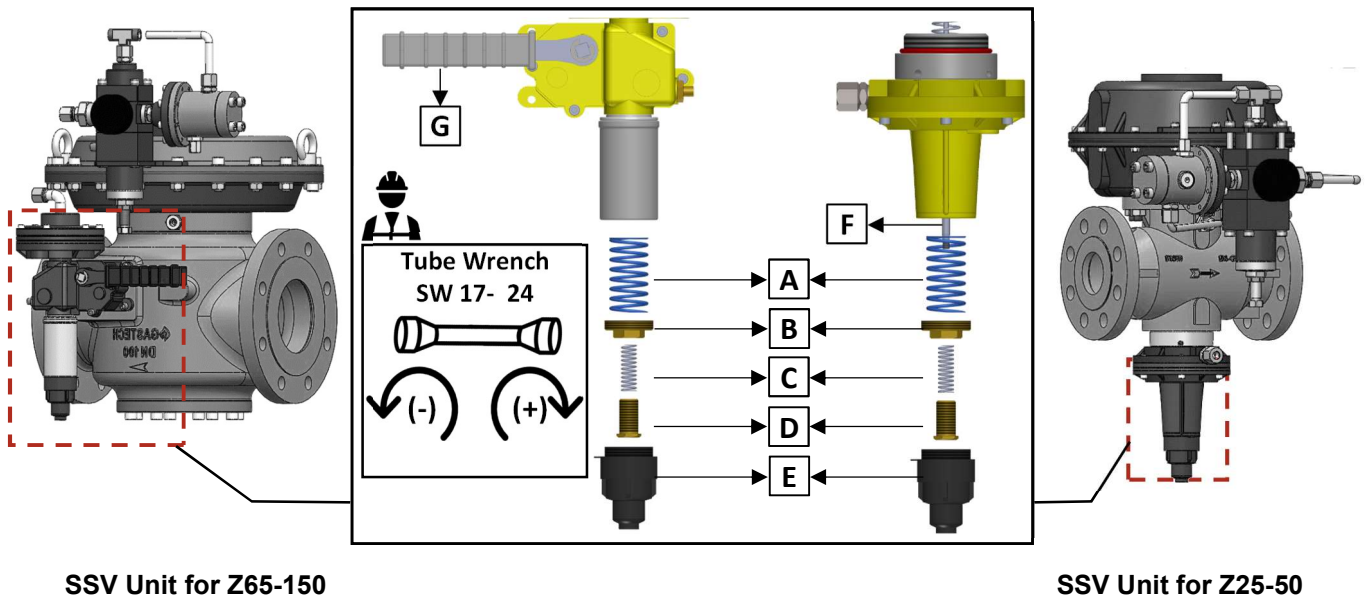
Slum Shut Unit for Z-P Serie

Article No	Type	DN Size
2.80.0311	S-BP	DN25-40
2.80.0312	S-MP	DN25-40
2.80.0313	S-AP	DN25-40
2.80.0330	S-HP	DN50
2.80.0314	S-BP	DN50
2.80.0315	S-MP	DN50
2.80.0316	S-AP	DN50
2.80.0331	S-HP	DN50
2.80.0317	S-BP	DN65-80
2.80.0318	S-MP	DN65-80
2.80.0319	S-AP	DN65-80
2.80.0332	S-HP	DN65-80
2.80.0320	S-BP	DN100
2.80.0321	S-MP	DN100
2.80.0322	S-AP	DN100
2.80.0333	S-HP	DN100
2.80.0323	S-BP	DN150
2.80.0324	S-MP	DN150
2.80.0325	S-AP	DN150
2.80.0334	S-HP	DN150



 Please, select the springs (OPSO and UPSO Range), Refer to Page 22 and 23

Setting Procedure of the Slum Shut Valve



⚠ SSV units have a built-in bypass system for safety and easy installation. When you pull the cover, the bypass system is activated and the outlet is slowly pressurized. If the outlet main valve is not closed; It takes too long to fill out the exit and you cannot activate SSV.

Setting Procedure of the Slum Shut Valve (Maximum and Minimum)

Pos	Practice
1	Use ring nut (B) to completely load maximum pressure spring (A). Loosen adjusting screw (D) to completely relieve minimum pressure spring (C).
2	Use a small pump or other appropriate means to raise pressure to normal operating level on the downstream vent valve (2).
3	Relatch controller and allow pressure to drop to minimum pressure triggering level.
4	Using adjusting screw (D), slowly load minimum pressure spring (C) until actuator triggers.
5	Repeat steps 2 and 3 above, making any necessary adjustments in setting. Least three times
6	Bring pressure back to normal values.
7	Relatch controller and raise pressure until it reaches maximum pressure triggering level.
8	Using ring nut (B), slowly unload spring (A) until actuator triggers.
9	Repeat steps 6 and 7 above, making any necessary adjustments in setting. Least three times
10	Close the downstream vent valve (2) and disconnect the external pressure source.

 It is recommended that slam-shut controller efficiency be checked periodically.

Cut-off Test

Pos	Practice
1	Close inlet and outlet main valves (1) (5). The controller should trigger at minimum pressure (only if so set).
2	Using a small pump or other appropriate means on the downstream vent valve (2) , raise pressure in the line to normal operating level. Relatch controller in case it has triggered following on step 1 above.
3	Simulate pressure increase until maximum triggering pressure is reached.
4	Bring the line back to full operating conditions as described in Startup procedure.

Controller-seal Check

Pos	Practice
1	Slowly close the main outlet valve (5) located downstream.
2	Disable the ssv unit and close the stream
3	Loosen one fitting in the line downstream of the slam-shut valve and apply soapy water in order to make sure that there are no leaks. In case of any leak being detected, proceed with the necessary maintenance of the controller.

F 25 – 50 Startup of the Slum Shut Valve

Previously calibrated

Pos	Practice
1	Make sure that the main inlet and outlet valves are closed.
2	Open the main inlet valve (1) slowly
3	Remove cap (E) reverse and screw it onto stem (F).
4	Pull cap (E) and keep it pulled several seconds until outlet pressure stabilizes, and SSV is easily activated.
	<p>☞ SSV units have a built-in bypass system for safety and easy installation. When you pull the cover, the bypass system is activated and the outlet is slowly pressurized. If the outlet main valve is not closed; it takes too long to fill out the exit and you cannot activate SSV.</p>
5	Open the main outlet valve slowly and ensure gas supply to the system
6	Repeat the above procedure, making sure that controller remains properly latched, then mount cap back in its original position

F65 – 150 Startup of the Slum Shut Valve

Previously calibrated

Pos	Practice
1	Make sure that the main inlet and outlet valves are closed.
2	Open the main inlet valve (1) slowly
3	Slowly lift the handle of SSV (G) up and keep it a few seconds until outlet pressure stabilizes, and SSV is easily activated.
	<p>☞ SSV units have a built-in bypass system for safety and easy installation. When you pull the cover, the bypass system is activated and the outlet is slowly pressurized. If the outlet main valve is not closed; it takes too long to fill out the exit and you cannot activate SSV.</p>
4	Open the main outlet valve slowly and ensure gas supply to the system

