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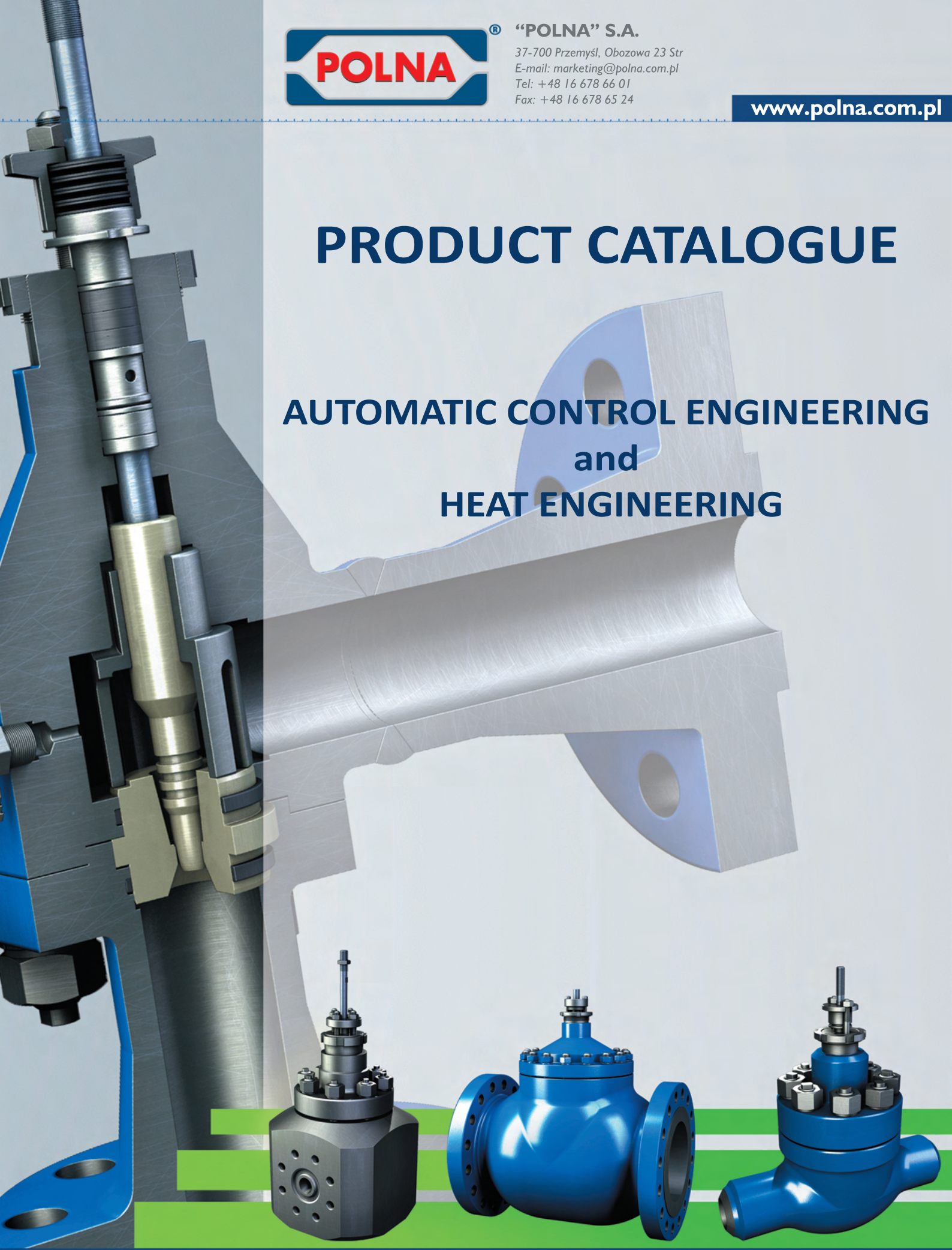
PRODUCT CATALOGUE

AUTOMATIC CONTROL ENGINEERING and HEAT ENGINEERING



- SINGLE-PORTED GLOBE CONTROL VALVES
- THREE-WAY CONTROL VALVES
- DOUBLE-PORTED CONTROL VALVES
- ROTARY PLUG CONTROL VALVES
- PISTON DESUPERHEATERS
- MINIMUM FLOW VALVES
- SELF-ACTUATING PRESSURE REGULATORS
- NEEDLE AND MANIFOLD VALVES

Certificate

Standard **ISO 9001:2008**

Certificate Registr. No. 0198 100 00434

TÜV Rheinland Polska Sp. z o.o. certifies:

Certificate Holder:

Zakłady Automatyki POLNA S.A.
ul. Obozowa 23
PL - 37-700 Przemyśl

Scope: regulating valves, actuators, self-operating pressure controllers, strainers, central lubrication equipment and hydraulic control devices, distillers, iron and steel castings

An audit was performed, Report No. 0 00434. Proof has been furnished that the requirements according to ISO 9001:2008 are fulfilled.

Validity: The certificate is valid from 2012-11-26 until 2015-11-25.
First certification 1995

Warszawa, 2012-11-20

Grzegorz Grabka
TÜV Rheinland Polska Sp. z o.o.
ul. 17 Stycznia 56 02-146 Warszawa

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TÜVRheinland®
Precisely Right.

„POLNA" S.A.

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	+48 16 678 66 01	extension / mobile phone	
The Board of Directors		**200**	
Sales and Marketing Director		**379 / +48 693 920 446**	
Marketing Department		**248 / +48 533 301 083**	
Export Department [offers and orders]		**258 / +48 609 369 810**	
Service		**382 / +48 609 369 265 +48 16 678 66 25**	
Sales and Marketing Specialists			
Control valves, butterfly valves complete with electric and pneumatic acutators		Offers	**269; 389**
		Orders realization	**310**
Self-actuating regulators, strainers, central lubrication equipment, water distillers		**312**	
E-mail addresses			
Marketing and Sales Department	marketing@polna.com.pl		
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Professionalism Responsibility Leadership Reliability Ambition
Profesjonalizm Odpowiedzialność Liderowanie Niezawodność Ambicja

Dear Ladies and Gentlemen,

we are proud to present you with POLNA's great offer of a wide range of products from the automatic control engineering and heat engineering sectors, to central lubrication and laboratory equipment. We specialize in the designing and manufacturing of control valves, steam desuperheaters, needle valves, regulators, central lubrication equipment, distillers and re-distillers.

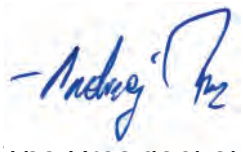
We aim at fulfilling the Customer's needs. Our traditions date back over 80 years, which enhances the determination for constant improvement of our products, processes and everything that we do within our team and in the whole organization.

It is our mission to ensure:

- the highest quality and reliability of products for our Customers,
- a stable increase of the company's goodwill for our Shareholders,
- the feeling of security and opportunities for development for our Employees,
- business responsibility (protection of the natural environment and social interests).

Designing and manufacture of individual products is based on complete realization of the technical assumptions agreed on with the Customer. We are constantly broadening our offer of non-catalog products, aimed at individual needs of our recipients.

Kind regards
Andrzej Piszcz



The President of the Management Board,
Executive Director

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Our Company

Zakłady Automatyki POLNA S.A. is a company with a long tradition. It has been producing industrial fittings since the end of the 1960s. Over the years, the range of manufactured products has been systematically broadened and the construction solutions used have been improved. The current trademark has been used since 1972 and products bearing that trademark are well known among domestic and foreign customers.

Apart from standard catalogue products, POLNA specializes in special manufactures of valves adjusted to individual Customers' requirements.

Our customers include some of the leading companies from various branches of industry:

- ALSTOM POWER – power industry
- SYNTHOS DWORY– chemical industry
- SIEMENS – automatic control
- Polish Oil & Gas Company (PGNiG) – gas industry
- ORLEN – petrochemical industry
- FOSTER WHEELER – power industry
- AUSTRIAN ENERGY – power industry
- SKODA POWER – power industry

The quality of POLNA's products is guaranteed by Quality Management System certificates it holds:
- Quality Management System Certificate of Conformity with EN ISO 9001:2008 norm.
- Quality Assurance System Certificate of Conformity with Directive 97/23/EC – Module H.
- Quality Assurance System Certificate of Conformity with Directive 97/23/EC – Annex I, p.4.3.
- We confirm compliance of control valves and actuators with ATEX Directive 94/9/EC.

More information about the company, its certificates and its product offer can be found on our website: www.polna.com.pl.

PRZEMYŚL- Think it over and come!


Fot. Grzegorz Karnas

Przemyśl belongs to a select group of the oldest and most beautiful Polish towns. A thousand years old, tempestuous history of the town has been inseparably intertwined with the history of the whole Republic of Poland. It is located in the south-east corner of Poland, in the eastern part of Podkarpackie Voivodeship and in the valley of the river San. Przemyśl, together with its surroundings, has many tourist, recreation and historical virtues. The town also constitutes an important transport interchange, connecting the East with the West and the North with the South of Europe. Besides, it plays an important role in transboundary cooperation with Ukraine.

Industrial values

Przemyśl has got a direct connection with the transit route Wrocław – Kraków – Korczowa (A4 and Road no.4). The last section of the motorway from Kraków to the Ukrainian border (currently road no. 4), which 20 km before Przemyśl turns into the dual carriageway no. 77, leading to Medyka, is planned to be finished by 2012.

The closest airport is located in Jasionka near Rzeszów (appr. 90 km from Przemyśl). The airport off ers national and international air connections (including cheap airlines).

In industrial part of town is located PRZEMYŚL SUB-ZONE OF TARNOBRZEG SPECIAL ECONOMIC ZONE EURO-PARK WISŁOSAN (TSSE), www.tsse.pl.

Źródło: BRMP

Tourist values

Welcome to Przemyśl! It is a beautiful and unique town. Mother nature herself took care of the picturesqueness nature of this part of the country, and its attractive location makes it possible to reach the Bieszczady highlands, the tourist routes of Pogórze Przemyskie, as well as the great city of Lvov, situated less than 100 kilometres from Przemyśl. For many centuries communication routes between East with West and North with South have crossed here, thanks to which the town was formed, Walking along its narrow streets, you can touch ten centuries of the town's history with numerous material traces, almost a thousand of which have been registered as construction and architectural monuments.


Fot. Grzegorz Karnas

Being situated at the meeting point of cultures and religions of the East and West has resulted in a national diversity and rich cultural heritage, developed by generations of Polish, Ukrainian and Jewish communities. The periods of the Polish partitions and the reign of the Austro-Hungarian monarchy contributed to the very special nature of the town.


Fot. Dariusz Hop

The Fortress of Przemyśl

The strategic location of Przemyśl induced the Austrian authorities to commence a construction of a huge fortress in the 19th century that played a significant role during WWI. Its presence, attractiveness and fame directed the tourist development of the town under the promotional name "Tourist Town Przemyśl Fortress". The town attracts many tourists and lovers of fortifications with its ruins of massive forts and war cemeteries. Enthusiasts of militaria and fortification mysteries will surely find the bunkers of the Molotov Line attractive.

Active and cultural tourism

Przemyśl is one of the rare towns, in the centre of which you can sunbathe by the San River in the middle of summer and ski during winter down the 800-metre lit slope, equipped with ski-lift. Tourists, who appreciate the beauty of nature and landscapes, are fascinated with history, multiple cultures and prefer active leisure will surely feel wonderful here.


Fot. Bogusław Świtała

Natural sights, plenty of which can be found in Przemyśl and the Foothills, may be considered as combining ACTIVE AND CULTURAL tourism. The most valuable of these is Arboretum in Bolestraszyce (7 km from the town). Here you can see rare species of trees and bushes from all over the world. In the manor house dating back to the 19th century the Institute of Physical Geography was established.

Castles, Cathedrals, Churches…

The very location of Przemyśl, at the meeting point of cultures and religions, and their mutual inter-penetration, led to a unique effect in the form of abundant monuments of sacral, secular and military architecture, expressed in almost a thousand registered construction and architectural objects. The centre of the town is especially rich in historical buildings. The Casimir Castle dating back to the 14th century, with pallatium and rotunda of the turn of 10th and 11th centuries, remains of the fortified walls, Reformati Monastery and Benedictine Nunnery with churches of 16th century, Franciscan and Carmelite monastery complexes from the Baroque period, as well as many bourgeois town houses. The Market Square and narrow streets are the most frequently visited places in the town The good condition of these historical objects, clear signs, numerous leaflets, folders and guides has made it possible to move freely in this attractive area of the town. The very centre of the Old Town has its own "underground town". The majority of buildings have basements and underpasses, which are often interconnected.

Tatar Mound (**Kopiec Tatarski) and the „Zniesienie" citadel**

Unique mounds only found in the Małopolska region of Poland – in Cracow and, particularly numerous, in Przemyśl area – will probably remain an archaeology mystery forever. The time of their creation is unknown; the Tatar Mound (Kopiec Tatarski) was a mystery as early as in the 16th century. The mound is worth visiting, since there is a wonderful view from this highest point in the area. Nearby, there are ruins of the citadel fort XVI "Zniesienie". Even nowadays can we see steel rails here: the tracks on which huge mortars used to turn around.

Przemyśl is a beautiful, interesting and unique place. It is worth coming to stay here.

POLNA S.A.

Details of Company issuing the Request for Proposal/Offer

Company	
Adress	
Contact person	
Fax	
E-mail	

Technical data necessary for creating a valve offer:

1.	Flow max [t/h, Nm^3/h, itp.]	
2.	Inlet Pressure p_1 [bar, MPa, itp.]	
3.	Outlet pressure p_2	
3a.	**or pressure drop** on Valle (p_1-p_2)	
4.	Working fluid	
5.	Fluid temperature (°C)	
6.	Tightnes class	
7.	Flow characteristics [P,L,S]	

Additional information, if they are known:

Type or the actuator:
Pneumatic P (normally open) or R (normally close)

8.		
	or	
	Electric	

9. Accesories to pneumatic actuators:

9a.	Pneumatic or electropneumatic positioner	
9b.	Air set (with filter)	
9c.	Electromagnetic valve 3/2	
9d.	Limit switches	
9e.	Other	
10.	Body material	
11.	Pipeline [Dz/g]	

Please send the filled in form to the e-mail address:
sales@polna.com.pl, fax +48 16678 65 24
tel. +48 16678 66 01 ext. 258

www.polna.com.pl

Download this questionnaire from: http://www.polna.com.pl/en/catalogues-and-products.html

POLNA®

ZAKLADY AUTOMATYKI
POLNA SA
37-700 Przemysl, ul. Obozowa 23

TECHNICAL SPECIFICATION FORM
CONTROL VALVES

Measurement point no.
Manufacturer serial number
User serial number

TECHNICAL PARAMETERS TO BE CONSIDERED FOR VALVE SELECTION

1	Place of installation				
2	Function				
3	Explosion hazard zone				
4	Ambient temperature	min	max		
5	Allowed noise level				
6	Pipeline identification no.				
7	DN /	PN	Wall thickness mm		
8	Pipeline material				
9	Pipeline insulation ☐ Thermal ☐ Acoustic				
10					
11	Pipeline connections				
12	Working medium				
13	Working medium at outlet ☐ fluid ☐ steam ☐ gas				
14					
15		min	norm	max	unit
16	Flow				
17	Inlet pressure P1				
18	Outlet pressure P2				
19	Temperature T1				
20	Medium density at inlet P1 or M				
21	Evaporation pressure Pv				
22	Critical pressure Pc				
23	Kinematic viscosity				
24	Specific heat y				
25	Compressibility coefficient Z				
26					
27	Pressure with valve closed	P1	P2		
28	Supply air pressure	min	max		
29	Valve status w/o supply ☐ open ☐ closed ☐ susp.				
30					

Kv /NOISE

31	Max calculated flow ratio Kv	
32	Min calculated flow ratio Kv	
33	Selected catalogue Kv	
34	Calculated noise level	dB(A)

VALVE UNIT

35	Manufacturer	Type
36	Body type	
37	Flow direction	
38	Nominal pressure	
39	Nominal sizes	
40	End connections ☐ flanged ☐ flangeless ☐ welding ☐ threaded	
41		
42	Extended connections	
43	Bonnet type ☐ standard ☐ extension ☐ bellow seal ☐ TA-Luft	
44		
45	Body / bonnet material /	
46	Valve plug - valve seat unit ☐ standard ☐ silenced ☐ .	
47	Characteristics ☐ linear ☐ equal percentage ☐ on/off	
48	Valve plug / valve plug stem material /	
49	Guiding sleeve / valve seat material /	
50		
51	Valve seat type ☐ metallic ☐ soft	
52	Valve plug - valve seat unit hardening coating	
53		
54	Tightness class	
55	Packing ☐ PTFE ☐ graphite ☐ .	
56		

ACTUATOR

57	Manufacturer	Type	
58	Pneumatic ☐ Diaphragm type ☐ Piston type ☐ .		
59	Operation ☐ Unilateral ☐ Bilateral ☐ .		
60	Size	Membrane working area	
61	Stroke / rotation angle		
62	Supply pressure	min	max
63	Input signal range		
64			
65	Air connection		
66	Other actuators ☐ electric ☐ hydraulic ☐ hand operated		
67			
68	Handwheel ☐ Top ☐ Lateral		
69			

POSITION LEVER

70	Manufacturer	Type
71	Input signal ☐ pneumatic ☐ electric	
72	Valve open at	
73	Valve closed at	
74	Operation ☐ unilateral ☐ bilateral	
75	Characteristics ☐ linear ☐ .	
76	Air connections	
77	Accessories ☐ by-pass ☐ manometers	
78	Explosion-proof execution ☐ spark-safe ☐ explosion safe	
79		

LIMIT SWITCHES

80	Manufacturer	Type
81	Switch type ☐ mech. ☐ approx. ☐ pneum.	
82	Switch position ☐ closed ☐ % stroke ☐ open	
83	Switch operation ☐ open ☐ close	
84	Explosion-proof execution ☐ spark-safe ☐ explosion-safe	
85		

SOLENOID VALVE

86	Manufacturer	Type
87	Valve type ☐ 2-way ☐ 3-way ☐ 4-way	
88	Valve supply failure status ☐ open ☐ closed ☐ susp.	
89		
90	Air connection	Connection size
91	Electric parameters V Hz W	
92	Explosion-proof execution ☐ spark-safe ☐ explosion-safe	
93		

ACCESSORIES

94	☐ Reducing valve Manufacturer	Type
95	☐ with filter ☐ with manometer	
96	☐ Location transmitter Manufacturer	Type
97		
98	☐ Pneumatic booster Manufacturer	Type
99		
100	☐ Blocking valve Manufacturer	Type
101		
102	Pulse tubes	material
103		

SPECIAL REQUIREMENTS

104	Attestations ☐ chemical and mechanical tests	
105	Other examinations	
106	Certificates ☐ body/bonnet	☐ bolts/nuts
107	☐ valve plug-valve seat unit	
108		
109		
110		
111		
112		

Comments:

						Design	Fig. no.	
						Item	Offer request no.	
Change	Date	Name	Change	Date	Signature	Order no.	Item no.	No. of pcs.

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CONTENT

TECHNICAL INFORMATION

AUTOMATIC CONTROL ENGINEERING PRODUCTS

HEAT ENGINEERING

TECHNICAL INFORMATION

HEAT ENGINEERING PRODUCTS

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PRODUCTS OF AUTOMATIC CONTROL ENGINEERING - **TECHNICAL INFORMATION**

CONTENT

INTRODUCTION

Fluid flow ratio regulation appliances, which keep the required regulation characteristics, are critical in industrial automatics systems. The main component of such appliances are controllers, which adjust the resistance for flowing fluid, and drives (actuators), which provide mechanic energy required in setting of controllers.

The following are representatives of this group of appliances, manufactured by Zakłady Automatyki POLNA SA:

- globe and angle control valves,
- three-way control valves,
- butterfly valves.

Regarding the type of drive, controllers are manufactured in following executions:

- with spring diaphragm pneumatic actuators,
- with electric and electro-hydraulic actuators,
- with pneumatic piston actuators,
- with hand operated drive,
- without drive.
-

Regarding the fact that valves are the largest group of controllers, the expression "valves" is hereinafter often interchangeable with expression "controllers".

While selecting valves for specific working conditions one should consider the following aspects:

1. valve design version,
2. material execution,
3. nominal pressure,
4. flow coefficient,
5. flow characteristics,
6. internal tightness,
7. bonnet type and packing,
8. body connection types,
9. hardening of valve internal parts,
10. selection of drive,
11. harmful effects in valve operation.

1. DESIGN VERSIONS

The design version aspect applies only to valves.

Valves can be subdivided using the following criteria:

a) position of body inlet and outlet
- globe,
- three-way,
- angle,

b) closing component
- with linear motion valve plug,
- with rotary motion valve plug,

c) shape of closing component
- profile valve plug,
- perforated valve plug,
- multi-stage valve plug,
- cage valve plug,

d) balancing of axial forces
- unbalanced,
- balanced,

e) reversibility of operation
- reversible design double-ported valves,
- irreversible design single-ported valves.

Globe valves with linear situation of input and output are the basic, most common group of valves. Three-way valves are used in installations where mixing or separation of fluid is required. Angle valves are preferred option in applications where flashing (evaporation) and large pressure drops occur. A variation of angle valves are „ ⅂ ” valves, with parallel but not axial body ends.

Rotary plug globe valves are recommended in cases of large flows and demand for precise adjustment in the beginning of opening. Perforated (perforated) components are used mostly to reduce noise emissions. Multi-stage valve plugs reduce cavitation and choked flow.

In cage valves there is a piston valve plug, working with perforated control cage. They are used for large pressure drops applications.

Pressure balancing of valve aims at equalization of static pressure on both sides of valve plug, by means of balance holes or internal valve plug (pilot).

For selection of the valve balancing method the following factors must be taken into account:

a) plug - pilot
- flow direction - above the plug (Flow To Close - FTC),
- high leakage class - (V class),
- enhanced rangeability,
- limited possibility to manufacture two-stage plugs to apply throttling cages.

b) balancing and relieving holes in the plug
- flow direction under the plug (Flow To Open - FTO), - max. leakage class (IV class),
- plug sealing subjects to wearing - it must be replaceable, - possibility to manufacture multi-stage plugs to and apply throttling cages.

Reversibility of valve operation denotes possibility of changing its function (pressing the valve plug stem can cause opening or closing of valve) in the consequence of different assembly of valve internal parts.

While selecting valve design one should consider the following aspects:

- leakage class

Single-ported valves are more tight than double-ported ones.

- balancing of axial forces

Double-ported valves require smaller resetting forces and allow transferring of larger pressure drops than in the case of single-ported valves with same actuators.

- flow coefficient

Single-ported valves feature better possibility of flow reduction, whereas double-ported valves and rotary plug valves feature better flow coefficients than single-ported ones, with same valve diameter.

- nominal pressure

Irreversible valves are used in applications with higher nominal pressure than in the case of reversible valves.

- fluid viscosity

It is recommended, that single-ported valves are used with dense fluids, with viscosity $v>10^{-5}$ [m^2/s], where laminar flow may be observed.

2. MATERIAL EXECUTIONS

Material execution is determined by material in which body is executed.
Basic material executions of the body casts:

- cast iron:	EN-GJL 250,	per PN-EN 1561
- spheroidal iron:	EN-GJS-400-15,	per PN-EN 1563
	EN-GJS-400-18LT,	per PN-EN 1563
- carbon steel:	GP240GH, (1.0619),	per PN-EN 10213-2
	G20Mn5, (1.6220)	wg PN-EN 10213-3
	WCB,	per ASTM A216
- alloy steel:	G17CrMo9-10, (1.7379),	per PN-EN 10213-2
	WC9,	per ASTM A217
- stainless steel:	GX5CrNiMo19-11-2, (1.4408),	per PN-EN 10213-4
	CF8M,	per ASTM A351

Criteria for selection of material:

- corrosion proofness,
- working temperature,
- nominal pressure,
- requirements of technical specifications (AD 2000 Merkblatt, WUDT-UC, ASME Code)

Material corrosion proofness depends on type of fluid, its temperature, concentration, etc. It is to be assessed base don generally available tables and recommendations, or information by valve manufacturer. Relationship between working temperature and pressure are illustrated in tables in catalog product charts. Minimum operating temperature for all materials is -10°C.
There is a possibility of lowering operating temperature, as below:

- 40°C	for spheroidal irons, EN-GJS-400-18LT,
- 60°C	for carbon steels, GP240GH, (1.0619) i WCB,
- 90°C	for carbon steels G20Mn5, (1.6220),
-196 °C	for stainless steels, GX5CrNiMo19-11-2, (1.4408) i CF8M, provided that:

- design pressure is reduced respectively,
- results of impact strength tests at working temperature are positive,
- heat treatment (stress relieving) of casting is performed.

Requirements of AD 2000 Merkblatt specification, sheet A4, do not allow pressure equipment execution in grey iron, with exception of products executed under Article 3.3 of Pressure Equipment Directive in accordance with Technical Specification WUDT-UC.

3. NOMINAL PRESSURE

Nominal pressure is a dimensionless marking of maximum operating pressure at ambient temperature, preceded with PN or CL symbol.
Control valves are executed in following nominal pressures:

PN6; 10; 16; 25; 40; 63; 100; 160; 250; 320; 400	per PN-EN 1092-1, DIN2548, DIN2549, DIN2550, DIN2551, PN-H-74306, PN-H-74307
CL150; 300; 600; 900; 1500; 2500	per ANSI/ASME B16.5, PN-EN 1759-1
PN20; 50; 110; 150; 260; 420	per PN-EN 1759-1, PN-ISO 7005-1

Pressures PN20…420 are equivalent to CL150…2500.

4. FLOW RATIO

Flow coefficient Kv is the stream of water in [m^3/h], with temperature 5°C to 40°C, flowing through the valve, at pressure drop 1 [bar], for specific stroke of valve.
Kv coefficient describes minimum hydraulic resistance of valve. Familiarity with Kv coefficient allows to directly determine valve nominal size DN and diameter of pipe the valve is to be connected to.
Many different Kv values can be obtained for same nominal sizes DN, in the consequence of application of reduced passages of valve seats. Nominal (catalog) value of flow coefficient is marked Kvs.
Relationships between flow coefficient, flow rate and pressure drop for various states of aggregation and flow conditions can be determined using formulas on page 5.

Said formulas allow approximation of Kv coefficient. They however do not account for effects of fluid viscosity, change in density of flowing fluid, critical flow, etc. For more details refer to PN-EN 60534-2-1 “Industrial-process control valves. Flow capacity-sizing equations for fluid flow under installed conditions.

It is advised that DIVENT valve calculation and calculation program is used, which can be downloaded from the following website

www.polna.com.pl

To ensure correct work of automatic controls and to avoid oversizing of the valve, adopted catalog value of flow coefficient is to be higher than calculated. It is assumed that maximum value of calculated flow coefficient is to be achieved within the 70…90% range of valve plug stroke.

5. FLOW CHARACTERISTIC

Valve flow characteristics is the relation between flow value and closing component stroke. Regarding pressure drop we can divide characteristics into internal and working characteristics.
Internal characteristics describes relation between relative flow coefficient “kv” and relative stroke “h” at constant pressure drop in valve, where:

$$k_v = \frac{K_v}{K_{v100}} \qquad h = \frac{H}{H_{100}}$$

Working characteristic describes change in flow in function of stroke at variable pressure drop in valve, in installation conditions.
Valves have the following flow characteristics:

- linear - „L”
- equal percentage - „P”
- modified - „M”
- quick opening - „S”

Valve characteristic is obtained by proper design of fluid flow area between valve choking components regarding the stroke. This function is realized through contoured valve plugs or perforated components (perforated valve plugs, control cages):
- linear characteristic: equal increase in relative stroke “h” correspond with equal increase in relative flow coefficient “kv”.

$$k_v = k_{v0} + m \cdot h$$

where: k_{v0} is a minimum controlled relative flow ratio,

$$k_{v0} = \frac{K_{v0}}{K_{vs}}$$

m - characteristic inclination
For POLNA valves: k_{v0} = 0,02; m = 1

- equal percentage characteristic: equal increase in relative stroke “h” corresponds with equal per cent increase in relative flow coefficient „kv”

$$k_v = k_{v0} \cdot e^{n \cdot h}$$

where: n is characteristic inclination drawn in semi-logarithmic coordinates (h, lg kv).

$$n = ln\frac{1}{k_{v0}} = ln\ 50 = 3{,}912$$

- modified characteristic: is a characteristics in between “L” and “P”, created for individual needs and specific installations. It mostly is of equal percentage nature at the beginning of stroke (h=0…0.3) and linear in the subsequent part of stroke.
- quick opening characteristic: used for “open-close” on-off operation; it allows achievement of nominal flow at low stroke (h=0.6…0.7) and increase in flow coefficient by ca. 20% regarding catalog value, at full stroke.

Selection between value with equal percentage and linear characteristics depends on requirements concerning changes in flow rate and pressure on valve.
With small changes in flow rate during valve operation, up to 50%, selection of characteristics has no material effect to performance of control system. However for valves operating at large changes in flow rate, with variable pressure drop, and in case of doubt selection of constant per cent characteristics is recommended.

Valves with linear characteristics are recommended for systems, where pressure drop on valve is independent from flow rate, e.g. control of fluid level.

Valve plugs with quick opening characteristics are designated exclusively for on-off operation. Limitations in application of perforated components are due to their susceptibility to contaminants suspended in fluids, hence the need for their permanent filtering.

Flow type	Fluid	Gas	Steam
Subcritical $p_2 \rangle \frac{p_1}{2}$ $\Delta p \langle \frac{p_1}{2}$	$K_v = \frac{Q}{31{,}6}\sqrt{\frac{\rho_1}{\Delta p}}$	$K_v = \frac{Q_N}{504}\sqrt{\frac{\rho_N \cdot T_1}{\Delta p \cdot p_2}}$ $K_v = \frac{G}{504}\sqrt{\frac{T_1}{\rho_N \cdot \Delta p \cdot p_2}}$	$K_v = \frac{G}{31{,}6}\sqrt{\frac{\nu_2}{\Delta p}}$
Supercritical $p_2 \langle \frac{p_1}{2}$ $\Delta p \rangle \frac{p_1}{2}$	$K = \frac{G}{31{,}6}\sqrt{\frac{1}{\rho_1 \cdot \Delta p}}$	$K_v = \frac{Q_N}{252 \cdot \rho_1}\sqrt{\rho_N \cdot T_1}$ $K_v = \frac{G}{252 \cdot \rho_1}\sqrt{\frac{T_1}{\rho_N}}$	$K_v = \frac{G}{31{,}6}\sqrt{\frac{2\nu}{\rho_1}}$

Kv [m³/h] - flow coefficient (calculated)
Q [m³/h] - fluid flow volume intensity
Q_N [Nm³/h] - gas flow volume intensity in normal conditions (0°C, 760 mm Hg)
G [kg/h] - flow mass intensity
p_1 [bar(a)] - absolute pressure upstream valve
p_2 [bar(a)] - absolute pressure downstream valve
Δp [bar] - pressure drop on valve (available pressure drop)
ρ_1 [kg/m³] - fluid density upstream valve
ρ_N [kg/m³] - fluid density in normal conditions
T_1 [K] - fluid temperature before agent
v_2 [m³/kg] - specific volume of steam for parameters p_2 and T_1
v [m³/kg] - specific volume of steam for parameters (p_1/2) and T_1

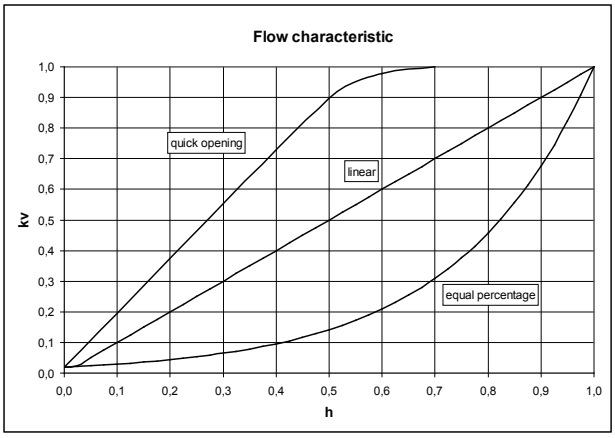

Fig. 1. Flow characteristics for valves

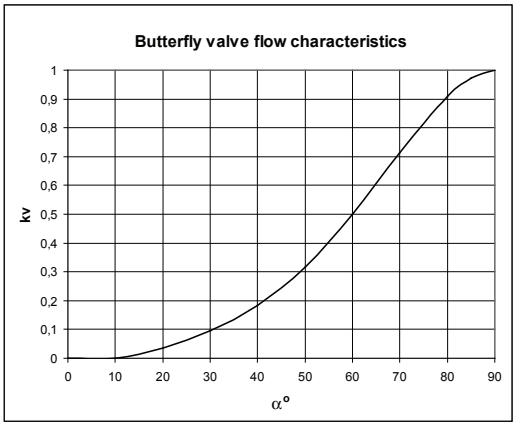

Fig. 2. Flow characteristics for butterfly valves

Three way and rotary valve plug valves feature linear characteristics, whereas butterfly valves feature characteristics similar to equal percentage characteristics in the range of opening angles 0°…60° (Fig. 2).

6. INTERNAL TIGHTNESS

Maximum leakage of closure by valve choking components (“plug - seat”) is described in leakage classes as per PN-EN 60534-4.

Leakage class	Allowed leakage
II	- $5 \cdot 10^{-3}$ Kvs
IV	- 10^{-4} Kvs

V - $3 \cdot 10^{-4} \cdot \Delta p \cdot D$ [cm³/min]

VI - 1 [blister/min] do D = 25

Allowable leakage [blister / min.]	Seat diameter D [mm]
1	25
2	40
3	50
4	65

Allowable leakage [bubble / min.]	Seat diameter D [mm]
6	80
11	100
27	150
45	200

Checking the internal tightness is carried out as part of acceptance tests of the product with the use of air with pressure 3…4 [bar] (for valves in classes II, IV and VI) and with water with working pressure conforming to the order (for valves in class V).

Valves in class VI have seats (single-seat valves) or plugs (two-seat valves) equipped with packing rings made of PTFE reinforced with glass fibre.

Because of durability of the packing material, pressure drop on the valve must not exceed 35 bar.

Valves in class V require careful and laborious fitting of closing elements and a greater disposition force of the drive.

Another acceptance criterion is the norm PN-EN 12266-1 “Industrial valves. Testing of metallic valves. Part 1: Pressure tests, test procedures and acceptance criteria. Mandatory requirements.”

The following can be used as test media:

• Air (for pressure 6 bar),
• Water (for pressures $1{,}1 \cdot \Delta p_{max.}$).

Acceptable leakage [mm³/s] can be calculated for the given class according to the following formulas:

Medium	Class A	Class B	Class C	Class D	Class E	Class F	Class G
Water	0	0,01 · D	0,03 · D	0,1 · D	0,3 · D	1,0 · D	2,0 · D
Air	0	0,3 · D	3,0 · D	30 · D	300 · D	3000 · D	6000 · D

where: Δp [bar] - working pressure drop
D [mm] - valve seat diameter

Internal tightness is checked during acceptance tests, using air at pressure 3…4 [bar] for valves of class II, IV, VI, and using water at working pressure as per order, for valves of class V.

Class VI valves valve seats (single-ported valves) or valve plugs (double-ported valves) are equipped with PTFE seal ring reinforced with glass fiber. Due to durability of sealing material pressure drop on valve cannot exceed 35 bar.

Class V valves require precise and time-consuming fitting of valve closing components and higher available force of drive.

7. BONNETS, TYPES AND PACKINGS

Bonnet is a pressure equipment used to contain and seal the component (valve plug stem, shaft) transmitting motion from drive to closing component.
Bonnet can be integral part of body or be separated from body.
Control valves are fitted with following types of bonnets:
- standard bonnet
- extension bonnet
- bellow seal bonnet

The basic criterion in selection of bonnet is fluid temperature. Extension bonnets are used in both high and low temperatures. There is a execution of extension bonnet specially designed for cryogenics (temperatures up to -196°C).

Bellow seal bonnets ensure absolute internal tightness and they are used mostly for aggressive media. Standard bellow seal bonnets can be used up to pressure 35 bar. Application for higher pressures require to use multi-layer bellows.

Cast iron valves are only fitted with standard bonnet. Control valves DN150…250, PN160…CL2500 can be equipped with self-sealing bonnets. Type of valve plug stem packing in bonnet depends on temperature and type of fluid. In majority of cases PTFE rings with graphite are applied. Pure graphite packing is recommended for steam and high temperature operations. Such packing does not require lubrication, although they do require adjustment during operation, due to relaxation and wearing-off.

Among maintenance-free packings are PTFE-V and TA Luft packings. PTFE-V ones are executed in PTFE in the form of V-profile rings, pressed to sealed surfaces with spiral spring. TA Luft packing comprises two kits of seal rings loaded with package of disk springs, and compliant in terms of tightness requirements of TA Luft:2002, Clause 5.2.6.4, and VDI 2440:2000.

8. END CONNECTIONS, TYPES

Body connections are used to connect valve to pipeline and they should provide tightness, pressure resistance, vibration resistance and pipeline deformations.
Valves are executed with following types of connections:

- flanged,
- flangeless,
- welding.

Flanged connections are executed as per European (PN-EN 1092-1, PN-EN 1092-2, PN-EN 1759-1, DIN 2548, DIN 2549, DIN 2550, DIN 2551, PN-ISO 7005-1, PN-H-74306, PN-H-74307) and American (ANSI/ASME B16.5) standards.
Regarding sealing surface type flanges can be executed with:

- raised face type B1, B2, B, RF
- groove, type D, D1, GF, DL
- recess type F, F1, FF
- ring-joint, type J, RTJ

Rotary plug valves and butterfly valves have flangeless connections of Sandwich type. Body is fitted between pipeline counter-flanges by means of bolted ends.
Valves with welding connections are designed for butt welding, BW type, or socket welding, SW type. Pipe dimensions and body lengths specified in catalog apply to execution of connections from body casting. Application of smaller pipe dimensions is limited due to minimum internal diameter of pipe that can be achieved from casting (D1 min). In such case reduction stub is to be welded to body, which shall cause elongation of valve body by 100 mm (DN15…50), 150 mm (DN80, 100), 200 mm (DN150) and 300 mm (DN200, 250) – in case of stubs fixed on both sides of the valve.

9. HARDENING OF VALVE INTERNAL PARTS

In standard execution valve internal parts: valve plugs, valve seats, valve plug stems, cages, guiding sleeves are executed in high-alloy austenitic steel X6CrNiMoTi 17-12-2 (1.4571) as per PN-EN 10088-1.

In order to improve mechanical and chemical resistance to fluid the following hardening methods of internal parts are used: stelliting, nitriding, heat treatment, protective coatings.
Stelliting hardens the surface down to ca. 1 mm, to hardness of ca. 40 HRC. Stelliting can be applied to sealing phases of valve plug and valve seat, or additionally valve plug trim surfaces, openings of valve seats and guiding sleeves, valve plug stem friction surfaces.
Plugs with the diameter smaller than 10mm can be made of solid stellite.

Nitriding (CrN) consists in hardening of component surfaces down to ca. 0.1 mm, to hardness of ca. 900HV, in the effect of plasma or diffusion processes. Nitriding is recommended for application with surfaces exposed to friction or erosion. Heat treatment is applied in order to achieve high durability and resistance to wear. Depending on the material type hardness achieved is up to 45 HRC (1.4057) or 55 HRC (1.4125).
Composite protecting coatings (BELZONA) are applied on body internal surfaces in order to protect them from erosion (flashing, abrasive fluids).

Hardening of valve internal parts is recommended in the following cases:

- handling of erosive fluids,
- wet gas or saturated steam,
- dry, pure gas

(Δp> 25 bar (up to DN100), Δp> 12 bar (DN>100)),

- chocked flow,
- initial cavitation: (liquid Δp> 10 bar, temp. > 315°C).

Contraindications for stelliting

- boiler water pre-treated with hydrazine,
- perforated components,

10. SELECTION OF DRIVE

Valves and butterfly valves can be equipped with spring diaphragm pneumatic actuator, piston actuator, electric actuator, electro-hydraulic actuator, handwhell, or no drive at all.

Equipment without drives can be completed by end user with other types of actuators, such as springless diaphragm pneumatic, piston pneumatic acutator, crank actuator, and others, provided that such actuators are adapted to connection with valve bonnet and valve plug stem.

Hand operated equipment is mostly used for applications requiring on-off regulation.

While selecting spring diaphragm pneumatic actuator the following is to be determined:

- actuator type,
- actuator size,
- spring range,
- supply pressure,
- stroke,
- requirements concerning accessories.

Selection of pneumatic actuator (whether direct or reverse action) depends on equipment operation control signal failure. Whether the valve is to stay open or closed on control signal failure is the technical requirement of installation.

Actuator size, spring range and supply pressure are to be taken from tables in catalog, depending on required available force of actuator.

Available force of actuator is to be lower than Fs calculated using the below formula:

$$F_s = 0{,}785 \cdot 10^{-4} \cdot \Delta p \cdot D^2 + F_d$$

where: F_s [kN] - available force
Δp [bar] - pressure drop on closed valve
D [mm] - valve seat diameter
F_d [kN] - tightening force

Values D and Fd are to be taken from catalog charts, and Δp from order.

Disposition force of type „P" actuators - F_{SP} [kN] is dependent on the active flank of the actuator A [cm^2], supply pressure p_Z [kPa] and the final spring travel p_2 [kPa].

$$F_{SP}=10^{-4} \cdot A \cdot (p_Z-p_2)$$

Disposition force of type "R" actuators – F_{SR} [kN] is dependent on the active flank of the actuator A [cm^2] and the initial spring travel p_1 [kPa].

$$F_{SR}=10^{-4} \cdot A \cdot p_1$$

Disposition forces F_{SP} and F_{SR} calculated that way are established without consideration of friction force of movable elements (spindle of the actuator and the valve) or tolerances of spring manufactures, hence they should be treated with a 20% reserve regarding those factors.

The calculations refer to single-seat valves type Z, Z1A and Z1B in a closed position.

Catalog charts provide allowable pressure drops for various pneumatic actuators and various internal leakage classes of valves.

Those values apply to single-ported valves, unbalanced, with fluid fed under the valve plug (FTO).

With fluid fed above the valve plug (FTC) allowable pressure drop may be higher, however such an arrangement causes valve plug hitting the valve seat when closing and disturbances to control. Hence it is used mostly in on-off operations, with actuator equipped with higher stiffness springs. For valves with valve plug unbalanced it is assumed that available force Fs is at least equal to tightening force for class V leakage.

In the case of double-ported valves it is not possible to procure a table of allowable pressure drops, due to dynamic forces occurring, which depend on i.a. actual flow conditions (pressure, fluid type, valve plug type, valve operation type). In case when knowledge of forces acting on double-ported valve plug stem is required, please contact manufacturer, stating all the data related to valve operation.

Pneumatic actuator accessories may comprise the following:

- top-mounted or side-mounted handwheel,
- positioner: pneumatic, electro-pneumatic with analog or digital signal (smart positioner),
- air set,
- three-way solenoid valve,

- position transmitter,
- limit switches,
- lock-up valve,
- volume booster,
- quick exhaust valve.

Handwheel is applied in case of control signal failure, as well as to limit valve stroke.

Application of positioners is recommended in following cases:
- for systems requiring large pressure drops on valve,
- for high working pressure,
- for valves of nominal diameter DN > 100 mm,
- for distance between valve and reducing valve exceeding 50 m,
- for three-way valves,
- for systems requiring high-speed action,
- for viscous or highly contaminated fluids sedimenting on valve seat,
- for media of temperature higher than 250°C or lower than -20°C,
- when spring range does not correspond with range of out signal from controller.

Designation of accessories:
- filter reductor is used to reduce supplying pressure to required value and to clean incoming air.
- solenoid valve assists remote switching of control circuit on and off.
- position transmitter is used to reflect position of valve plug stem in the form of unified pneumatic (e.g. 20…100 kPa) or electric (e.g. 4…20 mA) signal.
- limit switches are used to signal preset positions of actuator stem.
- lock-up valve is used to block valve plug stem movement in current position with control signal missing.
- volume booster is used to accelerate actuator time of action.
- quick drain valve allows to reduce actuator chamber drainage time.

11. HARMFUL EFFECTS IN VALVE OPERATION

Harmful effects in valve operation, such as noise, cavitation, choked flow, flashing, are discussed in the study titled „Harmful phenomena in the work of valves”.

NOTES:

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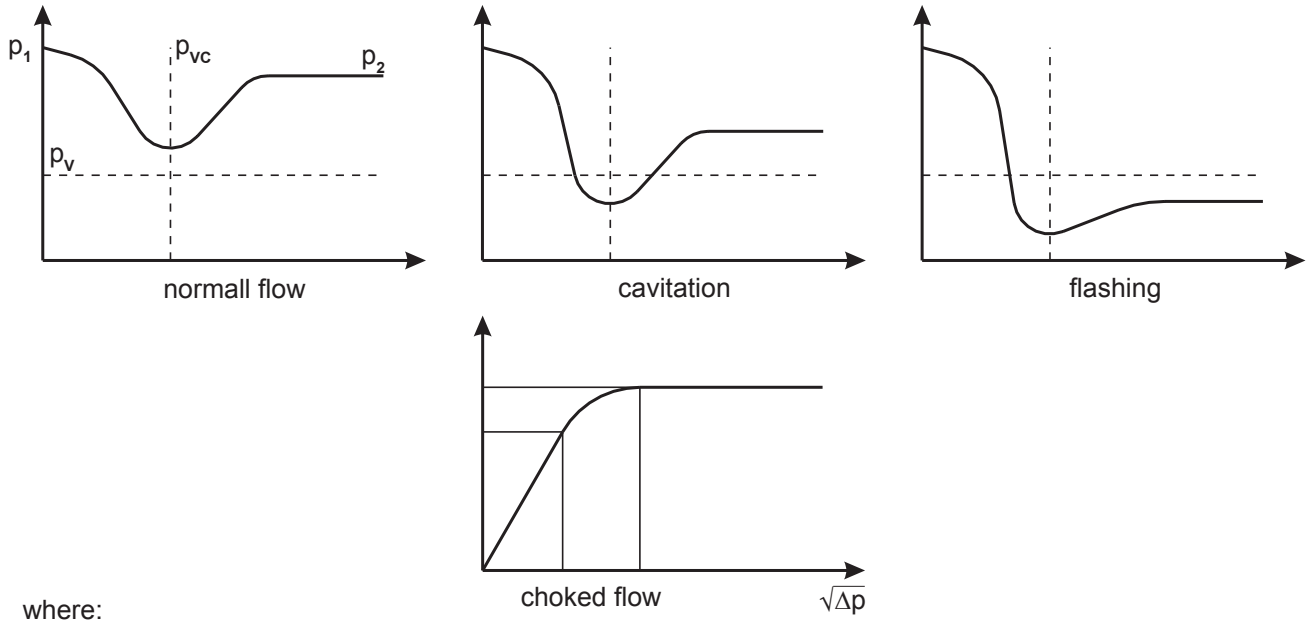
HARMFUL PHENOMENA IN THE WORK OF VALVES. - **TECHNICAL INFORMATION**

The flow of medium through the valve (depending on the kind and parameters of the medium) may cause phenomena having a negative impact on the environment and be destructive to the product's durability.
Risk factors should be diagnosed in detail in order to be used for actions aimed at limiting or eliminating their negative influence.
Harmful phenomena connected with the flow include the following factors:

- Noise
- Cavitation
- Evaporating (flashing)
- Choked flow

The conditions in which the above-mentioned phenomena occur are explained by the following graphs:



where:
p_1 - pressure before the valve,
p_2 - pressure after the valve,
p_{vc} - pressure in the "vena contracta" zone,
p_v - pressure of evaporating.

Medium flowing through valve shall invariably cause noise.
Adverse effect of noise is due to its harmful effect to health and working environment. Noise is also the symptom of processes inside the valve, generally reducing durability of appliance, including damage.
Noise level is measured in [dBA] units, 1 m from the pipeline surface and valve axis, in the direction to medium outlet.
Human ear is most sensitive to frequencies 3000 to 4000 Hz. Allowable workplace noise level depends on duration of exposure. For continuous work it is 85 dB(A), for short exposures, say 15 minutes a day, it is up to 115 dB(A). 3 dB(A) difference means double increase in noise level; hence two appliances generating 82 dB(A) are equivalent to one appliance generating 85 dB(A). Noise level drops by 3 dB(A) with each doubling of distance from pipeline.

Sources of valve noise emissions may be as follows:
- mechanic noise,
- aerodynamic noise,
- hydrodynamic noise.

Mechanic noise may be caused by vibrations of valve internal parts, resonance, misguiding of moving parts, excessive clearance. One of the methods to eliminate such noise is application of cage construction and selection of proper clearances to valve working conditions.

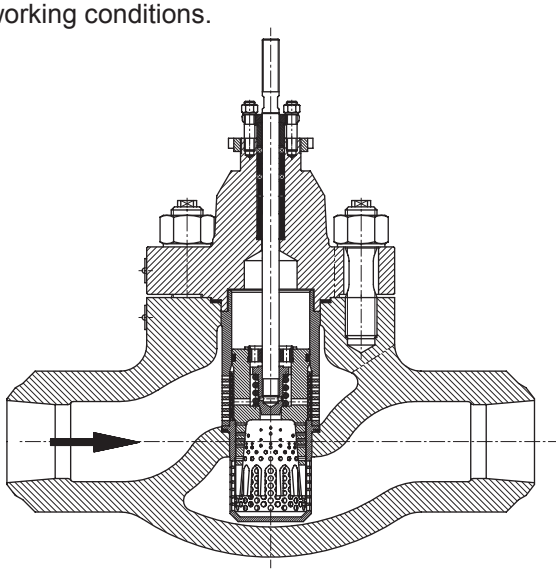


Fig. 1. Valve for high pressure and high temperature operation

In Fig. 1 a valve is shown designated for operation at temperatures up to 500°C, with possibility of thermal shocks. Valve plug is guided in valve seat and in cage. Application of steel spring ring allows increase of clearance between valve plug and cage without causing vibrations and loss of tightness. Mechanic vibrations can also be reduced through change in valve plug weight and direction of medium flow.

Aerodynamic noise is generated when mechanic energy of compressible medium flow is transformed to acoustic energy. Source of noise is increase in flow speed due to medium decompression, often exceeding speed of sound.

Noise reduction can be achieved by means of using proper installation (insulation on outlet pipeline, increased thickness of pipeline walls), or by means of selecting proper valve construction. The most important and most efficient way is to apply in valve perforated control structures in the form of perforated valve plugs (Fig. 2) or cages (Fig. 3).

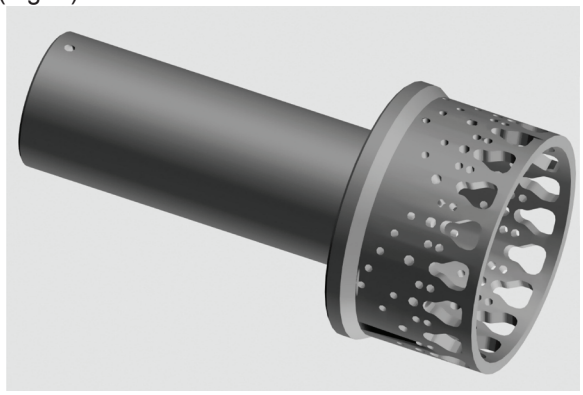


Fig. 2. Perforated valve plug

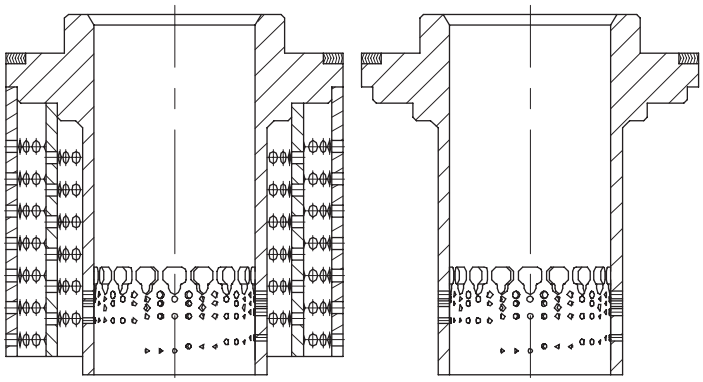


Fig. 3. Perforated control cages

Splitting of a single stream to multitude of smaller, well adjusted streams, causes reduction in noise emission as high as by 10 dB(A), due to following:
- reduction in efficiency of mechanic to acoustic energy transformation,
- smaller spin causes generation of higher frequency energy, which is easier to damp by walls and insulation,
- high frequency sound (> 10 000 Hz) is less harmful to human ears.

Another way of reducing aerodynamic noise (by ca. 5 dBA) is reduction in medium outflow speed at outlet. The most common method of doing so is increasing the outlet pressure by application of choking structures in the form of perforated cages and plates, and application of diffusers. In cases of high noise level it is often necessary to apply all those solutions at the same time (Fig. 4).

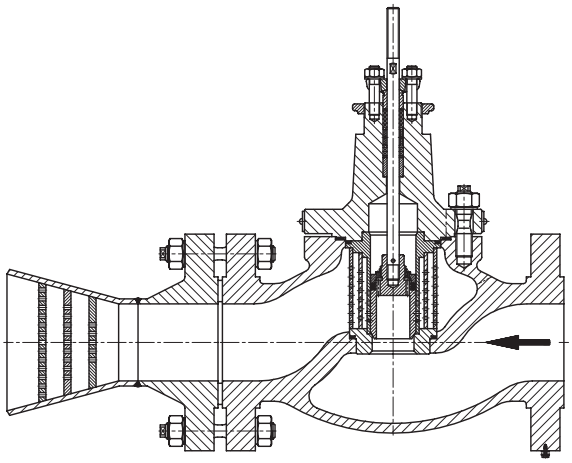


Fig. 4. Valve for compressible media to operate in noise and choked flow

Fig. 5. Damage of valve due to cavitation

Fig. 6. Damage of valve due to flashing

Hydrodynamic noise is generated by flow of fluids, and its sources can be as follows:
- turbulent flow interacting with valve and pipeline walls,
- cavitation,
- evaporation (flashing).

Cavitation consists in local, usually in vena contracta area, evaporation of fluid due to pressure drop below evaporation pressure p_v. Then, due to valve outlet pressure increase to value $p_2 > p_v$, implosion of generated steam bubbles occurs. In addition to noise, such a phenomenon features sudden accelerations and blows of two-phase mixture (fluid-steam), and resulting damages (Fig. 5) to valve or pipeline surfaces.

Should outlet pressure stay lower than evaporation pressure ($p_2 < p_v$) fluid is permanently turned to mixture of fluid and steam, with steam share depending on pressure and temperature.

This phenomenon is called evaporation (flashing).

Then sudden increase in flow volume and speed occurs. Mixture stream erodes internal valve surfaces (Fig. 6) and pipeline, and is the source of noise as well. The most harmful phenomenon is however cavitation. Its effect can be reduced by means of application of proper materials and surface hardening technologies on one hand, and application of design methods for elimination or controlling of cavitation on the other hand.

Another proven methods are: improving valve plug and valve seat durability by stelliting their phases or whole trims, diffusion or plasma nitriding, allowing achievement of surface hardness 950 HV to the depth of ca.0.1 mm, or through hot-setting to hardness 55 HRC. The basic design solution of anti-cavitation valves is execution with multi-stage valve plug (Fig. 7). The concept behind that solution is possibility of achieving pressure drops on each stage below critical value. It is however difficult to achieve effective choking on individual stages at the beginning of valve opening. In such cases we use contoured and perforated multi-stage valve plugs, with active structures which resistance depends on valve opening, and passive structures, in the form of cages and perforated plates (Fig. 8).

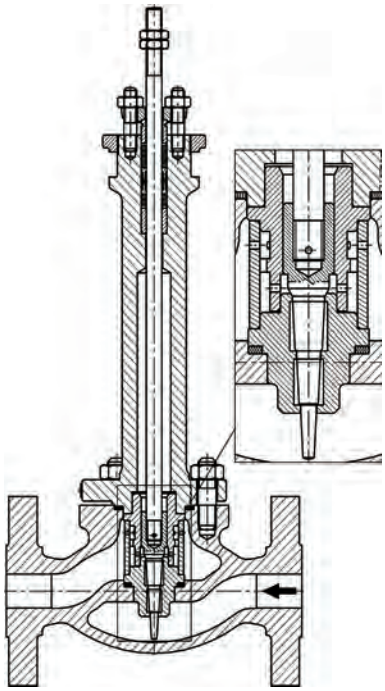


Fig. 7. Multi-stage anti-cavitation valve for small flows

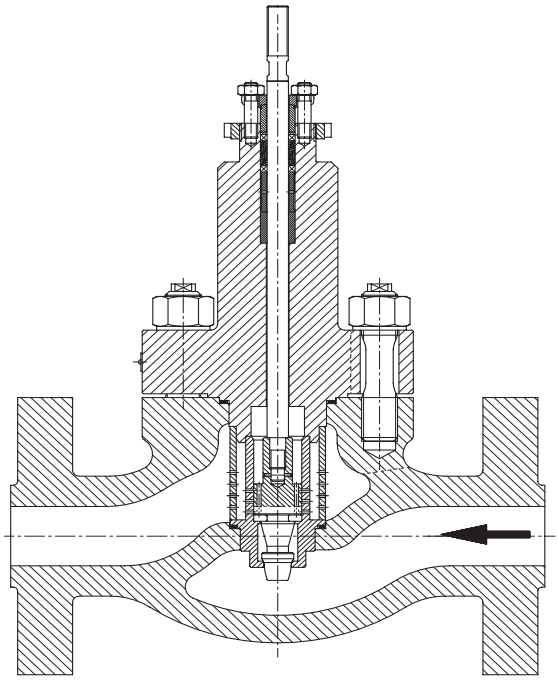


Fig. 8. Multi-stage anti-cavitation valve with various choking structures

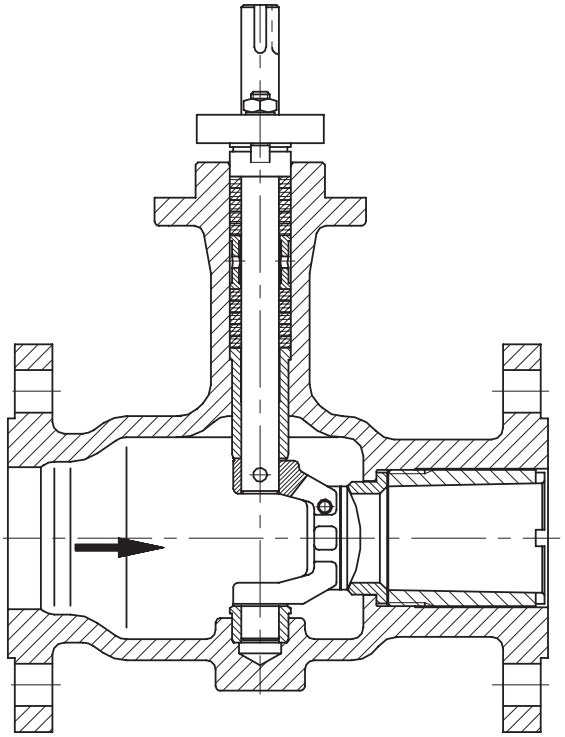


Fig. 9. Rotary valve for operation In flashing conditions

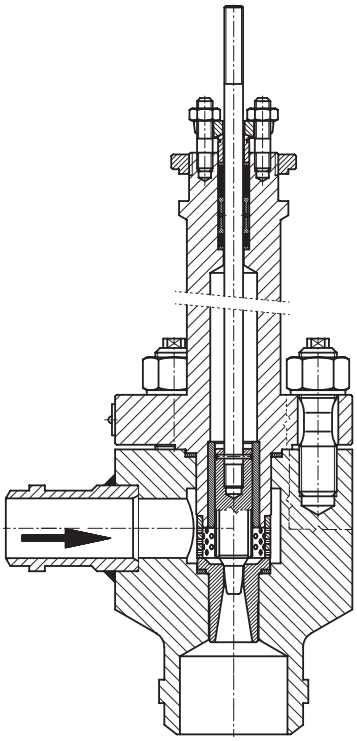


Fig. 10. Angle valve with anti-erosion seating

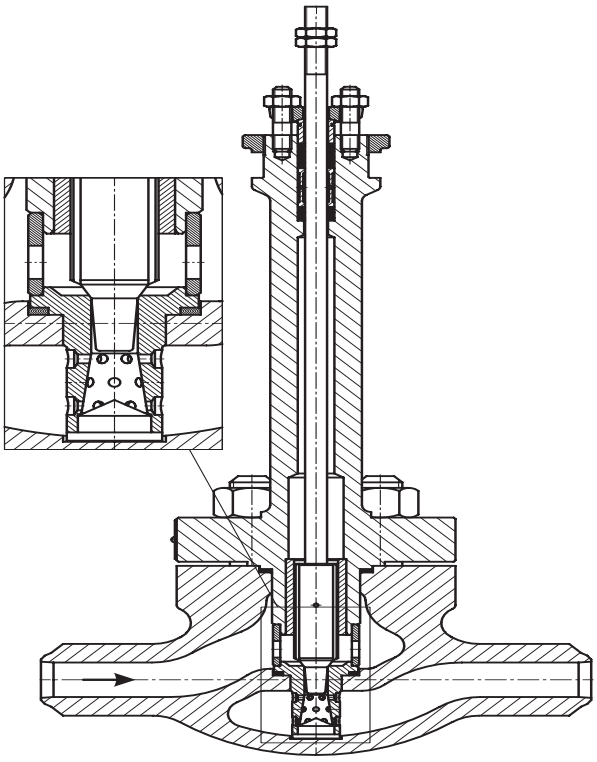


Fig. 11. Valve fitted with protective cage

Although occurrence of flashing depends only on flow parameters, and cannot be eliminated through design changes, its damaging effects can - and have to – be eliminated.
In addition to above discussed methods of improving durability of valve components, POLNA offers also application of hardening coatings on internal valve body surfaces, and application of valves fitted with anti-corrosion bushing (Fig. 9); angle valves (Fig. 10); and valves with protective cage (Fig. 11).

All above noise reduction methods applied in control valves by Zakłady Automatyki POLNA SA in Przemysl, are tailored to Customers' needs.
We design our valves after thorough analysis of phenomena occurring in flow process, based on detailed data and using specialized computer software DiVent and CONVAL®. Not only do our designs meet all standards, but also they solve problems the Customer's are unaware of.
CONVAL® software has a Polish version, made by our own company, and contains data about the POLNA product offer.

NON-CATALOG PRODUCTION

Zakłady Automatyki "POLNA" S.A. in Przemyśl have been operating non-stop since 1899.

Since 1960s, nineteen sixties, its many production programs can be divided into four product groups:

- automatic control engineering (industrial automation)
- heat engineering
- central lubrication equipment and systems
- laboratory equipment: water distillers.

The biggest product group consists of automatic control engineering products.
This production started in 1967, when a licence for control valves and pneumatic actuators was purchased from MASONEILAN company – one of the world leaders in this industry.

In subsequent years work continued on post-license works developing and expanding the range of and varieties of products, as well as developing its own designs for the needs and requirements of the market.

Such work led to the creation of a big offer of valves and pneumatic actuators within the Company's catalog. The product range consists of valves ranging in size from DN15 up to 300 and with nominal pressure from PN6 – 400 and with flow coefficients from Kvs 0,01- 6,300 and with cast bodies made from various materials:

- globe valves, passage, single-port valves with linear motion of the plug:

Types **Z**, **Z1A**, **Z1B**, **Z2,**

- globe valves, passage, double-port valves with linear motion of the plug:

Type **Z10**,

- globe valves, passage, single-port, with rotary-plug:

Type **Z33**,

- globe valves three-way valves with linear motion of the plug:

Type **Z3**,

- tight butterfly valves, lined:

Type **PRS**,

- diaphragm, pneumatic, multi-spring actuators:

Type **P/R**, **P1/R1**, **P5/R5**.

Over the last tens years, the importance of non-catalog products has increased, as they are designed and too the the requirements of the client and the technological needs of their project.

At present, the share of the automatic control engineering products now exceeds 30% of production, thus the necessity of presenting them in more detail.

1. Valves constructed using forged elements.

The use of forgings in pressure elements of valves enables the use of this product to work in the highest burdens in terms of pressure, temperature and the corrosive environment, which is only achieved thanks to the proper selection of materials and construction solutions.

Depending on the needs, we manufacture valves with various construction solutions: angle, passage, passage/angle („Ł" shaped with parallel, non-axial ends) and three way valves.

POLNA also offers a whole range of connections for pipelines; flange (made to EN and ANSI standards) for BW welding, direct for the body, flange-less and others.

The material used for the body is chosen depends on the working pressure during maximum working temperature. The most commonly used materials are:

- S355J2G3 (1.0570),
- 13CrMo4-5 (1.7335),
- 14MoV6-3 (1.7715),
- X10CrMoVNb9-1 (1.4903)) and others.

2. The Elimination or restriction of harmful effects related to flow.

The flow of substances through a valve, depending on it's type and parameters can cause such phenomena as high noise, cavitation, evaporation (flashing), choked flow and erosion levels, that could have a negative impact on the environment, reducing the regulatory values of the valve and having a negative impact on the product's durability.

To avoid such an impact these factors should be analyzed in detail. These actions are mainly focused on restricting the speed flow and the division of total pressure reduction on the valve into a few steps, so that the pressure reductions do not exceed critical levels.

Multihole elements (plugs, cages, plates), are in common use, and their main role being to limit noise levels. The division of pressure is achieved by means of resistance structures within the valve, such as multi-stage plugs, cages and throttling plates.

Reduction of flow speed is achieved by division of pressure reduction on the valve and/or application of enlarged outflow diameter in the valve's body or expanding elements (diffusers).

An important role is played by the proper choice of materials and the ways of increasing hardness of internal valve elements. We often utilize hardened surfaces using stelliting, plasma or diffusion nitriding, heat enhancing and protective coating.

All these factors will only fulfill their role if work conditions are known, valves are constructed properly with the skills and knowledge of our long experience.

The opinions of POLNA product users prove that we can design and manufacture valves completely fulfilling even the very highest of their requirements.

3. Valves designed for work in aggressive or dangerous environments.

POLNA produces valves for work with dangerous substances such as oxygen, hydrogen, natural gas, acidic gases containing H_2S and in dangerous environments where there are risks of explosions.

The preparation consists of the careful cleaning of surfaces coming into contact with the substance using both mechanical and chemical means, as well as using materials and ways of production and control complying with safety regulations.
Products intended for work in atmospheres with high risk of explosion are manufactured in compliance with the ATEX directive.

4. Products adapted to the specifics of particular industries.

Every branch of industry has its own characteristics, which have to be taken into consideration in the phase of designing, manufacture and control of automatic control engineering.

For products designed for power industry, the possibility of the occurrence of high temperature and pressure, thermal shocks, choked flows and excess noise must be taken into consideration.

POLNA has some tried and tested applications of product especially designed for various uses in power industry, such as:

- boiler feed valves, also fulfilling the role of starting valves,
- reducing and cooling stations with integrated injection in a pressure reducing valve,
- elements of reducing and cooling stations with integrated steam pressure reducing valves, desuperheaters, injection valves.

Pressure reducing valves, passage and angle models, with balanced plugs, eliminating choked flow, with a vast range of flow regulation.

Piston, ring, lance and steam-atomizing desuperheaters.
Anti-cavitation injection valves.

- minimum flow valves used as pump by-pass valves,
- condensate piling valves
- three-way valves for power industry applications.

For products designed for the gas and petrochemical industry, chemical resistance, it is important to take account of resistance to high pressures, flow speeds and significant temperature changes, as well as protection of the environment and work safety.

Products include:

- pressure reducing valves for significant changes of flow values,
- valves eliminating choked flow and limiting noise,
- valves working in low temperature environments (e.g. in Siberia),
- deposit water valves,
- high-pressure natural gas valves,
- valves used in cryogenics,
- anti-cavitation valves and valves resistant to erosion (flashing) for gas mines, stamping presses and gas distribution plants.

5. Valves complying with boiler regulations.

Basic valve products refer to production in accordance with the 93/27/EC pressure directive , concerning the fixing on pipelines.

POLNA also has the capability of manufacturing valves designed for vessels, in accordance with PL-EN 12952-3:2004 norm (“Water-tub boilers and auxiliary installations – Part 3: Design and calculation for pressure parts”) .

6. Custom built valves manufactured to the clients requirements.

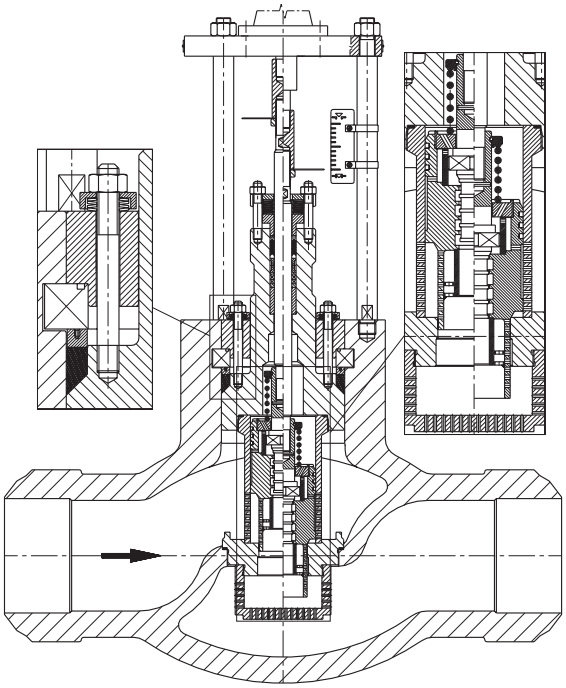
POLNA has the capability to design and manufacture valves adjusted especially for particular uses. Detailed description of requirements is key. With the use of a professional computer program CONVAL we determine phenomena occurring in particular points of a valve’s work. That information, together with long-standing experience, enables us to design valves fulfilling the recipient’s requirements. To mention just a few examples showing the variety of manufactures, we have made:

- valves for underground installations, with a proper solution of valve’s drive,
- high-pressure control and cut-off valves for the food industry,
- a wide range of valves adjusted to work in conditions of cavitation risk. The structures of valves take into consideration the requirements concerning changes of flow values (regulatability) and reduction of pressure on the valve occurring at the change of valve’s opening. Due to the uniquity of those conditions, each valve may have a structure different from the others in terms of details of technical solution.

Boiler feed valve, also fulfilling the role of a starting valve.

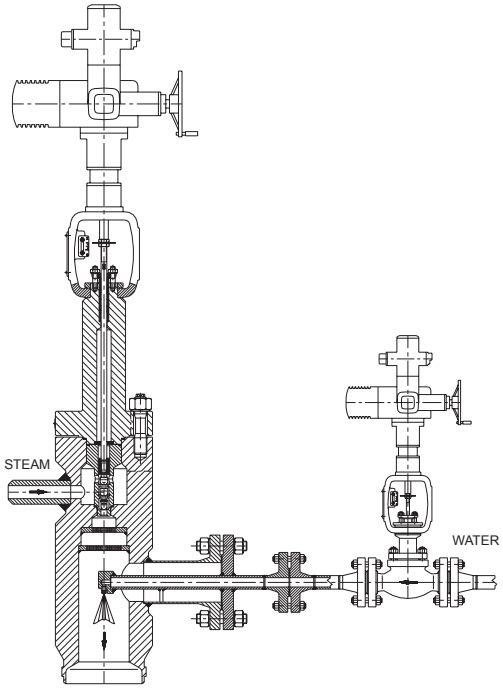
A cast body, material G17CrMo9-10 (1.7379), with a self-tightening bonnet. The main plug is controlled by an auxiliary plug (pilot), flow over the plug (FTC). A multi-step pilot allows to regulate small flows at big pressure reductions without the risk of cavitation occurring.

The main plug: two-step up to the middle of lift, with resistance elements (plates). When opened wider, no internal throttling; the function of filling the boiler is carried out at a small pressure reduced. A protective cage on the seat. It is highly air-tight



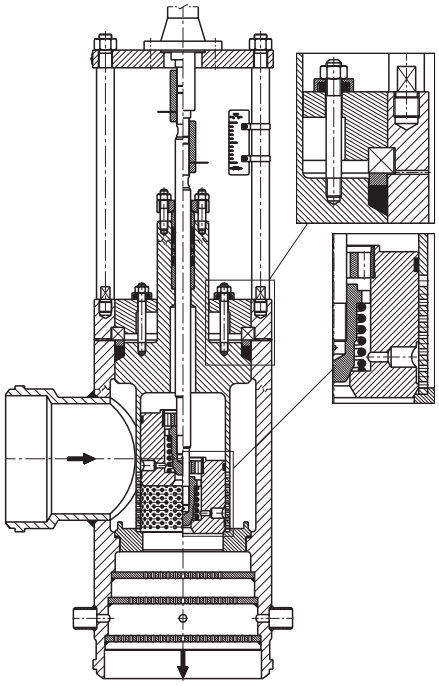
Reducing and cooling station.

An angle steam power reduction valve DN25 / DN150, is made of X10CrMoVNb9-1 (1.4903). A multi-stage plug and resistance plates on the outflow aiming at elimination of choked flow and limiting the noise levels. The cooling chamber is an integral part of the valve. A lance desuperheater, an injection valve with an anti-cavitation structure.



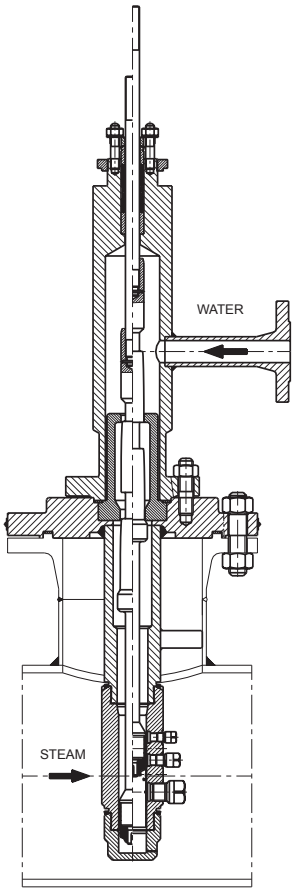
Steam reduction valve.

An angular body made of 13CrMo4-5 (1.7335). A self-tightening bonnet. The main plug: cage type, controlled by an auxiliary plug (pilot). A diffuser integral with the body of the valve with three resistance plates.



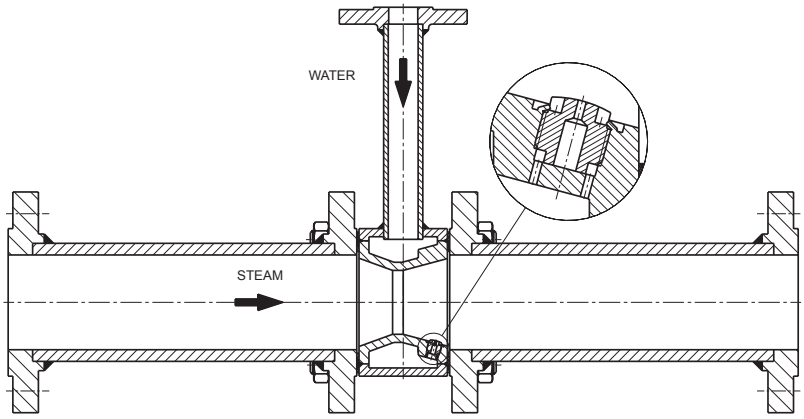
Piston desuperheater

Regulation scope Kvmax 10; regulatability 1:40, V class tightness in accordance with PN-EN 60534-4 standards. The valve part with a one- or two-step profile plug made of the 13CrMo4-5 (1.7335).
The pipeline diameter ranges to over DN200.



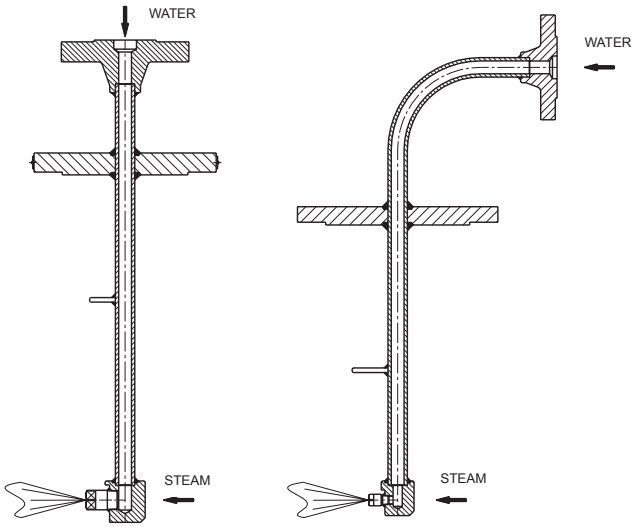
Ring desuperheater.

Regulation scope Kvmax 1.0; regulatability 1:3. Range of pipeline diameters: up to DN150.



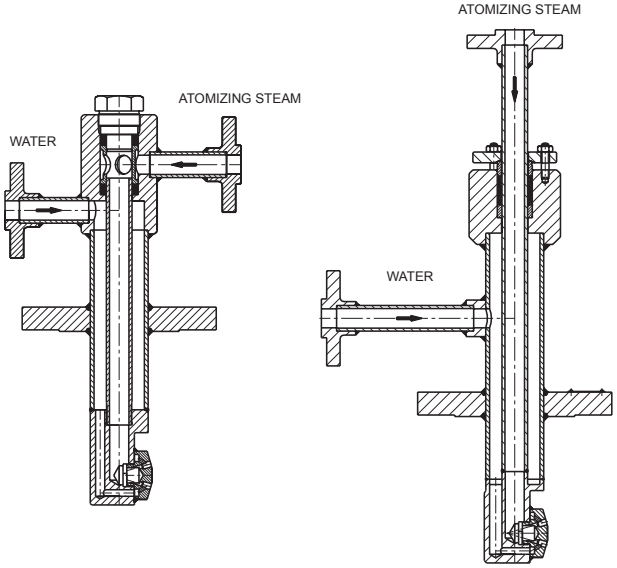
Lance desuperheater.

Regulation scope Kvmax 1.0; regulatability 1:3. Range of pipeline diameters: up to DN300.



Steam-atomizing desuperheater.

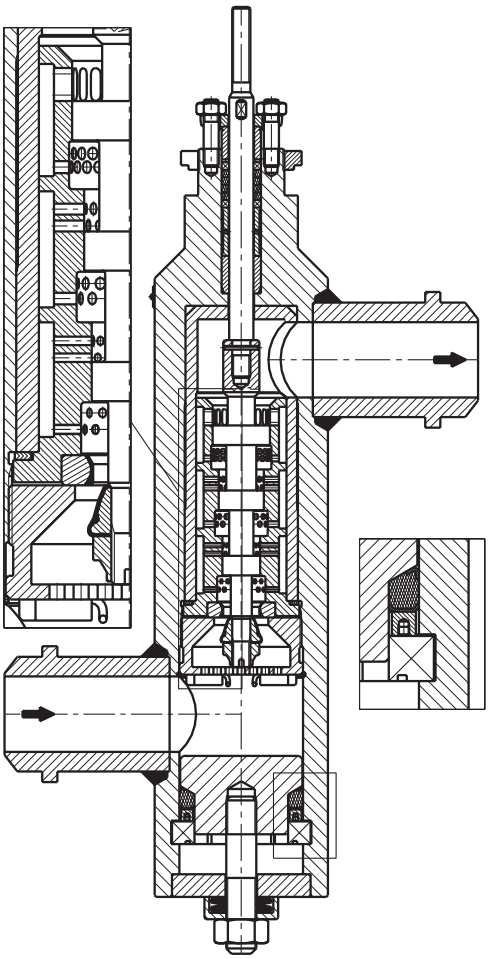
Feeding with auxiliary steam is necessary. Regulatability 1:15. Range of pipeline diameters: over DN150.



Minimum flow valve.

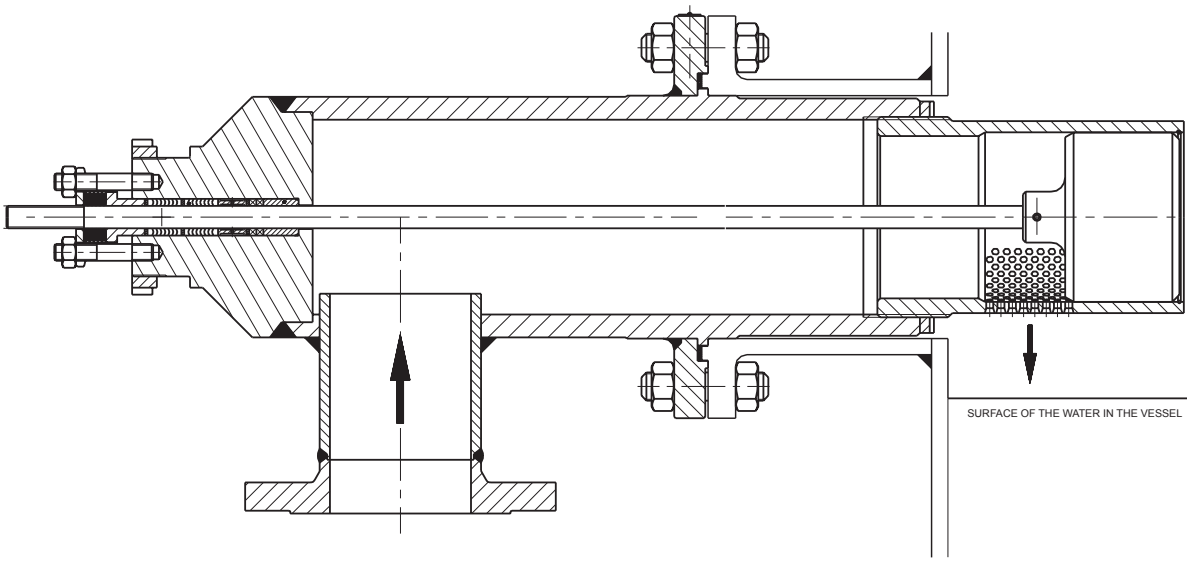
Nominal size of the valve: DN50 PN320. It's used for flow regulation approx. 60t/h at pressure reduction of up to 200 bar. Non-bonnet design with a packing seal in the low pressure zone.

A three-step plug combined with a multi-hole sleeve creates six steps of throttling. Perfect closure tightness as a result of flow over the poppet (FTC). Adjusted to on-off function and control one, used in by-pass systems of feeding pumps.



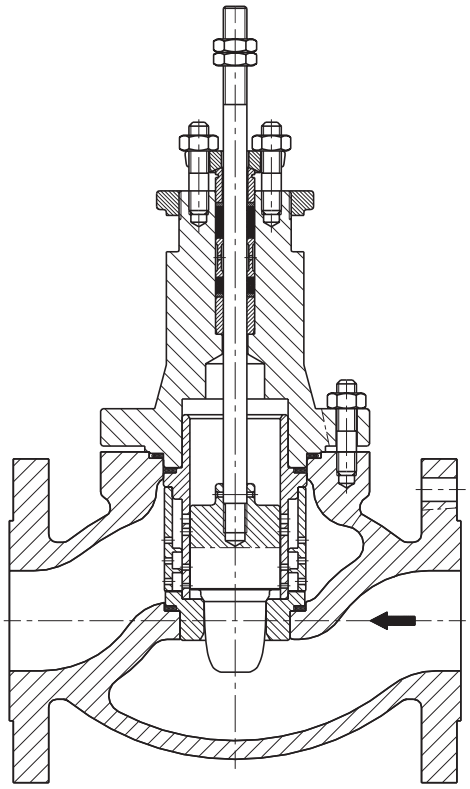
Condensate piling valve.

It is fixed directly at the container with the outflow directed to the liquid surface, which eliminates potential destruction of the vessel's elements by cavitation and erosion.



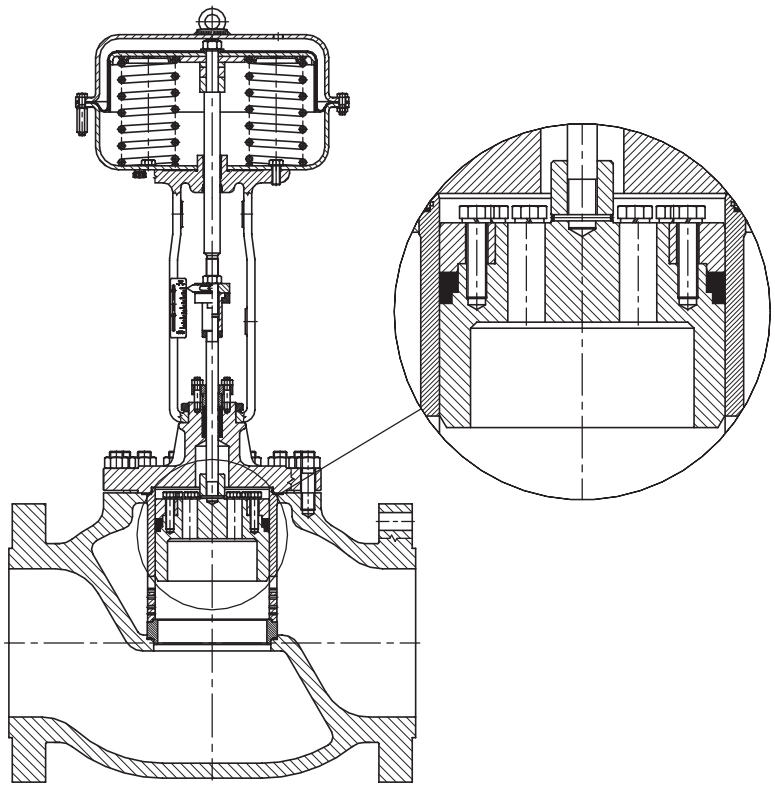
Valve with a two-step plug and a throttling cage with several throttling chambers.

It is designed for applications reducing noise level and eliminating cavitation or choked flow.



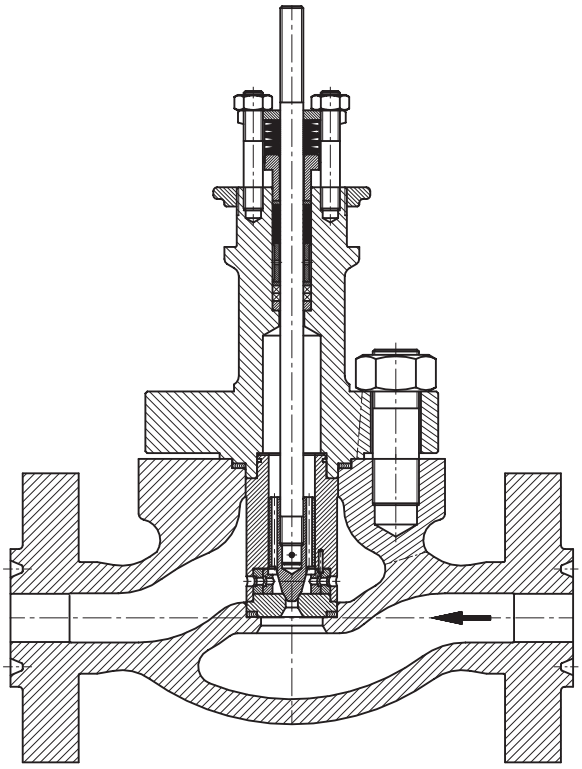
Control valve for low environment temperatures.

DN300, CL600 valve works on natural gas installations in Siberia. A balanced plug, casts elements of the valve and an actuator made of cast steel are capable of working in low temperatures are available in the ASTM A352LC2 variety. The elastomer parts of the actuator (diaphragm, seals) are made of silicone.



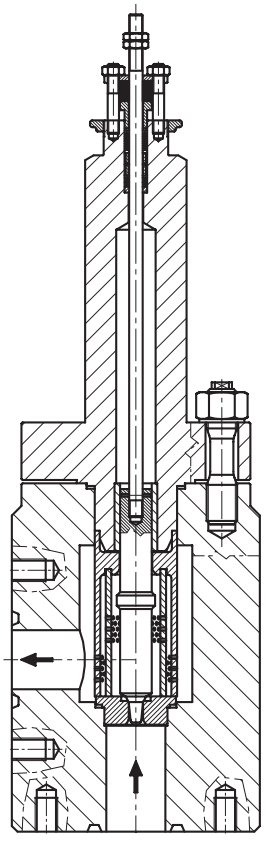
Deposit water valve.

An anti-cavitation structure with three multi-hole resistance plates.



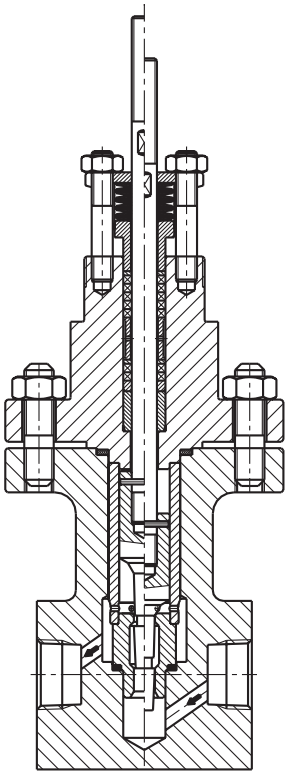
Natural gas valve.

An angular body, pipeline counter flanges directly connected to the body. Working pressure 450 bar, nominal pressure PN700. Flow under the plug (FTO); full opening of the plug cuts off access of the agent and impact of pressure on valve stem packing.



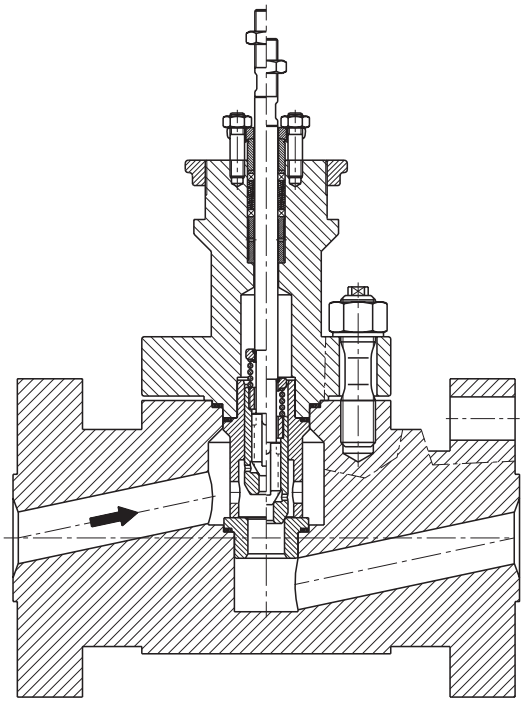
Anti-cavitation valve.

The body is made of a forging, threaded ends. A multi-step plug, and a throttling cage. Non-service packing of stem fulfilling tightness requirements according to TA Luft. It is currently in use at the “Dębno” gas mine in Poland.



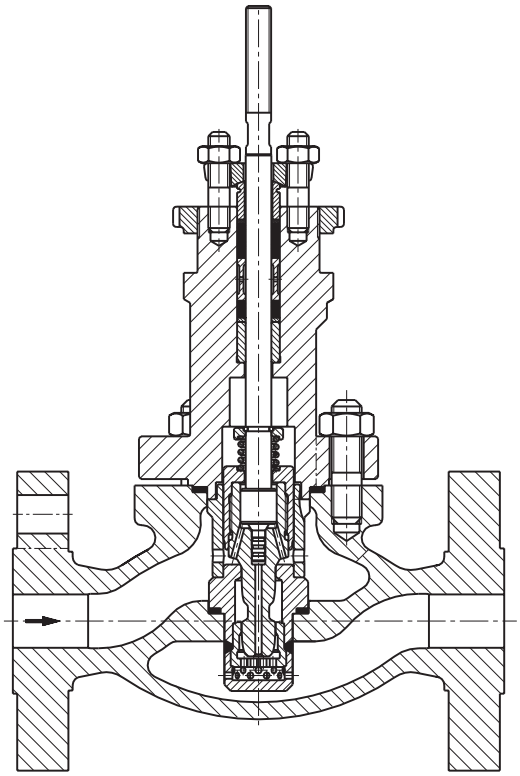
Cut-off valve.

A flange body is made of forged X2CrNiMo17-12-2 (1.4404) – 316L. material Working pressure is up to 530 bar. Two-part plug structure: an internal plug and a main plug for static relief upon the opening of the valve.. Flow over the plug (FTC), high closure tightness. This product has been designed especially for the food industry.



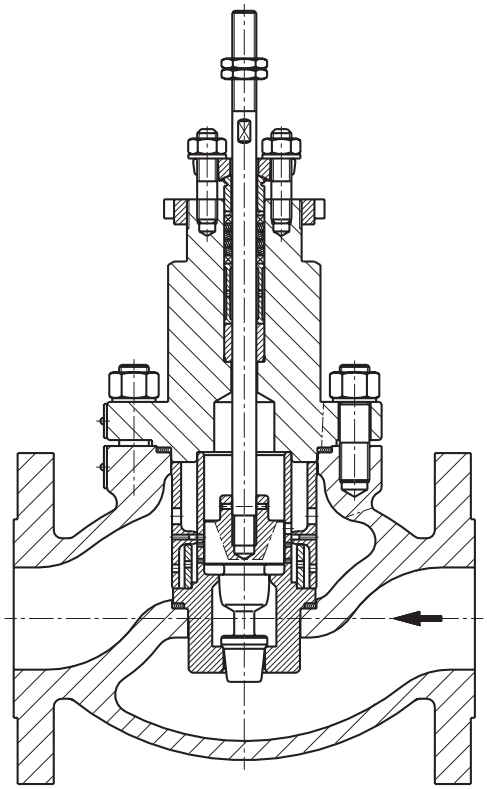
Anti-cavitation valve.

This product solves the problem of regulation and anti-cavitation protection at small opening of the valve. The internal plug – multi-step, the main plug – two-step, with a throttling cage in the seat. Flow over the plug (FTC).



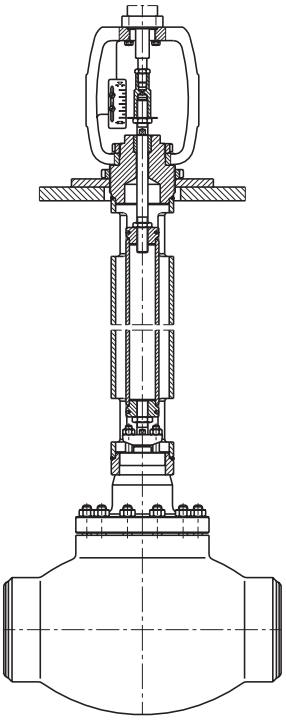
Double-position anti-cavitation valve.

This product solves the problem of small flows during big pressure reductions and big flows at small pressure reductions, if there is a risk of cavitation in both cases. A three-step profile/piston plug, a throttling cage divided into chambers with proper throttling.



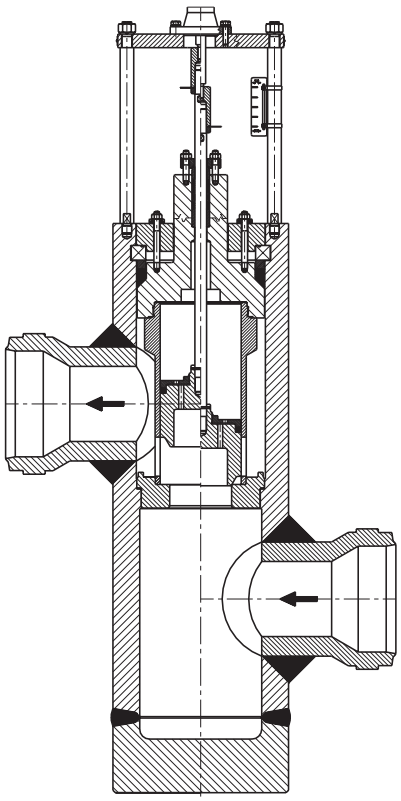
Valves for work in underground installations.

Such valves require leading the drive over ground and connecting it to the valve in a durable and reliable way. The length of distance elements and the way of fixing them to the ground must be chosen with considering the possibilities of the valve's localization.



High parameters control valve.

The body is made of forged elements with structure „ 乚” DN250 PN320, Kvs320P. The material used is 13CrMo4-5 (1.7335), a self-tightening bonnet, a plug balanced by a graphite ring. Manufacture conforming to PN-EN 12952 3:2004 “Water-tub boilers”.



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SINGLE-PORTED GLOBE CONTROL VALVES **TYPE Z®**

APPLICATIONS:

Single-ported globe control valves type Z® are used in automatic and remote control systems to control flow of gases and liquids. Wide range of material and design versions make the valves widely sought-after in chemical industry, heat and power generation industry, paper industry, food industry, metallurgy and coal mining (versions for Western Europe market is marked: BR11).

CHARACTERISTICS:

- range of nominal sizes from DN15 to DN250 for pressure values PN10 to CL300,
- various materials of valve body cast and internal parts, adapted to specific working conditions,
- wide range of flow ratios and control characteristics,
- reduction in aggressive and toxic media emissions to environment through application of bellow seal bonnets or bonnet packings meeting requirements of TA - LUFT,
- easy assembly and dismantling of valve internal parts for maintenance and service,
- high durability and reliability due to application of top-class materials and surface improvement processes (burnishing, stelliting, heat treatment, CrN coatings),
- possibility of mating with reversible action P/R (column) multi-spring actuators and changing the spring range with no extra parts (keeping the number of springs),
- possibility of fitting actuators with top drive,
- possibility of performing diagnostics of "valve-actuator" system due to application of smart electro-pneumatic positioners,
- high tightness of closure due to application of soft valve seats (with PTFE seals in the whole range of flows and characteristics, for valve plugs, balanced and unbalanced,
- same flow ratios and control characteristics for "hard" valve seats (metal-to-metal) and "soft" valve seats (metal-gasket), for valve plugs, balanced and unbalanced,
- reliable actuator-stem and valve seat-body connections,
- small guiding sleeve control forces due to application of balanced valve plugs in valves DN40…250,
- top-class flat and bonnet packings,
- wide range of electric actuators,
- possibility of mating with NN type hand operated drives,
- possibility of special executions for oxygen, hydrogen, gas fuels, low temperature mediums (liquid oxygen, liquid nitrogen), acid gases containing H_2S; explosive atmospheres as per 94/9/EC - ATEX,
- competitive prices – due to simple and functional design of valves and actuators and applied materials,
- design and production process meets the requirements of Quality Management System ISO 9001 and Directive 97/23/EC, and regulations of AD2000 Merkblatt, designated for installation on pipelines,

Z ® is a trademark registered with Republic of Poland Patent Office.

DESIGN AND TECHNICAL SPECIFICATION:

Body (1): single-ported, flanged, cast in cast iron or cast steel.
Nominal sizes: DN15; 20; 25; 32; 40; 50; 65; 80; 100; 125*); 150; 200; 250
*) special execution, technical data according to individual inquiries.
Nominal pressure: PN10; 16; 25; 40 (as per PN-EN 1092-1:2010 and PN-EN 1092-2:1999); CL150; CL300 (as per PN-EN 1759-1:2005).
Steel flanges CL150; CL300 are so designed that they can be assembled with flanges executed per American standards ANSI/ASME B16.5 and MSS SP44. In American standards flanges are identified with nominal values in "Classes", to which nominal pressure (PN) values as per PN-ISO 7005-1:2002 correspond.
Equivalent identification as per PN are: CL150: PN 20 and CL300: PN 50.
Table 1. Flanged end connections

Material	Nominal pressure	Facing of flange types			
		Raised face	Groove	Recess	Ring - joint
		Identification			
Grey iron	PN10; 16	B [2]	-	-	-
Spheroidal iron	PN10; 16; 25; 40		-	-	-
Cast steel	PN10; 16; 25; 40		D	F	-
	CL150		-	-	J (RTJ)
	CL300		DL (D1 [1])	F (F1)	
[1]) - only for CL300; [2]) - B1 – (Ra=12.5 mm, concentric surface structure "C"), B2 – (Ra as agreed with the customer); () - identification of connections as per ASME B16.5					
Possible execution of flanges per specification and indicated standards					

Face-to-face dimensions: as per PN-EN 60534-3-1; 2000r. - Fig. no. 7 ; Table 19 and 20. Series 1 - for PN10; 16; 25; 40; series 37- for CL150; series 38 - for CL300

Bonnet (2) - non-cast - assembled to body via assembly plate (DN15-100)
- cast (DN150-250): a) standard, b) extension (for cast steel valves), c) bellows (for cast steel valves).

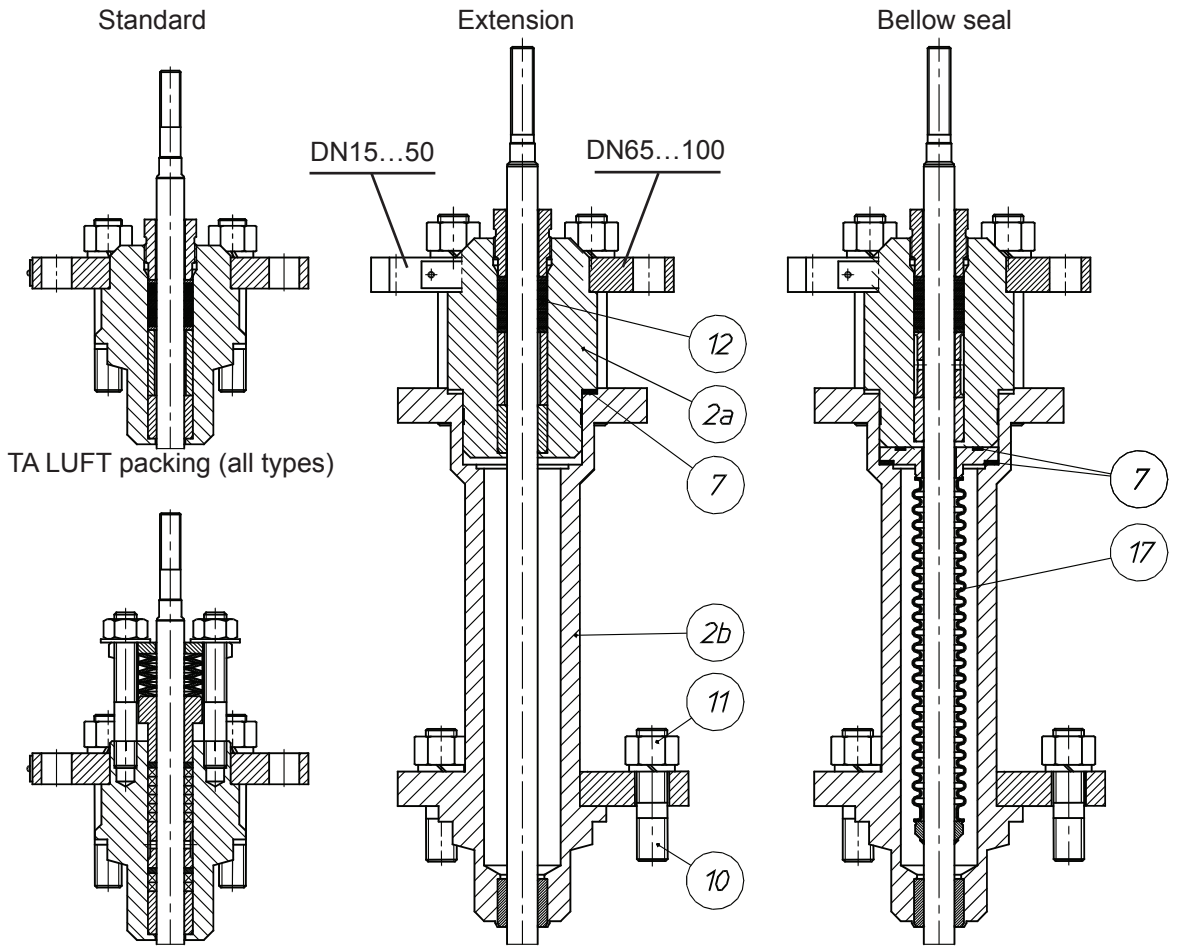


Fig. 1. Bonnets DN15…100

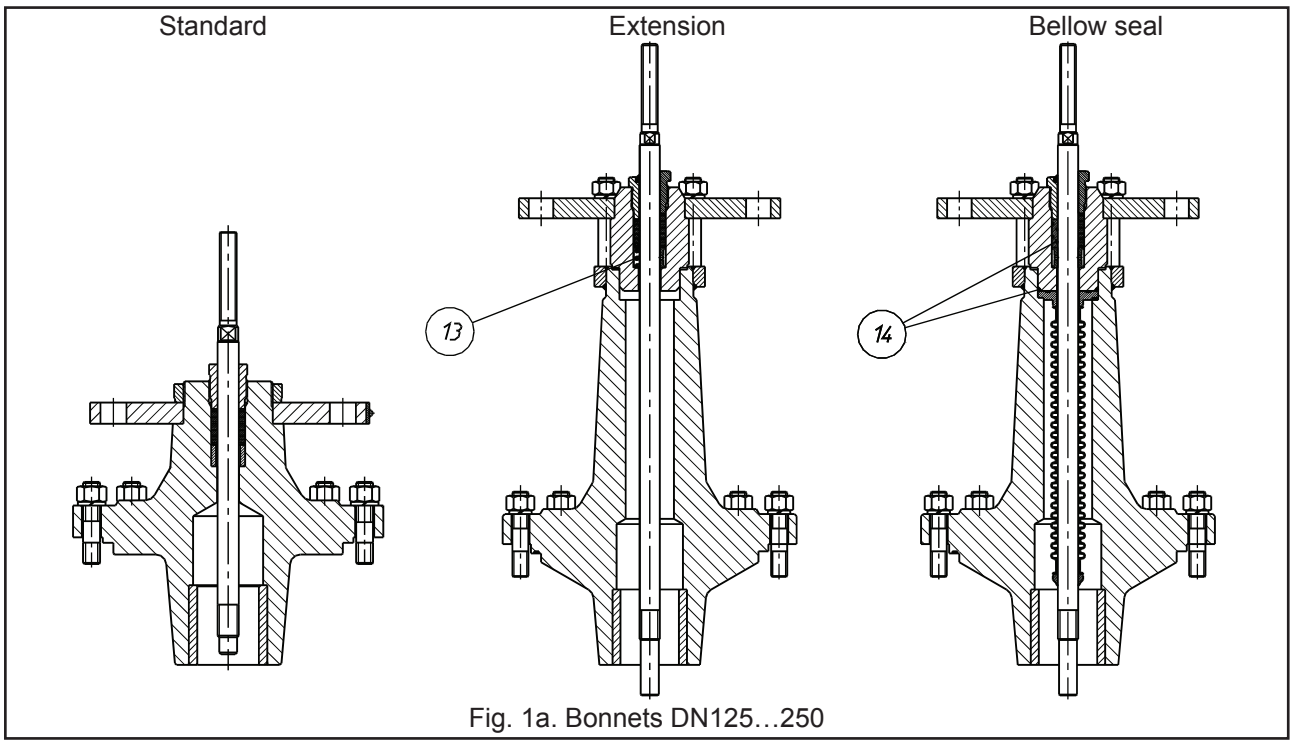


Fig. 1a. Bonnets DN125…250

Valve plug (3) - contoured, balanced, unbalanced

- control characteristics: - linear (L)
  - equal percentage (P)
  - quick-opening (S)
- rangeability: - 50:1

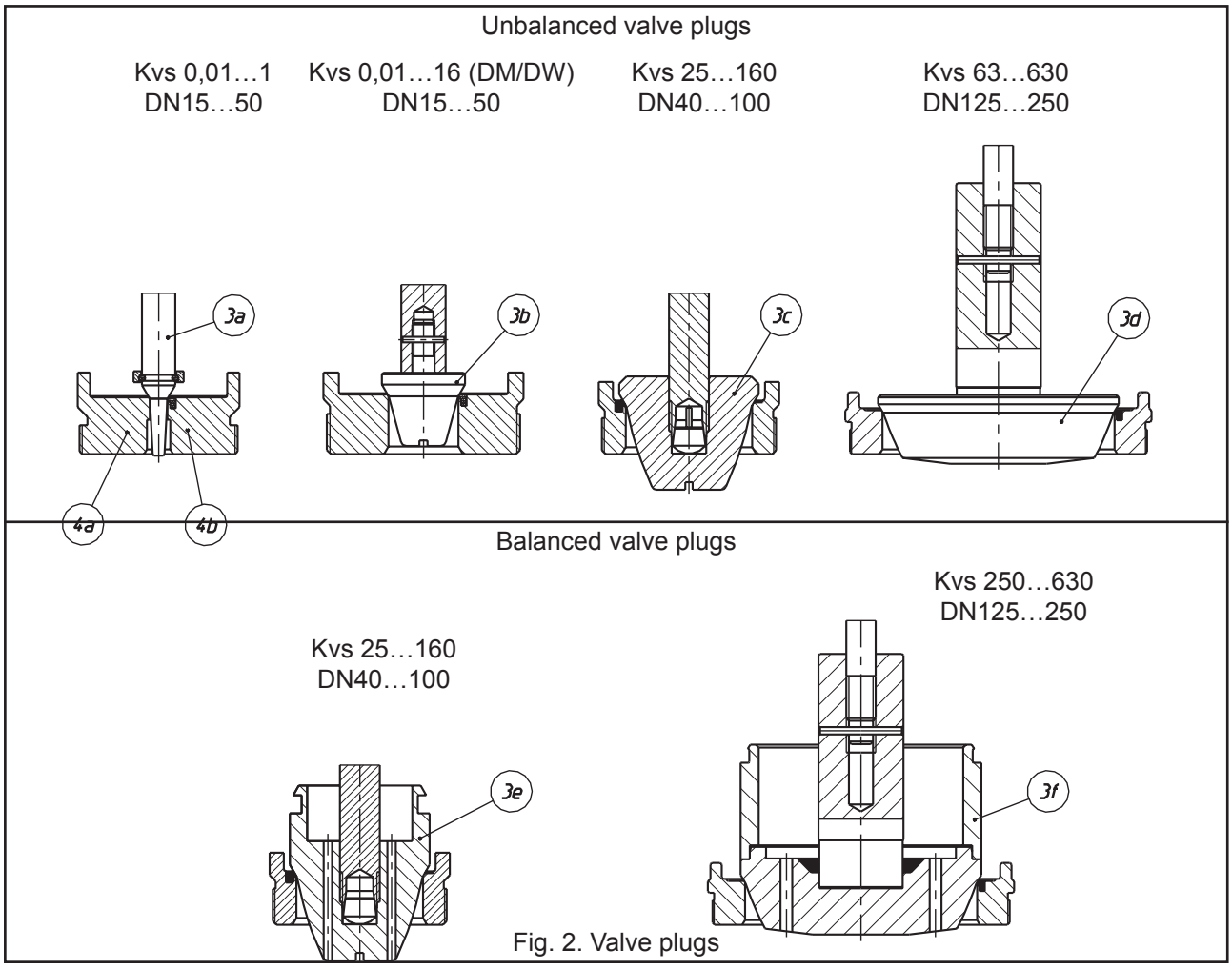


Fig. 2. Valve plugs

Valve seat (4) - screwed in, with centering cone, sealing and preventing unscrewing:
- hard version,
- soft version (PTFE packing).

Valve plug stem (5) - burnished or quenched and tempered, polished sealing contact surface
Drain plug (6) - steel or stainless steel: allows cleaning of body interior (delivered separately)
Body gasket (7) - asbestos-free:
- flat – aramid and hardened graphite (1.4571); in metallic casing (1.4571), multiple edges
- bonnet: - packings formed in various materials (PTFE-V; PTFE+graphite; expan ded graphite; braided graphite);
  - with TA Luft compression springs (PTFE-V; graphite)

Table 2. Packing types with application ranges.

Packing	PN / CL	Temperature [°C]		
		Bonnet		
		Standard	Extension	Bellow
PTFE-V	PN10…CL300	-46...+200	-198...-46 +200...+300	-100...+200
PTFE + Graphite				
PTFE-V / TA-LUFT				
Graphite		+200...+300	+300...+450	+200...+400
Graphite / TA-LUFT				

Leakage class: - basic: Class IV as per PN-EN 60534-4 - hard valve seat
- bubble-tight Class VI as per PN-EN 60534-4 - soft valve seat

Table 3. Listing of components with materials

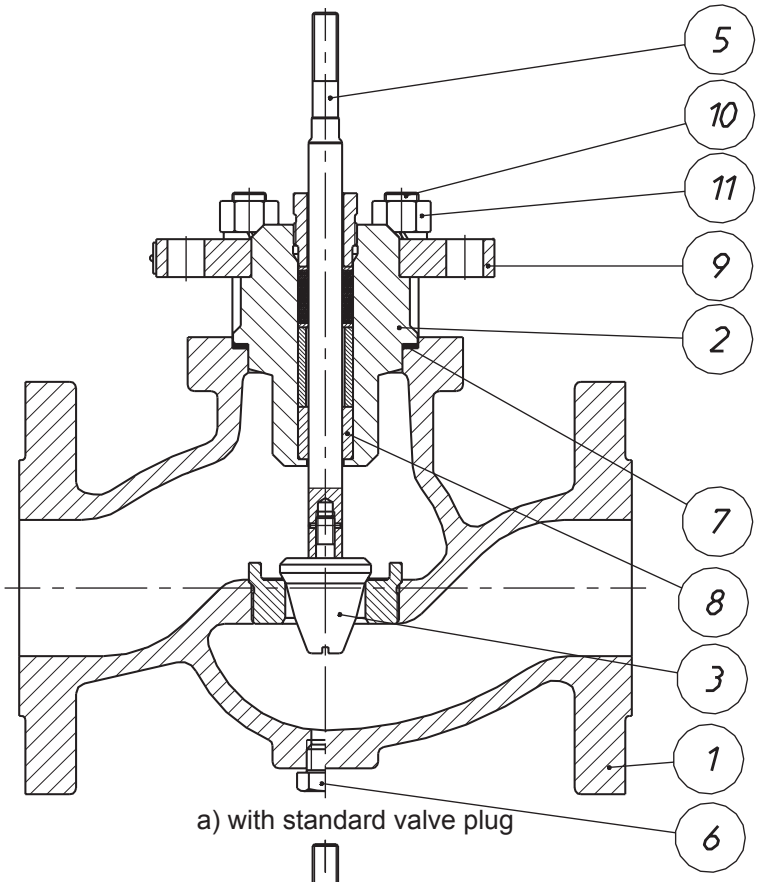
Item	Component		Materials					
1	Body		EN-GJL 250 (EN-JL 1040)	EN-GJS 400-18 LT (EN-JS 1025)	GP 240 GH (1.0619)	WCB	GX5CrNiMo 19-11-2 (1.4408)	CF8M
2	Bonnet	DN15…100	S 355 J2G3 (1.0570)				X6CrNiMoTi 17-12-2 (1.4571)	
		DN125…250	EN-GJL 250 (EN-JL 1040)	EN-GJS 400-18 LT (EN-JS 1025)	GP 240 GH (1.0619)	WCB	GX5CrNiMo 19-11-2 (1.4408)	CF8M
3	Plug		X6CrNiMoTi 17-12-2; (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment					
4	Seat		X6CrNiMoTi 17-12-2; (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite X6CrNiMoTi 17-12-2; (1.4571) + PTFE X17CrNi 16-2; (1.4057) + heat treatment					
5	Stem		X6CrNiMoTi 17-12-2; (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment					
6	Drain plug		S 355 J2G3 (1.0570)				X6CrNiMoTi 17-12-2; (1.4571)	
7	Body gasket		in metal casing X6CrNiMoTi 17-12-2 (1.4571) ; NOVATEC PREMIUM; SIGRAFLEX HOCHDRUCK; MWK-50 SPETOMET					
8	Guiding sleeve		X6CrNiMoTi 17-12-2; (1.4571) + CrN X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment					
9	Compression plate		C45 (1.0503); X30Cr13 (1.4028); X6CrNiMoTi 17-12-2; (1.4571)					
10	Bolt		8.8				A4 - 70	
11	Nut		8				A4 - 70	
12	Packing		PTFE + GRAFIT; PTFE - „V"; GRAPHITE					
13	Spring		12R10 (SANDVIK)					
14	O-ring		Fluorine rubber (FKM)					
15	Guiding sleeve		X6CrNiMoTi 17-12-2; (1.4571) + CrN X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment					
16	Seal ring		PTFE + X6CrNiMoTi 17-12-2 (1.4571); TURCON + X6CrNiMoTi 17-12-2 (1.4571)					
17	Bellow		X6CrNiMoTi 17-12-2; (1.4571)					

Relevant materials standards	
Material	Standard
EN-GJL 250 ; (EN-JL 1040)	PN-EN 1561
EN-GJS 400-18 LT ; (EN-JS 1025)	PN-EN 1563
GP 240 GH ; (1.0619)	PN-EN 10213-2
WCB	ASTM A 216
GX5CrNiMo 19-11-2 ; (1.4408)	PN-EN 10213-4
CF8M	ASTM A 351
S 355 J2G3 ; (1.0570)	PN-EN 10025
X6CrNiMoTi 17-12-2 ; (1.4571)	PN-EN 10088
X17CrNi 16-2 ; (1.4057)	PN-EN 10088
C45 (1.0503)	PN-EN 10083-1
X30Cr13 (1.4028)	PN-EN 10088

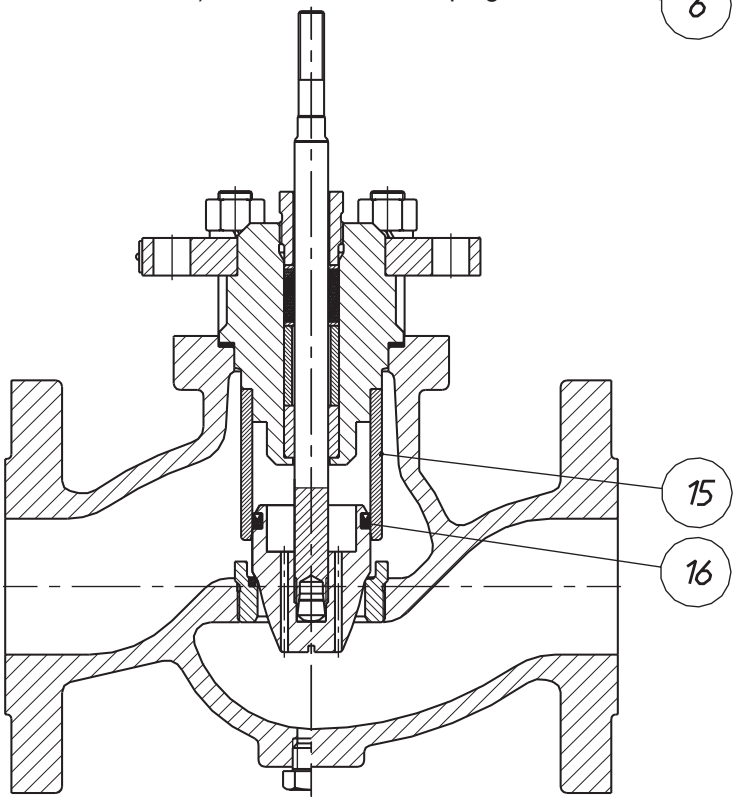
NOTE:
Hardening method used for hardening of valve internal parts comprises:
a) stelliting – padding of surfaces with stellite: ~40HRC
b) CrN coating – introducing chromium nitride to external layer of detail, to the depth of ca.0.1 mm;~950HV
c) heat treatment: plug (~45HRC), seat (~35HRC), stem (~35HRC), guide sleeve (~45HRC)
d) Maximum working temperature -200…+250°C (for KEFLOY 25 material), higher temperatures: upon consultation with the manufacturer.

Table 4. Working parameters for special executions of valves.

Valve execution	Working temperature [˚C]		Max working pressure [bar]
	Min.	Max.	
With balanced plug	-50	+200	40
With soft valve seat (PTFE)	-100		35
With bellow seal bonnet	-100	+400	35

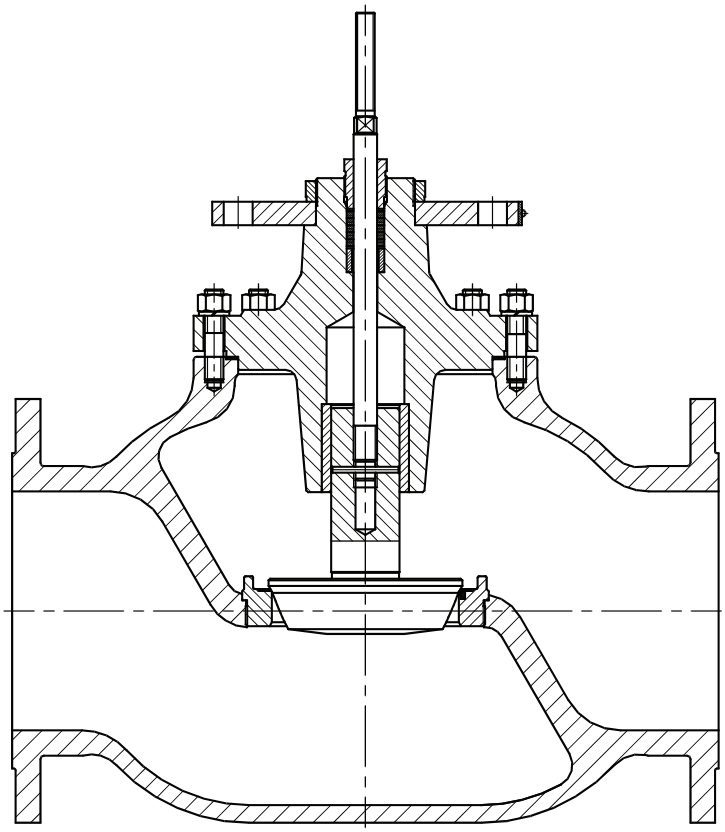


a) with standard valve plug

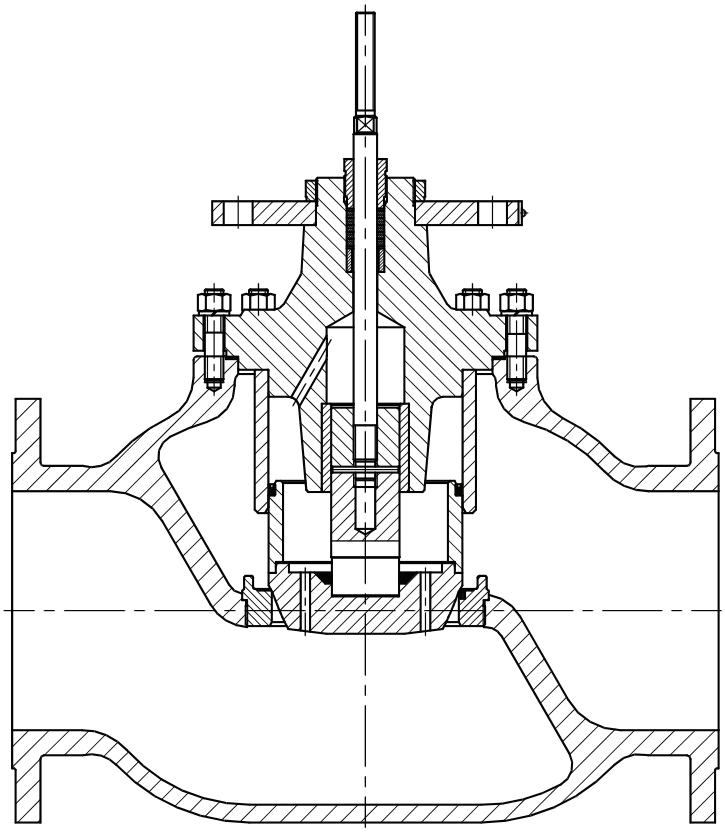


b) with balanced valve plug

Fig. 3. Control valve DN15-100



a) with standard valve plug



b) with balanced valve plug

Fig. 4. Control valve DN125-250

Table 5…11. Allowable working overpressure for materials at proper temperatures

Table 5. Material: EN-GJL 250 as per PN-EN 1561

PN	Standard	Temperature [˚C]						
		-10…120	150	180	200	230	250	300
		Allowable working pressure [bar]						
PN10	PN-EN 1092-2	10	9	8,4	8	7,4	7	6
PN16		16	14,4	13,4	12,8	11,8	11,2	9,6

Table 6. Material: EN-GJS 400-18 LT as per PN-EN 1563

PN	Norma	Temperature [˚C]					
		-10…120	150	200	250	300	350
		Allowable working pressure [bar]					
PN10	PN-EN 1092-2	10	9,7	9,2	8,7	8	7
PN16		16	15,5	14,7	13,9	12,8	11,2
PN25		25	24,3	23	21,8	20	17,5
PN40		40	38,8	36,8	34,8	32	28

Table 7. Material: GP240GH (1.0619) as per PN-EN 10213-2

PN / CL	Norma	Temperature [˚C]							
		-10…50	100	150	200	250	300	350	400
		Allowable working pressure [bar]							
PN10	EN 1092-1	10	9,2	8,8	8,3	7,6	6,9	6,4	5,9
PN16		16	14,8	14	13,3	12,1	11	10,2	9,5
CL150	PN-EN 1759-1	17,3	15,4	14,6	13,8	12,1	10,2	8,4	6,5
PN25	EN 1092-1	25	23,2	22	20,8	19	17,2	16	14,8
PN40		40	37,1	35,2	33,3	30,4	27,6	25,7	23,8
CL300	PN-EN 1759-1	45,3	40,1	38,1	36	32,9	29,8	27,8	25,7

Table 8. Material: GX5CrNiMo 19-11-2 (1.4408) as per PN-EN 10213-4

PN / CL	Norma	Temperature [˚C]									
		-10…50	100	150	200	250	300	350	400	425	450
		Allowable working pressure [bar]									
PN10	EN 1092-1	10	10	9	8,4	7,9	7,4	7,1	6,8	-	6,7
PN16		16	16	14,5	13,4	12,7	11,8	11,4	10,9	-	10,7
CL150	PN-EN 1759-1	17,9	16,3	14,9	13,5	12,1	10,2	8,4	6,5	5,6	4,7
PN25	EN 1092-1	25	25	22,7	21	19,8	18,5	17,8	17,1	-	16,8
PN40		40	40	36,3	33,7	31,8	29,7	28,5	27,4	-	26,9
CL300	PN-EN 1759-1	46,7	42,5	38,9	35,3	32,9	30,5	28,8	27,6	27,2	26,9

Table 9. Material: G20Mn5 (1.6220) wg PN-EN 10213-3

PN / CL	Norma	Temperature [˚C]					
		-40	100	150	200	250	300
		Allowable working pressure [[bar]					
PN10	-	6	6	3,8	3,6	3,48	3,4
PN16		16	16	10,1	9,6	9,28	9,07
PN25		25	25	15,8	15	14,5	14,2
PN40		40	28	28	27	26	25

Table 10. Material: WCB as per ASTM A216

PN / CL	Norma	Temperature [˚C]								
		-10…50	100	150	200	250	300	350	375	400
		Allowable working pressure [bar]								
PN10	EN 1092-1	10	10	9,7	9,4	9	8,3	7,9	7,7	6,7
PN16		16	16	15,6	15,1	14,4	13,4	12,8	12,4	10,8
CL150	PN-EN 1759-1	19,3	17,7	15,8	14	12,1	10,2	8,4	7,4	6,5
PN25	EN 1092-1	25	25	24,4	23,7	22,5	20,9	20	19,4	16,9
PN40		40	40	39,1	37,9	36	33,5	31,9	31,1	27
CL300	PN-EN 1759-1	50	46,4	45,1	43,9	41,8	38,9	36,9	36,6	34,6

Table 11. Material: CF8M as per ASTM A351

PN / CL	Norma	Temperature [˚C]										
		-10…50	100	150	200	250	300	350	375	400	425	450
		Allowable working pressure [bar]										
PN10	EN 1092-1	8,9	7,8	7,1	6,6	6,1	5,8	5,6	5,5	5,4	5,4	5,3
PN16		14,3	12,5	11,4	10,6	9,8	9,3	9	8,8	8,7	8,6	8,5
CL150	PN-EN 1759-1	18,4	16	14,8	13,6	12	10,2	8,4	7,4	6,5	5,6	4,6
PN25	EN 1092-1	22,3	19,5	17,8	16,5	15,5	14,6	14,1	13,8	13,6	13,5	13,4
PN40		35,6	31,3	28,5	26,4	24,7	23,4	22,6	22,1	21,8	21,6	21,4
CL300	PN-EN 1759-1	48,1	42,3	38,6	35,8	33,5	31,6	30,4	29,6	29,3	29	29

NOTES:

1. It is allowed to apply spheroidal iron, carbon steel and acid proof cast steel for temperatures lower than given in Tables 5...11, provided that working pressure is reduced respectively, working temperature impact tests are performed and cast is heat treated. Details are to be consulted with manufacturer.
2. Working pressure for intermediate temperature values can be calculated by interpolation.

Table 12. Flow ratios Kvs [m³/h] for unbalanced valve plugs

Kvs [m³/h]	Stroke [mm]	Valve seat diameter D [mm]	F_D [kN]		Nominal size DN												Characteristics		
			Hard valve seat	Soft valve seat	15	20	25	32	40	50	65	80	100	125*)	150	200	250	L	P	S
0,010	20	6,35	0,1	0,16	■	■	■	■	■	■								■		
0,016					■	■	■	■	■	■								■		
0,025					■	■	■	■	■	■								■		
0,040					■	■	■	■	■	■								■		
0,063					■	■	■	■	■	■								■		
0,10					■	■	■	■	■	■								■		
0,16					■	■	■	■	■	■								■		
0,25					■	■	■	■	■	■								■	■	
0,40					■	■	■	■	■	■								■	■	
0,63					■	■	■	■	■	■								■	■	
1,0					■	■	■	■	■	■								■	■	
1,6		9,52	0,15	0,25	■	■	■	■	■	■								■	■	
2,5		12,7	0,2	0,3	■	■	■	■	■	■								■	■	
4,0					■	■	■	■	■	■								■	■	■
6,3		19,05	0,3	0,5		■	■	■	■	■								■	■	■
10		20,64	0,35	0,5			■	■	■	■								■	■	■
16		25,25	0,4	0,6				■	■	■	■							■	■	■
25		31,72	0,5	0,8					■	■	■	■						■	■	■
40		41,25	0,7	1,0						■	■	■	■	■				■	■	■
63	38	50,8	0,8	1,3							■	■	■	■	■			■	■	■
94		66,7	1,1	1,7								■	■	■	■	■		■	■	■
125		88,9	1,4	2,2									■	■	■	■	■	■	■	■
160													■	■	■	■	■	■	■	■
250	50	107,92	1,7	2,7											■	■	■	■	■	■
320		126,95	2,0	3,2											■	■	■	■	■	■
500	63	158,72	2,5	4,0												■	■	■	■	■
630		195	3,1	4,9													■	■	■	■

Calculated ratios: F_L = 0,9 ; X_T = 0,72 ; Fd = 0,46 ; xFz = 0,65

Table 13. Flow ratios Kvs [m³/h] for balanced valve plugs

Kvs [m³/h]	Stroke [mm]	Valve nominal size DN									Characteristics		
		40	50	65	80	100	125*)	150	200	250	L	P	S
25	20	■	■								■	■	■
40			■	■							■	■	■
63	38			■	■						■	■	■
94					■	■	■				■	■	■
125						■	■				■	■	■
160						■	■				■	■	■
250	50							■	■		■	■	■
320								■	■		■	■	■
500	63								■	■	■	■	■
630										■	■	■	■

NOTE:
Valve seat diameter for balanced valve plug flow ratio Kvs 250 is 126.95 mm.
*)DN125 - special execution, technical data according to individual inquiries.

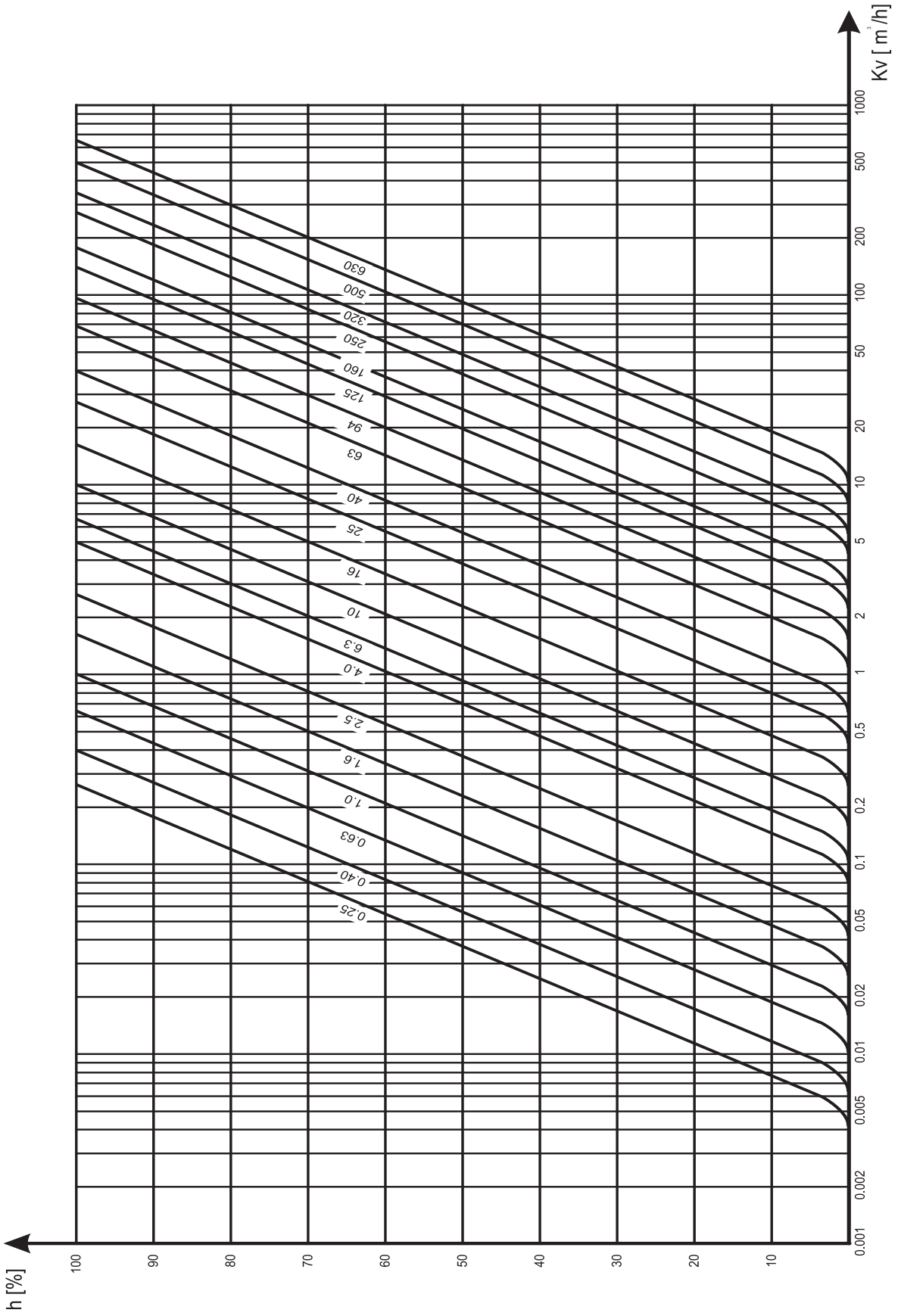


Diagram 1. Equal percentage flow characteristics for control valves Kvs=0.25…630 m³/h

ALLOWABLE PRESSURE DROPS Δp.

Pressure drops Δp [bar] in Tables 15 and 16 apply to closed valve and they are calculated for valve drive potential. Actual pressure drops should not exceed 70% of allowable working pressure for given nominal pressure, material execution and working temperature, as per tables 5…11.

$$\Delta p = \frac{Fs - F_D}{0{,}785 \cdot 10^{-4} \cdot D^2} \quad \text{or} \quad Fs = 0{,}785 \cdot 10^{-4} \cdot D^2 \cdot \Delta p + F_D$$

where
- Δp [bar] - calculated pressure drop
- Fs [kN] - actuator available force (Table 14)
- F_D [kN] - valve plug to valve seat pressure (Table 12)
- D - valve seat diameter [mm] (Table 12)

Table 14. Available force F_S [kN] of pneumatic actuators

Actuator size	Direct actuator P			Reverse actuator R					
	Supply pressure [kPa]			Spring range [kPa]					
	140	250	400	20 - 100	40 - 120; 40 - 200	60 - 140	80 - 240	120 - 280	180 - 380
160	0,64	2,4	4,8	0,32	0,64	0,96	1,28	1,92	-
250	1,0	3,8	7,5	0,5	1,0	1,5	2,0	3,0	-
400	1,6	6,0	12,0	0,8	1,6	2,4	3,2	4,8	-
630	2,5	9,5	18,9	1,3	2,5	3,8	5,0	7,6	11,3
1000	4,0	15,0	30,0	2,0	4,0	6,0	8,0	12,0	18,0

NOTE:
1. For direct actuators P adopted spring range is 20 – 100 kPa
2. For electric and other actuators Δp value can be calculated using above formula and data from Tables 12 and 14, taking nominal load capacity as available force F_S, as per actuator catalog chart.
3. For balanced valve plugs available force Fs at least equal to F_D value for soft valve seats in Table 12 should be adopted.

Table 15. Allowable pressure drops ∆p [bar] for valves with unbalanced valve plugs and hard valve seats, with pneumatic actuators.

Flow ratio Kvs [m^3/h]	Valve nominal diameter DN	Stroke [mm]	Air – to – close					Air – to – open		
			Actuator		∆p [bar]			Actuator		∆p [bar]
			Size	Spring range [kPa]	Supply pressure [kPa]			Size	Spring range [kPa]	
					140	250	400			
do 4	15; 20; 25; 32; 40; 50	20	160	20-100	34	-	-	160	20-100 40-200	9 34
6,3	20; 25; 32; 40; 50				11	40	-		20-100 40-200 60-140	7 11 23
10	25; 32; 40; 50				9	40	-		20-100 40-200 60-140 80-240	0,7 9 19 28
16	32; 40; 50				4	40	-		20-100 40-200 60-140 80-240 120-280	- 4 11 17 30
do 4	15; 20; 25; 32; 40; 50		250		40	-	-	250	20-100 40-200	23 40
6,3	20; 25; 32; 40; 50				24	40	-		20-100 40-200 60-140	7 24 40
10	25; 32; 40; 50				20	40	-		20-100 40-200 60-140 80-240	5 20 34 40
16	32; 40; 50				12	40	-		20-100 40-200 60-140 80-240 120-280	2 12 22 32 40
	65		400		24	40	-	400	20-100 40-200 60-140	8 24 40
25	40; 50; 65; 80				14	40	-		20-100 40-200 60-140 80-240 120-280	4 14 24 34 40
40	50; 65; 80; 100; 125				6,5	38	40		40-200 60-140 80-240 120-280	6 12 18 29
63	65; 80; 100; 125	38	630	20-100	8,5	40	-	630	40-200 60-140 80-240 120-280 180-380	9 15 21 34 40
	150		1000		16	40	-	1000	40-200 80-240 120-280	16 36 40
94	80; 100; 125		630		4	24	40	630	40-200 60-140 80-240 120-280 180-380	4 8 11 18 29
	150; 200		1000		8	32	40	1000	40-200 80-240 120-280 180-380	8 20 31 40
125; 160	100; 125		630		2	13	28	630	40-200 60-140 80-240 120-280 180-380	2 4 6 10 16
	150; 200; 250		1000		4	22	40	1000	40-200 80-240 120-280 180-380	4 10 17 26
250	150; 200; 250	50			2,5	14	30		40-200 80-240 120-280 180-380	2,5 6,5 11 17,5
320	150; 200; 250				1,5	10	22		40-200 80-240 120-280 180-380	1,5 4,5 8 12,5
500	200; 250	63			-	6	14		40-200 80-240 120-280 180-380	- 2,5 5 7,5
630	250				-	4	9		40-200 80-240 120-280 180-380	- 1,5 3 5

*)DN125 - special execution, technical data according to individual inquiries.

Note: 1. In Table 15, theoretical acceptable pressure drops are included. Actual pressure drops with consideration of tolerance of spring manufacture and friction of internal parts of the actuator are lower than those given by 20%.
Pressure drops chosen that way guarantee internal tightness of closing of the valves.
2. In air-to-open valves actuator with spring range of 40-200 [kPa] can be replaced with actuator with spring range of 40-120 [kPa], at the same pressure drops.
3. In valves with balanced valve plugs and hard valve seats for pressure drops up to Δp=40 [bar], actuators are to be selected as below:
- for air-to-close action: spring range 20-100 [kPa], supply pressure 140 [kPa]
- for air-to-open action: spring range 40-120 [kPa], or 40-200 [kPa]

Table 16. Allowable pressure drops Δp [bar] for valves with unbalanced valve plugs and soft valve seats, with pneumatic actuators.

Flow ratio Kvs [m³/h]	Valve nominal diameter DN	Stroke [mm]	Air – to – close					Air – to – open		
			Actuator		Δp [bar]			Actuator		Δp [bar]
			Size	Spring range [kPa]	Supply pressure [kPa]			Size	Spring range [kPa]	
					140	250	400			
do 4	15; 20; 25; 32; 40; 50	20	160	20-100	25	-	-	160	20-100 40-200	- 25
6,3	20; 25; 32; 40; 50				5	35	-		40-200 60-140	5 16
10	25; 32; 40; 50				3	35	-		40-200 60-140 80-240	3 13 22
16	32; 40; 50				-	35	-		40-200 60-140 80-240 120-280	- 6 12 25
do 4	15; 20; 25; 32; 40; 50		250		35	-	-	250	20-100 40-200	15 35
6,3	20; 25; 32; 40; 50				17	35	-		40-200 60-140	17 35
10	25; 32; 40; 50				12	35	-		40-200 60-140 80-240	12 26 35
16	32; 40; 50				6	35	-		40-200 60-140 80-240 120-280	6 16 26 35
	65		400		18	35	-	400	40-200 60-140 80-240	18 34 35
25	40; 50; 65; 80				10	35	-		40-200 60-140 80-240 120-280	10 20 30 35
40	50; 65; 80; 100; 125				3,5	35	-		40-200 60-140 80-240 120-280	3,5 9 15 26
63	65; 80; 100; 125	38	630		6	35	-	630	40-200 60-140 80-240 120-280 180-380	6 12 19 31 35
	150		1000		13	35		1000	40-200 80-240 120-280	13 33 35
94	80; 100; 125		630		3	23	35	630	40-200 60-140 80-240 120-280 180-380	3 7 10 18 28
	150; 200		1000		7	35	-	1000	40-200 80-240 120-280 180-380	7 19 30 35
125; 160	100		630		-	11	26	630	40-200 60-140 80-240 120-280 180-380	- 2 4 8 14
	150; 200; 250		1000		2,5	20	35	1000	40-200 80-240 120-280 180-380	2 9 15 25
250	150; 200; 250	50			1,2	13	29		40-200 80-240 120-280 180-380	1 5 10 16
320	150; 200; 250				-	9	21		40-200 80-240 120-280 180-380	- 3,5 6,5 11,5
500	200; 250	63			-	5	8		40-200 80-240 120-280 180-380	- 2 4 7
630	250				-	3	8		40-200 80-240 120-280 180-380	- 1 2 4

*) DN125 - special execution, technical data according to individual inquiries.

Note:

1. In Table 16, theoretical acceptable pressure drops are included. Actual pressure drops with consideration of tolerance of spring manufacture and friction of internal parts of the actuator are lower than those given by 20%.
Pressure drops chosen that way guarantee internal tightness of closing of the valves.
2. In air-to-open valves actuator with spring range of 40-200 [kPa] can be replaced with actuator with spring range of 40-120 [kPa], at the same pressure drops.
3. In valves with balanced valve plugs and soft valve seats for pressure drops up to Δp=35 [bar],actuators are to be selected as below:
   - for air-to-close action: spring range 20-100 [kPa], supply pressure 140 [kPa]
   - for air-to-open action: spring range 40-120 [kPa], or 40-200 [kPa]
4. For rotary actuators – R, supply pressure is to be 40 kPa higher than upper spring range [kPa].

VALVE DRIVES:

1. Diaphragm multi-spring pneumatic actuators w/o manual drive type P/R or with top-mounted handweel type P/R-N – as per Tables 17 and 20.

Table 17. Pneumatic actuators

Size	Diaphragm effective area [cm^2]	Stroke [mm]	Rev per rated stroke (P/R-N)
160	160	20	5
250	250	20	5
400	400	20	5
630	630	38	9
1000	1000	38; 50; 63	8; 10; 13

CHARACTERISTICS:

- complete reversibility of operation allows changing function P (direct action) and R (reverse action) with no additional parts,
- option of changing spring range (tension) with no additional parts,
- option of pre-tensioning of springs,
- option of fitting with top-mounted handweel.

DESIGN AND TECHNICAL SPECIFICATION:

As per Fig. 5.

CONSTRUCTION:

Actuator diaphragm cases (1) and (2) of steel sheets making pressure chamber
Diaphragm (3) of constant effective area, linear relationship between control actuator pressure and plug movement. Executed in neoprene with polyester spacer.
Diaphragm plate (4) stamped from steel sheet, with spring seats.
Support (6) is used for tightening and operating the stem.
Springs (7) of construction spring steel. There are 3, 6 or 12 springs regarding the required range.
Bushing (8) and spacers (9) – used for altering actuator action from direct to reverse and altering spring range.
Warning plates (10) with information on safe disassembly.

TECHNICAL SPECIFICATION:

Control air connection: NPT 1/4”, NPT 1/2”

Pipe diameter: ∅ 6x1, ∅ 8x1, ∅ 10x1, ∅ 12x1

Spring ranges:	20…100 kPa; 40…120 kPa; 60…140 kPa	- 3 springs,
	40…200 kPa; 80…240 kPa; 120…280 kPa	- 6 springs,
	180…380 kPa	- 12 springs; (only sizes 630-1000).

Max supply pressure: actuator size 160…630 - 600 kPa, for actuator size 1000 - 500 kPa.

Actuator ambient temperature range: -40…+80°C
Optional accessories:
- top-mounted handweel,
- pneumatic positioner,
- electro-pneumatic positioner,
- air-set,
- three-way solenoid valve,
- lock-up,
- limit switches,
- quick exhaust valve.

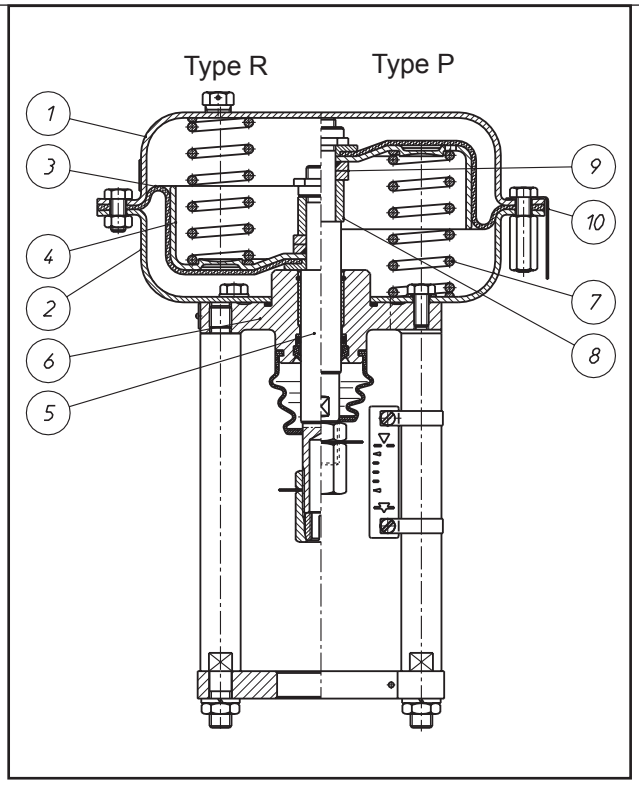


Fig. 5. P/R multi-spring actuator

2. Electric actuators

There is a possibility of employing any electric or electro-hydraulic actuator following adjustment of connecting elements. Details and technical specifications of electric actuators as per separate catalog charts.

3. NN manual drives

Drives allowing manual operation of valve, adapted to direct assembly on valve (with no extra parts).

Table 18. Drive sizes.

Size	Stroke [mm]	Rev per rated stroke
250	20	5
400	20	5
630	38	9
1000	38; 50; 63	8; 10; 13

EXTERNAL DIAMETERS AND CONNECTION DIAMETERS, WEIGHTS OF VALVES, PNEUMATIC ACTUATORS AND MANUAL DRIVES

Table 19. Valve connection diameters [mm]

DN	d_1	d_3	E	L	L_1	P	R
15…25	M12x1,25	12	44	125	111	12,5	110
32…50				118	102	16,5	132
						20,5	160
65…100		16	50	122	104	16,5	132
						20,5	160
125…250	M16x1,5	20	95	200	180		
			80	138	118	24,5	216

Note:

1) R and ∅P can be as per customer request
2) R=160 - for electrical actuators
3) L and L_1 - for valve plug location – valve closed
4) L=138 - for electric actuators
*) DN125 - special execution, technical data according to individual inquiries.

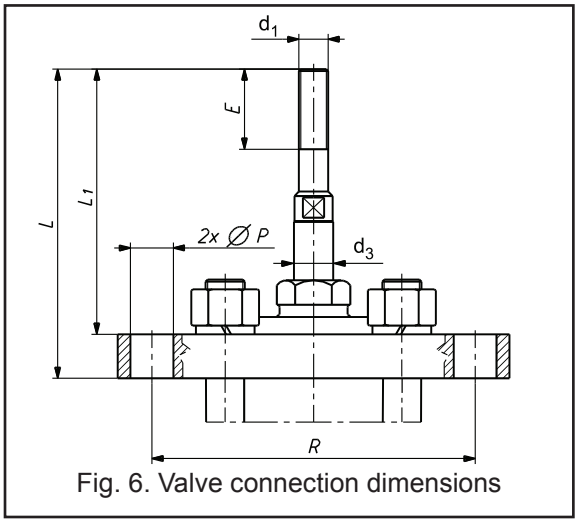
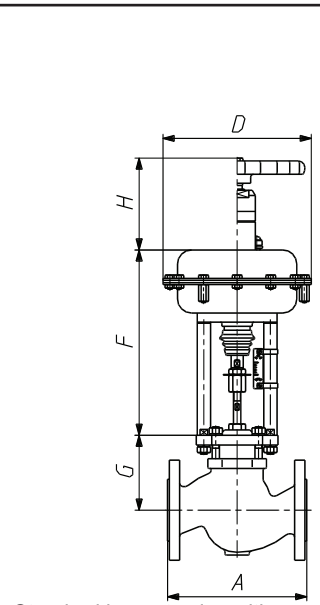
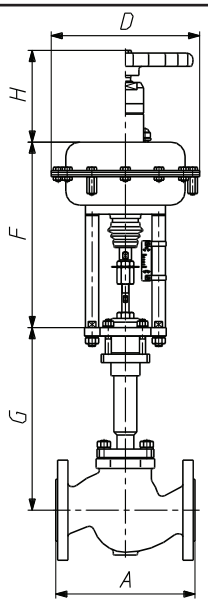


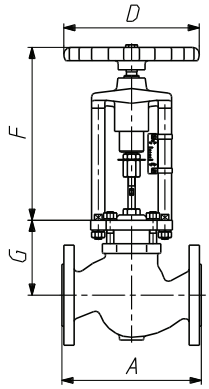
Fig. 6. Valve connection dimensions



Standard bonnet valve with pneumatic actuator



Expansion or bellows seal valve with pneumatic actuator



Manual drive valve NN

Fig. 7. Valve external dimensions

Table 20. Valve dimensions incl. drives [mm].

DN	A			G		F									D									H
	CL150	CL300	PN10…40	Standard bonnet.	Ext. and bellow seal bonnet	P/R 160	P/R 250	P/R 400	P/R 630	P/R 1000	NN 250	NN 400	NN 630	NN 1000	P/R 160	P/R 250	P/R 400	P/R 630	P/R 1000	NN 250	NN 400	NN 630	NN 1000	
15	184	190	130	107	241	288	306	-	-	-	290	-	-	-	210	240	-	-	-	225	-	-	-	162
20	184	194	150	107	241	288	306	-	-	-	290	-	-	-	210	240	-	-	-	225	-	-	-	162
25	184	197	160	107	241	288	306	-	-	-	290	-	-	-	210	240	-	-	-	225	-	-	-	162
32	200	213	180	114	243	288	306	-	-	-	290	-	-	-	210	240	-	-	-	225	-	-	-	162
40	222	235	200	118	253	288	306	312	-	-	290	290	-	-	210	240	305	-	-	225	225	-	-	162
50	254	267	230	122	257	288	306	312	-	-	290	290	-	-	210	240	305	-	-	225	225	-	-	162
65	276	292	290	166	410		-	312	402	-	-	290	308	-		-	305	375	-	-	225	305	-	162
80	298	317	310	166	410		-	312	402	-	-	290	308	-		-	305	375	-	-	225	305	-	162
100	352	368	350	173	417		-	312	402	-	-	290	308	-		-	305	375	-	-	225	305	-	162
125	special execution, technical data according to individual inquiries.																							
150	451	473	480	305	510		-	-	-	585	-	-	-	510		-	-	-	477	-	-	-	450	240
200	543	568	600	458	623		-	-	-	585	-	-	-	510		-	-	-	477	-	-	-	450	240
250	673	708	730	475	623		-	-	-	585	-	-	-	510		-	-	-	477	-	-	-	450	240

Note: Dimension A for CL150 and CL300 refers to bodies with valve face B or RF. For other body versions you can calculated A_1 dimension using formulas in Table 21.

Table 21.

Body	Marking		A_1
	PN	ANSI	
Groove CL300	D1	GF	$A_1 = A + 5 \times 2$
Recess CL300	F1	FF	
Ring-joint CL300 DN15	J	RTJ	$A_1 = A + 5{,}5 \times 2$
Ring-joint CL150			$A_1 = A + 6{,}5 \times 2$
Ring-joint CL300 DN20…40			
Ring-joint CL300 DN50…250			$A_1 = A + 8 \times 2$

Table 22. Valve weights w/o drives [kg].

DN	Valve	
	Standard bonnet	Extended and bellow seal bonnet
15	6	9
20	7	10
25	7,5	11
32	9,5	13
40	11,5	16
50	14,5	20
65	20	28
80	28,5	36,5
100	42	50
125	110	135
150	120	135
200	180	195
250	320	335

Table 23. Actuator weights [kg]

Actuator	Weight
P / R - 160	9
P / R - N - 160	13,5
P / R - 250	10
P / R - N - 250	14,5
P / R - 400	16
P / R - N - 400	20,5
P / R - 630	30
P / R - N - 630	37
P / R - 1000	74
P / R - N - 1000	100

Table 24. Manual drive weights [kg]

Drive	Weight
NN - 250	5,5
NN - 400	6,5
NN - 630	8,5
NN - 1000	40

PARTITION AND MARKING

Type and action:

- pneumatic with direct action:	**P**
- pneumatic with reverse action:	**R**
- pneumatic with top manual drive:	**PN; RN**
- electric:	**E**
- manual:	**NN**

Bonnet:

- standard:	**1**
- extension:	**2**
- bellow seal:	**3**
- other:	**X**

Packing:

- PTFE, braided	**A**
- PTFE, typ V	**B**
- PTFE, for oxygen	**C**
- graphite, braided	**D**
- graphite, expanded	**E**
- TA-Luft, PTFE	**F**
- TA-Luft, graphite	**G**

Leakage class:

- basic: class IV	**4**
- bubble: class IV	**6**

Valve plug:

- unbalanced	**7**
- balanced	**8**

Choke cages:

- no choke cages	**0**

Plug characteristics and type:

- linear, contoured	**L**
- equal percentage	**P**
- quick-opening, (on-off)	**S**
- other	**X**

Body material:

- grey iron	**1**
- spheroidal iron	**2**
- carbon steel	**3**
- stainless steel	**5**
- other	**X**

MARKING EXAMPLE:

Control valve type Z with reverse action pneumatic actuator with top-mounted handweel, extension bonnet, expanded graphite stem sealing, leakage class IV, equal percentage contoured plug, execution in stainless steel:

RN-Z-2E470P5

Marking is shown on valve nameplate.

Additional information:
- nominal size [DN],
- nominal pressure [PN],
- max working temperature [TS],
- max working pressure [PS],
- test pressure [PT],
- flow ratio [Kvs],
- plug stroke [H],
- plug stroke fluid group [1 or 2],
- serial number and year of manufacture.

ORDERING:

The order should contain all information as per data questionnaire. Full information can be obtained from the Sales and Marketing Department or Technical and Development Department.

Revision: Z/06/2013
Valid until the next revision.

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www.polna.com.pl

CONTROL VALVES **TYPE Z®** WITH QUICK CLOSURE CIRCUITS FOR GASES

APPLICATION AREA:

Control valves with pneumatic actuators fitted with quick closure circuits are designed for burners and other gas appliances, where they control the flow, and in case of emergency, cut the flow off.
Time to full closure is less than 1 second.

FEATURES:

Possible applications:

- range of nominal sizes from DN15…250 for nominal pressures PN10…40; CL150; CL300,
- all surfaces exposed to fluids are resistant to flammable gases and lubricants;
- various materials of valve body and internal parts, adapted to specific working conditions
- wide range of flow coefficients and control characteristics,
- easy assembly and dismantling of valve internal parts for maintenance and service,
- possibility of mating with revers-action multi-spring actuators, types R-250; 400; 630; 1000 with no extra parts (keeping the number of springs),
- high tightness of closure due to application of soft seats,
- reliable connection between actuator stem and valve, and between seat and body,
- maintenance-free bonnet packings:
  - sylphon bellows s/s with FVH-PTFE or TA-LUFT packing,
- competitive prices due to simple and functional design of valves and actuators and used materials,
- design and production process meet the requirements of Quality Management System ISO 9001 and Directive 97/23/EC, and regulations of AD2000 Merkblatt, designated for installation on pipelines.
- valves manufacture process meets requirements of ATEX Directive 94/9/EC.

Z ® - is a trademark registered with Republic of Poland Patent Office.

Body : single-ported, flanged, cast in carbon steel or stainless steel.
Nominal size: DN15; 20; 25; 32; 40; 50; 65; 80; 100; 150; 200; 250
Nominal pressure: PN10; 16; 25; 40 (as per PN-EN 1092-1:2010 and PN-EN 1092-2:1999); CL150; CL300 (as per PN-EN 1759-1:2005).
Steel flanges CL150; CL300 are so designed that they can be assembled with flanges executed per American standards ANSI/ASME B16.5 and MSS SP44. In American standards flanges are identified with nominal values in "Classes", to which nominal pressure (PN) values as per PN-ISO 7005-1:2002 correspond.
Equivalent identification as per PN are: CL150: PN 20 and CL300: PN 50.

Table 1. Flanged end connections

Material	Nominal pressure	Facing of flange types			
		Raised face	Groove	Recess	Ring - joint
		Identification			
Grey iron	PN10; 16	B [2]	-	-	-
Spheroidal iron	PN10; 16; 25; 40		-	-	-
Cast steel	PN10; 16; 25; 40		D	F	-
	CL150		-	-	J (RTJ)
	CL300		DL (D1 [1])	F (F1)	
[1]) - only for CL300; [2]) - B1 – (Ra=12.5 mm, concentric surface structure "C"), B2 – (Ra as agreed with the customer); () - identification of connections as per ASME B16.5					
Possible execution of flanges per specification and indicated standards					

Face-to-face dimensions (body): as per PN-EN 60534-3-1; 2000r., Series 1 - for PN10; PN16; 25; 40; series 37- for CL150; series 38 - for CL300

Bellows seat bonnet - non-cast, fixed to body via mounting plate (DN15-100)
- cast (DN150-250).

Valve plug - contoured, unbalanced.
- control characteristics: - linear (L)
  - equal percentage (P)
  - quick-opening (S)
- rangeability: - 50:1

Valve seat - screwed in, with cone - centering, sealing and protecting against unscrewing, soft (PTFE packing).

Leakage class – bubble: class VI to PN-EN 60534-4

NOTE:
Other data as per catalog of Z valves and P/R actuators.

ACTUATOR ACCESSORIES:
- positioner,
- quick exhaust valve,
- solenoid valve 3/2,
- limit switches, etc.

• Valve accessories:
- Strainers are to be installed upstream the valve (Strainer class 600 meshes/cm²)

• Additional information:
- used electric appliances – for application in explosion hazard areas (EEx).
- valves are suitable for application based on **Technical Approval No. 05-003/96 (edition IV/2001)**, issued by OIL AND GAS INSTITUTE.
- valves manufactured based on recommendations of standard **PN-EN 161**.

OPERATION:
Pneumatic control signal is supplied to pressure chamber of actuator through activated three-way solenoid valve (open to control signal). Increase in pneumatic control signal generates force which moves the counteracting springs, causing movement of stem with plug towards open position. Any break of the electric circuit (e.g. due to power supply failure) causes de-energizing of the solenoid valve and valve pressure relief. Spring force causes movements of actuator and valve motion elements towards closed position and cutting-off media flow. Air is vented from the actuator chamber to atmosphere. Cutting-off (closure of valve) occurs also in the case of pneumatic signal fading (supply pressure failure).

NOTE:
In case of need for quick emergency opening of valve (pressure fading, breaking of electric circuit) there is a possibility of executing valve with quick opening functionality by application of P type pneumatic actuators.

TECHNICAL SPECIFICATION:

- nominal sizes:	DN15...250
- nominal pressures:	PN10...40; CL150; CL300
- flow ratios:	Kvs 0,01…160
- max. stroke	38 mm
- ambient temperature:	- 40°C … + 80°C
- fluid temperature:	max. + 220°C
- leakage class:	class VI as per PN-EN 60534-4
- reset time:	about 1sec.

Type Z valve with pneumatic actuator

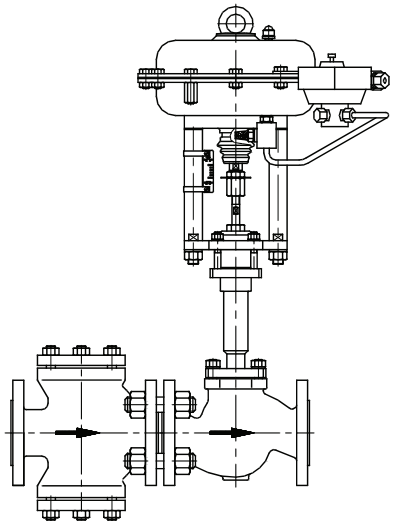

Fig. 1. Design

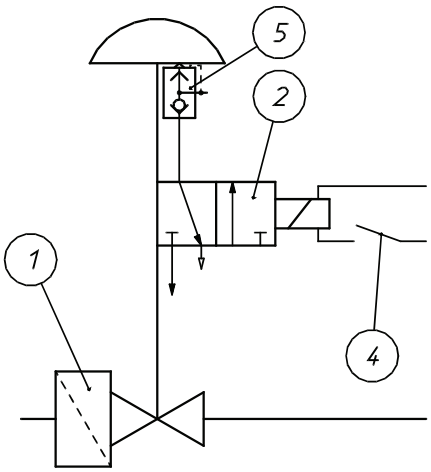

Fig.2. Operation diagram

Type Z valve with pneumatic actuator and positioner

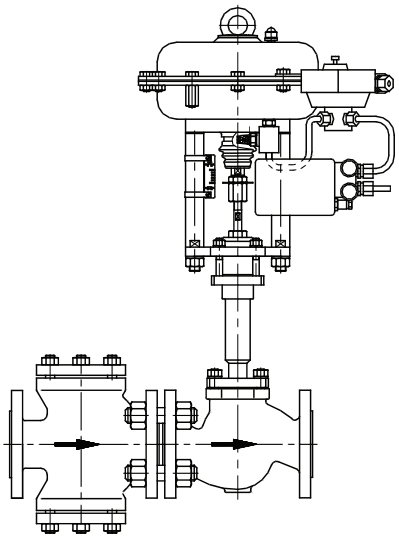

Fig. 3. Design

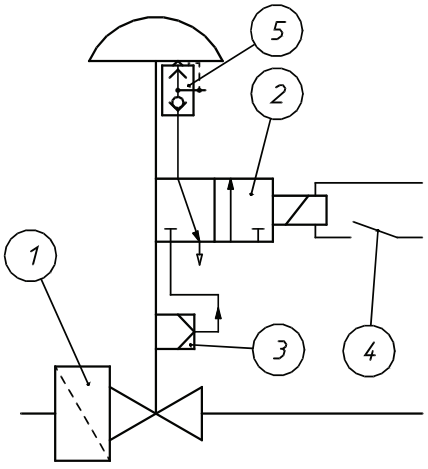

Fig.4. Operation diagram

1) Strainer
2) Solenoid valve 3/2 (control)
3) Positioner
4) Auxiliary emergency closure circuit switch - optional
5) Quick exhaust valve

ORDERING:
The order should contain:
- valve type and size, or technical and operational parameters, to allow calculations and selection of valve (as per technical specification questionnaire),
- valve designation: type of utilities, operation mode, etc.,
- actuator accessories: pneumatic or electro-pneumatic positioner, air-set, three-way solenoid valve, quick drainage valve, limit switches, etc.,
- valve accessories: strainer (mesh density/cm²),
- reset time,
- valve identification as per relevant data sheets.

For assistance in selecting valve please contact the personnel of Sales and Marketing Department or Technical Department.

NOTE:
For detailed technical specification of accessories refer to separate catalogs of respective accessories.

Revision: Z-GASES/06/2013
Valid until the next revision.

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www.polna.com.pl

SINGLE-PORTED GLOBE CONTROL VALVES **TYPE Z1A®**

APPLICATION AREA:

Single-ported globe control valves type Z®1A are used in automatic and remote control instalations as flow control elements to adjust flow of liquids, steam and gases. Wide range of material and design versions makes the valves applicable in most demanding working conditions in power generation, petroleum chemistry, heating, chemical industry, metallurgy, etc. versions designated for Western Europe market can be marked BR12.

FEATURES:

- various materials of valve body and internal parts, adapted to specific working conditions,
- design provides noise reduction, enhanced resistance to cavitation and flashing, and elimination of choked flow,
- wide range of nominal pressures, PN10 to CL2500, and flow ratio and control characteristics,
- reduction in aggressive and toxic media emissions to environment through application of bellow seal bonnets or bonnet packings meeting requirements of TA - LUFT,
- easy assembly and dismantling of valve internal parts for maintenance and service,
- high durability and reliability due to application of top-class materials and surface improvement processes (burnishing, stelliting, heat treatment, CrN coating),
- possibility of mating with revers action P/R (column) and P1/R1 (cast yoke) multi-spring actuators, and changing the spring range with no extra parts (keeping the number of springs),
- possibility of fitting actuators with side-mounted (P1/R1) or top-mounted (P/R) handwheel,
- possibility of performing diagnostics of "valve - actuator" due to application of smart electro-pneumatic positioners,
- wide range of electric actuators,
- special designs for oxygen, hydrogen, gas fuels, low temperature fluids (liquid oxygen, liquid nitrogen), acid gases containing H_2S; with heat jacket; for potentially explosive atmospheres as per ATEX Directive 94/9/EC,
- design and production process meet the requirements of Quality Management System ISO 9001 and Directive 97/23/EC, and regulations of AD2000 Merkblatt, designated for installation on pipelines.

Z1A ® is a trademark registered with Republic of Poland Patent Office

DESIGN AND TECHNICAL SPECIFIACTION:

***Body** (1)*: single-ported, cast

Nominal size: DN15; 20; 25; 40; 50; 80; 100; 150; 200; 250; 300

Nominal pressure:

- PN10; 16; 25; 40; 63; 100 (as per PN-EN 1092-1:2010)
- PN-H-74306:1985; PN-H-74307:1985.
- CL150; CL300; CL600; CL900; CL1500; CL2500 (as per PN-EN 1759-1:2005).

divided as follows: DN15...300: PN10...100; CL150…CL600 *)
DN15...150: CL900; PN160 *)
DN15...100: PN250…400; CL1500…CL2500 *)

*) higher nominal pressures available after agreement with the manufacturer

Connections: - flanged: as per Table 1
- butt welding ends BW, as per Table 19 and 18
- socket welding ends SW, as per Table 21

Steel flanges CL150; CL300; CL600; CL900; CL1500; CL2500 are so designed that they can be assembled with flanges as per American standards ANSI/ASME B16.5 and MSS SP44. In American standards flanges are identified with nominal values in “Classes”, to which nominal pressure (PN) values as per PN-ISO 7005-1:2002 correspond.

Equivalent identification as per PN are: CL150: PN 20 CL300: PN 50
CL600: PN 110 CL900: PN 150
CL1500: PN 260 CL2500: PN 420

Table 1. Flanged end connections

Nominal pressure	Facing of flange types			
	Raised face	Groove	Recess	Ring - joint
	Identification			
PN10; 16; 25; 40; 63; 100; 160; 250; 320; 400	B 3)	D 1)	F 1)	-
CL150; 300	B 3)	DL (D1 2)	F (F1 1)	J (RTJ)
CL600; 900; 1500; 2500	B 3) (RF)	DL (GF)	F (FF)	J (RTJ)
1) - do PN160; 2) - tylko dla CL300; 3) - B1 – (Ra=12.5 mm, concentric surface structure “C”), B2 – (Ra as agreed with the customer); () - identification of connections as per ASME B16.5				
Possible execution of flanges per specification and indicated standards				

Face-to-face dimensions: - flanged valves as per PN-EN 60534-3-1; PN-M-74005; ISA S75.16-1993; Fig. 5**;** Table 16; 17
- welding ends valves; Fig. 5; Table 18
- as per PN-EN 60534-3-3: for PN 10...100 and CL150…600
- as for flanged valves PN 160: for PN 160 and CL900
- as for flanged valves PN 400: for PN 250...400 and CL1500…2500

Materials: - as per Table 2;
Relationship between working pressure and temperature as per Table 3…9.

Bonnet (2): - standard
- extension
- bellows seal (PN10…40; CL150…300)

Valve plug (3): - piston, sleeve guided, hard. Rangeability: 50:1
- variants: contoured,
piston - perforated,(multi-hole)
- flow characteristics: equal percentage - P
linear - L
quick opening - S (only for contoured valve plugs)

Valve seat (4): - fitted-in and and sealed with body, hard (tight seat after consulting the manufacturer)

Valve plug stem (5): - burnished, polished sealing face.

Pressing cage (6A): - valve seat to body fixture.

Choke cage (6B): - perforated valve seat fixture, causing reduction in pressure drop between seat and plug.

Body gasket (7) and seat gasket (8): spiral, graphite+1.4404 in all executions.

Stem packing (9): - PTFE-V packing, compressed with spring bolt (18),
- ring gaskets formed in braided packing cords (PTFE +GRAPHITE),
- graphite kits (expanded and silky graphite) or gaskets formed in braided graphite cords,
- TA-LUFT sealing with PTFE-V packing kit or graphite kit; packing structure as per Figs. 1 and 2, range of applications as per Table 10.

Leakage class: (as per PN-EN 60534-4)
-basic: (class IV) less than 0,01% Kv_s
-enhanced: (class V) $3 \cdot 10^{-4}\ D \cdot \Delta p$ [cm^3/min]
where D (mm) - is seat diameter as per Table 10
Δp [bar] -actual pressure drop in closed valve.

Fluid flow direction: to valve plug.

Flow coefficients: as per Table 11

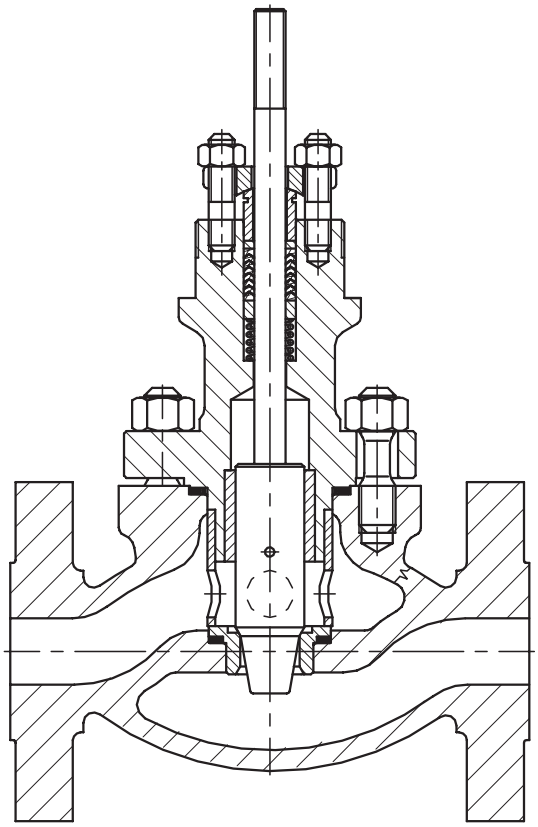


Fig. 1a. Valve Z1A - contoured valve plug and compression cage

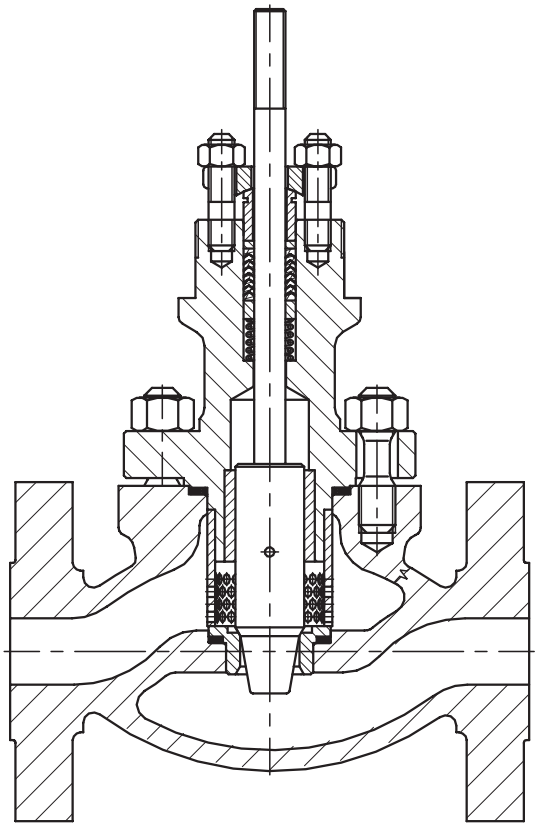


Fig. 1b. Valve Z1A - contoured valve plug and choke cage

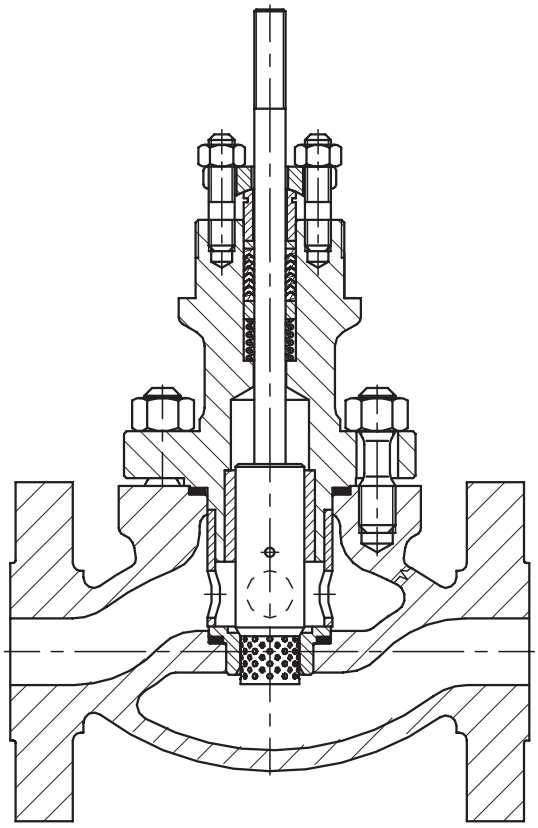


Fig. 1c. Valve Z1A - perforated valve plug and compression cage.

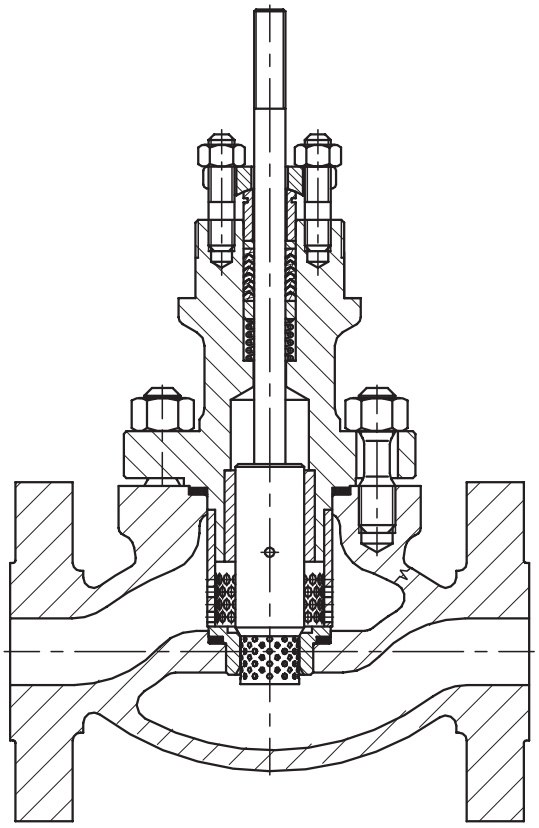


Fig. 1d. Valve Z1A – perforated valve plug and choke cage

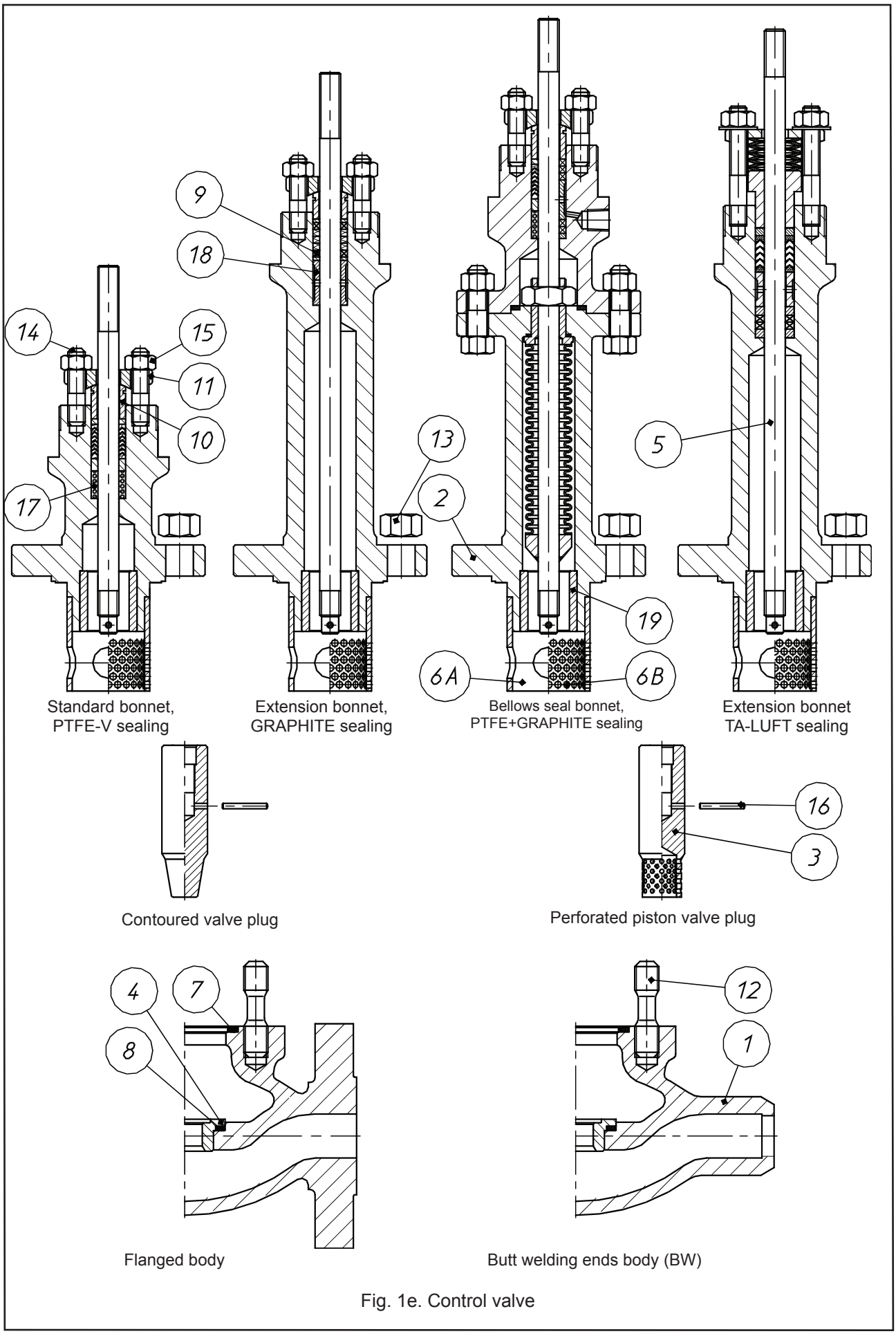


Fig. 1e. Control valve

Table 2. Part list with materials

Item	Part		Materials		
1	Body		GP 240 GH ; (1.0619) WCB	G17CrMo 9-10 ; (1.7379) WC9	GX5CrNiMo 19-11-2 ; (1.4408) CF8M
2	Bonnet	DN15…50	S 355 J2G3 (1.0570)	13CrMo4-4 ; (1.7335)	X6CrNiMoTi 17-12-2 ; (1.4571)
		DN80…300	GP 240 GH ; (1.0619) WCB	G17CrMo 9-10 ; (1.7379) WC9	
3	Plug		X6CrNiMoTi 17-12-2; (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment		
4	Seat		X6CrNiMoTi 17-12-2; (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite X17CrNi 16-2; (1.4057) + heat treatment		
5	Stern		X6CrNiMoTi 17-12-2; (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment		
6A	Compression cage		X6CrNiMoTi 17-12-2; (1.4571) X17CrNi 16-2; (1.4057) + heat treatment		
6B	Choke cage				
7	Body gasket		GRAPHITE (98%) + 1.4404 (spiral)		
8	Seat gasket				
9	Packing kit		PTFE + GRAPHITE		
			PTFE „V" (Rings)		
			GRAPHITE		
10	Press sleeve		X6CrNiMoTi 17-12-2; (1.4571)		
11	Press lever		S 355 J2G3 ; (1.0570)		
12	Body screw	PN10…CL300	8.8	A4 - 70 *)	
		PN63…CL2500	42CrMo4 (1.7225)	21CrMoV5-7 (1.7709)	X6NiCrTiMoVB 25-15-2 (1.4980)
13	Body nut	PN10…CL300	8.8	A4 - 70 *)	
		PN63…CL2500	42CrMo4 (1.7225)	21CrMoV5-7 (1.7709)	X6NiCrTiMoVB 25-15-2 (1.4980)
14	Bonnet screw		8.8	A4 - 70 *)	
15	Bonnet nut		8.8	A4 - 70 *)	
16	Notched peg		X6CrNiMoTi 17-12-2; (1.4571)		
17	Spring		12R10 (SANDVIK)		
18	Spacer sleeve		X6CrNiMoTi 17-12-2; (1.4571)		
19	Guide sleeve		X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment		

Relevant material standards	
Material	Standard
GP 240 GH ; (1.0619)	PN-EN 10213-2
WCB	ASTM A 216
G17CrMo 9-10 ; (1.7379)	PN-EN 10213-2
WC9	ASTM A 217
GX5CrNiMo 19-11-2 ; (1.4408)	PN-EN 10213-4
CF8M	ASTM A 351
S 355 J2G3 ; (1.0570)	PN-EN 10025
13CrMo4-4; (1.7335)	PN-EN 10028
X6CrNiMoTi 17-12-2 ; (1.4571)	PN-EN 10088
X17CrNi 16-2 ; (1.4057)	PN-EN 10088
C45 (1.0503)	PN-EN 10083-1
X30Cr13 (1.4028)	PN-EN 10088
8.8	EN 20898-1
A4-70 *)	EN ISO 3506-2
42CrMo4 (1.7225)	EN 10269
21CrMoV5-7 (1.7709)	EN 10269
X6NiCrTiMoVB 25-15-2 (1.4980)	EN 10269

NOTE:
*) - to be applied for nominal pressures PN10…CL600.
Hardening of valve internal surfaces comprises:
a) stelliting – padding of surfaces with stellite: ~ 40HRC
b) CrN coating – introducing chromium nitride to external layer of detail, to the depth of ca. 0,1mm; ~950HV
c) heat treatment: valve plug (~45HRC), valve seat (~35HRC), guide sleeve (~45HRC)

Table 3…9. Allowable working overpressure for materials at proper temperatures.

Table 3.	Material: GP240GH (1.0619) as per PN-EN 10213-2								
PN / CL	Standard	Temperature [˚C]							
		-10…50	100	150	200	250	300	350	400
		Allowable working pressure [bar]							
PN10	EN 1092-1	10	9,2	8,8	8,3	7,6	6,9	6,4	5,9
PN16		16	14,8	14	13,3	12,1	11	10,2	9,5
CL150	PN-EN 1759-1	17,3	15,4	14,6	13,8	12,1	10,2	8,4	6,5
PN25	EN 1092-1	25	23,2	22	20,8	19	17,2	16	14,8
PN40		40	37,1	35,2	33,3	30,4	27,6	25,7	23,8
CL300	PN-EN 1759-1	45,3	40,1	38,1	36	32,9	29,8	27,8	25,7
PN63	EN 1092-1	63	58,5	55,5	52,5	48	43,5	40,5	37,5
PN100		100	92,8	88	83,3	76,1	69	64,2	59,5
CL600	PN-EN 1759-1	90,5	80,2	76,1	72	65,8	59,7	55,5	51,4
CL900		136	120	114	108	98,7	89,5	83,3	77,1
PN160		160	148,5	140,9	133,3	121,9	110,4	102,8	95,2
PN250		250	232,1	220,2	208,3	190,4	172,6	160,7	148,8
CL1500		226	201	190	180	165	149	139	129
PN320		320	297,1	281,9	266,6	243,8	220,9	205,7	190,4
PN400		400	371,4	352,3	333,3	304,7	276,1	257,1	238
CL2500		377	334	317	300	274	249	231	214

NOTES:

1. It is allowed to apply carbon steel and acid proof cast steel for temperatures lower than given in Tables 3...9, provided that working pressure is reduced respectively, working temperature impact tests are performed and cast is heat treated. Details are to be consulted with manufacturer.
2. Working pressure for intermediate temperature values can be calculated by interpolation.
3. Temperature range for flanged connections: up to +537°C, for welding connections: up to +650°C

Table 4.	Material: G17CrMo 9-10 (1.7379) as per PN-EN 10213-2																	
PN / CL	Standard	Temperature [˚C]																
		-10…50	100	150	200	250	300	350	400	425	450	475	500	510	520	530	540	550
		Allowable working pressure [bar]																
PN10	-	10	10	10	10	10	10	9,7	9,2	9	8,8	7,6	6,4	5,6	4,9	4,2	3,7	3,2
PN16		16	16	16	16	16	16	15,6	14,8	14,4	14	12,1	10,2	8,9	7,8	6,8	5,9	5,1
CL150	PN-EN 1759-1	19,5	17,7	15,8	14	12,1	10,2	8,4	6,5	5,6	4,7	3,7	2,8	2,4	2	1,7	1,4	-
PN25	EN 1092-1	25	25	25	25	25	25	24,4	23,2	22,6	22	19	16	14	12,2	10,7	9,2	8
PN40		40	40	40	40	40	40	39	37,1	36,1	35,2	30,4	25,7	22,4	19,6	17,1	14,8	12,9
CL300	PN-EN 1759-1	51,7	51,5	50,2	48,3	46,3	42,8	40,2	36,6	35,1	33,8	31,7	28,2	26,6	23,5	20,6	17,8	15,5
PN63	EN 1092-1	63	63	63	63	63	63	61,5	58,5	57	55,5	48	40,5	35,4	30,9	27	23,4	20,4
PN100		100	100	100	100	100	100	97,6	92,8	90,4	88	76,1	64,2	56,1	49	42,8	37,1	32,3
CL600	PN-EN 1759-1	103	103	100	96,7	92,6	85,7	80,4	73,1	70,2	67,6	63,3	56,4	53,3	47,1	41,1	35,7	31,1
CL900		155	155	151	145	139	129	121	110	105	101	95	84,6	79,9	70,6	61,7	53,5	46,6
PN160		160	160	160	160	160	160	156,1	148,5	144,7	140,9	121,8	102,8	88,9	78,4	68,5	59,4	51,8
PN250		250	250	250	250	250	250	244	232,1	226,1	220,2	190,4	160,7	140,4	122,6	107,1	92,8	80,9
CL1500		259	258	251	242	232	214	201	183	175	169	158	141	133	118	103	89,1	77,7
PN320		320	320	320	320	320	320	312,3	297,1	289,5	281,9	243,7	205,7	179,8	156,9	137,1	118,8	103,6
PN400		400	400	400	400	400	400	390,4	371,4	361,8	352,3	304,7	257,1	224,7	196,1	171,4	148,5	129,5
CL2500		431	429	418	403	386	357	335	305	292	282	264	235	222	196	171	149	130

Table 5.	Material: GX5CrNiMo 19-11-2 (1.4408) as per PN-EN 10213-4																		
PN / CL	Standard	Temperature [˚C]																	
		-10…50	100	150	200	250	300	350	400	425	450	475	500	510	520	530	540	550	600
		Allowable working pressure [bar]																	
PN10	EN 1092-1	10	10	9	8,4	7,9	7,4	7,1	6,8	-	6,7	-	6,6	-	-	-	-	6,5	5,6
PN16		16	16	14,5	13,4	12,7	11,8	11,4	10,9	-	10,7	-	10,5	-	-	-	-	10,4	8,9
CL150	PN-EN 1759-1	17,9	16,3	14,9	13,5	12,1	10,2	8,4	6,5	5,6	4,7	3,7	2,8	2,4	2	1,7	1,4	-	-
PN25	EN 1092-1	25	25	22,7	21	19,8	18,5	17,8	17,1	-	16,8	-	16,5	-	-	-	-	16,3	14
PN40		40	40	36,3	33,7	31,8	29,7	28,5	27,4	-	26,9	-	26,4	-	-	-	-	26	22,4
CL300	PN-EN 1759-1	46,7	42,5	38,9	35,3	32,9	30,5	28,8	27,6	27,2	26,9	26,6	26,4	26,3	22,5	22,4	22,3	22,2	-
PN63	EN 1092-1	63	63	57,3	53,1	50,1	46,8	45	43,2	-	42,4	-	41,7	-	-	-	-	41,1	35,4
PN100		100	100	90,9	84,2	79,5	74,2	71,4	68,5	-	67,3	-	66,1	-	-	-	-	65,2	56,1
CL600	PN-EN 1759-1	93,4	85	77,8	70,6	65,8	61	57,6	55,2	54,5	53,8	53,3	52,8	52,6	44,9	44,8	44,6	44,4	-
CL900		140	127	117	106	98,6	91,4	86,4	82,8	81,7	80,6	79,9	79,2	78,9	67,4	67,1	66,9	66,7	-
PN160		160	160	145,5	134,8	127,2	118,8	114,2	109,7	-	107,8	-	105,9	-	-	-	-	104,3	89,9
PN250		250	250	227,3	210,7	198,8	185,7	178,5	171,4	-	168,4	-	165,4	-	-	-	-	163	140,4
CL1500		233	212	194	176	164	152	144	138	136	134	133	132	132	112	112	111	111	-
PN320		320	320	291	269,7	254,4	237,7	228,5	219,4	-	215,6	-	211,8	-	-	-	-	208,7	179,8
PN400		400	400	363,8	337,1	318	297,1	285,7	274,2	-	269,5	-	264,7	-	-	-	-	260,9	224,7
CL2500		389	354	324	294	274	254	240	230	227	224	222	220	219	187	187	186	185	-

Table 7. Material: WCB as per ASTM A216

PN / CL	Standard	Temperature [˚C]								
		-10…50	100	150	200	250	300	350	375	400
		Allowable working pressure [bar]								
PN10	EN 1092-1	10	10	9,7	9,4	9	8,3	7,9	7,7	6,7
PN16		16	16	15,6	15,1	14,4	13,4	12,8	12,4	10,8
CL150	PN-EN 1759-1	19,3	17,7	15,8	14	12,1	10,2	8,4	7,4	6,5
PN25	EN 1092-1	25	25	24,4	23,7	22,5	20,9	20	19,4	16,9
PN40		40	40	39,1	37,9	36	33,5	31,9	31,1	27
CL300	PN-EN 1759-1	50	46,4	45,1	43,9	41,8	38,9	36,9	36,6	34,6
PN63	EN 1092-1	63	63	61,5	59,6	56,8	52,7	50,3	49	42,5
PN100		100	100	97,7	94,7	90,1	83,6	79,8	77,8	67,5
CL600	PN-EN 1759-1	100,1	92,8	90,6	87,8	83,6	77,5	74	72,9	69,1
CL900		150,1	139,2	135,7	131,4	125,1	116,1	110,8	109,5	103,4
PN160		159,2	147,6	143,9	139,4	132,7	123,1	117,5	116,1	109,7
PN250		241,4	223,5	217,8	211,2	201,1	186,6	178,1	175,8	166,2
CL1500		250,5	231,9	226	219,2	208,7	193,6	184,8	182,4	172,5
PN320		313	289,9	282,6	273,9	260,8	242	231	227,9	215,6
PN400		396,4	367,3	358	346,9	330,3	306,6	292,6	288,6	273,1
CL2500		417,2	386,6	376,9	365,1	347,7	322,7	308	303,8	287,5

Table 6. Material: G20Mn5 (1.6220) wg PN-EN 10213-3

PN / CL	Norma	Temperature [˚C]					
		-40	100	150	200	250	300
		Allowable working pressure [bar]					
PN10	-	6	6	3,8	3,6	3,48	3,4
PN16		16	16	10,1	9,6	9,28	9,07
PN25		25	25	15,8	15	14,5	14,2
PN40		40	28	28	27	26	25
PN63		63	59	58	55	53	51
PN100		100	95	92	87	85	82
PN160		160	152	148	140	136	132

Table 8. Material: WC9 as per ASTM A217

PN / CL	Standard	Temperature [˚C]																		
		-10…50	100	150	200	250	300	350	375	400	425	450	475	500	510	520	525	530	540	550
		Allowable working pressure [bar]																		
PN10	EN 1092-1	10	10	10	10	10	10	10	10	9,9	9,7	9,5	7,3	5,5	5	4,4	-	3,9	3,4	2,9
PN16		16	16	16	16	16	16	16	16	15,9	15,6	15,3	11,7	8,9	8	7,1	-	6,2	5,4	4,7
CL150	PN-EN 1759-1	19,5	17,7	15,8	14	12,1	10,2	8,4	7,4	6,5	5,6	4,6	3,7	2,8	-	-	1,9	-	1,3	-
PN25	EN 1092-1	25	25	25	25	25	25	25	25	24,8	24,4	23,9	18,3	14	12,6	11,2	-	9,8	8,5	7,4
PN40		40	40	40	40	40	40	40	40	39,7	39	38,3	29,2	22,3	20,2	18	-	15,7	13,6	12
CL300	PN-EN 1759-1	51,7	51,5	50,3	48,7	46,3	42,9	40,4	38,9	36,5	35,2	33,7	31,7	27,7	-	-	21,6	-	-	15,3
PN63	EN 1092-1	63	63	63	63	63	63	63	63	62,5	61,5	60,3	46	35,2	31,9	28,3	-	24,8	21,4	18,8
PN100		100	100	100	100	100	100	100	100	99,2	97,6	95,6	73,1	55,9	50,6	44,9	-	39,3	34	29,9
CL600	PN-EN 1759-1	103,4	103,1	100,3	97,5	92,7	85,7	80,4	77,6	73,3	70,2	67,7	63,4	55,7	-	-	43,3	-	-	30,7
CL900		155,1	154,6	150,6	146,2	139	128,6	120,7	116,5	109,8	105,4	101,4	95,1	83,4	-	-	64,9	-	-	46
PN160		164,5	163,9	159,5	154,7	147,4	136,4	128	123,6	116,5	111,8	107,6	100,8	87,3	-	-	68,9	-	-	48,8
PN250		249,2	248,1	239,8	231,2	222,6	206,6	193,8	187	176,4	169,2	162,9	152,5	122,2	-	-	104,4	-	-	74,1
CL1500		258,6	257,7	250,8	244	231,8	214,4	201,1	194,1	183,1	175,6	169,1	158,2	138,9	-	-	108,4	-	-	76,9
PN320		323,2	321,9	312,3	302,3	289,2	268	251,4	242,5	228,8	219,4	211,4	197,8	165,7	-	-	135,4	-	-	96
PN400		409,4	408	397,1	385,7	366,8	339,4	318,5	307,1	289,7	277,9	267,7	250,7	218,5	-	-	171,5	-	-	121,5
CL2500		430,9	429,5	418,3	406,5	386,2	357,2	335,3	323,2	304,9	292,5	281,8	263,9	231,7	-	-	180,5	-	-	127,9

Table 9. Material: CF8M as per ASTM A351

PN / CL	Standard	Temperature [˚C]																						
		-10…50	100	150	200	250	300	350	375	400	425	450	475	500	510	520	525	530	540	550	575	600	625	649
		Allowable working pressure [bar]																						
PN10	EN 1092-1	8,9	7,8	7,1	6,6	6,1	5,8	5,6	5,5	5,4	5,4	5,3	5,3	5,2	5,2	5,2	-	5,2	5,1	5,1	4,7	3,8	-	-
PN16		14,3	12,5	11,4	10,6	9,8	9,3	9	8,8	8,7	8,6	8,5	8,5	8,4	8,3	8,3	-	8,3	8,3	8,2	7,6	6,1	-	-
CL150	PN-EN 1759-1	18,4	16	14,8	13,6	12	10,2	8,4	7,4	6,5	5,6	4,6	3,7	2,8	-	-	1,9	-	1,4	-	-	-	-	-
PN25	EN 1092-1	22,3	19,5	17,8	16,5	15,5	14,6	14,1	13,8	13,6	13,5	13,4	13,3	13,2	13,1	13,1	-	13	13	12,9	12	9,6	-	-
PN40		35,6	31,3	28,5	26,4	24,7	23,4	22,6	22,1	21,8	21,6	21,4	21,2	21	21	20,9	-	20,8	20,8	20,7	19,1	15,5	-	-
CL300	PN-EN 1759-1	48,1	42,3	38,6	35,8	33,5	31,6	30,4	29,6	29,3	29	29	28,7	27,3	-	-	25,2	-	-	24	22,9	19,9	15,7	12,8
PN63	EN 1092-1	56,1	49,2	44,9	41,6	38,9	36,9	35,5	34,9	34,4	34	33,7	33,5	33,2	33	32,9	-	32,8	32,7	32,6	30,2	24,4	-	-
PN100		89,1	78,1	71,3	66	61,8	58,5	56,4	55,3	54,5	54	53,4	53,1	52,6	52,4	52,2	-	52,1	51,9	51,7	47,9	38,7	-	-
CL600	PN-EN 1759-1	96,3	84,5	77,1	71,2	66,7	63,1	61	59,8	58,9	58,3	57,7	57,3	54,8	-	-	50,6	-	-	47,8	45,5	39,8	31,7	25,5
CL900		144,4	126,8	115,6	107	100,2	95	91,3	89,7	88,2	87,3	86,6	86	82,1	-	-	75,9	-	-	71,8	68,3	59,7	47,5	38,3
PN160		153,1	134,4	122,6	113,5	106,3	100,7	96,8	95,1	93,6	92,6	91,8	91,2	87,1	-	-	80,5	-	-	76,2	72,5	63,3	50,4	40,3
PN250		231,9	203,3	185,4	171,9	160,9	152,4	146,7	143,9	141,7	140,3	139,1	138,1	131,7	-	-	121,8	-	-	115,4	109,8	95,9	76,3	61
CL1500		240,6	210,9	192,4	178,4	167	158,1	152,2	149,3	147,1	145,6	144,3	143,3	136,7	-	-	126,4	-	-	119,8	114	99,5	79,2	63,8
PN320		300,8	263,7	240,6	223	208,7	197,6	190,3	186,7	184	182,1	180,3	179,2	170,9	-	-	158	-	-	149,7	142,5	124,4	98,9	79,2
PN400		381	334,1	304,8	282,4	264,2	250,3	241,1	236,5	233,1	230,7	228,4	227	216,6	-	-	200,2	-	-	189,5	180,5	157,7	125,1	100,4
CL2500		401	351,7	320,8	297,2	278,1	263,5	253,8	249	245,4	242,9	240,4	238,9	228	-	-	210,7	-	-	199,5	190	166	131,7	106,5

DESIGNS

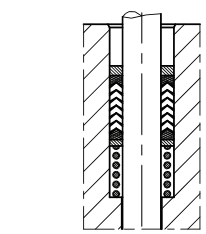
Design and material options are to be selected to suit working conditions. Contoured plug and press cage valve is the basic design for normal working conditions. In cases of noise emissions exceeding the level accepted by customer (normally 85 dBA) perforated valve plugs are to be applied, which are exchangeable with contoured plugs and allow noise reduction by 10dBA with respect to the basic design. Further noise reduction (by 5 dBA) can be achieved by application of choke cage, which causes reduction in pressure drop between plug and seat. Such design is also recommended in case of choked flow, cavitation and flashing. Perforated structures feature higher pressure recovery coefficient F_L, which allows achievement of higher flow at the same Kv_S and Δp as in basic design. In case of compressive media it is advisable to apply diffusers at the valve outlet. Design variant of valve is to be selected based on computer-aided calculations of flow ratio, noise level, medium status, and effectiveness of such actions depends on precision of data submitted by customer.

In justified cases (noise, choked flow) diffusers can be fitted with additional perforated choke structures in the form of plates assembled between flanges or welded in diffuser interior. On customer's request, also when flow conditions justify such solution, special executions are recommended concerning materials, flow ratios, control characteristics, leakage class, etc.

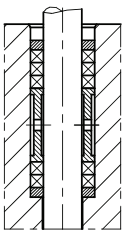
Tablica 10: Packing types with application ranges.

Packing	PN	Temperature [°C]		
		Bonnet		
		Standard	Extension	Bellow seal
PTFE-V	up to CL600)*	-46...+200	-198...-46 +200...+300	-100...+200
PTFE + Graphite				
PTFE-V / TA-LUFT				
Graphite	up to CL2500)*	+200...+300	+300...+537 ,(+650)**	+200...+400
Graphite / TA-LUFT				

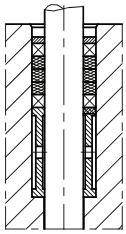
)* PN10…40; CL150…300 - for below seal bonnet)** - for welding ends valves



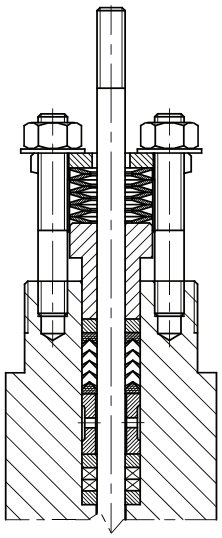
Packing (PTFE-V)



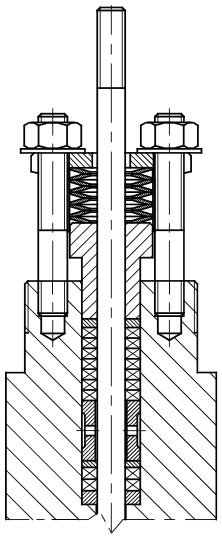
Packing (PTFE+GRAPHITE)



Packing (GRAPHITE)



Packing kit TA-LUFT PTFE-V



Packing kit TA-LUFT with graphite kit

Fig. 2. Bonnet packings

Table 11. Flow ratios Kvs.

Kvs					Stroke	Seat for. [D]	F_D		Nominal size DN										
Contoured plugs			Perforated plugs				Cl. IV	Cl. V											
L	P	S	L	P	[mm]	[mm]	[kN]		15	20	25	40	50	80	100	150	200	250	300
0,1	-	-	-	-	20	6,35	0,1	0,65	■	■	■	■	■						special execution, technical data according to individual inquiries
0,16	-	-	-	-					■	■	■	■	■						
0,25		-	-	-					■	■	■	■	■						
0,4		-	-	-					■	■	■	■	■						
0,63		-	-	-					■	■	■	■	■						
1,0		-	-	-					■	■	■	■	■						
1,6		-	-	-		9,52	0,15	1,0	■	■	■	■	■						
2,5		-	-	-		12,7	0,2	1,3	■	■	■	■	■						
4,0		4,8	-	-					•	■	■	■	■						
6,3		7,6				19,05	0,3	1,95		•	■	■	■						
10		12	6,3			20,64	0,33	2,1			•	■	■						
16		20	10			25,25	0,4	2,6				■	■						
25		30	16			31,72	0,5	3,3				•	■	■					
40		48	25			41,25	0,7	4,6					•	■	■				
63		-	40		38	50,8	0,8	5,2						■	■	■			
94		115	63			66,7	1,1	7,2						•	■	■	■		
125		-	125	94		88,9	1,4	9,1							■	■	■	■	
160		192													•	■	■	■	
250		-	180	125	50	107,92	1,7	11								■	■	■	
320		384	260	200		126,95	2,0	13									■	■	
500		600	425	320	63	158,72	2,5	16										■	
630		-	630	400		195	3,1	20											■
800		960	720	500	80	203,2	3,2	21											

Calculation coefficients

Contoured plugs: F_L=0,9 ; X_T=0,72; Fd=0,46; xFz=0,65
Perforated plugs: F_L=0,95 ; X_T=0,78; Fd=0,1; xFz=0,75

NOTE

1. ■ • - no executions for PN250…CL2500
2. Quick-opening valves (S) - only for maximum values of Kv_s for individual DN.

ALLOWABLE PRESSURE DROPS Δp.

Pressure drops Δp [bar] in Tables 13 apply to closed valve and they are calculated with account for the valve drive performance. Actual pressure drops should not exceed 70% of allowable working pressure for given nominal pressure, material execution and working temperature, as per tables 3…9.

$$\Delta p = \frac{Fs - F_D}{0{,}785 \cdot 10^{-4} \cdot D^2} \quad \text{or} \quad Fs = 0{,}785 \cdot 10^{-4} \cdot D^2 \cdot \Delta p + F_D$$

where
- Δp [bar] - calculated pressure drop
- Fs [kN] - actuator available force (tabel 12)
- F_D [kN] - valve plug to valve seat pressure (tabel 11)
- D [mm] - valve seat diameter (tabel 11)

Tabel 12: Available force Fs [kN] of pneumatic actuators

Actuator size	Direct actuator P ; P1			Reverse actuator R ; R1					
	Supply pressure [kPa]			Spring range [kPa]					
	140	250	400	20 - 100	40 - 120; 40 - 200	60 - 140	80 - 240	120 - 280	180 - 380
160	0,64	2,4	4,8	0,32	0,64	0,96	1,28	1,92	-
250	1,0	3,8	7,5	0,5	1,0	1,5	2,0	3,0	-
400	1,6	6,0	12,0	0,8	1,6	2,4	3,2	4,8	-
630	2,5	9,5	18,9	1,3	2,5	3,8	5,0	7,6	11,3
R-630T	-	-	-	2,6	5,0	7,6	10,0	15,2	22,6
1000	4,0	15,0	30,0	2,0	4,0	6,0	8,0	12,0	18,0
1500	6,0	22,5	45,0	3,0	6,0	9,0	12,0	18,0	27,0
1500T	12,0	45,0	90,0	6,0	12,0	18,0	24,0	36,0	54,0

NOTE:

1. For direct actuators P, P1 adopted spring range is 20 - 100kPa.
2. For electric and other actuators Δp value can be calculated using above formula and figures from Tables 11, taking nominal load capacity as available force Fs, as per actuator catalog chart

Table 13: Pressure drops Δp [bar] for valves with pneumatic actuators, leakage class class IV and V

Valve seat diameter [mm]	Actuator size	Air-to-close Spring range 20…100 kPa						Air-to-open											
		IV class			V class			IV class						V class					
		Supply pressure [kPa]						Spring range [kPa]						Spring range [kPa]					
		140	250	400	140	250	400	20…100	40…120 40…200	60…140	80…240	120…280	180…380	20…100	40…120 40…200	60…140	80…240	120…280	180…380
		Δp [bar]																	
do 12,7	160	24	173	280	-	85	274	9	34	60	85	135	-	-	-	-	-	47	-
	250	61	273	280	-	188	280	23	61	100	138	215	-	-	-	15	54	130	-
	400	107	280	-	23	280	-	47	110	173	236	280	-	-	22	85	148	274	-
19,05	160	11	73	157	-	14	99	-	11	23	34	56	-	-	-	-	-	-	-
	250	24	118	240	-	62	190	7	24	41	58	93	-	-	-	-	-	36	
	400	45	196	280	-	14	280	17	45	72	100	155	-	-	-	15	43	98	
20,64	160	9	62	133	-	7	79	-	9	19	28	47	-	-	-	-	-	-	-
	250	20	100	210	-	48	159	5	20	34	49	78	-	-	-	-	-	26	-
	400	37	166	280	-	115	280	14	37	60	84	131	-	-	-	9	32	79	-
	630	65	272	280	11	218	280	27	65	103	140	216	280	-	11	49	86	162	274
	R-630T	-	-	-	-	-	-	65	140	216	280	280	280	11	86	162	237	280	280
25,25	160	4	40	87	-	-	43	-	4	11	17	30	-	-	-	-	-	-	-
	250	12	67	142	-	23	98	2	12	22	32	52	-	-	-	-	-	8	-
	400	24	112	232	-	68	188	8	24	40	56	88	-	-	-	-	12	44	-
	630	42	180	280	-	136	280	17	42	67	92	143	218	-	-	23	48	98	174
	R-630T	-	-	-	-	-	-	42	92	143	193	280	280	-	48	98	149	249	280
31,72	160	1,5	24	54	-	-	19	-	1	5	9	17	-	-	-	-	-	-	-
	250	6	41	88	-	5	53	-	6	12	19	31	-	-	-	-	-	-	-
	400	14	70	145	-	34	110	4	14	24	34	54	-	-	-	-	-	19	-
	630	25	113	232	-	78	197	10	25	41	57	90	137	-	-	6	21	54	101
	R-630T	-	-	-	-	-	-	25	57	89	121	185	280	-	22	54	85	149	245
41,25	160	-	13	31	-	-	3	-	-	2	4	9	-	-	-	-	-	-	-
	250	2	23	51	-	-	24	-	2	6	10	17	-	-	-	-	-	-	-
	400	7	40	84	-	12	57	1	7	13	19	31	-	-	-	-	-	3	-
	630	13	63	130	-	35	102	4	13	22	31	49	75	-	-	-	3	21	48
	R-630T	-	-	-	-	-	-	14	32	51	70	108	164	-	5	24	43	81	137
50,8	630	9	43	90	-	21	69	2,5	9	15	21	34	53	-	-	-	-	12	30
	1000	16	71	146	-	49	124	6	16	26	36	56	86	-	-	4	14	34	64
	1500	25	107	218	3	85	196	10	25	40	55	84	129	-	3	18	33	62	107
66,7	630	4	24	50	-	6	33	-	4	8	11	18	29	-	-	-	-	-	11
	1000	8	40	83	-	22	65	3	8	14	20	31	48	-	-	-	2	14	30
	1500	14	61	125	-	44	108	5	14	23	31	48	74	-	-	5	14	30	56
88,9	630	1,5	12	28	-	-	15	-	1	3	5	9	16	-	-	-	-	-	3
	1000	4	22	46	-	10	34	1	4	7	11	17	27	-	-	-	-	5	14
	1500	7	34	70	-	21	58	3	7	12	17	27	41	-	-	-	5	14	29
107,92	1000	3	14	30	-	4	20	-	3	5	7	11	18	-	-	-	-	1	8
	1500	5	23	47	-	13	37	1	5	8	11	18	28	-	-	-	1	8	17
	1500T	11	48	96	1	37	86	5	11	18	24	37	57	-	1	8	14	27	47
126,95	1000	1,5	10	22	-	1	13	-	1	3	4	7	12	-	-	-	-	-	3
	1500	3	16	34	-	8	25	-	3	6	8	13	20	-	-	-	-	4	11
	1500T	8	34	70	-	25	61	3	8	13	17	27	41	-	-	4	9	18	33
158,72	1000	0,5	6	13	-	-	6	-	-	1	2	4	7	-	-	-	-	-	-
	1500	2	10	21	-	3	14	-	2	3	5	8	12	-	-	-	-	1	6
	1500T	5	21	44	-	14	37	2	5	8	10	17	26	-	-	1	4	10	19
195	1500	-	7	14	-	-	8	-	1	2	3	5	8	-	-	-	-	-	2
	1500T	3	14	29	-	8	23	1	3	5	7	11	17	-	-	-	1	5	11
203,2	1500	-	6	13	-	-	7	-	-	2	3	4,5	7	-	-	-	-	-	2
	1500T	3	13	27	-	7	21	-	3	4,5	6	10	16	-	-	-	-	5	10

NOTE:

1. In Table 13, theoretical acceptable pressure drops are included. Actual pressure drops with consideration of tolerance of spring manufacture and friction of internal parts of the actuator are lower than those given by 20%. Pressure drops chosen that way guarantee internal tightness of closing of the valves.
2. In valves working along the procedure: “increased control pressure – valve opens”, the actuator with springs ranged 40-120 kPa can be replaced with an actuator ranged 40-200 kPa, with the same pressure drops.
3. For reverse-working actuators (type R or R1), supply pressure should be higher than the upper spring range by at least 40kPa.

NOISE REDUCTION:
Should noise due to cavitation or aerodynamic phenomena exceed level acceptable by customer, it can be reduced by applying the following solutions:
- perforated valve plugs (Fig. 1 and Table 11)
- silencier plates on valve outlet and/or inside of reduction joint (Fig. 3, 4 and Table 14)
- - reduction ends (diffusers) - (Fig.4).

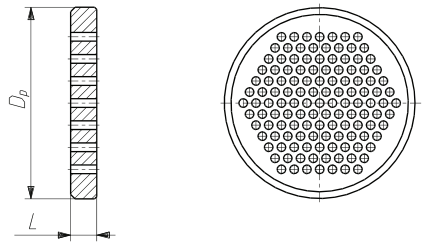


Fig. 3. Silence plate

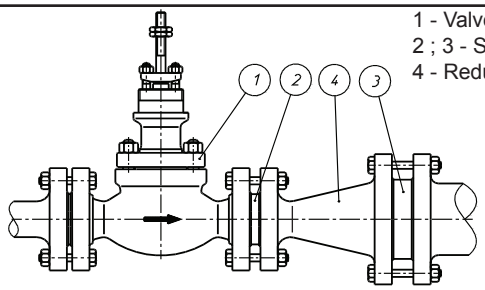


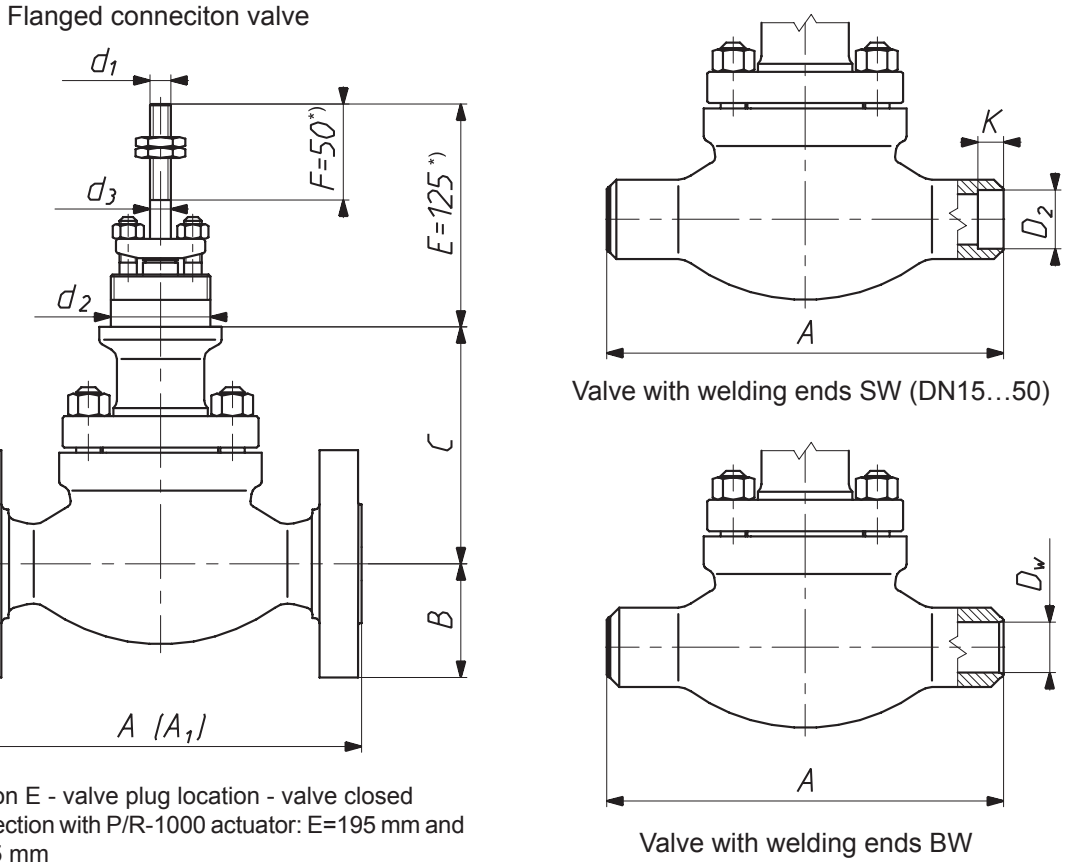
Fig. 4. Installation of silencer plates (or kits)

Table 14. Dimensions and flow ratios for silencer plates.

DN	15	20	25	40	50	80	100	150	200	250	300	350
Kvs	4	6,3	10	25	40	94	160	320	500	800	1000	1500
	3,6	5,7	9	22,5	36	84	144	288	450	720	900	1350
	3,2	5	8	20	32	75	128	256	400	640	800	1200
	2,8	4,4	7	17,5	28	66	112	224	350	560	700	1050
L [mm]	5			6		10		15		20		
Dp [mm]	45	58	68	88	102	138	162	218	285	345	410	465

Multi-plate silence kits are custom-built for requirements of individual processes.

DIMENSIONS AND WEIGHTS



Dimension E - valve plug location - valve closed
*) Connection with P/R-1000 actuator: E=195 mm and F=115 mm

Fig. 5. Valve connection dimensions

Table 15a: Control valves connection dimensions

DN		15…25						40						50					
PN/CL		PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500
B max		63	70	75		80	90	75	85	93		98	110	83	98	108		105	118
C	DS	135		149	193			145		172	214			155		175	237		
	DW	306		320	364			316		348	385			326		345	402		
	DM	254	-	-	-	-	-	254	-	-	-	-	-	270	-	-	-	-	-
Weight [kg]		8	8,5		9,5			15,5	17,5	19	20	22	23	22	25	28	31	33	34

DN		80						100						150		
PN/CL		PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10…CL300	PN63...CL600	CL900;PN160
B max		105	145	120	133	138	153	128	138	145	155	168	185	160	178	190
C	DS	206		233	257			217		252	329			287		365
	DW	375		402	447			407		442	498			426		483
	DM	405	-	-	-	-	-	405	-	-	-	-	-	470	-	-
Weight [kg]		40	43	44	50	51	52	65	72	75	86	89	95	132	147	156

DN		200		250		
PN/CL		PN10...CL300	PN63...CL600	PN10...CL300	PN10...CL300 (kv800)	PN63...CL600
B max		190	235	258		255
C	DS	439		458		
	DW	539		558		
	DM	580	-	580	660	-
Weight [kg]		195	220	320	330	360

DN300 - special execution, technical data according to individual inquiries. (table: 15a and 15b).

NOTE: Weight of valve with standard bonnet and without actuator.

Table 15b: Control valves connection dimensions

DN	15…50	40…50	80...100	80; 100	100	150		200	200; 250			250	
Kvs [1]	0,1…16	25…40		63; 94	125; 160	63…160	250; 320	94	125; 160	250; 320	500	630	800
Stroke	20			38			50	38		50	63		80
d_1	M12x1,25			M16x1,5			M20x1,5	M16x1,5		M20x1,5	M24x1,5		
d_2 [2]	57,15 / 2 1/4"-16UN2A					84,15 / 3 5/16"-16NS2A		95,25 / 3 3/4"-12UN2A					
d_3	12		16			20		24					
Actuator	160 250 400 630 R-630T			630 1000 1500			1000 1500 1500T	1000 1500		1000 1500 1500T		1500 1500T	

NOTE:

[1] Kvs value for contoured plugs L and P. For other plugs Kvs as per Table 11 for same seat diameter.

[2] For DN80 and DN100 valves with TA-LUFT packing d_2 = 84,15

Table 16. Control valve length, flanges.

DN	Dimension A [mm]										
	PN / DIN					CL					
	10; 16; 25; 40	63 - 100	160	250 - 320	400	CL150	CL300	CL600	CL900	CL1500	CL2500
15	130	230*	230*	260*	300*	184	190	203	236	273	308
20	150	230	230	260	300		194	206	241		
25	160						197	210	248		
40	200	260	260	300	350	222	235	251	270	311	359
50	230	300	300	350	400	254	267	286	311	340	400
80	310	380	380	450	500	298	317	336	387	460	498
100	350	430	430	520	580	352	368	394	464	530	575
150	480	550	550	**	**	451	473	508	556	**	**
200	600	650	**	**	**	543	568	610	**	**	**
250	730	775	**	**	**	673	708	752	**	**	**
300	special execution, technical data according to individual inquiries										
*CAUTION! For DN15 (as per PN) housing lengths were adopted as for DN20 (with exception of PN10; 16; 25; 40) ** higher nominal pressures available after agreement with the manufacturer											

NOTE: Dimensions „A" as listed in Table 16 for CL150; CL300; Cl600; CL900; CL1500; CL2500 apply to bodies with B seat (RF). For other designs dimension A_1 can be calculated using relations presented in Table 17.

Table17. Algorithms for calculation of control valve body length for valves with flanged end:

- with groove
- with recess
- with ring-joint

Body type and identification PN / ANSI	Pressure CL	DN	A_1
With groove DL / (GF) With recess F / (FF)	CL300	15…250	$A_1 = A + 5 \times 2$
	CL600 CL900 CL1500 CL2500		$A_1 = A - 1,5 \times 2$
With ring-joint J / (RTJ)	CL300	15	$A_1 = A + 5,5 \times 2$
		20…40	$A_1 = A + 6,5 \times 2$
	CL150	15…250	
	CL300	50…250	$A_1 = A + 8 \times 2$
	CL600 CL900 CL1500	15…40	$A_1 = A$
	CL2500	15…25	
	CL600	50…250	$A_1 = A + 1,5 \times 2$
	CL900 CL1500	50…100	
	CL900	150	
	CL2500	80	$A_1 = A + 3 \times 2$
		100	$A_1 = A + 4,5 \times 2$

Table 18: Control valve length, welding ends.

DN	Dimension A [mm] Nominal pressure		
	PN 10...CL600	CL900…PN160	PN250...CL2500
15; 20; 25	210	230	300
40	251	260	350
50	286	300	400
80	337	380	500
100	394	430	580
150	508	550	**
200	610	**	**
250	752	**	**
300	special execution, technical data according to individual inquiries		
** higher nominal pressures available after agreement with the manufacturer			

Table 19: Butt welding ends BW

DN	Dz [mm]	t [mm]	Dw [mm]	PN (DIN3239)									
				10	16	25	40	63	100	160	250	320	400
15	21,3	2	17,3 •	x	x	x	x	x	x	x			
		2,6	16,1 •								x		
		3,2	14,9 •									x	
		5	11,3 •										x
20	26,9	2,3	22,3	x	x	x	x	x	x				
25	33,7	2,6	28,5	x	x	x	x	x	x				
		2,9	27,9							x			
		3,6	26,5								x		
		5	23,7									x	
		7,1	19,5 •										x
	42,4		28,2										x
40	48,3	2,6	43,1	x	x	x	x						
		2,9	42,5					x	x				
		3,6	41,1							x			
		5	38,3								x		
		6,3	35,7									x	
		10	28,3										x
50	60,3	2,9	54,5	x	x	x	x	x					
		3,2	53,9						x				
		4	52,3							x			
		6,3	47,7								x		
		8	44,3									x	
		12,5	35,3										x
80	88,9	3,2	82,5	x	x	x	x						
		3,6	81,7 •					x					
		4	80,9 •						x				
		6,3	76,3							x			
		11	66,9								x		
		12,5	63,9									x	
		17,5	53,9 •										x
	114,3		79,3										x
100	114,3	3,6	107,1	x	x	x	x						
		4	106,3					x					
		5	104,3						x				
		8	98,3 •							x			
		14,2	85,9								x		
		16	82,3									x	
		22,2	69,9 •										x
	139,7	20	99,7										x
150	168,3	4,5	159,3	x	x	x	x						
		5,6	157,1 •					x					
		7,1	154,1 •						x				
		12,5	143,3 •							x			
	193,7		168,7							x			
200	219,1	5,9	207,3	x	x								
		6,3	206,5			x	x						
		7,1	204,9					x					
		10	199,1 •						x				
	244,5	12,5	219,5						x				
250	273	6,3	260,4	x	x								
		7,1	258,8			x	x						
		8,8	255,4					x					
		12,5	248						x				
300	special execution, technical data according to individual inquiries												

DN	Schedule	Dz [mm]	t [mm]	Dw [mm]	ANSI (ASME 36.10 M)					
					CL150	CL300	CL600	CL900	CL1500	CL2500
1/2"	40	21,3	2,8	15,7 •	x	x	x	x		
	80		3,7	13,9 •					x	
	160		4,8	11,7 •						x
3/4"	40	26,7	2,9	20,9	x	x	x	x		
	80		3,9	18,9 •					x	
	160		5,6	15,5 •						x
1"	40	33,4	3,4	26,6	x	x	x	x		
	80		4,5	24,4					x	
	160		6,4	20,6 •						x
	XXS		9,1	15,2 •						x
1 1/2"	40	48,3	3,7	40,9 •	x	x	x	x		
	80		5,1	38,1 •	x	x	x	x	x	
	160		7,1	34,1					x	
	XXS		10,2	27,9 •						x
2"	40	60,3	3,9	52,5	x	x	x	x		
	80		5,5	49,3 •				x		
	160		8,7	42,9					x	
	XXS		11,1	38,1 •						x
3"	40	88,9	5,5	77,9 •	x	x	x			
	80		7,6	73,7 •				x		
	160		11,1	66,7					x	
	XXS		15,2	58,5						x
4"	40	114,3	6	102,3	x	x	x			
	80		8,6	97,1 •				x		
	120		11,1	92,1 •					x	
	160		13,5	87,3 •					x	
	XXS		17,1	80,1 •						x
6"	40	168,3	7,1	154,1 •	x	x				
	80		11	146,3 •			x	x		
	120		14,3	139,7 •				x		
	160		18,3	131,7 •				x		
8"	20	219,1	6,4	206,3	x	x				
	30		7	205,1		x				
	40		8,2	202,7		x				
	60		10,3	198,5 •			x			
	80		12,7	193,7 •			x			
10"	20	273	6,4	260,2	x	x				
	30		7,8	257,4		x				
	40		9,3	254,4		x				
	60		12,7	247,6 •			x			
	80		15,1	242,8 •			x			
12"	special execution, technical data according to individual inquiries									

where:

D_Z [mm] - pipe external diameter,

D_W [mm] - pipe internal diameter,

t [mm] - pipe wall thickness.

NOTE:

•) - execution with reduction stubs as per Fig. 7.

Table 18 contains series of example butt welding connections.

It is allowed to execute connections for other dimensions of pipes. Should pipe dimensions fall within the range ∅B min / ∅A max. (Fig. 6, Table 20), connection can be executed as cast. Otherwise reduction stub is to be welded to body end, which shall result in extension of housing by L or 2L size (Fig.7, Tabel 20). Other connection dimensions are allowed upon consulting with manufacturer.

Table 20: Dimensions of non-processed butt welding ends (executed as cast) and lengths of reduction stubs.

DN	Pressure	A max	B min	L
15 ... 25	PN 10...40, CL 150, 300	38	20	50
	PN 63...100, CL 600	48	20	
	PN 160, CL 900	40	23	
	PN 250...400, CL 1500,2500	48	23	
40	PN 10...40, CL 150, 300	64	42	
	PN 63...100, CL 600	75	42	
	PN 160, CL 900	66	38	
	PN 250...400, CL 1500,2500	66	28	
50	PN 10...100, CL 150...600	80	55	
	PN 160, CL 900	80	50	
	PN 250...400, CL 1500,2500	92	42	
80	PN 10...40, CL 150, 300	110	82	75
	PN 63...100, CL 600	122	82	
	PN 160, CL 900	111	76	
	PN 250...400, CL 1500,2500	127	56	
100	PN 10...100, CL 150...600	144	102	
	PN 160, CL 900	144	102	
	PN 250...400, CL 1500,2500	165	81	
150	PN 10...40, CL 150, 300	183	160	100
	PN 63...100, CL 600	196	160	
	PN 160, CL 900	217	154	
200	PN 10...40, CL 150, 300	243	200	150
	PN 63...100, CL 600	248	200	
250	PN 10...40, CL 150, 300	291	248	
	PN 63...100, CL 600	346	248	

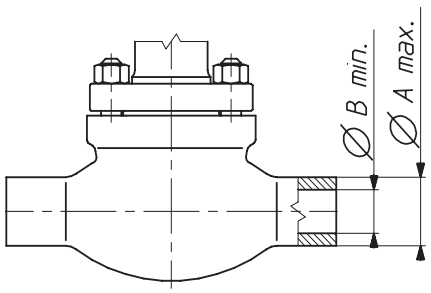


Fig. 6. Dimension of butt welding ends executed as cast

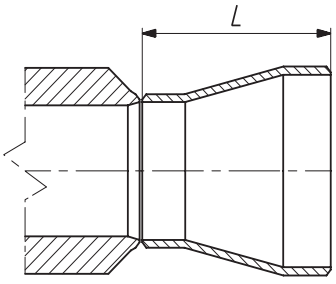


Fig. 7. Reduction stub

Table 21: SW socket welding ends

DN	D_2	K
15	21,7	9,7
20	27	13
25	34	
40	48,7	
50	61	16

VALVE ACTUATOR:

Pneumatic: - diaphragm multi-spring actuator as per Table 22:

P1/R1 - cast yoke, no handwheel
P1B/R1B - cast yoke, side-mounted handwheel
P/R - column type, no handwheel
PN/RN - column type, top-mounted handwheel

NOTE: P - direct action; air-to-close
R - reverse action; air-to-open

Table 22: Pneumatic actuators

Type	Size	Diaphragm effective area [cm²]	Stroke [mm]	Revolutions per stroke
P/R ; PN/RN	160	160	20	5
	250	250		
P1/R1 ; P/R ; P1B/R1B ; PN/RN	400	400		
	630	630	20 ; 38	5 ; 9
	R-630T *)	2 x 630		
	1000	1000	38 ; 50 ; 63	8 ; 10 ; 13
P1/R1 ; P1B/R1B	1500	1500	38 ; 50 ; 63 ; 80; 100	8 ; 10 ; 13 ; 16; 20
	1500T	2 x 1500		
*) - there are no top mounted handweel for R-630T				

Table 23: Sizes and weights of pneumatic actuators P/R and PN/RN - Fig. 8.

Actuator size	D_1	D_2	H_1	H_2	Weight [kg]	
	mm				P/R	PN/RN
160	210	225	306	468	9	13,5
250	240		324	486	10	14,5
400	305		332	494	16	20,5
630	375	305	424	586	30	37
R-630T		-	638	-	45	-
1000	477	450	607	847	74	100
1500	550	-	704	-	95	-
1500T		-	1008	-	200	-

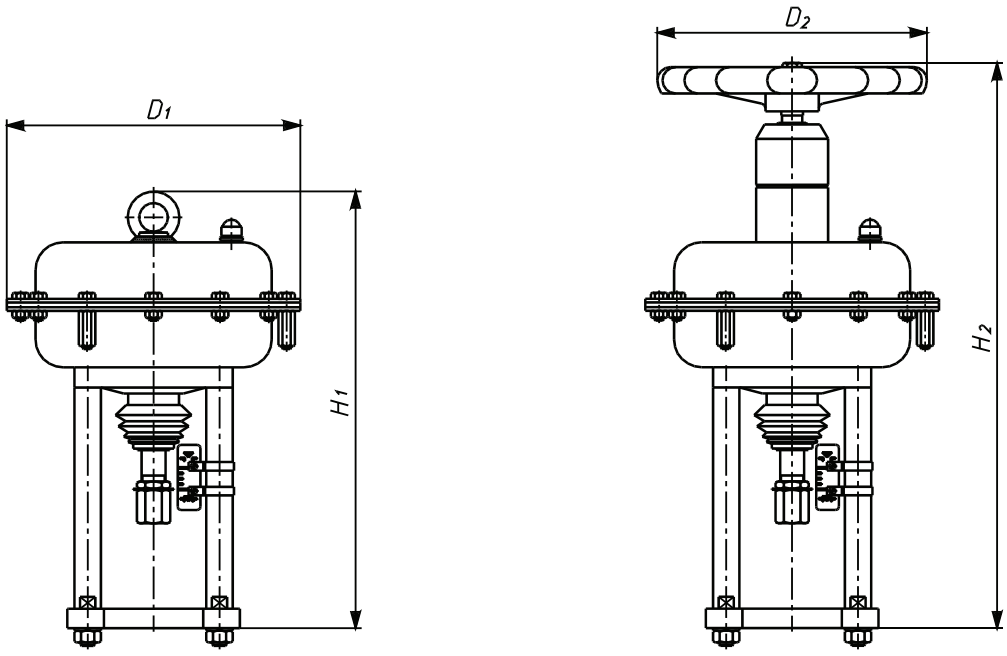
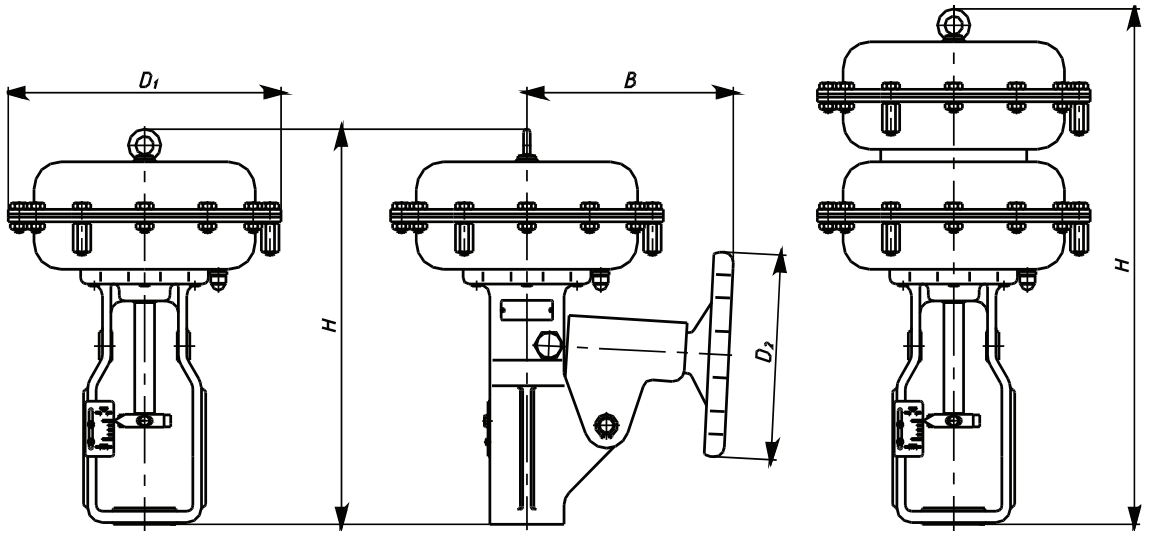


Fig. 8. Actuators P/R, PN/RN

Table 24: Sizes and weights of pneumatic actuators P1/R1 and P1B/R1B - Fig. 9.

Actuator size	B	D_1	D_2	H	Weight [kg]	
	mm				P1/R1	P1B/R1B
400	255	305	225	453	20	28
630	280	375	305	548	40	50
1000	340	477	450	773	85	105
1500	410	550		833	120	150
3000				1138	225	255



P1/R1 , P1B/R1B - 400...1500 P1/R1-3000

Fig. 9. Actuators P1/R1 , P1B/R1B

Control air connections: 1/4” NPT ; NPT 1/2”, Rc 1/2”
- tube diameters: 6x1 ; 8x1 ; 10x1; 12x1
- spring ranges: 20...100kPa ; 40...120kPa ; 60...140kPa - 3 springs
40...200kPa ; 80...240kPa ; 120...280kPa - 6 springs
180...380kPa *) - 12 springs
*)not applicable for actuators P/R; P1/R1-250; 400

For actuator P1/R1-3000 (Tandem) - for each range double the above numbers of springs.

- maximum supply pressure: actuator size 160...630 - 600kPa
actuator size R-630T and 1000...1500 - 500kPa
- accessories (upon request): handwheel, side-mounted handwheel (P1/R1) or top-mounted handwheel (P/R),
pneumatic positioner,
electro-pneumatic positioner,
smart electro-pneumatic positioner,
air set,
three-way solenoid valve,
lock-up valve,
position transducer,
limit switches.

Electric: - electric drives; domestic and foreign electro-hydraulic drives (for details and technical specification refer to manufacturers’ catalogs)
Manual: - manual drive type 20, Fig. 10 Table 25.

Table 25: Handwheels series 20 - types, sizes and weights.

Type	Stroke [mm]	d_1	d_2	H	D	rev./stroke	Weight [kg]
20-20-57-M12	20	M12x1,25	57,15	265	228	8	7,5
20-20-84-M12			84,15				
20-38-57-M16	38	M16x1,5	57,15		298	15	10
20-38-84-M16			84,15				
20-38-95-M16			95,25				
20-50-84-M20	50	M20x1,5	84,15	385	457	16	16
20-50-95-M20			95,25				
20-63-95-M24	63	M24x1,5				20	
20-80-95-M24	80			533	610	19	24

Marking:
Example: 20-38-57-M16 - manual drive type 20; stroke - 38mm; d_2=57,15mm; d_1=M16x1,5

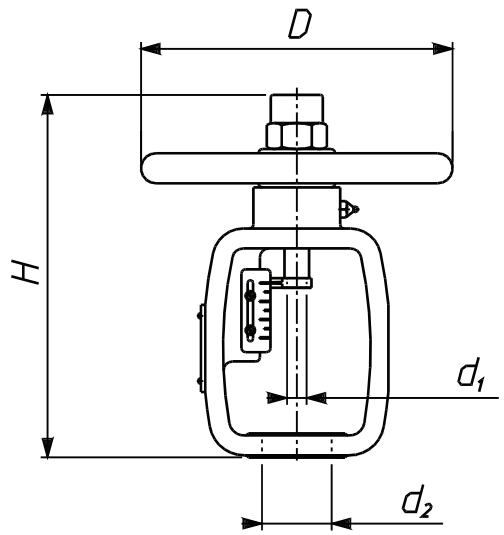


Fig. 10. Manual drive type 20.

SPECIAL OPTIONS:

- oxygen and hydrogen option:
Application of adequate materials, mechanical and chemical cleaning, inspections and assembly ensure compatibility with oxygen and hydrogen flows.

- low temperature fluid option:
Application of adequate materials and special bonnet design ensures reliable isolation of valve drive from the impact of low temperatures. Used mostly for liquid oxygen and liquid nitrogen.

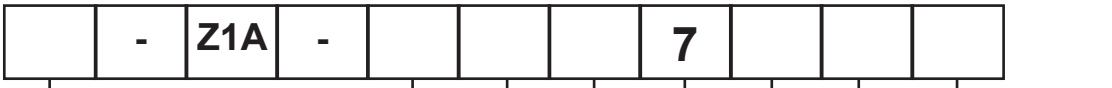
- acid gas option:
Parts of valve can be made of materials and under conditions to enable valve operation with gases of H_2S content as per NACE MR-0175.

- heat jacket option:
Design and technical parameters as per customer's specification.

- tight valve-seat option:
When class VI tightness is required (up to $\Delta p \leqslant 35$ bar)

– valves with non-cast bodies:
If a special construction of the valve body is needed, it is possible to design a valve for individual customer's needs (angle valves – type L and Z).

CLASSIFICATION AND MARKING:



Type and action:
- pneumatic with direct action: **P ; P1**
- pneumatic with reverse action: **R ; R1**
- pneumatic with side-mounted handwheel: **P1B;R1B**
- pneumatic with top-mounted handwheel: **PN; RN**
- electric: **E**
- manual: **20**

Bonnet:
- standard: **1**
- extension: **2**
- bellow seal: **3**
- other: **X**

Packing:
- PTFE, braided **A**
- PTFE, V type **B**
- PTFE, for oxygen **C**
- graphite, braided **D**
- graphite, expanded **E**
- TA-Luft, PTFE **F**
- TA-Luft, graphite **G**

Leakage class:
- basic: class IV **4**
- enhanced: class V **5**
- tight (special) class VI **6**

Valve plug:
- unbalanced **7**

Choke cages:
- no choke cages **0**
- one choke cage **1**

Plug characteristics and type:
- linear, contoured **L**
- equal percentage **P**
- quick-opening, (on-off) **S**
- linear, perforated **T**
- equal percentage, perforated **V**
- other **X**

Body material:
- carbon steel **3**
- alloy steel **4**
- stainless steel **5**
- other **X**

MARKING EXAMPLE:

Control valve type Z1A with reverse action pneumatic actuator with a top-mounted handwheel, extension bonnet, expanded graphite stem packing, leakage class IV, choke cage, equal percentage contoured plug, execution in alloy steel:

RN-Z1A-2E471P4

Marking is shown on valve nameplate.

Additionaly, it shows:
- nominal size [DN],
- nominal pressure [PN],
- max working temperature [TS],
- max working pressure [PS],
- test pressure [PT],
- flow ratio [Kvs],
- plug stroke [H],
- plug stroke fluid group [1 or 2],
- serial number and year of manufacture.

ORDERING:

The order should contain all information as per data questionnaire. Full information can be obtained from the Sales and Marketing Department or Technical and Development Department.

Revision: Z1A/06/2013
Valid until the next revision.

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SINGLE-PORTED GLOBE CONTROL VALVES **TYPE Z1A®**

Design solutions for special applications

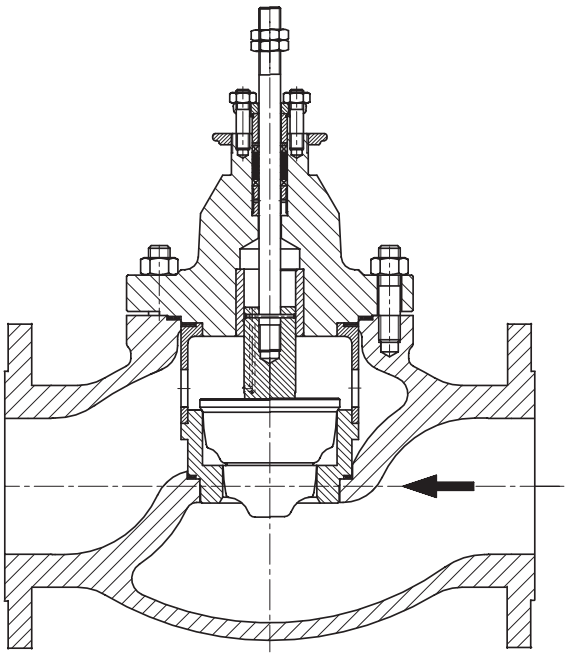
INTRODUCTION:

Product versions of valves type Z1A include numerous special executions adjusted especially for particular requirements of installations, in which they are to be installed.

The flow of fluid through the valve (depending on the kind and parameters of the fluid) may cause phenomena having a negative impact on the environment and be destructive to the product's durability.

It often happens that process parameters require application of valves designed strictly for flow parameters, so as to eliminate the occurrence of such phenomena as cavitation, chocked flow, noise and to prevent erosion of internal parts.

This catalogue card presents some of most commonly used valve designs, which are comprised in Z1A series, but being special executions, were not included in the main catalogue card of Z1A valves.

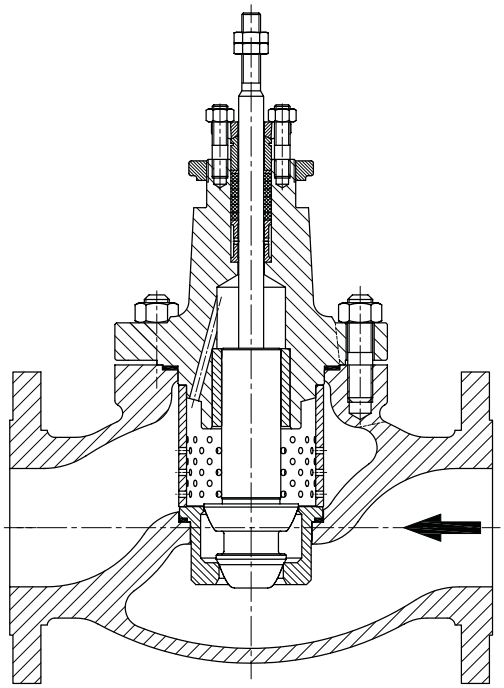


Valve with profile plug and pressuring cage

Valves with two-step plugs are designed for eliminating cavitation and chocked flow. Each step of throttling has been precisely selected, so as to generate pressure drops below critical values at each point of work. Valve's internal parts are toughened or stellited and nitrided.

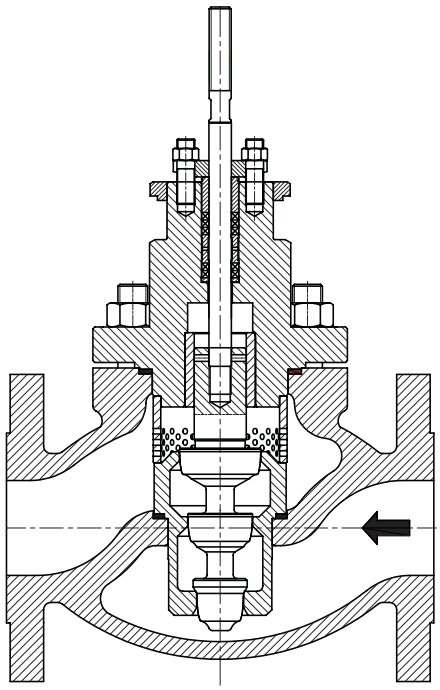
Valve with two-step plug and throttling cage

Valves with two-step plugs are designed for eliminating cavitation and chocked flow. Second throttling cage is to implement additional throttling step and to reduce the noise level through multihole structure. Valve's internal parts are toughened or stellited and nitrided.



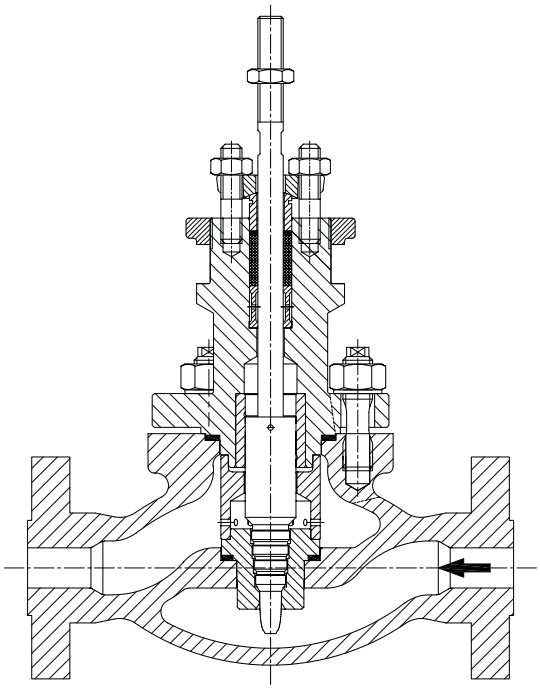
Valve with three-step plug and throttling cage

Valves with three-step plugs are designed for eliminating cavitation and chocked flow for higher pressure drops than valves with two-step plugs. Additional throttling cage is to implement additional throttling step and to reduce the noise level through multihole structure. Valve's internal parts are toughened or stellited and nitrided.



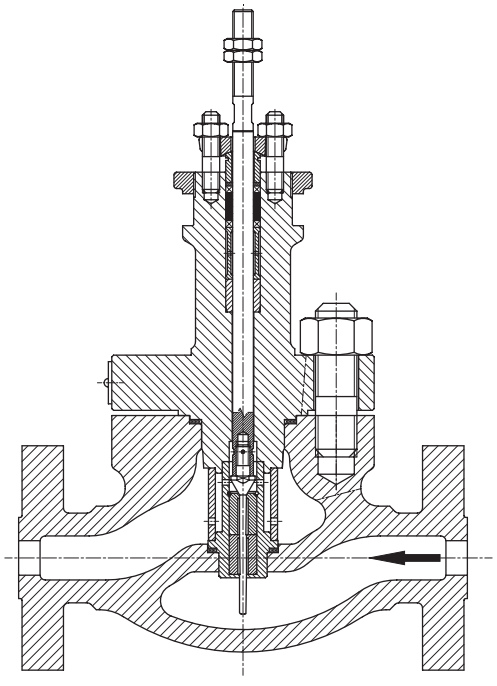
Valve with multi-step plug

Valves with multi-step plugs are designed for highest pressure drops. Valve's internal parts are toughened or stellited and nitrided, and for most demanding service they are made of ceramics or titanium.



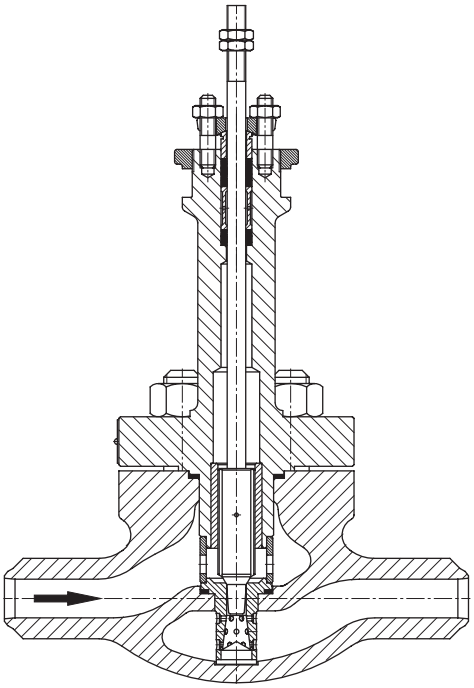
Valve with multi-step plug for micro-flow

Valves for micro-flows are manufactured with multi-step plugs, which are toughened or made of full stellite. Step-seat is made from toughened stainless steel with stellite inserts. This design allows for precise flow regulation with coefficient below Kv 0,02.



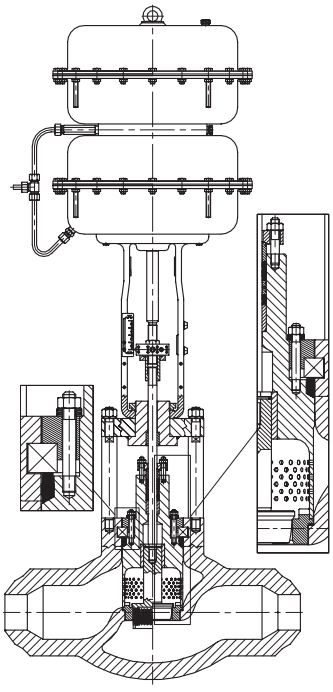
Valve with reverse flow (FTC) for flashing

Valves with fluid flow over the plug (FTC) are used for service with full evaporation (flashing). A protective cage with conical insert is mounted under the seat aiming at protection of valve body bottom against erosion. All internal parts are made of highly toughened stainless steel.



Valves DN150-300 for nominal pressures PN160-420

Valves for nominal pressures higher than those in the main catalogue card of Z1A valves are made available upon customised requests. Due to large bonnet diameter and high pressure, the packing system in a form of conical self-tightening (under pressure) seal was used. Product versions with profile and perforated plugs in different materials are available.



Revision: special executions Z1A/06/2013
Valid until the next revision.

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DOUBLE-PORTED CONTROL VALVES **TYPE Z1B®**

APPLICATION AREA:

Single-ported globe control valves type Z®1B are used in automatic and remote control instalations as flow control elements to adjust flow of liquids, steam and gases. Wide range of materials, excellent pressure and temperature parameters, multiple design variants, meeting requirements of various processes, make the valves applicable under the most demanding working conditions in power generation, petroleum chemistry, heating, chemical industry, metallurgy, etc. Versions designated for Western Europe market can be marked BR12.

FEATURES:

- various materials of valve body and internal parts, adapted to specific working conditions,
- design provides noise reduction, enhanced resistance to cavitation and flashing, and elimination of choked flow,
- wide range of nominal pressures, PN10 to CL2500, and flow ratio and control characteristics,
- reduction in aggressive and toxic media emissions to environment through application of bellow seal bonnets or bonnet packings meeting requirements of TA - LUFT,
- easy assembly and dismantling of valve internal parts for maintenance and service,
- high durability and reliability due to application of top-class materials and surface improvement processes (burnishing, stelliting, heat treatment, CrN coatings),
- possibility of mating with reverse action P/R (column) and P1/R1 (cast yoke) multi-spring actuators, and changing the spring range with no extra parts (keeping the number of springs),
- possibility of fitting actuators with lateral (P1/R1) or top (P/R) handwheel,
- possibility of performing diagnostics of "valve-actuator" due to application of smart electro-pneumatic positioners,
- wide range of electric actuators,
- special executions for oxygen, hydrogen, gas fuels, low temperature fluids (liquid oxygen, liquid nitrogen), acid gases containing H_2S; with heat jacket; for explosive atmospheres as per ATEX Directive 94/23/EC,
- design and production process meet the requirements of Quality Management System ISO 9001 and Directive 97/23/EC, and regulations of AD2000 Merkblatt, designated for installation on pipelines.

Z1B ® is a trademark registered with Republic of Poland Patent Office.

DESIGN AND TECHNICAL SPECIFIACTION:

***Body** (1)*: single-ported, cast

Nominal size: DN 25; 40; 50; 80; 100; 150; 200; 250; 300

Nominal pressure:

- PN10; 16; 25; 40; 63; 100 (as per PN-EN 1092-1:2010)
- PN-H-74306:1985; PN-H-74307:1985.
- CL150; CL300; CL600; CL900; CL1500; CL2500 (as per PN-EN 1759-1:2005).

divided as follows: DN25...250: PN10...100; CL150…CL600 *)
DN25...150: CL900; PN160 *)
DN25...100: PN250…400; CL1500…CL2500 *)

*) higher nominal pressures available after agreement with the manufacturer

Connections: - flanged: as per Table 1
- butt welding ends BW, as per Table 19 and 20
- socket welding ends SW, as per Table 21

Steel flanges CL150; CL300; CL600; CL900; CL1500; CL2500 are so designed that they can be assembled with flanges as per American standards ANSI/ASME B16.5 and MSS SP44. In American standards flanges are identified with nominal values in “Classes”, to which nominal pressure (PN) values as per PN-ISO 7005-1:2002 correspond.

Equivalent identification as per PN are: CL150: PN 20 CL300: PN 50
CL600: PN 110 CL900: PN 150
CL1500: PN 260 CL2500: PN 420

Table 1. Flanged end connections

Nominal pressure	Facing of flange types			
	Raised face	Groove	Recess	Ring - joint
	Identification			
PN10; 16; 25; 40; 63; 100; 160; 250; 320; 400	B 3)	D 1)	F 1)	-
CL150; 300	B 3)	DL (D1 2)	F (F1 1)	J (RTJ)
CL600; 900; 1500; 2500	B 3) (RF)	DL (GF)	F (FF)	J (RTJ)
1) - do PN160; 2) - tylko dla CL300; 3) - B1 – (Ra=12.5 mm, concentric surface structure “C”), B2 – (Ra as agreed with the customer); () - identification of connections as per ASME B16.5				
Possible execution of flanges per specification and indicated standards				

Face-to-face dimensions: - flanged valves as per PN-EN 60534-3-1; PN-M-74005; ISA S75.16-1993; Fig. 5; Table 16; 17
- welding ends valves; Fig. 5; Table 18
- as per PN-EN 60534-3-3: for PN 10...100 and CL150…600
- as for flanged valves PN 160: for PN 160 and CL900
- as for flanged valves PN 400: for PN 250...400 and CL1500…2500

Materials: - as per Table 2;
Relationship between working pressure and temperature as per Table 3…9.

Bonnet (2): - standard
- extension
- bellows seal (PN10…40; CL150…300)

Valve plug (3a,b,c): - piston, sleeve guided, hard. Rangeability: 50:1
- variants: unbalanced,
balanced, (from DN40 - K_{vs} 25),
balanced with pilot, (from DN50 - K_{vs} 40)
- flow characteristics: equal percentage - P
linear - L

Valve seat (4): - fitted-in and sealed with body, hard (tight seat after consulting the manufacturer)

Valve plug stem (5): - burnished, polished sealing face.

Control cage (6A): - perforated element executing preset flow characteristics and fixing seat.

Choke cage (6B,C): - perforated valve seat fixture, causing reduction in pressure drop between seat and plug.

Body gasket (7), seat gasket (8), control cage gasket (9): spiral, graphite+1.4404 in all executions.

Stem packing (9): - PTFE-V packing, compressed with spring bolt (18a),
- ring gaskets formed in braided packing cords (PTFE +GRAPHITE),
- graphite kits (expanded and silky graphite) or gaskets formed in braided graphite cords,
- TA-LUFT sealing with PTFE-V packing kit or graphite kit; packing structure as per Fig.s 1 and 2, range of applications as per Table 10.

Leakage class: (as per PN-EN 60534-4)
-basic: (class IV) less than 0,01% Kv_s
-enhanced: (class V) $3 \cdot 10^{-4} \cdot D \cdot \Delta p$ [cm^3/min]
where D (mm) - is seat diameter as per Table 10
Δp [bar] -actual pressure drop in closed valve.

Fluid flow direction: Under the plug for valves as per Fig. 1a and 1b, over the plug for valves as per Fig. 1 c

Flow coefficients: as per Table 11.

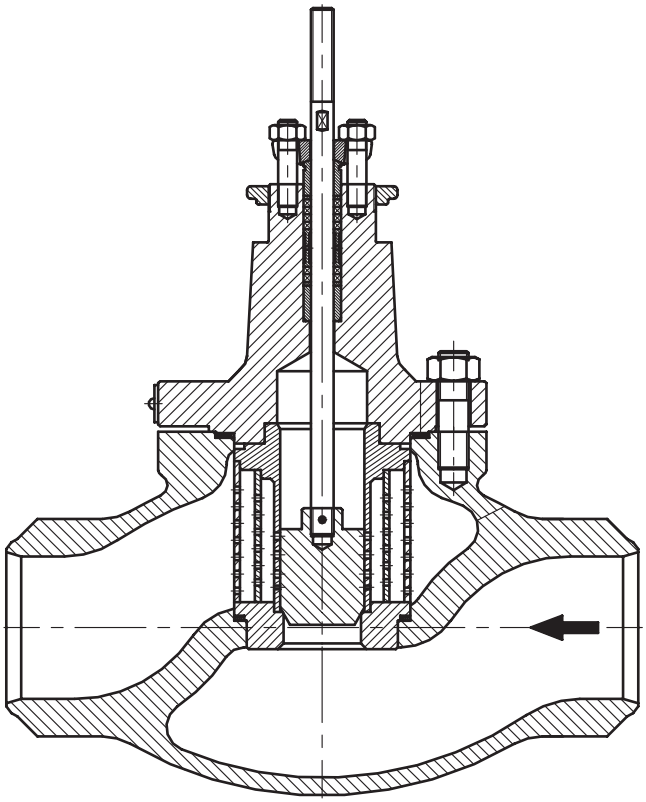


Fig. 1a. Valve Z1B - unbalanced plug.

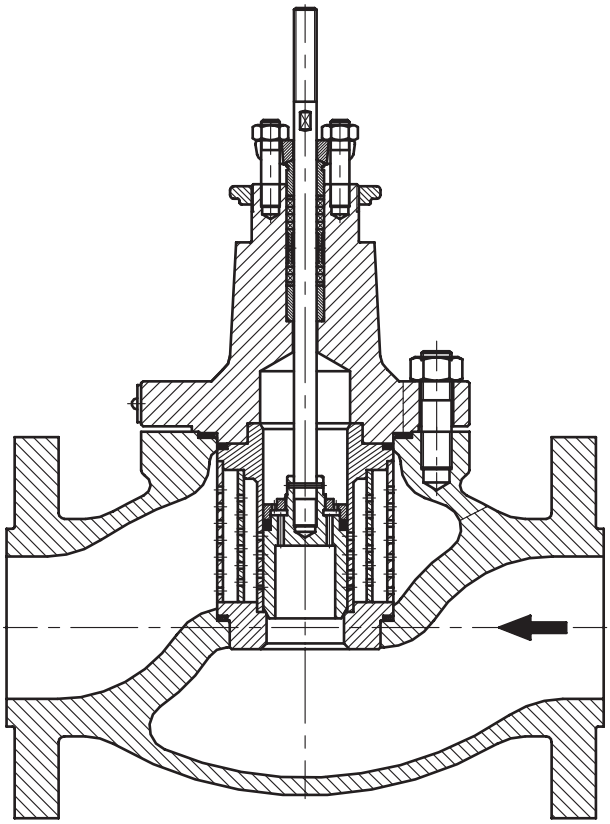


Fig. 1b. Valve Z1B - balanced plug.

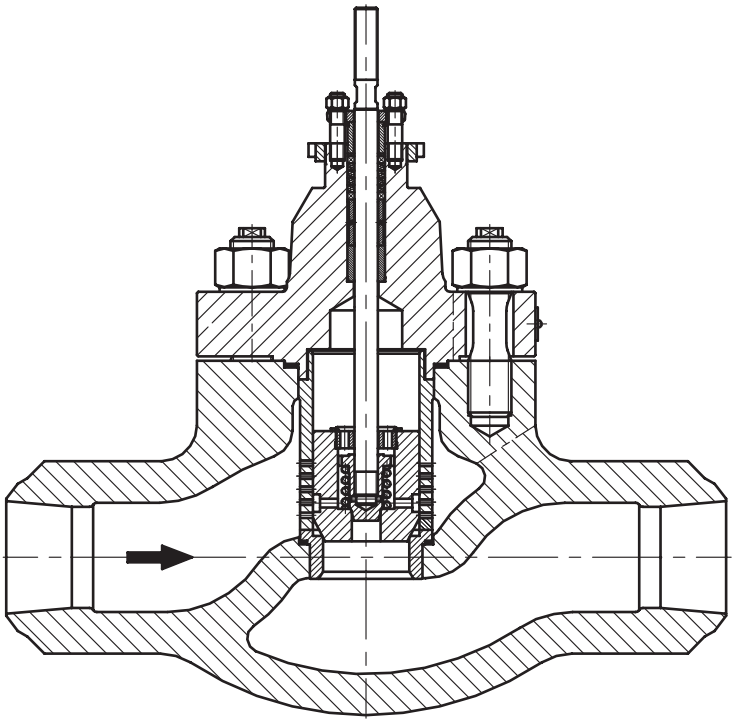
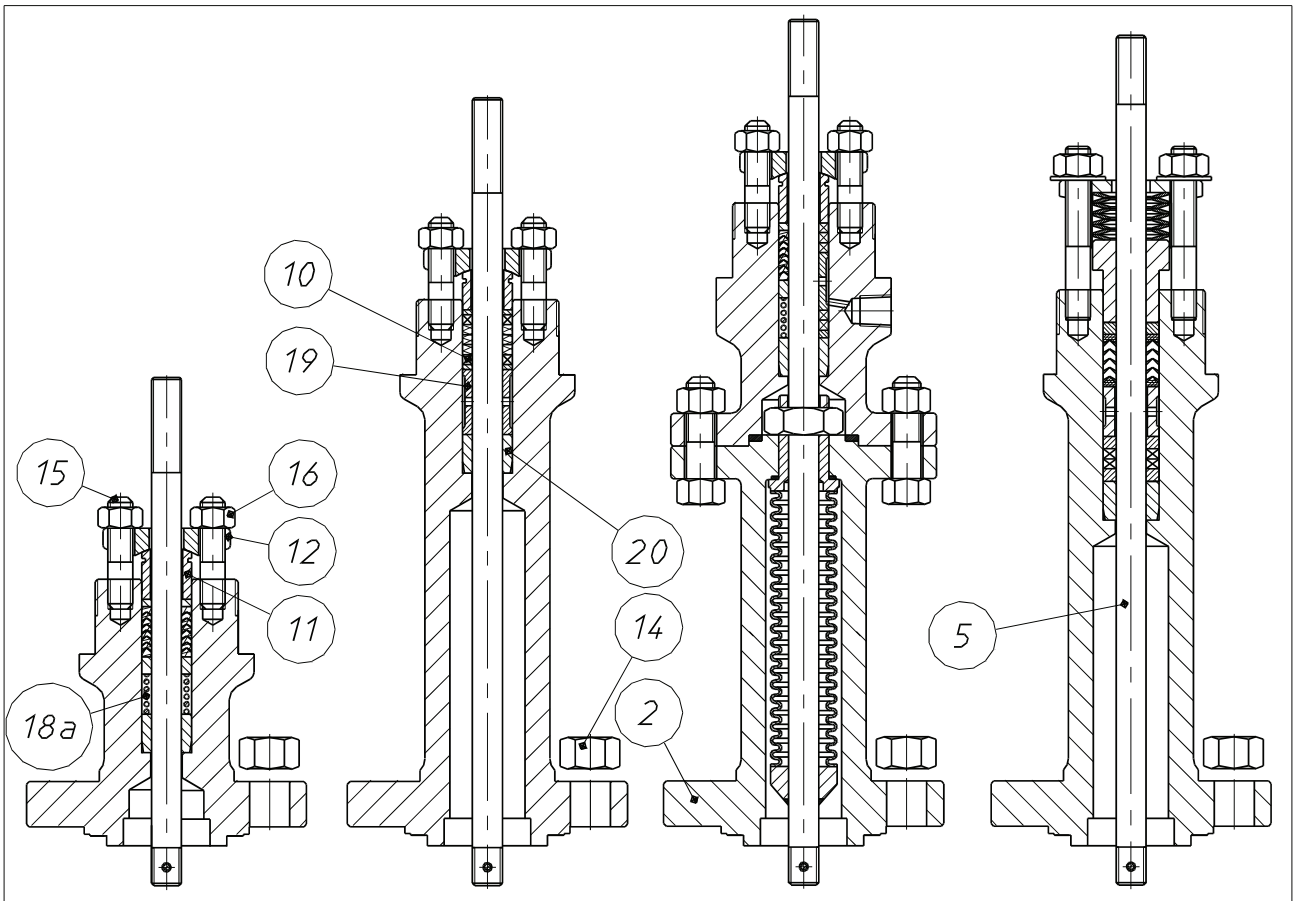
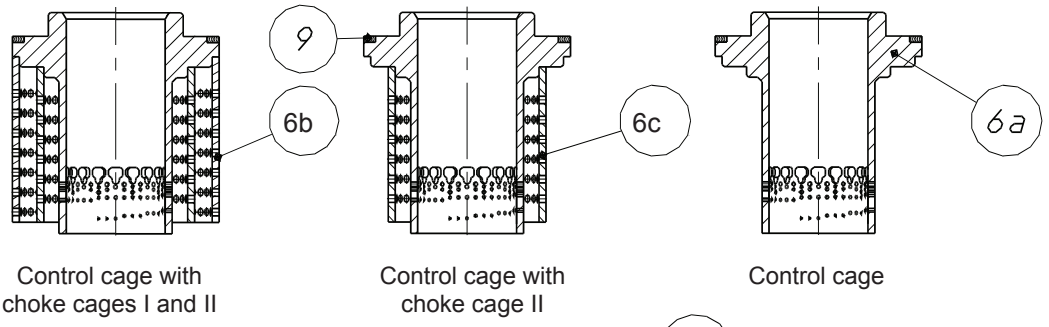


Fig. 1c. Valve Z1B - balanced plug with pilot.





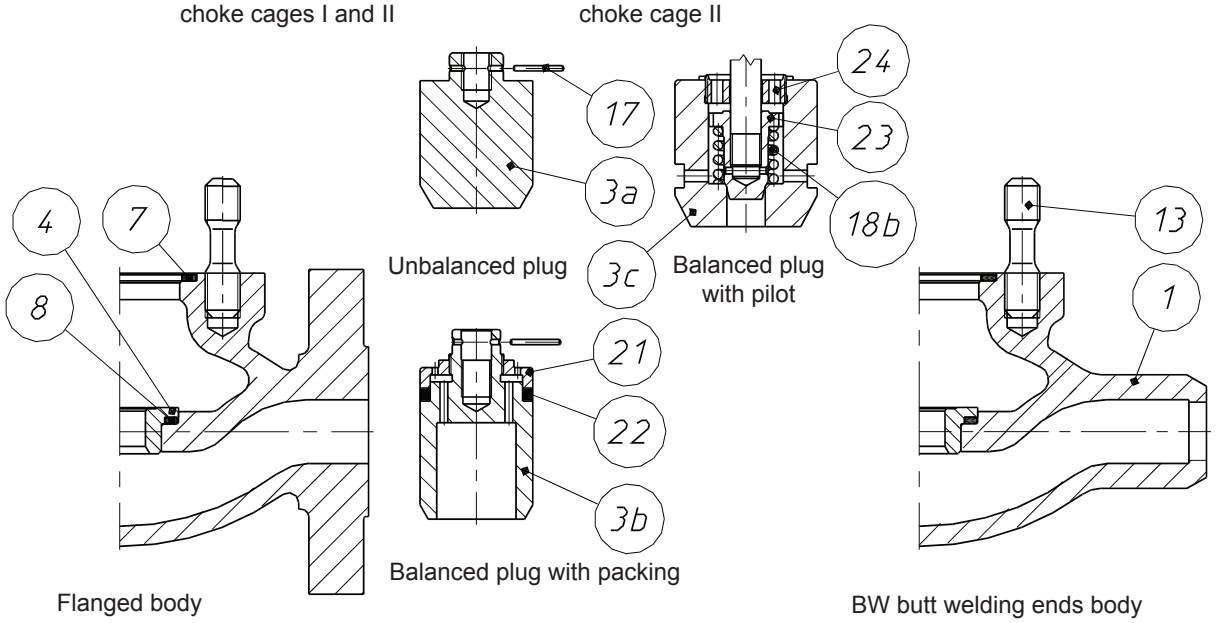


Fig. 1d. Control valve

Table 2. Part list with materials

Item	Part		Materials		
1	Body		GP 240 GH ; (1.0619) WCB	G17CrMo 9-10 ; (1.7379) WC9	GX5CrNiMo 19-11-2 ; (1.4408) CF8M
2	Bonnet	DN15…50	S 355 J2G3 (1.0570)	13CrMo4-4 ; (1.7335)	X6CrNiMoTi 17-12-2 ; (1.4571)
		DN80…300	GP 240 GH ; (1.0619) WCB	G17CrMo 9-10 ; (1.7379) WC9	
3a,b,c	Unbalanced plug Balanced plug Balanced plug (pilot)		X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment		
4	Seat		X6CrNiMoTi 17-12-2; (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite X17CrNi 16-2; (1.4057) + heat treatment		
5	Stem		X6CrNiMoTi 17-12-2; (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment		
6A	Control cage		X6CrNiMoTi 17-12-2; (1.4571) X17CrNi 16-2; (1.4057) + heat treatment		
6B	Choke cage I				
6C	Choke cage II				
7	Body gasket		GRAPHITE (98%) + 1.4404 (spiral)		
8	Seat gasket				
9	Control cage gasket				
10	Packing kit		PTFE + GRAPHITE		
			PTFE „V" (rings)		
			GRAPHITE		
11	Pressing sleeve		X6CrNiMoTi 17-12-2; (1.4571)		
12	Pressing level		S 355 J2G3 ; (1.0570)		
13	Body screw	PN10…CL300	8.8	A4 - 70 *)	
		PN63…CL2500	42CrMo4 (1.7225)	21CrMoV5-7 (1.7709)	X6NiCrTiMoVB 25-15-2 (1.4980)
14	Body nut	PN10…CL300	8.8	A4 - 70 *)	
		PN63…CL2500	42CrMo4 (1.7225)	21CrMoV5-7 (1.7709)	X6NiCrTiMoVB 25-15-2 (1.4980)
15	Bonnet screw		8.8	A4 - 70 *)	
16	Bonnet nut		8.8	A4 - 70 *)	
17	Notched peg		X6CrNiMoTi 17-12-2; (1.4571)		
18a,b	Spring		12R10 (SANDVIK), 9Ru10; ((1.4568) (SANDVIK)); Nimonic 90; (2.4969)		
19	Spacer sleeve		X6CrNiMoTi 17-12-2; (1.4571)		
20	Guide sleeve		X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment		
21	Plug nut		X6CrNiMoTi 17-12-2; (1.4571)		
22	Plug sealing ring		Expanded graphite		
23	Pilot		X105CrMo17; (1.4125)		
24	Back nut		X6CrNiMoTi 17-12-2; (1.4571)		

Relevant material standards

Material	Standard
GP 240 GH ; (1.0619)	PN-EN 10213-2
WCB	ASTM A 216
G17CrMo 9-10 ; (1.7379)	PN-EN 10213-2
WC9	ASTM A 217
GX5CrNiMo 19-11-2 ; (1.4408)	PN-EN 10213-4
CF8M	ASTM A 351
S 355 J2G3 ; (1.0570)	PN-EN 10025
13CrMo4-4; (1.7335)	PN-EN 10028
X6CrNiMoTi 17-12-2 ; (1.4571)	PN-EN 10088
X17CrNi 16-2 ; (1.4057)	PN-EN 10088
X105CrMo17; (1.4125)	PN-EN 10088
C45 (1.0503)	PN-EN 10083-1
X30Cr13 (1.4028)	PN-EN 10088
8.8	EN 20898-1
A4-70 *)	EN ISO 3506-2
42CrMo4 (1.7225)	EN 10269
21CrMoV5-7 (1.7709)	EN 10269
X6NiCrTiMoVB 25-15-2 (1.4980)	EN 10269

NOTE:

*) to be applied for nominal pressures PN10…CL600

Hardening of valve internal surfaces comprises:

a) stelliting – padding of surfaces with stellite: ~40HRC

b) CrN coating – introducing chromium nitride to external layer of detail, to the depth of ca.0.1 mm:~950HV

c) heat treatment: valve plug (~45HRC), valve seat (~35HRC), stem (~35HRC), cages (~35HRC), guide sleeve (~45HRC), pilot (~55HRC).

Table 3…9. Allowable working overpressure for materials at relevant temperatures

Table 3.	Material: GP240GH (1.0619) as per PN-EN 10213-2								
PN / CL	Standard	Temperature [˚C]							
		-10…50	100	150	200	250	300	350	400
		Allowable working pressure [bar]							
PN10	EN 1092-1	10	9,2	8,8	8,3	7,6	6,9	6,4	5,9
PN16		16	14,8	14	13,3	12,1	11	10,2	9,5
CL150	PN-EN 1759-1	17,3	15,4	14,6	13,8	12,1	10,2	8,4	6,5
PN25	EN 1092-1	25	23,2	22	20,8	19	17,2	16	14,8
PN40		40	37,1	35,2	33,3	30,4	27,6	25,7	23,8
CL300	PN-EN 1759-1	45,3	40,1	38,1	36	32,9	29,8	27,8	25,7
PN63	EN 1092-1	63	58,5	55,5	52,5	48	43,5	40,5	37,5
PN100		100	92,8	88	83,3	76,1	69	64,2	59,5
CL600	PN-EN 1759-1	90,5	80,2	76,1	72	65,8	59,7	55,5	51,4
CL900		136	120	114	108	98,7	89,5	83,3	77,1
PN160		160	148,5	140,9	133,3	121,9	110,4	102,8	95,2
PN250		250	232,1	220,2	208,3	190,4	172,6	160,7	148,8
CL1500		226	201	190	180	165	149	139	129
PN320		320	297,1	281,9	266,6	243,8	220,9	205,7	190,4
PN400		400	371,4	352,3	333,3	304,7	276,1	257,1	238
CL2500		377	334	317	300	274	249	231	214

NOTES:

1. It is allowed to apply carbon steel and acid proof cast steel for temperatures lower than given in Tables 3...9, provided that working pressure is reduced respectively, working temperature impact tests are performed and cast is heat treated. Details are to be consulted with manufacturer.
2. Working pressure for intermediate temperature values can be calculated by interpolation.
3. Temperature range for flanged connections: up to +537°C, for welding connections: up to +650°C

Table 4.	Material: G17CrMo 9-10 (1.7379) as per PN-EN 10213-2																	
PN / CL	Standard	Temperature [˚C]																
		-10…50	100	150	200	250	300	350	400	425	450	475	500	510	520	530	540	550
		Allowable working pressure [bar]																
PN10	-	10	10	10	10	10	10	9,7	9,2	9	8,8	7,6	6,4	5,6	4,9	4,2	3,7	3,2
PN16		16	16	16	16	16	16	15,6	14,8	14,4	14	12,1	10,2	8,9	7,8	6,8	5,9	5,1
CL150	PN-EN 1759-1	19,5	17,7	15,8	14	12,1	10,2	8,4	6,5	5,6	4,7	3,7	2,8	2,4	2	1,7	1,4	-
PN25	EN 1092-1	25	25	25	25	25	25	24,4	23,2	22,6	22	19	16	14	12,2	10,7	9,2	8
PN40		40	40	40	40	40	40	39	37,1	36,1	35,2	30,4	25,7	22,4	19,6	17,1	14,8	12,9
CL300	PN-EN 1759-1	51,7	51,5	50,2	48,3	46,3	42,8	40,2	36,6	35,1	33,8	31,7	28,2	26,6	23,5	20,6	17,8	15,5
PN63	EN 1092-1	63	63	63	63	63	63	61,5	58,5	57	55,5	48	40,5	35,4	30,9	27	23,4	20,4
PN100		100	100	100	100	100	100	97,6	92,8	90,4	88	76,1	64,2	56,1	49	42,8	37,1	32,3
CL600	PN-EN 1759-1	103	103	100	96,7	92,6	85,7	80,4	73,1	70,2	67,6	63,3	56,4	53,3	47,1	41,1	35,7	31,1
CL900		155	155	151	145	139	129	121	110	105	101	95	84,6	79,9	70,6	61,7	53,5	46,6
PN160		160	160	160	160	160	160	156,1	148,5	144,7	140,9	121,8	102,8	88,9	78,4	68,5	59,4	51,8
PN250		250	250	250	250	250	250	244	232,1	226,1	220,2	190,4	160,7	140,4	122,6	107,1	92,8	80,9
CL1500		259	258	251	242	232	214	201	183	175	169	158	141	133	118	103	89,1	77,7
PN320		320	320	320	320	320	320	312,3	297,1	289,5	281,9	243,7	205,7	179,8	156,9	137,1	118,8	103,6
PN400		400	400	400	400	400	400	390,4	371,4	361,8	352,3	304,7	257,1	224,7	196,1	171,4	148,5	129,5
CL2500		431	429	418	403	386	357	335	305	292	282	264	235	222	196	171	149	130

Table 5.	Material: GX5CrNiMo 19-11-2 (1.4408) as per PN-EN 10213-4																		
PN / CL	Standard	Temperature [˚C]																	
		-10…50	100	150	200	250	300	350	400	425	450	475	500	510	520	530	540	550	600
		Allowable working pressure [bar]																	
PN10	EN 1092-1	10	10	9	8,4	7,9	7,4	7,1	6,8	-	6,7	-	6,6	-	-	-	-	6,5	5,6
PN16		16	16	14,5	13,4	12,7	11,8	11,4	10,9	-	10,7	-	10,5	-	-	-	-	10,4	8,9
CL150	PN-EN 1759-1	17,9	16,3	14,9	13,5	12,1	10,2	8,4	6,5	5,6	4,7	3,7	2,8	2,4	2	1,7	1,4	-	-
PN25	EN 1092-1	25	25	22,7	21	19,8	18,5	17,8	17,1	-	16,8	-	16,5	-	-	-	-	16,3	14
PN40		40	40	36,3	33,7	31,8	29,7	28,5	27,4	-	26,9	-	26,4	-	-	-	-	26	22,4
CL300	PN-EN 1759-1	46,7	42,5	38,9	35,3	32,9	30,5	28,8	27,6	27,2	26,9	26,6	26,4	26,3	22,5	22,4	22,3	22,2	-
PN63	EN 1092-1	63	63	57,3	53,1	50,1	46,8	45	43,2	-	42,4	-	41,7	-	-	-	-	41,1	35,4
PN100		100	100	90,9	84,2	79,5	74,2	71,4	68,5	-	67,3	-	66,1	-	-	-	-	65,2	56,1
CL600	PN-EN 1759-1	93,4	85	77,8	70,6	65,8	61	57,6	55,2	54,5	53,8	53,3	52,8	52,6	44,9	44,8	44,6	44,4	-
CL900		140	127	117	106	98,6	91,4	86,4	82,8	81,7	80,6	79,9	79,2	78,9	67,4	67,1	66,9	66,7	-
PN160		160	160	145,5	134,8	127,2	118,8	114,2	109,7	-	107,8	-	105,9	-	-	-	-	104,3	89,9
PN250		250	250	227,3	210,7	198,8	185,7	178,5	171,4	-	168,4	-	165,4	-	-	-	-	163	140,4
CL1500		233	212	194	176	164	152	144	138	136	134	133	132	132	112	112	111	111	-
PN320		320	320	291	269,7	254,4	237,7	228,5	219,4	-	215,6	-	211,8	-	-	-	-	208,7	179,8
PN400		400	400	363,8	337,1	318	297,1	285,7	274,2	-	269,5	-	264,7	-	-	-	-	260,9	224,7
CL2500		389	354	324	294	274	254	240	230	227	224	222	220	219	187	187	186	185	-

Table 7. Material: WCB as per ASTM A216

PN / CL	Standard	Temperature [°C]								
		-10…50	100	150	200	250	300	350	375	400
		Allowable working pressure [bar]								
PN10	EN 1092-1	10	10	9,7	9,4	9	8,3	7,9	7,7	6,7
PN16		16	16	15,6	15,1	14,4	13,4	12,8	12,4	10,8
CL150	PN-EN 1759-1	19,3	17,7	15,8	14	12,1	10,2	8,4	7,4	6,5
PN25	EN 1092-1	25	25	24,4	23,7	22,5	20,9	20	19,4	16,9
PN40		40	40	39,1	37,9	36	33,5	31,9	31,1	27
CL300	PN-EN 1759-1	50	46,4	45,1	43,9	41,8	38,9	36,9	36,6	34,6
PN63	EN 1092-1	63	63	61,5	59,6	56,8	52,7	50,3	49	42,5
PN100		100	100	97,7	94,7	90,1	83,6	79,8	77,8	67,5
CL600	PN-EN 1759-1	100,1	92,8	90,6	87,8	83,6	77,5	74	72,9	69,1
CL900		150,1	139,2	135,7	131,4	125,1	116,1	110,8	109,5	103,4
PN160		159,2	147,6	143,9	139,4	132,7	123,1	117,5	116,1	109,7
PN250		241,4	223,5	217,8	211,2	201,1	186,6	178,1	175,8	166,2
CL1500		250,5	231,9	226	219,2	208,7	193,6	184,8	182,4	172,5
PN320		313	289,9	282,6	273,9	260,8	242	231	227,9	215,6
PN400		396,4	367,3	358	346,9	330,3	306,6	292,6	288,6	273,1
CL2500		417,2	386,6	376,9	365,1	347,7	322,7	308	303,8	287,5

Table 6. Material: G20Mn5 (1.6220) wg PN-EN 10213-3

PN / CL	Norma	Temperature [°C]					
		-40	100	150	200	250	300
		Allowable working pressure [bar]					
PN10	-	6	6	3,8	3,6	3,48	3,4
PN16		16	16	10,1	9,6	9,28	9,07
PN25		25	25	15,8	15	14,5	14,2
PN40		40	28	28	27	26	25
PN63		63	59	58	55	53	51
PN100		100	95	92	87	85	82
PN160		160	152	148	140	136	132

Table 8. Material: WC9 as per ASTM A217

PN / CL	Standard	Temperature [°C]																		
		-10…50	100	150	200	250	300	350	375	400	425	450	475	500	510	520	525	530	540	550
		Allowable working pressure [bar]																		
PN10	EN 1092-1	10	10	10	10	10	10	10	10	9,9	9,7	9,5	7,3	5,5	5	4,4	-	3,9	3,4	2,9
PN16		16	16	16	16	16	16	16	16	15,9	15,6	15,3	11,7	8,9	8	7,1	-	6,2	5,4	4,7
CL150	PN-EN 1759-1	19,5	17,7	15,8	14	12,1	10,2	8,4	7,4	6,5	5,6	4,6	3,7	2,8	-	-	1,9	-	1,3	-
PN25	EN 1092-1	25	25	25	25	25	25	25	25	24,8	24,4	23,9	18,3	14	12,6	11,2	-	9,8	8,5	7,4
PN40		40	40	40	40	40	40	40	40	39,7	39	38,3	29,2	22,3	20,2	18	-	15,7	13,6	12
CL300	PN-EN 1759-1	51,7	51,5	50,3	48,7	46,3	42,9	40,4	38,9	36,5	35,2	33,7	31,7	27,7	-	-	21,6	-	-	15,3
PN63	EN 1092-1	63	63	63	63	63	63	63	63	62,5	61,5	60,3	46	35,2	31,9	28,3	-	24,8	21,4	18,8
PN100		100	100	100	100	100	100	100	100	99,2	97,6	95,6	73,1	55,9	50,6	44,9	-	39,3	34	29,9
CL600	PN-EN 1759-1	103,4	103,1	100,3	97,5	92,7	85,7	80,4	77,6	73,3	70,2	67,7	63,4	55,7	-	-	43,3	-	-	30,7
CL900		155,1	154,6	150,6	146,2	139	128,6	120,7	116,5	109,8	105,4	101,4	95,1	83,4	-	-	64,9	-	-	46
PN160		164,5	163,9	159,5	154,7	147,4	136,4	128	123,6	116,5	111,8	107,6	100,8	87,3	-	-	68,9	-	-	48,8
PN250		249,2	248,1	239,8	231,2	222,6	206,6	193,8	187	176,4	169,2	162,9	152,5	122,2	-	-	104,4	-	-	74,1
CL1500		258,6	257,7	250,8	244	231,8	214,4	201,1	194,1	183,1	175,6	169,1	158,2	138,9	-	-	108,4	-	-	76,9
PN320		323,2	321,9	312,3	302,3	289,2	268	251,4	242,5	228,8	219,4	211,4	197,8	165,7	-	-	135,4	-	-	96
PN400		409,4	408	397,1	385,7	366,8	339,4	318,5	307,1	289,7	277,9	267,7	250,7	218,5	-	-	171,5	-	-	121,5
CL2500		430,9	429,5	418,3	406,5	386,2	357,2	335,3	323,2	304,9	292,5	281,8	263,9	231,7	-	-	180,5	-	-	127,9

Table 9. Material: CF8M as per ASTM A351

PN / CL	Standard	Temperature [°C]																						
		-10…50	100	150	200	250	300	350	375	400	425	450	475	500	510	520	525	530	540	550	575	600	625	649
		Allowable working pressure [bar]																						
PN10	EN 1092-1	8,9	7,8	7,1	6,6	6,1	5,8	5,6	5,5	5,4	5,4	5,3	5,3	5,2	5,2	5,2	-	5,2	5,1	5,1	4,7	3,8	-	-
PN16		14,3	12,5	11,4	10,6	9,8	9,3	9	8,8	8,7	8,6	8,5	8,5	8,4	8,3	8,3	-	8,3	8,3	8,2	7,6	6,1	-	-
CL150	PN-EN 1759-1	18,4	16	14,8	13,6	12	10,2	8,4	7,4	6,5	5,6	4,6	3,7	2,8	-	-	1,9	-	1,4	-	-	-	-	-
PN25	EN 1092-1	22,3	19,5	17,8	16,5	15,5	14,6	14,1	13,8	13,6	13,5	13,4	13,3	13,2	13,1	13,1	-	13	13	12,9	12	9,6	-	-
PN40		35,6	31,3	28,5	26,4	24,7	23,4	22,6	22,1	21,8	21,6	21,4	21,2	21	21	20,9	-	20,8	20,8	20,7	19,1	15,5	-	-
CL300	PN-EN 1759-1	48,1	42,3	38,6	35,8	33,5	31,6	30,4	29,6	29,3	29	29	28,7	27,3	-	-	25,2	-	-	24	22,9	19,9	15,7	12,8
PN63	EN 1092-1	56,1	49,2	44,9	41,6	38,9	36,9	35,5	34,9	34,4	34	33,7	33,5	33,2	33	32,9	-	32,8	32,7	32,6	30,2	24,4	-	-
PN100		89,1	78,1	71,3	66	61,8	58,5	56,4	55,3	54,5	54	53,4	53,1	52,6	52,4	52,2	-	52,1	51,9	51,7	47,9	38,7	-	-
CL600	PN-EN 1759-1	96,3	84,5	77,1	71,2	66,7	63,1	61	59,8	58,9	58,3	57,7	57,3	54,8	-	-	50,6	-	-	47,8	45,5	39,8	31,7	25,5
CL900		144,4	126,8	115,6	107	100,2	95	91,3	89,7	88,2	87,3	86,6	86	82,1	-	-	75,9	-	-	71,8	68,3	59,7	47,5	38,3
PN160		153,1	134,4	122,6	113,5	106,3	100,7	96,8	95,1	93,6	92,6	91,8	91,2	87,1	-	-	80,5	-	-	76,2	72,5	63,3	50,4	40,3
PN250		231,9	203,3	185,4	171,9	160,9	152,4	146,7	143,9	141,7	140,3	139,1	138,1	131,7	-	-	121,8	-	-	115,4	109,8	95,9	76,3	61
CL1500		240,6	210,9	192,4	178,4	167	158,1	152,2	149,3	147,1	145,6	144,3	143,3	136,7	-	-	126,4	-	-	119,8	114	99,5	79,2	63,8
PN320		300,8	263,7	240,6	223	208,7	197,6	190,3	186,7	184	182,1	180,3	179,2	170,9	-	-	158	-	-	149,7	142,5	124,4	98,9	79,2
PN400		381	334,1	304,8	282,4	264,2	250,3	241,1	236,5	233,1	230,7	228,4	227	216,6	-	-	200,2	-	-	189,5	180,5	157,7	125,1	100,4
CL2500		401	351,7	320,8	297,2	278,1	263,5	253,8	249	245,4	242,9	240,4	238,9	228	-	-	210,7	-	-	199,5	190	166	131,7	106,5

DESIGN

Single-ported globe control valves Z1B are recommended for application under heavy-duty working conditions, with excessive noise, flashing or choked flow. Selection of designs and materials depends on working conditions. It is based on computer-aided calculations of flow coefficients, noise level, fluid status, and effectiveness of such actions depends on data submitted by customer. Application of perforated control elements allows noise reduction by 10dBA regarding execution with contoured plug. Further noise reduction (by 5 dBA) can be achieved by application of choke cage, which causes reduction in pressure drop between plug and seat. Such design is also recommended in case of choked flow, cavitation and flashing. Perforated structures feature higher pressure recovery coefficient FL, which allows achievement of higher flow at same Kv_s and Δp as in basic design. Customers shall also appreciate possibility of achieving maximum flow ratio for all nominal sizes and control characteristics, and reduction in actuator costs due to application of balanced plugs. In case of compressive media it is advisable to apply diffusers at the valve outlet. In justified cases (noise, choked flow) diffusers can be fitted with additional perforated choke structures in the form of plates assembled between flanges or welded in diffuser interior. On customer's request, also when flow conditions justify such solution, special executions are recommended concerning materials, flow ratios, control characteristics, leakage class, etc.

Table 9. Packing types with application ranges.

Packing	PN	Temperature [˚C]		
		Bonnet		
		Standard	Extension	Bellow seal
PTFE-V PTFE + Graphite PTFE-V / TA-LUFT	up to CL600)*	-46...+200	-198...-46 +200...+300	-100...+200
Graphite Graphite / TA-LUFT	up to CL2500)*	+200...+300	+300...+537 ,(+650)**	+200...+400

)* PN10…40; CL150…3000 for below seal bonnet)** for welding ends valves

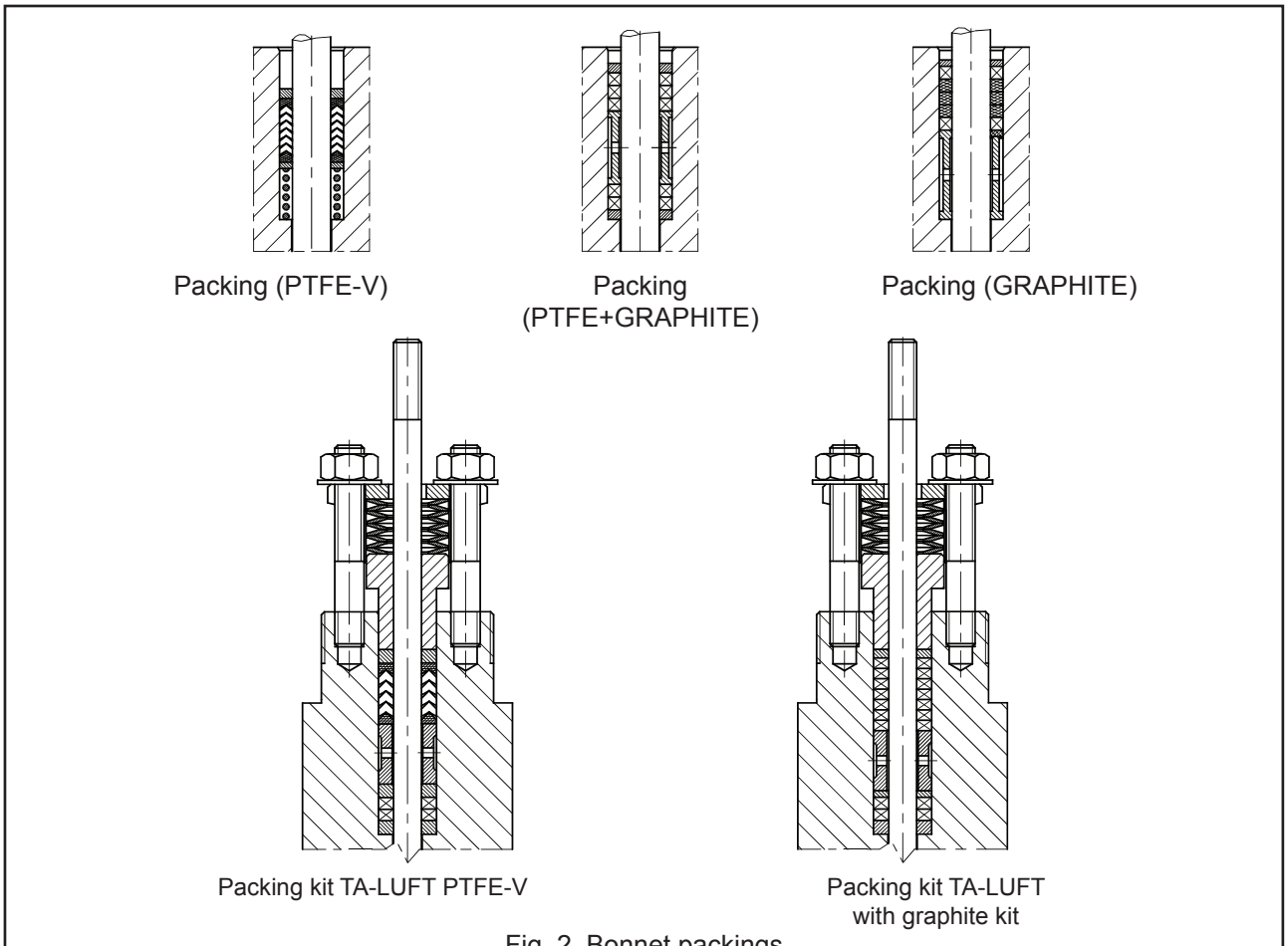


Fig. 2. Bonnet packings

Table 11: Flow ratios Kv_s.

Kvs		Stroke	Seat diameter D	F_D		Nominal size DN								
				IV kl.	V kl.									
L	P	[mm]	[mm]	[kN]		25	40	50	80	100	150	200	250	300
10		20	20,64	0,33	2,1	• K1**)	K2	K2						special execution, technical data according to individual inquiries
16			25,25	0,4	2,6		K1	K2						
25			31,72	0,5	3,3		• K1	K1	K2					
40		38	41,25	0,7	4,6			• K1	K2	K2				
63			50,8	0,8	5,2				K1	K2	K2			
94			66,7	1,1	7,2				• K0	K1	K2	K2		
125		50	88,9	1,4	9,1					K1	K2	K2	K2	
160										• K1	K2	K2	K2	
200		63	107,92	1,7	11						K1	K2	K2	
250											K1	K2	K2	
320		80	126,95	2,0	13						K1	K2	K2	
500		100	158,72	2,5	16							K1	K2	
630			203,2	3,2	21								K1	
800	-												K1	
Calculation coefficients														
F_L=0,95 ; X_T=0,78; Fd=0,1; xFz=0,75														

NOTE

1. • - no executions for PN250…CL2500
2. **) - for PN10…CL300 - K0
3. „K" - maximum number of choke cages in valve.
4. The number of choked cages does not concern the balanced valves by a pilot.

K0 - no choke cages,
K1 - one choke cage,
K2 - two choke cages.

ALLOWABLE PRESSURE DROPS Δp.

Pressure drops Δp [bar] in Table 13 apply to closed valve and they are calculated with regard to the valve drive performance. Actual pressure drops should not exceed 70% of allowable working pressure for given nominal pressure, used material and working temperature, as per tables 3…9.

$$\Delta p = \frac{Fs - F_D}{0{,}785 \cdot 10^{-4} \cdot D^2} \quad \text{or} \quad Fs = 0{,}785 \cdot 10^{-4} \cdot D^2 \cdot \Delta p + F_D$$

where
- Δp [bar] - calculated pressure drop
- Fs [kN] - actuator available force (Table 12)
- F_D [kN] - valve plug to valve seat pressure (Table 11)
- D [mm] - valve seat diameter (Table 11)

NOTE

1. Valves with balanced plug and with gasket are manufactured only in leakage class IV. For balanced plugs assume the available force of F_S at least equal to F_D for class V (Table 11).
2. For valves relieved with a remote control, drive disposition forces need to be agreed on with the manufacturer.

Table 12: Available force F_S [kN] of pneumatic actuators

Actuator size	Direct actuator P ; P1			Reverse actuator R ; R1					
	Supply pressure [kPa]			Spring range [kPa]					
	140	250	400	20 - 100	40 - 120; 40 - 200	60 - 140	80 - 240	120 - 280	180 - 380
160	0,64	2,4	4,8	0,32	0,64	0,96	1,28	1,92	-
250	1,0	3,8	7,5	0,5	1,0	1,5	2,0	3,0	-
400	1,6	6,0	12,0	0,8	1,6	2,4	3,2	4,8	-
630	2,5	9,5	18,9	1,3	2,5	3,8	5,0	7,6	11,3
R-630T	-	-	-	2,6	5,0	7,6	10,0	15,2	22,6
1000	4,0	15,0	30,0	2,0	4,0	6,0	8,0	12,0	18,0
1500	6,0	22,5	45,0	3,0	6,0	9,0	12,0	18,0	27,0
1500T	12,0	45,0	90,0	6,0	12,0	18,0	24,0	36,0	54,0

NOTE:

1. For direct actuators P; P1 adopted spring range is 20 – 100 kPa
2. For electric and other actuators Δp value can be calculated using above formula and data from Table 11, taking nominal load capacity as available force FS, as per actuator data sheet.

Table 13: Pressure drops Δp [bar] for valves with pneumatic actuators, leakage class class IV and V

Valve seat diameter [mm]	Actuator size	Air-to-close Spring range 20…100 kPa						Air-to-open											
		IV class			V class			IV class						V class					
		Supply pressure [kPa]						Spring range [kPa]						Spring range [kPa]					
		140	250	400	140	250	400	20…100	40…120 40…200	60…140	80…240	120…280	180…380	20…100	40…120 40…200	60…140	80…240	120…280	180…380
		Δp [bar]																	
20,64	160	9	62	133	-	7	79	-	9	19	28	47	-	-	-	-	-	-	-
	250	20	100	210	-	48	159	5	20	34	49	78	-	-	-	-	-	26	-
	400	37	166	280	-	115	280	14	37	60	84	131	-	-	-	9	32	79	-
	630	65	272	280	11	218	280	27	65	103	140	216	280	-	11	49	86	162	274
	R-630T	-	-	-	-	-	-	65	140	216	280	280	280	11	86	162	237	280	280
25,25	160	4	40	87	-	-	43	-	4	11	17	30	-	-	-	-	-	-	-
	250	12	67	142	-	23	98	2	12	22	32	52	-	-	-	-	-	8	-
	400	24	112	232	-	68	188	8	24	40	56	88	-	-	-	-	12	44	-
	630	42	180	280	-	136	280	17	42	67	92	143	218	-	-	23	48	98	174
	R-630T	-	-	-	-	-	-	42	92	143	193	280	280	-	48	98	149	249	280
31,72	160	1,5	24	54	-	-	19	-	1	5	9	17	-	-	-	-	-	-	-
	250	6	41	88	-	5	53	-	6	12	19	31	-	-	-	-	-	-	-
	400	14	70	145	-	34	110	4	14	24	34	54	-	-	-	-	-	19	-
	630	25	113	232	-	78	197	10	25	41	57	90	137	-	-	6	21	54	101
	R-630T	-	-	-	-	-	-	25	57	89	121	185	280	-	22	54	85	149	245
41,25	630	13	63	130	-	35	102	4	13	22	31	49	75	-	-	-	3	21	48
	R-630T	-	-	-	-	-	-	14	32	51	70	108	164	-	5	24	43	81	137
50,8	630	9	43	90	-	21	69	2,5	9	15	21	34	53	-	-	-	-	12	30
	1000	16	71	146	-	49	124	6	16	26	36	56	86	-	-	4	14	34	64
	1500	25	107	218	3	85	196	10	25	40	55	84	129	-	3	18	33	62	107
66,7	630	4	24	50	-	6	33	-	4	8	11	18	29	-	-	-	-	-	11
	1000	8	40	83	-	22	65	3	8	14	20	31	48	-	-	-	2	14	30
	1500	14	61	125	-	44	108	5	14	23	31	48	74	-	-	5	14	30	56
88,9	1000	4	22	46	-	10	34	1	4	7	11	17	27	-	-	-	-	5	14
	1500	7	34	70	-	21	58	3	7	12	17	27	41	-	-	-	5	14	29
107,92	1000	3	14	30	-	4	20	-	3	5	7	11	18	-	-	-	-	1	8
	1500	5	23	47	-	13	37	1	5	8	11	18	28	-	-	-	1	8	17
	1500T	11	48	96	1	37	86	5	11	18	24	37	57	-	1	8	14	27	47
126,95	1500	3	16	34	-	8	25	-	3	6	8	13	20	-	-	-	-	4	11
	1500T	8	34	70	-	25	61	3	8	13	17	27	41	-	-	4	9	18	33
158,72	1500	2	10	21	-	3	14	-	2	3	5	8	12	-	-	-	-	1	6
	1500T	5	21	44	-	14	37	2	5	8	10	17	26	-	-	1	4	10	19
203,2	1500	-	6	13	-	-	7	-	-	2	3	4,5	7	-	-	-	-	-	2
	1500T	3	13	27	-	7	21	-	3	4,5	6	10	16	-	-	-	-	5	10

NOTE:

1. In Table 13, theoretical acceptable pressure drops are included. Actual pressure drops with consideration of tolerance of spring manufacture and friction of internal parts of the actuator are lower than those given by 20%. Pressure drops chosen that way guarantee internal tightness of closing of the valves.
2. In valves working along the procedure: “increased control pressure – valve opens”, the actuator with springs ranged 40-120 kPa can be replaced with an actuator ranged 40-200 kPa, with the same pressure drops.
3. For reverse-working actuators (type R or R1), supply pressure should be higher than the upper spring range by at least 40kPa.

NOISE REDUCTION:
Should noise due to cavitation or aerodynamic phenomena exceed level acceptable by customer, it can be reduced by applying the following solutions:
- perforated valve plugs (Fig. 1a, 1b and 1d)
- silencer plates on valve outlet and/or inside of reduction joint (Fig. 3,4 and Table 13)
- reduction ends (diffusers) - (Fig. 4)

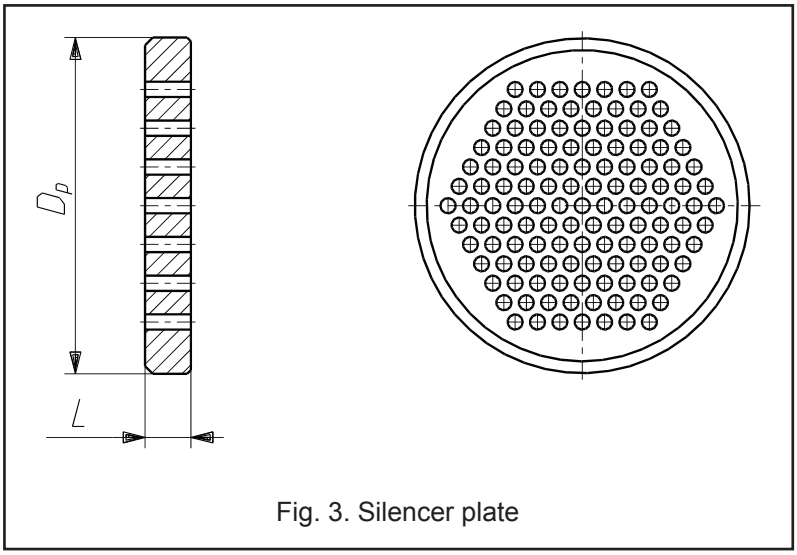


Fig. 3. Silencer plate

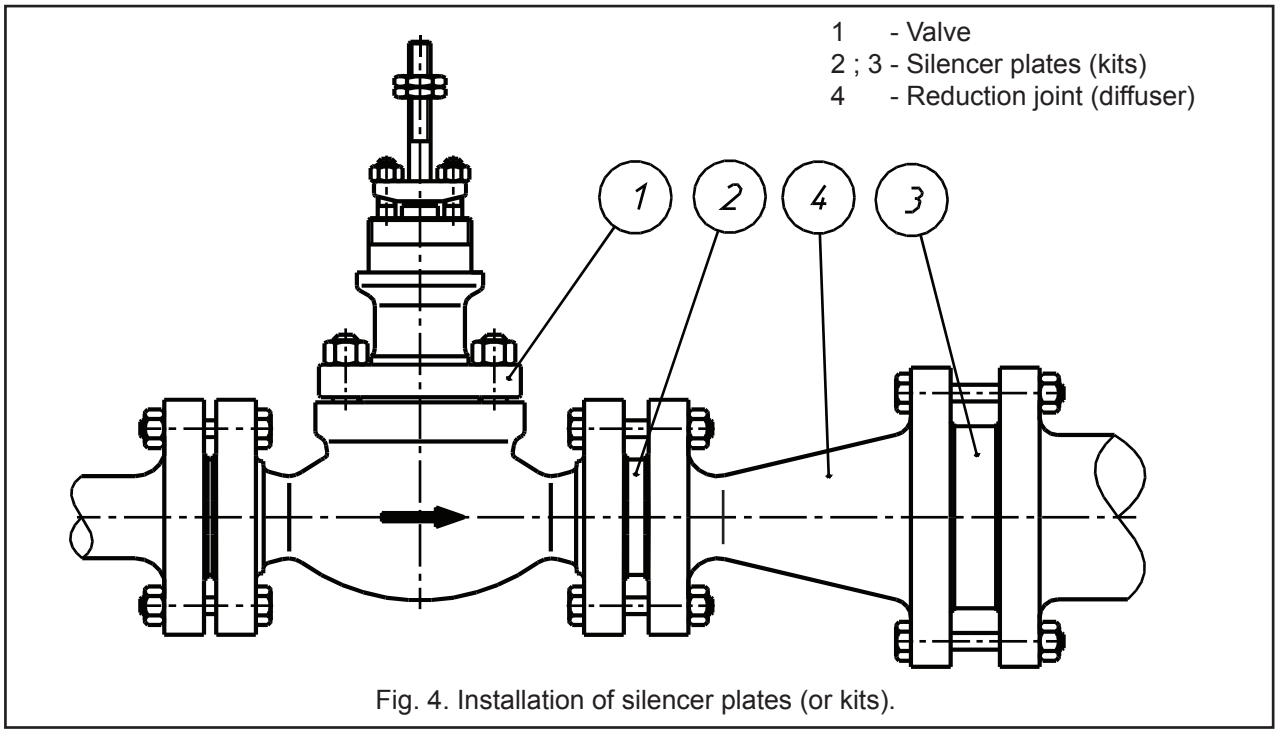


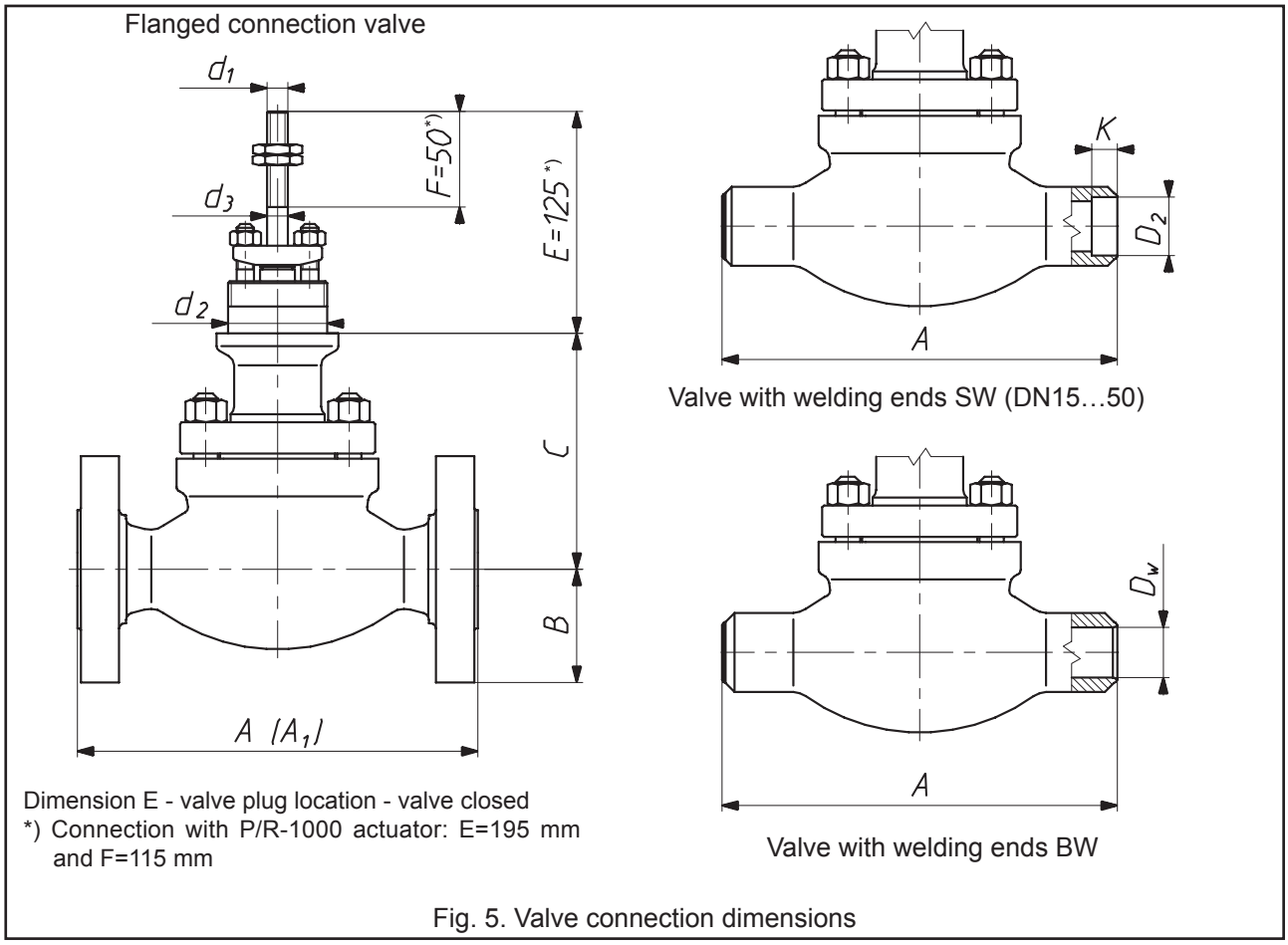
Fig. 4. Installation of silencer plates (or kits).

Table 14: Dimensions and flow ratios for silencer plates

DN	25	40	50	80	100	150	200	250	300	350
Kvs	10	25	40	94	160	320	500	800	1000	1500
	9	22,5	36	84	144	288	450	720	900	1350
	8	20	32	75	128	256	400	640	800	1200
	7	17,5	28	66	112	224	350	560	700	1050
L [mm]	5	6		10		15		20		
Dp [mm]	68	88	102	138	162	218	285	345	410	465

Multi-plate silencer kits are customized for requirements of individual processes.

DIMENSIONS AND WEIGHTS



Dimension E - valve plug location - valve closed
*) Connection with P/R-1000 actuator: E=195 mm and F=115 mm

Fig. 5. Valve connection dimensions

Table 15a: Control valves connection dimensions

DN		25						40						50					
PN/CL		PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500
B max		63	70	75		80	90	75	85	93		98	110	83	98	108		105	118
C	DS	135		149	193			145		172	214			155		175	237		
	DW	306		320	364			306		348	385			326		345	402		
	DM	254	-	-	-	-	-	254	-	-	-	-	-	270	-	-	-	-	-
Weight [kg]		8	8,5		9,5			15,5	17,5	19	20	22	23	22	25	28	31	33	34

DN		80						100						150		
PN/CL		PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10... CL300	PN63... CL600	CL900; PN160	PN250; CL1500	PN320	PN400; CL2500	PN10…CL300	PN63...CL600	CL900;PN160
B max		105	145	120	133	138	153	128	138	145	155	168	185	160	178	190
C	DS	206		233	257			217		252	329			287		365
	DW	375		402	447			407		442	498			426		483
	DM	405	-	-	-	-	-	405	-	-	-	-	-	470	-	-
Weight [kg]		40	43	44	50	51	52	65	72	75	86	89	95	132	147	156

DN		200		250		
PN/CL		PN10...CL300	PN63...CL600	PN10...CL300	PN10...CL300 (kv800)	PN63...CL600
B max		190	235	258		255
C	DS	439		458		
	DW	539		558		
	DM	580	-	580	660	-
Weight [kg]		195	220	320	330	360

DN300 - special execution, technical data according to individual inquiries. (table: 15a and 15b).

NOTE: Weight of valve with standard bonnet and without actuator.

Table 15b: Control valves connection dimensions

DN	25…50	50	80	80; 100	80; 100	100	150				200	200; 250				250
Kvs	10…25	40	25	40	63; 94	125; 160	63; 94	125; 160	200; 250	320	94	125; 160	200; 250	320	500	630; 800
Stroke	20	38	20	38	38	50	38	50	63	80	38	50	63	80	100	
d_1	M12x1,25				M16x1,5				M20x1,5		M16x1,5		M20x1,5		M24x1,5	
d_2 [1)]	57,15 / 2 1/4"-16UN2A						84,15 / 3 5/16"-16NS2A				95,25 / 3 3/4"-12UN2A					
d_3	12		16				20				24					
Actuator	160 250 400 630 R-630T	630 R-630T	160 250 400 630 R-630T	630 R-630T	630 1000 1500	1000 1500	630 1000 1500	1000 1500	1000 1500 1500T	1500 1500T	1000 1500	1000 1500 1500T	1500 1500T			

NOTE:

1) For DN80 and DN100 valves with TA-LUFT packing d_2 = 84.15

Table 16. Control valve length, flanges.

DN	Dimesion A [mm]										
	PN / DIN					CL					
	10; 16; 25; 40	63 - 100	160	250 - 320	400	CL150	CL300	CL600	CL900	CL1500	CL2500
25	160	230	230	260	300	184	197	210	248	273	308
40	200	260	260	300	350	222	235	251	270	311	359
50	230	300	300	350	400	254	267	286	311	340	400
80	310	380	380	450	500	298	317	336	387	460	498
100	350	430	430	520	580	352	368	394	464	530	575
150	480	550	550	*	*	451	473	508	556	*	*
200	600	650	*	*	*	543	568	610	*	*	*
250	730	775	*	*	*	673	708	752	*	*	*
300	special execution, technical data according to individual inquiries										
* higher nominal pressures available after agreement with the manufacturer											

Note: Dimension A presented in Table 15 for CL150; CL300; CL600; CL900; CL1500; CL2500 apply to bodies with B seat (RF). For other executions dimension A_1 can be calculated using relations presented in Table 17.

Table 17. Algorithms for calculation of control valve body length for valves with flanged end

- with groove
- with races
- with ring-joint

Body type and identification PN / ANSI	Pressure CL	DN	A_1
With groove DL / (GF) With races F / (FF)	CL300	25…250	$A_1 = A + 5 \times 2$
	CL600 CL900 CL1500 CL2500		$A_1 = A - 1,5 \times 2$
With ring-joint J / (RTJ)	CL150	25…250	$A_1 = A + 6,5 \times 2$
	CL300	25…40	
	CL300	50…250	$A_1 = A + 8 \times 2$
	CL600 CL900 CL1500	25…40	$A_1 = A$
	CL2500	25	
	CL600	50…250	$A_1 = A + 1,5 \times 2$
	CL900 CL1500	50…100	
	CL900	150	
	CL2500	80	$A_1 = A + 3 \times 2$
		100	$A_1 = A + 4,5 \times 2$

Table 18: Control valve length, welding ends.

DN	Dimension A [mm]		
	Nominal pressure		
	PN 10...CL600	CL900…PN160	PN250...CL2500
25	210	230	300
40	251	260	350
50	286	300	400
80	337	380	500
100	394	430	580
150	508	550	*
200	610	*	*
250	752	*	*
300	special execution, technical data according to individual inquiries		
* higher nominal pressures available after agreement with the manufacturer			

Table 19: Butt welding ends BW.

DN	Dz [mm]	t [mm]	Dw [mm]	PN (DIN3239)									
				10	16	25	40	63	100	160	250	320	400
25	33,7	2,6	28,5	x	x	x	x	x	x				
		2,9	27,9							x			
		3,6	26,5								x		
		5	23,7									x	
		7,1	19,5 •										x
	42,4		28,2										x
40	48,3	2,6	43,1	x	x	x	x						
		2,9	42,5					x	x				
		3,6	41,1							x			
		5	38,3								x		
		6,3	35,7									x	
		10	28,3										x
50	60,3	2,9	54,5	x	x	x	x	x					
		3,2	53,9						x				
		4	52,3							x			
		6,3	47,7								x		
		8	44,3									x	
		12,5	35,3										x
80	88,9	3,2	82,5	x	x	x	x						
		3,6	81,7 •					x					
		4	80,9 •						x				
		6,3	76,3							x			
		11	66,9								x		
		12,5	63,9									x	
		17,5	53,9 •										x
	114,3		79,3										x
100	114,3	3,6	107,1	x	x	x	x						
		4	106,3					x					
		5	104,3						x				
		8	98,3							x			
		14,2	85,9								x		
		16	82,3									x	
		22,2	69,9 •										x
	139,7	20	99,7										x
150	168,3	4,5	159,3	x	x	x	x						
		5,6	157,1 •					x					
		7,1	154,1 •						x				
		12,5	143,3 •							x			
	193,7		168,7							x			
200	219,1	5,9	207,3	x	x								
		6,3	206,5			x	x						
		7,1	204,9					x					
		10	199,1 •						x				
	244,5	12,5	219,5						x				
250	273	6,3	260,4	x	x								
		7,1	258,8			x	x						
		8,8	255,4					x					
		12,5	248						x				
300	special execution, technical data according to individual inquiries												

DN	Schedule	Dz [mm]	t [mm]	Dw [mm]	ANSI (ASME 36.10 M)					
					CL150	CL300	CL600	CL900	CL1500	CL2500
1”	40	33,4	3,4	26,6	x	x	x	x		
	80		4,5	24,4					x	
	160		6,4	20,6 •						x
	XXS		9,1	15,2 •						x
1 1/2”	40	48,3	3,7	40,9 •	x	x	x	x		
	80		5,1	38,1 •	x	x	x	x	x	
	160		7,1	34,1					x	
	XXS		10,2	27,9 •						x
2”	40	60,3	3,9	52,5	x	x	x	x		
	80		5,5	49,3 •				x		
	160		8,7	42,9					x	
	XXS		11,1	38,1 •						x
3”	40	88,9	5,5	77,9 •	x	x	x			
	80		7,6	73,7 •				x		
	160		11,1	66,7					x	
	XXS		15,2	58,5						x
4”	40	114,3	6	102,3	x	x	x			
	80		8,6	97,1 •				x		
	120		11,1	92,1 •					x	
	160		13,5	87,3 •					x	
	XXS		17,1	80,1 •						x
6”	40	168,3	7,1	154,1 •	x	x				
	80		11	146,3 •			x	x		
	120		14,3	139,7 •				x		
	160		18,3	131,7 •				x		
8”	20	219,1	6,4	206,3	x	x				
	30		7	205,1		x				
	40		8,2	202,7		x				
	60		10,3	198,5 •			x			
	80		12,7	193,7 •			x			
10”	20	273	6,4	260,2	x	x				
	30		7,8	257,4		x				
	40		9,3	254,4		x				
	60		12,7	247,6 •			x			
	80		15,1	242,8 •			x			
12’’	special execution, technical data according to individual inquiries									

where:

D_Z [mm] - pipe external diameter,

D_W [mm] - pipe internal diameter,

t [mm] - pipe wall thickness.

NOTE:

•) - execution with reduction stubs as per Fig. 7.

Table 19 contains series of example butt welding connections.

It is allowed to execute connections for other dimensions of pipes. Should pipe dimensions fall within the range ∅B min / ∅A max (Fig. 6, Table 20), connection can be executed as cast. Otherwise reduction stub is to be welded to body end, which shall result in extension of the housing by L or 2L size (Fig. 7, Table 20). Other connection dimensions are allowed upon consulting with manufacturer.

Table 20: Dimensions of non-processed butt welding ends (executed as cast) and lengths of reduction stubs.

DN	Pressure	A max	B min	L
25	PN 10...40, CL 150, 300	38	20	50
	PN 63...100, CL 600	48	20	
	PN 160, CL 900	40	23	
	PN 250...400, CL 1500,2500	48	23	
40	PN 10...40, CL 150, 300	64	42	
	PN 63...100, CL 600	75	42	
	PN 160, CL 900	66	38	
	PN 250...400, CL 1500,2500	66	28	
50	PN 10...100, CL 150...600	80	55	
	PN 160, CL 900	80	50	
	PN 250...400, CL 1500,2500	92	42	
80	PN 10...40, CL 150, 300	110	82	75
	PN 63...100, CL 600	122	82	
	PN 160, CL 900	111	76	
	PN 250...400, CL 1500,2500	127	56	
100	PN 10...100, CL 150...600	144	102	
	PN 160, CL 900	144	102	
	PN 250...400, CL 1500,2500	165	81	
150	PN 10...40, CL 150, 300	183	160	100
	PN 63...100, CL 600	196	160	
	PN 160, CL 900	217	154	
200	PN 10...40, CL 150, 300	243	200	150
	PN 63...100, CL 600	248	200	
250	PN 10...40, CL 150, 300	291	248	
	PN 63...100, CL 600	346	248	

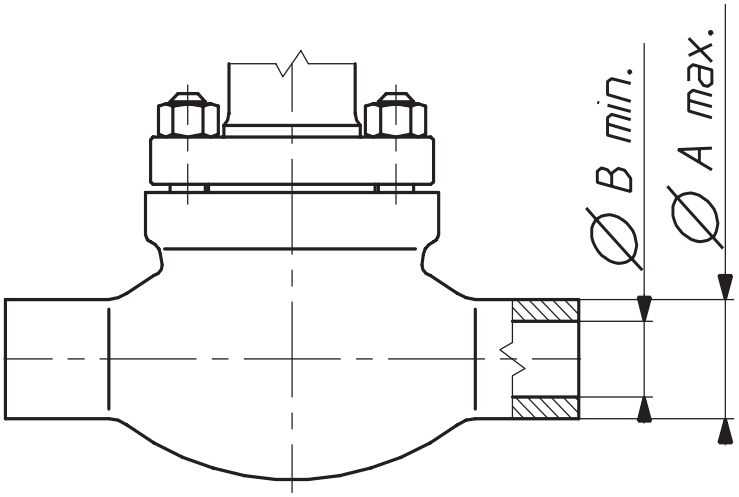


Fig. 6. Dimension of butt welding ends executed as cast

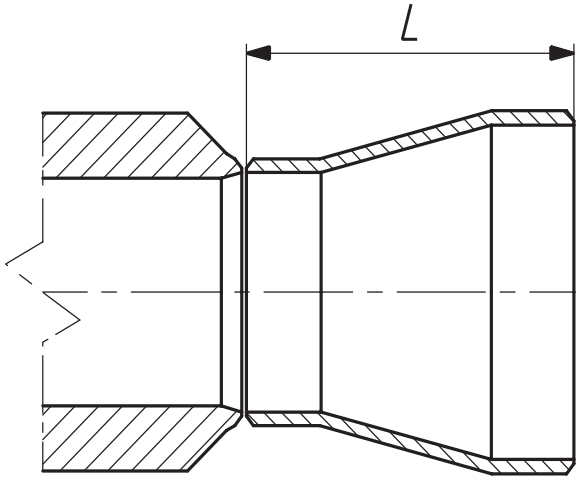


Fig. 7. Reduction stub

Table 21: SW socket welding ends.

DN	D_2	K
25	34	13
40	48,7	
50	61	16

VALVE ACTUATOR:

Pneumatic: - diaphragm multi-spring actuator as per Table 21:

P1/R1 - cast yoke, no handwheel

P1B/R1B - cast yoke, side-mounted

P/R - column type, no handwheel

PN/RN - column type, top-mounted handwheel

NOTE: P - direct action; air-to-close

R - reverse action; air-to-open

Table 22: Pneumatic actuators.

Type	Size	Diaphragm effective area [cm²]	Stroke [mm]	Revolutions per stroke
P/R ; PN/RN	160	160	20	5
	250	250		
P1/R1 ; P/R ; P1B/R1B ; PN/RN	400	400		
	630	630	20 ; 38	5 ; 9
	R-630T *)	2 x 630		
	1000	1000	38 ; 50 ; 63	8 ; 10 ; 13
P1/R1 ; P1B/R1B	1500	1500	38 ; 50 ; 63 ; 80; 100	8 ; 10 ; 13 ; 16; 20
	1500T	2 x 1500		
*) - there are no top mounted handweel for R-630T				

Table 23: Sizes and weights of pneumatic actuators P/R and PN/RN - Fig. 8.

Actuator size	D_1	D_2	H_1	H_2	Weight [kg]	
	mm				P/R	PN/RN
160	210	225	306	468	9	13,5
250	240		324	486	10	14,5
400	305		332	494	16	20,5
630	375	305	424	586	30	37
R-630T		-	638	-	45	-
1000	477	450	607	847	74	100
1500	550	-	704	-	95	-
1500T		-	1008	-	200	-

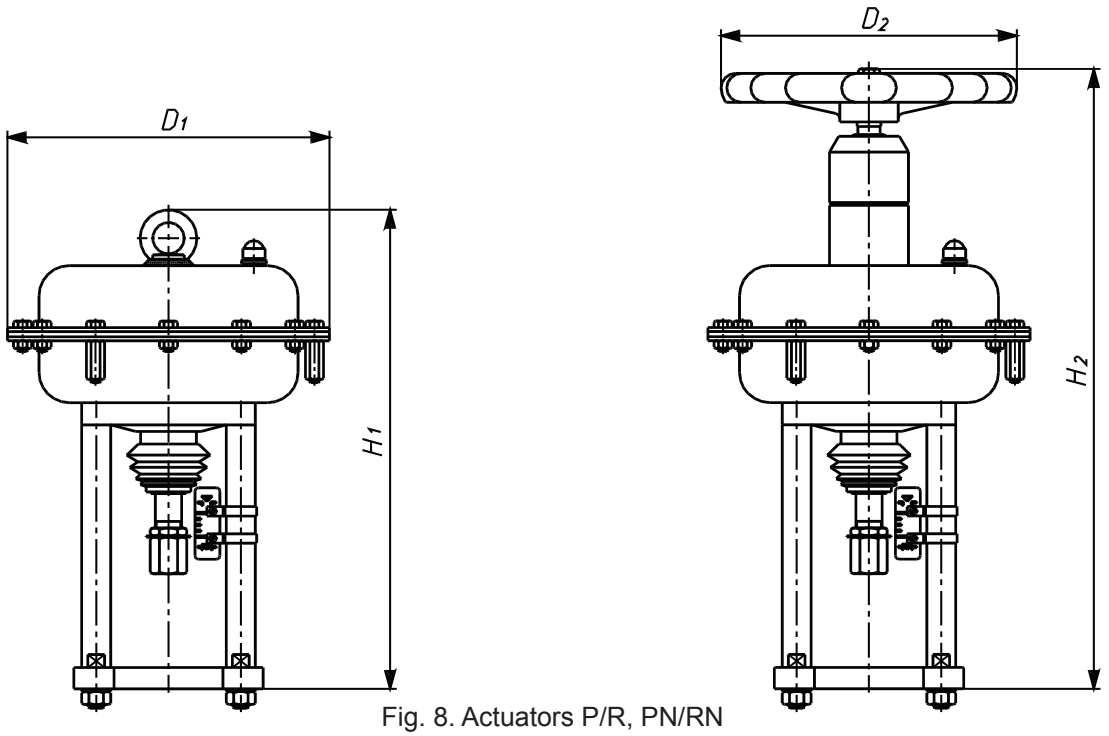
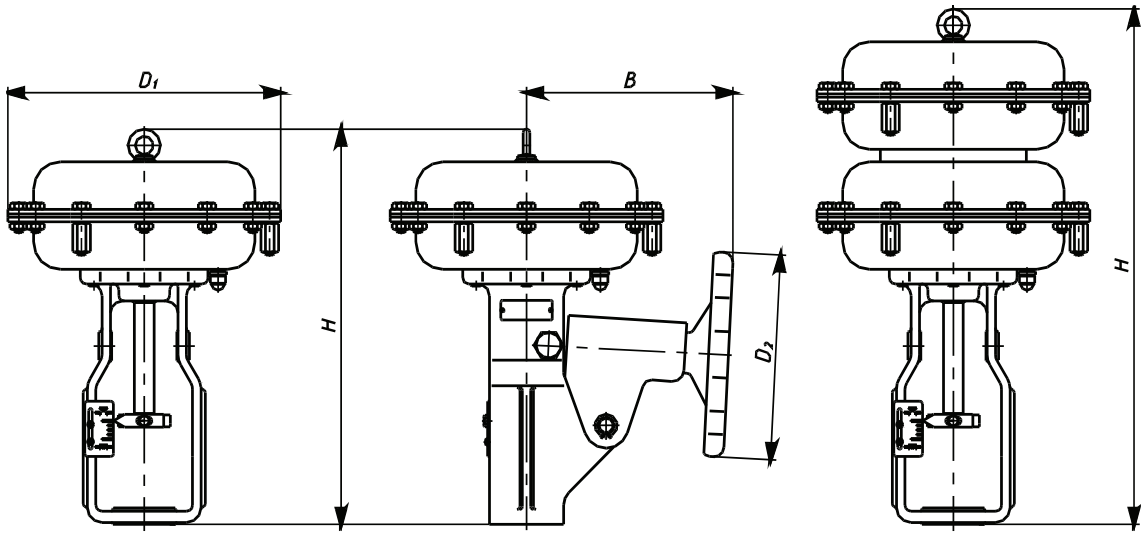


Fig. 8. Actuators P/R, PN/RN

Table 24: Sizes and weights of pneumatic actuators P1/R1 and P1B/R1B - Fig. 9

Actuator size	B	D_1	D_2	H	Weight [kg]	
	mm				P1/R1	P1B/R1B
400	255	305	225	453	20	28
630	280	375	305	548	40	50
1000	340	477	450	773	85	105
1500	410	550		833	120	150
3000				1138	225	255



P1/R1 , P1B/R1B - 400...1500 P1/R1-3000

Fig. 9. Actuators P1/R1, P1B/R1B

Control air connections:	1/4” NPT ; NPT 1/2”, Rc 1/2”	
- tube diameters:	6x1 ; 8x1 ; 10x1; 12x1	
- spring ranges:	20...100kPa ; 40...120kPa ; 60...140kPa	- 3 springs
	40...200kPa ; 80...240kPa ; 120...280kPa	- 6 springs
	180...380kPa *)	- 12 springs
	(not applicable for actuators P/R; P1/R1-250; 400)	
For actuator P1/R1-3000 (Tandem) -	for each range double the above numbers of springs (tandem)	
- maximum supply pressure:	actuator size 160...630 - 600kPa	
	actuator size R-630T and 1000...1500 - 500kPa	
- accessories (upon request):	side-mounted handwheel (P1/R1) or topmounted handwheel (P/R) ,	
	pneumatic positioner,	
	electro-pneumatic positioner,	
	smart electro-pneumatic positioner,	
	air-set,	
	three-way solenoid valve,	
	lock-up valve,	
	position transmitter,	
	limit switches.	

Electric: - electric drives; domestic and foreign electro-hydraulic drives (for details and technical specification refer to manufacturers catalogs)
Manual: - manual drive type 20, Fig. 10 Table 25.

Table 25: Manual drives type 20 - types, sizes and weights.

Type	Stroke [mm]	d_1	d_2	H	D	rev/stroke	Weight [kg]
20-20-57-M12	20	M12x1,25	57,15	265	228	8	7,5
20-20-84-M12			84,15				
20-38-57-M12	38		57,15		298	15	10
20-38-57-M16		M16x1,5					
20-38-84-M16			84,15				
20-38-95-M16			95,25				
20-50-57-M16	50		57,15	385	457	16	16
20-50-84-M16			84,15				
20-50-95-M16			95,25				
20-63-84-M20	63	M20x1,5	84,15			20	
20-63-95-M20			95,25				
20-80-84-M20	80		84,15	533	610	19	24
20-80-95-M20			95,25				
20-100-95-M24	100	M24x1,5					

Marking:
Example: 20-38-57-M16 - manual drive type 20; stroke - 38mm; d_2=57,15mm; d_1=M16x1,5

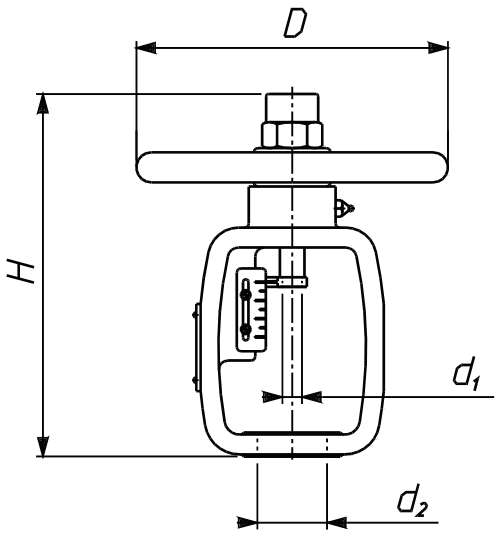


Fig. 10. Manual drive type 20.

SPECIAL OPTIONS:

- oxygen and hydrogen option:

Application of adequate materials, mechanical and chemical cleaning, inspections and assembly ensure compatibility with oxygen and hydrogen flows.

- low temperature media option:

Application of adequate materials and special bonnet design ensures effective isolation of valve drive from the impact of low temperatures. Used mostly for liquid oxygen and liquid nitrogen.

- acid gas option:

Parts of the valve can be made of materials and under conditions ensuring valve operation with gases of H_2S content as per NACE MR-0175.

- heat jacket option:

Design and technical parameters as per customer's specification.

- balanced valves with pilot:

Construction allows achievement of high leakage class at high pressure drops and reduced available force of actuator, flow direction - above the plug.

– valves with non-cast bodies:

If a special construction of the valve body is needed, it is possible to design a valve for individual customer's needs (angle valves – type L and Z).

CLASSIFICATION AND MARKING:

Type and action:

- pneumatic with direct action:	**P ; P1**
- pneumatic with reverse action:	**R ; R1**
- pneumatic with side-mounted handwheel	**P1B;R1B**
- pneumatic with top-mounted handwheel	**PN; RN**
- electric:	**E**
- manual	**20**

Bonnet:

- standard:	**1**
- extension:	**2**
- bellow seal:	**3**
- other	**X**

Packing:

- PTFE, braided	**A**
- PTFE, V type	**B**
- PTFE, for oxygen	**C**
- graphite, braided	**D**
- graphite, expanded	**E**
- TA-Luft, PTFE	**F**
- TA-Luft, graphite	**G**

Leakage class:

- basic: class IV	**4**
- enhanced: class V	**5**
- tight (special) cl. VI	**6**

Valve plug:

- unbalanced	**7**
- balanced with gasket	**8**
- balanced with pilot	**9**

Choke cages:

- no choke cages	**0**
- one choke cage	**1**
- two choke cages	**2**

Plug characteristics and type:

- linear	**L**
- equal percentage	**P**
- other	**X**

Body material:

- carbon steel	**3**
- alloy steel	**4**
- stainless steel	**5**
- other	**X**

MARKING EXAMPLE:

Control valve type Z1B with pneumatic actuator of reverse type, complete with top-mounted handwheel, extension bonnet, packing: expanded graphite, leakage class cl.VI, with throttling cage, balanced equal-percentage plug, body material: stainless steel.

RN-Z1B-2E481P5

Marking is shown on valve nameplate.

Additionaly, it shows:
- nominal size [DN],
- nominal pressure [PN],
- max working temperature [TS],
- max working pressure [PS],
- test pressure [PT],
- flow ratio [Kvs],
- plug stroke [H],
- plug stroke fluid group [1 or 2],
- serial number and year of manufacture.

ORDERING:

In case of valves with choke cages please specify flow coefficients for the cage or other information that is necessary to calculate that parameter in accordance with the technical data questionnaire. Contact our staff from the Marketing and Sales Department as well as the Technical and Development Department for assistance to select the most suitable valves.

Revision: Z1B/06/2013
Valid until the next revision.

NOTES:

Revision: Z1B/06/2013
Valid until the next revision.

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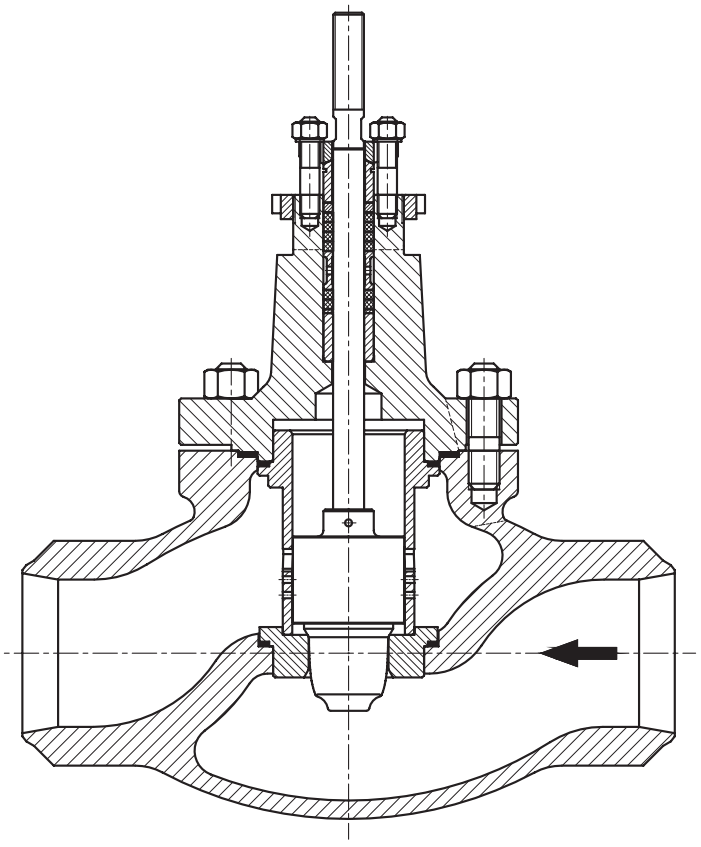
SINGLE-PORTED GLOBE CONTROL VALVES **TYPE Z1B®**

Design solutions for special applications

INTRODUCTION:

Product versions of valves type Z1B include numerous special executions adjusted especially for particular requirements of installations, in which they are to be installed.

The flow of fluid through the valve (depending on the kind and parameters of the fluid) may cause phenomena having a negative impact on the environment and be destructive to the product's durability.
It often happens that process parameters require application of valves designed strictly for flow parameters, so as to eliminate the occurrence of such phenomena as cavitation, chocked flow, noise and to prevent erosion of internal parts.
This catalogue card presents some of most commonly used valve designs, which are comprised in Z1B series, but being special executions, were not included in the main catalogue card of Z1B valves.

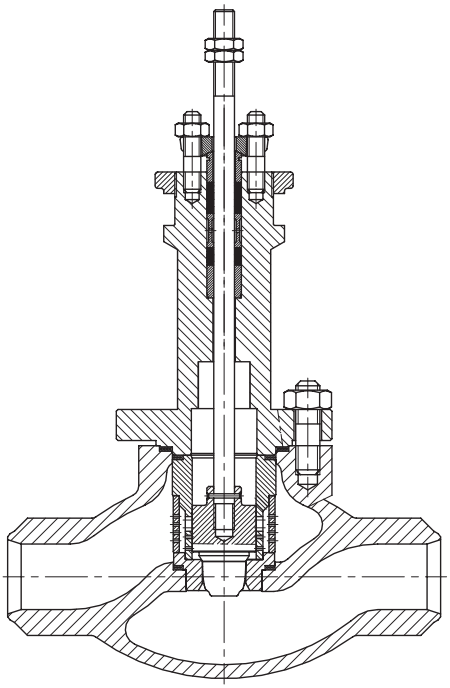


Valve with two-step plug

Valves with two-step plugs are designed for eliminating cavitation and chocked flow. Each step of throttling has been precisely selected, so as to generate pressure drops below critical values at each point of work. Valve's internal parts are toughened or stellited and nitrided.

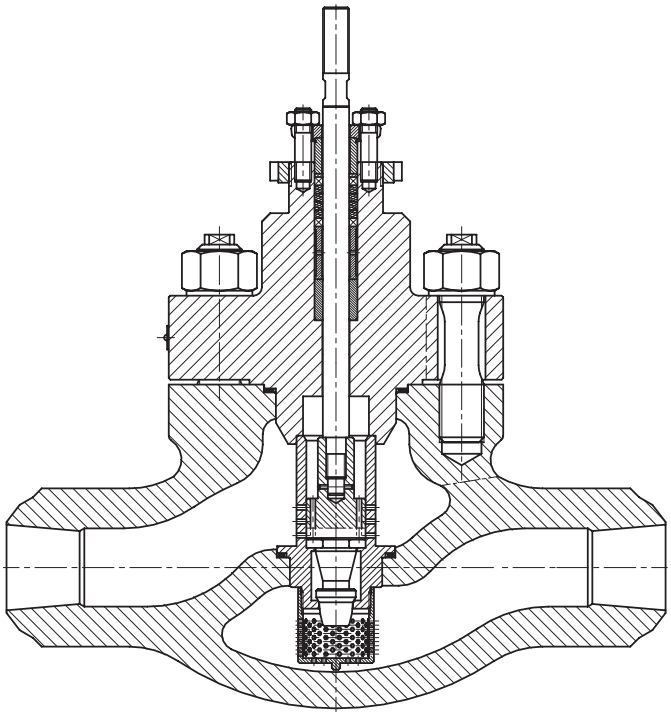
Valve with two-step plug and throttling cage

Valves with two-step plugs are designed for eliminating cavitation and chocked flow. Additional throttling cage is to implement additional throttling step and to reduce the noise level through multihole structure. Valve's internal parts are toughened or stellited and nitrided.



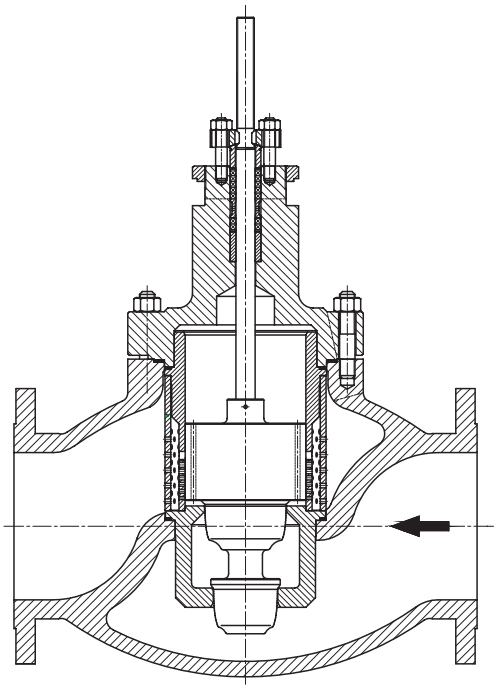
Valve with three-step plug and filtrating element under the seat

Valves with two-step plugs are designed for eliminating cavitation and chocked flow for higher pressure drops than valves with two-step plugs. Additional filtrating structure under the seat is to protect internal parts against damaging effect of solid particles, which may be present in the fluid. Valve's internal parts are toughened or stellited and nitrided.



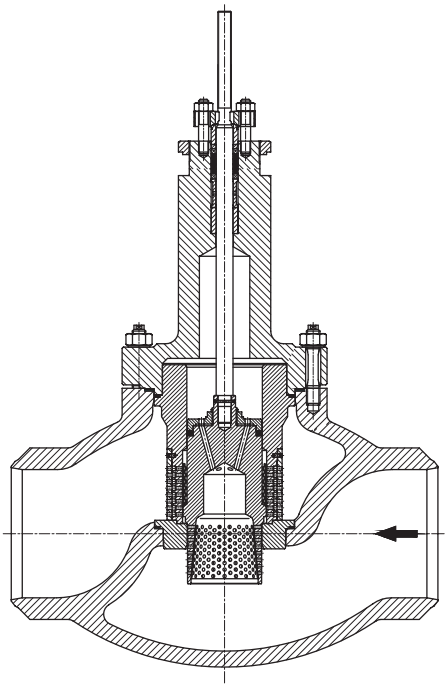
Valve with three-step plug and throttling cage

Valves with three-step plugs are designed for eliminating cavitation and chocked flow for higher pressure drops than valves with two-step plugs. Additional throttling cage is to implement additional throttling step and to reduce the noise level through multihole structure. Valve's internal parts are toughened or stellited and nitrided.



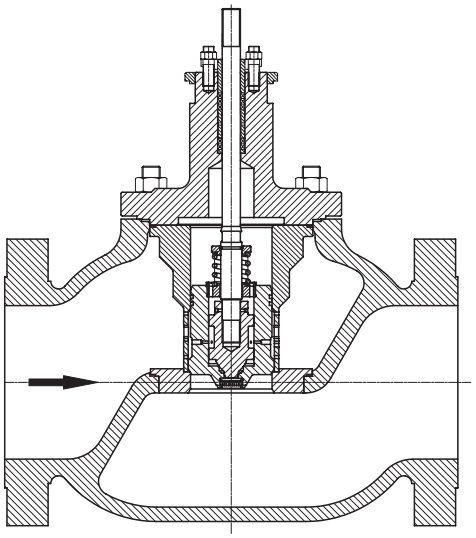
Valve with two-step perforated plug and two-step active throttling cage

Valves with multi-step active throttling structures in a form of perforated multihole elements, are used for regulation of steam flow, as well as other gas fluids at high pressure drops. This design aims at eliminating chocked flow and excessive noise. Valve's internal parts are toughened or stellited and nitrided.



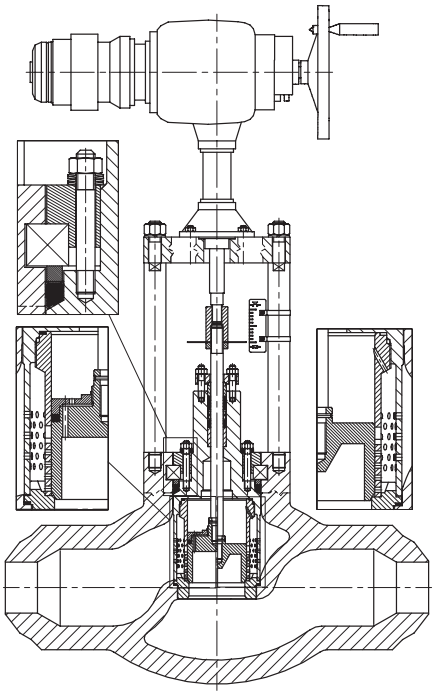
Valve with two-step plug pilot balanced and throttling plate

Valves with plug balanced by inner pilot are used for applications requiring increased rangeability. Due to plug being balanced by pilot, it is possible to achieve very high disposable pressure drops at small half-opening of the valve plug and high shut-off tightness of the valve. Valve's internal parts are toughened or stellited and nitrided.



Valves DN150-300 for nominal pressures PN160-420

Valves for nominal pressures higher than those in the main catalogue card of Z1B valves are made available upon customised requests. Due to large bonnet diameter and high pressure, the packing system in a form of conical self-tightening (under pressure inside the valve) seal was used. Product versions with pressure balanced plugs in different materials are available.



Revision: special executions Z1B/06/2013
Valid until the next revision.

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SINGLE-PORTED GLOBE CONTROL VALVES **TYPE Z®2**

APPLICATION AREA:

Single-ported globe control valves type Z®2 are used in automatic systems and remote control instalations as executive elements to control flow of liquids and gases. Operation (reverse action – air-to-open) and actuator assembly are adapted for SIEMENS electric and electro-hydraulic actuators. Recommended for application in city heating and HVAC systems and many branches of industry.

FEATURES:

- wide range of nominal dimensions, DN15…150 for nominal pressures PN10…40; CL150; CL300,
- various materials for valve body and internal parts casts, adapted to specific working conditions.
- wide range of flow coefficients and control characteristics,
- easy assembly and dismantling of valve internal parts for maintenance and service,
- high durability and reliability due to application of top-class materials and surface improvement processes (burnishing, stelliting, heat treatment, CrN coatings),
- possibility of mating with emergency function electric and electro-hydraulic actuators (no air – valve closed) or without emergency function (no air - valve remains in previous position),
- wide range of electric actuators, regarding supply and control type, available forces, operation speed and accessories,
- high tightness of closure due to application of soft seats (PTFE sealing) in the whole range of flows and characteristics, for balanced and unbalanced plugs.
- same flow ratios and control characteristics for "hard" (metal-metal) and "soft" (metal-gasket) seats, for lightened and non-lightened plugs,
- reliable connection between actuator stem and valve, and between seat and body,
- small resetting forces due to application of lightened plugs for valves DN32...150,
- top-class flat sealing and bonnet packing,
- competitive prices due to simple and functional design of valves and actuators and materials applied,
- design and production processes meet the requirements of Quality Management System ISO 9001 and Directive 97/23/EC, and regulations of AD2000 Merkblatt, designated for installation on pipelines.

Z ® - is a trademark registered with Republic of Poland Patent Office

DESIGN AND TECHNICAL SPECIFIACTION:

***Body** (1)*: single-ported, flanged, cast, with integrated bonnet.
Nominal size: DN15; 20; 25; 32; 40; 50; 65; 80; 100; 150
Nominal pressure: PN10; 16; 25; 40 (as per PN-EN 1092-1:2010 and PN-EN 1092-2:1999); CL150; CL300 (as per PN-EN 1759-1:2005).

Steel flanges CL150; CL300 are so designed that they can be assembled with flanges executed per American standards ANSI/ASME B16.5 and MSS SP44. In American standards flanges are identified with nominal values in "Classes", to which nominal pressure (PN) values as per PN-ISO 7005-1:2002 correspond.

Equivalent identification as per PN are: CL150: PN 20 and CL300: PN 50.

Table 1. Flanged end connections

Material	Nominal pressure	Facing of flange types			
		Raised face	Groove	Recess	Ring-joint
		Identification			
Grey iron	PN10; 16	B [2]	-	-	-
Spheroidal iron	PN10; 16; 25; 40		-	-	-
Cast steel	PN10; 16; 25; 40		D	F	-
	CL150		-	-	J (RTJ)
	CL300		DL (D1 [1])	F (F1)	
[1]) - only for CL300; [2]) - B1 – (Ra=12.5 mm, concentric surface structure "C"), B2 – (Ra as agreed with the customer); () - identification of connections as per ASME B16.5					
Possible execution of flanges per specification and indicated standards.					

Face-to-face dimmensions (body): as per PN-EN 60534-3-1; 2000r. - Fig. 2 ; Table 11 and 12. Series 1 - for PN10; 16; 25; 40; series 37- for CL150; series 38 - for CL300

Valve plug (2) - contoured, unbalanced (Kvs 0,25…25) or balanced (Kvs 16…320)

- control characteristics: - linear (L)
  - equal percentage (P)
- rangeability: - 50:1

Table 2. K_{vs} flow ratio and calculation coefficients (F_{D4}, F_{D6})

K_{vs}		0,25	0,40	0,63	1,0	1,6	2,5	4,0	6,3	8,0	10	16	20	25	40	63	94	125	160	250	320
Stroke [mm]		20														40					
Seat dia. D [mm]		12,7				19,1			20,6	22,5	25,3	28,5	31,7	33,5	41,3	50,8	66,7	88,9		107,9	127
DN	15	N	N	N	N	N	N	N													
	20	N	N	N	N	N	N	N	N												
	25	N	N	N	N	N	N	N	N	N											
	32	N	N	N	N	N	N	N	N	N	N	N,O									
	40	N	N	N	N	N	N	N	N	N	N	N,O	N,O	N,O							
	50	N	N	N	N	N	N	N	N	N	N	N,O	N,O	N,O	O						
	65											N,O	N,O	N,O	O	O					
	80													N,O	O	O	O				
	100														O	O	O	O	O		
	150															O	O	O	O	O	O
F_{D4} [kN]		0,2				0,3			0,33	0,36	0,4	0,45	0,5	0,53	0,7	0,8	1,1	1,4		1,7	2,0
F_{D6} [kN]		0,3				0,48			0,5	0,6	0,6	0,75	0,8	0,9	1,0	1,3	1,6	2,2		2,7	3,2

DN25 - Kvs 8; DN32 - Kvs16; DN40 - Kvs25 - only metallic seats, **N** - unbalanced valve plugs, **O** - balanced valve plugs

Valve seat (3): • hard, metallic, • soft, with PTFE sealing

Leakage class: as per PN-EN 60534-4
for metallic seats: - basic, (class IV)
for soft seats: - bubble-tight (class VI)

In case of highly abrasive medium, cavitation, high temperatures and flow velocity it is recommended that stelliting of plugs and metallic seats (seat surfaces, guide surfaces or all profile) is performed, or plasma nitriding (tenifering) of plug. Where medium corrosion conditions allow to use plugs, seats and stems in heat treated steel X17CrNi 16-2 (1.4057).

Stem (4): - burnished and polished sealing interface

Packings (5):

- temp. range -20...+220°C - PTFE-V maintenance-free packing kit, compressed with screw spring
  - ring gaskets formed in braided sealing cords of PTFE+GRAPHITE
  - valves with balanced plug and/or tight seat
  220...350°C - ring gaskets in graphite, metallic seats

Fluid flow direction: to open.

Table 3…9. Allowable working overpressure for materials at proper temperatures.

Table 3.		Material: EN-GJL 250 as per PN-EN 1561						
PN	Standard	Temperature [˚C]						
		-10…120	150	180	200	230	250	300
		Allowable working pressure [bar]						
PN10	PN-EN 1092-2	10	9	8,4	8	7,4	7	6
PN16		16	14,4	13,4	12,8	11,8	11,2	9,6

Table 4.		Material: EN-GJS 400-18 LT as per PN-EN 1563					
PN	Norma	Temperature [˚C]					
		-10…120	150	200	250	300	350
		Allowable working pressure [bar]					
PN10	PN-EN 1092-2	10	9,7	9,2	8,7	8	7
PN16		16	15,5	14,7	13,9	12,8	11,2
PN25		25	24,3	23	21,8	20	17,5
PN40		40	38,8	36,8	34,8	32	28

NOTES:

1. It is allowed to apply spheroidal iron, carbon steel and acid proof cast steel for temperatures lower than given in Tables 3...9, provided that working pressure is reduced respectively, working temperature impact tests are performed and cast is heat treated. Details are to be consulted with manufacturer.
2. Working pressure for intermediate temperature values can be calculated by interpolation.

Table 5.		Material: GP240GH (1.0619) as per PN-EN 10213-2							
PN / CL	Norma	Temperature [˚C]							
		-10…50	100	150	200	250	300	350	400
		Allowable working pressure [bar]							
PN10	EN 1092-1	10	9,2	8,8	8,3	7,6	6,9	6,4	5,9
PN16		16	14,8	14	13,3	12,1	11	10,2	9,5
CL150	PN-EN 1759-1	17,3	15,4	14,6	13,8	12,1	10,2	8,4	6,5
PN25	EN 1092-1	25	23,2	22	20,8	19	17,2	16	14,8
PN40		40	37,1	35,2	33,3	30,4	27,6	25,7	23,8
CL300	PN-EN 1759-1	45,3	40,1	38,1	36	32,9	29,8	27,8	25,7

Table 6.		Material: GX5CrNiMo 19-11-2 (1.4408) as per PN-EN 10213-4									
PN / CL	Norma	Temperature [˚C]									
		-10…50	100	150	200	250	300	350	400	425	450
		Allowable working pressure [bar]									
PN10	EN 1092-1	10	10	9	8,4	7,9	7,4	7,1	6,8	-	6,7
PN16		16	16	14,5	13,4	12,7	11,8	11,4	10,9	-	10,7
CL150	PN-EN 1759-1	17,9	16,3	14,9	13,5	12,1	10,2	8,4	6,5	5,6	4,7
PN25	EN 1092-1	25	25	22,7	21	19,8	18,5	17,8	17,1	-	16,8
PN40		40	40	36,3	33,7	31,8	29,7	28,5	27,4	-	26,9
CL300	PN-EN 1759-1	46,7	42,5	38,9	35,3	32,9	30,5	28,8	27,6	27,2	26,9

Table 7.	Material: G20Mn5 (1.6220) wg PN-EN 10213-3						
PN / CL	Norma	Temperature [˚C]					
		-40	100	150	200	250	300
		Allowable working pressure [[bar]					
PN10	-	6	6	3,8	3,6	3,48	3,4
PN16		16	16	10,1	9,6	9,28	9,07
PN25		25	25	15,8	15	14,5	14,2
PN40		40	28	28	27	26	25

Table 8.		Material: WCB as per ASTM A216								
PN / CL	Norma	Temperature [˚C]								
		-10…50	100	150	200	250	300	350	375	400
		Allowable working pressure [bar]								
PN10	EN 1092-1	10	10	9,7	9,4	9	8,3	7,9	7,7	6,7
PN16		16	16	15,6	15,1	14,4	13,4	12,8	12,4	10,8
CL150	PN-EN 1759-1	19,3	17,7	15,8	14	12,1	10,2	8,4	7,4	6,5
PN25	EN 1092-1	25	25	24,4	23,7	22,5	20,9	20	19,4	16,9
PN40		40	40	39,1	37,9	36	33,5	31,9	31,1	27
CL300	PN-EN 1759-1	50	46,4	45,1	43,9	41,8	38,9	36,9	36,6	34,6

Table 9.		Material: CF8M as per ASTM A351										
PN / CL	Norma	Temperature [˚C]										
		-10…50	100	150	200	250	300	350	375	400	425	450
		Allowable working pressure [bar]										
PN10	EN 1092-1	8,9	7,8	7,1	6,6	6,1	5,8	5,6	5,5	5,4	5,4	5,3
PN16		14,3	12,5	11,4	10,6	9,8	9,3	9	8,8	8,7	8,6	8,5
CL150	PN-EN 1759-1	18,4	16	14,8	13,6	12	10,2	8,4	7,4	6,5	5,6	4,6
PN25	EN 1092-1	22,3	19,5	17,8	16,5	15,5	14,6	14,1	13,8	13,6	13,5	13,4
PN40		35,6	31,3	28,5	26,4	24,7	23,4	22,6	22,1	21,8	21,6	21,4
CL300	PN-EN 1759-1	48,1	42,3	38,6	35,8	33,5	31,6	30,4	29,6	29,3	29	29

ALLOWABLE PRESSURE DROPS Δp.

Pressure drops Δp [bar] refer to closed valve and they are calculated with regard to actuator capabilities. Actual pressure drops should not exceed 70% of allowable working pressure for the given nominal pressure, material execution and working temperature, as per tables 3…11.

a) unbalanced plugs $$\Delta p = \frac{Fs - F_D}{0{,}785 \cdot 10^{-4} \cdot D^2} \quad \text{or} \quad Fs = 0{,}785 \cdot 10^{-4} \cdot D^2 \cdot \Delta p + F_D$$

b) balanced plugs $$\Delta p \le 0{,}7 \cdot p_t \quad \text{at } Fs \ge F_{D6}$$

where Δp [bar] - calculated pressure drop
p_t [bar] - allowable working pressure,
Fs [kN] - actuator available force (Table 10),
F_D [kN] - valve plug to valve seat pressure,
$F_D = F_{D4}$ - for class IV leakage class,
$F_D = F_{D6}$ - for class VI leakage class,
D [mm] - valve seat diameter.

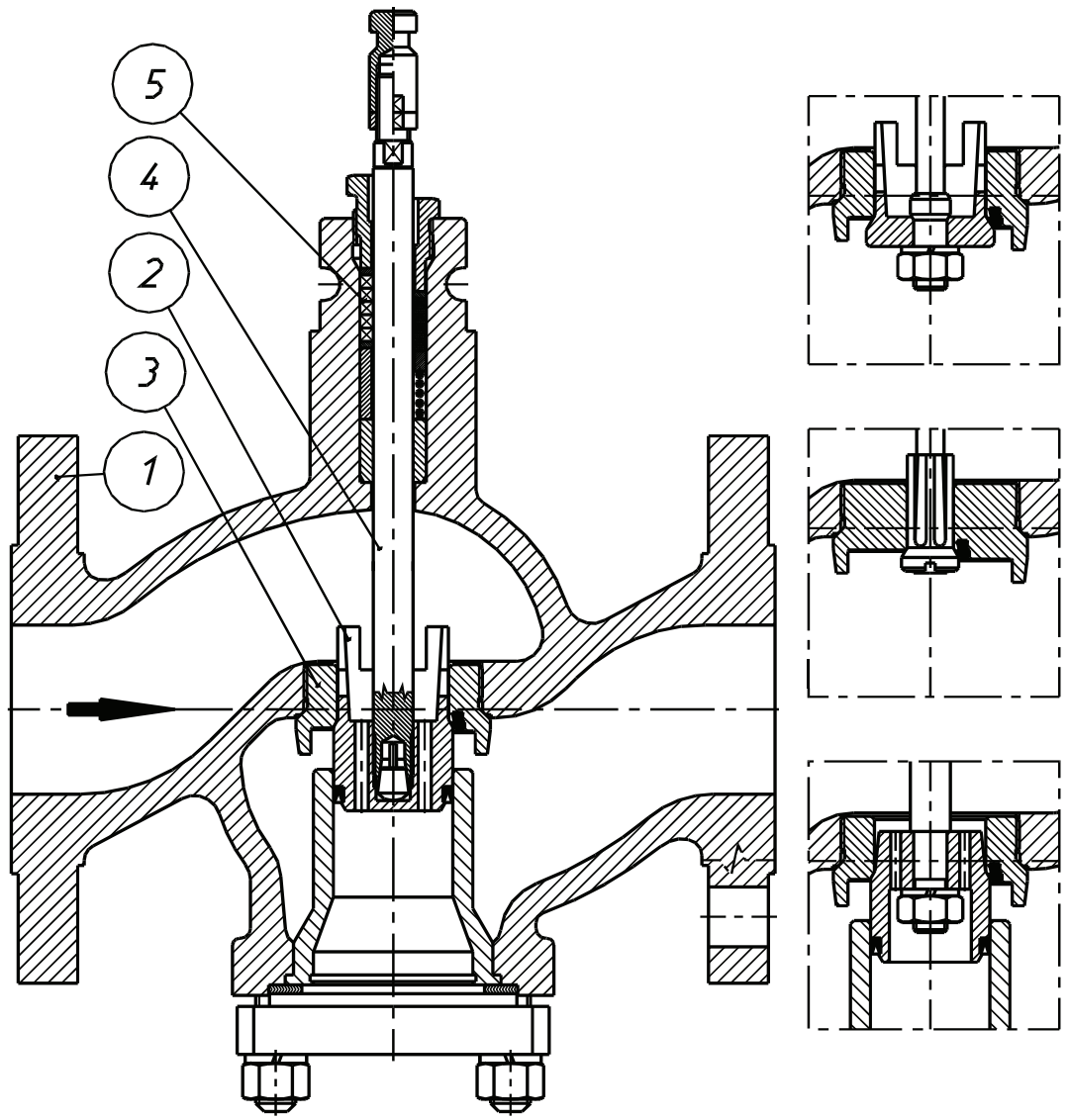


Fig.1. Control valve

Table 10:Technical specification of actuators

Actuator	Stroke [mm]	Available force [kN]	Supply voltage [V , AC]	Control	Course time [s]	Emer-gency operation	Emergency operation time [s]	Accessories				Allowable working temperature [°C]
								1S	2S	1P	1SP	
SQX 31.00	20	0,5	230	3 points.	150			X	X		X	140
SQX 31.03		0,5			35			X	X		X	140
SQX 31.06		0,5			300			X	X		X	140
SKD 32.50		0,8			120				X	X		140
SKD 32.51		0,6			120	X	8		X	X		140
SKB 32.50		3,5			120				X	X		220)*
SKB 32.51		2,8			120	X	10		X	X		220)*
SKC 32.60	40	3,5			120				X	X		220)*
SKC 32.61		2,8			120	X	18		X	X		220)*
SQX 81.00	20	0,5	24	3 points.	150			X	X		X	140
SQX 81.03		0,5			35			X	X		X	140
SKD 82.50		0,8			120				X	X		140
SKD 82.51		0,6			120	X	8		X	X		140
SQX 61	20	0,5	24	constant 0...10V	35							140
SKD 62		0,6			30	X	15	X				140
SKB 62		2,8			120	X	15	X				220)*
SKC 62	40	2,8			120	X	20	X				220)*

Accessories:
1S - one auxiliary switch,
2S - two auxiliary switches,
1P - one potentiometer 1000 Ω,
1SP - one auxiliary switch and one potentiometer 1000 Ω.

Note: - only one accessory can be ordered, all actuators are fitted with a handwheel, casing protection class IP54,
-)* in special execution up to +350°C

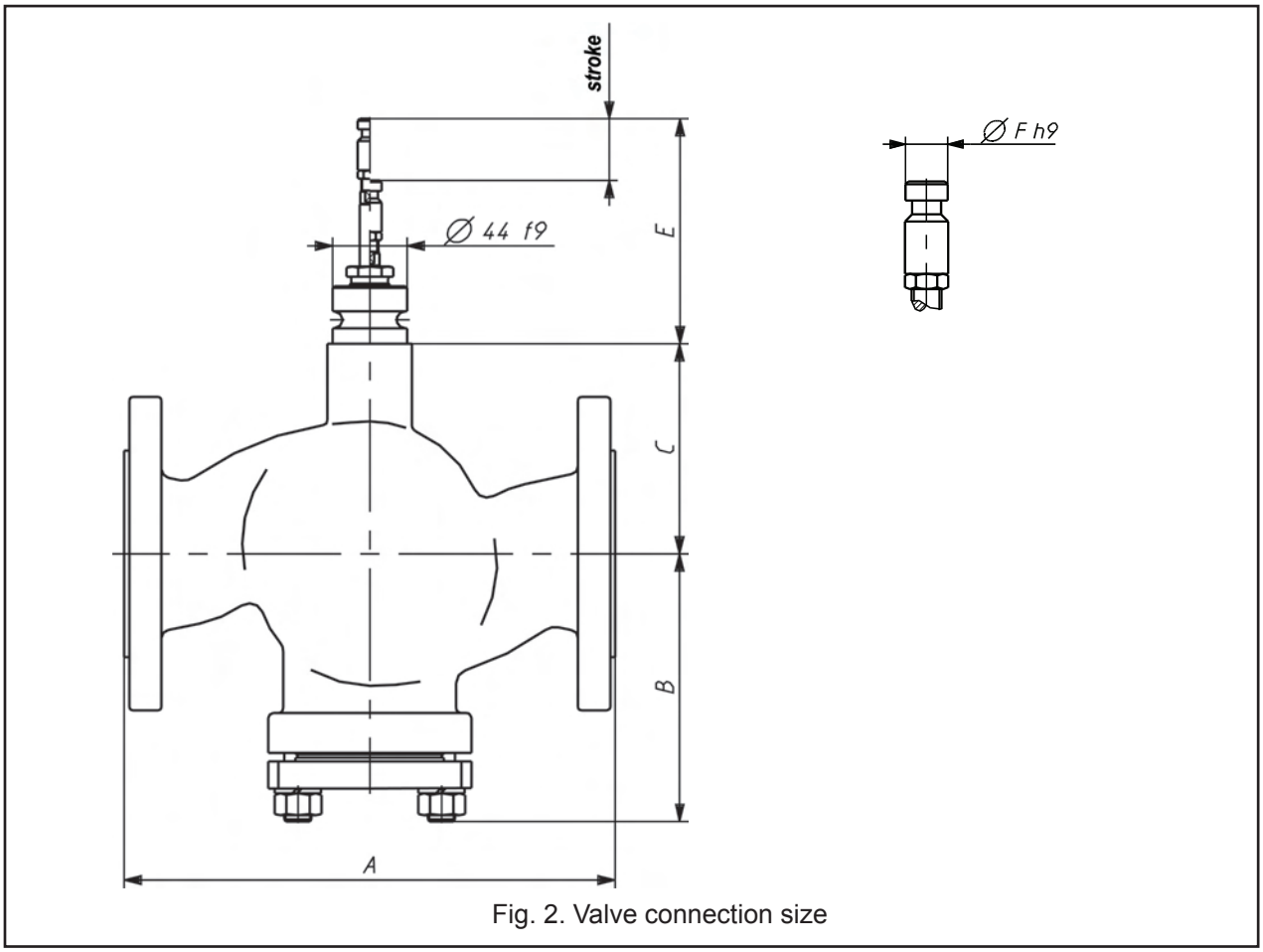


Fig. 2. Valve connection size

Table 11. Sizes of acutated valves [mm].

DN	A			B	C	
	CL150	CL300	PN10…40	[mm]	stroke 20 [mm]	stroke 38 [mm]
15	184	190	130	92	93	-
20		194	150			
25		197	160			
32	200	213	180	111	114	
40	222	235	200	113		
50	254	267	230	120		
65	276	292	290	156	136	156
80	298	317	310	160		
100	352	368	350	168	167	187
150	451	473	480	218	-	210

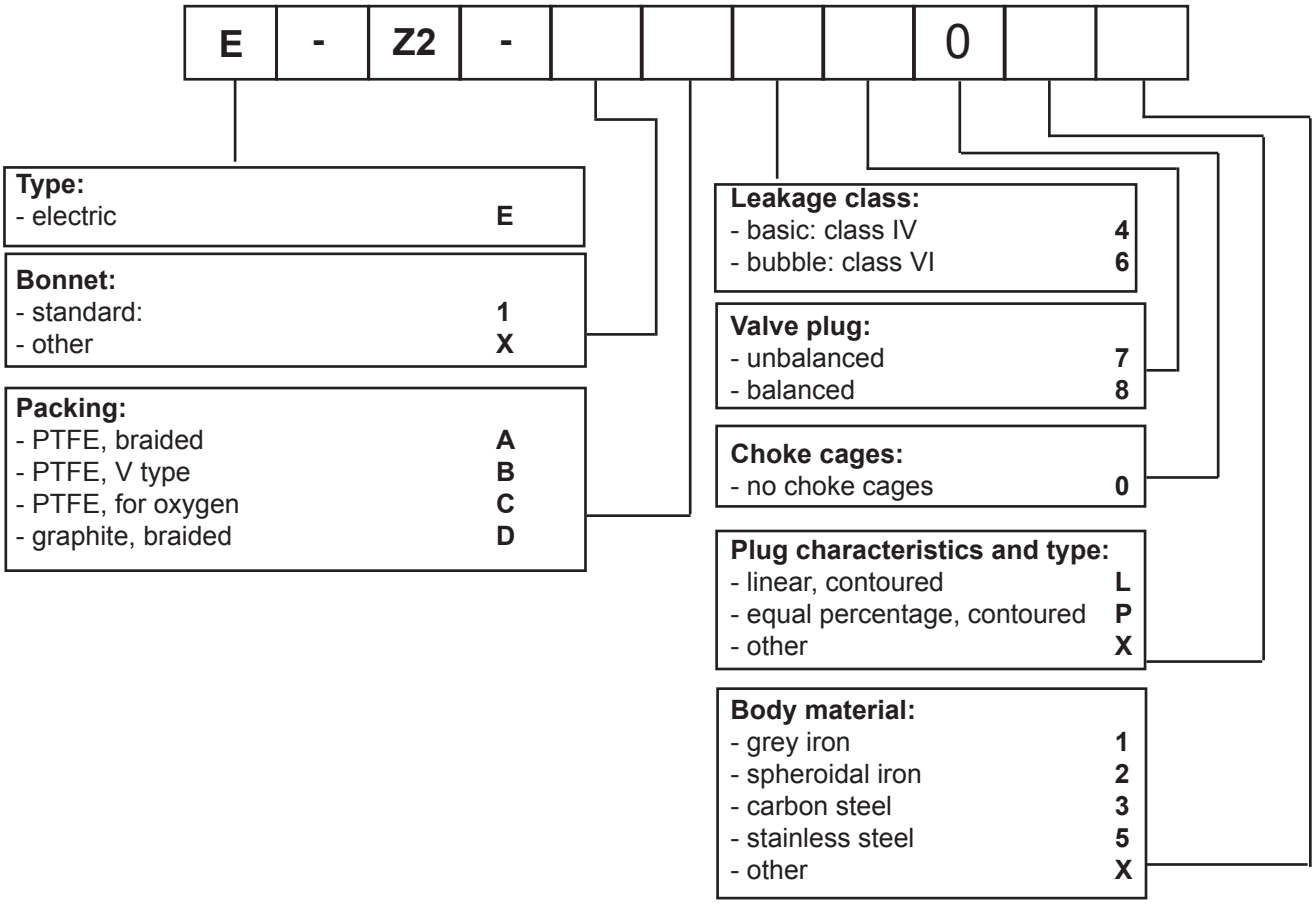
Stroke	E	∅F
20	96,5	10
40	116,5	14

NOTE: Face-to-face A dimension for CL150 and CL300 refer to bodies with B or RF seat. For other executions of body you can calculate A_1 from formulas presented in Table 12.

Table 12.

Body	Marking		A_1
	PN	ANSI	
Groove CL300	D1	GF	$A_1 = A + 5 \times 2$
Recess CL300	F1	FF	
Ring-joint CL300 DN15	J	RTJ	$A_1 = A + 5,5 \times 2$
Ring-joint CL150			$A_1 = A + 6,5 \times 2$
Ring-joint CL300 DN20…40			
Ring-joint CL300 DN50…250			$A_1 = A + 8 \times 2$

CLASSIFICATION AND MARKING



MARKING EXAMPLE:

Control valve type Z2 with standard bonnet, braided graphite valve stem packing, leakage class VI, equal percentage contoured plug, execution in stainless steel:

E-Z2-1D680P5

Marking is shown on valve nameplate.

Additional information:
- nominal size [DN],
- nominal pressure [PN],
- max working temperature [TS],
- max working pressure [PS],
- test pressure [PT],
- flow ratio [Kvs],
- plug stroke [H],
- fluid group [1 or 2],
- serial number and year of manufacture.

ORDERING:

The order should contain all information as per data questionnaire. Full information can be obtained from the Sales and Marketing Department or Technical Department.

Revision: Z2/06/2013
Valid until the next revision.

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THREE-WAY CONTROL VALVES **TYPE Z3®**

APPLICATION AREA:

Three-way control valves type Z®3 are used in automatic systems and remote control systems as flow control elements to adjust flow of liquids and gases. Type Z3M is designed to mix two streams of medium, whereas type Z3R is designed to split one stream into two. Recommended for application in city-heating and HVAC systems and many branches of industry. They can be delivered with P/R actuators (basic option) or with P1/R1; P3/R3 acutators (upon request) electric actuators, handwheels type 20 or with no drives.

FEATURES:

- wide range of nominal dimensions, DN15…150 for nominal pressures PN10…40; CL150; CL300,
- various materials of valve body and internal parts casts, adapted to specific working conditions,
- wide range of flow coefficients,
- reduction in aggressive and toxic fluids emissions to environment through application of bellow seal bonnets or bonnet packings meeting requirements of TA - LUFT,
- easy assembly and dismantling of valve internal parts for maintenance and service,
- high durability and reliability due to application of top-class materials and surface improvement processes (burnishing, stelliting, heat treatment, CrN coatings),
- possibility of mating with P/R multi-spring actuators (basic option), P1/R1. Full reversibility of actuator operation and changing the spring range with no extra parts,
- optional fitting of pneumatic actuators with a handwheel,
- option of diagnostics of "valve - actuator" system, thanks to applicaiton of smart electro-pneumatic positioners,
- high tightness of closure due to application of soft seats (PTFE sealing) in the whole range of flow ratios,
- same flow ratios and control characteristics for "hard" (metal-to-metal) and "soft" (metal-gasket) seats,
- reliable connection between actuator stem and valve, and between screwed in seat and body,
- top-class flat sealing and bonnet packing,
- broad range of electric actuators ,
- possibility of mating with handwheels type 20 or NN,
- special executions for oxygen, hydrogen, acidic gases with H_2S content, explosive atmospheres - as per ATEX Directive 94/9/EC,
- competitive prices due to simple and functional design of valves and actuators and materials applied,
- design and production process meet the requirements of Quality Management System ISO 9001 and Directive 97/23/EC, and regulations of AD2000 Merkblatt, designated for installation on pipelines.

Z3 ® - is a trademark registered with Republic of Poland Patent Office

DESIGN AND TECHNICAL SPECIFIACTION:

***Body** (1)*: flanged, cast, with integrated bonnet (cast iron execution) or welded bonnet (cast steel execution).
Nominal size: DN15; 20; 25; 32; 40; 50; 65; 80; 100; 150 *)

Nominal pressure: PN10; 16; 25; 40 (as per PN-EN 1092-1:2010 and PN-EN 1092-2:1999);
CL150; CL300 (as per PN-EN 1759-1:2005) *)

*) higher nominal dimensions [DN] and higher nominal pressures are available after agreement with the manufacturer

Steel flanges CL150; CL300 are so designed that they can be assembled with flanges executed per American standards ANSI/ASME B16.5 and MSS SP44. In American standards flanges are identified with nominal values in "Classes", to which nominal pressure (PN) values as per PN-ISO 7005-1:2002 correspond.

Equivalent identification as per PN are: CL150: PN 20 and CL300: PN 50.

Table 1. Flanged end connections

Material	Nominal pressure	Facing of flange types			
		Raised face	Groove	Recess	Ring - joint
		Identification			
Grey iron	PN10; 16	B [2]	-	-	-
Spheroidal iron	PN10; 16; 25; 40		-	-	-
Cast steel	PN10; 16; 25; 40		D	F	-
	CL150		-	-	J (RTJ)
	CL300		DL (D1 [1])	F (F1)	
[1]) - only for CL300; [2]) - B1 – (Ra=12.5 mm, concentric surface structure "C"), B2 – (Ra as agreed with the customer); () - identification of connections as per ASME B16.5					
Possible execution of flanges per specification and indicated standards					

face-to-face dimensions (body): as per PN-EN 60534-3-1; 2000r; series 1 - for PN10; 16; 25; 40; series 37- for CL150; series 38 - for CL300

Bonnet (1a) - standard or extension bonnet integrated with body; cast or welded depending on material - refer to Table 3

Stub (2) - flanged: steel (rod); stub offset from axis as per Fig.5; Table 14

Valve plug (3) - contoured-piston (with side type cuts), linear control characteristics
- rangeability 50:1

Seats (4) - screwed in (4.1) and fitted-in (4.2): • hard, • soft with PTFE packing

Valve plug stem (5) - burnished or toughened with polished sealing face.

Sealing (7,8) - body gaskets: spiral type, "graphite+1.4404", bonnet gaskets: as per Table 2.

Table 2. Packing types with application ranges.

Packing	PN / CL	Temperature [°C] / Bonnet	
		Standard	Extension
PTFE-V	PN10…CL300	-46...+200	-198...-46 +200...+300
PTFE + Graphite			
PTFE-V / TA-LUFT			
Graphite		+200...+300	+300...+450
Graphite / TA-LUFT			

Leakage class:
- basic: Class IV as per PN-EN 60534-4 - hard valve seat
- bubble-tight: Class VI as per PN-EN 60534-4 - soft valve seat

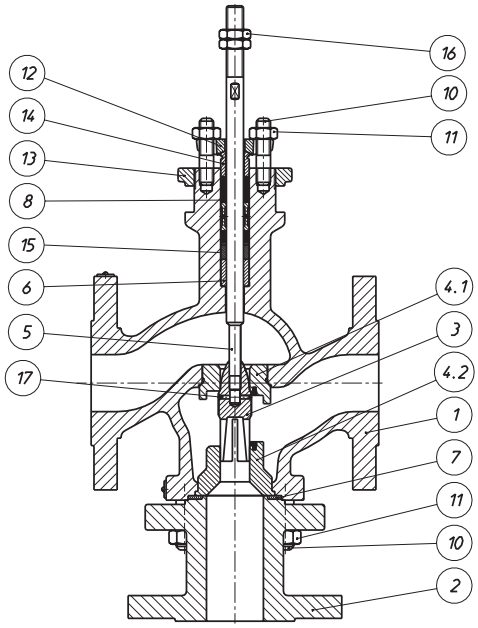


Fig.1. Control valve

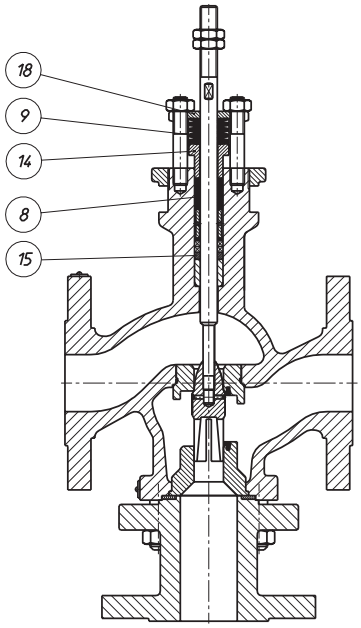


Fig.2. Control valve with TA-LUFT sealing

Special designs: Control valve with below seal and control valve with welded ends. (dimensions must be agreed with producer.

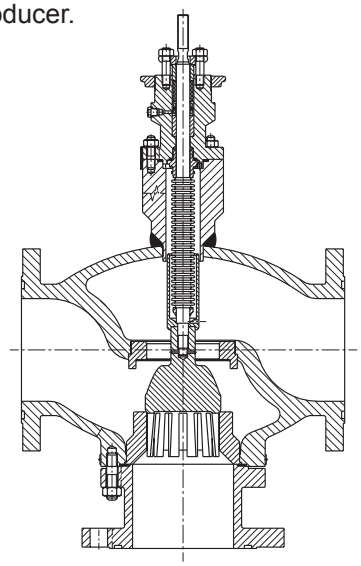
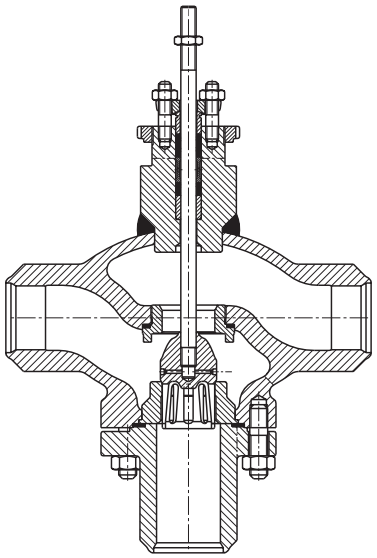


Fig. 3. Control valve with below seal



Rys. 4. control valve with welded ends

Table 3. Listing of components with materials

Poz.	Component	Materials						
1	Body	EN-GJL 250 (EN-JL 1040)	EN-GJS 400-18 LT (EN-JS 1025)	GP 240 GH ; (1.0619)	WCB	G20Mn5 (1.6220)	GX5CrNiMo 19-11-2 (1.4408)	CF8M
1a	Bonnet			S 355 J2G3(1.0570)		G20Mn5 (1.6220)	X6CrNiMoTi 17-12-2 (1.4571)	
2	Stub	S 355 J2G3 (1.0570)				P355 NL2 (1.1106)	X6CrNiMoTi 17-12-2 (1.4571)	
3	Plug	X6CrNiMoTi 17-12-2 (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN X17CrNi 16-2 ; (1.4057) + heat treatment						
4.1 4.2	Screwed in seat Fitted in seat	X6CrNiMoTi 17-12-2; (1.4571) X6CrNiMoTi 17-12-2; (1.4571) + stellite X6CrNiMoTi 17-12-2; (1.4571) + PTFE X17CrNi 16-2; (1.4057) + heat treatment						
5	Stem	X6CrNiMoTi 17-12-2; (1.4571) X17CrNi 16-2; (1.4057);						
6	Guiding sleeve	X6CrNiMoTi 17-12-2; (1.4571) + CrN X17CrNi 16-2; (1.4057) + CrN						
7	Body gasket	Grafit (98%) + 1.4404 (spiral)						
8	Packing kit	PTFE + GRAFIT PTFE - „V” GRAFIT						
9	Disk spring	12R10 (SANDVIK)						
10.1 10.2	Bolt	8.8				A4 - 70		
11.1 11.2	Nut	8				A4 - 70		
12	Press lever	C45						
13	Fixing nut	X6CrNiMoTi 17-12-2; (1.4571)						
14.1 14.2	Press sleeve	X6CrNiMoTi 17-12-2; (1.4571)						
15.1 15.2	Spacer sleeve	X6CrNiMoTi 17-12-2; (1.4571)						
16	Nut (low)	C45				X6CrNiMoTi 17-12-2; (1.4571)		
17	Peg	X6CrNiMoTi 17-12-2; (1.4571)						
18	Compression plate	X6CrNiMoTi 17-12-2; (1.4571)						

Relevant material standards	
Material	Numer normy
EN-GJL 250 ; (EN-JL 1040)	PN-EN 1561
EN-GJS 400-18 LT ; (EN-JS 1025)	PN-EN 1563
GP 240 GH ; (1.0619)	PN-EN 10213-2
WCB	ASTM A 216
G20Mn5 ; (1.6220)	PN-EN 10213-3
GX5CrNiMo 19-11-2 ; (1.4408)	PN-EN 10213-4
CF8M	ASTM A 351
S 355 J2G3 ; (1.0570)	PN-EN 10025
P355 NL2 ; (1.1106)	PN-EN 10028-3
X6CrNiMoTi 17-12-2 ; (1.4571)	PN-EN 10088
X17CrNi 16-2 ; (1.4057)	PN-EN 10088
C45	PN-EN 10083-1

NOTE:

Hardening method used for hardening of valve internal parts comprises:

a) stelliting – padding of surfaces with stellite: ~40HRC

b) CrN coating – introducing chromium nitride to external layer of detail, to the depth of ca.0.1 mm:~950HV

c) heat treatment: valve plug (~45HRC), valve seat (~35HRC), guiding sleeve (~45HRC)

Table 4…10. Allowable working overpressure for materials at proper temperatures

Table 4.		Material: EN-GJL 250 as per PN-EN 1561						
PN	Standard	Temperature [˚C]						
		-10…120	150	180	200	230	250	300
		Allowable working pressure [bar]						
PN10	PN-EN 1092-2	10	9	8,4	8	7,4	7	6
PN16		16	14,4	13,4	12,8	11,8	11,2	9,6

Table 5.		Material: EN-GJS 400-18 LT as per PN-EN 1563					
PN	Norma	Temperature [˚C]					
		-10…120	150	200	250	300	350
		Allowable working pressure [bar]					
PN10	PN-EN 1092-2	10	9,7	9,2	8,7	8	7
PN16		16	15,5	14,7	13,9	12,8	11,2
PN25		25	24,3	23	21,8	20	17,5
PN40		40	38,8	36,8	34,8	32	28

NOTES:

1. It is allowed to apply spheroidal iron, carbon steel and acid proof cast steel for temperatures lower than given in Tables 4...10, provided that working pressure is reduced respectively, working temperature impact tests are performed and cast is heat treated. Details are to be consulted with manufacturer.
2. Working pressure for intermediate temperature values can be calculated by interpolation.

Table 6.		Material: GP240GH (1.0619) as per PN-EN 10213-2							
PN / CL	Norma	Temperature [˚C]							
		-10…50	100	150	200	250	300	350	400
		Allowable working pressure [bar]							
PN10	EN 1092-1	10	9,2	8,8	8,3	7,6	6,9	6,4	5,9
PN16		16	14,8	14	13,3	12,1	11	10,2	9,5
CL150	PN-EN 1759-1	17,3	15,4	14,6	13,8	12,1	10,2	8,4	6,5
PN25	EN 1092-1	25	23,2	22	20,8	19	17,2	16	14,8
PN40		40	37,1	35,2	33,3	30,4	27,6	25,7	23,8
CL300	PN-EN 1759-1	45,3	40,1	38,1	36	32,9	29,8	27,8	25,7

Table 7.		Material: GX5CrNiMo 19-11-2 (1.4408) as per PN-EN 10213-4									
PN / CL	Norma	Temperature [˚C]									
		-10…50	100	150	200	250	300	350	400	425	450
		Allowable working pressure [bar]									
PN10	EN 1092-1	10	10	9	8,4	7,9	7,4	7,1	6,8	-	6,7
PN16		16	16	14,5	13,4	12,7	11,8	11,4	10,9	-	10,7
CL150	PN-EN 1759-1	17,9	16,3	14,9	13,5	12,1	10,2	8,4	6,5	5,6	4,7
PN25	EN 1092-1	25	25	22,7	21	19,8	18,5	17,8	17,1	-	16,8
PN40		40	40	36,3	33,7	31,8	29,7	28,5	27,4	-	26,9
CL300	PN-EN 1759-1	46,7	42,5	38,9	35,3	32,9	30,5	28,8	27,6	27,2	26,9

Table 8.	Material: G20Mn5 (1.6220) wg PN-EN 10213-3						
PN / CL	Norma	Temperature [˚C]					
		-40	100	150	200	250	300
		Allowable working pressure [[bar]					
PN10	-	6	6	3,8	3,6	3,48	3,4
PN16		16	16	10,1	9,6	9,28	9,07
PN25		25	25	15,8	15	14,5	14,2
PN40		40	28	28	27	26	25

Table 9.		Material: WCB as per ASTM A216								
PN / CL	Norma	Temperature [˚C]								
		-10…50	100	150	200	250	300	350	375	400
		Allowable working pressure [bar]								
PN10	EN 1092-1	10	10	9,7	9,4	9	8,3	7,9	7,7	6,7
PN16		16	16	15,6	15,1	14,4	13,4	12,8	12,4	10,8
CL150	PN-EN 1759-1	19,3	17,7	15,8	14	12,1	10,2	8,4	7,4	6,5
PN25	EN 1092-1	25	25	24,4	23,7	22,5	20,9	20	19,4	16,9
PN40		40	40	39,1	37,9	36	33,5	31,9	31,1	27
CL300	PN-EN 1759-1	50	46,4	45,1	43,9	41,8	38,9	36,9	36,6	34,6

Table 10.		Material: CF8M as per ASTM A351										
PN / CL	Norma	Temperature [˚C]										
		-10…50	100	150	200	250	300	350	375	400	425	450
		Allowable working pressure [bar]										
PN10	EN 1092-1	8,9	7,8	7,1	6,6	6,1	5,8	5,6	5,5	5,4	5,4	5,3
PN16		14,3	12,5	11,4	10,6	9,8	9,3	9	8,8	8,7	8,6	8,5
CL150	PN-EN 1759-1	18,4	16	14,8	13,6	12	10,2	8,4	7,4	6,5	5,6	4,6
PN25	EN 1092-1	22,3	19,5	17,8	16,5	15,5	14,6	14,1	13,8	13,6	13,5	13,4
PN40		35,6	31,3	28,5	26,4	24,7	23,4	22,6	22,1	21,8	21,6	21,4
CL300	PN-EN 1759-1	48,1	42,3	38,6	35,8	33,5	31,6	30,4	29,6	29,3	29	29

Table 11: Kvs flow ratios and calculation coefficients (design).

Kvs		0,63	1,0	1,6	2,5	4,0	6,3	10	16	25	40	63	94	125	160	250	320
Stroke [mm]		20										38				50	
Seat dia. [mm] D		12,7				19,05		20,64	25,25	31,72	41,25	50,8	66,7	88,9		107,92	126,95
DN	15																
	20																
	25																
	32																
	40																
	50																
	65																
	80																
	100																
	150																
Metallic seat	F_D [kN]	0,2		0,3		0,33		0,4		0,5	0,7	0,8	1,1	1,4		1,7	2,0
Soft seat		0,25				0,5		0,5	0,6	0,8	1,0	1,3	1,7	2,2		2,7	3,2
Calculation coefficients: $F_L = 0,9$; $X_T = 0,7$; $F_d = 0,41$; $xF_z = 0,65$																	
higher nominal diameters and Kvs flow ratios are availabe after agreement with the manufacturer																	

ALLOWABLE PRESSURE DROPS Δp.

Pressure drops Δp [bar] refer to closed valve and they are calculated for valve drive potential. Actual pressure drops should not exceed 70% of allowable working pressure for given nominal pressure, material execution and working temperature, as per tables 4…10.

$$\Delta p = \frac{Fs - F_D}{0,785 \cdot 10^{-4} \cdot D^2} \quad \text{or} \quad Fs = 0,785 \cdot 10^{-4} \cdot D^2 \cdot \Delta p + F_D$$

where
- Δp [bar] - calculated pressure drop
- Fs [kN] - actuator available force (Table 11)
- F_D [kN] - valve plug to valve seat pressure (Table 10)
- D - valve seat diameter [mm] (Table 10)

Table 12: Available force F_S [kN] of pneumatic actuators

Actuator size	Direct actuator P			Reverse actuator R					
	Supply pressure [kPa]			Spring range [kPa]					
	140	250	400	20 - 100	40 - 120; 40 - 200	60 - 140	80 - 240	120 - 280	180 - 380
160	0,64	2,4	4,8	0,32	0,64	0,96	1,28	1,92	-
250	1,0	3,8	7,5	0,5	1,0	1,5	2,0	3,0	-
400	1,6	6,0	12,0	0,8	1,6	2,4	3,2	4,8	-
630	2,5	9,5	18,9	1,3	2,5	3,8	5,0	7,6	11,3
1000	4,0	15,0	30,0	2,0	4,0	6,0	8,0	12,0	18,0

NOTE:
1. For direct actuators P adopted spring range is 20 - 100 kPa
2. For electric and other actuators Δp value can be calculated using above formula and data from Tables 12 and 14, taking nominal load capacity as available force FS, as per actuator catalog chart.

When using pneumatic actuators their available forces are to be calculated separately for extreme position of stem, accounting for operation (direct or reverse), and valve operation (mixing or separation). To facilitate and simplify selection of pneumatic actuators spring ranges and supply pressures were unified, regardless of operation (simple or reverse). For parameters of pneumatic actuators to be used in calculation of available forces refer to Tables 13 and 13a.

Table 13 i 13a. Technical specification of pneumatic actuators

Parameter	Unit	Spring range					
$p_1 - p_2$	[kPa]	20…100	40...120	60...140	80...240	120...280	180...380
p_Z	[kPa]	250			400		
A_S	[cm²]	160; 250; 400; 630; 1000					630; 1000

Actuator type	P / R				
Size	160	250	400	630	1000
H [mm]	20			38	38; 50; 63

where: H - stroke [mm]
$p_1 \div p_2$ - spring range [kPa]; p_Z - supply pressure [kPa];
A_s - effective area of actuator diaphragm [cm²];

Available force of pneumatic actuators Fs [kN] is to be derived from below formulas, regarding valve function, actuator operation and pressure point (top or bottom port)

a) Valve function: mixing

$$F_{SP1} = 10^{-4}\ p_1 \bullet A_s \quad ; \quad F_{SR1} = 10^{-4}\ (p_z - p_2) \bullet A_s$$
$$F_{SP2} = 10^{-4}\ (p_z - p_2) \bullet A_s \quad ; \quad F_{SR2} = 10^{-4}\ p_1 \bullet A_s$$

b) Valve function: diverting

$$F_{SP1} = 10^{-4}\ (p_z - p_1) \bullet A_s \quad ; \quad F_{SR1} = 10^{-4}\ p_2 \bullet A_s$$
$$F_{SP2} = 10^{-4}\ p_2 \bullet A_s \quad ; \quad F_{SR2} = 10^{-4}\ (p_z - p_1) \bullet A_s$$

Interpretation concerning individual available forces F_s of pneumatic actuators:

F_{SP1} - direct P actuator; closed screwed-in port (top),
F_{SP2} - direct P actuator; closed fitted-in port (bottom),
F_{SR1} - direct R actuator; closed screwed in port (top),
F_{SR2} - direct R actuator; closed fitted-in port (bottom).

NOTE:
Ranges 20…100kPa and 180…380kPa are not recommended for mixing function due to high difference between available forces for top and bottom port.

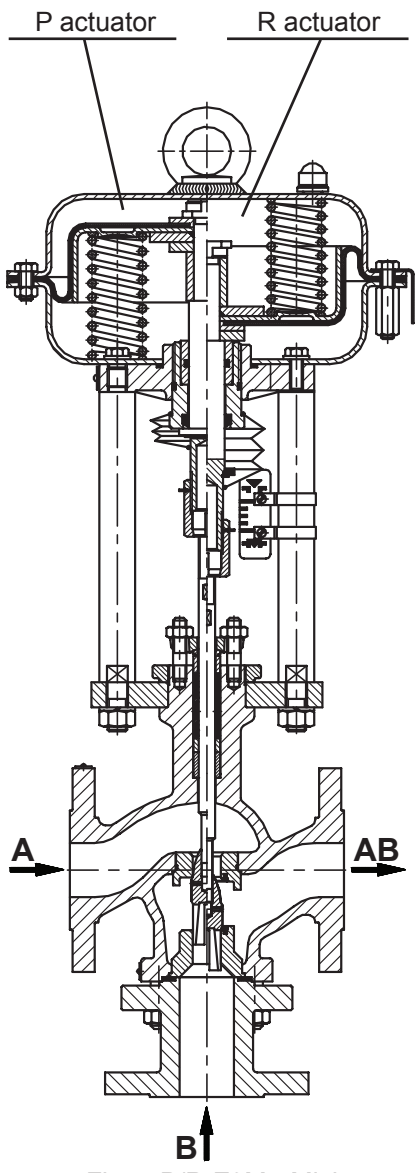


Fig.5. P/R-Z3M - Mixing

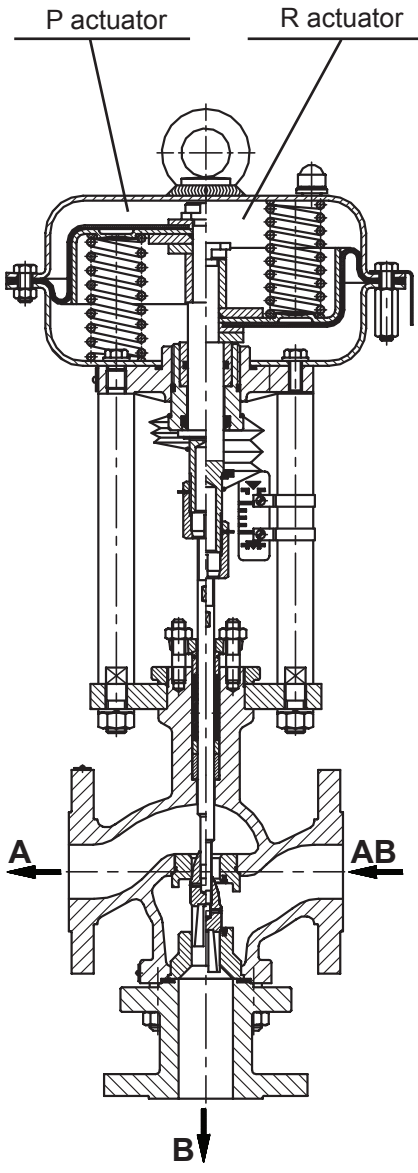


Fig.6. P/R-Z3R – Diverting

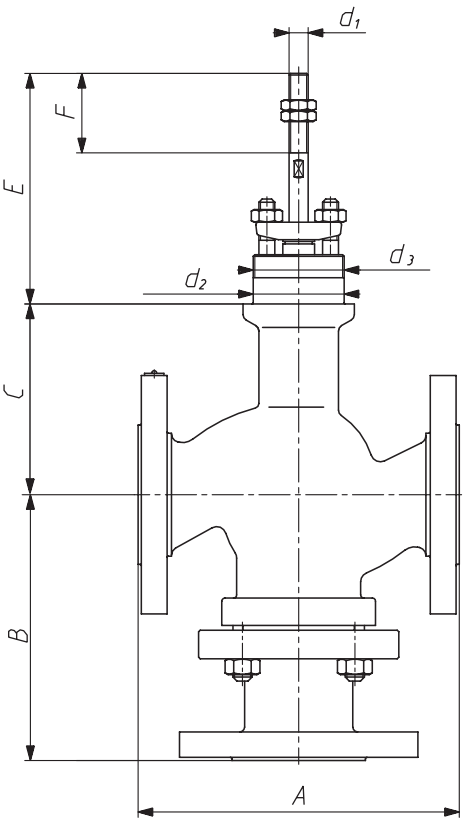


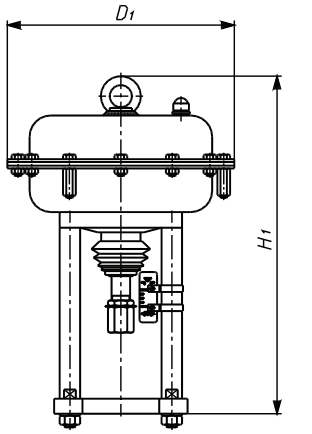
Fig.7. External and connection dimensions

Table 14. Control valves connection dimensions

Dimensions		Unit	DN									
			15	20	25	32	40	50	65	80	100	150
A	PN10; 16; 25; 40	[mm]	130	150	160	180	200	230	290	310	350	480
	CL150		-	-	184	-	222	254	-	298	352	451
	CL300		-	-	197	-	235	267	-	317	368	473
B		[mm]	140			162		184	215,5	233,5	240	295
C	Standard bonnet	[mm]	97			110	117	128	140	146	171	205
	Extension bonnet		297			310	317	328	340	346	371	405
E [1)]		[mm]	125									195 *)
F		[mm]	50									100
d_1		[mm]	M12x1,25									M16x1,5
d_2		[mm]	57,15									84,15
d_3		-	2 1/4”-16UN2A									3 5/16”-16NS2A
Weight		[kg]	8,5	10,5	12	15	18	26,5	36	55	75	150
[1)] - valve in closed position, fitted-in bottom port; *) - dimension for P/R-1000, for actuators P1/R1 E=125; F=80												
higher nominal dimensions [DN] are available after agreement with the manufacturer												

Table 15. Application of pneumatic actuators

Actuators	DN									
	15	20	25	32	40	50	65	80	100	150
P / R - 250										
P / R - 400										
P / R - 630										
P / R - 1000										



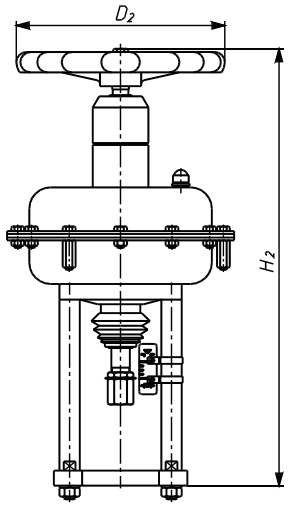


Fig.8. Actuators P/R, PN/RN

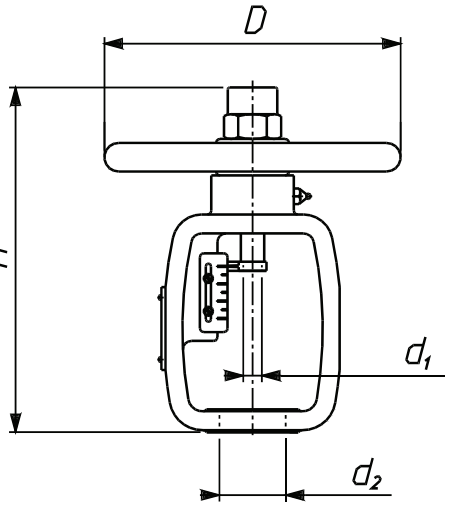


Fig.9.Handwheel type 20

Table 16: Sizes and weights of pneumatic actuators P/R and PN/RN - Fig.6.

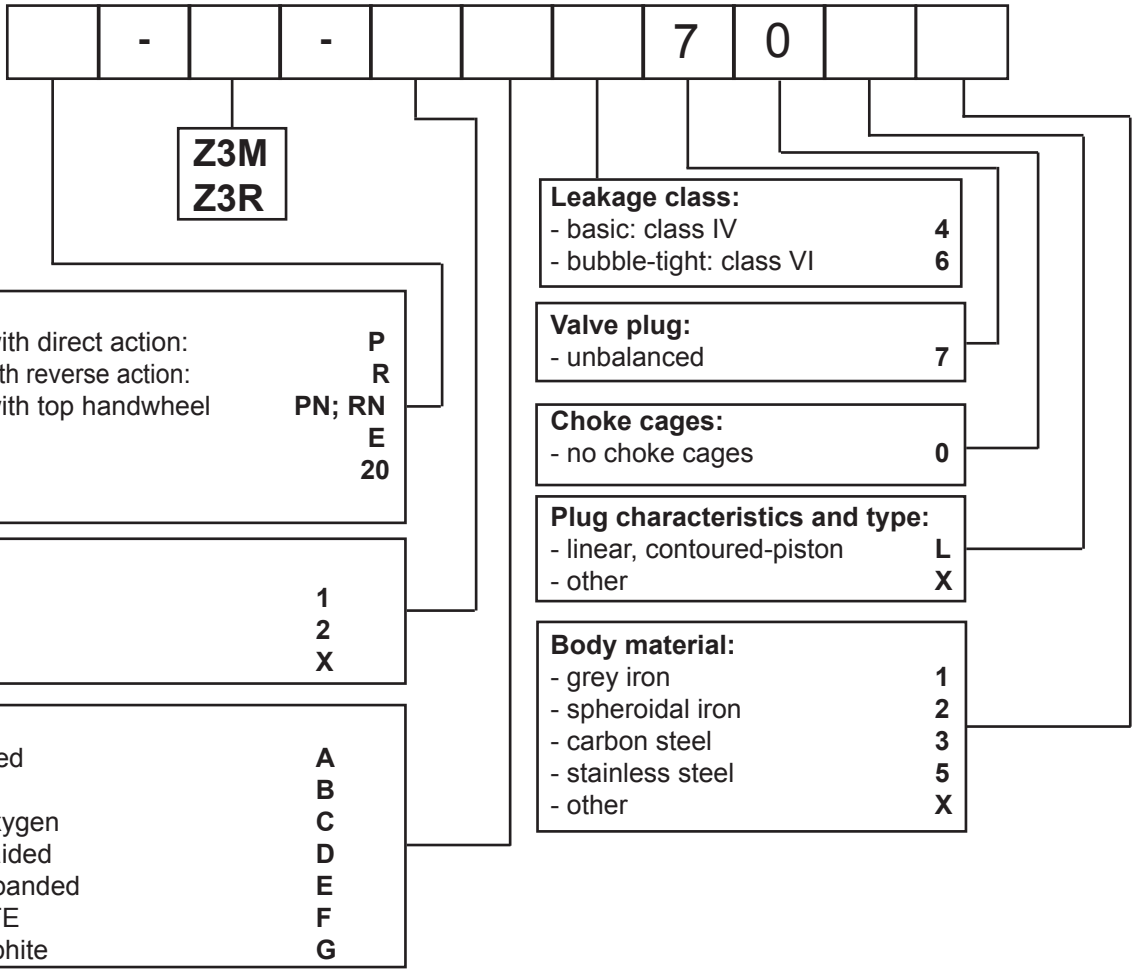
Actuator size	D_1	D_2	H_1	H_2	Weight [kg]	
	mm				P/R	PN/RN
250	240	225	377	474	10	14,5
400	305		385	484	16	20,5
630	375	305	477	574	30	37
1000	477	450	660	835	74	100

Table 17: Types, sizes and weights of handwheels type 20 - Fig.7.

Type	Stroke [mm]	d_1	d_2	H	D	Rev. / stroke	Weight [kg]
20-20-57-M12	20	M12x1,25	57,15	265	228	8	7,5
20-38-57-M12	38				298	15	10
20-38-84-M16		M16x1,5	84,15				
20-50-84-M16	50			385	457	16	16

Marking method:
Example: 20-38-57-M12 - handwheel type 20; stroke 38 mm; d_2=57.15mm; d_1=M12x1.25

CLASSIFICATION AND MARKING:



MARKING EXAMPLE:

Control valve type Z3, mixing function, reverse action pneumatic actuator with top-mounted handweel, extension bonnet, expanded graphite stem seal, leakage class IV, execution in stainless steel:

RN-Z3M-2E470L5

Marking is shown on valve nameplate.

Additional information:
- nominal size [DN],
- nominal pressure [PN],
- max working temperature [TS],
- max working pressure [PS],
- test pressure [PT],
- flow coefficient [Kvs],
- plug stroke [H],
- fluid group [1 or 2],
- serial number and year of manufacture.

ORDERING:

The order should contain all information as per data questionnaire. Full information can be obtained from the Sales and Marketing Department or Technical Department.

Revision: Z3/06/2013
Valid until the next revision.

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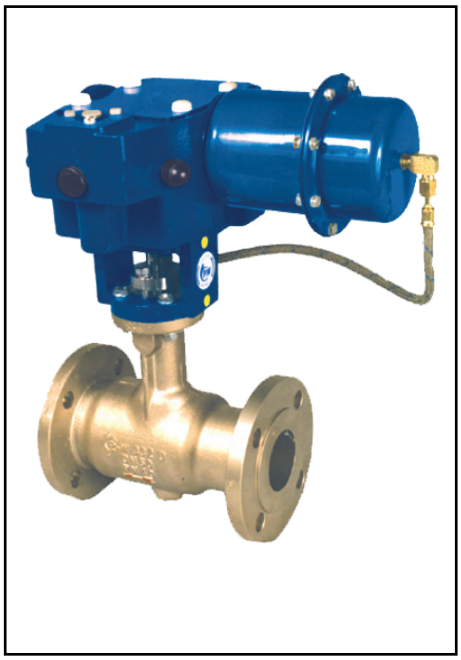
ROTARY PLUG CONTROL VALVES **TYPE Z33®**

APPLICATION AREA:

Rotary plug control valves Z33 represent the design of valves, where change in flow ratio is achieved through eccentrically set rotary plug.
Such structures are particularly useful for control of flow under heavy-duty conditions, with high probability of cavitation and erosion.
High rangeability (200:1) and wide range of material and design variants make them ideal for application in many branches of industry, such as power generation, metallurgy, chemical and petroleum industry, food industry, paper industry, etc.

FEATURES:

- one-piece valve body (cast with bonnet), no static or dynamic sealing except shaft sealing chamber,
- no "detachment effect" between plug and seat,
- ability to change Kv_s without changing plug or seat,
- easy replacement of rotary, symmetrical plug,
- elongated bonnet allows application of double sealing for shaft, meeting "low emission" standards equal to TA-LUFT conditions,
- the same Kv_s coefficients for "hard" and "soft" seats,
- leakage class less than 0.01%Kvs for "hard" seats (metal-metal),
- same flow direction for "hard" and "soft" seats,
- valve-actuator connection accessible from outside, which allows pivoting actuator to valve axis by 90° increments,
- special executions: with heat jacket, erosion-proof, for crystallizable media.



DESIGN AND TECHNICAL SPECIFICATION:

Body (1) flanged or flangeless, cast in cast steel
Nominal sizes: DN 25; 40; 50; 80; 100; 150; 200; 250; 300
Nominal pressures: PN10; 16; 25; 40 (as per PN-EN 1092-1:2006); CL150; CL300 (as per PN-EN 1759-1:2005).

Steel flanges CL150; CL300 are so designed that they can be assembled with flanges executed per American standards ANSI/ASME B16.5 and MSS SP44. In American standards flanges are identified with nominal values in "Classes", to which nominal pressure (PN) values as per PN-ISO 7005-1:2002 correspond.
Equivalent identification as per PN are: CL150: PN 20 and CL300: PN 50.

Table 1. Nominal pressures and end connections

Nominal pressure	Facing of flange types			
	Raised face	Groove	Recess	Ring-joint
	Identification			
PN10; 16; 25; 40	B [2)]	D	F	-
CL150		-	-	J (RTJ)
CL300		DL (D1 [1)])	F (F1)	

[1)] - only for CL300; [2)] - B1 – (Ra=12.5 mm, concentric surface structure "C"), B2 – (Ra as agreed with the customer);
() - identification of connections as per ASME B16.5

Possible execution of flanges per specification and indicated standards

Z33® is a trademark registered with Republic of Poland Patent Office.

Face-to-face dimensions:
a) flanged valves — as per PN-EN 60534-3-1:2000; Table 1, Series 1
as per ANSI B16.10:1992; Table 1 i 2, Series 19
b) flangeless (sandwich) — as per PN-EN 60534-3-2:2002

Bridge (2) functions as rotary closure, cast in grey iron or steel (welded),

Valve plug (3) working piece in the form of globe section:

- flow characteristics: - linear (L)
  - equal percentage (P) only with positioner
- rangeability: 200 : 1

Valve seat (4) loosely resting in body opening; susceptible to fitting to spherical cap of valve plug
- hard
- soft (with PTFE sealing)

Leakage class:
- basic: class IV as per PN-EN 60534-4 - metallic seat
- bubble-tight: class VI as per PN-EN 60534-4 - soft seat

Screw plug (5) fixing seat to body (medium flow direction „**under plug”**); in special executions its function is preventing erosion (medium flow direction „**above plug”**)

Shaft (6) transmits torque from actuator to valve plug: burnished, with polished sealing interface.

Guiding sleeves of plug (7) and shaft (8) - function as slide bearings; surface hardened (CrN coating) or PTFE coated

Packing (9) -packing kits formed in various materials (PTFE-V; PTFE+graphite; braided or expanded graphite); special “low emission” kit, with follower sprigs TA-LUFT.

Table 2. Packing types with application ranges.

Packing	Nominal pressure PN / CL	Temperature [˚C]
PTFE - V	PN10 - 40 CL150; CL300	-46…+200
PTFE + Graphite		
PTFE - V / TA-LUFT		
Graphite		+200…+250 (+200…+450)*
Graphite / TA-LUFT		
* - drive retracted from valve (extended yoke)		

Table 3…7. Allowable working overpressure for materials at proper temperatures.

Table 3. Material: GP240GH (1.0619) wg PN-EN 10213-2

PN / CL	Norma	Temperature [˚C]							
		-10…50	100	150	200	250	300	350	400
		Dopuszczalne ciśnienie robocze [bar]							
PN10	PN-EN 1092-1	10	9,2	8,8	8,3	7,6	6,9	6,4	5,9
PN16		16	14,8	14	13,3	12,1	11	10,2	9,5
CL150	PN-EN 1759-1	17,3	15,4	14,6	13,8	12,1	10,2	8,4	6,5
PN25	PN-EN 1092-1	25	23,2	22	20,8	19	17,2	16	14,8
PN40		40	37,1	35,2	33,3	30,4	27,6	25,7	23,8
CL300	PN-EN 1759-1	45,3	40,1	38,1	36	32,9	29,8	27,8	25,7

Table 4. Material: GX5CrNiMo 19-11-2 (1.4408) wg PN-EN 10213-4

PN / CL	Norma	Temperature [˚C]									
		-10…50	100	150	200	250	300	350	400	425	450
		Allowable working pressure [bar]									
PN10	PN-EN 1092-1	10	10	9	8,4	7,9	7,4	7,1	6,8	-	6,7
PN16		16	16	14,5	13,4	12,7	11,8	11,4	10,9	-	10,7
CL150	PN-EN 1759-1	17,9	16,3	14,9	13,5	12,1	10,2	8,4	6,5	5,6	4,7
PN25	PN-EN 1092-1	25	25	22,7	21	19,8	18,5	17,8	17,1	-	16,8
PN40		40	40	36,3	33,7	31,8	29,7	28,5	27,4	-	26,9
CL300	PN-EN 1759-1	46,7	42,5	38,9	35,3	32,9	30,5	28,8	27,6	27,2	26,9

Table 5. Material: G20Mn5 (1.6220) wg PN-EN 10213-3

PN / CL	Norma	Temperature [˚C]					
		-40	100	150	200	250	300
		Allowable working pressure [bar]					
PN10	-	6	6	3,8	3,6	3,48	3,4
PN16		16	16	10,1	9,6	9,28	9,07
PN25		25	25	15,8	15	14,5	14,2
PN40		40	28	28	27	26	25

Table 6. Material: WCB wg ASTM A216

PN / CL	Norma	Temperature [˚C]								
		-10…50	100	150	200	250	300	350	375	400
		Allowable working pressure [bar]								
PN10	EN 1092-1	10	10	9,7	9,4	9	8,3	7,9	7,7	6,7
PN16		16	16	15,6	15,1	14,4	13,4	12,8	12,4	10,8
CL150	PN-EN 1759-1	19,3	17,7	15,8	14	12,1	10,2	8,4	7,4	6,5
PN25	EN 1092-1	25	25	24,4	23,7	22,5	20,9	20	19,4	16,9
PN40		40	40	39,1	37,9	36	33,5	31,9	31,1	27
CL300	PN-EN 1759-1	50	46,4	45,1	43,9	41,8	38,9	36,9	36,6	34,6

Table 7. Material: CF8M wg ASTM A351

PN / CL	Norma	Temperature [˚C]									
		-10…50	100	150	200	250	300	350	375	400	425	450
		Allowable working pressure [bar]										
PN10	EN 1092-1	8,9	7,8	7,1	6,6	6,1	5,8	5,6	5,5	5,4	5,4	5,3
PN16		14,3	12,5	11,4	10,6	9,8	9,3	9	8,8	8,7	8,6	8,5
CL150	PN-EN 1759-1	18,4	16	14,8	13,6	12	10,2	8,4	7,4	6,5	5,6	4,6
PN25	EN 1092-1	22,3	19,5	17,8	16,5	15,5	14,6	14,1	13,8	13,6	13,5	13,4
PN40		35,6	31,3	28,5	26,4	24,7	23,4	22,6	22,1	21,8	21,6	21,4
CL300	PN-EN 1759-1	48,1	42,3	38,6	35,8	33,5	31,6	30,4	29,6	29,3	29	29

NOTES:
1. It is allowed to apply carbon steel and acid proof cast steel for temperatures lower than given in Tables 3...7, provided that working pressure is reduced respectively, working temperature impact tests are performed and cast is heat treated. Details are to be consulted with manufacturer.
2. Working pressure for intermediate temperature values can be calculated by interpolation.

Table 8. Listing of components with materials

Item	Component	Materials				
1.	Body	GP240GH; (1.0619)	WCB	G20Mn5 ; (1.6220)	GX5CrNiMo 19-11-2; (1.4408)	CF8M
2.	Bridge					
3.	Plug	X6CrNiMoTi 17-12-2 (1.4571); X6CrNiMoTi 17-12-2+ stellite X2CrNiMoTi 17-12-2 (1.4404); X2CrNiMoTi 17-12-2+stellite				
4a.	Metallic seat	X6CrNiMoTi 17-12-2 (1.4571); X6CrNiMoTi 17-12-2+stellite X2CrNiMoTi 17-12-2 (1.4404); X2CrNiMoTi 17-12-2+stellite				
4b.	Soft seat	X6CrNiMoTi 17-12-2+PTFE; X2CrNiMoTi 17-12-2+PTFE				
5.	Screw plug	X6CrNiMoTi 17-12-2 (1.4571)				
6.	Shaft					
7.	Guiding sleeve	X6CrNiMoTi 17-12-2 (1.4571)+CrN				
8.	Shaft sealing	X6CrNiMoTi 17-12-2+PTFE				
9.	Packing kit	PTFE-V; PTFE+graphite; GRAPHITE				
10a ,10b	Sealing ring	FKM				
11.	Sweep ring	VMQ				
12.	Disk spring	12R10 (SANDVIK)				
13.	Spacer sleeve	X6CrNiMoTi 17-12-2 (1.4571)				
14.	Lubricating sleeve					
15.	Follower sleeve					
16.	Pressing lever	X6CrNiMoTi 17-12-2 (1.4571) ;GX5CrNiMo 19-11-2 (1.4408)				
17.	Cylindrical pin	X6CrNiMoTi 17-12-2 (1.4571)				
18.	Conical pin					
19.	Stud bolt	8.8			A4-70	
20	Nut	8			A4-70	

Material relevant standard	
Material	Standard
GP240GH (1.0619)	PN-EN 10213-2
WCB	ASTM A 216
GX5CrNiMo19-11-2 (1.4408)	PN-EN 10213-4
CF8M	ASTM A 351
X6CrNiMoTi 17-12-2 (1.4571)	PN-EN 10088
X2CrNiMoTi 17-12-2 (1.4404)	PN-EN 10088

NOTES

- Spare part

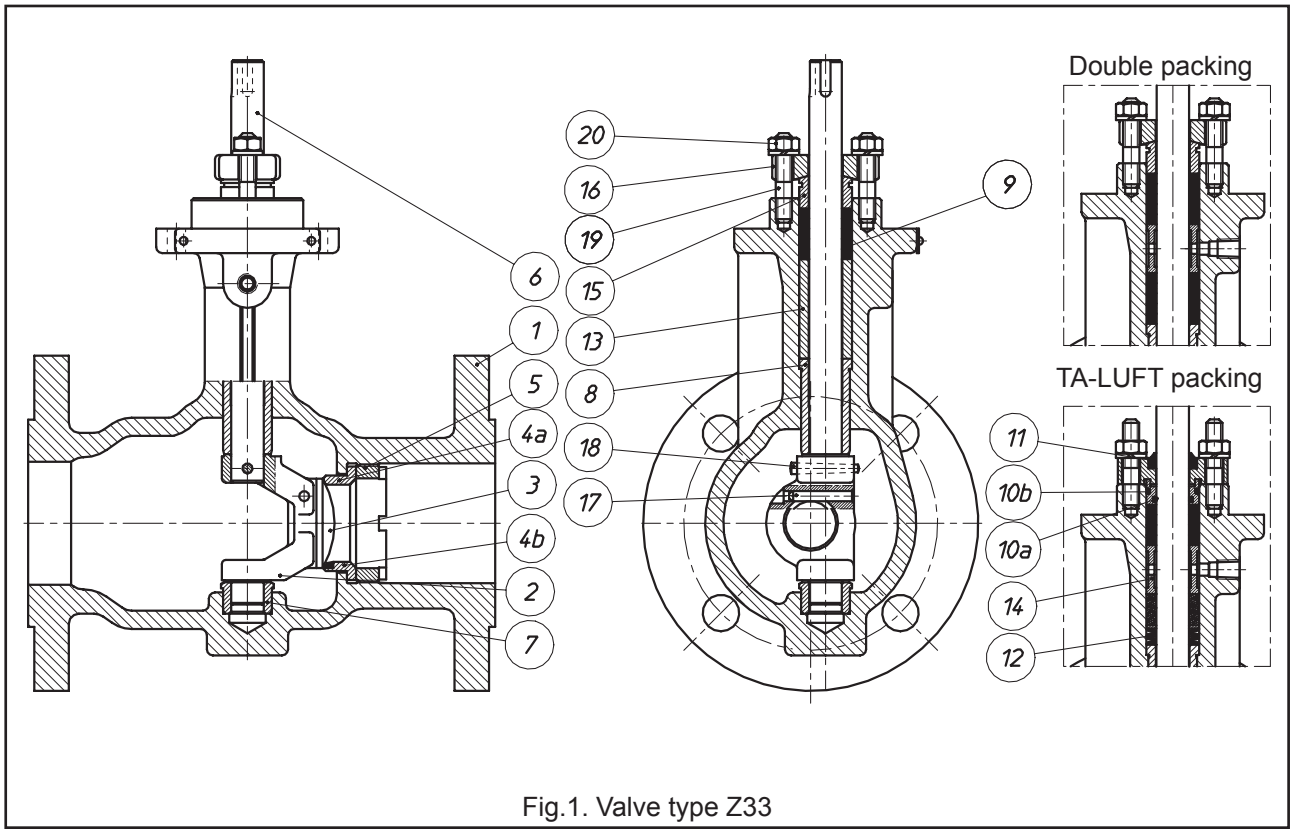


Fig.1. Valve type Z33

Kv_s FLOW RATIOS AND PRESSURE DROPS Δp

Table 9. Metallic seat (leakage class IV); reverse action actuator (air-to-open)

Actuator type						R99-1-R [120 cm²]		R99-2-R [240 cm²]		R99-3-R [780 cm²]	
Spring range [kPa]						100-200	160-320	80-160	160-320	100-200	160-320
DN	Kv_S 100%	Kv_S 75%	Kv_S 45%	Kv_S** 120%	Seat dia. [mm]	Maximum pressure drop [bar]					
25	15	11	7	18	18	50*	-	-	-	-	-
25	6	5	3	7	12	50*	-	-	-	-	-
40	40	30	18	48	28,5	50*	-	-	-	-	-
40	16	12	7	19	20	50*	-	-	-	-	-
50	60	45	27	72	38	50*	-	-	-	-	-
50	24	18	11	29	26	50*	-	-	-	-	-
80	150	113	68	180	58	11	32	50*	50*	-	-
80	60	45	27	72	38	33	50*	50*	50*	-	-
100	240	180	108	288	72	2	13	27	50*	-	-
100	96	72	43	115	48	11	36	50*	50*	-	-
150	500	375	225	600	110	-	-	9	23	50*	50*
150	200	150	90	240	72	-	-	25	50*	50*	50*
200	800	600	360	960	136	-	-	-	13	44	50*
200	320	240	144	384	88	-	-	-	37	50*	50*
250	1250	938	563	1500	170	-	-	-	5	20	45
250	500	375	225	600	110	-	-	-	17	50*	50*
300	1800	1350	810	2160	200	-	-	-	2	12	28
300	720	540	324	864	126	-	-	-	10	34	50*

Table 10. Soft seat (leakage class VI); reverse action actuator (air-to-open)

Actuator type						R99-1-R [120 cm²]		R99-2-R [240 cm²]		R99-3-R [780 cm²]	
Spring range [kPa]						100-200	160-320	80-160	160-320	100-200	160-320
DN	Kv_S 100%	Kv_S 75%	Kv_S 45%	Kv_S** 120%	Seat dia. [mm]	Maximum pressure drop [bar]					
25	15	11	7	18	18	50*	-	-	-	-	-
25	6	5	3	7	12	50*	-	-	-	-	-
40	40	30	18	48	28,5	50*	-	-	-	-	-
40	16	12	7	19	20	50*	-	-	-	-	-
50	60	45	27	72	38	50*	-	-	-	-	-
50	24	18	11	29	26	50*	-	-	-	-	-
80	150	113	68	180	58	14	35	50*	50*	-	-
80	60	45	27	72	38	38	50*	50*	50*	-	-
100	240	180	108	288	72	5	16	30	50*	-	-
100	96	72	43	115	48	15	40	50*	50*	-	-
150	500	375	225	600	110	-	-	10	25	50*	50*
150	200	150	90	240	72	-	-	28	50*	50*	50*
200	800	600	360	960	136	-	-	-	15	38	50*
200	320	240	144	384	88	-	-	-	39	50*	50*
250	1250	938	563	1500	170	-	-	-	6	18	39
250	500	375	225	600	110	-	-	-	19	48	50*
300	1800	1350	810	2160	200	-	-	-	3	11	25
300	720	540	324	864	126	-	-	-	11	30	50*

* - Do not exceed nominal pressure

** - For 120% setting it is recommended that listed pressure drops are reduced

In Tables 9...10, theoretical acceptable pressure drops are included. Actual pressure drops with consideration of tolerance of spring manufacture and friction of internal parts of the actuator are lower than those given by 20%. Pressure drops chosen that way guarantee internal tightness of closing of the valves.Calculated ratios:

$$F_L=0{,}854,\quad X_T=0{,}6,\quad F_D=0{,}7,\quad xF_Z=0{,}58$$

Table 11. Metallic seat (leakage class IV); direct action actuator (air-to-close)

Actuator type						P99-1-P [120 cm²]		P99-2-P [240 cm²]		P99-3-P [780 cm²]	
Voltage pressure [kPa]						240	400	240	400	240	400
DN	Kv_S 100%	Kv_S 75%	Kv_S 45%	Kv_S** 120%	Seat dia. [mm]	Maximum pressure drop [bar]					
25	15	11	7	18	18	50*	50*	-	-	-	-
25	6	5	3	7	12	50*	50*	-	-	-	-
40	40	30	18	48	28,5	50*	50*	-	-	-	-
40	16	12	7	19	20	50*	50*	-	-	-	-
50	60	45	27	72	38	50*	50*	-	-	-	-
50	24	18	11	29	26	50*	50*	-	-	-	-
80	150	113	68	180	58	11	50*	50*	50*	-	-
80	60	45	27	72	38	33	50*	50*	50*	-	-
100	240	180	108	288	72	2	24	27	50*	-	-
100	96	72	43	115	48	11	50*	50*	50*	-	-
150	500	375	225	600	110	-	-	9	38	50*	50*
150	200	150	90	240	72	-	-	25	50*	50*	50*
200	800	600	360	960	136	-	-	-	23	44	50*
200	320	240	144	384	88	-	-	-	50*	50*	50*
250	1250	938	563	1500	170	-	-	-	10	20	50*
250	500	375	225	600	110	-	-	-	29	50*	50*
300	1800	1350	810	2160	200	-	-	-	5	12	44
300	720	540	324	864	126	-	-	-	17	34	50*

Table 12. Soft seat (leakage class VI); direct action actuator (air-to-close)

Actuator type						P99-1-P [120 cm²]		P99-2-P [240 cm²]		P99-3-P [780 cm²]	
Voltage pressure [kPa]						240	400	240	400	240	400
DN	Kv_S 100%	Kv_S 75%	Kv_S 45%	Kv_S** 120%	Seat dia. [mm]	Maximum pressure drop [bar]					
25	15	11	7	18	18	50*	50*	-	-	-	-
25	6	5	3	7	12	50*	50*	-	-	-	-
40	40	30	18	48	28,5	50*	50*	-	-	-	-
40	16	12	7	19	20	50*	50*	-	-	-	-
50	60	45	27	72	38	50*	50*	-	-	-	-
50	24	18	11	29	26	50*	50*	-	-	-	-
80	150	113	68	180	58	14	50*	50*	50*	-	-
80	60	45	27	72	38	38	50*	50*	50*	-	-
100	240	180	108	288	72	5	27	30	50*	-	-
100	96	72	43	115	48	15	50*	50*	50*	-	-
150	500	375	225	600	110	-	-	10	40	50*	50*
150	200	150	90	240	72	-	-	28	50*	50*	50*
200	800	600	360	960	136	-	-	-	50*	38	50*
200	320	240	144	384	88	-	-	-	50*	50*	50*
250	1250	938	563	1500	170	-	-	-	11	18	50*
250	500	375	225	600	110	-	-	-	30	48	50*
300	1800	1350	810	2160	200	-	-	-	6	11	50*
300	720	540	324	864	126	-	-	-	19	30	50*

* - Do not exceed nominal pressure

** - For 120% setting it is recommended that listed pressure drops are reduced

In Tables 11...12, theoretical acceptable pressure drops are included. Actual pressure drops with consideration of tolerance of spring manufacture and friction of internal parts of the actuator are lower than those given by 20%. Pressure drops chosen that way guarantee internal tightness of closing of the valves.Calculated ratios:

$$F_L=0,854,\quad X_T=0,6,\quad F_D=0,7,\quad xF_Z=0,58$$

VALVE DRIVES

Rotary pneumatic valves, diaphragm and spring type P/R - 99, with or without a handwheel - special design to drive Z33 valves.

Table 13. Types of rotary pneumatic acutators .

Size	Diaphragm effective area [cm ^{2}]	Spring range [kPa]	Rotation angle of output element (crankshaft)
P/R 99-1	120	100…200, 160…320	25^0- 45^0 - 60^0 - 90^0
P/R 99-2	240	80…160, 160…320	
P/R 99-3	780	100…200, 160…320	

ACTUATOR CHARACTERISTICS:

- total reversibility of action, allowing change in function from “air-to-close - P” to “air-to-open - R”, with no extra parts,
- ability to mount actuator on valve, in various positions, pivotting with 90° increments,
- option with a handwheel,
- fixed diaphragm effective area, ensuring linear movement to pressure ratio,
- optional NAMUR connections.

DESIGN AND TECHNICAL SPECIFICATION OF ACTUATOR:

Body (21) - among the basic components of actuator, designed to hold and assemble other components; executed in grey or spheroidal iron.

Yoke (28) - connects valve to actuator; executed in grey iron or pressed in steel sheets and welded.

Diaphragm (25) and spring (26) case - make a pressure chamber and springs case; executed as steel die; welded or cast in spheroidal iron.

Diaphragm (31) - executed in acrylic-butadiene rubber (NBR); reinforced with nylon insert.

Diaphragm plate (24) - formed in plastic or cast in aluminum alloy.

Lever (22) - transmits plane motion of membrane unit to rotary movement of crankshaft; executed in spheroidal cast-iron.

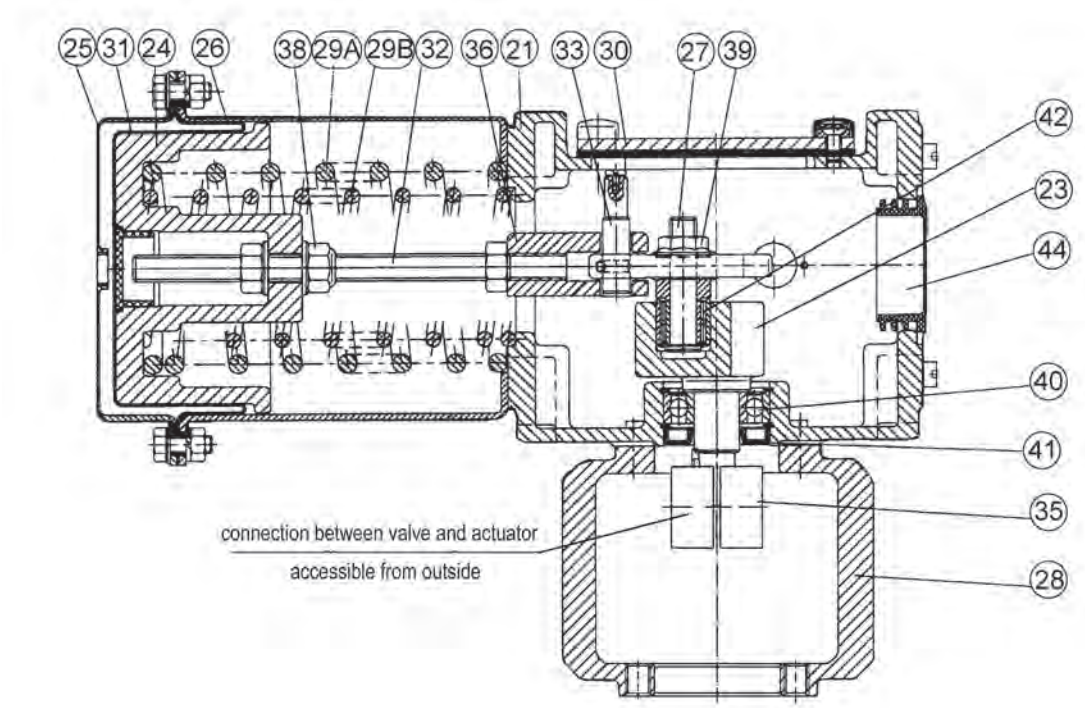
Crankshaft (23) - in connection with lever makes an output (driving) element of actuator in the form of rotating pin with key grooves; cast in alloy steel and heat processed.

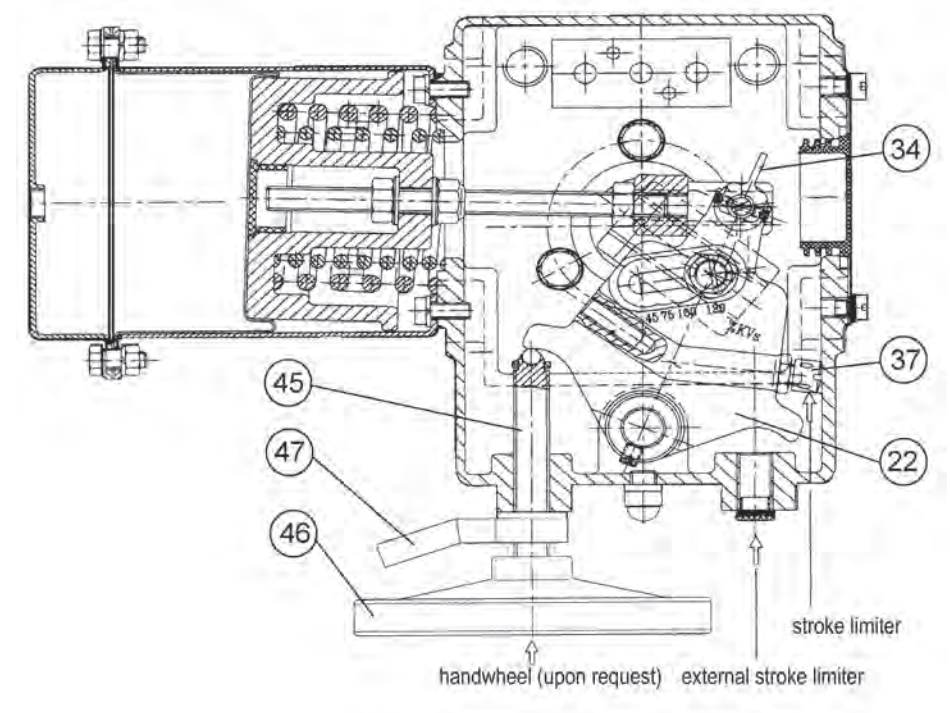
Spring (29) - executed in construction spring steel; 2 springs for range 160 - 320 kPa.

Bearing pin (27) - connects lever and crankshaft; in special execution (extended) projects from the body and connects actuator to accessories (positioner, limit switches, etc.); executed in alloy steel (stainless steel).

BASIC TECHNICAL SPECIFICATION OF ACTUATOR:

- maximum supply pressure: 450 kPa
- control air connection: G 1/4”
- connection pipes diameter: ∅6x1 (∅8x1)
- ambient temperature range: - 40°C …+ 80°C
- control pressure change tolerance:
  - with no positioner: 4% of nominal range
  - with positioner: 1.5% of nominal range
- hysteresis deviation:
  - with no positioner: 4% of stroke range
  - with positioner: 1% of stroke range
- dead zone:
  - with no positioner: 2% of nominal pressure range
  - with positioner: 1% of nominal pressure range
- optional accessories (on request):
  - handwheel,
  - positioner,
  - air set,
  - three-way solenoid valve,
  - lock-up valve,
  - limit switches,
  - quick exhaust valve.





No in fig.	Part
21	Body
22	Lever
23	Crankshaft
24	Diaphragm plate
25	Diaphragm case
26	Spring case
27	Bearing pin
28	Yoke
29	Spring (A+B)
30	Front nameplate
31	Diaphragm
32	Screw
33	Fork pin
34	Stroke indicator
35	Connector
36	Fork
37	Stroke limiter
38	Adjusting nut
39	Securing nut
40	Ball bearing
41	Sealing ring
42	Needle bearing
44	Closure plug
45	Handwheel screw
46	Wheel
47	Counterlever

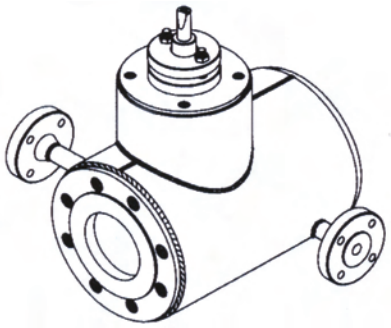
- Spare parts

Fig. 2. Rotary pneumatic actuator (spring and diaphragm) type P/R-99

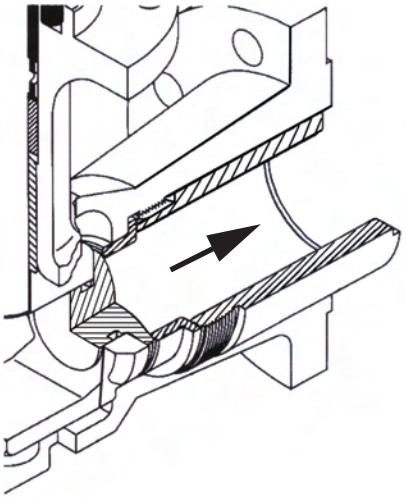
Pneumatic actuators, rotary piston type:
It is possible to apply rotary piston (spring or springless) actuators by any manufacturer, as required. For detailed technical specifications of actuators and completion methods refer to catalog charts.

Electric actuators:
In process installations where no pneumatic actuators can be applied, valves can be driven using electric rotary actuators of various types. For technical specifications refer to separate catalog charts.

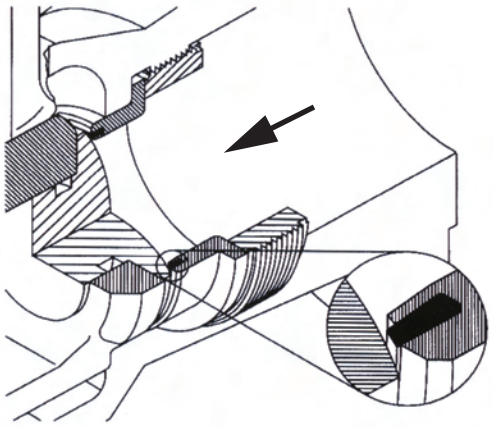
SPECIAL EXECUTIONS:
Valve executions as per Fig.3.



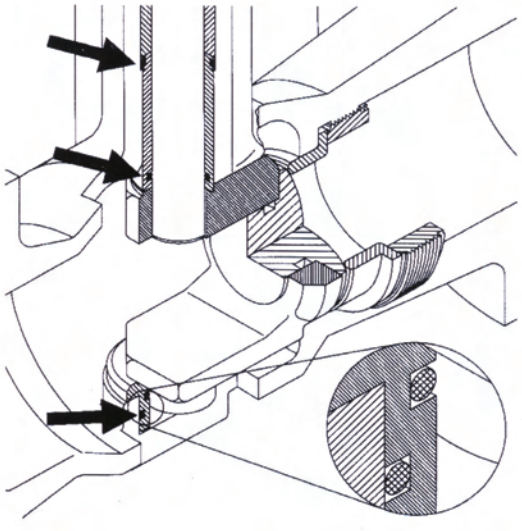
Heat jacket



Plug, seat and extension screw plug - erosion proof execution



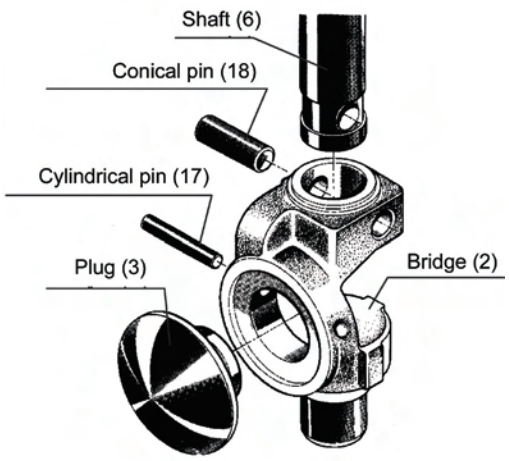
PTFE soft sealing to guarantee bubble tightness (Class VI)



Sealing of guiding sleeves for chloride and crystallizable media

Fig. 3. Special executions of Z33 valve

OPERATION PRINCIPLE (transformation of plane motion to rotary motion)



Adjustment of rotation angle of actuator type 99 (patent pending) via system of two levers. **Lever (22)** attached to **diaphragm (24)** plate always turns by 30°, hence stroke, pressure range and positioner feedback lever position do not change. With change in setting of **bearing pin (27)** turn angle of **crankshaft (23)** (and also valve shaft) changes too, within values 25°, 45°, 60° and 90°, which corresponds with changes in flow ratio values to 45%, 75%, 100% and 120% Kvs. In closed position of valve movement of bearing pin to crankshaft guide at the beginning of lever rotation is parallel, hence closed position of valve is maintained. **Connector (35)**, which connects actuator to valve shaft, allows turning of actuator to valve by each 90°, and since it is accessible from outside it eliminates the need for actuator or valve disassembly. Required position (see Fig.5) can be set by manufacturer as per customer's request.

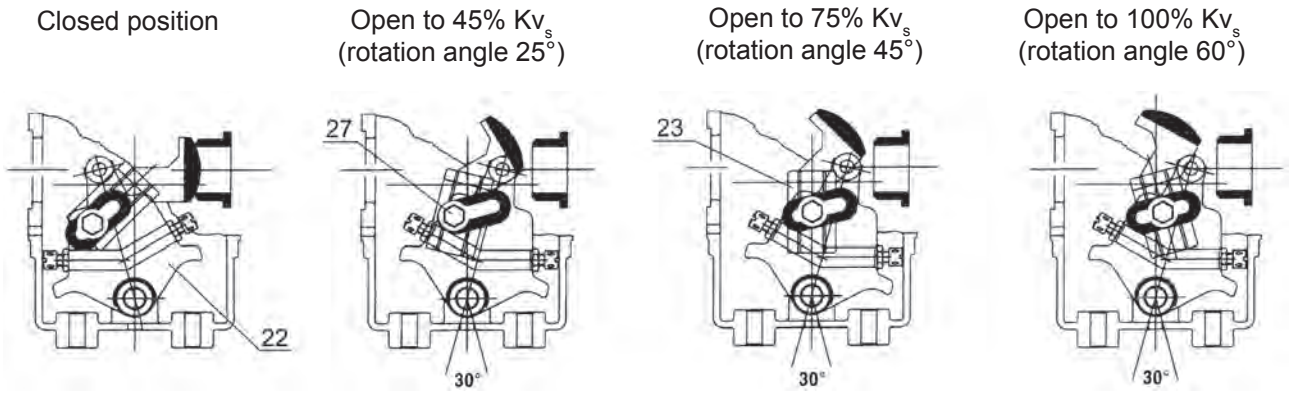


Fig. 4. Bearing pin (27) position on lever (22) regarding crankshaft (23) (valve shaft - Kv_s) rotation angle.

1. Air-to-open mode (fail-to-close position)

2. Air-to-close mode (fail-to-open)

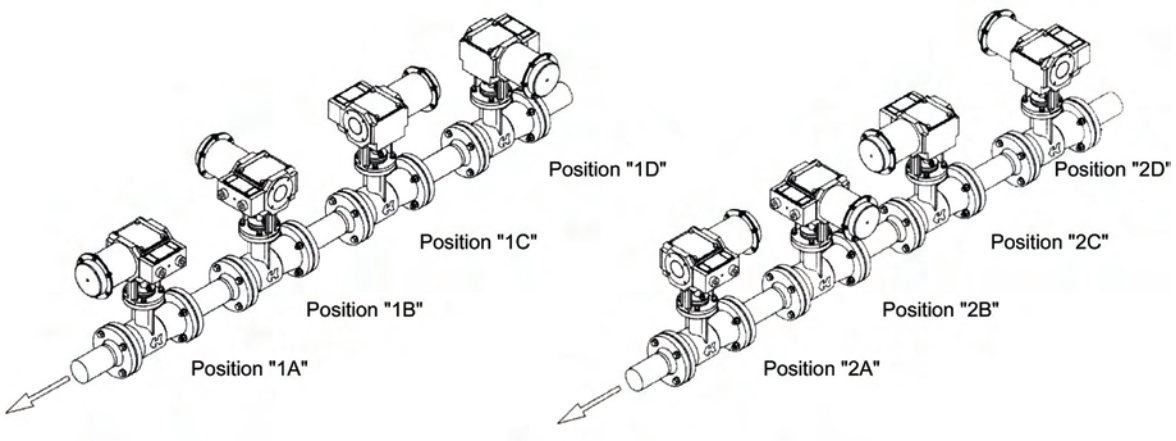


Fig. 5. Possible actuator type P/R-99 positions to valve axis.

EXTERNAL SIZES, END CONNECTION SIZES; WEIGHTS

Table 14. Valve end connection sizes

DN	End connection as per ISO 5211	E	F	G
25…50	F07	83	16	55
80…100	F12	83	16	85
		116	28	
150	F14	113	28	100
		123	36	
200…300	F16	133	28	130
		120	36	

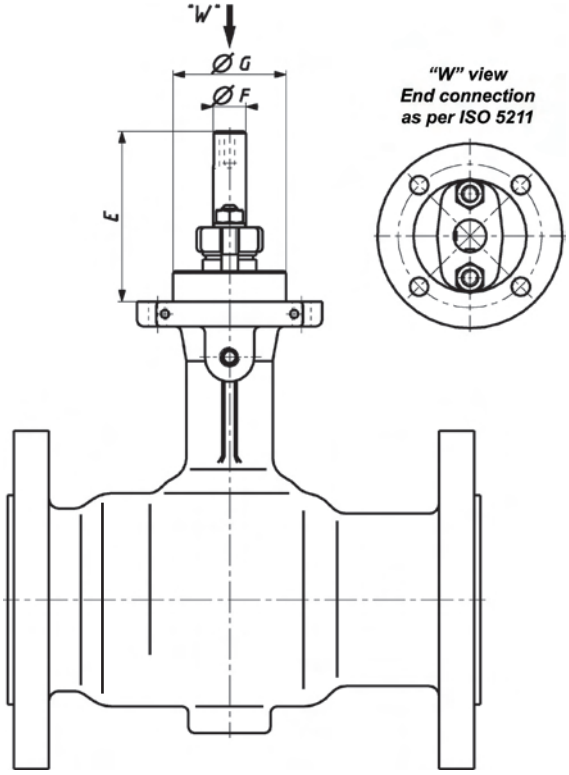


Table 15. Actuator type 99 end connection sizes

Size	End connection as per ISO 5211	L	K	$G^{+0,5}_{+0,3}$	F	S	Weight [kg]
99-1	F07	110	36	55	16	24	18
	F12			85			
99-2	F12	180	60	85	28	60	54
	F14			100			
	F16	200		130			
99-3	F14	200	60	100	36	71	189
	F16			130			

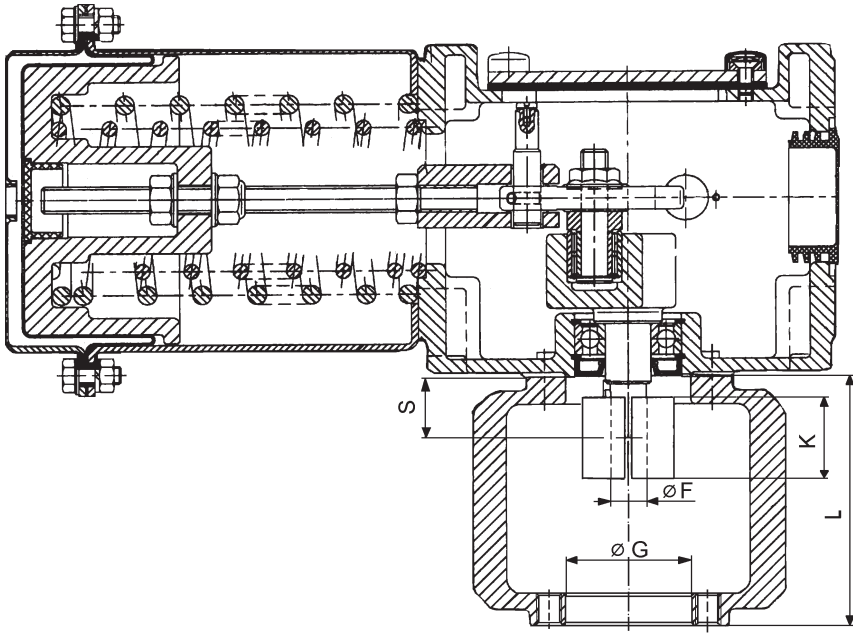
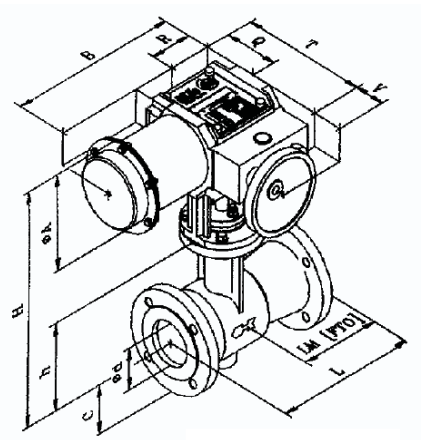
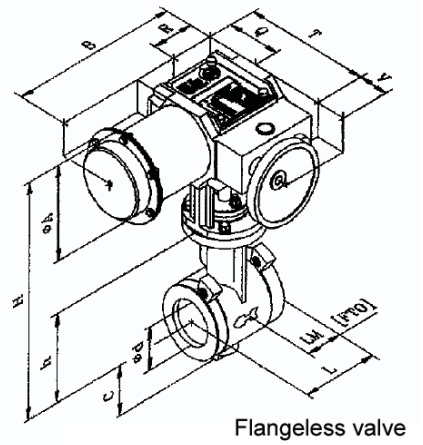


Table 16. Dimensions of valves with actuators type 99

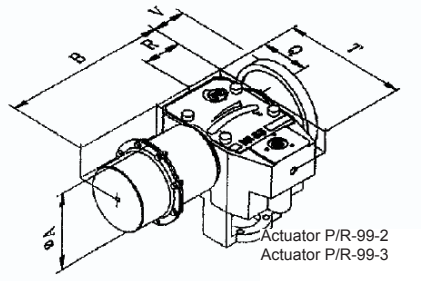
DN	Flanges	Actuator	H [mm]	h [mm]	d [mm]	A [mm]	C [mm]	L [mm]	LM [mm]	B [mm]	R [mm]	Q [mm]	V [mm]	T [mm]	Weight [1] [kg]
25	PN40	99-1	409	134	37	175	55	160	89	274	92	105	90	234	20
25	CL150	99-1	409	134	37	175	55	184	113	274	92	105	90	234	20
25	CL300	99-1	409	134	37	175	55	197	126	274	92	105	90	234	21
25	Sandw.	99-1	409	134	37	175	55	102	60	274	92	105	90	234	18
40	PN40	99-1	415	140	48	175	64	200	115	274	92	105	90	234	22
40	CL150	99-1	415	140	48	175	64	222	137	274	92	105	90	234	22
40	CL300	99-1	415	140	48	175	64	235	150	274	92	105	90	234	23
40	Sandw.	99-1	415	140	48	175	64	114	64	274	92	105	90	234	20
50	PN40	99-1	420	145	60	175	70	230	123	274	92	105	90	234	23
50	CL150	99-1	420	145	60	175	70	255	135	274	92	105	90	234	23
50	CL300	99-1	420	145	60	175	70	267	141	274	92	105	90	234	25
50	Sandw.	99-1	420	145	60	175	70	124	70	274	92	105	90	234	22
80	PN40	99-1	467	192	88	175	90	310	190	274	92	105	90	234	34
80	PN40	99-2	607	192	88	250	90	310	190	573	135	143	75	348	55
80	CL150	99-1	467	192	88	175	90	298	178	274	92	105	90	234	34
80	CL150	99-2	607	192	88	250	90	298	178	573	135	143	75	348	55
80	CL300	99-1	467	192	88	175	90	318	197	274	92	105	90	234	39
80	CL300	99-2	607	192	88	250	90	318	197	573	135	143	75	348	60
80	Sandw.	99-1	467	192	88	175	90	165	92	274	92	105	90	234	31
80	Sandw.	99-2	607	192	88	250	90	165	92	573	135	143	75	348	52
100	PN40	99-1	477	202	107	175	103	350	215	274	92	105	90	234	55
100	PN40	99-2	617	202	107	250	103	350	215	573	135	143	75	348	76
100	CL150	99-1	477	202	107	175	103	353	223	274	92	105	90	234	55
100	CL150	99-2	617	202	107	250	103	353	223	573	135	143	75	348	76
100	CL300	99-1	477	202	107	175	103	368	234	274	92	105	90	234	65
100	CL300	99-2	617	202	107	250	103	368	234	573	135	143	75	348	86
100	Sandw.	99-1	477	202	107	175	103	194	116	274	92	105	90	234	51
100	Sandw.	99-2	617	202	107	250	103	194	116	573	135	143	75	348	72
150	PN40	99-2	699	284	162	250	195	480	270	573	135	143	75	348	100
150	PN40	99-3	789	284	162	430	195	480	270	925	220	230	90	526	190
150	CL150	99-2	699	284	162	250	195	451	241	573	135	143	75	348	100
150	CL150	99-3	789	284	162	430	195	451	241	925	220	230	70	526	190
150	CL300	99-2	699	284	162	250	195	473	263	573	135	143	75	348	114
150	CL300	99-3	789	284	162	430	195	473	263	925	220	230	70	526	204
150	Sandw.	99-2	699	284	162	250	195	229	140	573	135	143	75	348	82
150	Sandw.	99-3	789	284	162	430	195	229	140	925	220	230	70	526	172
200	PN40	99-2	727	312	204	250	216	600	365	573	135	143	75	348	190
200	PN40	99-3	817	312	204	430	216	600	365	925	220	230	70	526	280
200	CL150	99-2	727	312	204	250	216	543	336,5	573	135	143	75	348	180
200	CL150	99-3	817	312	204	430	216	543	336,5	925	220	230	70	526	270
200	CL300	99-2	727	312	204	250	216	568	349	573	135	143	75	348	210
200	CL300	99-3	817	312	204	430	216	568	349	925	220	230	70	526	300
200	Sandw.	99-2	727	312	204	250	216	243	157	573	135	143	75	348	130
200	Sandw.	99-3	817	312	204	430	216	243	157	925	220	230	70	526	220
250	PN40	99-2	751	336	250	250	250	730	430	573	135	143	75	348	230
250	PN40	99-3	841	336	250	430	250	730	430	925	220	230	70	526	320
250	CL150	99-2	751	336	250	250	250	673	401,5	573	135	143	75	348	200
250	CL150	99-3	841	336	250	430	250	673	401,5	925	220	230	70	526	290
250	CL300	99-2	751	336	250	250	250	708	421	573	135	143	75	348	230
250	CL300	99-3	841	336	250	430	250	708	421	925	220	230	70	526	320
250	Sandw.	99-3	841	336	250	430	250	297	190	925	220	230	70	526	230
300	PN40	99-2	769	338	300	250	258	850	553	573	135	143	75	348	430
300	PN40	99-3	859	338	300	430	258	850	553	925	220	230	70	526	520
300	Sandw.	99-2	769	342	300	250	238	338 [2]	197,5	573	135	143	75	348	300
300	Sandw.	99-3	859	342	300	430	238	338 [2]	197,5	925	220	230	70	526	390



Flanged valve
Actuator P/R-99-1



Flangeless valve
"Sandwich"
Actuator P/R-99-1



Actuator P/R-99-2
Actuator P/R-99-3

[1]) - Valve weight (w/o actuators)
[2]) - non-compliant with PN-EN 60534-3-2

CLASSIFICATION AND MARKING:

Actuator unit

Type:	
- pneumatic, rotary, diaphragm-spring, direct action:	P**99**
- pneumatic, rotary, diaphragm-spring, reverse action:	R**99**
- pneumatic, rotary, diaphragm-spring, direct action, with a handwheel:	PN**99**
- pneumatic, rotary, diaphragm-spring, reverse action, with a handwheel:	**RN99**
- pneumatic, piston type:	**PT**
- electric:	**E**

Valve unit

Type:	**Z33**

End connection type:	
- flanged:	**FL**
- flangeless (sandwich):	**SD**

Flow characteristics:	
- linear:	**L**
- equal percentage:	**P**

Leakage class:	
- basic: class IV as per PN-EN 60534-4:	**4**
- blister: class VI as per PN-EN 60534-4:	**6**

MARKING EXAMPLE:

Control valve type Z33, with actuator type 99, reverse action, with no handwheel, flanged, linear characteristics, basic leakage class:

R99 - Z33 - FL - L - 4

Marking is shown on valve nameplate.

Additional information: nominal size (DN), nominal pressure (PN), max working temperature (TS), max working pressure (PS), test pressure (PT), flow ratio (Kvs), plug stroke fluid group (1), serial number / year of manufacture.

MARKING OF ACTUATOR TYPE 99:

Type:

Actuator types:	
- direct action actuator, with no handwheel:	**P**
- direct action actuator, with handwheel:	**PN**
- reverse action actuator, with no handwheel:	**R**
- reverse action actuator, with handwheel:	**RN**

Diaphragm effective area:	
- 120 cm²	**1**
- 240 cm²	**2**
- 780 cm²	**3**

Spring range:	
- 80…160 kPa:	**1**
- 160…320 kPa:	**2**
- 100…200 kPa:	**3**

End connection as per ISO 5211:

- F07; F12; F14; F16.

MARKING EXAMPLE:

Pneumatic actuator type 99, diaphragm effective area: 240 cm²; simple action, with handwheel, spring range 80…160 kPa; end connection F12:

PN-99 - 2 - 1 - F12

ORDERING

The order should contain all information as per data questionnaire. Full information can be obtained from the Sales and Marketing Department or Technical Department.

Revision: Z33/06/2013
Valid until the next revision.

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ROTARY PLUG CONTROL VALVES **TYPE Z33®** WITH ELECTRIC AND PISTON ACTUATORS

APPLICATION AREA:

The rotary plug control valves type Z33 have already been manufactured for coupling with diaphragm-type spring-loaded rotary pneumatic actuators type P/R-99. The presented solutions are intended to expand the offer of acutation to cover rotary pneumatic actuators and electric motors that are available on the market in abundant diversity and used by a number of manufacturers.

FEATURES:

- capable to incorporate alternative drives manufactured with connecting ports to ISO 5211,
- wide series of design types and variations,
- extensive offer of additional equipments and accessories,
- wide range of torque values,
- small dimensions,
- cost effectiveness in relation to technical performances.

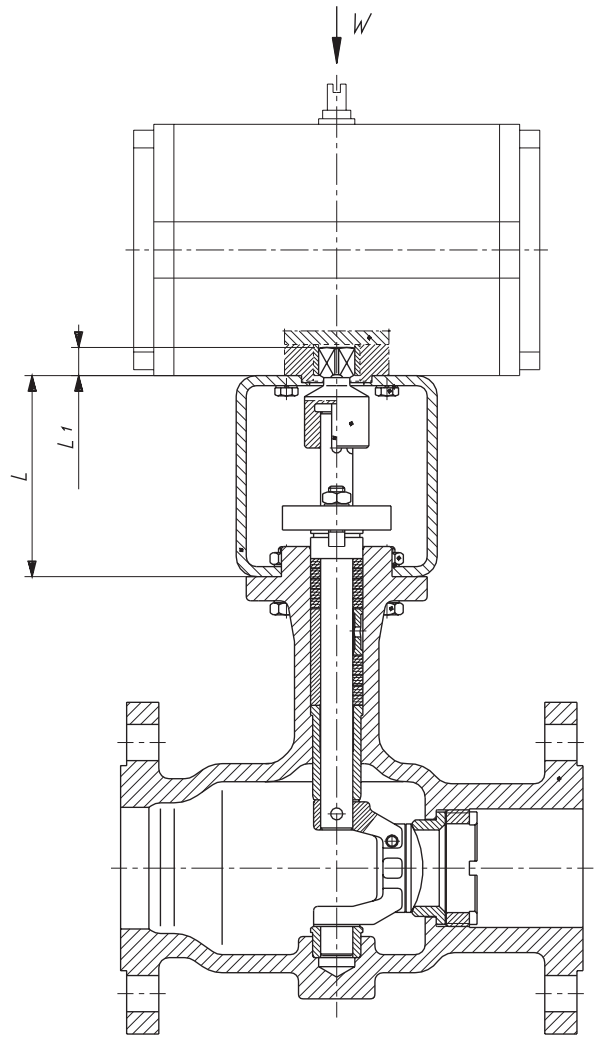
TECHNICAL PARAMETERS OF VALVES:
The valve with a rotary plug and a one-piece body, type BR 33.
Sizes: DN 25; 40; 50; 80; 100; 150; 200; 250; 300.
Pressure ranges and connection ports:
PN10…40; CL150; 300 - with flanges
CL300 - without flanges (sandwich type).
Flow coefficient Kvs: 3...1800.
Materials: body: carbon steel GP240GH (1.0619), G20Mn5 (1.6220)
stainless steel GX5CiNiMo 19-11-2 (1.4408)
interanal parts: X6CrNiMo 17-12-2 (1.4571).
Temperature: -40...+250 [°C] (option +450 [°C]).

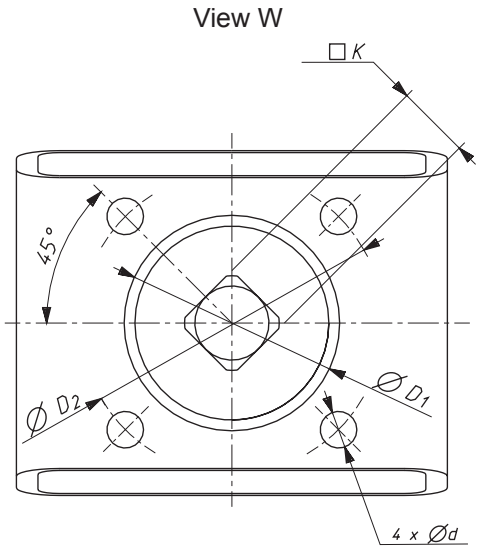
Please refer to the data sheet "GLOBE VALVES WITH ROTARY PLUG TYPE BR 33" for further information.

ROTARY PISTON PNEUMATIC ACTUATION (AT SERIES):
Design options:
- double action,
- single action (sprig-loaded to return to the initial position).

Maximum torque for individual ports to ISO 5211:
Type: F 05 - 125 [Nm],
F 07 - 250 [Nm],
F 12 - 1000 [Nm],
F 14 - 2000 [Nm]
F 16 - 4000 [Nm].
Control pressure: 300 do 800 [kPa].
Ambient temperature: -20...+80 [°C] (other temperature ranges upon agreement)
Control utilities: purified and dried compressed air, natural gases
Rotation angle: 90°

Z33® is a trademark registered with Republic of Poland Patent Office.





DN	Port type	D_1	D_2	d	L	L_1	K
25...50	F 05	35	50	7	100	15	14
	F 07	55	70	9		18	17
80...100	F 12	85	125	13	130	22	27
150					140		
	F14	100	140	17		37	36
200...300					140		
	F 16	130	165	22		48	46

Fig. 1. Dimensional drawing for connections

DIMENSIONS FOR ASSEMBLY WITH A ROTARY ELECTRIC DRIVING UNIT:

Power supply:	230V AC; 24V AC; 3x400 V.
Control signal:	0 - 10 V; 2 - 10 V; 0 - 20 mA; 4 - 20 mA.
Design options:	• infinite control, • On/Off.
Maximum torque:	as per pneumatic actuators.
Rotation angle:	90°
Ambient temperature:	-20...+60°C (other temperature ranges upon agreement).
Additional equipment (optional) :	torque switches, limit switches, position transmitters of current or potentiometer types, position indicator, manual override.

Please refer to the data sheets provided by manufacturers of driving units for more detailed information.

PERMISSIBLE PRESSURE DROPS:

Permissible pressure drops across the closed valve depend on the following factors:
- available torque of the actuator,
- nominal diameter of the valve DN,
- orifice seat diameter D,
- type of valve seat closing (”metal” – “soft”)

According to recommendations of actuator manufacturers the 25% surplus of available torque was adopted.

where:

$$\Delta p = \frac{10 \cdot (0,75 M_d - K)}{C}$$

- Δp [bar] - maximum permissible pressure drop across the closed valve,
- M_d [Nm] - maximum available torque of the actuator at the border position (valve closed),
- D [mm] - internal diameter of the valve seat,
- C - coefficient that depends on relation between valve and seat diameters (full or reduced flow), in accordance to Table 2,
- K - coefficient that depends on valve diameter and its closing type in accordance to Table 2,
- $K=K_1$ - "metal to metal" closing (hard/metal seated valve - leakage class IV to PN-EN 60534-4),
- $K=K_2$ - "metal to PTFE" closing (soft seated valve - leakage class VI to PN-EN 60534-4).

Tabel 2 Calculation coefficients

Example 1:

DN	25		40		50		80		100		150		200		250		300	
D	12	18	20	28,5	26	38	38	58	48	72	72	110	88	136	110	170	126	200
C	0,45	1,03	2,2	4,6	3,9	8,2	11,5	26,9	23,5	52,9	72	169	131	312	253	635	390	980
K_1 (metal-metal)	0,82	1,23	2,3	2,9	2,9	4,4	6,1	9,2	10,4	14,3	19,6	32	30,1	47,3	48	74,8	62	100
K_2 (metal-PTFE)	1,23	2,05	3,5	4,6	5,1	7,3	10,2	15,3	16,9	24,7	33,8	52	49,5	77,4	77	123	106	165

What is the pressure drop across the valve Z33, with DN 100, PN40 full flow, soft seated, with the actuator type AP6SR from SIRCA, single-acting, 6 springs on each side of the actuator and closing torque of the actuator 354 Nm?

M_d = 354 Nm ; K = K_2 = 24,7 ; C = 52,9

$$\Delta p = \frac{10 \cdot (0,75 \cdot 354 - 24,7)}{52,9} = 45,5 \text{ [bar]}$$

As the rated (nominal) pressure of the valve is PN 40, the pressure drop should not exceed Δp = 40 bar.

Example 2:

The same actuator as in Example 1 has the connecting port F12 and can be combined with the valve DN 150. What is the pressured drop across the valve for full flow and soft seated plug powered by the actuator as above?

M_d = 354 Nm ; K = K_2 = 52 ; C = 169

$$\Delta p = \frac{10 \cdot (0,75 \cdot 354 - 52)}{169} = 12,6 \text{ [bar]}$$

Example 3:

Find out an electric actuator that will guarantee pressure drop Δp = 20 bar across the valve DN 80, full flow, metal seated poppet, port to connect the actuator is F12 or F07.

$$\Delta p = \frac{10 \cdot (0,75 M_d - K)}{C} \rightarrow M_d = \frac{\Delta p \cdot C + 10K}{7,5}$$

where:

Δp = 20 bar ; C = 26,9 ; K = K_1 = 9,26

$$M_d = \frac{20 \cdot 26,9 + 10 \cdot 9,2}{7,5} = 84 \text{ Nm}$$

Thus, the actuator ISOMACT SP 2 with torque of 125 Nm and the F07 connecting port to ISO 5211 was selected.

ORDER PLACEMENT:

Orders must contain all the information that is required to calculate valve parameters based on the technical data questionnaire. Please do not hesitate to ask the officers from the Marketing and Sales Department as well as the Technical Department for assistance to choose valves that suit your needs.

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DOUBLE-PORTED CONTROL GLOBE VALVES **TYPE Z®10**

APPLICATION AREA:

The valves type Z10 with pressure balanced plug are used as final flow control units for automatic and remote control systems. They can be applied to adjust flow of fluids in various industries, such as chemical plants, steelworks, shipyards, etc. The offer includes valves with or without driving units, where pneumatic actuators with spring membranes, production of POLNA are used as standard driving appliances.

CONSTRUCTION:

The valves units incorporate the following major components:

Body (1):
Flanges with plain mating surfaces, with a groove or a tongue to:
PN-H-74306:1985, PN-H-74307:1985,
ISO 2084-1974, ISO 2441-1975,
as well as with the RF plain flange or with the RTJ groove to ANSI B16.10-1986, for welding to PN 160.

Nominal diameters:
20; 25; 32; 40; 50; 65; 80; 100; 150; 200; 250; 300.

Nominal pressures:
16; 25; 40; 63; 100; 160 or CL150; CL300; CL600.

In case of possible solidification of the flowing fluid or crystalline precipitation, which may lead to jamming the valve plug, the cast steel body can be fitted with a heat jacket, made from piping or die-pressed sheets that are joint together by welding.

The valve bodies with heating jackets are manufactured for valves:
- DN20...40 i DN150...200 for the rated pressures PN 16...40,
- DN50...100 for the rated pressures PN16...100.

The valves employ steam or hot oil with working temperature < 200°C.

- The following flange sized are used to connect the appliance to heating pipelines:
- DN15 PN16 acc. to PN-H-74731:1987 for DN20…80,
- DN25 PN16 acc. to PN-H-74731:1987 for DN100…200.

Standard bonnet (2) - is made of the same material as the valve body and can be of the following design options:
– standard - for the fluid temperature -20...+260°C,
– finned AB - for the fluid temperature +260...+650°C,
– extended EB - for the fluid temperature -180...-20°C.
– bellow-type DM - for the fluid temperature up to +300°C for the valves DN 20 … 100 with rated pressure PN16 … 25 as well as for the valves DN150 with rated pressure PN16.
Bellow-type bonnets are used for toxic, explosive and flammable agents.

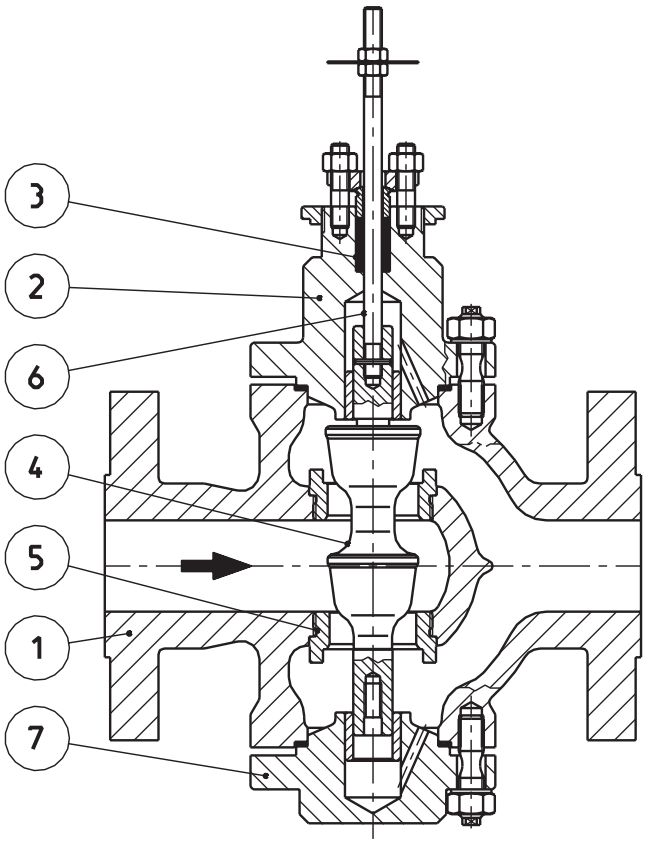
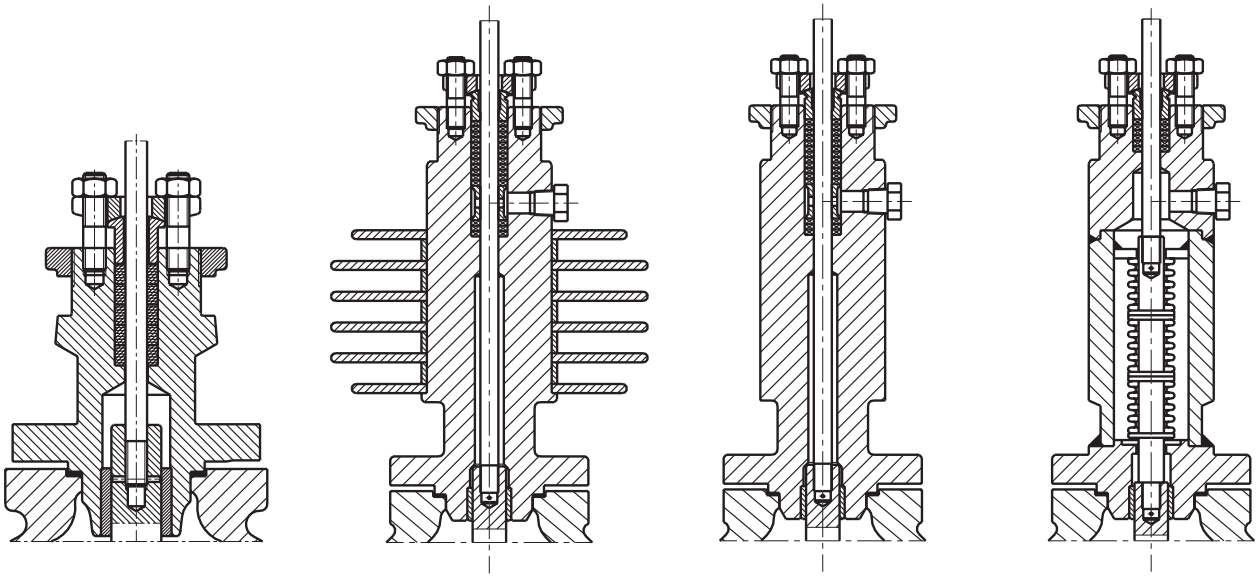


Fig. 1 Valve parts



a) standard b) finned AB c) extended EB d) bellow-type DM

Fig. 2. Bonnet types

Bonnet sealing (3) - made in form of the rings, can be madr of the following materials:
- PTFE – braided,
- PTFE – V-shaped rings,
- graphite – braided,
- balanced graphite – rings

Table 1. Type and options for bonnet sealing.

Type and options of sealing	Maximum allowable pressure		Fluid temperature [°C]		
	fluid and gases	steam	standard	finned	extended
PTFE – braided	160	25	-20...260	260...350	-180...-20
PTFE – V-shaped rings					
graphite – braided		160	260...350	350...650	
balanced graphite – rings					

To select type of sealing it is necessary to take account for character of the handled fluid, its temperature and working pressure.

Plug (4) and Seat (5)

Are made of stainless steel. X6CrNiMoTi 17-12-2 (1.4571) or stainless steel X17CrNi 16-2 (1.4057) heat processed.

When handing fluids with abrasive properties the hardfacing techniques can be applied, e.g.:
Within the technology of hardening internal elements of valves, the following are used:
a) stelliting of mating surfaces: ~ 40HRC (plugs and valve seats for the full range of valve diameters DN 20…300, stelliting the entire contour of plugs and seats for the valves DN 20…100),
b) CrN coating – inserting chromium nitride into the external layer of a detail at the depth of approx. 0.1mm; ~950HV
c) heat processing: plug (~45HRC), seat (~35HRC), stem (~35HRC), sleeve (~45HRC)

Seats with soft inserts (PTFE), only made of acid resistant steel, with retention of the maximum pressure drop to 35 bar and working temperature (-180°C…+180°C).

The following kinds of plugs are manufactured:
- profile,
- perforated.

Depending on the desired characteristic curve the following plug types are used:
– equal percentage, contoured,
– quick opening, poppet type – for on/off control,
– linear, contoured.

Leakage class of the valve
- below 0.5% K_{VS} (II class to PN-EN 60534-4) – for hard plugs
- bubble tightness (VI class to PN-EN 60534-4) – for plugs with soft sealing

Table 2. Types of plugs and valves function

Plug type and characteristic curve	Plug symbol	The valve function is obtained by means of linear drive	
		rise of the control air pressure (pneumatic signal)	
			
Equal percentage	P	opens valve	closes valve
Quick opening	S		
Linear	L		

Hard plugs are manufactured for full passage via the valve seat as well as for volumetric flow reduced to 40% of the rated valve capacity and for flow coefficients as per Table 3.

Table 3. Flow coefficients K_{VS}(m^3/h)

Nominal diameter DN	Stroke [mm]	Full flow		Reduced flow 0.4	
		Plug flow characteristic			
		linear (L) equal percentage (P)	quick opening (S)	linear (L) equal percentage (P)	quick opening (S)
20	12,7	6,8	8,6	4	5
25	12,7	10,3	12,8	4	5
32	19,1	15,4	20,5	6	8,2
40	19,1	24	28,3	9,4	11,3
50	25,4	41	51,4	16,3	20,5
65	25,4	62	77	25	31
80	38,1	94	120	37,6	48
100	38,1	167	215	67	86
150	50,8	385	464	154	185
200	63,5	640	840	256	336
250	63,5	1000	1330	395	532
300	88,9	1390	1930	560	772
Calculation coefficients: F_L^2=0,9, X_T=0,75, Fd=0,34, xF_z=0,58					

Valve stem (6) - made of stainless steel, X6CrNiMoTi 17-12-2 (1.4571) or X17CrNi 16-2 (1.4057) heat processed. Enables sturdy connection of the valve plug with the actuator shaft.

Draining plug (7) - is made of the same material as the valve body. Beside its principal function, which consists in sealing the bottom part of the valve body and guiding the valve plug, it can also be used for easy draining of dirt that is trapped in the valve sump during valve operation, with no need do dismantle the bonnet and actuator.

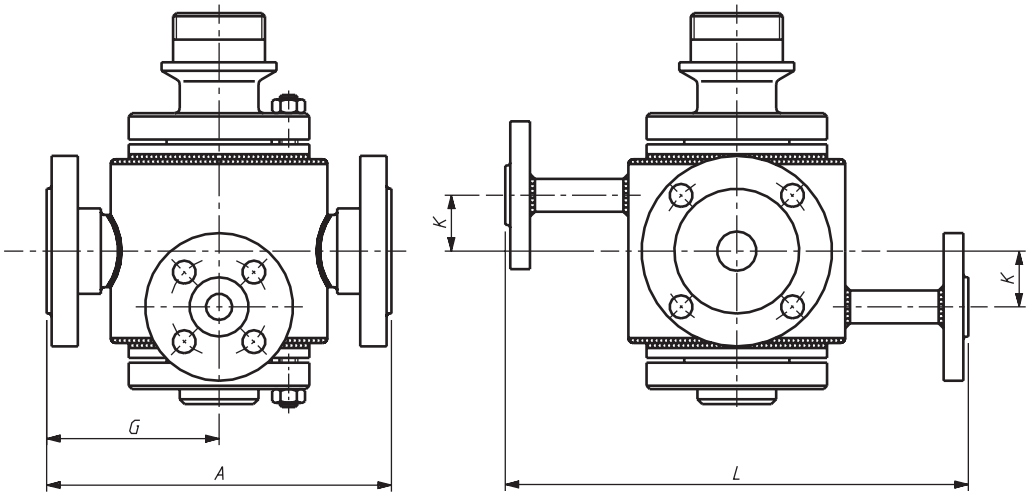
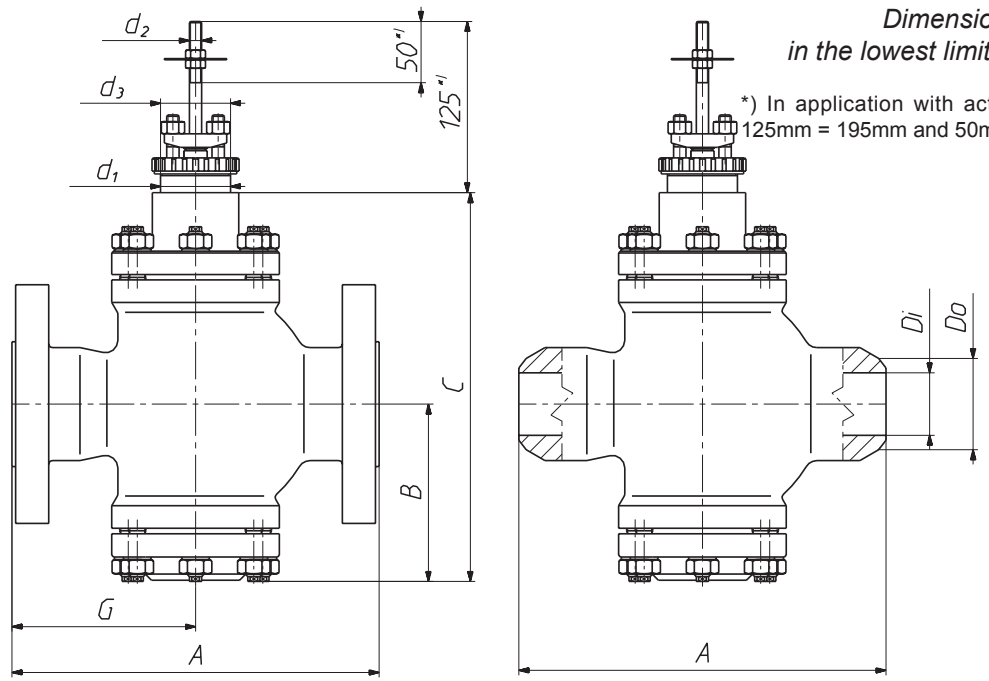


Fig. 4. Overall dimensions of the valve body with a heating jacket

Table 4. Dimensions of the valve with a heating jacket – weight of heating jackets

Nominal diameter DN	A	G	K	L	Weight of the heating jacket
[mm]					[kg]
20	230	115	33	258	3,5
25	230	115	33	258	3,5
32	260	130	39	258	3,5
40	260	125	55	277	4,5
50	300	145	54	299	6,0
65	340	158	64	316	7,5
80	380	180	78	343	9,0
100	430	200	100	408	15,0
150	550	245	153	503	37,0
200	600	270	198	550	48,0

OVERALL DIMENSIONS, CONNECTIONS AND WEIGHT OF VALVES



Dimensions – for the valve stem in the lowest limit position (valve closed)

*) In application with actuator P/R-1000 dimension 125mm = 195mm and 50mm =115mm.

Valve with welding ends

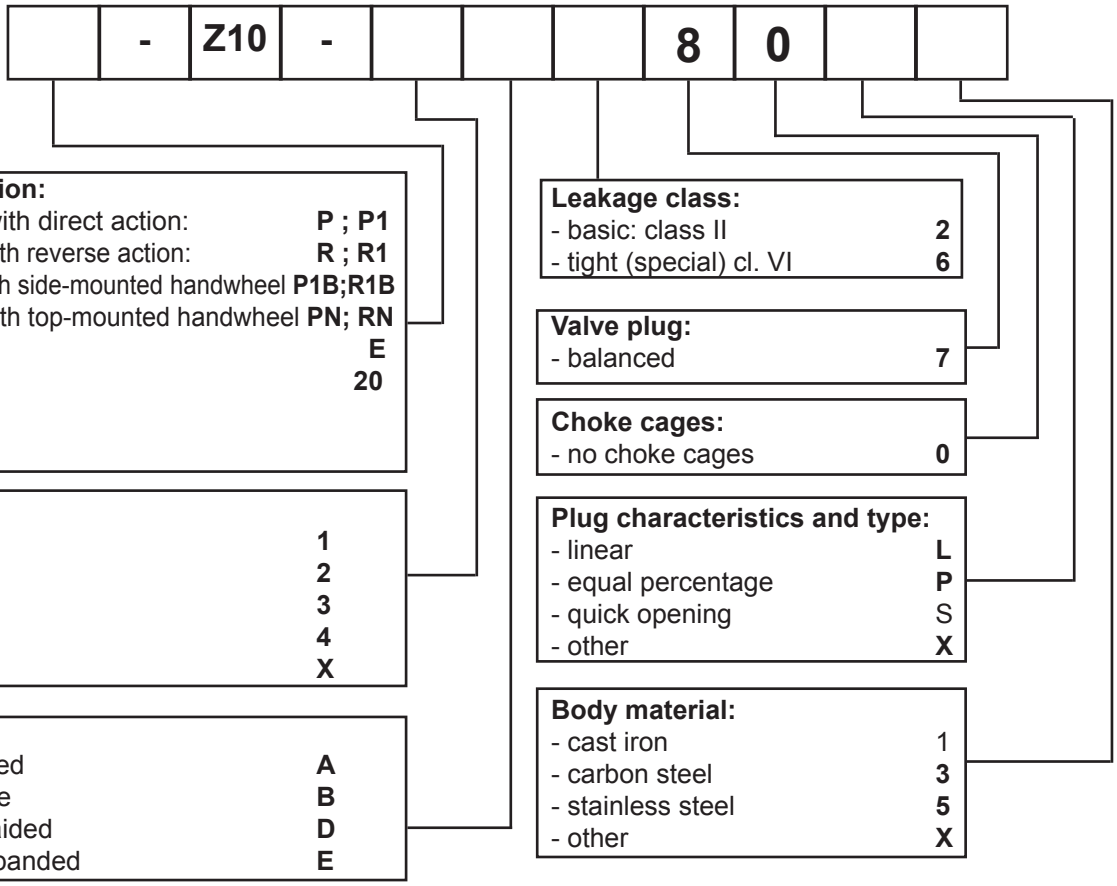
Fig. 4 Overall and connections dimensions

Table 5. Dimensions and weight of valves

Nominal diameter DN	Nominal pressure PN	Body						B	d_1	d_2 ----- Maximum acceptable stem load [kN]	d_3	Bonnet			Weight
		flanged		for welding								std.	AB;EB	DM	
		A	G	A	G	D_0	D_i					C			
[mm]	[bar]	[mm]								[in]		[mm]			[kg]
20	10 - 16 25 - 40 63 - 160	150 150 230	72 72 115	- - -	- - -	- - -	- - -	108	57,15	5/16”-24UNF3A ----- [4 kN]	2 1/4”-16UN2A	245	355	445 445 —	7,0 7,5 8,0
25	10 - 16 25 - 40 63 - 160	160 160 230	77 77 115	- - 230	- - 115	- - 36	- - 26					245	355	445 445 —	7,5 8,0 8,5
32	10 - 16 25 - 40 63 - 160	180 180 260	87 87 130	- - 260	- - 130	- - 44	- - 32	115				260	370	505 505 —	10,5 11,0 12,0
40	10 - 16 25 - 40 63 - 100 160	200 200 260 260	95 95 125 125	- - - 260	- - - 125	- - - 52	- - - 38	120 120 130 130				275 275 275 295	390 390 390 400	475 475 — —	16,0 16,5 17,0 20,0
50	10 - 16 25 - 40 63 - 100 160	230 230 300 300	110 110 145 145	- - - 300	- - - 145	- - - 67	- - - 51	145 145 145 165		3/8”-24UNF3A ----- [6,3 kN]		315 315 315 355	430 430 430 475	590 590 — —	23,0 24,0 25,0 30,5
65	10 - 16 25 - 40 63 - 100 160	290 290 340 340	135 135 158 158	- - - 340	- - - 158	- - - 84	- - - 64	160 160 160 195				355 355 355 415	460 460 460 535	615 615 — —	30,0 31,0 31,5 40,0
80	10 - 16 25 - 40 63 - 100 160	310 310 380 380	145 145 180 180	- - - 380	- - - 180	- - - 100	- - - 76	195 195 195 205		1/2”-20UNF3A ----- [10 kN]		430 430 430 450	525 525 525 540	760 760 — —	36,0 37,0 38,0 60,5
100	10 - 16 25 - 40 63 - 100 160	350 350 430 430	165 165 200 200	- - - 430	- - - 200	- - - 130	- - - 102	205 205 205 240				445 445 445 515	555 555 555 630	780 780 — —	63,0 64,0 65,5 85,0
150	10 - 16 25 - 40 63 - 100 160	480 480 550 550	210 210 245 245	- - - 550	- - - 245	- - - 192	- - - 152	280 280 280 290	84,15	5/8”-18UNF3A ----- [16 kN]	3 5/16”-16NS2A	595 595 595 700	735 735 735 820	905 — — —	137 138 140 170
200	10 - 16 25 - 40 63 - 100 160	600 600 650 650	270 270 295 295	- - - 650	- - - 295	- - - 253	- - - 203	335 335 335 355				705 705 705 790	840 840 840 970	— — — —	201 204 209 252
250	10 - 16 25 - 40 63 - 100 160	730 730 775 775	331 331 350 350	- - - 775	- - - 350	- - - 318	- - - 254	375 375 375 405		3/4”-16UNF3A ----- [25 kN]		785 785 785 965	885 885 885 1085	— — — —	350 355 365 425
300	10 - 16 25 - 40 63 - 100 160	850 850 900 900	346 346 375 375	- - - 900	- - - 375	- - - 336	- - - 264	450 450 450 525	95,25		3 3/4”-12UN2A	960 960 960 1175	1140 1140 1140 1340	— — — —	530 535 545 640

Note: Valve weight without actuator, with a standard bonnet

VALVE MARKING:



MARKING EXAMPLE:

Control valve type Z10 with pneumatic actuator reverse action with top mounted handweel, extension bonnet, packing: graphite: expanded, leakage class VI with equal percentage plug, body material carbon steel:

RN-Z10-2E680P3

Marking is shown on valve nameplate.

Additionaly, it shows:
- nominal size [DN],
- nominal pressure [PN],
- max working temperature [TS],
- max working pressure [PS],
- test pressure [PT],
- flow ratio [Kvs],
- plug stroke [H],
- plug stroke fluid group [1 or 2],
- serial number and year of manufacture.

OTHER ACTUATORS:

1. Pneumatic actuators type P/R or P1/R1 POLNA S.A production.
2. The handwheel type 20 from Zakłady Automatyki POLNA S.A.
3. Other electric or electro-hydraulic actuators

Selection of linear drives should be agreed on with Zakłady Automatyki “POLNA” S.A.
Detailed information and technical data of actuators – according to separate catalogue sheets.
For detailed information and technical parameters of specific actuators please refer to relevant datasheets.

ORDERING:

Orders must contain complete information that is necessary to calculate parameters of the valve in accordance with the technical data questionnaire. To find out the most suitable valves please refer to the staff of the Marketing and Sales Departments and Technical Department for assistance.

Revision: Z10/06/2013
Valid until the next revision.

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SINGLE-PORTED GLOBE CONTROL VALVES TYPE **TYP Z®H**

APPLICATION AREA:

These valves are used as flow control valves for automatic and remote control systems, for stepless, infinite or ON/OFF flow control in water or steam heating systems as well as for ventilation and air conditioning circuits (HVAC).
These valves can be combined with actuators manufactured by **Honeywell** or **Controlmatica**.

FEATURES:

- range of nominal diameters from DN15 to DN100 for rated pressured from PN10 to CL300,
- variety of materials and designs of the valve bodies and internal parts makes it possible to select the most appropriate valve for specific operating conditions,
- wide range of flow coefficients and characteristic curves for flow control,
- easy dismantling and disassembling of the valve internal components for inspection and maintenance,
- high durability and reliability of operation due to usage of top quality materials and techniques for surface treatment (burnishing, stelliting, heat treatment, CrN coatings),
- combining with electric actuators from Honeywell, types: ML 6420A; ML6425A,B; ML 7420A; ML 7425A,B; M 6421A,B M 7421A,B or Controlmatica type ESL-16,
- high tightness of closure due to application of soft seats (with PTFE sealing for the full range of flow parameters and characteristic curves,
- the same flow coefficients and flow control characteristic curves for both "hard" seats (metal-metal) and "soft" seats (metal-sealing ring), as well as for unbalanced and balanced plugs,
- low values of excessive control forces owing to application of balanced plugs for DN25…100 valves,
- reliable connections between actuator rods and valve stems as well as between valve seats and bodies,
- high quality of flat sealing and gland packing,
- competitive prices – as a result of simple design and high performance of the offered valves and actuators as well as careful selection of applied materials,
- design and manufacturing procedures conform to requirements of the Quality Assurance System to ISO 9001 as well as Directives 97/23/EC and codes AD2000 Merkblatt as applicable to installation on pipelines.

DESIGN AND TECHNICAL PARAMETERS:

- Operation principle: down movement of the valve stem results in valve closing.
- Nominal sizes: DN15; 20; 25; 32; 40; 50; 65; 80; 100
- Codes for rated pressure: PN10; 16; 25; 40 (to PN-EN 1092-1:2010 and PN-EN 1092-2:1999); CL150; CL300 (to PN-EN 1759-1:2005).
- Installation length (body): to PN-EN 60534-3-1; 2000r. series 1 - for PN10; 16; 25; 40; series 37 - to CL150; series 38 - for CL300

Z ® - the product trademark, registered in the Patent Office of Poland

Body: flanged, material: cast iron to EN-GJL 250 (EN-JL 1040); EN-GJS 400-18 LT (EN-JS 1025) or cast steel (GP 240 GH (1.0619); GX5CrNiMo 19-11-2 (1.4408)). Maximum excessive pressure for the used materials at respective temperatures are listed in the data sheet for the „Z®" type flow control valves.
Gland: non-cast, attached to the valve body by means of the intermediate connecting plate.
Plug: purposefully shaped, unbalanced or balanced, material: acid resistant (stainless) steel or steel for quenching, rangeability 50:1.
Characteristic curves for flow control: linear (L), equal percentage (P) and quick-opening (S)
Seat: screwed-in with a centering cone for sealing and protection against unintentional unscrewing. The seat can be either hard (metal) or soft (with PTFE sealing).
Leakage class: - basic: IV class to PN-EN 60534-4 - hard seat
- for bubbles: VI class to PN-EN 60534-4 - soft seat
Stem: burnished or heat treated and polished on sealing-mating surfaces.
Plug: steel or acid resistant, enables draining/purging of the body interior (delivered upon separate order).
Sealing: asbestos-free: flat sealing: aramide and graphite, with strengthened graphite fibres in metal enclosures (1.4571); gland packing: the sealing package PFTE-V with a loading spring.
Maximum temperature of handled utilities: 260°C (PTFE).
PERMISSIBLE PRESSURE DROPS Δp.
The permissible pressure drops Δp [bar] refer to closed valves and are calculated with regard to capacities of valve drives and possible inflow of the handled utilities under the valve plug. Actual pressure drops should not extend 70% of the maximum allowed working pressure for the specific rated pressure, used materials and working temperature.
Table 1. Maximum permissible pressure drops Δp [bar].

Actuator	Force [N]	Kvs [m³/h]								
		do 4	6,3	10	16	25	40	63	94	125; 160
Pressure unbalanced valves (T / PTFE)										
ML 6420A; ML 6425A,B ML 7420A; ML 7425A,B ESL-16-00; ESL-16-01	600	30 / 23	10 / 3	9 / -	4 / -	1,2 / -	-	-	-	-
ESL-16-06; ESL-16-07	1000	40 / 35	24 / 17	20 / 15	12 / 8	6 / 2,5	2 / -			
M 6421A,B; M 7421A,B	1800	40 / 35	40 / 35	40 / 35	28 / 22	16 / 12	8 / 5	5 / 2	2 / 1	-
Pressure balanced valves (T / PTFE)										
ML 6420A; ML 6425A,B ML 7420A; ML 7425A,B ESL-16-00; ESL-16-01	600	-	-	40 / 35	40 / -	40 / -	-	-	-	-
ESL-16-06; ESL-16-07	1000	-	-	40 / 35	40 / 35	40 / 35	40 / -			
M 6421A,B; M 7421A,B	1800	-	-	40 / 35	40 / 35	40 / 35	40 / 35	40 / 35	40 / 35	40 / -
T - hard (metal) seat; PTFE - soft (sealed) seat										

Tablica 2. Siutable actuators.

	Actuator	Force [N]	Power voltage	Return spring		Stroke [mm]	Control signal	Protection class
HONEYWELL	ML 6420A	600	24V AC or 230V AC	-	-	20	3-point control	IP 54
	ML 6425A			A	-			
	ML 6425A		24V AC	-	B			
	ML 7420A			-	-		0…10V DC or 2…10V DC	
	ML 7425A,B			A	B			
	M 6421A	1800	24V AC or 230V AC	-	-		3-point control	
	M 6421B			-	-	38		
	M 7421A		24V AC	-	-	20	0…10V DC or 2…10V DC	
	M 7421B			-	-	38		
	Action of the return spring: A – closes the valve; B – opens the valve							

	Actuator	Force [N]	Power voltage	Control signal	Changeover time [s]	Protection class
CONTROLMATICA	ESL-16-00-00-01-1-1-01	600	24V AC	3-point w/out position transducer	100	IP 54
	ESL-16-00-00-01-2-1-01			3-point, with transducer 4-20 mA		
	ESL-16-00-00-01-3-1-01			0(2)…10V DC; 0(4)…20mA DC		
	ESL-16-00-00-01-1-1-02		230V AC	3-point w/out position transducer		
	ESL-16-00-00-01-2-1-02			3-point, with transducer 4-20 mA		
	ESL-16-00-00-01-3-1-02			0(2)…10V DC; 0(4)…20mA DC		
	ESL-16-01-00-01-1-1-01		24V AC	3-point w/out position transducer	60	
	ESL-16-01-00-01-2-1-01			3-point, with transducer 4-20 mA		
	ESL-16-01-00-01-3-1-01			0(2)…10V DC; 0(4)…20mA DC		
	ESL-16-01-00-01-1-1-02		230V AC	3-point w/out position transducer		
	ESL-16-01-00-01-2-1-02			3-point, with transducer 4-20 mA		
	ESL-16-01-00-01-3-1-02			0(2)…10V DC; 0(4)…20mA DC		
	ESL-16-06-00-01-1-1-01	1000	24V AC	3-point w/out position transducer	100	
	ESL-16-06-00-01-2-1-01			3-point, with transducer 4-20 mA		
	ESL-16-06-00-01-3-1-01			0(2)…10V DC; 0(4)…20mA DC		
	ESL-16-06-00-01-1-1-02		230V AC	3-point w/out position transducer		
	ESL-16-06-00-01-2-1-02			3-point, with transducer 4-20 mA		
	ESL-16-06-00-01-3-1-02			0(2)…10V DC; 0(4)…20mA DC		
	ESL-16-07-00-01-1-1-01		24V AC	3-point w/out position transducer	60	
	ESL-16-07-00-01-2-1-01			3-point, with transducer 4-20 mA		
	ESL-16-07-00-01-3-1-01			0(2)…10V DC; 0(4)…20mA DC		
	ESL-16-07-00-01-1-1-02		230V AC	3-point w/out position transducer		
	ESL-16-07-00-01-2-1-02			3-point, with transducer 4-20 mA		
	ESL-16-07-00-01-3-1-02			0(2)…10V DC; 0(4)…20mA DC		

Please refer to homepages of the relevant manufacturers for more detailed information about the devices:

HONEYWELL
www.honeywell.com.pl

CONTROLMATICA
www.controlmatica.com.pl.

Table 3. Flow coefficients Kvs [m³/h] - for unbalanced plugs

Kvs [m³/h]	Stroke [mm]	Seat diameter [mm]	Nominal diameter DN								Characteristic curve		
			15	20	25	32	40	50	65	80	L	P	S
0,010	20	6,35	■	■	■	■	■	■			■		
0,016			■	■	■	■	■	■			■		
0,025			■	■	■	■	■	■			■		
0,040			■	■	■	■	■	■			■		
0,063			■	■	■	■	■	■			■		
0,10			■	■	■	■	■	■			■		
0,16			■	■	■	■	■	■			■		
0,25			■	■	■	■	■	■			■	■	
0,40			■	■	■	■	■	■			■	■	
0,63			■	■	■	■	■	■			■	■	
1,0			■	■	■	■	■	■			■	■	
1,6		9,52	■	■	■	■	■	■			■	■	
2,5		12,7	■	■	■	■	■	■			■	■	
4,0			■	■	■	■	■	■			■	■	■
6,3		19,05		■	■	■	■	■			■	■	■
10		20,64			■	■	■	■			■	■	■
16		25,25				■	■	■			■	■	■
	38								■		■	■	■
25	20	31,72					■	■			■	■	■
	38								■	■	■	■	■
40	20	41,25						■			■	■	■
	38								■	■	■	■	■
63		50,8							■	■	■	■	■
94		66,7								■	■	■	■
Calculation coefficients: F_L = 0,9 ; X_T = 0,72 ; Fd = 0,46 ; xFz = 0,65													

Table 4. Flow coefficients Kvs [m³/h] - for balanced plugs

Kvs [m³/h]	Stroke [mm]	Seat diameter [mm]	Nominal diameter DN							Characteristic curve		
			25	32	40	50	65	80	100	L	P	S
10	20	20,64	■	■						■	■	■
16		25,25		■	■					■	■	■
25		31,72			■	■				■	■	■
40		41,25				■				■	■	■
	38						■			■	■	■
63		50,8					■	■		■	■	■
94		66,7						■	■	■	■	■
125		88,9							■	■	■	■
160									■	■	■	■
Calculation coefficients: F_L = 0,9 ; X_T = 0,72 ; Fd = 0,46 ; xFz = 0,65												

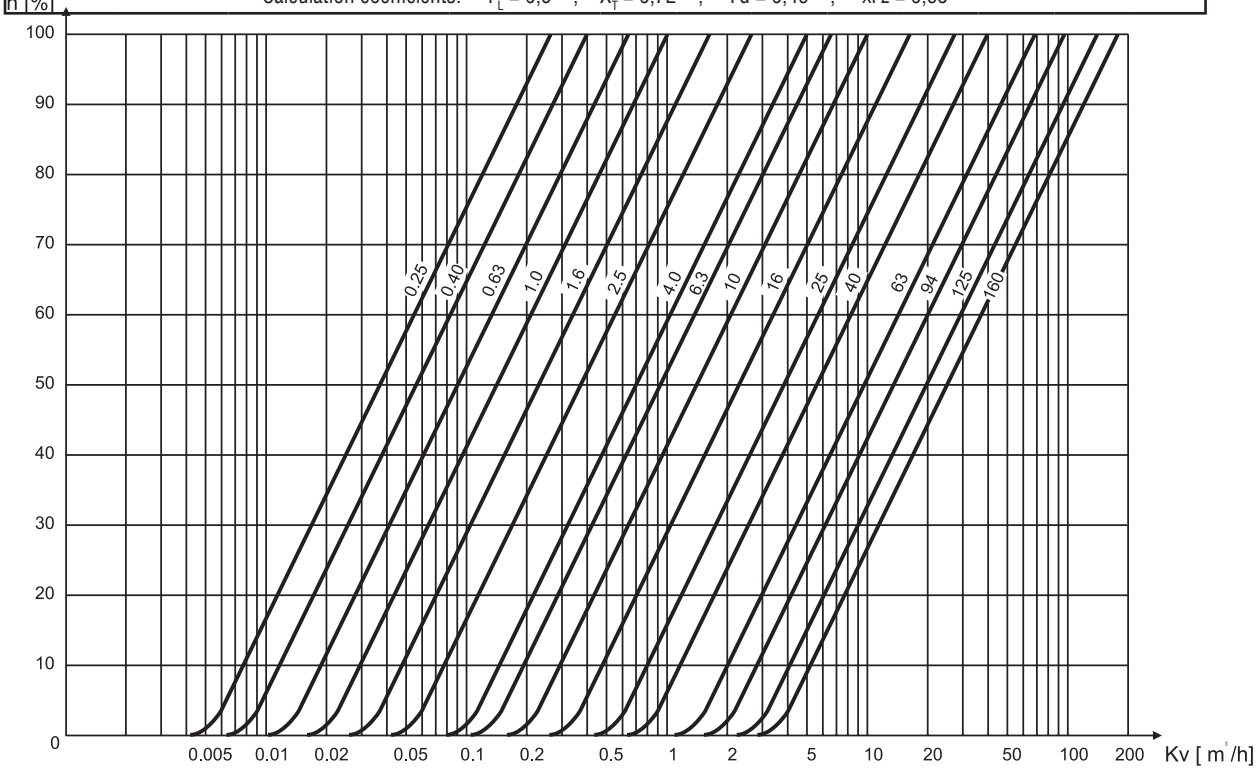

Diagram 1. Characteristic curves for the equal percentage flow through the flow control valve, Kvs = 0,25…94 m³/h.

DIMENSIONS:

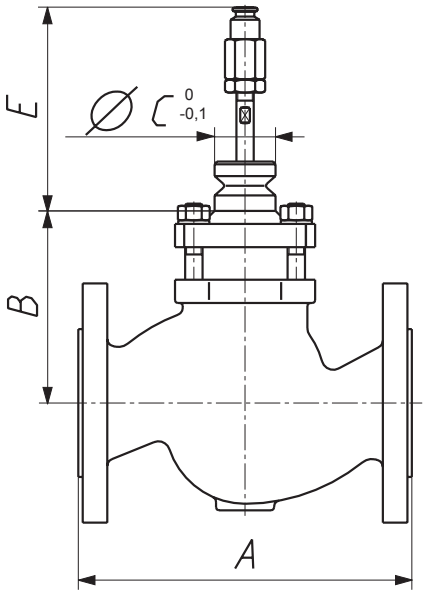

Table 5: Basic dimensions of the valves.

DN	A			B	C	E
	CL150	CL300	PN10…40	[mm]	[mm]	[mm]
15	184	190	130	92	34,8	89
20	184	194	150			
25	184	197	160			
32	200	213	180	110		
40	222	235	200	113		
50	254	267	230			
65	276	292	290	176	47,6	133
80	298	317	310			
100	352	368	350	182		
Dimension E - for seat placed - valve close						

Note: The “A” values for the installation length of CL150 and CL300 valves refer to the devices with flanges of B or RF types. For other designs of valve bodies the installation length “A1“ must be calculated with formulas provided in Table 6. Piping designs and assembly procedures must take account for dimensions of the actuator and necessary free space for installation. Please refer to datasheets for specific actuators as well as to the datasheet “Single-ported globe control valves, type Z” for more information.

Table 6.

Body	Marking		A_1
	PN	ANSI	
Groove CL300	D1	GF	$A_1 = A + 5 \times 2$
Recess CL300	F1	FF	
Ring-joint CL300 DN15	J	RTJ	$A_1 = A + 5{,}5 \times 2$
Ring-joint CL150			$A_1 = A + 6{,}5 \times 2$
Ring-joint CL300 DN20…40			
Ring-joint CL300 DN50…250			$A_1 = A + 8 \times 2$

PRODUCT CODE:

E	–	**ZH**	–	1	B			0		

Actuator type:
- electric: **E**

Gland type:
- standard: **1**

Sealing:
- PTFE, type V **B**

Plug balance:
- unbalanced plug **7**
- balanced plug **8**

Throttling cages:
- without throttling cages **0**

Leakage class:
- basic: IV class **4**
- for bubbles: VI class **6**

Plug type and characteristics:
- shaped plug, linear **L**
- shaped plug, equal percentage **P**
- quick-opening, (on-off) **S**
- other **X**

Body material:
- grey iron **1**
- spheroidal iron **2**
- carbon steel **3**
- stainless steel **5**
- other **X**

EXAMPLE OF THE PRODUCT CODE:

The flow control valve, type ZH with an actuator, unbalanced plug, leakage class: class IV, linear characteristic, material of the valve body: carbon steel:

Note: Please specify the actuator type.

E-ZH-1B470L3

This code is placed on the rating plate of the valve. Besides, the rating plate contains the following information:
- nominal size of the valve [DN],
- rated pressure of the valve [PN],
- max. working temperature [TS],
- max. working pressure [PS]
- test pressure [PT]
- flow coefficient [Kvs],
- plug stroke [H] and group of fluids [1 or 2],
- serial number and year of manufacturing.

ORDER PLACEMENT:

Orders must contain all the information that is required to calculate valve parameters based on the technical data questionnaire. Please do not hesitate to ask the officers from the Marketing and Sales Department as well as the Technical Department for assistance to choose valves that suit your needs.

Revision: ZH/06/2013
Valid until the next revision.

"POLNA" S.A.
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Tel: +48 16 678 66 01
Fax: +48 16 678 65 24

BUTTERFLY VALVES **TYPE PRS**

APPLICATION AREA:

The tight butterfly valves type PRS are used as flow control units in the automatic and remote control systems to adjust flow intensity of liquids and gases. Due to high leakage class they are preferred as devices that cut off flow of utilities. Besides, they can be used as flow control throttling valves with throttling disc angle 25 … 75°. Versatility of construction designs and used materials makes it possible to use butterfly valves in a number industrial sectors, such as chemical factories, paper mills, food processing plants, thermal and electric power engineering, steelworks, mining industry, etc.

FEATURES:

- absolute leakage class at pressure drops to 20 bar,
- design of the butterfly valve enable installation on flanged connections of pipelines constructed to ISO, DIN, PN and ANSI standards,
- seat reinforced by aluminium frame makes it possible to reach rated pressure values up to PN20 (CL150),
- diversity of materials for seats enables selection of butterfly valves throttling disks that best suit the handled liquids,
- self-lubricated guiding bushes for the throttling disk rod,
- wide range of flow coefficients,
- various types of drive manual operated levers and gearboxes, pneumatic and electric drives.

CONSTRUCTION:

Body - spheroidal iron with two design options:
- without flanges, to install between pipeline flanges: **PRS-1**
- with tapped stubs to mount separately with every pipeline flange: **PRS-2**

Butterfly disk - spheroidal iron of spherical shape around all the perimeter that ensures perfect tightness of the disk and reduces wear of packing rings.

Packing ring - a rubber ring with the aluminium reinforcing frame to ensure tightness between the pipe and the throttling disk with an actuating rod. The ring can be made of EPDM, BUNA-N, NEOPREN, VITON or SILICON and others materials corresponding to operating conditions or client's demands – see application guidelines in Table 5.

Shaft - two-piece shaft, made of corrosion resistant steel.

Guiding bushes - steel, with self-lubrication coating.

TECHNICAL PARAMETERS

Table 1. Flow coefficient Kv [m³/h]

DN		40	50	65	80	100	125	150	200	250	300
Throttling disc angle	25°	2,6	5,2	8,6	13	23	50	83	142	220	319
	30°	4,3	7,8	13	20	35	74	121	211	327	465
	40°	9,5	15,5	23	33,6	61	129	211	353	560	819
	50°	15,5	24	38	56	99	211	345	590	974	1353
	60°	22,5	47,5	73	112	198	414	677	1099	1810	2629
	70°	38,8	62	94,8	142	259	526	871	1478	2327	3405
	75°	47,5	79,3	116,4	181	336	702	1138	1858	3017	4224
	80°	60,4	95	142	215,5	400	845	1392	2302	3664	5129
	90°	69	116,4	181	267	465	948	1646	2746	4224	6336

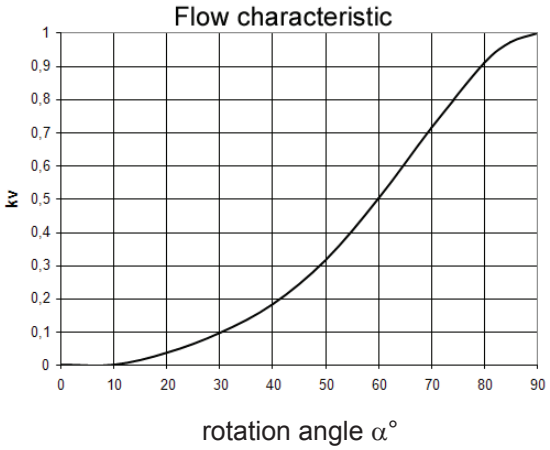


Fig. 1 Rrelation between the flow coeffcient kv=Kv/Kvs and the rotation angle of the butterfly disk

Table 2. Required values of available torque of drives [Nm]

DN	40	50	65	80	100	125	150	200	250	300
PN6	9	11	13	17	24	38	62	75	125	190
PN10	11	15	19	20	37	67	107	150	215	290
PN16	17	19	29	31	55	99	136	230	320	435
PN20 (CL150)	20	30	41	49	84	138	205	350	480	640

The above values for torque refer to application of the butterfly valve to control flow of fluids. In case of non-lubricating utilities, such as air, gases, solid bulks (dust, cement, etc) these figures must be increased by 50%. Manufacturing of the valve sized to PN25 must be agreed with the manufacturer.

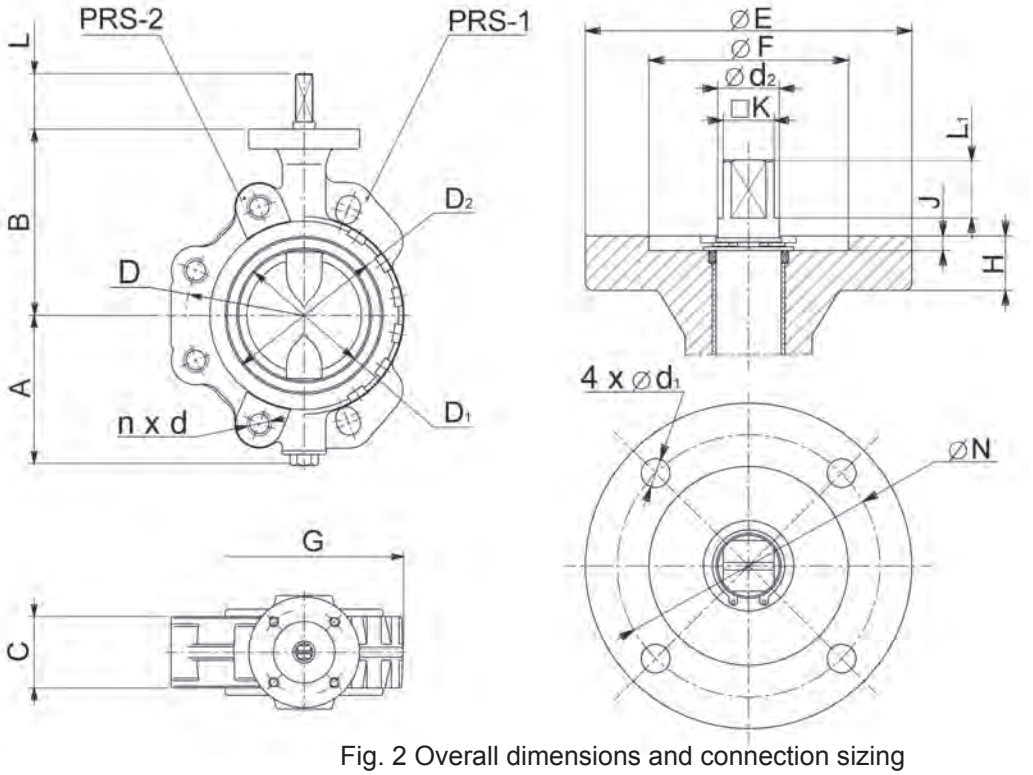


Fig. 2 Overall dimensions and connection sizing

Table 3. Dimensions and weights of the PRS-1 butterfly valves

DN	A	B	C	D_1	D_2	d_1	d_2	E	F	G	H	J	□ K	L	L_1	N	Flange * type	Weight [kg]
40	74	105	34	46,5	67	8,5	17	90	55	92	15	4	14	21	16	70	F07	2,3
50	83	115	43	56,5	80	8,5	17	90	55	103	15	4	14	21	16	70		2,7
65	95	130	46	66,5	92	8,5	17	90	55	121	15	4	14	21	16	70		3,2
80	109	135	46	78,5	108	8,5	17	90	55	134	15	4	14	21	16	70		3,8
100	120	150	52	102	134	8,5	17	90	55	162	15	4	14	21	16	70		5,4
125	136	175	56	128	161	8,5	21	90	55	192	15	4	17	22	17	70		7,2
150	152	190	56	153	190	8,5	21	90	55	218	15	4	17	22	17	70		8,9
200	176	225	60	198	242	8,5	21	90	55	273	18	4	17	22	17	70		10,4
250	218	270	68	247	294	11	28	125	70	328	18	4	22	27,5	22,5	102	F10	22
300	257	300	78	299	345	11	28	125	70	378	18	4	22	27,5	22,5	102		33

D1 - internal diameter of the packing ring
D2 - external diameter o the packing ring
*) - to ISO 5211
C - installation length to ISO 5752-1982 (short) Table 5 / DIN 3202 - K1

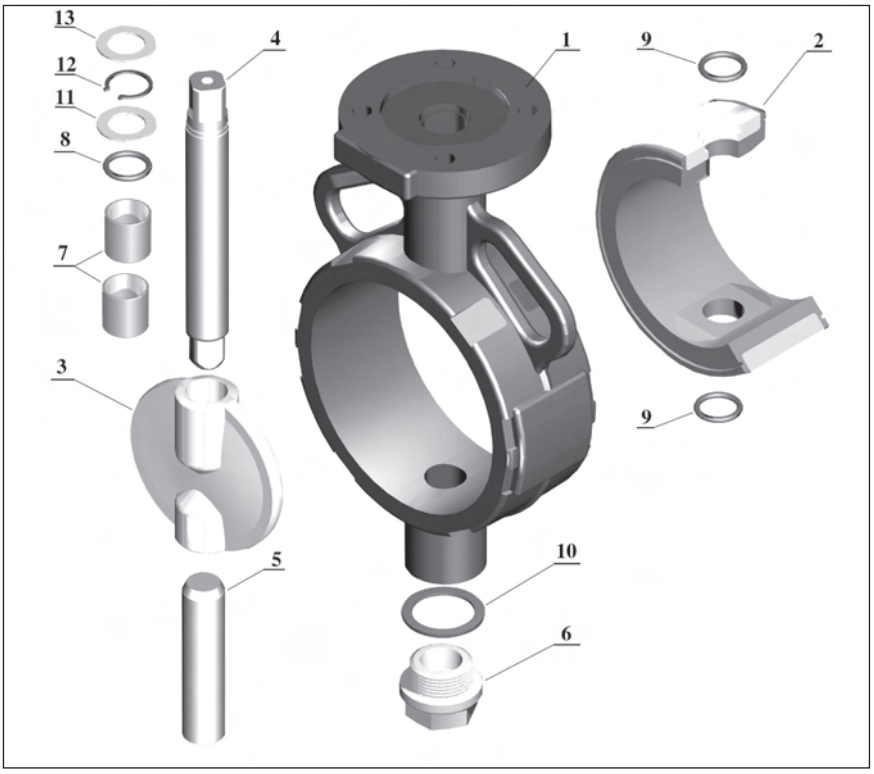
Table 4. Dimensions and weights of the PRS-2 butterfly valves

DN	PN6			PN10			PN16			PN20			CL150			Weight [kg]
	D	d	n	D	d	n	D	d	n	D	d	n	D	d	n	
40	100	M12	4	110	M16	4	110	M16	4	98,5	M14	4	$3^7/_8$"	1/2"	4	3
50	110			125			125			120,5	M16		$4^3/_4$"	5/8"		4
65	130			145			145			139,5			$5^1/_2$"			4,8
80	150	M16		160			160		8	152,5			$6^1/_{16}$"			5,4
100	170		4*	180		8	180			190,5		8	$7^1/_2$"		8	8
125	200		8	210			210			216	M20		$8^1/_2$"	3/4"		11,5
150	225			240	M20		240	M20		241,5			$9^1/_2$"			14
200	280			295			295		12	298,5			$11^3/_4$"			19,5
250	335		12	350		12	355	M22		362	M24	12	$14^1/_4$"	7/8"	12	29,4
300	395	M20		400			410			432			17"			45

D - pitch diameter
d - thread diameter
n - number of holes

NOTE:
d thread for CL150 - type UNC
* - the butterfly valve for oils has 8 holes

Other dimensions - see Table 3.



Components of the butterfly valve:

1 - body
2 - packing ring
3 - disk
4 - driving rod
5 - rod
6 - drain plug
7 - guiding bushes
8 - sealing ring (o-ring)
9 - sealing ring (o-ring)
10 - seal
11 - washer
12 - fixing sprig ring
13 - washer

Fig. 3 Structure of the butterfly valve – exploded view

Table 5. Material for packing rings - application guidelines

Symbol	Application temperature [°C]	Recommended for utilities	Prohibited for utilities
EPDM	-35...+110	water, water steam, seawater, saline, ketones, alkalis, diluted acids	hydrocarbons, oils, fatty oils
EPDM - HT	-35...+150		
NBR(Buna N)	-18...+90	seawater, hydrocarbons, natural gas, oils, fatty oils, air	diluted acids, bezene, solvents
NR (natural rubber)	-35...+65	non-aggressive abrasive products	water steam, solvents, acids, hydrocarbons
VMQ(silikone)	-35...+150	eatable products	acids, water steam, hydrocarbons
FKM(Viton)	-10...+160	acids, oils, hydrocarbons, mineral spirit	water steam, freon, alkalis, ketones, solvents
CR(Neopren)	-18...+90	acids, oils, hydrocarbons, natural spirit	water steam, acids, ketones
CSM(Hypalon)	-18...+100	acids, organic acids, oils, fatty oils	nitric acid, water steam, ketones

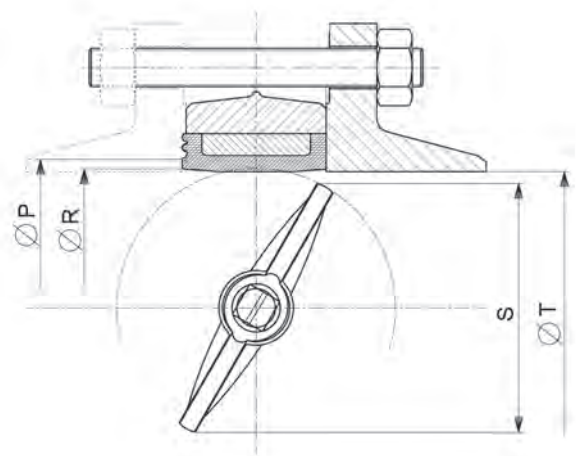


Fig. 4 Installation of a butterfly valve on a pipeline

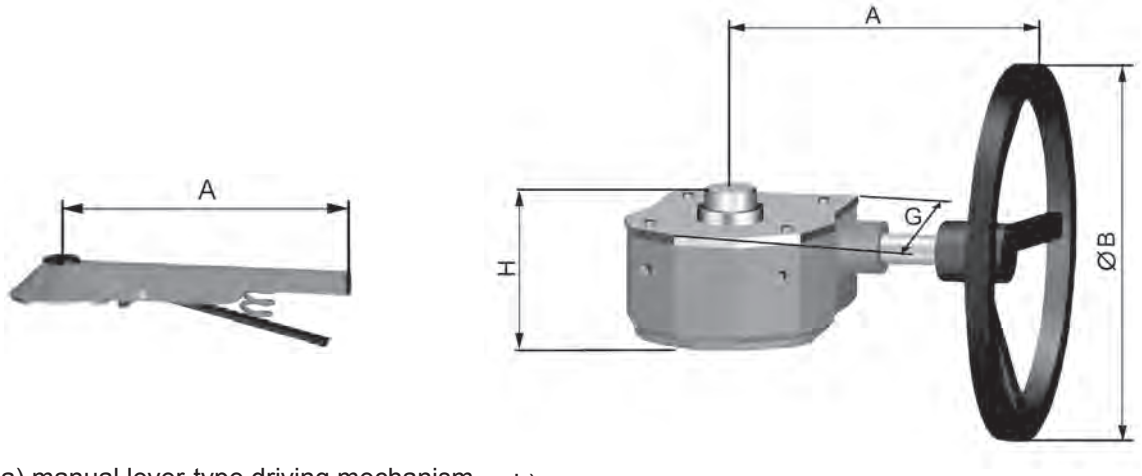
Table 6. Mounting dimensions

DN	R	P	S
40	47	51	32
50	57	64	45,5
65	72	79	48
80	84	92	64
100	104	112	88
125	130	136	116
150	157	165	142,5
200	205	212	189
250	254	264	238
300	304	315	289

NOTE: The T size must be between the values of S and P

DRIVES

Various types of drive manual operated levers and gearboxes, pneumatic and electric drives.



a) manual lever-type driving mechanism

Drive type	DN	A [mm]	Weight [kg]
D1	40...100	250	1,3
D2	125...150	320	1,6

b) worm gear

Drive type	DN	A [mm]	∅B [mm]	G [mm]	H [mm]	Weight [kg]
R1	40...100	130	135	113	56	4
R2	125...200	145	135	127	60	7
R3	250...300	245	300	200	72	10

Fig. 5 Manual driving mechanisms

COMBINING BUTTERFLY VALVES WITH PISTON-TYPE PNEUMATIC ACTUATORS

- control pressure: double-acting actuator - 1 to 10 bar
  single-acting actuator - 2 to 10 bar
- rotation angle 90° ± 4° in the both border positions (120°C or 180°C as an option)
- temperature of control utilities: -20°C do +80°C (+20°C or +150°C as an option)
- protection class IP65 (better on request),
- explosion proof options available on request,
- electromechanical terminal switches,
- pneumatic and electropneumatic position indicators,
- solenoid distributing vales (manifolds).

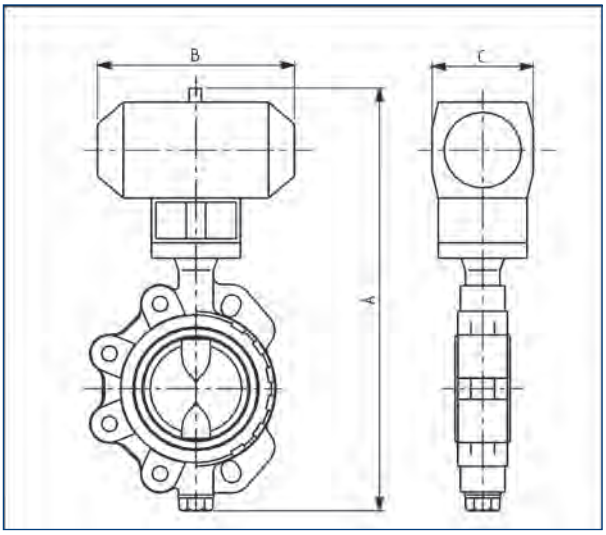


Fig. 6. The PRS butterfly valve with a piston-type pneumatic actuator

Table 7. Dimensions an weights of PRS butterfly valves with piston-type pneumatic actuators

DN	A	B	C	Actuator* type	Weight [kg]	
					PRS-1	PRS-2
40	340	152	81	AT1-DA	3,8	4,5
50	349			or - SR	4,2	5,5
65	397	202	92	AT2-DA	6	7,6
80	416			or - SR	6,6	8,2
100	468	271	118	AT3-DA	11,3	13,9
125	509			or - SR	13,1	17,4
150	595	360	143	AT4-DA	20,9	26
200	624			or - SR	22,4	31,5
250	797	464	179	AT5-DA	44	51,4
300	866			or - SR	55	67

* - other types of actuators on request

COMBINING BUTTERFLY VALVES WITH ELECTRIC MOTORS

- power supply: 3 phases 230/400 V, 50 Hz, 1 phase 230 V, 50 Hz or 24V DC
- rated load factor - 30%
- insulation class - F
- protection class - IP67
- ambient temperature -30°C +75°C
- electric limit switches
- manual override
- position indicators

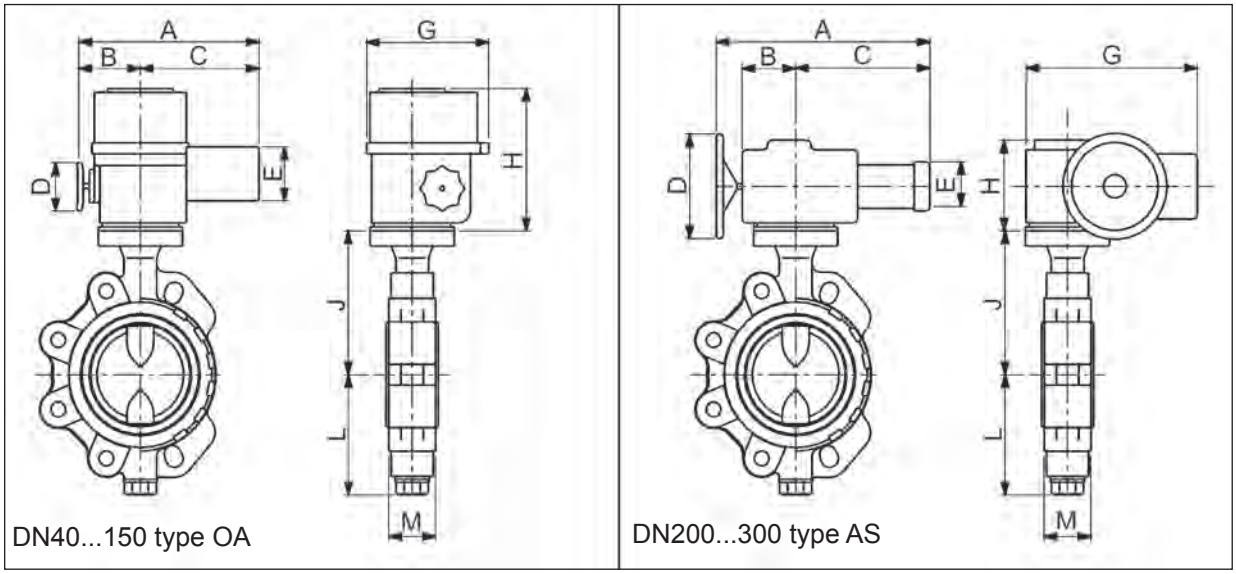


Fig. 7. The PRS butterfly valve with the BERNARD electric motor

Table 8. Dimensions an weights of PRS butterfly valves with electric motors

DN	A	B	C	D	E	G	H	J	L	M	Motor type *	Closing time	Power [kW]	Weight [kg]	
														PRS-1	PRS-2
40	290	90	200	60	106	215	215	98	74	34	OA-6	6	0,03	8	8,5
50	290	90	200	60	106	215	215	109	82	43				9	9,5
65	290	90	200	60	106	215	215	122	95	46				9,6	10,6
80	290	90	200	60	106	215	215	132	109	46				10	11
100	290	90	200	60	106	215	215	153	120	52	OA-8		0,10	12	14
125	372	90	200	100	106	215	223	177	136	56	OA-15	15;25	0,03	15	17,5
150	372	112	260	100	106	215	223	194	152	56				16	18,6
200	527	187	260	165	139	315	177	225	176	60	ASP-25	30;60		28	33
250	527	187	260	250	139	315	177	275	218	68	AS-50	30	0,10	36,5	45,5
300	527	187	260	250	139	315	177	297	257	78				48	58,5

* - other types of electric motors on request

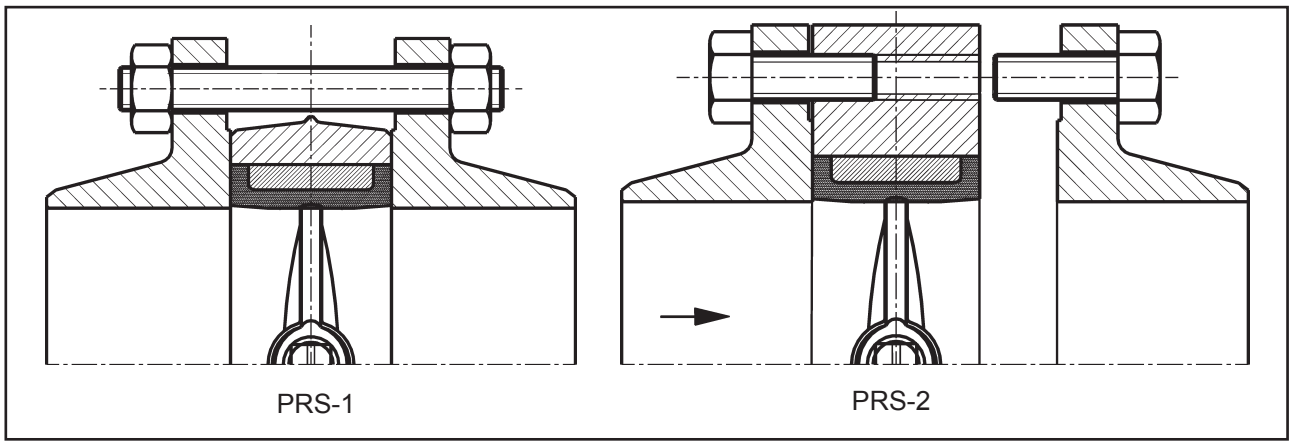


Fig. 8 Installation of the butterfly valve on a pipeline

Table 9. Sizing of connecting bolts or PRS-1 butterfly valves

DN	PN6		PN10		PN16		PN20		CL150	
	Bolt size	Bolt q-ty	Bolt size	Bolt q-ty	Bolt size	Bolt q-ty	Bolt size	Bolt q-ty	Bolt size	Bolt q-ty
40	M12x100	4	M16x110	4	M16x110	4	M14x110	4	1/2" x 4 5/16"	4
50	M12x120	4	M16x130	4	M16x130	4	M16x130	4	5/8" x 5 1/8"	4
65	M12x120	4	M16x130	4	M16x130	4	M16x130	4	5/8" x 5 1/8"	4
80	M16x130	4	M16x140	4	M16x140	8	M16x140	4	5/8" x 5 1/2"	4
100	M16x140	4*	M16x150	8	M16x150	8	M16x140	8	5/8" x 5 1/2"	8
125	M16x150	8	M16x150	8	M16x150	8	M20x160	8	3/4" x 6 3/8"	8
150	M16x150	8	M20x160	8	M20x160	8	M20x160	8	3/4" x 6 3/8"	8
200	M16x160	8	M20x170	8	M20x170	12	M20x170	8	3/4" x 6 3/4"	8
250	M16x180	12	M20x180	12	M22x190	12	M24x190	12	7/8" x 7 1/2"	12
300	M20x190	12	M20x190	12	M22x200	12	M24x210	12	7/8" x 8 3/8"	12

* - 8 bolts are used for butterfly valves for oils

Tabel 10. Sizing of connecting bolts or PRS-2 butterfly valves

DN	PN6		PN10		PN16		PN20		CL150	
	Bolt size	Bolt q-ty	Bolt size	Bolt q-ty	Bolt size	Bolt q-ty	Bolt size	Bolt q-ty	Bolt size	Bolt q-ty
40	M12x25	8	M16x30	8	M16x30	8	M14x30	8	1/2" x 1 3/16"	8
50	M12x30	8	M16x35	8	M16x35	8	M16x35	8	5/8" x 1 1/2"	8
65	M12x30	8	M16x35	8	M16x35	8	M16x35	8	5/8" x 1 1/2"	8
80	M16x35	8	M16x35	8	M16x35	16	M16x35	8	5/8" x 1 1/2"	8
100	M16x35	8*	M16x40	16	M16x40	16	M16x45	16	5/8" x 1 3/4"	16
125	M16x40	16	M16x45	16	M16x45	16	M20x45	16	3/4" x 1 3/4"	16
150	M16x40	16	M20x45	16	M20x45	16	M20x50	16	3/4" x 2"	16
200	M16x40	16	M20x50	16	M20x50	24	M20x55	16	3/4" x 2 1/4"	16
250	M16x50	24	M20x55	24	M22x55	24	M24x55	24	7/8" x 2 1/4"	24
300	M20x55	24	M20x60	24	M22x60	24	M24x60	24	7/8" x 2 1/2"	24

* - 16 bolts are used for butterfly valves for oils

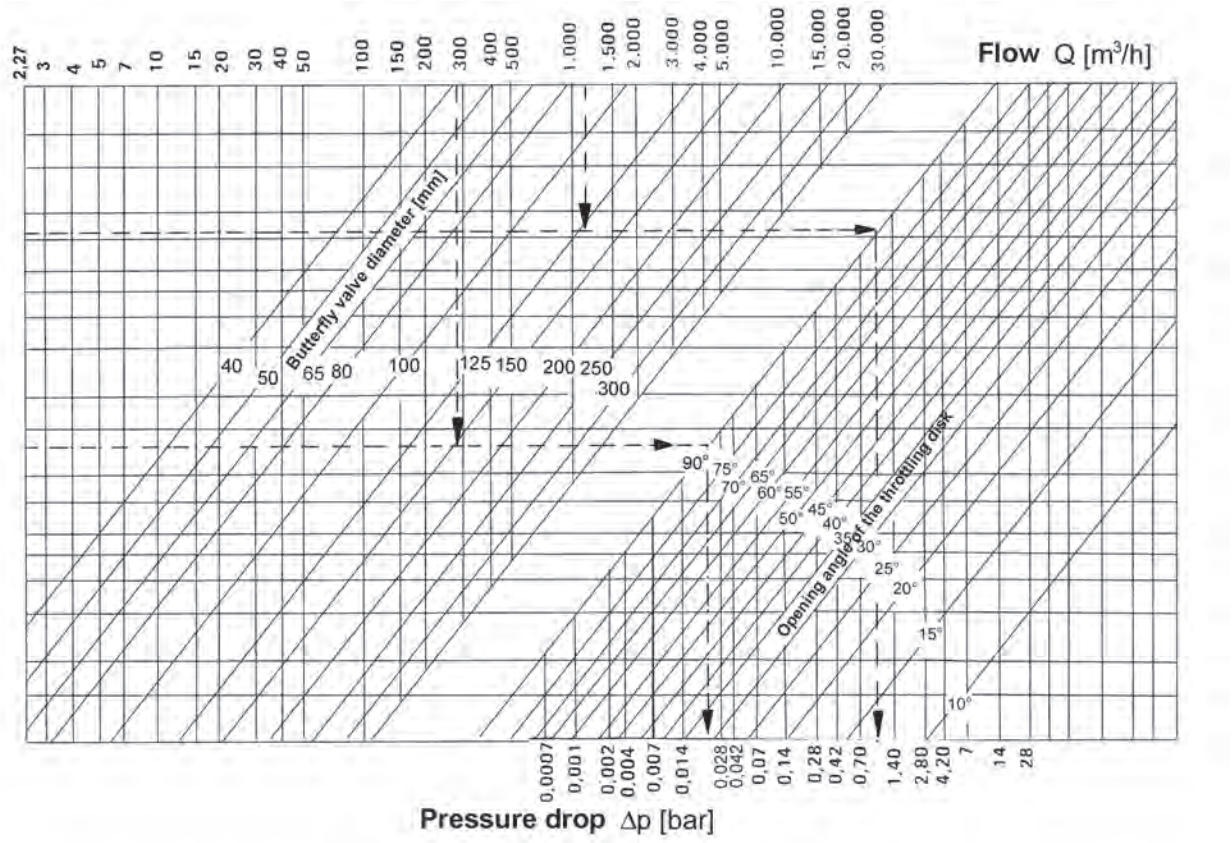


Fig. 9 Pressure drop Δp vs. opening angle of the throttling disk for flow of water

INSTALLATION

Butterfly valves can be installed on pipelines for whichever direction of flow. They are suitable for installation between pipeline flanges to PN, DIN or ANSI standards with no need of additional gaskets. They can be installed at discretional mounting position.

Before installation of a butterfly valve between pipeline flanges it is recommended to apply a thin coat of silicone grease onto these surfaces of the packing gasket that match the flanges in order to avoid sticking of the gasket and its damage during installation.

After having the PRS-1 butterfly valve with the half-open throttling disk placed between the pipeline flanges it should be carefully aligned. Then insert the stud bolt to fix position of the valve on the outer surface of the body. Place nuts and tighten then uniformly. After completion of the installation the valve should be opened and closed for several times to make sure that it has been correctly installed. Position of the throttling disk is indicated by the notch on the driving rod.

The PRS-2 butterfly valves can be installed at the end of pipelines as co called termination valves for fluids. If so, it is recommended to use necked flanges. If a butterfly valve is used a termination device the utility pressure should not exceed 50% of the rated value for the valve.

MARKING

Orders must contain type of the butterfly valve, its nominal size, rated pressure PN, material of the packing ring or utility specification and temperature as well as type of actuating mechanism.

EXAMPLE
PRS1-DN80-PN10-EPDM-D1

Revision: PRS/06/2013
Valid until the next revision.

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PISTON DESUPERHEATERS **TYPE ST-1**

APPLICATION AREA:

The Piston Desuperheater is used for steam temperature control systems in industry and power engineering. It offers important advantages, including perfect atomization of water and high rangeability.

FEATURES:

- possible customizing of the device design to adjust flow rates to customers' demands,
- removing of device vibrations owing to the support on a pipeline connecting stud,
- resistance to loss of tightness due to application of a spiral and spring washer made of metal and graphite and installed on the connecting stud,
- wide range of flange connections,
- selection of materials according to customers' demands,
- easy replacement of the seat and other internal components of the desuperheater,
- no welded joints between nozzles and device heads,
- possible application of a uniformed type of pneumatic actuators with stroke range up to 100 mm,
- possible use of other actuators upon customers' requirements, including pneumatic, electric or hydraulic driving units.

OPERATION PRINCIPLE:

After having the seat opened the cooling water is delivered via the lateral flange connection into the desuperheater interior, The desuperheater head incorporates a series of independent jets that are able to atomize water within the full cone of injection with the top angle of 90°. The piston, sealed with steel packing rings, moves inside the head. Piston movements enable water flow to subsequent nozzles which makes the flow characteristic linear, with nearly equal percentage rates. Number and flow capacity of individual nozzles are accordingly adjusted to achieve the desired flow coefficient. Both the head and all the nozzles are secured against unintentional unscrewing by a permanent set (a bead) on the securing ring. The desuperheater has split design that allows for easy replacement of seat and internal parts.

DESIGN

Flanged ports:
- water: DN25/ 40/ 50; PN40; 63; 100; 160
- steam: DN80/ 100/ 150; PN25; 40; 63; 100

Other values of DN /PN as well as flanged ports to ANSI standards - upon request.

Nozzles:
- with full and empty atomization cone, spraying angle 60…90°.

Materials:

- body, bonnet:	13CrMo 4-5 ; (1.7335)
- head, internal components:	X17CrNi 16-2 ; (1.4057)
- nozzles:	X6CrNiMoTi 17-12-2 ; (1.4571)

Other materials - upon request.

Flow coefficients: Kv 0,15…10
Leakage class (leakage class): class V to PN-IEC 60534-4
Rangeability: 40:1

Actuation:
A spring-loaded pneumatic actuator of diaphragm type, diaphragm active area series P4 of 240cm², maximum stroke - 100mm, supply pressure - 400 kPa, spring range 160…320 kPa.
Other actuators - upon request.

Table 1. Piston stroke vs. Kvs and diameter of steam port

Steam port DN	Kv	Stroke [mm]
80	0,15…1,0	60
100	1,0…2,5	
150	2,5…5	80
	5…10	100

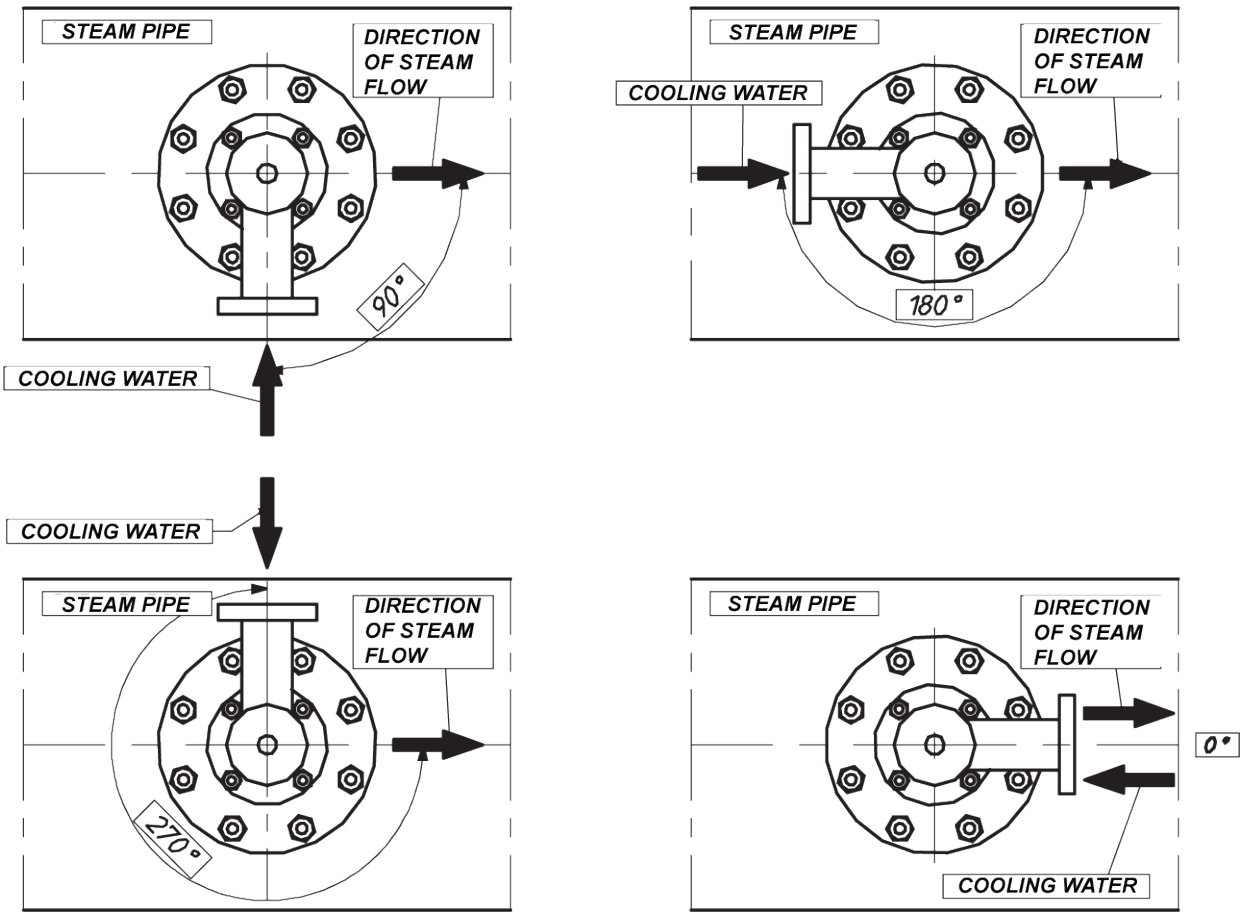


Fig. 1 Possible locations of the flanged water port with respect to steam flow direction

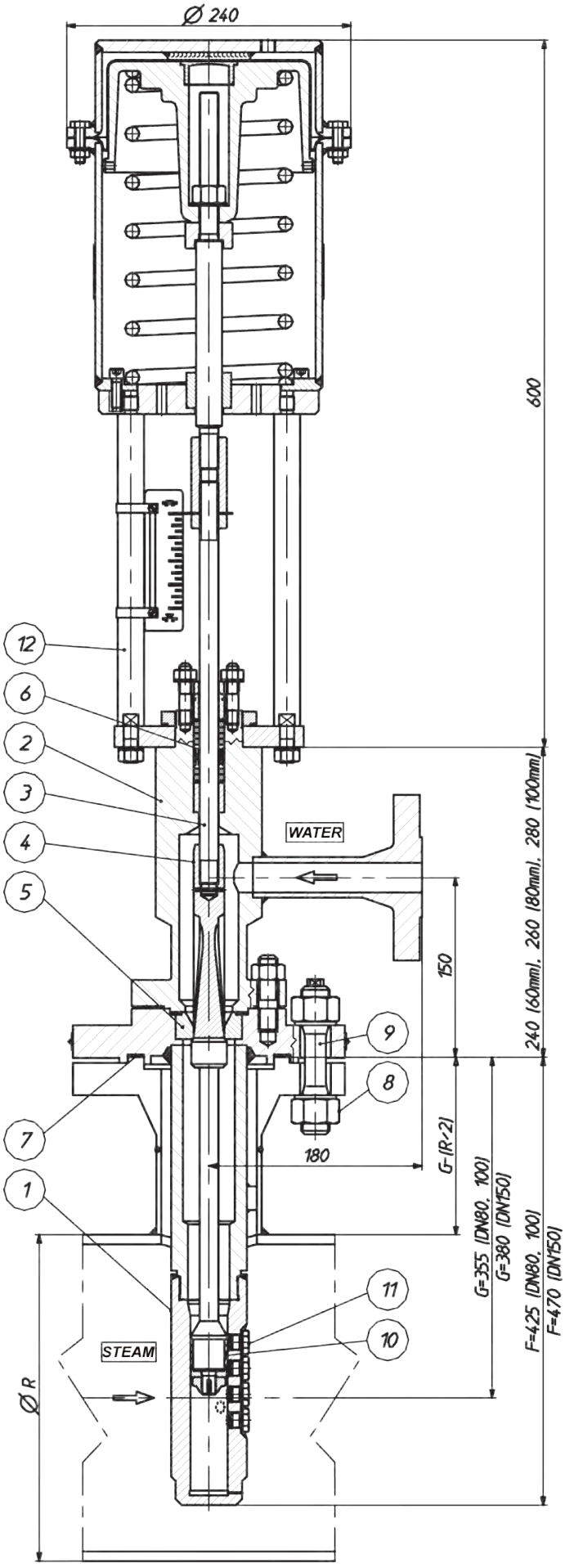


Fig. 2. Desuperheater cross-section and overall dimensions (other dimensions upon request).

Table 2. Part list

No	Part name
1.	Head
2.	Bonnet
3.	Stud
4.	Piston
5.	Seat
6.	Packing set
7.	Spiral seal
8.	Nut
9.	Bolt
10.	Ring
11.	Nozzles
12.	Actuator, type P4

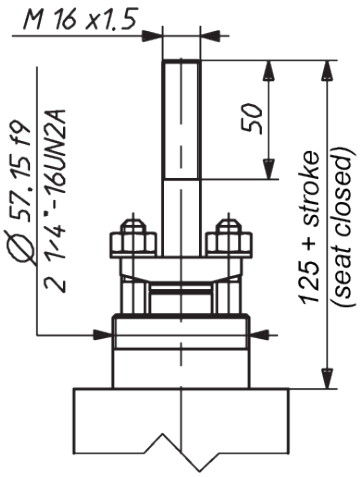
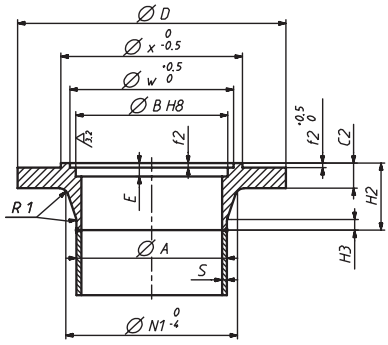


Fig. 3 Dimensional drawing of the desuperheater connection
(other dimensions upon request)

Table 3. Dimensions of the mating steam flange



DN	PN	A	s [min.]	D	x	w	B	E	f2	C2	H2	H3	R1	N1	K	n	L
80	25; 40	88,9	3,2	200	131,5	-	110	10	4,5	24	58	12	8	105	160	8	18
	63		3,6	215	136,5					28	72			112	170		22
	100		4,0	230						32	78			120	180		26
100	25; 40	114,3	3,6	235	149	129	120		5	24	65			134	190		22
	63		4,0	250						30	78			138	200		26
	100		5,0	265						36	90			150	210		30
150	25; 40	168,3	4,5	300	203	183	170	15		28	75		10	192	250		26
	63		5,6	345						36	95			202	280		33
	100		7,1	355						44	115			210	290	12	33

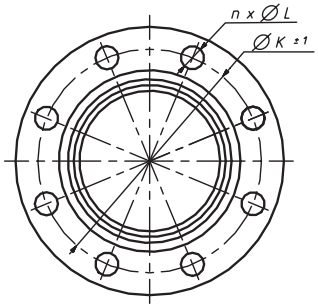


Fig. 4 Steam port dimension

The manufacturer (Zakłady Automatyki POLNA S.A.) is able to customize connection of the desuperheater according to customers' needs.
Should the customer anticipate to work out such a connection on his own the diameter and wall thickness of the pipe must be specified in the order.
Dimensions of the desuperheater connections conform to the standard PN-EN 1092-1: 2010, flange type (C). Typical sealing as for flange connections of (C / D) types. The spiral spring gasket is recommended, made of the material X6CrNiMoTi 17-12-2; (1.4571) + GRAPHITE. .

Table 4. Gasket dimensions

DN	Dimensions of the flange gasket
80	131 x 111 x 3,2 (PN25; 40) 135 x 111 x 3,2 (PN63; 100)
100	148 x 130 x 3,2
150	202 x 184 x 3,2

PRODUCT CODE

	-	ST-1	-		-		-		-		-	

Actuator type:
- pneumatic actuator: **P4**
- electric acutator: **E**
- hydraulic actuator: **H**
- other types: **X**

Connection port (steam side): **DN / PN**

Connection port (water side): **DN / PN**

Steam pipeline: **DN / PN**

Kvs: by Table 1 or underlying data to enable calculation of the parameter

Location of the water flange: 0°, 90°, 180°, 270°

CODE EXAMPLE: The pneumatic actuator of direct action , size - 240cm^2, stroke 60 mm, control pressure range 160...320 kPa, steam port DN80 PN63, water port DN25 PN40, steam pipeline DN600 PN40, location of the water port 270°, Kvs 1, linear characteristic curve:

P4 - ST-1 - DN80/PN63 - DN25/PN40 - DN600/PN40 - 270° - Kvs 1L

ORDER PLACEMENT:

Orders must contain specification of the actuator by the original manufacturer (OEM) data sheets, marking code of the desuperheater and its working parameters: pressure and temperature of the flowing fluids.
Beside the aforementioned parameters the rated plate of a desuperheater comprises the following information:
- maximum working temperature [TS],
- maximum working pressure [PS]
- test pressure [PT]
- class of fluids [2],
- serial number and year of manufacturing .

Please refer to our Marketing and Sales Department as well as the Technical Department for assistance to choose valves that suit your needs.

Revision: ST-1/06/2013
Valid until the next revision.

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MINIMUM FLOW VALVE TYPE **ZM1 and Z1B-M**

APPLICATION:

Minimum flow valves are designed for work in recirculation systems of pumps feeding power station boilers. They protect the pumps from hydraulic and heat overload in the case of a low water reception by the boiler, guaranteeing a minimum flow in a by-pass circuit of the pump.

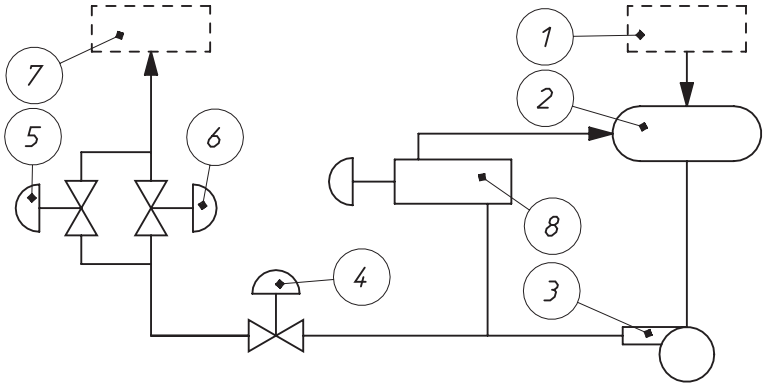


Figure 1. Diagram of installation of power station boiler feedwater.

1) Condensate pump.
2) Degasser.
3) Boiler feedwater pump.
4) Cut-off valve.
5) Boiler feedwater start-up valve.
6) Boiler feedwater control valve.
7) Boiler.
8) Minimum flow valve type ZM1.

FEATURES:

- Anti-cavitation manufacture with active and passive choking structures, allowing for valve's work both in the regulation function and in the on-off function,
- Body integrated with a bonnet, which reduces the number of potential leakage places. Another side of the body is protected with a self-tightening closure.
- High tightness of closure achieved thanks to FCT function (pressure closes).
- High durability and effectiveness of bonnet packings achieved, among other things, by placing them in low pressure zone,
- Use of an element protecting regulatory parts of the valve from polluting.

DESIGN AND TECHNICAL SPECIFIACTION:

Body:	forged, single-unit with a bonnet, with welded inlet / outlet stubs.
Nominal size:	DN50
Nominal pressure:	PN320
Body ends:	for welding, ∅76x13
Closure tightness:	V class in accordance with PN-EN 60534-4.
Flow direction:	over the plug

Flow coefficient: Kvs 10
Characteristics: linear

Figure 2. Valve intersection.

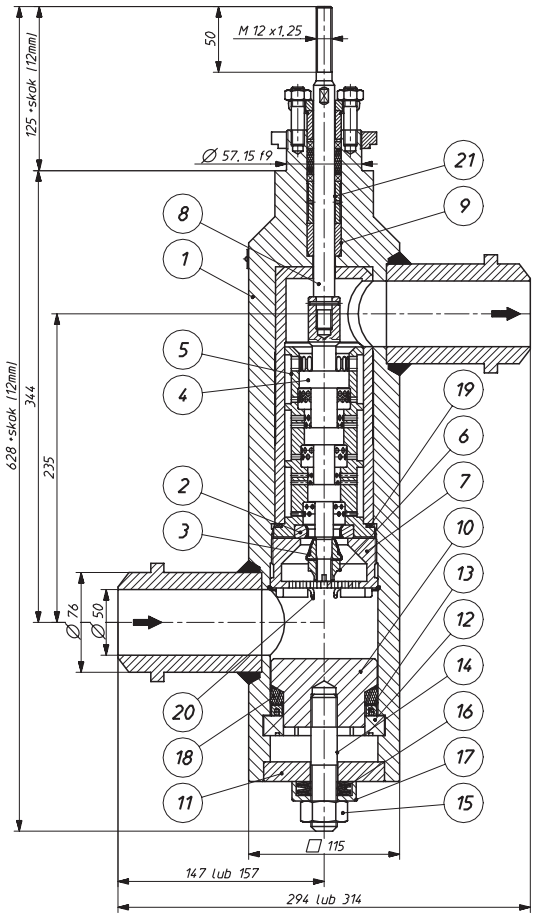


Table 1 Parts and Materials List

Item	Name of part	Material	Norm
1	Body with sleeve	S 355 J2G3 (1.0570) + X17CrNi 16-2 ; (1.4057) + heat processing	PN-EN 10025
2	Seat	X6CrNiMoTi 17-12-2; (1.4571) + stellit	PN-EN 10088
3	Plug	X6CrNiMoTi 17-12-2; (1.4571) + stellit	PN-EN 10088
4	Piston	X17CrNi 16-2 ; (1.4057) + heat processing	PN-EN 10088
5	Sleeve	X17CrNi 16-2 ; (1.4057) + heat processing	PN-EN 10088
6	Nut	X17CrNi 16-2 ; (1.4057)	PN-EN 10088
7	Screw plug	X17CrNi 16-2 ; (1.4057) + heat processing	PN-EN 10088
8	Stem	X17CrNi 16-2 ; (1.4057) + heat processing	PN-EN 10088
9	Guiding sleeve	X17CrNi 16-2 ; (1.4057) + heat processing	PN-EN 10088
10	Clamp	X17CrNi 16-2 ; (1.4057) + heat processing	PN-EN 10088
11	Cover	X17CrNi 16-2 ; (1.4057)	PN-EN 10088
12	Divided ring	X17CrNi 16-2 ; (1.4057) + heat processing	PN-EN 10088
13	Ring	X17CrNi 16-2 ; (1.4057) + heat processing	PN-EN 10088
14	Screw M20x75	8.8	EN 20898-1
15	Nut M20	8	PN-EN 20898-2
16	Plate spring	X10CrNi18-8 (1.4310)	PN-EN 10088
17	Spring cover	X17CrNi 16-2 ; (1.4057)	PN-EN 10088
18	Tightening ring	SPETOGRAF GUS 962 APX	SPETECH
19	Seat packing	Spiraltherm GRAFIT (98%) + 1.4404 (spiral)	BURGMANN
20	Protective ring	12R10	SANDVIK
21	Tightening set	GRAFIT	SPETECH

NOTE:
As part of the technology of hardening the internal elements of the valve, the following means are used:
a) stelliting – surface padding with stellite: ~ 40HRC
b) heat processing: (35…45HRC depending on the function of a part)

Table 2. Acceptable working pressures depending on working temperature in accordance with PN-EN 1092-1.

t [C°]	100	200	250	300
p [bar]	320	266,6	243,8	220,9

Actuator type:
Pneumatic actuator: membrane, multi-spring, type R-400; R1-400 or R5-400.
Spring range: basic: 120…280 kPa,
actual (12mm): 180…280 kPa
Supply pressure: 400 kPa

Electrical actuator:
Disposition force: 10kN
Note: other data as in catalogue sheets of actuators type P/R, P1/R1, P5/R5.

MARKING EXAMPLE:
In the marking, the actuator's symbol and valve type have to be given, e.g. **R-400-ZM1; R1-400-ZM1; R5N-400-ZM1**.
The mark is placed on the data plate of the valve.
Besides, the following items are given:
nominal size of the valve [DN], marking of nominal pressure of the valve [PN], max. working temperature [TS], max. working pressure [PS], test pressure [PT], flow coefficient [Kvs], leap of plug [H], fluid group [1 or 2], serial number and year of manufacture.

ORDERING:
An order should include information necessary for calculating the valve's properties in accordance with the technical data questionnaire. You can be assisted with selecting valves by workers of the Marketing and Sales Department and the Technical Department.

Revision: ZM1 and Z1B-M/06/2013
Valid until the next revision.

MINIMUM FLOW VALVE TYPE Z1B-M

APPLICATION:

Valve type Z1B-M, owing to its design, material choice and manufacturing technology, adjusted to operation under most demanding working conditions, at high pressure drop and with the risk of cavitation occurring.

The valve, as presented herein, can be used as a minimum flow valve in by-pass systems of feeding pumps in power boilers.

CHARACTERISTICS:

Minimum flow valve type Z1B-M is anti-cavitation valve designed for liquid at pressure drop of up to 200 bar and flow of 70 t/h.

Valve design provides for division of pressure drop on the valve into six steps, so that the pressure reductions do not exceed critical levels causing cavitation.

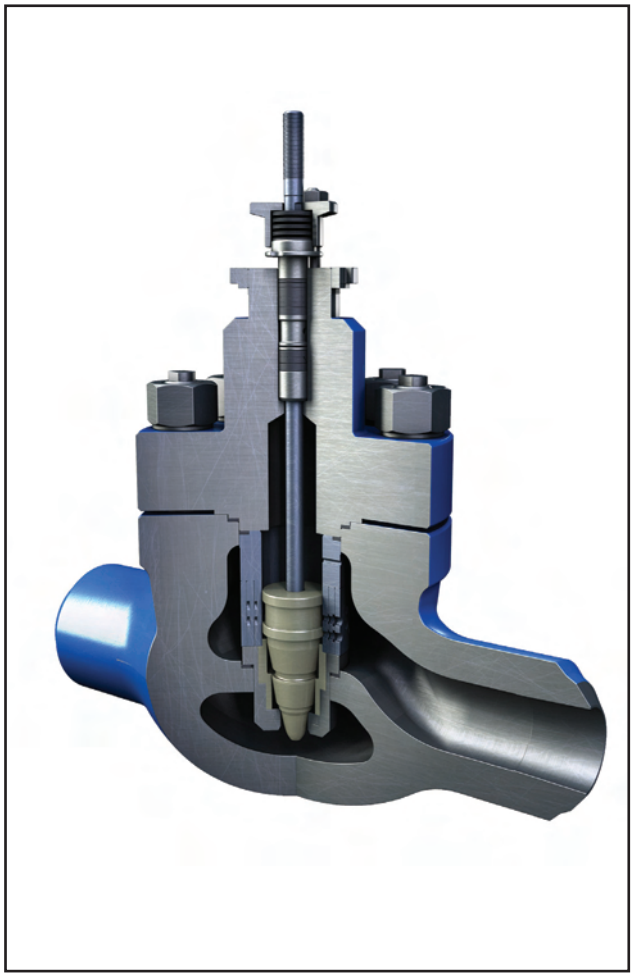
High quality of control, durability and reliability has been achieved due to appropriate design of internal parts and material selection.

Seat and three-step plug are made of ZrO_2 ceramics, which features excellent durability and chemical resistance.

Further pressure drop is achieved through active throttling in three multihole hardened sleeves with radial flow. Valve stem is made of titanium and it co-operates with bonnet packing set, which provides for external tightness in accordance with TA Luft regulations.

The valve guarantees high shut-off tightness.

It is also possible to adapt this design solution to other demanding applications in globe and angle designs.



Revision: ZM1 and Z1B-M/06/2013
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NOTES:

Revision: ZM1 and Z1B-M/06/2013
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DIAPHRAGM MULTI-SPRING PNEUMATIC ACTUATORS **TYPE P/R**

APPLICATION AREA

The multi-spring membrane pneumatic actuators of P/R type are applied for control operation of control valves and other positioning elements in industrial automatic systems.
There are three following design options of the acutator:

- direct action (air - advances the steam) - type P,
- reverse action (air – retracts the steam) - type R,
- direct action, handwheel - type PN,
- reverse action, handwheel - type RN

FEATURES

- completely reversible action, option to change spring range w/o extra parts,
- actuator mounted on the columns,
- wide range of the available forces,
- linear relationship between rod displacement and control pressure as a result of using membranes with constant active area,
- various ranges of spring pressures due to changeability of spring number and /or dislocation of distance fencers,
- capability of the actuator o incorporate side-mounted handwheel,pneumatic or electro-pneumatic positioners, limit switches, air sets, three-way pneumatic solenoid valves, lockup valves, position transducers,
- possibility to equip with accessories allowing to decrease or increase distortion time,
- high strength of diaphragms, springs and packings,
- small size and weight

TECHNICAL PARAMETERS

input signal range:	20...100 kPa;	spring range marking:	1
	40...200 kPa;		2
	40...120 kPa		3
	80...240 kPa;		4
	60...140 kPa;		5
	120...280 kPa		6
	180...380 kPa		7
Number of springs:	standard wersion:		
	range	1, 3, 5	- 3 springs
	range	2, 4, 6	- 6 springs
	range	7	- 12 springs
version TANDEM:	range	1, 3, 5	- 6 springs
	range	2, 4, 6	- 12 springs
	range	7	- 24 springs
- working temperature:	- 40...+80°C		
- relative humidity:	max. 98%		

Table 1. Technical parameters.

Size	Diaphragm effective area	Stroke	Spring range marking	Max. supply pressure
	[cm^2]	[mm]		[kPa]
160	160	20	1...6	600
250	250			
400	400			
630	630	20; 38	1...7	500
R-630T	2x630			
1000	1000	38; 50; 63		
1500	1500	38; 50; 63; 80; 100		
1500T	2x1500	50; 63; 80; 100		

DIMENSIONS AND WEIGHT

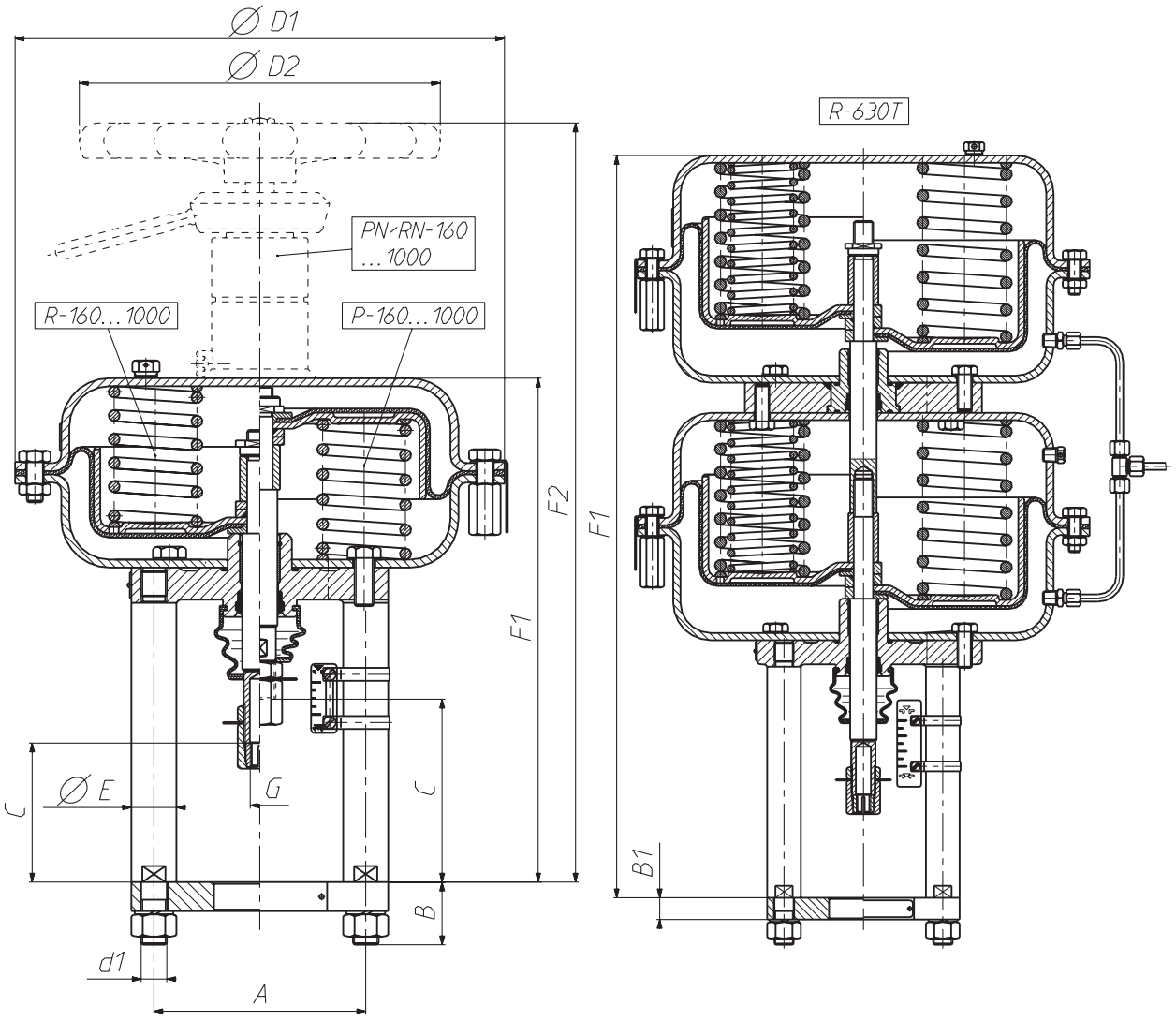

Table 2. Dimensions and weight of the actuators P/R-160…1000 .

Actuator size	A	B	B_1	C		D_1	D_2	d_1	E	F_1	F_2	G	Weight	
				P, PN	R, RN								P,R	PN, RN
	[mm]												[kg]	
160	110	31	18	110	84	210	225	M12	22	288	450	M12x1,25	9	13,5
250				112	86	240	225			306	468		10	14,5
400	132	39	20	116		305		M16	28	312	474		16	20,5
630			22	134		375	305			402	564		30	37
R-630T				-			-			616	-		45	52
1000	216	50		210	127	477	450	M24	42	585	825	M16x1,5	74	100

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DIMENSIONS AND WEIGHT

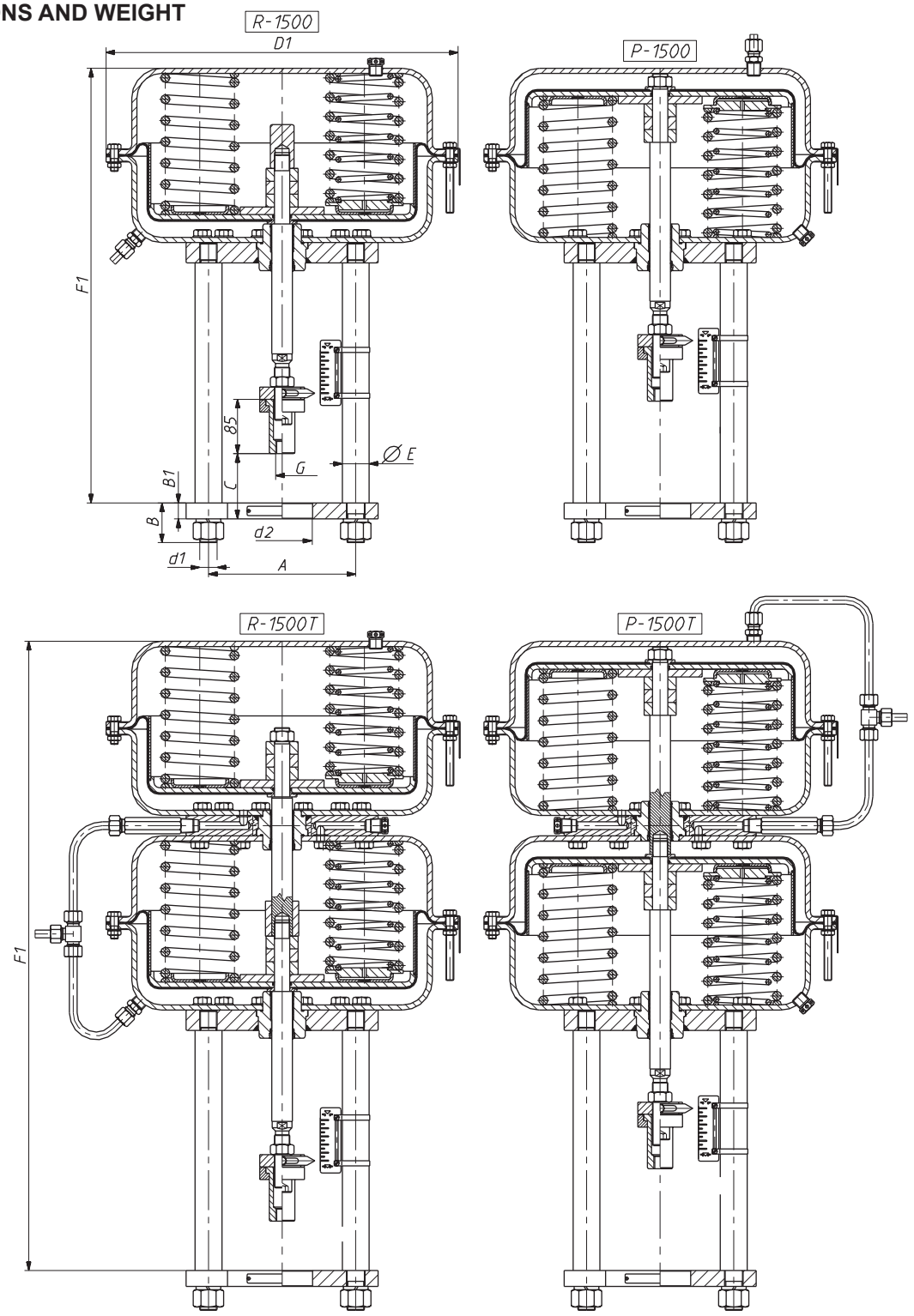

Table 3. Dimensions and weight of the actuators P/R-1500; 1500T.

Actuator size	A	B	B_1	d_2	D_1	d_1	E	F_1	G	Weight P,R
	[mm]									[kg]
1500	230	62	18	57,15	550	M27	42	679	M16x1,5 M20x1,5 M24x1,5	95
			22	84,15						
			25	70						
				95,25						
1500T			18	57,15				983		200
			22	84,15						
			25	70						
				95,25						

Actuator size	Stroke	C	
		P	R
	[mm]		
1500	38	142	102
	50	154	
	63	167	
	80	184	
	100	204	
1500T	50	154	
	63	167	
	80	184	
	100	204	

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Disposition forces:

Disposition actuator forces Fs [kN]:

Pneumatic actuator type P: $Fs = 10^{-4} \cdot A \cdot (p_z - p_2)$,

Pneumatic actuator type R: $Fs = 10^{-4} \cdot A \cdot p_1$

where:

A - Diaphragm effective area [cm^2] - acc. table 1,

p_z - supply pressure [kPa] - acc. table 4

p_1; p_2 - Opening and closing spring range [kPa] - acc. table 4.

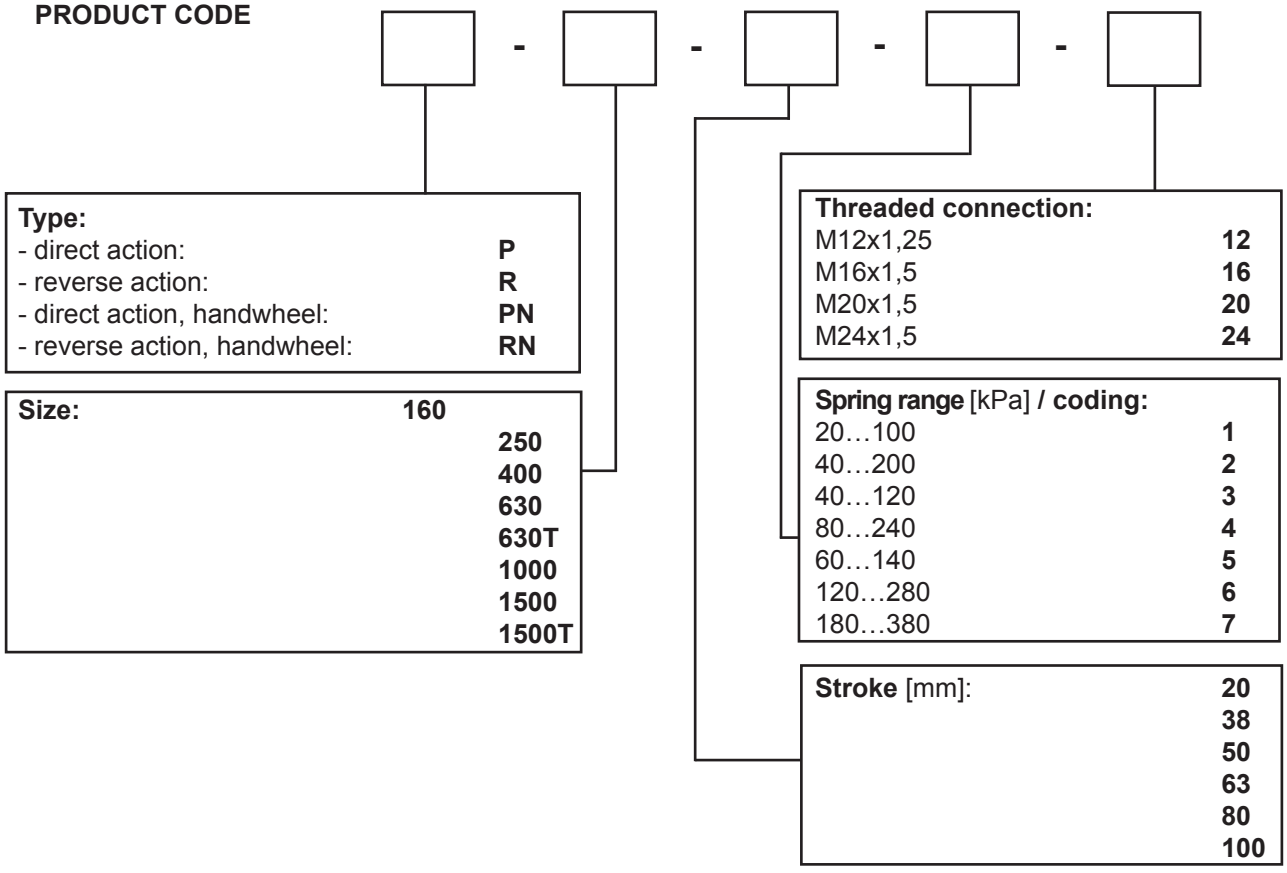
Table 4. Disposition forces for actuators Fs [kN].

Size	Actuator P			Actuator R					
	Supply pressure [kPa]			Spring range [kPa]					
	140	250	400	20…100	40…120 40…200	60…140	80…240	120…280	180…380
160	0,64	2,4	4,8	0,32	0,64	0,96	1,28	1,92	-
250	1,0	3,8	7,5	0,5	1,0	1,5	2,0	3,0	-
400	1,6	6,0	12,0	0,8	1,6	2,4	3,2	4,8	-
630	2,5	9,5	18,9	1,3	2,5	3,8	5,0	7,6	11,3
R-630T	-	-	-	2,6	5,0	7,6	10,0	15,2	22,6
1000	4,0	15,0	30,0	2,0	4,0	6,0	8,0	12,0	18,0
1500	6,0	22,5	45,0	3,0	6,0	9,0	12,0	18,0	27,0
1500T	12,0	45,0	90,0	6,0	12,0	18,0	24,0	36,0	54,0

Note:

1. For actuators ”P” assumed spring range 20…100 kPa and standard supply pressure.
2. Disposition forces calculated with the use of formulas or given in the table do not take into consideration friction or manufacture tolerances so the forces should be assumed as 15...20% lower than those values.
3. Actuator 630T occure only in type „R”.

PRODUCT CODE



Example of the product code:

The pneumatic actuator of inversed action, with a handwheel, size – 400, threaded connection M12x1,25, stroke 20 mm, spring range 40...200:

RN - 400 - 20 - 2 - 12

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DIAPHRAGM MULTI-SPRING PNEUMATIC ACTUATORS **TYPE P1/R1**

APPLICATION AREA

The multi-spring diaphragm pneumatic actuators of P1/R1 type are applied for control operation of control valves and other positioning elements in industrial automatic systems.
There are three design options of the acutators:

- direct action (air - advances the steam) - type P1,
- reverse action (air - retracts the steam) - type R1,
- direct action, handwheel - type P1B,
- reverse action, handwheel - type R1B

FEATURES

- completely reversible action, option to change spring range w/o extra parts,
- rigid structure of cast yoke,
- wide range of available forces,
- linear dependence of stem movement from control pressure, due to application of diaphragms with constant effective area,
- various spring ranges achieved by changing the number of springs and/or changing position of spacer elements,
- capability of the actuator to incorporate side-mounted handwheel, pneumatic or electro-pneumatic positioners, limit switches, air sets, three-way pneumatic solenoid valves, lockup valves, position transducers,
- high strength of diaphragms, springs and packings,
- low weights and small overall dimensions.

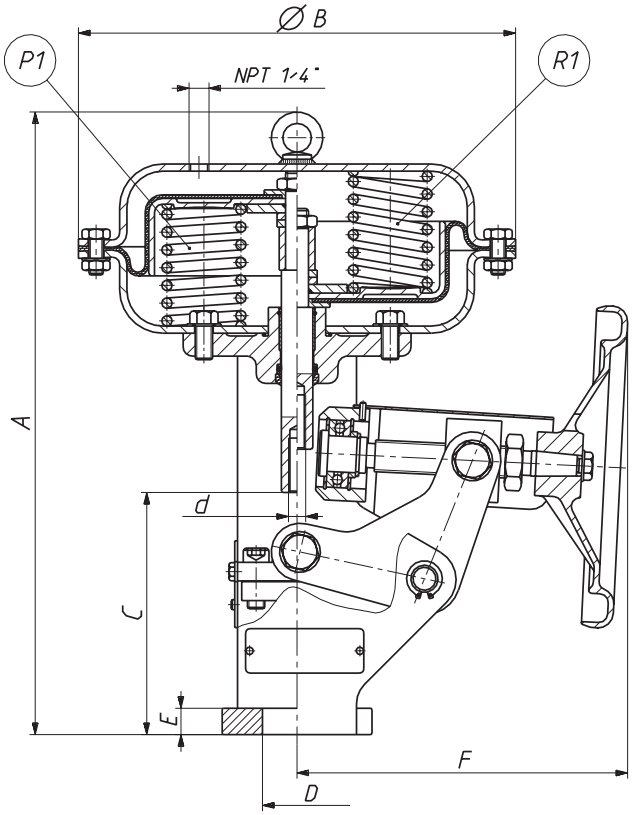
TECHNICAL PARAMETERS

- input signal range: 20…100 kPa; 40…120 kPa; 60…140 kPa - 3 springs
  40…200 kPa; 80…240 kPa; 120…280 kPa - 6 springs
  180…380 kPa - 12 springs
  Doubled number of springs (TANDEM version) for the 1500T actuator
- max. supply pressure: 400 kPa (450 kPa for the range 180…380 kPa)
- working temperature: - 40…+80°C
- relative humidity: max. 98%

Diaphragm effective area	Stroke	Spring range
[cm^2]	[mm]	[kPa]
400	20	1…6
630	20; 38	1…7
1000	38; 50; 63	
1500	38; 50; 63; 80; 100	
1500T	50; 63; 80; 100	

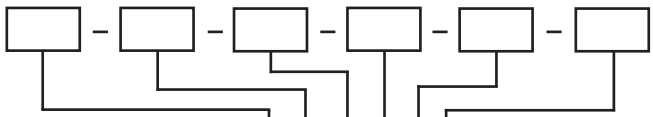
DIMENSIONS AND WEIGHTS

Actuator size	A	B	C		D	E	F	d
			P1; P1B	R1; R1B				
	[mm]							
400	453	305	127	100	57,15	17,7	255	M12x1,25
630	548	375	127	107	57,15	17,7	280	M12x1,25 M16x1,5
					84,15	22,5		
1000	773	477	153	90	57,15	17,7	340	M12x1,25 M16x1,5 M20x1,5
					84,15; 95,25	22,5		
1500	833	550	184	102	57,15	17,7	410	M12x1,25 M16x1,5 M20x1,5
					84,15; 95,25	22,5		
1500T	1138	550			84,15; 95,25			M24x1,5



Actuator size	Weight	
	P1; R1	P1B; R1B
	[kg]	
400	20	28
630	40	50
1000	85	105
1500	120	150
1500T	225	255

PRODUCT CODE



Type:
- direct action: **P1**
- reverse action: **R1**
- direct action, with drive: **P1B**
- reverse action, with drive: **R1B**

Size: **400** **630** **1000** **1500** **1500T**

Stroke [mm]**:** **20** **38** **50** **63** **80** **100**

Connection thread:
- M12x1,25 **12**
- M16x1,5 **16**
- M20x1,5 **20**

Spud diameter [mm]**:**
- 57,15 **57**
- 84,15 **84**
- 95,25 **95**

Spring range [kPa]**:**
- 20…100 **1**
- 40…200 **2**
- 40…120 **3**
- 80…240 **4**
- 60…140 **5**
- 120…280 **6**
- 180…380 **7**

Example of the product code:
The pneumatic actuator of reverse action, with handwheel, size – 400, stroke 20 mm, spring range 40…200 kPa, with yoke ∅ 57,15, and connection thread M12x1,25:

R1B - 400 - 20 - 2 - 57 - 12.

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HEAT ENGINEERING – TECHNICAL INFORMATION

INTRODUCTION:

Thermal centres play an important role within heat engineering. The following factors are the reasons for this:

- Automation of a thermal centre makes settlements between the supplier and consumer of heat possible, based on the heat actually consumed; at the same time it allows to regulate the heat receiver in accordance with the supplier's requirements (limiting flow through the centre and parameters of water returning to the network) and enable the consumer to limit the amount of heat received at their own will,
- Automation of the thermal centre accounts for the greatest percentage share in power saving out of the total saving that may be achieved through automation of the whole heating system and internal installations of a building,
- Without automation of the thermal centre, automation of internal installations of a building is impossible,
- Automation of a thermal centre makes heat supply to a building independent of fluctuations from the network parameters caused by changes in consumption from neighbouring thermal centres,
- A high number of thermal centres and the demand for automatic control equipment resulting from it, justifies the design and manufacture of specialized assortments of so called heat engineering equipment, including self-operating regulators.

GENERAL CHARACTERISTICS OF REGULATORS:

Zakłady Automatyki "POLNA" S.A. in Przemyśl produces two series of types of self operating regulators:

- Type ZSN, with a flanged body ranging from DN15 to 100,
- Type ZSG, with a thread body end ranging from DN15 to 32.

The regulators are designed for fixed set-point pressure regulation, regulation of pressure differences and/or flow differences in technological installations connected with the regulator's valve in series or parallel.

Depending on the purpose, regulators are divided into the following types:

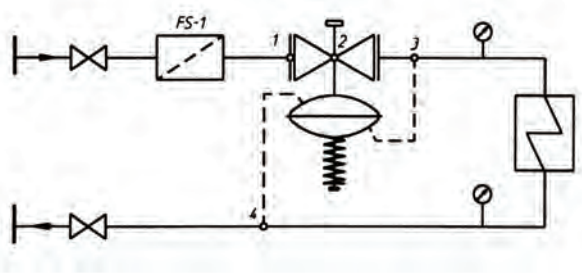
- ZSN1; ZSG1 – for regulation of pressure after the valve (reducer),
- ZSN2 – for regulation of pressure after the valve (reducer) with an intensifier,
- ZSN3; ZSG3 – for regulation of pressure before the valve (bleed regulator),
- ZSN5; ZSG5 – for regulation of pressure differences with flow limitation on the installation connected with the regulator's valve in series,
- ZSN6; ZSG6 – for regulation of pressure differences with flow limitation on the installation connected with the regulator's valve in series (installation on the return),
- ZSN7; ZSG7 – for regulation of pressure differences on the installation connected with the regulator's valve in parallel,
- ZSN8; ZSG8 – for flow regulation
- ZSN91; ZSG9.1 – for regulation of pressure differences and flow regulation on the installation connected with the regulator's valve in series (installation on the supply),
- ZSN92; ZSG9.2 – for regulation of pressure differences and flow regulation on the installation connected with the regulator's valve in series (installation on the return),
- ZSN10 – for regulation of pressure differences on the installation connected with the regulator's valve in series, with electromagnetic control.

PRINCIPLES OF SELECTING REGULATORS:

A. SELECTION OF REGULATOR'S VALVE

Selection of a regulator's valve means determination of flow coefficient Kv, and then the maximum flow of the medium through the valve or the minimum pressure drop on it.

Installation on the supply



Installation on the run-off

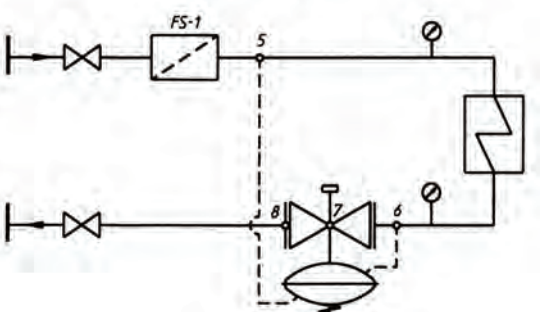


Figure 1

Input data:

Q - flow value [m^3/h],

Kvs - catalogue flow coefficient,

p_z - supply pressure [kPa], pressure in point 1 or 5,

Δp_r - regulated pressure difference [kPa], which means pressure drop on a technological installation connected in series with the valve of the regulator which needs to be stabilized. Pressure difference between points 3 and 4 or 5 and 6.

Δp_d - disposition pressure difference [kPa], which means pressure drop between the points with the highest and the lowest pressure in the centre. Pressure difference between points 1 and 4 or 5 and 8.

p_1 - pressure on valve's inlet (closing component) [kPa] (for steam and gases this should be regarded as the absolute pressure),

p_2 - pressure on valve's outlet [kPa] (for steam and gases this should be regarded as the absolute pressure),

Δp - pressure drop on the valve's closing component [kPa]; ($\Delta p=p_1-p_2$),

Δp_p - pressure difference on the flow limiter: (20 kPa lub 50 kPa),

In regulators without flow limitation, installed on the supply or on the return, and in regulators ZSN6 and ZSG6 (installed on the return), pressure drop on the valve should be assumed for the calculation of flow coefficient:

$$\Delta p = p_1-p_2 = \Delta p_d-\Delta p_r$$

For other regulators, installed on the supply or on the return:

$$\Delta p = p_1-p_2 = \Delta p_d-\Delta p_r-\Delta p_p$$

1. Selection procedure for water.

Pressure drop Δp [kPa] on the regulator's valve is:

$$\Delta p = p_1-p_2$$

The calculated flow coefficient of regulator's valve [m^3/h] is:

$$Kv = \frac{10 \cdot Q}{\sqrt{\Delta p}}$$

After calculating the minimum flow coefficient Kv that way, you should choose from the data board of the regulator, according to catalogue sheets, the nearest flow coefficient Kvs, so that:

$$Kv \leq 0{,}85 \cdot Kvs$$

The minimum pressure drop on a fully open valve of the regulator should be:

and

$$\Delta p_{min.} = \frac{100 \cdot Q^2}{Kvs^2}$$ - for regulators with a flow limiter

$$\Delta p_{min.} = \frac{100 \cdot Q^2}{Kvs^2} + \Delta p_p$$ - for regulators with a flow limiter

The maximum flow through the valve is:

$$Q_{max.} = 0{,}1 \cdot Kvs \cdot \sqrt{\Delta p}$$

2. Selection procedure for use on steam and gases.
Selection for those applications should be done by the manufacturer of the product.

B. NOISE.

Noise is generated by a valve results from cavitation (when concerning liquids) and excessive flow speed on the valve outlet (when concerning gases).

In regulators ZSN and ZSG no special construction means are designed to lower the potential noise. Therefore, below we just mention situations when excessive noise may occur, which need to be checked after selection of the regulator's valve.

If the boundary condition is exceeded, and the excessive noise is unacceptable (e.g. because of faster wearing out of the valve's closing component due to cavitation), systemic solutions should be applied to avoid such noise.

Such solution are as follows:

- By lowering the temperature on the valve's inlet (e.g. by moving the valve from the supply to the run-off),
- By lowering the pressure on the valve's inlet (e.g. by installing diaphragms before the valve or an additional reduction level)
- By increasing the pressure on the valve's inlet (e.g. by installing diaphragms after the valve or using choking elements in the form of multi-hole plates on the valve's outlet).

The reduction of noise has some conditions by not exceeding the boundary flow speed v = 3 [m/s] in water installations. This condition limits the maximum flow to the following value:

$$Q_{1\ max.}\ [m^3/h] = 8{,}5 \cdot 10^{-3} \cdot DN^2$$

At the flow speed of up to 5 [m/s], higher noise and a possibility of partial cavitation have to be taken into consideration and that value should not be exceeded:

$$Q_{2\ max.}\ [m^3/h] = 14 \cdot 10^{-3} \cdot DN^2$$

for DN50 - $Q_{1\ max.} = 21\ [m^3/h]$ i $Q_{2\ max.} = 35\ [m^3/h]$

C. SELECTION OF SETTING RANGE

The setting range of a regulator should be selected so that the value of regulated pressure would be in the lower half of the setting range. This ensures work with a lower spring tension and results in better parameters of work characteristics (proportionality, insensitivity and hysteresis ranges).

Apart from setting ranges recommended in our catalogue sheets, there are also special ranges that are possible.

D. CALCULATION EXAMPLES.

Example 1.

Regulator of pressure differences, installation on the supply, for water.

Technical data:

- Disposition pressure difference - $\Delta p_d = 450$ kPa,

- Regulated pressure difference - Δp_r = 60 kPa,
- Maximum flow - Q = 12 m^3/h

Calculations: $\Delta p = p_1 - p_2 = \Delta p_d - \Delta p_r = 450 - 60 = 390$ kPa

$$Kv = \frac{10 \cdot Q}{\sqrt{\Delta p}} = \frac{10 \cdot 12}{\sqrt{390}} = 6,0$$

In such a case, we choose a ZSN5 regulator, Kvs 8, setting range 40…160 kPa.

The nominal diameter of the regulator will be selected after an analysis of the flow speeds:

$$Q_{1\ max.}\ [m^3/h] = 8,5 \cdot 10^{-3} \cdot DN^2 \quad (\nu_{max.} = 3\ m/s),$$

$$Q_{2\ max.}\ [m^3/h] = 14 \cdot 10^{-3} \cdot DN^2 \quad (\nu_{max.} = 5\ m/s),$$

- for DN25 $Q_{1\ max.}$ = 5,3 m^3/h ; $Q_{2\ max.}$ = 8,75 m^3/h,
- for DN32 $Q_{1\ max.}$ = 8,7 m^3/h ; $Q_{2\ max.}$ = 14,3 m^3/h,
- for DN40 $Q_{1\ max.}$ = 13,6 m^3/h ; $Q_{2\ max.}$ = 22,4 m^3/h,

By choosing a DN25 regulator, we have to take into account a significant level of noise. Regulator DN32 in a special Kvs8 product is more beneficial. Regulator DN40 guarantees the greatest comfort as for the loudness of work.

Example 2.

A dual-function regulator of pressure differences and flow, for an installation on the return, for water.

Technical data:
- Disposition pressure difference - Δp_d = 400 kPa,
- Regulated pressure difference - Δp_r = 180 kPa,
- Maximum flow - Q = 32 m^3/h
- Choke setting assumed - Δp_p = 50 kPa,

Calculations: $\Delta p = p_1 - p_2 = \Delta p_d - \Delta p_r - \Delta p_p = 400 - 180 - 50 = 170$ kPa

$$Kv = \frac{10 \cdot Q}{\sqrt{\Delta p}} = \frac{10 \cdot 32}{\sqrt{170}} = 24,5$$

$$Kvs \cong \frac{Kv}{0,85} \cong 29 \qquad \text{assume Kvs 32}$$

In such a case we would choose a ZSN92; DN50; Kvs32; with pressure differences setting range 80…320 kPa, choke setting 50 kPa.

Depending on the flow speed, the flow is:

$$Q_{1\ max.} = 21\ m^3/h\ ;\ Q_{2\ max.} = 35\ m^3/h,$$

The regulator will work with an increased noise level.
The following condition is fulfilled:

$$\Delta p_d = 400 > 2 \cdot \Delta p_r = 2 \cdot 180 = 360$$

With a fully open choke, the valve works as a pressure differences regulator. The maximum flow is dependent on the acceptable flow speed. The range of flow regulation depends on the position of the choke and setting Δp_p.

$$Q = (0,1…1,0) \cdot 10^{-1} \cdot Kvs \cdot \sqrt{\Delta p_p}$$

$$Q_{min.} = 0,1 \cdot 10^{-1} \cdot 32 \cdot \sqrt{50} = 2,3\ m^3/h$$

$$Q_{max.} = 1 \cdot 10^{-1} \cdot 32 \cdot \sqrt{50} = 23\ m^3/h$$

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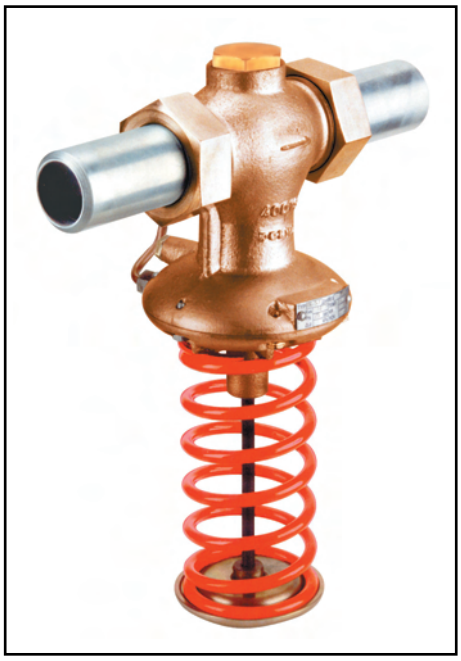
SELF-ACTUATING PRESSURE REDUCING REGULATORS **TYPE ZSG 1**

APPLICATION AREA:
These regulators are used to maintain the desired working pressure in process instalations that are connected to the outlet of the adjusting valve. Pressure rise in the monitored installation results in the valve shut-off. The valves are used in heating systems, industrial facilities to control pressure of flowing water, either cold or hot with temperature up to 150°C as well as non-flammable gases up to 80°C. Nominal pressure for the valves is PN25. Application of the devices for other utilities needs authorization of the manufacturer.

FEATURES:
- compact, sturdy design with small overall dimensions,
- high accuracy of adjustment,
- wide range of flow coefficients K_{VS},
- wide variety of connections, easy installation,
- protection against hydraulic overloads,
- guaranteed internal tightness and lack of external leaks,
- silent operation,
- long lifetime.



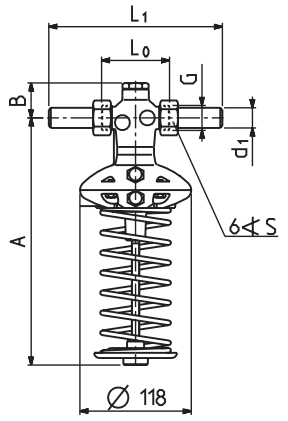
DESIGN:
The regulator consists of the flow control valve (01) and the hydraulic actuator (02) that are combined into a single (cast) structure. The adjusting unit (03) for the controlled pressure is placed outside the actuator.
Valve - single-ported, with a pressure balanced plug, with tight shut-off.
Actuator - diaphragm–type, with robust and durable diaphragm (active area of 40 cm^2).
Connections - pipe stubs for welding, threaded stubs or flanges to PN, DIN or ISO for pressure PN16 or PN25 as well as CL150 (the device with no connections is also available).

OPERATION PRINCIPLE:
When de-energized, the regulator valve is open. The impulse of adjustable pressure is delivered via a impulse pipe to the actuator chamber from the side of the spring. Pressure rise, above the presettable value that is adjusted by tension of the spring in the adjusting unit, results in proportional closing of the valve seat until the moment when the desired pressure value is restored.

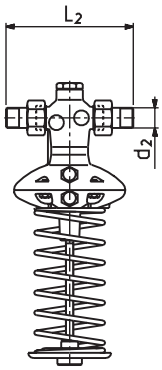
DESIGN OPTIONS:
ZSG 1.1 - with a permanent connection (factory-made) of pressure impulse to the regulator,
ZSG 1.2 - the impulse line can be connected to a whichever point of the installation downstream the regulator outlet.

TECHNICAL PARAMETERS:

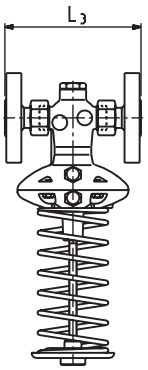
Nominal diameter DN		15	20	25	32
Flow coefficient K_{VS} [m^3/h]	full	3,6	5	7,2	10
	reduced	2,5 1,6 1 0,5	3,6 2,5 1,6 1	5,7 3,6 2,5 1,6	7,2 5,7 3,6 2,5
Noise factor Z		0,6		0,55	
Connection size for the body G		G 3/4	G 1	G 1 1/4	G 1 3/4
Outer diameter of the pipe d_1 [mm]		21,3	26,9	33,7	42,4
Outer diameter of the connecting stub d_2		R 1/2	R 3/4	R 1	R 1 1/4
Wrench size S		32	41	50	60
Face-to-face length	L_0 [mm]	70	75	80	105
	L_1 [mm]	184	199	224	269
	L_2 [mm]	136	151	164	195
	L_3 PN / CL [mm]	130 / 184	150 / 184	160 / 184	180 / 200
Height	A [mm]	250	250	250	265
	B [mm]	36	36	38	49



- with connecting stubs for welding



- with threaded connection



- with flanges

Nominal pressure:
- for the body – PN25
- for flanges – PN16; PN25; CL150

Allowable pressure drop:
- across the valve – 16 [bar]
- across the actuator – 16 [bar]

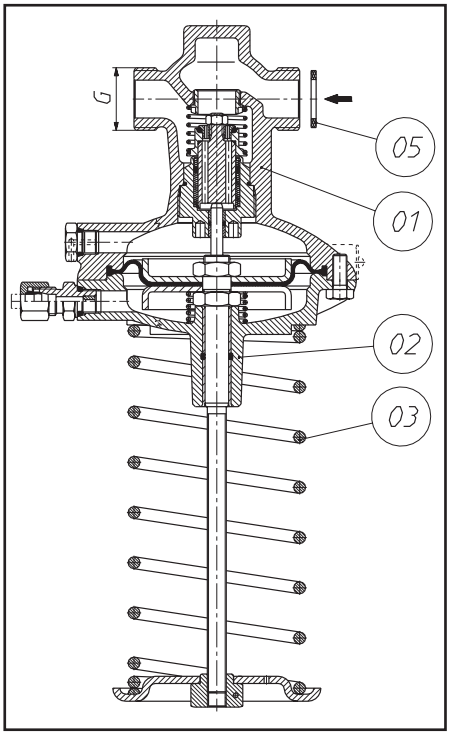
Allowable fluid temperature:
- liquids – +150 [°C]
- non-flammable gases – +80 [°C]

Range of settings – 10…100 [kPa] (green spring)
– 10…200 [kPa] (yellow spring)
– 20…400 [kPa] (red spring)

Leakage class – VI class to PN-EN 60534-4

MATERIALS

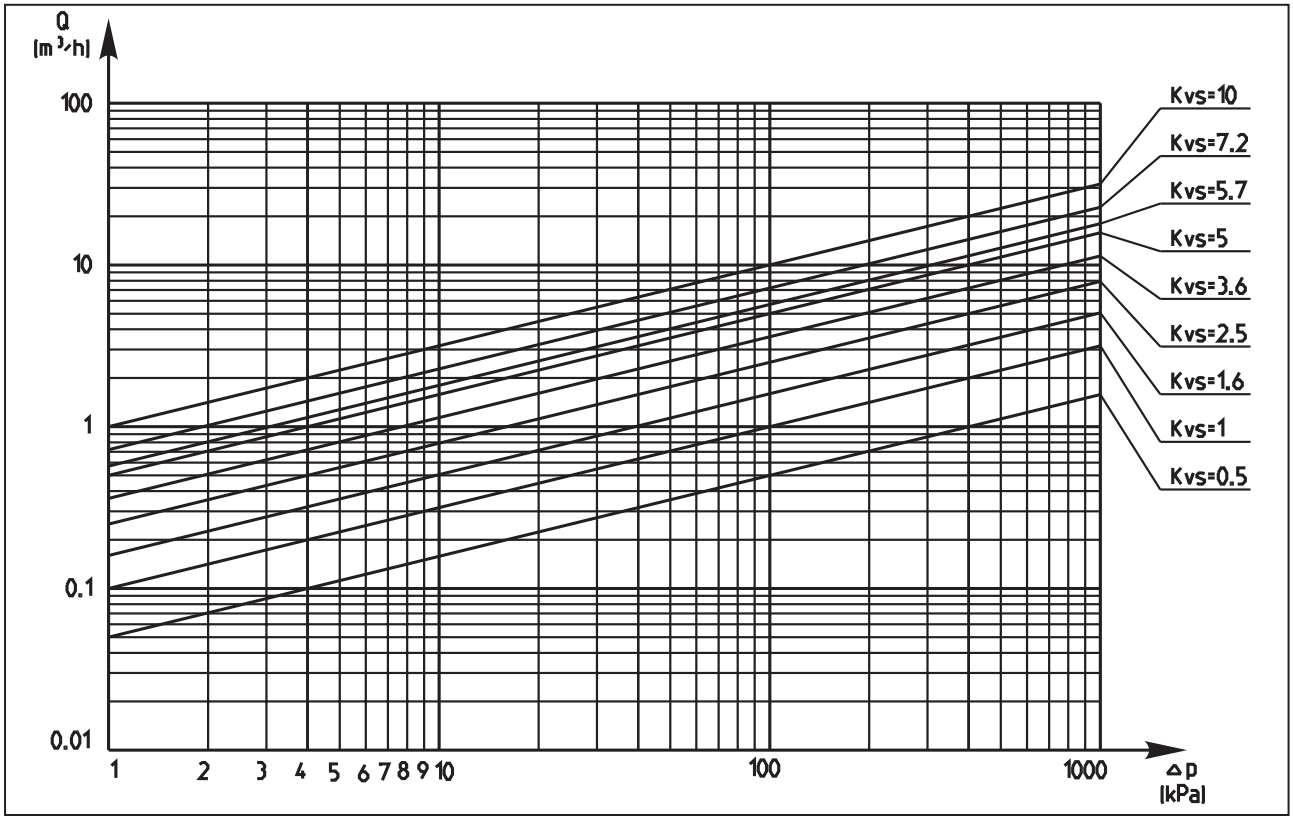
Body, bonnet – spheroidal iron to EN-GJS-400-18LT
Seat – steel K.O.X6CrNiMoTi17-12-2 (1.4571)
Plug – brass CuZn39Pb3
Stem – stainless steel X17CrNi16-2 (1.4057)
Guiding sleeves – steel with PTFE lining
Internal springs – spring stainless steel 12R10
Adjusting spring – spring steel C grade
Diaphragm – EPDM[1)] with polyester cloth
Sealing – EPDM[1)]
Connections – carbon steel for welding S355J2G3 (1.0570)



[1)] - or NBR in case of special options for oils or oil-containing gases.

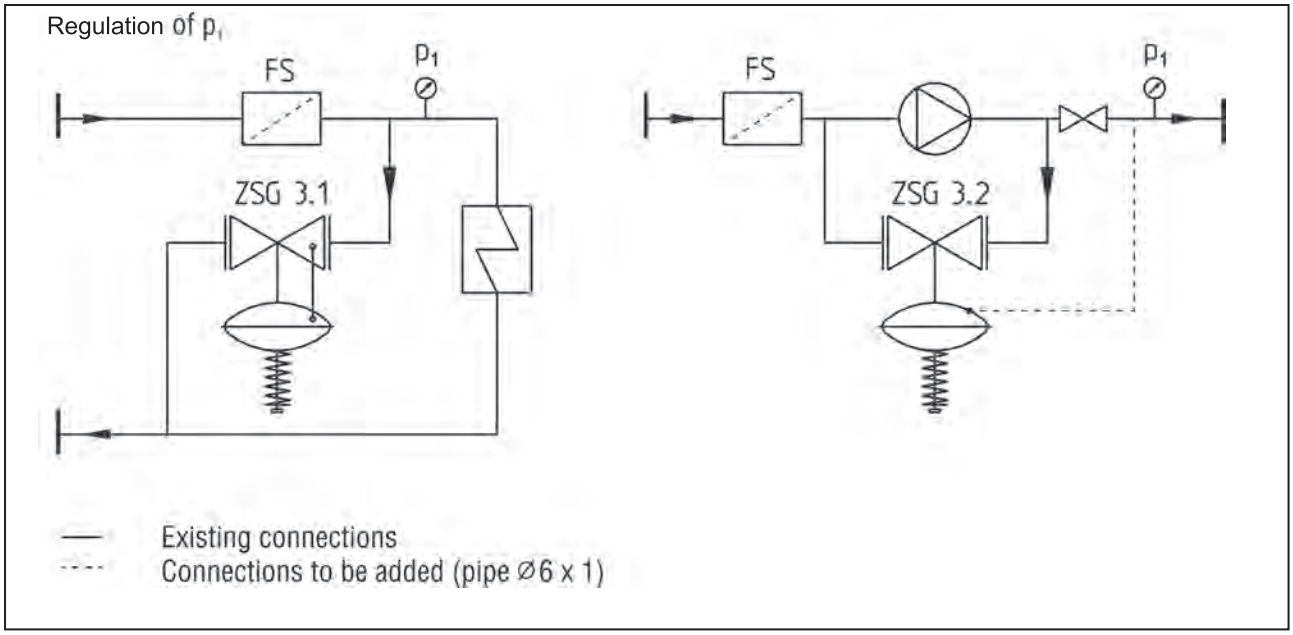
INSTALLATION

The regulator should be installed on a horizontal section of pipeline with the spring downward. Flow direction must match the arrow on the valve body. Application of strainers upstream of regulators is recommended.
To guarantee silent operation of the regulator the flow velocity of utilities in the controlled pipeline should not exceed 3 m/s for liquids and 12 m/s for gases.
Design of the regulator enables fitting of leaden seals to the adjustable parts after the desired settings are set. achieved.



Working temerature [°C]		120	135	150
Working pressure [bar]	PN16	16	15,5	15
	PN25	25	24	23,5

APPLICATION EXAMPLE: p_2



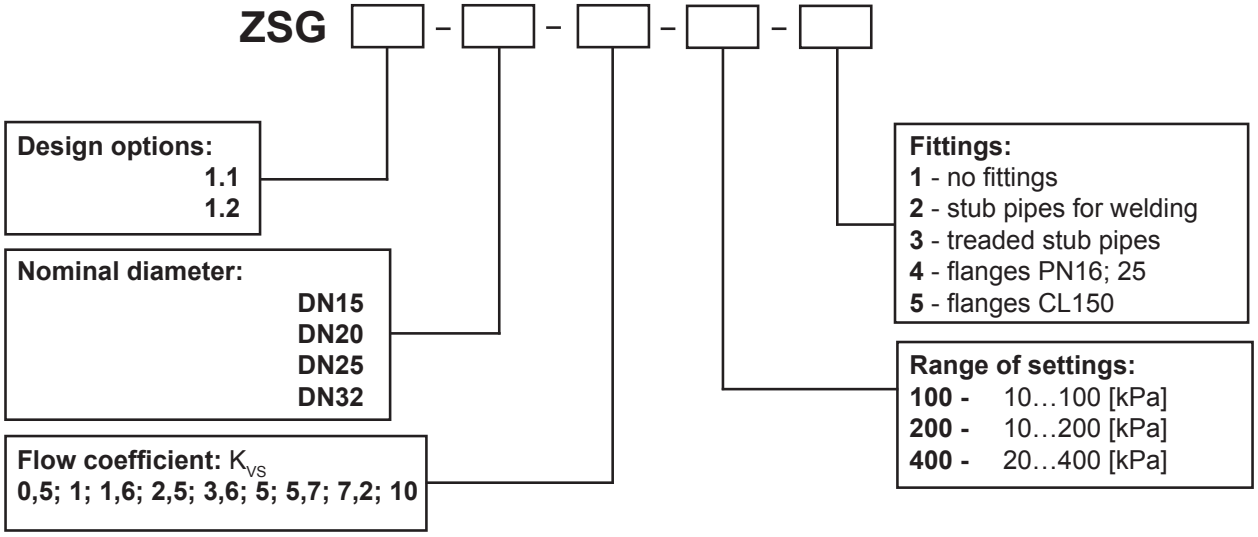
INSTALLATION KIT:

The regulator is delivered along with a factory-made installation kit that includes necessary fittings to connect impulse lines (pipes) ∅6 x 1. Connections for installation on a pipeline (e.g. mating flanges) can be delivered as supplementary fittings (upon a separate order).

Connection type		DN15	DN20	DN25	DN32
Stub pipe for welding		8520144000	8520145000	8520146000	8520147000
Threaded stub pipe		8520148000	8520149000	8520150000	8520151000
Flange	PN16; PN25	8520136000	8520138000	8520140000	8520142000
	CL150	8520137000	8520139000	8520141000	8520143000
Gasket (pos. 05)		8121795000	8121796000	8121797000	8121798000

ORDER PLACEMENT

Orders must contain full name of the product, nominal diameter DN, flow coefficient K_{VS}, range of settings and fittings.



EXAMPLE OF THE PRODUCT CODE:

Pressure regulator type ZSG, with connected impulse pipe; nominal diameter DN25; K_{VS} =3,6; range of settings 20…400 [kPa]; with stub pipes for welding:

ZSG1.1-25-3,6-400-2

Revision: ZSG1/03/2011
Valid until the next revision.

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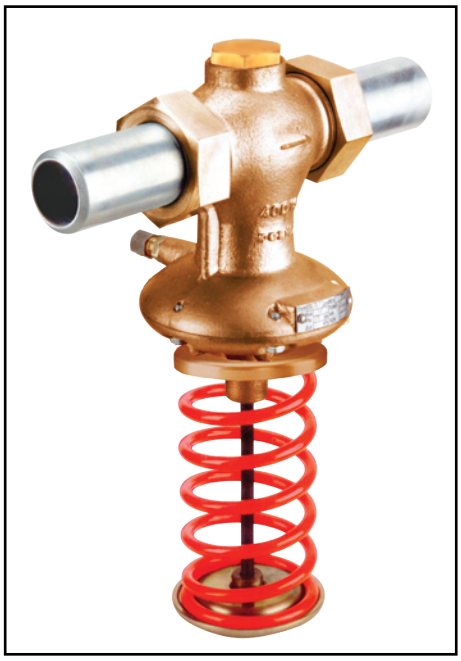
SELF-ACTUATING PRESSURE RELIEF REGULATORS **TYPE ZSG 3**

APPLICATION AREA:
These regulators are used to maintain the desired working pressure in process instalations that are connected to the inlet of the adjusting valve. Pressure rise in the monitored installation results in the valve opening. The valves are used in heating systems and industrial facilities to control pressure of flowing water, either cold or hot with temperature up to 150°C as well as non-flammable gases up to 80ºC. Nominal pressure for the valves is PN25. Application of the devices for other utilities needs authorization of the manufacturer.

FEATURES:
- compact, sturdy design with small overall dimensions,
- high accuracy of adjustment,
- wide range of flow coefficients K_{VS},
- wide variety of connections, easy installation,
- protection against hydraulic overloads,
- guaranteed internal tightness and lack of external leaks,
- silent operation,
- long lifetime.



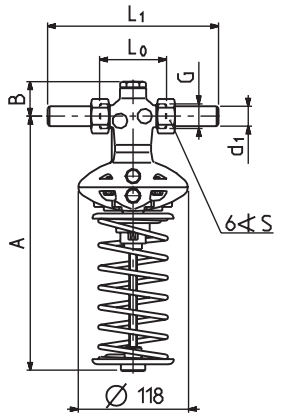
DESIGN:
The regulator consists of the flow control valve (01) and the hydraulic actuator (02) that are combined into a single (cast) structure. The adjusting unit (03) for the controlled pressure is placed outside the actuator.
Valve - single-ported, with a pressure balanced plug, with tight shut-off.
Actuator - diaphragm - type, with robust and durable diaphragm (active area of 40 cm^2)
Connections – pipe stubs for welding, threaded stubs or flanges to PN, DIN or ISO for pressure PN16 or PN25 as well as CL150 (the device with no connections is also available).

OPERATION PRINCIPLE:
When de-energized, the regulator valve is closed. The impulse of adjustable pressure is delivered via a impulse pipe to the actuator chamber from the side of the valve. Pressure rise, above the presettable value that is adjusted by tension of the spring in the adjusting unit, results in proportional opening of the valve seat until the moment when the desired pressure value is restored.

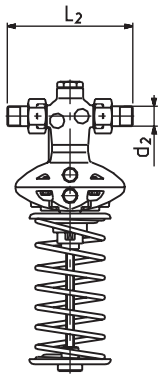
DESIGN OPTIONS:
ZSG 3.1 - with a permanent connection of pressure impulse to the regulator,
ZSG 3.2 - the impulse line can be connected to a whichever point of the installation upstream the regulator inlet.

TECHNICAL PARAMETERS:

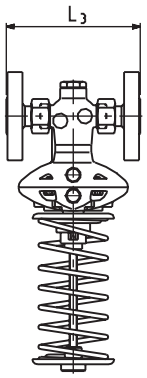
Nominal diameter DN		15	20	25	32
Flow coefficient K_{VS} [m^3/h]	full	3,6	5	7,2	10
	reduced	2,5 1,6 1 0,5	3,6 2,5 1,6 1	5,7 3,6 2,5 1,6	7,2 5,7 3,6 2,5
Noise factor Z		0,6		0,55	
Connection size for the body G		G 3/4	G 1	G 1 1/4	G 1 3/4
Outer diameter of the pipe d_1 [mm]		21,3	26,9	33,7	42,4
Outer diameter of the connecting stub d_2		R 1/2	R 3/4	R 1	R 1 1/4
Wrench size S		32	41	50	60
Face-to-face length	L_0 [mm]	70	75	80	105
	L_1 [mm]	184	199	224	269
	L_2 [mm]	136	151	164	195
	L_3 PN / CL [mm]	130 / 184	150 / 184	160 / 184	180 / 200
Height	A [mm]	273	273	273	288
	B [mm]	36	36	38	49



- with connecting stubs for welding



- with threaded connection



- with flanges

Nominal pressure:
- for the body – PN25
- for flanges – PN16; PN25; CL150

Allowable pressure drop:
- across the valve – 16 [bar]
- across the actuator – 16 [bar]

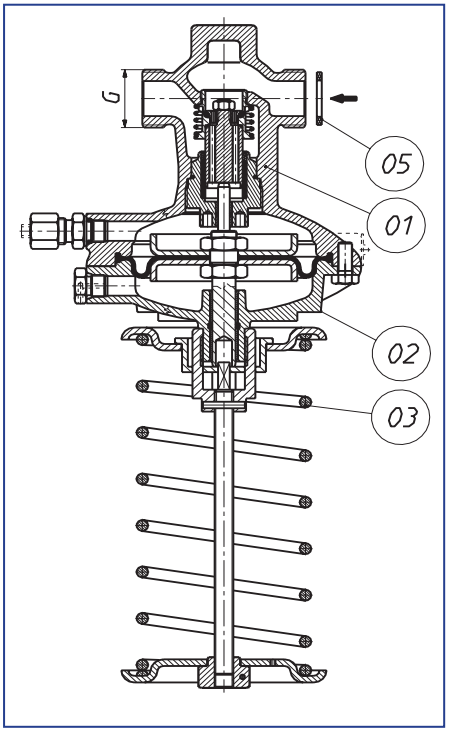
Allowable fluid temperature:
- liquids – +150 [°C]
- non-flammable gases – +80 [°C]

Range of settings – 10…100 [kPa] (green spring)
– 10…200 [kPa] (yellow spring)
– 20…400 [kPa] (red spring)

Leakage class – VI class to PN-EN 60534-4

MATERIALS

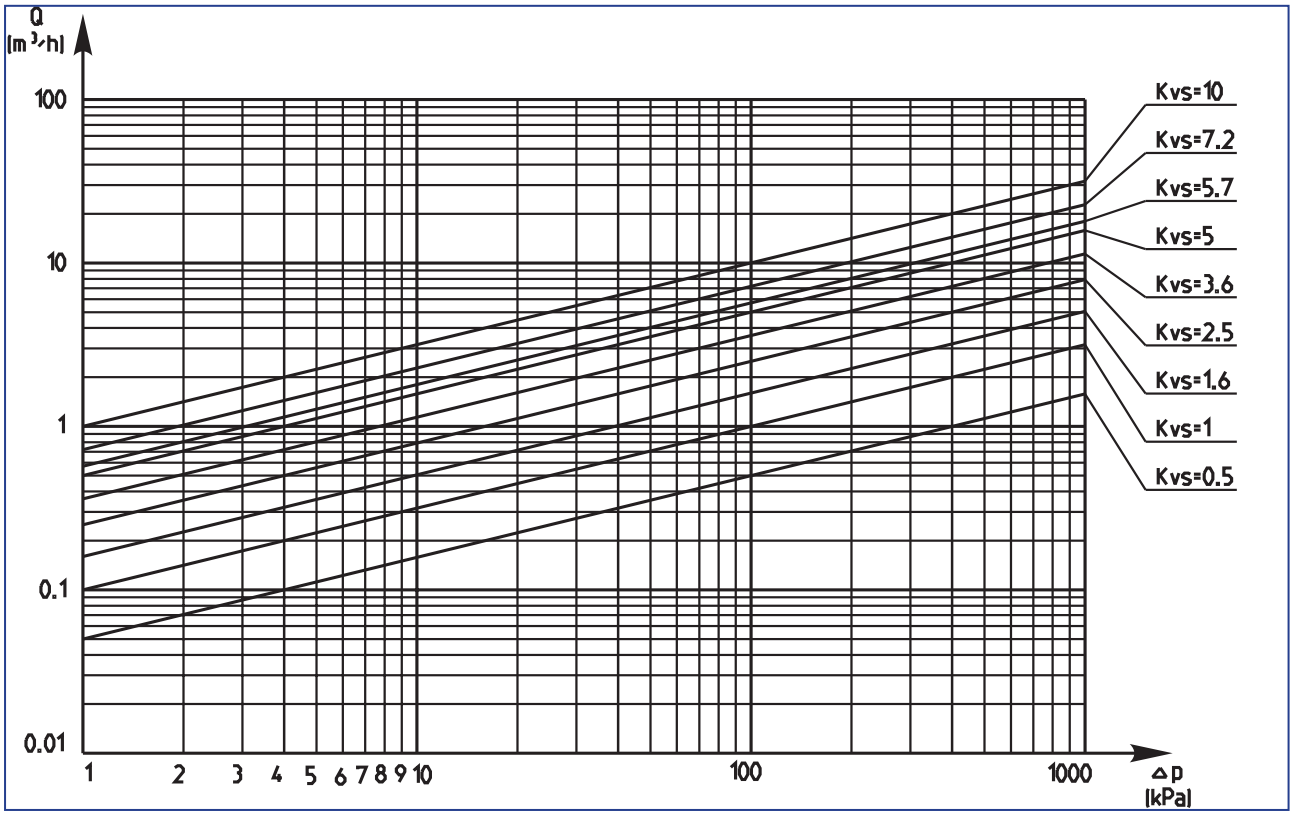
Body, bonnet – spheroidal iron to EN-GJS-400-18LT
Seat – steel K.O.X6CrNiMoTi17-12-2 (1.4571)
Plug – brass CuZn39Pb3
Stem – stainless steel X17CrNi16-2 (1.4057)
Guiding sleeves – steel with PTFE lining
Internal springs – spring stainless steel 12R10
Adjusting spring – spring steel C grade
Diaphragm – EPDM[1)] with polyester cloth
Sealing – EPDM[1)]
Connections – carbon steel for welding S355J2G3 (1.0570)



[1)] - or NBR in case of special options for oils or oil-containing gases.

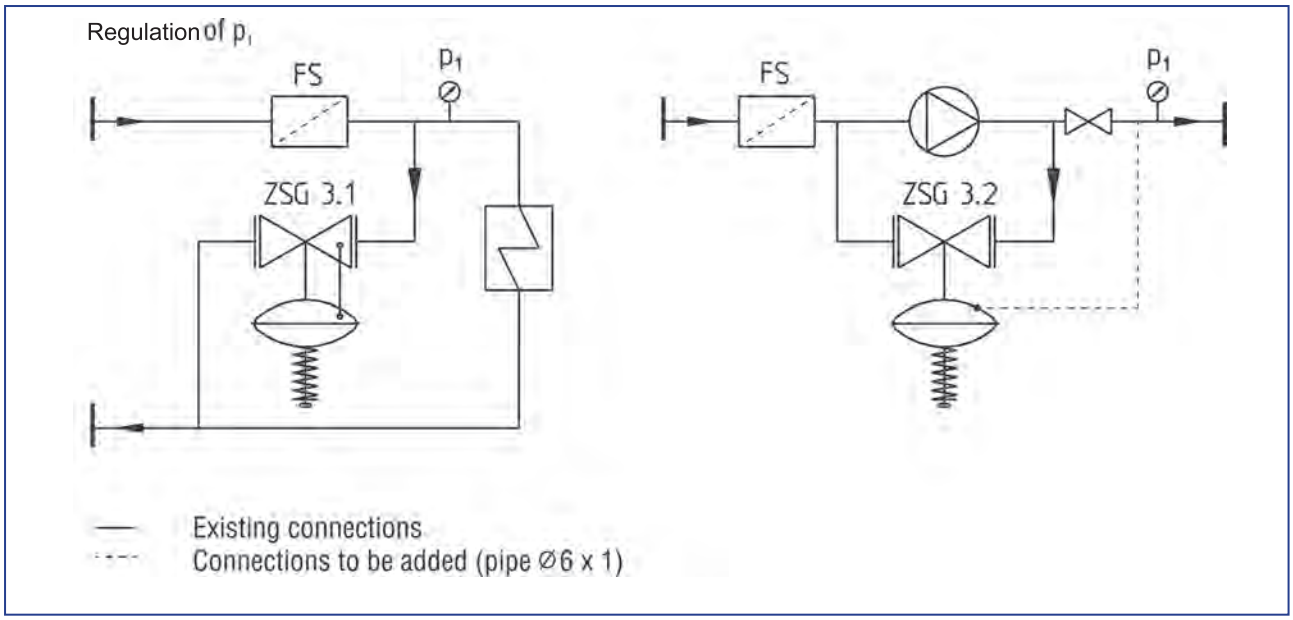
INSTALLATION

The regulator should be installed on a horizontal section of pipeline with the spring downward. Flow direction must match the arrow on the valve body. Application of strainers upstream of regulators is recommended.
To guarantee silent operation of the regulator the flow velocity of utilities in the controlled pipeline should not exceed 3 m/s for liquids and 12 m/s for gases.
Design of the regulator enables fitting of leaden seals to the adjustable parts after the desired settings are achieved.



Working temperature [°C]		120	135	150
Working pressure [bar]	PN16	16	15,5	15
	PN25	25	24	23,5

APPLICATION EXAMPLE:



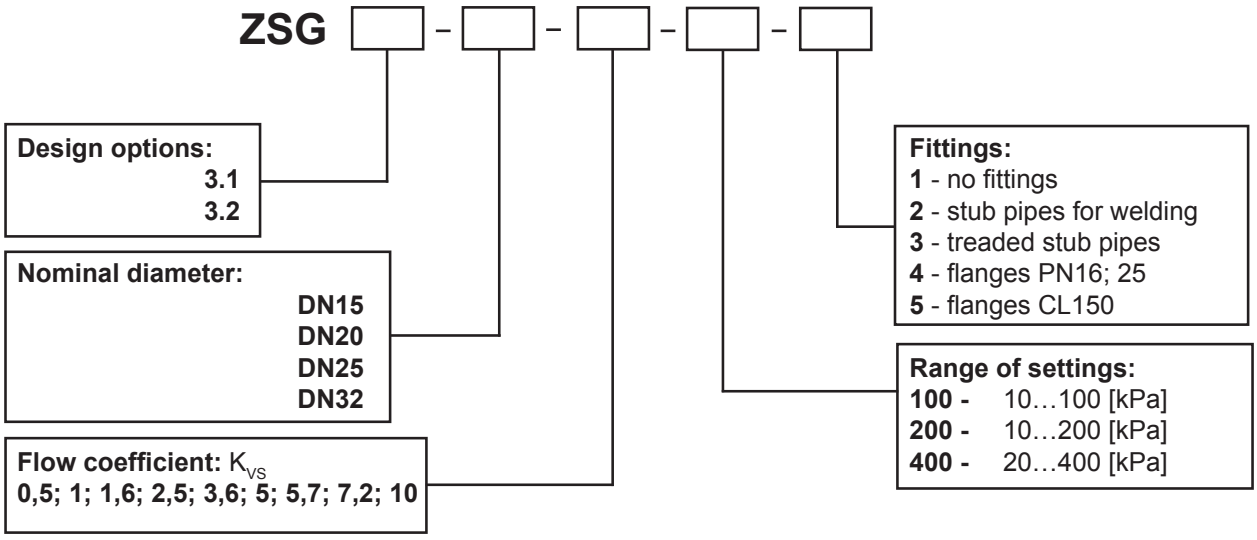
INSTALLATION KIT:

The regulator is delivered along with a factory-made installation kit that includes necessary fittings to connect imimpulse lines (pipes) ∅ 6 x 1. Connections for installation on a pipeline (e.g. mating flanges) can be delivered as supplementary fittings (upon a separate order).

Connection type		DN15	DN20	DN25	DN32
Stub pipe for welding		8520144000	8520145000	8520146000	8520147000
Threaded stub pipe		8520148000	8520149000	8520150000	8520151000
Flange	PN16; PN25	8520136000	8520138000	8520140000	8520142000
	CL150	8520137000	8520139000	8520141000	8520143000
Gasket (pos. 05)		8121795000	8121796000	8121797000	8121798000

ORDER PLACEMENT

Orders must contain full name of the product, nominal diameter DN, flow coefficient K_{VS}, range of settings and fittings.



EXAMPLE OF THE PRODUCT CODE:

The pressure regulator, type ZSG, with permanent connection of the impulse line, nominal diameter DN25; KVS = 3.6; range of settings 20 … 400 [kPa], with stub pipes for welding:

ZSG3.2-25-3,6-400-2

Revision: ZSG3/03/2011
Valid until the next revision.

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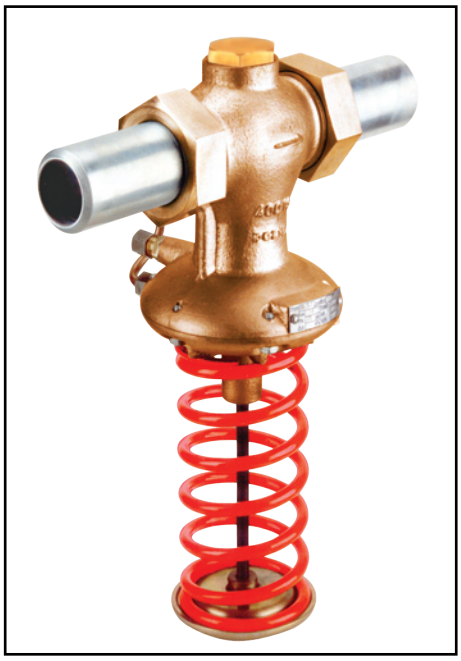
SELF-ACTUATING DIFFERENTIAL PRESSURE REDUCING REGULATORS **TYPE ZSG 5**

APPLICATIONS:
Regulators ZSG5 are used to control preset pressure difference in process installations connected to inlet or outlet of regulator valve on supply or return of installation. Increase in pressure difference causes valve closure. Regulators are applied in heating systems, in industrial processes with cold and hot (up to 150°C) water and non-flammable gases (up to 80°C), at nominal pressures up to PN25. Using with other media subject to consulting with manufacturer.

CHARACTERISTICS:
- compact and rigid design, small size,
- high control precision,
- wide range of flow ratios K_{VS},
- variety of end connections, easy installation,
- protected against hydraulic overloads,
- guaranteed internal and external tightness,
- low-noise operation,
- high durability.



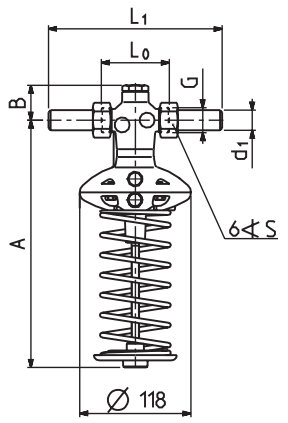
DESIGN:
Regulator comprises control valve (01) and hydraulic actuator (02), integrated in a single cast structural unit. Controlled value adjuster (03) is situated outside the actuator.
Valve - single-ported, with pressure balanced plug and tight closure.
Actuator - diaphragm type, high strength diaphragm (effective area 40 cm^2), protected against hydraulic overload.
End connections – welding, threaded or flanged end connections, as per PN, DIN, ISO, for pressure PN16 or PN25, and CL150 (available execution with no end-connections).

OPERATING PRINCIPLE:
Regulator valve is open when no supply. Impulse of higher pressure from controlled pressure difference is transferred via impulse duct to actuator chamber, from spring side, and impulse of lower pressure difference - to actuator chamber from valve side. Increase in pressure above the preset value, set by tightening of spring in adjuster, causes pro rata closure of valve port until value of regulator pressure difference reaches the preset value.

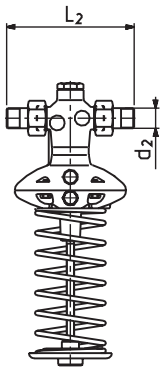
VARIANTS:
ZSG 5.1 - supply mounted, one permanent connection in higher pressure impulse regulator;
ZSG 5.2 - return mounted, one permanent connection in lower pressure impulse regulator;
ZSG 5.3 - supply/return mounted, connection of two impulse ducts.

TECHNICAL SPECIFICATIONS:

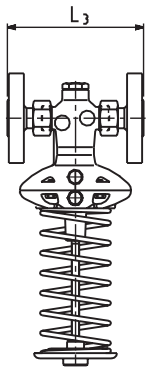
DN nominal diameter		15	20	25	32
K_{VS} flow ratio [m³/h]	full	3,6	5	7,2	10
	reduced	2,5 1,6 1 0,5	3,6 2,5 1,6 1	5,7 3,6 2,5 1,6	7,2 5,7 3,6 2,5
Noise coefficient, Z		0,6		0,55	
Body connection diameter, G		G 3/4	G 1	G 1 1/4	G 1 3/4
Pipe external diameter, d_1 [mm]		21,3	26,9	33,7	42,4
End external diameter, d_2		R 1/2	R 3/4	R 1	R 1 1/4
Wrench opening, S		32	41	50	60
Body length	L_0 [mm]	70	75	80	105
	L_1 [mm]	184	199	224	269
	L_2 [mm]	136	151	164	195
	L_3 PN / CL [mm]	130 / 184	150 / 184	160 / 184	180 / 200
Height	A [mm]	273	273	273	288
	B [mm]	36	36	38	49



- welding ends



- threaded ends



flanged ends

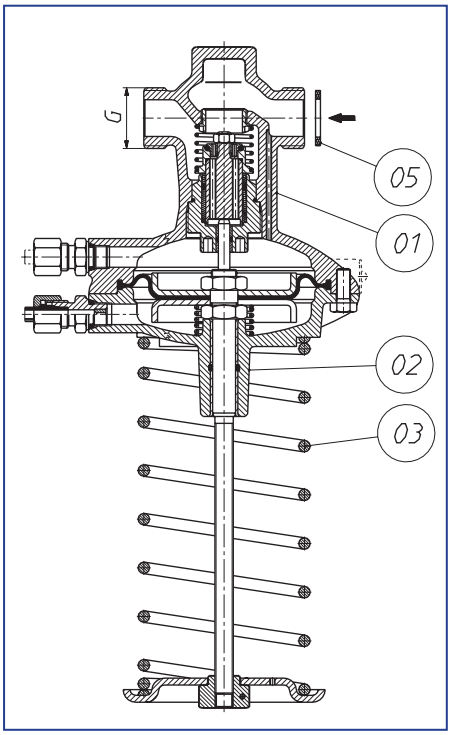
Nominal pressure:
- body – PN25
- flanges – PN16; PN25; CL150

Allowable pressure drop:
- in valve – 16 [bar]
- in actuator – 16 [bar]

Allowable medium temperature:
- fluids – +150 [°C]
- non-flammable gases – +80 [°C]

Setting range – 10…100 [kPa] (green spring)
– 10…200 [kPa] (yellow spring)
– 20…400 [kPa] (red spring)

Leakage class – Class VI as per PN-EN 60534-4



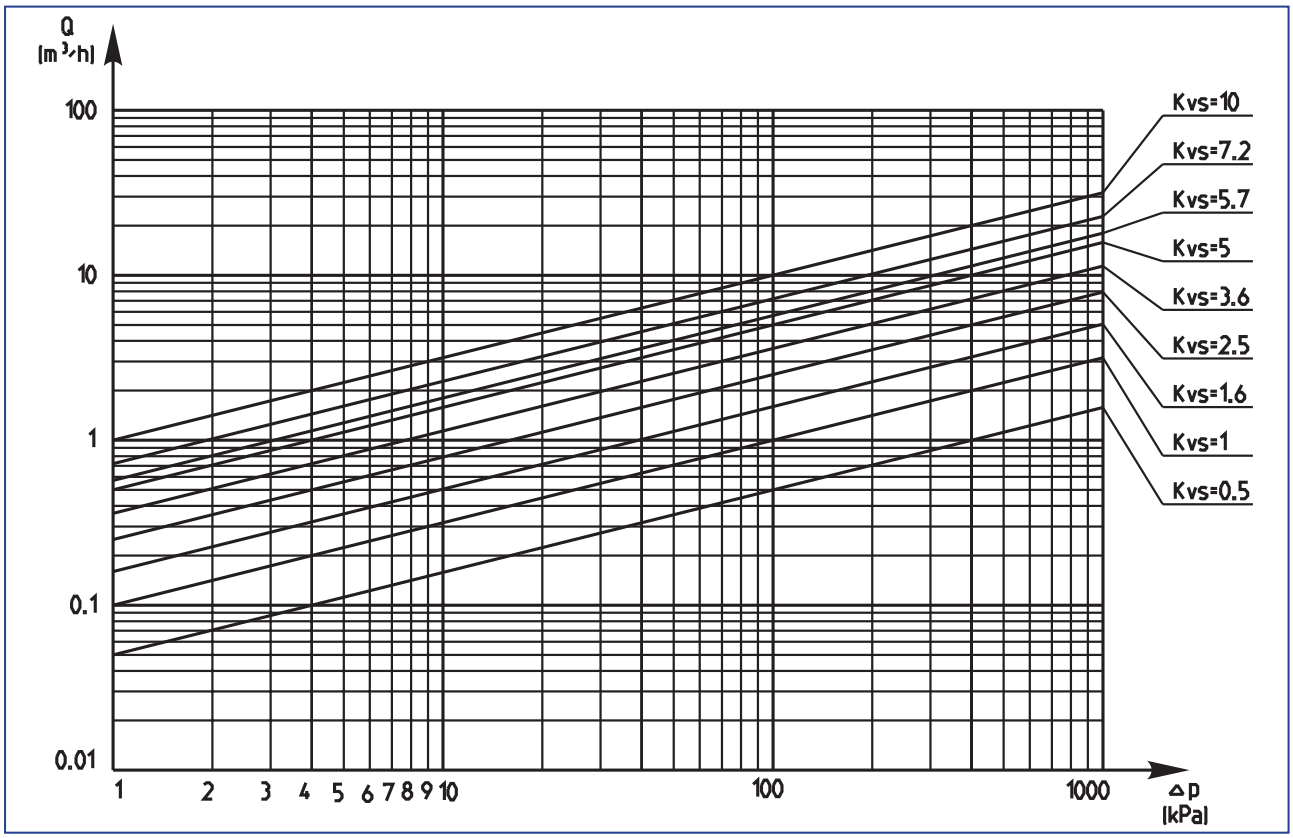
MATERIALS

Body, cover – spheroidal iron EN-GJS-400-18LT
Seat – steel K.O.X6CrNiMoTi17-12-2 (1.4571)
Plug – brass CuZn39Pb3
Stem – corrosion-proof steel X17CrNi16-2 (1.4057)
Slide sleeves – PTFE lined steel
Internal springs – stainless spring steel 12R10
Adjuster springs – spring steel C
Diaphragm – EPDM[1)] with polyester fabric
Packing – EPDM[1)]
End connections – weldable carbon steel S355J2G3 (1.0570)

[1)] - special NBR variant for oils or oily gases

INSTALLATION

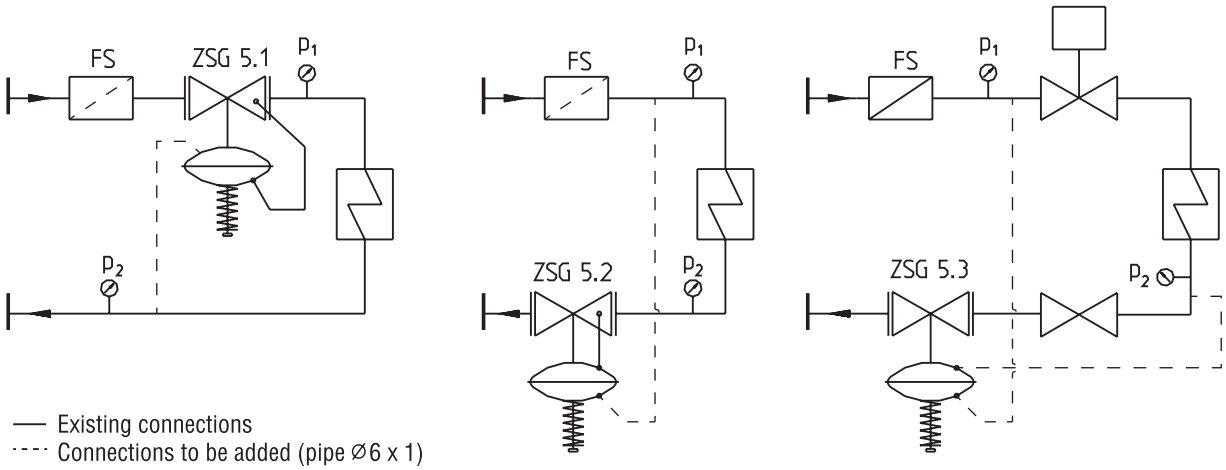
Regulator is to be installed on horizontal pipeline, spring down. Medium flow direction is to conform to arrow on body. Application of mesh filters upstream regulator is recommended.
For low-noise operation medium flow velocity is not to exceed 3 m/s for liquids and 12 m/s for gases.
Regulator design allows establishment of leaden seal on elements used for setting of preset value.



Working temperature [°C]		120	135	150
Working pressure [bar]	PN16	16	15,5	15
	PN25	25	24	23,5

EXAMPLES OF APPLICATION:

Regulation of $\Delta p = p_1 - p_2$

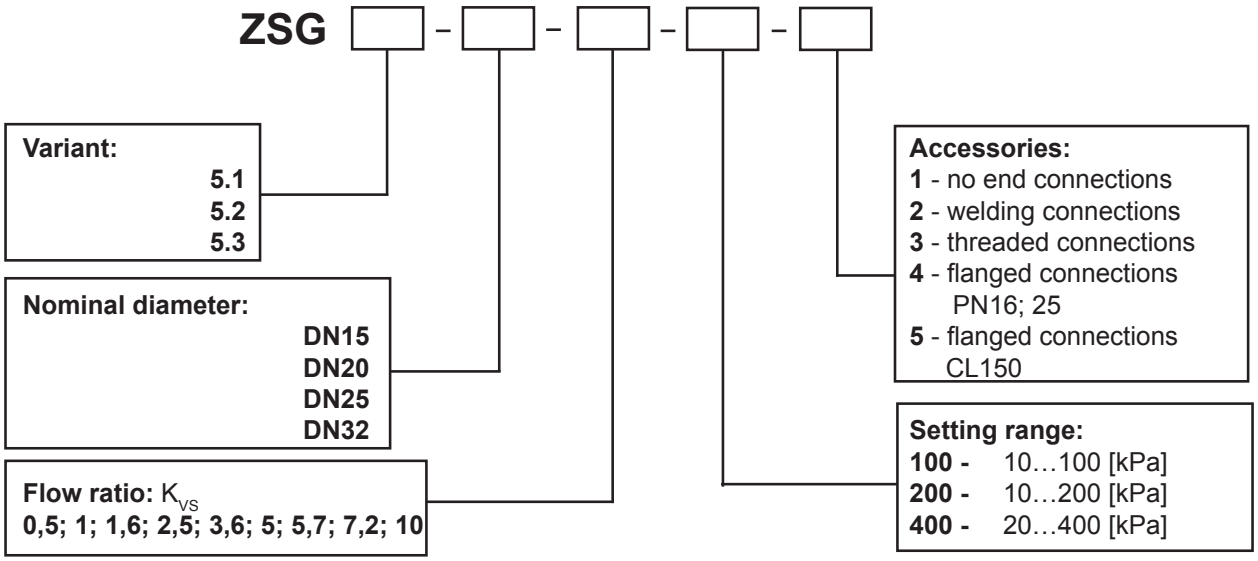


ACCESSORIES:

Regulator is delivered with respective couplings for impulse ducts (tubes) ∅ 6x1. Additional, optional, accessories include connections to pipeline installation (e.g. counterflanges).

End connection type		DN15	DN20	DN25	DN32
Welding connection		8520144000	8520145000	8520146000	8520147000
Threaded connection		8520148000	8520149000	8520150000	8520151000
Flanged connection	**PN16; PN25**	8520136000	8520138000	8520140000	8520142000
	CL150	8520137000	8520139000	8520141000	8520143000
Gasket (item 05)		8121795000	8121796000	8121797000	8121798000

ORDERING:
In your order specify product marking, DN nominal diameter, flow ratio Kvs, setting range and accessories.



EXAMPLE OF MARKING:

Differential pressure regulator type ZSG, supply mounted, nominal diameter DN25; K_{VS} =3,6; setting range 20…400 [kPa], welding connections.

ZSG5.1-25-3,6-400-2

Revision: ZSG5/03/2011
Valid until the next revision.

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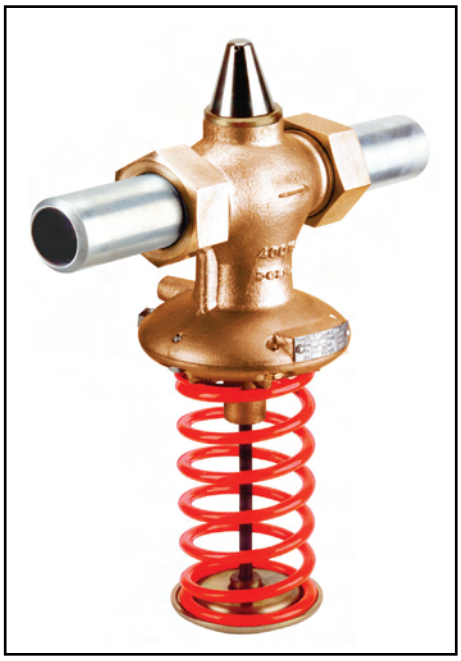
SELF-ACTUATING DIFFERENTIAL PRESSURE REDUCING REGULATORS WITH FLOW REDUCTION **TYPE ZSG 6**

APPLICATIONS:
Regulators are used to control preset pressure difference and to reduce flow in process installations connected to inlet of regulator valve on return of installation. Increase in pressure difference causes valve closure. Regulators are applied in heating systems, in industrial processes with cold and hot (up to 150°C) water and non-flammable gases (up to 80°C), at nominal pressures up to PN25. Using with other media subject to consulting with manufacturer.

CHARACTERISTICS:
- compact and rigid design, small size,
- high control precision,
- wide range of flow ratios K_{VS},
- variety of end connections, easy installation,
- protected against hydraulic overloads,
- guaranteed internal and external tightness,
- low-noise operation,
- high durability,

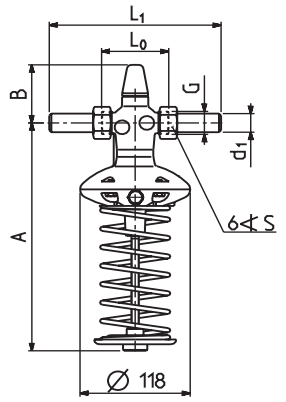


DESIGN:
Regulator comprises control valve (01) and hydraulic actuator (02), integrated in a single cast structural unit. Regulator value adjuster (03) is situated outside the actuator, while flow reduction flap is integrated with the valve,
Valve - single-ported, with pressure balanced plug and tight shut-off, with flow reduction flap.
Actuator - diaphragm type, high strength diaphragm (effective area 40 cm^2), protected against hydraulic overload.
End connections –welding, threaded or flanged end connections, as per PN, DIN, ISO, for pressure PN16 or PN25, and CL150 (available execution with no end-connections).

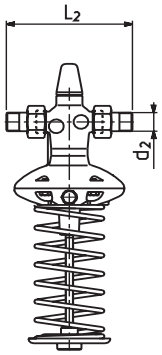
OPERATING PRINCIPLE:
Regulator valve is open when no supply. Impulse of higher pressure difference from upstream installation subject to control to actuator chamber from spring side. Impulse of lower pressure difference via internal ducts from behind flap to actuator chamber from valve side. Increase in pressure above the preset value, set by tightening of spring in adjuster (03), causes pro rata closure of valve port until value of controlled pressure difference reaches the preset value. Increase in flow above the preset value, set by flap (04), causes increase in flow resistance and increase in pressure difference in actuator chambers, which in turn causes closure of valve seat until reaching flow value set using the flap.

TECHNICAL SPECIFICATIONS:

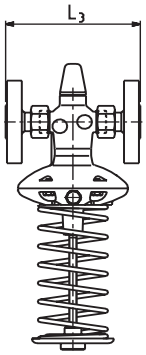
DN nominal diameter		15	20	25	32
K_{VS} flow ratio [m³/h]	full	3,6	5	7,2	10
	reduced	2,5 1,6 1	3,6	5,7	7,2
Noise coefficient, Z		0,6		0,55	
Body connection diameter, G		G 3/4	G 1	G 1 1/4	G 1 3/4
Pipe external diameter, d_1 [mm]		21,3	26,9	33,7	42,4
End external diameter, d_2		R 1/2	R 3/4	R 1	R 1 1/4
Wrench opening, S		32	41	50	60
Body length	L_0 [mm]	70	75	80	105
	L_1 [mm]	184	199	224	269
	L_2 [mm]	136	151	164	195
	L_3 PN / CL [mm]	130 / 184	150 / 184	160 / 184	180 / 200
Height	A [mm]	250	250	250	265
	B [mm]	69	69	71	82



- welding ends



- threaded ends



- flanged ends

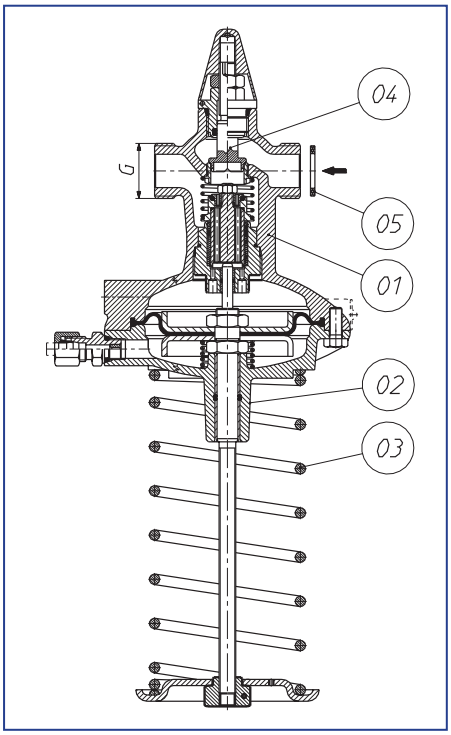
Nominal pressure:
- body – PN25
- flanges – PN16; PN25; CL150

Allowable pressure drop:
- in valve – 16 [bar]
- in actuator – 16 [bar]

Allowable medium temperature:
- fluids – +150 [°C]
- non-flammable gases – +80 [°C]

Setting range – 10…100 [kPa] (green spring)
– 10…200 [kPa] (yellow spring)
– 20…400 [kPa] (red spring)

Leakage class – Class VI as per PN-EN 60534-4



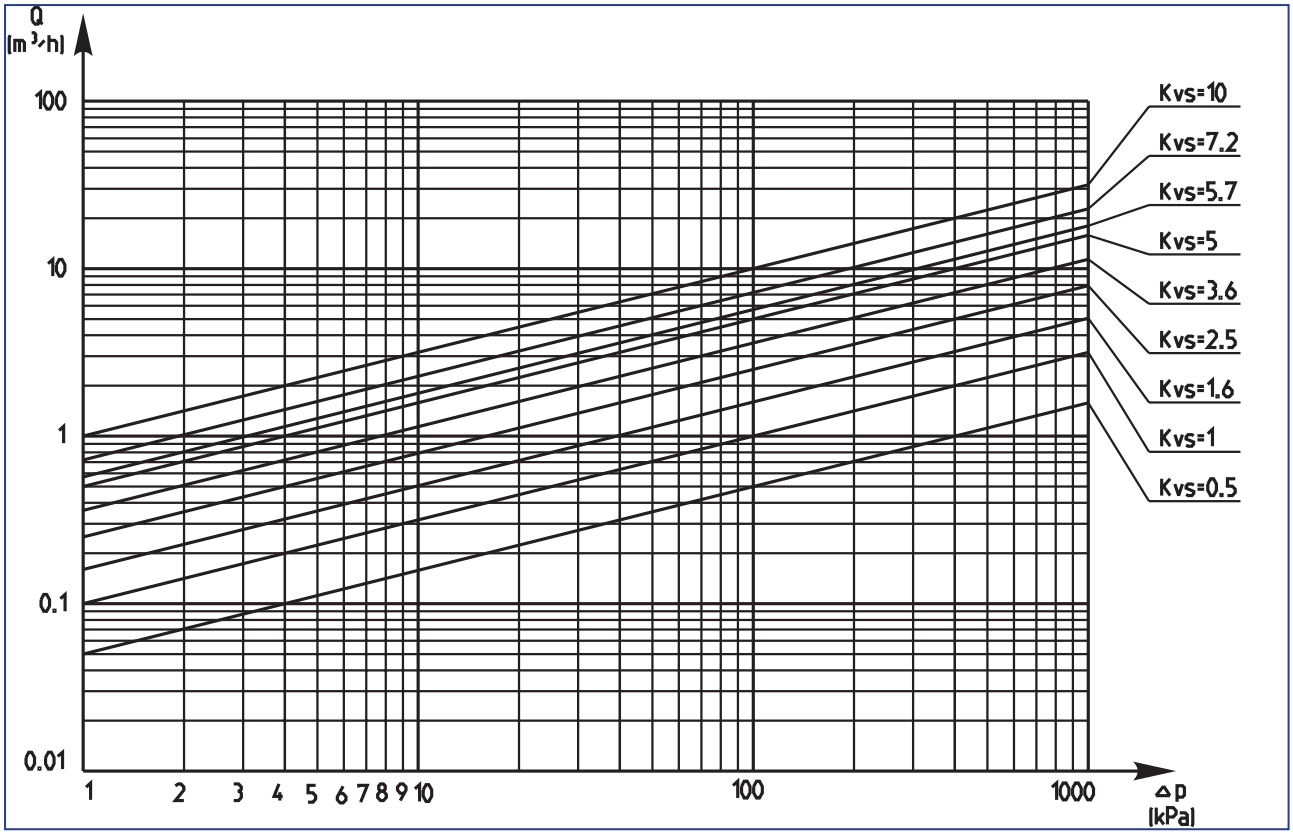
MATERIALS

Body, cover – spheroidal iron EN-GJS-400-18LT
Seat – steel K.O.X6CrNiMoTi17-12-2 (1.4571)
Plug – brass CuZn39Pb3
Stem – corrosion-proof steel X17CrNi16-2 (1.4057)
Slide sleeves – PTFE lined steel
Internal springs – stainless spring steel 12R10
Adjuster springs – spring steel C
Diaphragm – EPDM[1)] with polyester fabric
Packing – EPDM[1)]
End connections – weldable carbon steel S355J2G3 (1.0570)

[1)] - special NBR variant for oils or oily gases

INSTALLATION

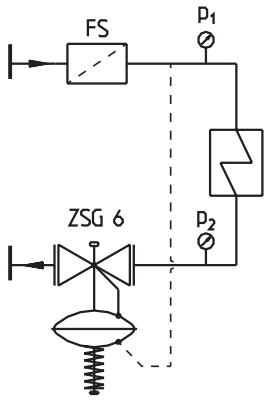
Regulator is to be installed on horizontal pipeline, spring down. Medium flow direction is to conform to arrow on body. Application of strainers upstream regulator is recommended.
For low-noise operation medium flow velocity is not to exceed 3 m/s for liquids and 12 m/s for gases.
Regulator design allows establishment of leaden seal on elements used for setting of preset value.



Working temperature [°C]		120	135	150
Working pressure [bar]	PN16	16	15,5	15
	PN25	25	24	23,5

EXAMPLES OF APPLICATION:

Regulation of $\Delta p = p_1 - p_2$



— Existing connections
- - - Connections to be added (pipe ∅ 6 x 1)

ACCESSORIES:

Regulator is delivered with respective couplings for impulse ducts (tubes) ∅ 6x1. Additional, optional, accessories include connections to pipeline installation (e.g. counterflanges).

End connection type		DN15	DN20	DN25	DN32
Welding connection		8520144000	8520145000	8520146000	8520147000
Threaded connection		8520148000	8520149000	8520150000	8520151000
Flanged connection	**PN16; PN25**	8520136000	8520138000	8520140000	8520142000
	CL150	8520137000	8520139000	8520141000	8520143000
Gasket (item 05)		8121795000	8121796000	8121797000	8121798000

ORDERING:

In your order specify product marking, DN nominal diameter, flow ratio K_{VS}, rangeability and accessories.

ZSG 6 – □ – □ – □ – □

Nominal diameter:
DN15
DN20
DN25
DN32

Flow ratio: K_{VS}
0,5; 1; 1,6; 2,5; 3,6; 5; 5,7; 7,2; 10

Accessories:
1 - no end connections
2 - welding connections
3 - threaded connections
4 - flanged connections PN16; 25
5 - flanged connections CL150

Setting range:
100 - 10…100 [kPa]
200 - 10…200 [kPa]
400 - 20…400 [kPa]

EXAMPLE OF MARKING:

Reduced flow differential pressure regulator type ZSG6, nominal diameter DN25; K_{VS} =3,6; setting range 20…400 [kPa], welding connections:

ZSG6-25-3,6-400-2

Revision: ZSG6/03/2011
Valid until the next revision.

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SELF-ACTUATING DIFFERENTIAL PRESSURE RELIEF REGULATORS **TYPE ZSG 7**

APPLICATIONS:
Regulators ZSG7 are used to control preset pressure difference in process installations connected to inlet of regulator valve. Increase in pressure difference causes valve closure. Regulators are applied in heating systems, in industrial processes with cold and hot (up to 150°C) water and non-flammable gases (up to 80°C), at nominal pressures up to PN25. Using with other media subject to consulting with manufacturer.

CHARACTERISTICS:
- compact and rigid design, small size,
- high control precision,
- wide range of flow ratios K_{VS},
- variety of end connections, easy installation,
- protected against hydraulic overloads,
- guaranteed internal and external tightness,
- low-noise operation,
- high durability.

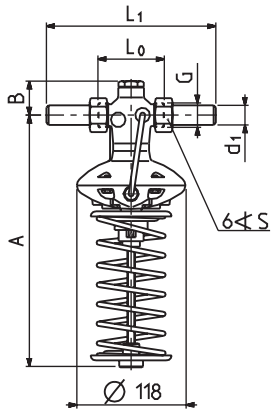
DESIGN:
Regulator comprises control valve (01) and hydraulic actuator (02), integrated in a single cast structural unit. Controlled value adjuster (03) is situated outside the actuator.
Valve - single-ported, with pressure balanced plug and tight closure.
Actuator - diaphragm type, high strength diaphragm (effective area 40 cm^2), protected against hydraulic overload.
End connections – welding, threaded or flanged end connections, as per PN, DIN, ISO, for pressure PN16 or PN25, and CL150 (available execution with no end-connections).

OPERATING PRINCIPLE:
Regulator valve is open when no supply. Impulse of higher pressure from controlled pressure difference is transferred via impulse duct to actuator chamber, from valve side, and impulse of lower pressure difference – to actuator chamber from spring side. Increase in pressure above the preset value, set by tightening of spring in adjuster, causes pro rata closure of valve port until value of regulator pressure difference reaches the preset value.

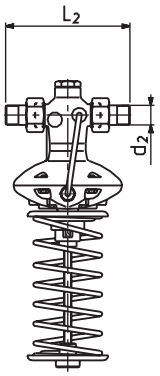
VARIANTS:
ZSG 7.1 - one permanent connection in higher and lower pressure impulse regulator,
ZSG 7.2 - connection of two impulse ducts.

TECHNICAL SPECIFICATIONS:

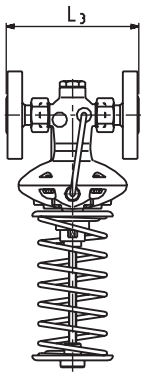
DN nominal diameter		15	20	25	32
K_{VS} flow ratio [m³/h]	full	3,6	5	7,2	10
	reduced	2,5 1,6 1 0,5	3,6 2,5 1,6 1	5,7 3,6 2,5 1,6	7,2 5,7 3,6 2,5
Noise coefficient, Z		0,6		0,55	
Body connection diameter, G		G 3/4	G 1	G 1 1/4	G 1 3/4
Pipe external diameter, d_1 [mm]		21,3	26,9	33,7	42,4
End external diameter, d_2		R 1/2	R 3/4	R 1	R 1 1/4
Wrench opening, S		32	41	50	60
Body length	L_0 [mm]	70	75	80	105
	L_1 [mm]	184	199	224	269
	L_2 [mm]	136	151	164	195
	L_3 PN / CL [mm]	130 / 184	150 / 184	160 / 184	180 / 200
Height	A [mm]	273	273	273	288
	B [mm]	36	36	38	49



- welding ends



- threaded ends



- flanged ends

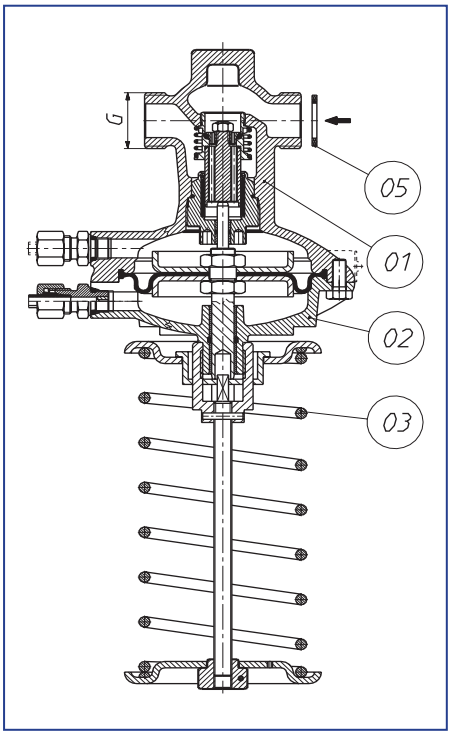
Nominal pressure:
- body – PN25
- flanges – PN16; PN25; CL150

Allowable pressure drop:
- in valve – 16 [bar]
- in actuator – 16 [bar]

Allowable medium temperature:
- fluids – +150 [°C]
- non-flammable gases – +80 [°C]

Setting range: – 10…100 [kPa] (green spring)
– 10…200 [kPa] (yellow spring)
– 20…400 [kPa] (red spring)

Leakage class – Class VI as per PN-EN 60534-4



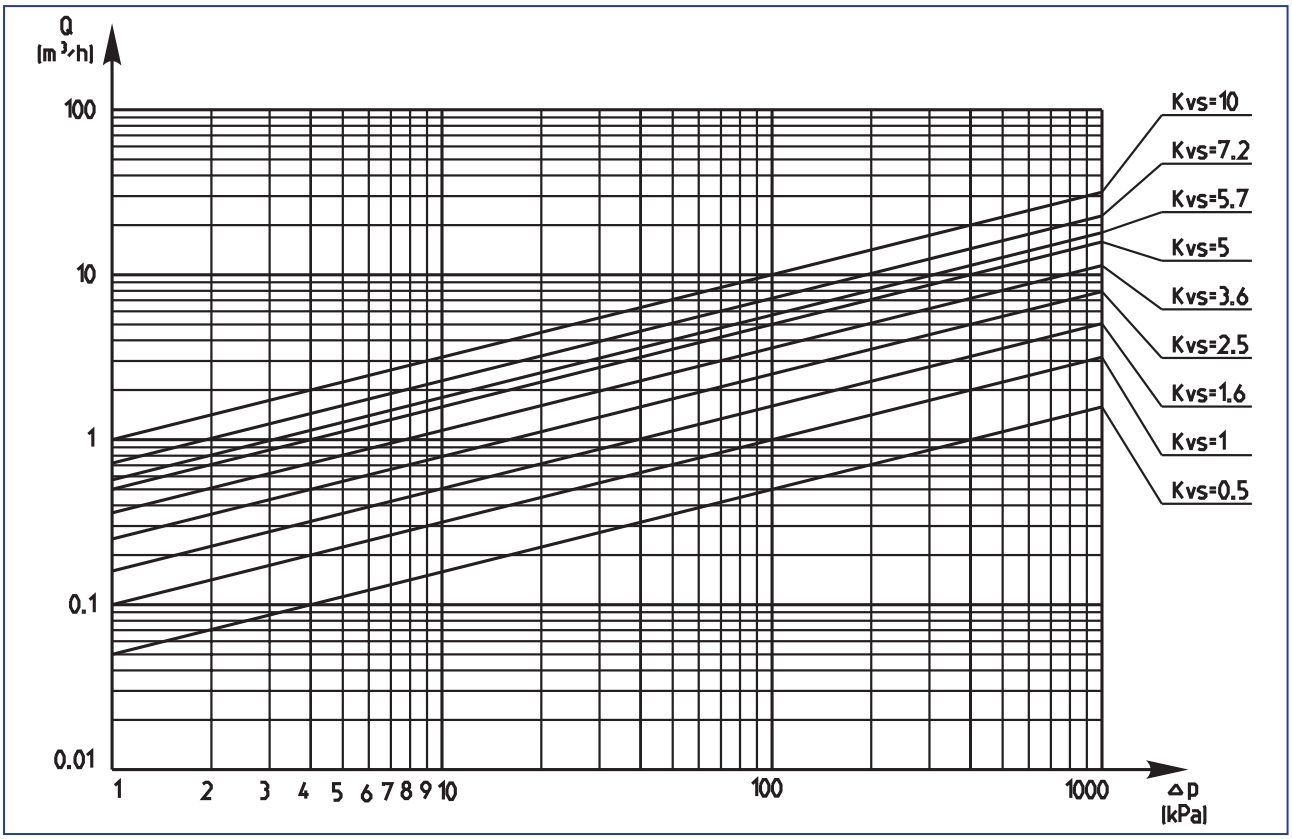
MATERIALS

Body, cover – spheroidal iron EN-GJS-400-18LT
Seat – steel K.O.X6CrNiMoTi17-12-2 (1.4571)
Plug – brass CuZn39Pb3
Stem – corrosion-proof steel X17CrNi16-2 (1.4057)
Slide sleeves – PTFE lined steel
Internal springs – stainless spring steel 12R10
Adjuster springs – spring steel C
Diaphragm – EPDM[1)] with polyester fabric
Packing – EPDM[1)]
End connections – weldable carbon steel S355J2G3 (1.0570)

[1)] - special NBR variant for oils or oily gases

INSTALLATION:

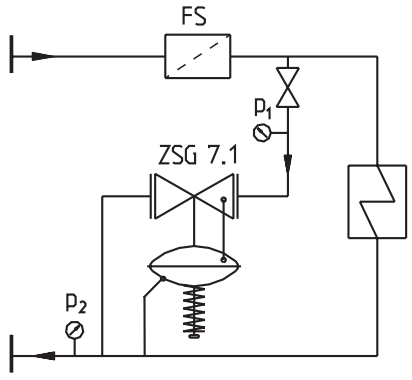
Regulator is to be installed on horizontal pipeline, spring down. Medium flow direction is to conform to arrow on body. Application of mesh filters upstream regulator is recommended.
For low-noise operation medium flow velocity is not to exceed 3 m/s for liquids and 12 m/s for gases.
Regulator design allows establishment of leaden seal on elements used for setting of preset value.

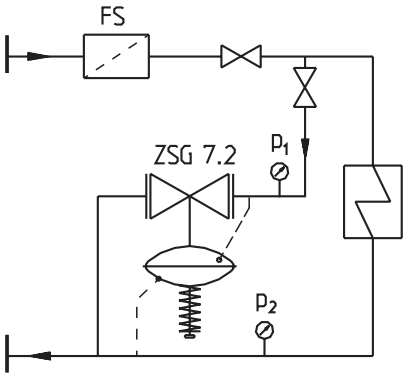


Working temperature [°C]		120	135	150
Working pressure [bar]	PN16	16	15,5	15
	PN25	25	24	23,5

EXAMPLES OF APLICATION

Regulation of $\Delta p = p_1 - p_2$





—— Existing connections
- — - Connections to be added (pipe Ø 6 x 1)

ACCESSORIES:

Regulator is delivered with respective couplings for impulse ducts (tubes) ∅ 6x1. Additional, optional, accessories include connections to pipeline installation (e.g. counterflanges).

End connection type		DN15	DN20	DN25	DN32
Welding connection		8520144000	8520145000	8520146000	8520147000
Threaded connection		8520148000	8520149000	8520150000	8520151000
Flanged connection	**PN16; PN25**	8520136000	8520138000	8520140000	8520142000
	CL150	8520137000	8520139000	8520141000	8520143000
Gasket (item 05)		8121795000	8121796000	8121797000	8121798000

ORDERING:

In your order specify product marking, DN nominal diameter, flow ratio K_{VS}, setting range and accessories.

ZSG ☐ – ☐ – ☐ – ☐ – ☐

Variant:
7.1
7.2

Nominal diameter:
DN15
DN20
DN25
DN32

Flow ratio: K_{VS}
0,5; 1; 1,6; 2,5; 3,6; 5; 5,7; 7,2; 10

Accessories:
1 -no end connections
2 - welding connections
3 - threaded connections
4 - flanged connections PN16; 25
5 - flanged connections CL150

Setting range:
100 - 10…100 [kPa]
200 - 10…200 [kPa]
400 - 20…400 [kPa]

EXAMPLE OF MARKING:

Differential pressure regulator type ZSG, permanent connection of higher pressure impulse, nominal diameter DN25; K_{VS} =3,6; setting range 20…400 [kPa], welding connections.

ZSG7.1-25-3,6-400-2

Revision: ZSG7/03/2011
Valid until the next revision.

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SELF-ACTUATING FLOW REGULATORS **TYPE ZSG 8**

APPLICATIONS:
Regulators ZSG8 are used to control preset flow rate in process installations. Increase in flow rate causes valve closure. Regulators are applied in heating systems, in industrial processes with cold and hot (up to 150°C) water and non-flammable gases (up to 80°C), at nominal pressures up to PN25. Using with other media subject to consulting with manufacturer.

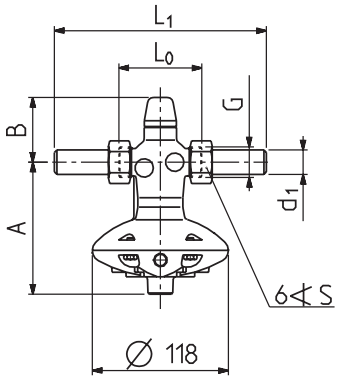
CHARACTERISTICS:
- compact and rigid design, small size,
- high control precision,
- wide range of flow ratios K_{VS},
- variety of end connections, easy installation,
- protected against hydraulic overloads,
- guaranteed internal and external tightness,
- low-noise operation,
- high durability.

DESIGN:
Regulator comprises control valve (01) and hydraulic actuator (02), integrated in a single cast structural unit. Pressure drop preset value spring (03) is situated inside the actuator, and flow rate setting flap (04) is part of the valve.
Valve - single-ported, with pressure balanced plug and tight closure, and gradual flow rate setting.
Actuators - diaphragm type, high strength diaphragm (effective area 40 cm^2), protected against hydraulic overload.
End connections – welding, threaded or flanged end connections, as per PN, DIN, ISO, for pressure PN16 or PN25, and CL150 (available execution with no end-connections).

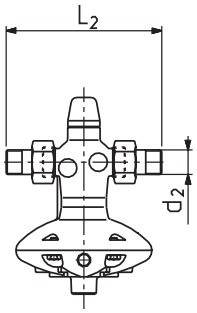
OPERATING PRINCIPLE
Regulator valve is open when no supply. Impulse of higher pressure from controlled pressure difference on flap (04) is transferred via impulse duct to external actuator chamber, whereas impulse of lower pressure via internal duct to actuator chamber from valve side. Regulator operation consists in measurement and control of permanent pressure difference on the flap of preset flow rate value adjuster. Increase in flow rate increase in pressure difference in actuator, and when such difference exceeds the preset value (20 or 50kPa), it causes a pro rata closure of valve port until value of regulator pressure difference reaches the preset value.

TECHNICAL SPECIFICATIONS:

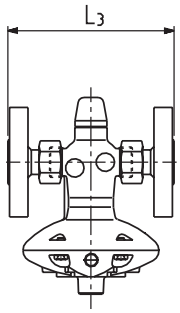
DN nominal diameter		15	20	25	32
K_{VS} flow ratio [m^3/h]	full	3,6	5	7,2	10
	reduced	2,5 1,6 1	3,6	5,7	7,2
Noise coefficient, Z		0,6		0,55	
Body connection diameter, G		G 3/4	G 1	G 1 1/4	G 1 3/4
Pipe external diameter, d_1 [mm]		21,3	26,9	33,7	42,4
End external diameter, d_2		R 1/2	R 3/4	R 1	R 1 1/4
Wrench opening, S		32	41	50	60
Body length	L_0 [mm]	70	75	80	105
	L_1 [mm]	184	199	224	269
	L_2 [mm]	136	151	164	195
	L_3 PN / CL [mm]	130 / 184	150 / 184	160 / 184	180 / 200
Height	A [mm]	115	115	115	130
	B [mm]	69	69	71	82



- welding ends



- threaded ends



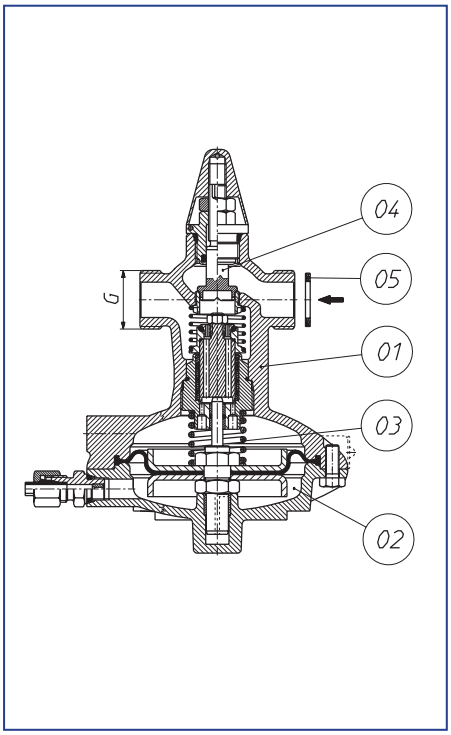
- flanged ends

Nominal pressure:
- body – PN25
- flanges – PN16; PN25; CL150

Allowable pressure drop:
- in valve – 16 [bar]
- in actuator – 16 [bar]

Allowable medium temperature:
- fluids – +150 [°C]
- non-flammable gases – +80 [°C]

Setting range of flow ratio, $\%K_{VS}$	Δp = 20 [kPa]	4…40 %
	Δp = 50 [kPa]	7…70%
Minimum pressure drop on valve		2 Δp



Leakage class – Class VI as per PN-EN 60534-4

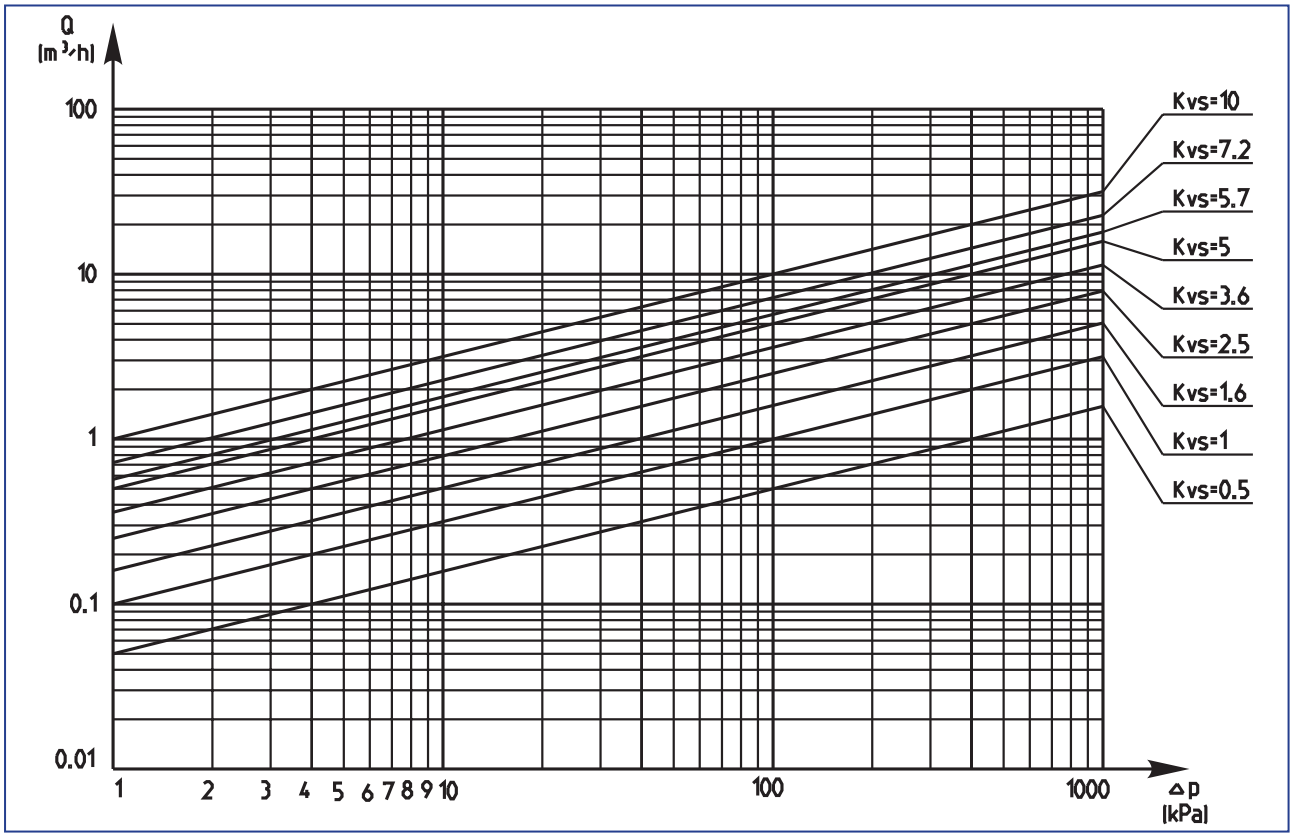
MATERIALS

Body, cover – spheroidal iron EN-GJS-400-18LT
Seat – steel K.O.X6CrNiMoTi17-12-2 (1.4571)
Plug – brass CuZn39Pb3
Stem – corrosion-proof steel X17CrNi16-2 (1.4057)
Internal springs – stainless spring steel 12R10
Adjuster springs – stainless spring steel 12R10
Adjuster springs – spring steel C
Diaphragm – EPDM[1)] with polyester fabric
Packing – EPDM[1)]
End connections – weldable carbon steel S355J2G3 (1.0570)

[1)] - special NBR variant for oils or oily gases.

INSTALLATION

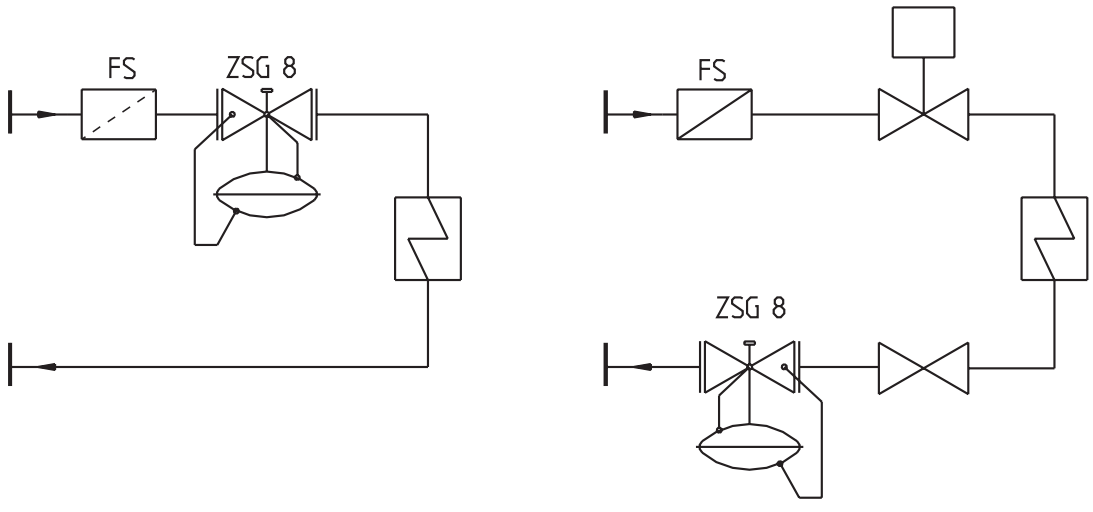
Regulator is to be installed on horizontal pipeline, spring down. Medium flow direction is to conform to arrow on body. Application of mesh filters upstream regulator is recommended.
For low-noise operation medium flow velocity is not to exceed 3 m/s for liquids and 12 m/s for gases.
Regulator design allows establishment of leaden seal on elements used for setting of preset value.



Working temperature [°C]		120	135	150
Working pressure [bar]	PN16	16	15,5	15
	PN25	25	24	23,5

EXAMPLES OF APPLICATION:

Regulation Q



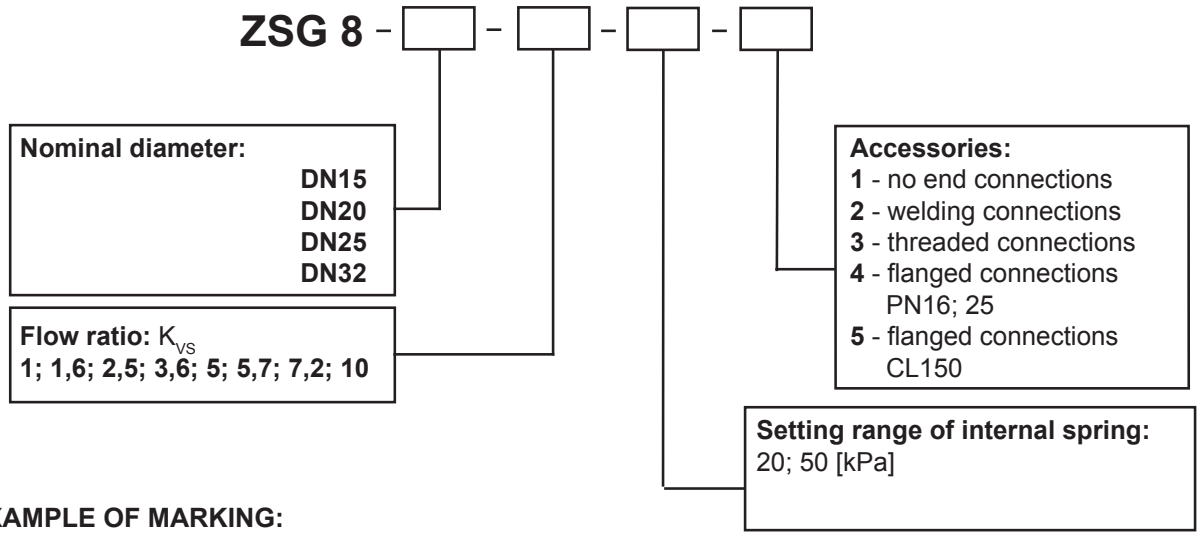
ACCESSORIES:

Regulator is delivered with respective couplings for impulse ducts (tubes) ∅ 6x1. Additional, optional, accessories include connections to pipeline installation (e.g. counterflanges).

End connection type		DN15	DN20	DN25	DN32
Welding connection		8520144000	8520145000	8520146000	8520147000
Threaded connection		8520148000	8520149000	8520150000	8520151000
Flanged connection	**PN16; PN25**	8520136000	8520138000	8520140000	8520142000
	CL150	8520137000	8520139000	8520141000	8520143000
Gasket (item 05)		8121795000	8121796000	8121797000	8121798000

ORDERING:

In your order specify product marking, DN nominal diameter, flow ratio K_{VS}, setting range and accessories.



EXAMPLE OF MARKING:

Flow regulator type ZSG8, nominal diameter DN25; K_{VS} =3,6; preset value 20 [kPa], welding connections.

ZSG8-25-3,6-20-2

Revision: ZSG8/03/2011
Valid until the next revision.

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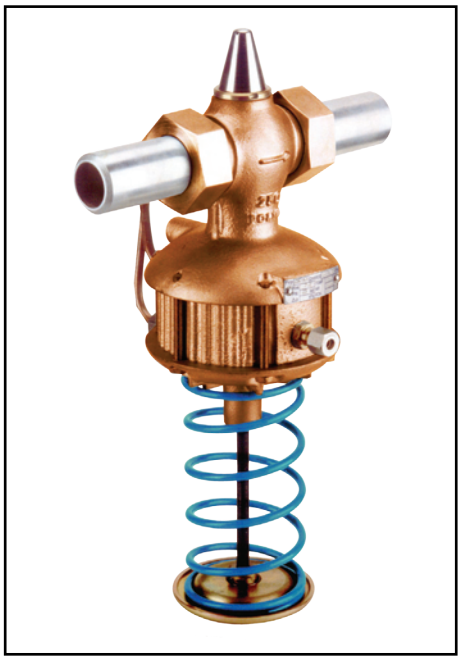
SELF-ACTUATING DIFFERENTIAL PRESSURE AND FLOW REGULATORS **TYPE ZSG 9**

APPLICATIONS AREA:

Regulators ZSG 9 are used to control preset pressure difference and flow rate in process installations connected to valve inlet or outlet. Regulators are applied in heating systems, in industrial processes with cold and hot (up to 150°C) water and non-flammable gases (up to 80°C), at nominal pressures up to PN25. Using with other media subject to consulting with manufacturer.

CHARACTERISTICS:

- compact and rigid design, small size,
- high control precision,
- wide range of flow ratios K_{VS},
- variety of end connections, easy installation,
- protected against hydraulic overloads,
- guaranteed internal and external tightness,
- low-noise operation,
- high durability.



DESIGN:

Regulator comprises control valve (01) and two serially connected hydraulic actuators: flow actuator (06) and pressure difference actuator (07). Inside the actuator (06) there is a pressure drop preset value spring (07), situated on adjustable valve flap (04). Outside the actuator (02) there is a controlled pressure difference adjuster unit (03) installed.
Valve - single-ported, with pressure balanced plug and tight closure, and gradual flow rate setting.
Actuators - diaphragm type, high strength diaphragm (effective area 40 cm^2), protected against hydraulic overload.
End connections – welding, threaded or flanged end connections, as per PN, DIN, ISO, for pressure PN16 or PN25, and CL150 (available execution with no end-connections).

OPERATING PRINCIPLE:

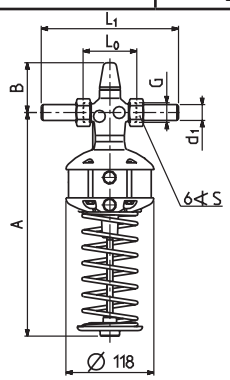
Regulator valve is open when no supply. Impulse of higher pressure is transferred to chamber further from the valve and lower pressure impulse to chamber nearer the valve. Impulses are collected from both sides of flap (04) to actuator (06), and from reduced pressure difference locations in installation to actuator (02). Regarding the designation of regulator – supply or return-mounted – majority of connections is executed permanently, using external duct or internal ducts of regulator. Increase in flow rate causes increase in pressure difference in actuator (02), and when such difference exceed preset value for spring (07), i.e. 20 or 50 kPa, it causes a pro rata closure of valve plug until flow rate value reaches preset value. Increase in controlled pressure difference above the preset value of adjuster (03), causes closure of valve plug until controlled pressure difference reaches preset value. Both control systems – flow rate and pressure difference – operate independently. Valve plug position is controlled by controlled value which deviates more from preset value.

VARIANTS:

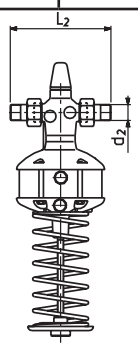
ZSG 9.1 - supply-mounted,
ZSG 9.2 - return mounted.

TECHNICAL SPECIFICATIONS:

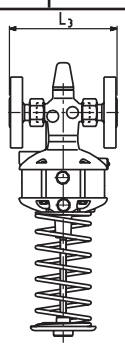
DN nominal diameter		15	20	25	32
K_{VS} flow ratio [m^3/h]	full	3,6	5	7,2	10
	reduced	2,5 1,6 1	3,6	5,7	7,2
Noise coefficient, Z		0,6		0,55	
Body connection diameter, G		G 3/4	G 1	G 1 1/4	G 1 3/4
Pipe external diameter, d_1 [mm]		21,3	26,9	33,7	42,4
End external diameter, d_2		R 1/2	R 3/4	R 1	R 1 1/4
Wrench opening, S		32	41	50	60
Body length	L_0 [mm]	70	75	80	105
	L_1 [mm]	184	199	224	269
	L_2 [mm]	136	151	164	195
	L_3 PN / CL [mm]	130 / 184	150 / 184	160 / 184	180 / 200
Height	A [mm]	289	289	289	306
	B [mm]	69	69	71	82



- welding ends



- threaded ends



- flanged ends

Nominal pressure:

- body – PN25
- flanges – PN16; PN25; CL150

Allowable pressure drop:

- in valve – 16 [bar]
- in actuator – 16 [bar]

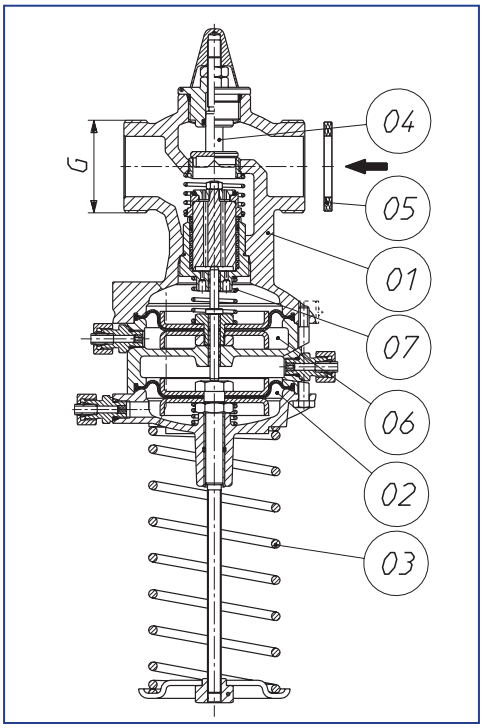
Allowable medium temperature:

- fluids – +150 [°C]
- non-flammable gases – +80 [°C]

Pressure difference setting range:

- 10…100 [kPa] (green spring)
- 10…200 [kPa] (yellow spring)
- 20…400 [kPa] (red spring)

Setting range of $\%K_{VS}$	Δp = 20 [kPa]	4…40 %
	Δp = 50 [kPa]	7…70%
Minimum pressure drop on the valve		2 Δp



Leakage class – Class VI as per PN-EN 60534-4

MATERIALS:

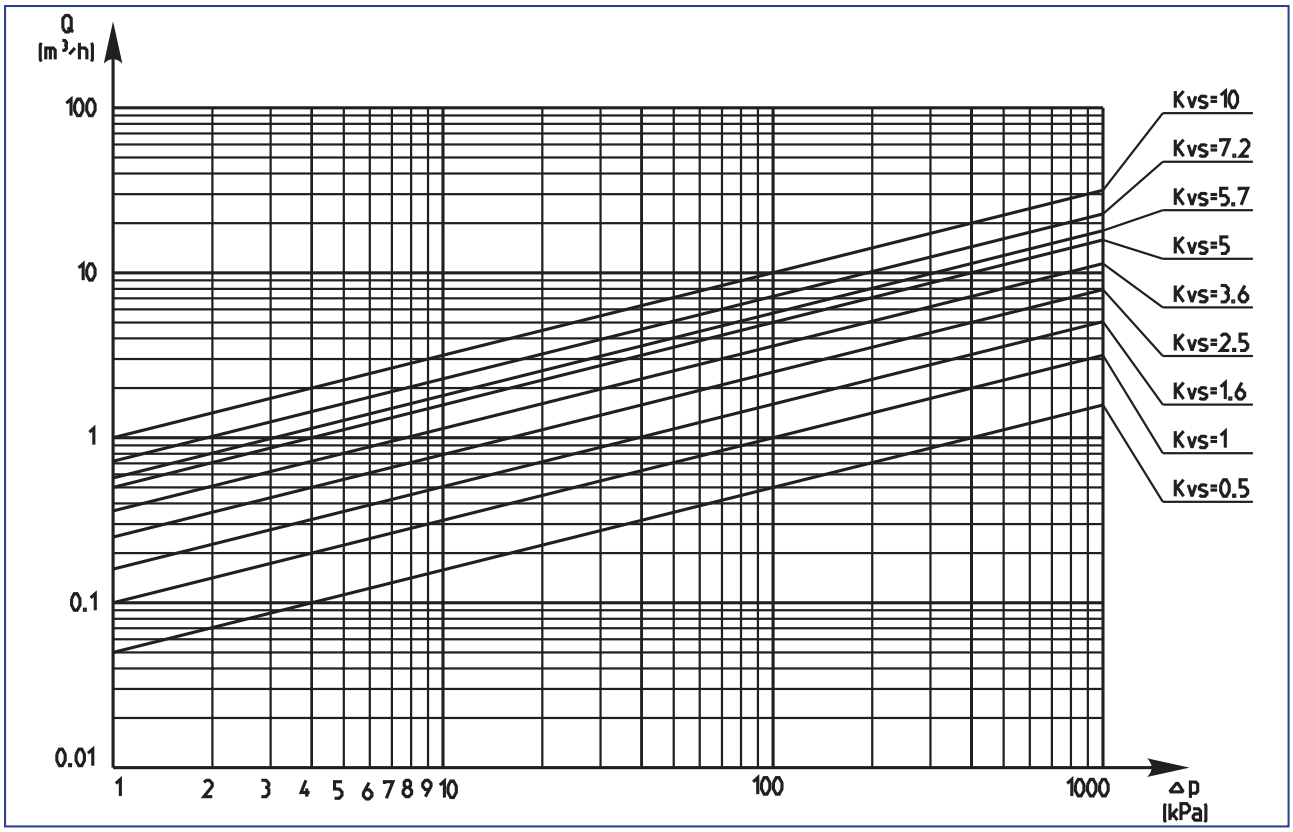
Body, cover – spheroidal iron EN-GJS-400-18LT
Seat – steel K.O.X6CrNiMoTi17-12-2 (1.4571)
Plug – brass CuZn39Pb3
Stem – corrosion-proof steel X17CrNi16-2 (1.4057)
Slide sleeves – PTFE lined steel

Internal springs	–	stainless spring steel 12R10
Adjuster springs	–	spring steel C
Diaphragm	–	EPDM[1)] with polyester fabric
Packing	–	EPDM[1)]
End connections	–	weldable carbon steel S355J2G3 (1.0570)

[1)] - special NBR variant for oils or oily gases

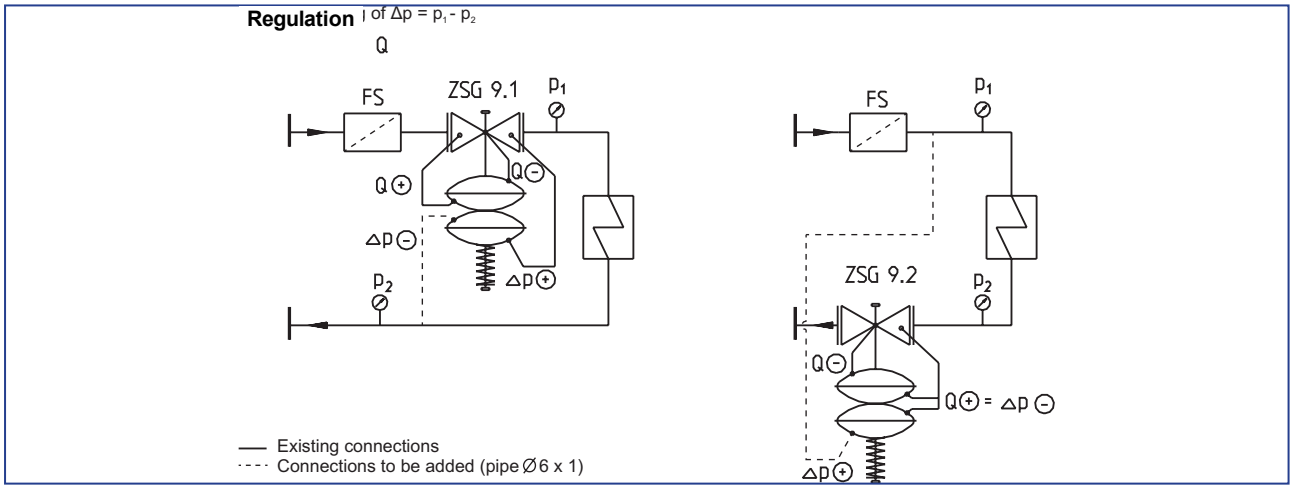
INSTALLATION:

Regulator is to be installed on horizontal pipeline, spring down. Medium flow direction is to conform to arrow on body. Application of mesh filters upstream regulator is recommended. **For low-noise operation medium flow velocity is not to exceed 3 m/s for liquids and 12 m/s for gases.** Regulator design allows establishment of leaden seal on elements used for setting of preset value.



Working temperature [°C]		120	135	150
Working pressure [bar]	PN16	16	15,5	15
	PN25	25	24	23,5

EXAMPLES OF APPLICATION:



ACCESSORIES:

Regulator is delivered with respective couplings for impulse ducts (tubes) ∅ 6x1. Additional, optional, accessories include connections to pipeline installation (e.g. counterflanges).

End connection type		DN15	DN20	DN25	DN32
Welding connection		8520144000	8520145000	8520146000	8520147000
Threaded connection		8520148000	8520149000	8520150000	8520151000
Flanged connection	**PN16; PN25**	8520136000	8520138000	8520140000	8520142000
	CL150	8520137000	8520139000	8520141000	8520143000
Gasket (item 05)		8121795000	8121796000	8121797000	8121798000

ORDERING:

In your order specify product marking, DN nominal diameter, flow ratio K_{VS}, setting range and accessories.

ZSG ☐ – ☐ – ☐ – ☐ – ☐ – ☐

Variant:
9.1
9.2

Nominal diameter:
DN15
DN20
DN25
DN32

Flow ratio: K_{VS}
1; 1,6; 2,5; 3,6; 5; 5,7; 7,2; 10

Accessories:
1 - no end connections
2 - welding connections
3 - threaded connections
4 - flanged connections PN16; 25
5 - flanged connections CL150

Internal spring preset value:
20; 50 [kPa]

Setting range:
100 - 10…100 [kPa]
200 - 10…200 [kPa]
400 - 20…400 [kPa]

EXAMPLE OF MARKING:

Flow regulator type ZSG, supply-mounted, nominal diameter DN25; K_{VS}=7,2; pressure difference spring range 10…100 [kPa], spring preset value 50 [kPa], welding connections.

ZSG9.1-25-7,2-100-50-2

Revision: ZSG9/03/2011
Valid until the next revision.

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SELF-ACTUATING PRESSURE REDUCING REGULATORS **TYPE ZSN1**

APPLICATION AREA:

Regulators ZSN1 are used to control preset pressure in process installations connected to regulator valve outlet. Regulators are applied in heating systems, in industrial processes with cold and hot water, steam, air and non-flammable gases. Using with other media subject to consulting with manufacturer.

DESIGN:

Regulator comprises three, temporary fastened main units: valve (01), actuator (02) and adjuster (03). Regulator valve single-ported with balanced plug. Flanged connections of valve body with valve face as per PN-EN 1092-1:2006 and PN-EN 1092-2:1999 for PN10; 16; 25; 40 PN-EN 1759-1:2005 for CL150; CL300.
Diaphragm actuator (diaphragm effective area 80 cm^2), with clammed housing, or diaphragm actuator (diaphragm effective area 160 cm^2), with bolted housing. Control pressure value adjuster with combination of three pre-tensioned springs, fixed coaxially with valve and actuator.

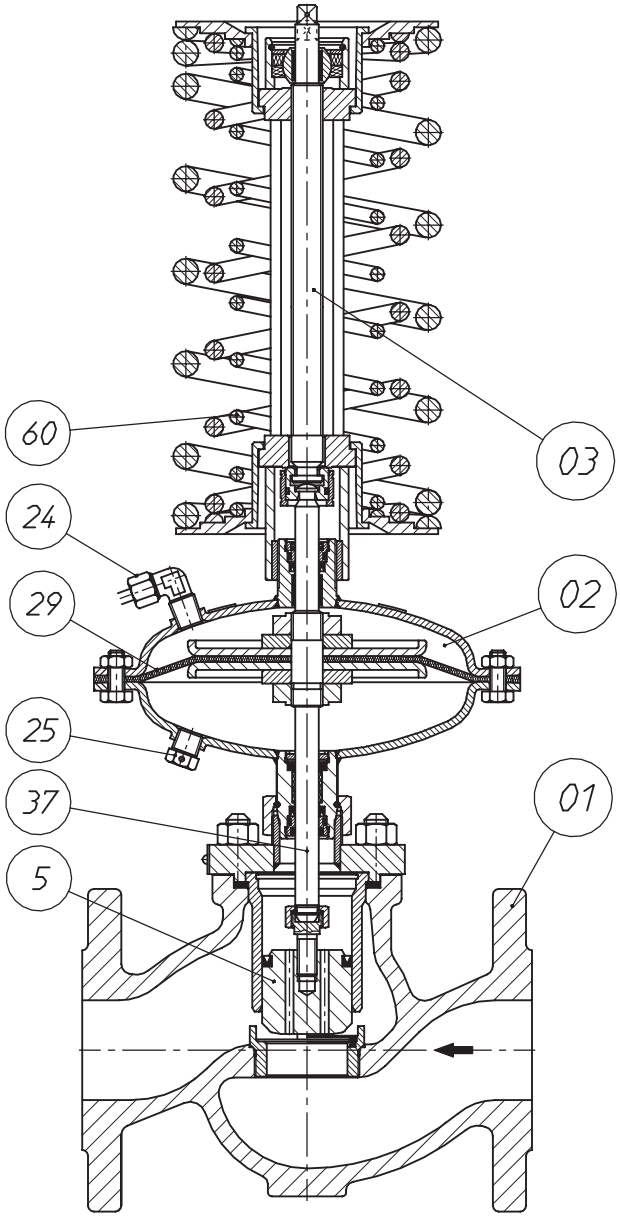
VARIANTS:

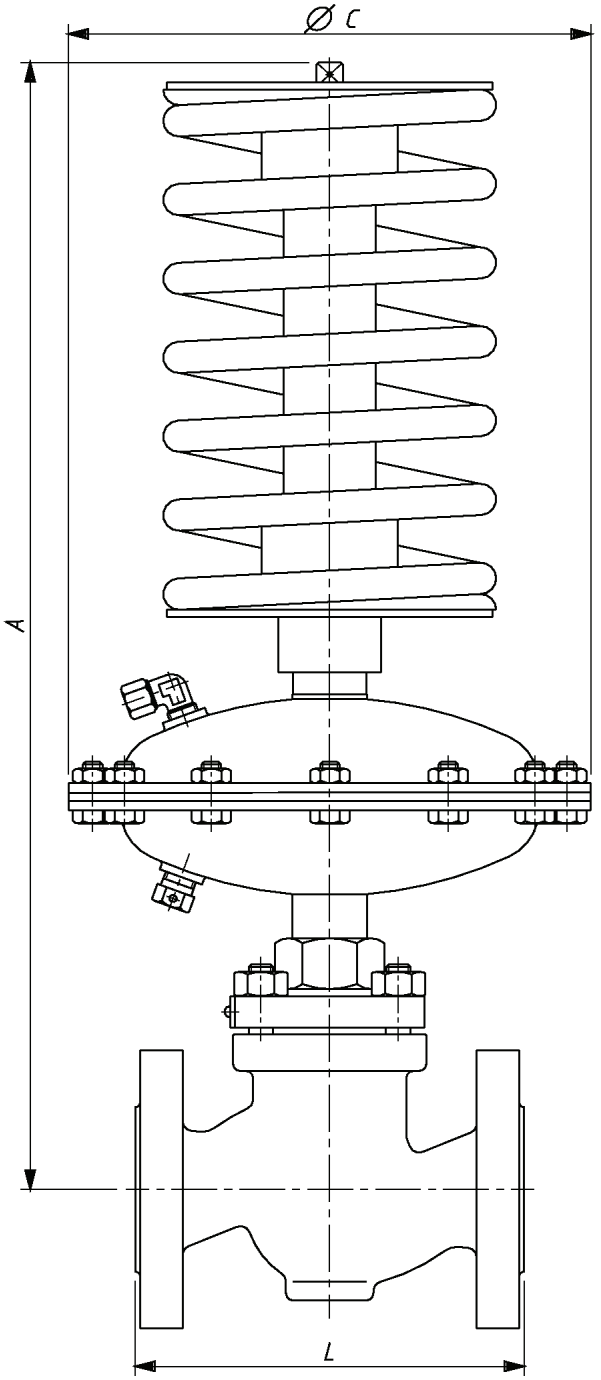
By valve leakage class:
- below 0,01% K_{VS} (class IV as per PN-EN 60534-4) - hard seat,
- bubble (class VI as per PN-EN 60534-4) - soft seat - PTFE or VMQ (ECOSIL).

By corrosion-proofness of actuator components:
- standard (ZSN 1.1) - carbon steel with protection coatings,
- special (ZSN 1.2) - stainless steel.

OPERATING PRINCIPLE:

Regulator valve is open when no supply. Controlled pressure is fed via impulse duct through connection (24) onto diaphragm (29) of actuator (02). Second actuator chamber is connected to atmosphere via deaeration plug (25). Increase in control pressure above preset value, set by tensioning of spring unit (60) in adjuster (03), causes deflection of diaphragm, movement of actuator stem (37) and closure of valve plug (5) until controlled pressure reaches preset value on adjuster.
Controlled pressure impulse collection point is to be situated downstream regulator valve outlet.





DIMENSIONS AND WEIGHTS

DN	A	L	Valve weight (01)
	[mm]		[kg]
15	470	130	4,0
20		150	5,1
25		160	5,6
32	485	180	8,5
40	490	200	10,6
50	495	230	14
65	605	290	23
80		310	29
100	615	350	44
125	special execution, technical data according to individual inquiries		
150			

Spring range [kPa]	C [mm]	Diaphragm effective area[cm²]	Weight		
			Actuator (02)	Adjuster (03)	
				DN 15…50	DN 65…100
40...160	215	160	4,4	3,2	3,6
100...400				5,6	7,1
200...800	150	80	2,4	6,8	8,5
280...1120					
other spring ranges available on request					

TECHNICAL SPECIFICATIONS

DN		15	20	25	32	40	50	65	80	100	125	150
K_{VS} [1] [m³/h]	full flow	3,2	5	8	12,5	20	32	50	80	125	technical data according to individual inquiries	
	reduced flow	1 1,6 2,5	1,6 2,5 3,2	2,5 3,2 5	5	8	12,5	20	32	50		
Stroke [mm]		6			8			12		14		
Noise coefficient Z		0,65	0,6	0,55		0,45	0,4		0,35			
Control characteristics		proportional										
Spring range [kPa] [2]		40...160; 100...400; 200...800; 280...1120										
Maximum pressure in actuator chamber [bar]		20										
Allowed pressure drop in valve [bar]		12						10				
Valve nominal pressure	valve body in grey iron	PN 16										
	valve body in spheroidal iron	PN 16; PN 25; PN 40										
	valve body in carbon steel and stainless steel	PN 16; PN 25; PN 40										
Maximum medium temperature [°C]	water	200										
	steam											
	gases	80										

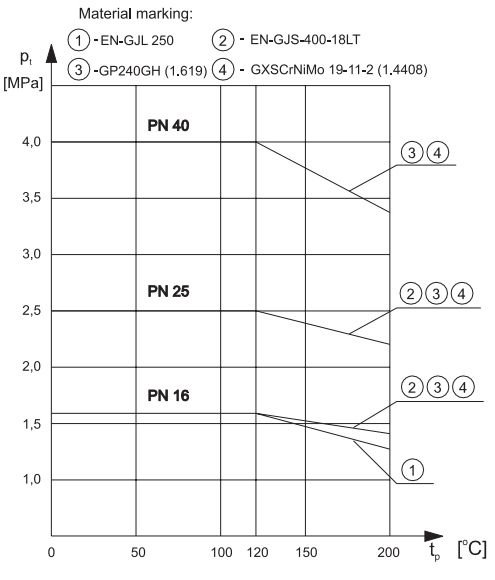
[1] other flow ratios K_{vs} subject to order specification.
[2] other ranges subject to order specification.

MATERIALS as per PN

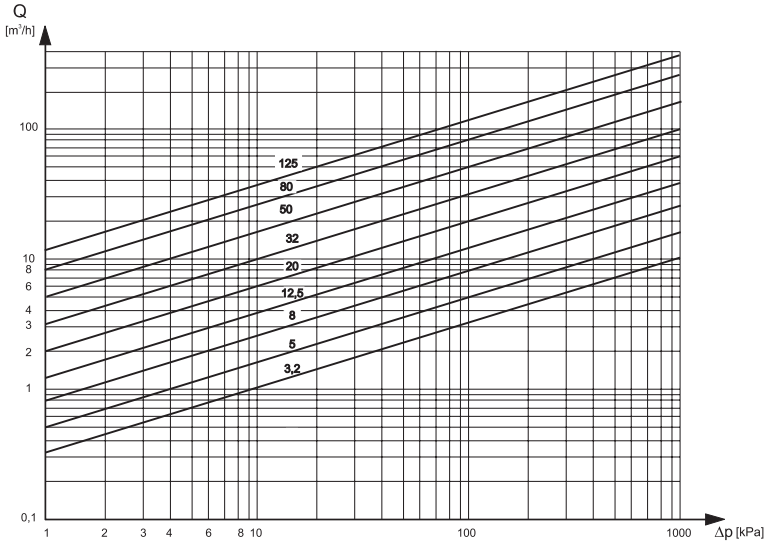
Regulator	ZSN 1.1	ZSN 1.2
VALVE (01)		
Body	grey iron EN-GJL-250 spheroidal iron EN-GJS-400-18LT carbon steel GP240GH (1.0619) stainless steel GX5CrNiMo 19-11-2 (1.4408)	
Plug and seat	X6CrNiMoTi 17-12-2 (1.4571)	
Guide sleeve		
Packing	EPDM[3]	
ACTUATOR (02)		
Housing	carbon steel S235JRG2C (1.0122)	stainless steel X6CrNiTi 18-10 (1.4541)
Stem	X17CrNi 16-2 (1.4057)	
Diaphragm	EPDM + polyester fabric[3]	
Packing	EPDM[3]	
Adjuster (03)		
Adjuster components	carbon steel C45 (1.0503)	
Springs	Spring steel 60Si7	

[3] other materials, subject to medium type.

NOMINAL PRESSURE, WORKING TEMPERATURE AND WORKING PRESSURE



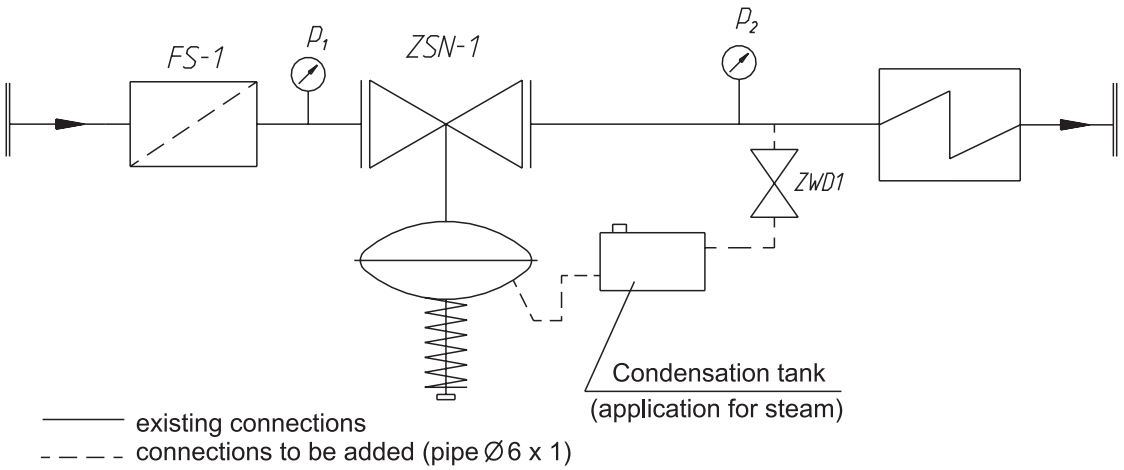
FLOW DIAGRAM FOR WATER



INSTALLATION

Regulator is to be installed on horizontal pipeline. Medium flow direction is to conform to arrow on body. At medium temperature lower than 130°C regulator position is optional, at higher temperatures it is recommended to install regulator with adjuster unit (03) down. To ensure reliable operation of regulator apply strainer FS1 upstream, and needle valve ZWD 1 at impulse supply. When using regulators for steam applications condensation tank is required.

EXAMPLE OF APPLICATION



ACCESSORIES

Delivered:
- nut and cutting ring for impulse tube,

Optional (ordered separately):
- strainer FS1,
- straight tube connection ∅ 6×1,
- elbow tube connection ∅ 6×1,
- connection stub NPT 1/4”
- impulse tube ∅ 6×1,
- adjustment wrench,
- condensation tank,
- needle valve ZWD 1.

ORDERING

In your order specify type and marking, ZSN 1.1 or ZSN 1.2, DN nominal diameter, flow ratio K_{vs}, body material, spring range, tightness type (only orders for tight execution).

Example of order:

ZSN 1.2 - DN 40; PN 25; Kvs 20; spheroidal iron; 100…400 kPa; tight.

Revision: ZSN1/06/2013
Valid until the next revision.

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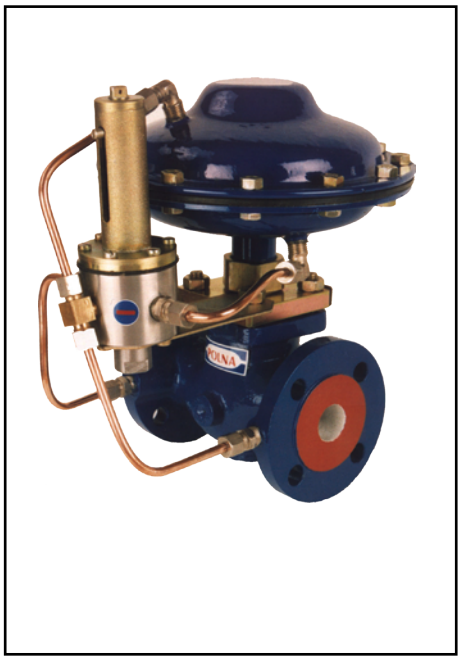
SELF-ACTUATING DIFFERENTIAL PRESSURE REDUCING REGULATORS **TYPE ZSN2**

APPLICATION AREA:

Regulators ZSN2 are used to control preset pressure in process installations connected to regulator valve outlet. Regulators are applied in heating systems, in industrial processes with cold and hot water (150°C), air and non-flammable gases (80°C). Using with other media subject to consulting with manufacturer.

DESIGN:

Regulator comprises three, temporary fastened main units: valve (01), actuator (02) and booster (06). Regulator valve single-ported with balanced plug. Flanged connections of valve body with valve face as per PN-EN 1092-1:2006 and PN-EN 1092-2:1999 for PN10; 16; 25; 40
PN-EN 1759-1:2005 for CL150; CL300.
Body length as per:
PN-EN 60534-3-1:2000 – Series 1 for PN10; 16; 25; 40;
Series 37 for CL150; Series 38 for CL300
Valve tightness – bubble (Class VI as per PN-EN 60534-4), tight seat in PTFE or VMQ (ECOSIL).
Diaphragm actuator (diaphragm effective area 160 cm^2), with bolted housing and spring, pre-tensioned to 20 [kPa] for DN15…32 valves and to 50 [kPa] for DN40 and DN50 valves, inside. Diaphragm type booster comprises control pressure value adjuster.



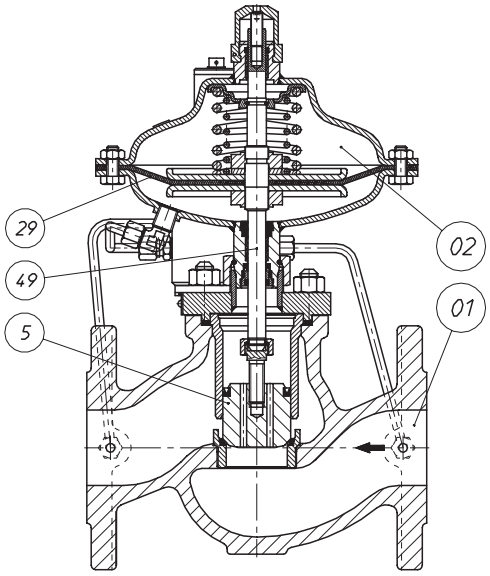
VARIANTS:

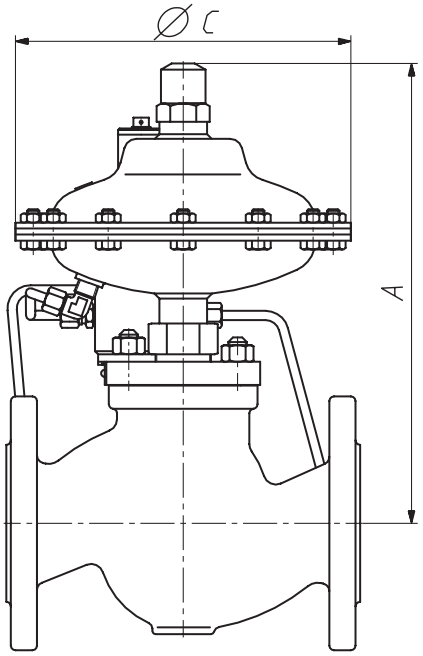
By corrosion-proofness of actuator components:
- standard (ZSN 2.1) - carbon steel with protection coatings,
- special (ZSN 2.2) - stainless steel.

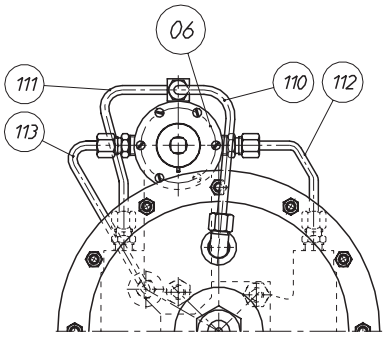
OPERATING PRINCIPLE:

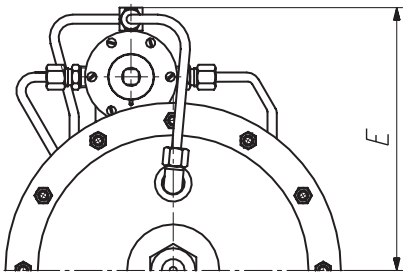
Valve is open when no supply. Connection of regulator to system causes its opening. Controlled pressure is fed via impulse duct (110) to actuator (02) chamber above diaphragm (29) and via impulse duct (111) to booster (06) under diaphragm (83). Pressure from upstream valve is transferred via duct (112) to booster, and via pressure divider (94) through duct (113) under actuator diaphragm. Both pressures are collected via impulse tubes (112) and (111) directly from valve inlet and outlet flange. Increase in controlled pressure above preset value, set by tensioning of spring (89) in booster (06), causes increases in pressure in actuator chamber above the diaphragm (29), movement of actuator stem (49) and closure of valve plug (5) until controlled pressure reaches value preset in booster. To ensure reliable operation a minimum pressure difference in valve equal to double value of actuator spring pre-tensioning: 40[kPa] or 100 [kPa].

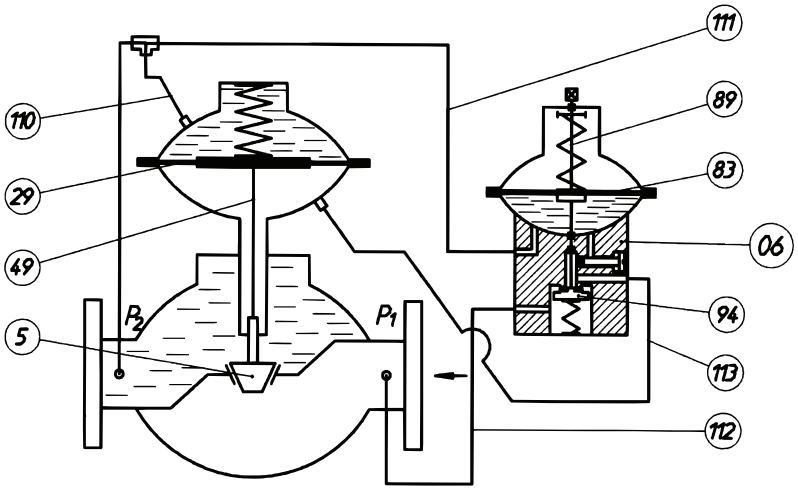
DIMENSIONS AND WEIGHTS

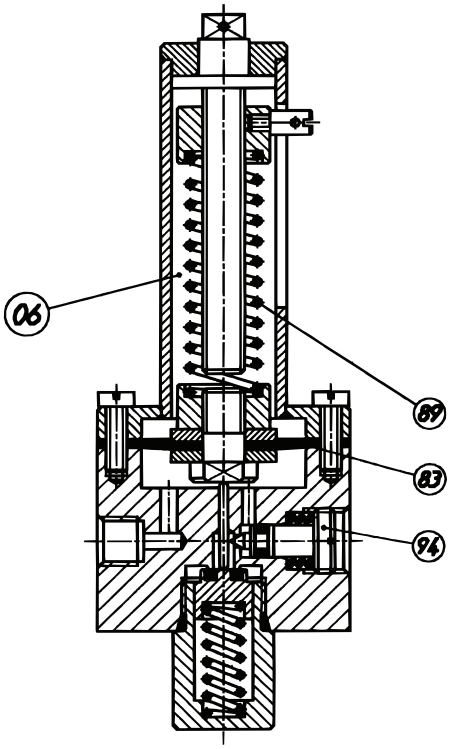












DN	A	C	Diaphragm effecti-ve area[cm²]	E	L	Weight
	[mm]					[kg]
15	279	215	160	165	130	8,8
20					150	9,9
25					160	10,4
32	294			170	180	13,4
40	299			175	200	15,5
50	304				230	19,3

TECHNICAL SPECIFICATIONS

DN		15	20	25	32	40	50
K_{VS} [1] [m³/h]	full flow	3,2	5	8	12,5	20	32
	reduced flow	1 1,6 2,5	1,6 2,5 3,2	2,5 3,2 5	5	8	12,5
Stroke [mm]		6			8		
Noise coefficient Z		0,65	0,6	0,55		0,45	0,4
Control characteristics		Integrating					
Spring range [kPa]		10…100; 40…400; 100…1000					
Allowed pressure drop in valve [bar]		12					
Minimum pressure drop in valve [bar]		0,4				1	
Valve nominal pressure		valve body in grey iron				PN 16	
		valve body in spheroidal iron				PN 16; PN 25; PN 40	
		valve body in carbon steel and stainless steel				PN 16; PN 25; PN 40	
Maximum medium temperature [˚C]		water				150	
		gases				80	

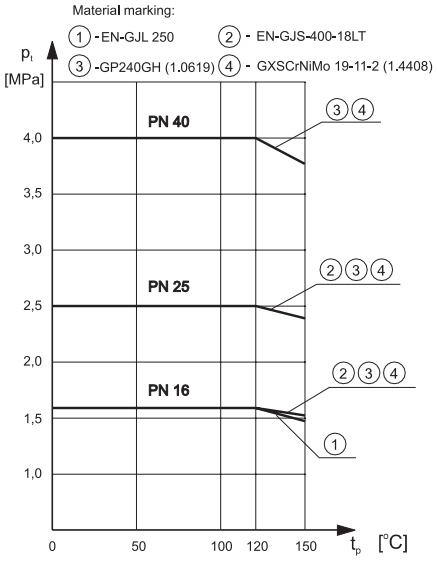
[1] other flow ratios K_{vs} subject to order specification.

MATERIALS as per PN

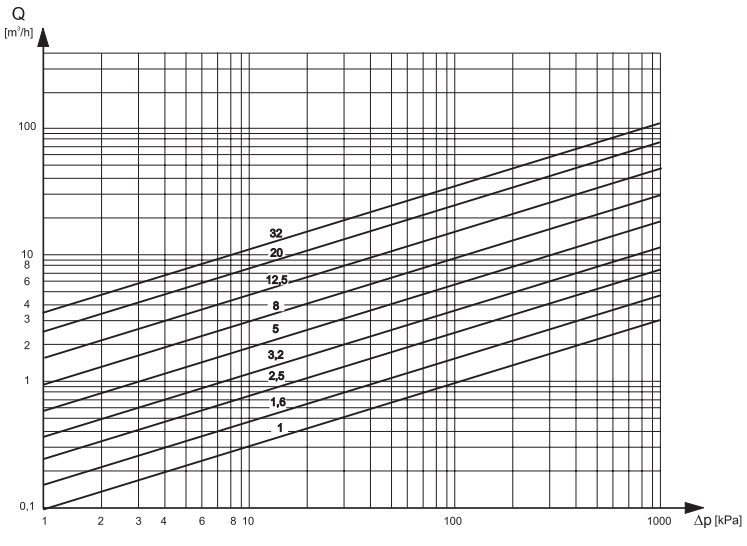
Regulator	**ZSN 2.1**	**ZSN 2.2**
VALVE (01)		
Body	grey iron EN-GJL-250 spheroidal iron EN-GJS-400-178LT carbon steel GP240GH (1.0619) stainless steel GX5CrNiMo 19-11-2 (1.4408)	
Plug and seat	X6CrNiMoTi 17-12-2 (1.4571)	
Guide sleeve		
ACTUATOR (02)		
Housing	carbon steel S235JRG2C (1.0122)	stainless steel X6CrNiTi 18-10 (1.4541)
Stem	X17CrNi 16-2 (1.4057)	
Diaphragm	EPDM + polyester fabric[2]	
Packing	EPDM[2]	
BOOSTER (06)		
Booster components	carbon steel X6CrNiTi 18-10 (1.4541)	
Springs	spring steel 12R10	
Diaphragm	EPDM + polyester fabric[2]	
Packings	EPDM[2]	

[2] other materials, subject to medium type.

NOMINAL PRESSURE, WORKING TEMPERATURE AND WORKING PRESSURE



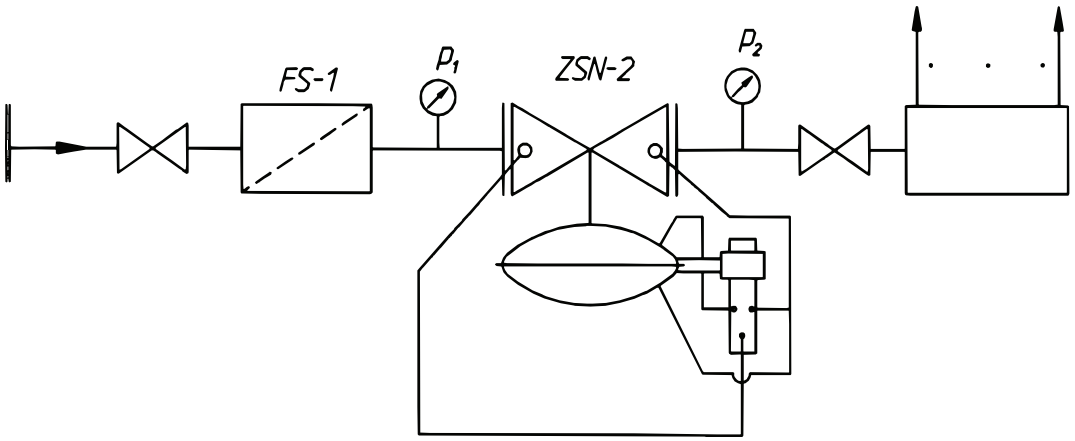
FLOW DIAGRAM FOR WATER



INSTALLATION

Regulator is to be installed on horizontal pipeline. Medium flow direction is to conform to arrow on body. At medium temperature lower than 100°C regulator position is optional, at higher temperatures it is recommended to install regulator with actuator unit (02) down. To ensure reliable operation of regulator apply strainer FS1 upstream.

EXAMPLES OF APPLICATION



ACCESSORIES

Optional (ordered separately):
- strainer FS1,
- straight tube connection ∅ 6×1,
- elbow tube connection ∅ 6×1,
- adjustment wrench,

ORDERING

In your order specify type and marking, ZSN 2.1 or ZSN 2.2, DN nominal diameter, PN nominal pressure, flow ratio K_{vs}, body material, spring range.

Example of order:

ZSN 2.1 – DN 25; PN 16; K_{vs} 5; spheroidal iron; 40…100 kPa.

Revision: ZSN2/06/2013
Valid until the next revision.

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SELF-ACTUATING DIFFERENTIAL PRESSURE RELIEF REGULATORS **TYPE ZSN3**

APPLICATION AREA:

Regulators ZSN3 are used to control preset pressure in process installations connected to regulator valve inlet. Regulators are applied in heating systems, in industrial processes with cold and hot water, steam, air and non-flammable gases. Using with other media subject to consulting with manufacturer.

DESIGN:

Regulator comprises three, temporary fastened main units: valve (01), actuator (02) and adjuster (03). Regulator valve single-ported with balanced plug. Flanged connections of valve body with valve face as per
PN-EN 1092-1:2006 and PN-EN 1092-2:1999 for PN10; 16; 25; 40
PN-EN 1759-1:2005 for CL150; CL300.
Body length as per:
PN-EN 60534-3-1:2000 – Series 1 for PN10; 16; 25; 40;
Series 37 for CL150; Series 38 for CL300
Valve tightness – bubble (Class VI as per PN-EN 60534-4), tight seat in PTFE or VMQ (ECOSIL).
Diaphragm actuator (diaphragm effective area 80 cm^2), with clammed housing or diaphragm actuator (diaphragm effective area 160 cm^2), with bolted housing.
Control pressure value adjuster with combination of three pre-tensioned springs, fixed coaxially with valve and actuator.

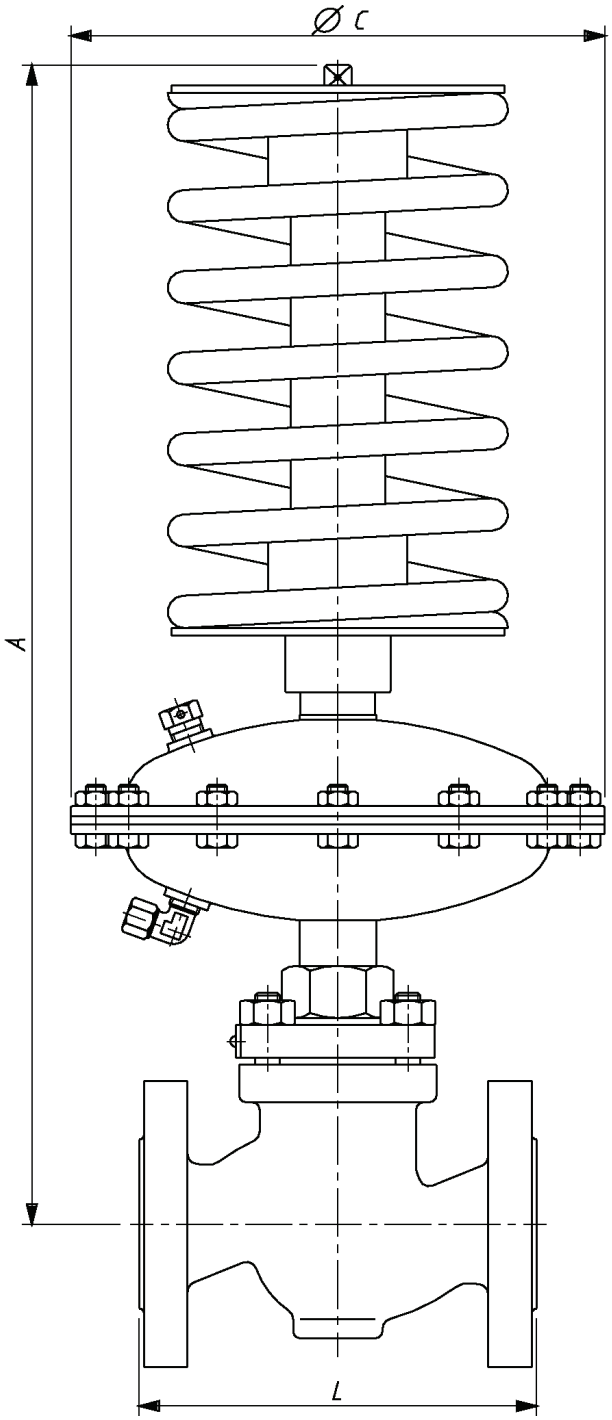
VARIANTS:

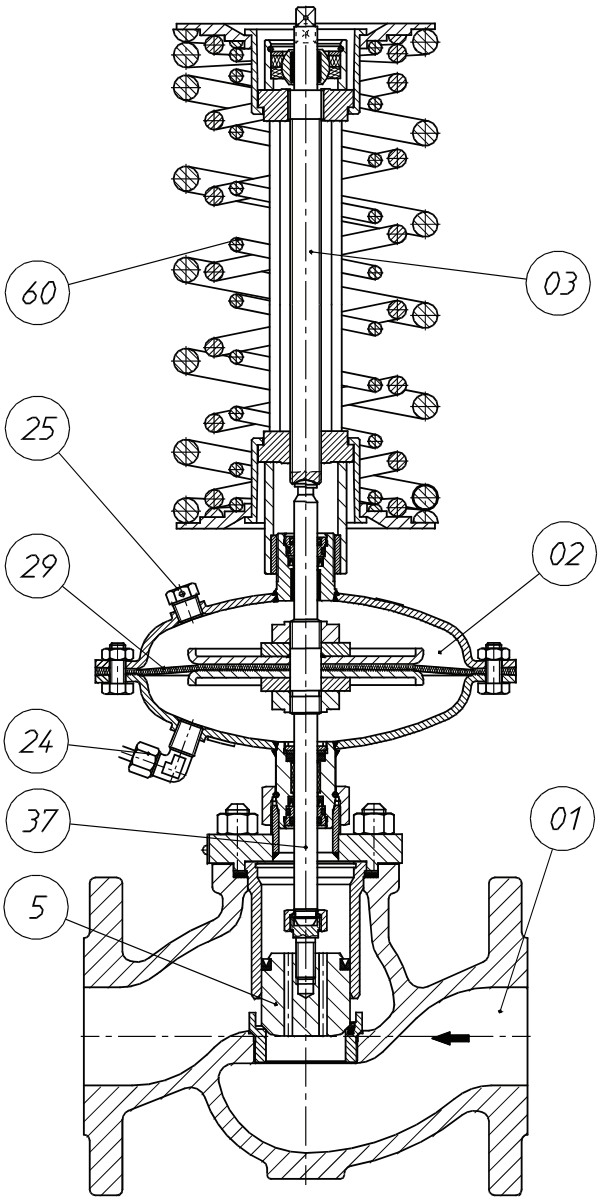
By corrosion-proofness of actuator components:
- standard (ZSN 3.1) - carbon steel with protection coatings,
- special (ZSN 3.2) - stainless steel.

OPERATING PRINCIPLE:

Valve is closed when no supply. Controlled pressure is fed via impulse duct through connection (24) under diaphragm (29) of actuator (02). Actuator second chamber is connected to atmosphere via deaeration plug (25). Increase in control pressure above preset value, set by tensioning of spring unit (60) in adjuster (03), causes deflection of diaphragm, movement of actuator stem (37) and opening of valve plug (5) until controlled pressure reaches value preset in booster.
Impulse collection point for controlled pressure is to be located upstream valve inlet.

DIMENSIONS AND WEIGHTS





DN	A	L	Valve weight (01)
	[mm]		[kg]
15	470	130	4,0
20		150	5,1
25		160	5,6
32	485	180	8,5
40	490	200	10,6
50	495	230	14
65	605	290	23
80		310	29
100	615	350	44
125	special execution, technical data according to individual inquiries		
150			

Spring range [kPa]	C [mm]	Diaphragm effective area[cm²]	**Weight**		
			Actuator (02)	**Adjuster (03)**	
				DN 15…50	**DN 65…100**
40...160	215	160	4,4	3,2	3,6
100...400				5,6	7,1
200...800	150	80	2,4	6,8	8,5
280...1120					
other spring ranges available on request					

TECHNICAL SPECIFICATIONS

DN		15	20	25	32	40	50	65	80	100	125	150
K_{VS} [1] [m³/h]	full flow	3,2	5	8	12,5	20	32	50	80	125	special execution, technical data according to individual inquiries	
	reduced flow	1 1,6 2,5	1,6 2,5 3,2	2,5 3,2 5	5	8	12,5	20	32	50		
Stroke [mm]		6			8			12		14		
Noise coefficient Z		0,65	0,6	0,55		0,45	0,4		0,35			
Control characteristics		proportional										
Spring range [kPa] [2]		40...160; 100...400; 200...800; 280...1120										
Maximum pressure in actuator chamber [bar]		20										
Allowed pressure drop in valve [bar]		12						10				
Valve nominal pressure		valve body in grey iron						PN 16				
		valve body in spheroidal iron						PN 16; PN 25; PN 40				
		valve body in carbon steel and stainless steel						PN 16; PN 25; PN 40				
Maximum medium temperature [°C]		water						200				
		steam										
		gases						80				

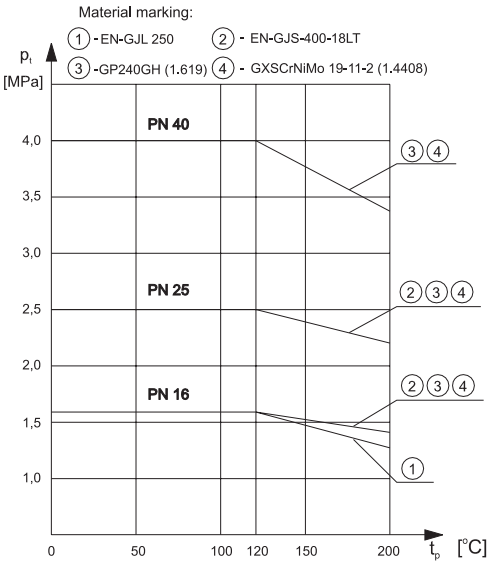
[1] other flow ratios K_{vs} subject to order specification.
[2] other ranges subject to order specification.

MATERIALS as per PN

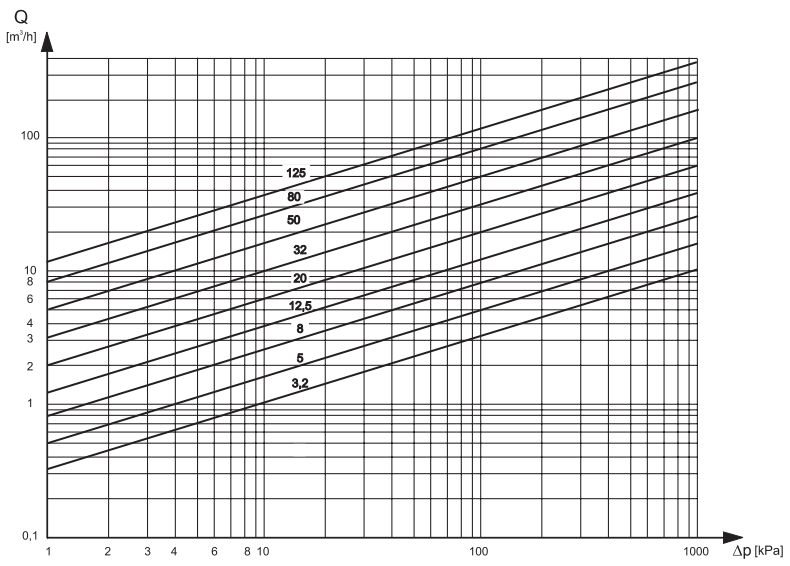
Regulator	ZSN 3.1	ZSN 3.2
VALVE (01)		
Body	grey iron EN-GJL-250 spheroidal iron EN-GJS-400-178LT carbon steel GP240GH (1.0619) stainless steel GX5CrNiMo 19-11-2 (1.4408)	
Plug and seat	X6CrNiMoTi 17-12-2 (1.4571)	
Guide sleeve		
Packing	EPDM[3]	
ACTUATOR (02)		
Housing	carbon steel S235JRG2C (1.0122)	stainless steel X6CrNiTi 18-10 (1.4541)
Stem	X17CrNi 16-2 (1.4057)	
Diaphragm	EPDM + polyester fabric[3]	
Packing	EPDM[3]	
Adjuster (03)		
Adjuster components	carbon steel C45 (1.0503)	
Springs	spring steel 60Si7	

[3] other materials, subject to medium type.

NOMINAL PRESSURE, WORKING TEMPERATURE AND WORKING PRESSURE



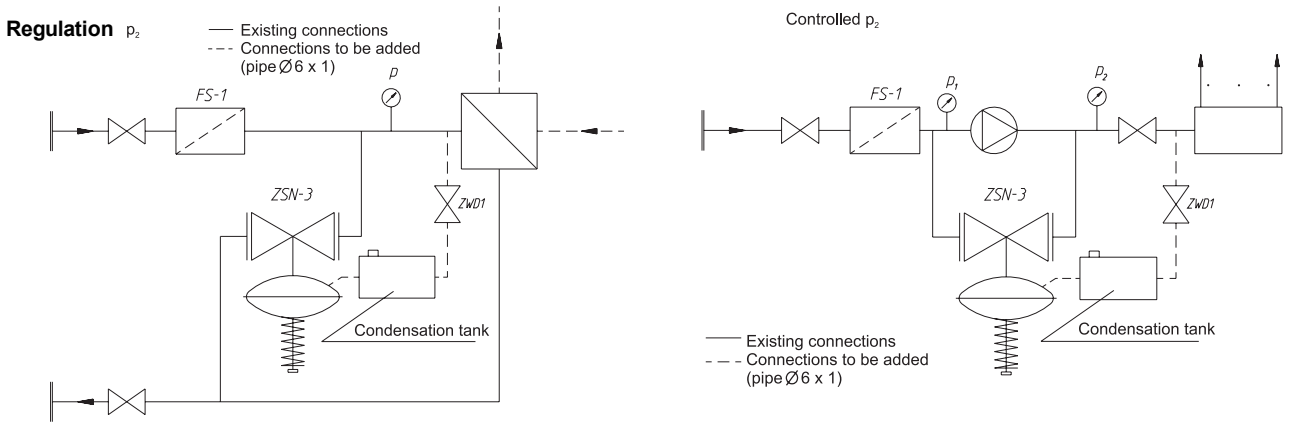
FLOW DIAGRAM FOR WATER



INSTALLATION

Regulator is to be installed on horizontal pipeline. Medium flow direction is to conform to arrow on body. At medium temperature lower than 130°C regulator position is optional, at higher temperatures it is recommended to install regulator with adjuster unit (03) down. To ensure reliable operation of regulator apply strainer FS1 upstream and needle valve ZWD 1 at impulse collection point. When applying regulator for steam installation of condensation tank is recommended.

EXAMPLES OF APPLICATION



ACCESSORIES

Delivered:
- nut and cutting ring for impulse tube,

Optional (ordered separately):
- strainer FS1,
- straight tube connection ∅ 6×1,
- connection stub NPT 1/4”
- impulse tube ∅ 6×1,
- adjustment wrench,
- condensation tank,
- needle valve ZWD 1.

ORDERING

In your order specify regulator type and marking, ZSN 3.1 or ZSN 3.2, DN nominal diameter, PN nominal pressure, flow ratio K_{vs}, body material, spring range.

Example of order:

ZSN 3.1 – DN 32; PN 16; Kvs 8; spheroidal iron; 200…800 kPa.

Revision: ZSN3/06/2013
Valid until the next revivsion.

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SELF-ACTUATING DIFFERENTIAL PRESSURE REDUCING REGULATORS **TYPE ZSN5**

APPLICATIONA AREA:

Regulators ZSN5 are used to control preset pressure in process installations connected to regulator valve inlet or outlet. Regulators are applied in heating systems, in industrial processes with cold and hot water, steam, air and non-flammable gases. Using with other media subject to consulting with manufacturer.

DESIGN:

Regulator comprises three, temporary fastened main units: valve (01), actuator (02) and adjuster (03). Regulator valve single-ported with balanced plug. Flanged connections of valve body with valve face as per
PN-EN 1092-1:2006 and PN-EN 1092-2:1999 for PN10; 16; 25; 40
PN-EN 1759-1:2005 for CL150; CL300.
Body length as per:
PN-EN 60534-3-1:2000 – Series 1 for PN10; 16; 25; 40;
Series 37 for CL150; Series 38 for CL300
Diaphragm actuator (diaphragm effective area 160 cm^2, 320 cm^2), with bolted housing.
Control pressure value adjuster with combination of three pre-tensioned springs, fixed coaxially with valve and actuator.

VAIANTS:

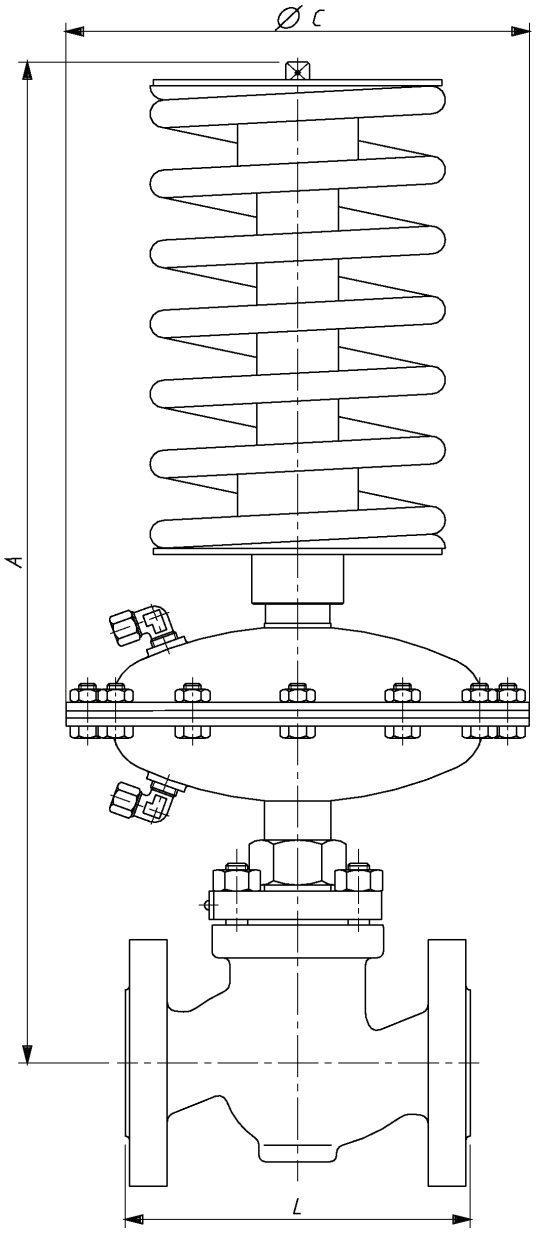
By valve leakage class:
- below 0,01% K_{VS} (class IV as per PN-EN 60534-4) - hard seat,
- bubble (class VI as per PN-EN 60534-4) - soft seat - PTFE or VMQ (ECOSIL).

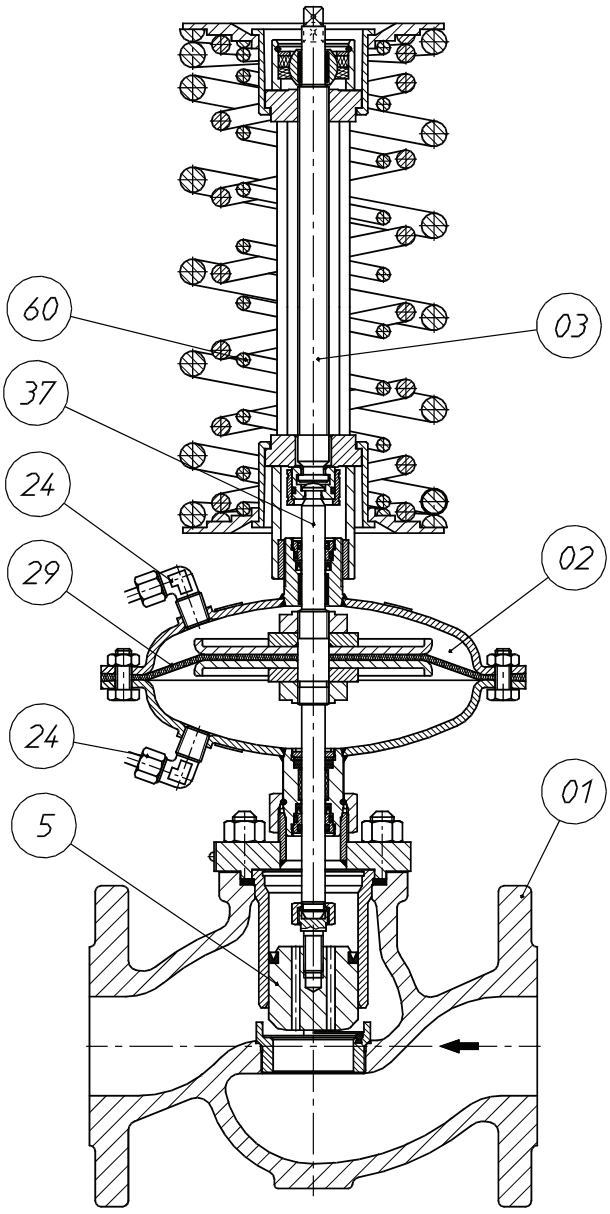
By corrosion-proofness of actuator components:
- standard (ZSN 5.1) - carbon steel with protection coatings,
- special (ZSN 5.2) - stainless steel.

OPERATING PRINCIPLE:

Valve is open when no supply. Impulse of higher pressure is fed via impulse duct through connection (24) and above diaphragm (29) of actuator (02) from adjuster (03) side. Impulse of lower pressure is fed via impulse duct through connection (24) and below diaphragm. Increase in control pressure above preset value, set by tensioning of spring (60) in adjuster (03), causes deflection of diaphragm, movement of actuator stem (37) and closure of valve plug (5) until controlled pressure reaches value preset in adjuster. When regulator is installed on supply of installation, impulse collection points are to be situated downstream regulator valve outlet. When regulator is installed on return of installation, impulse collection points are to be situated upstream valve inlet.

DIMENSIONS AND WEIGHTS





DN	A	L	Valve weight (01)
	[mm]		[kg]
15	470	130	4,0
20		150	5,1
25		160	5,6
32	485	180	8,5
40	490	200	10,6
50	495	230	14
65	605	290	23
80		310	29
100	615	350	44
125	special execution, technical data according to individual inquiries		
150			

Spring range [kPa]	C [mm]	Diaphragm effective area[cm²]	Weight		
			Actuator (02)	Adjuster (03)	
				DN 15...50	DN 65...100
10...40	282	320	9,1	2,4	2,8
20...80				3,2	3,6
40...160	215	160	4,4		
80...320				5,0	6,3
other spring ranges available on request					

TECHNICAL SPECIFICATIONS

DN		15	20	25	32	40	50	65	80	100	125	150
K_{VS} [1] [m³/h]	full flow	3,2	5	8	12,5	20	32	50	80	125	special execution technical data according to individual inquiries	
	reduced flow	1 1,6 2,5	1,6 2,5 3,2	2,5 3,2 5	5	8	12,5	20	32	50		
Stroke [mm]		6			8			12		14		
Noise coefficient Z		0,65	0,6	0,55		0,45	0,4		0,35			
Control characteristics		proportional										
Spring range [kPa] [2]		10...40; 20...80; 40...160; 80...320										
Maximum pressure in actuator chamber [bar]		20										
Allowed pressure drop in valve [bar]		12						10				
Valve nominal pressure		valve body in grey iron						PN 16				
		valve body in spheroidal iron						PN 16; PN 25; PN 40				
		valve body in carbon steel and stainless steel						PN 16; PN 25; PN 40				
Maximum medium temperature [°C]		steam						200				
		water										
		gases						80				

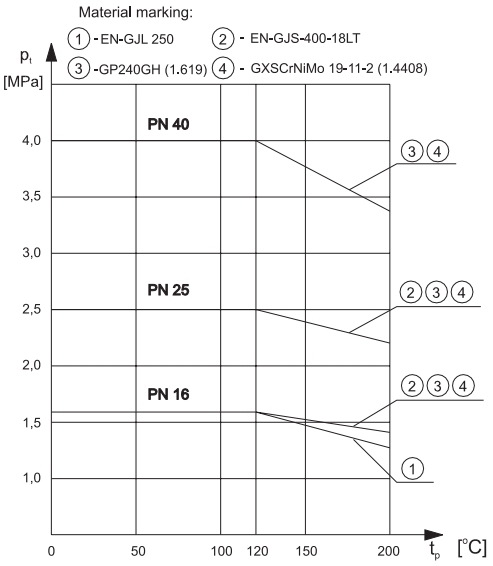
[1] other flow ratios K_{VS} subject to order specification.
[2] other ranges subject to order specification.

MATERIALS as per PN

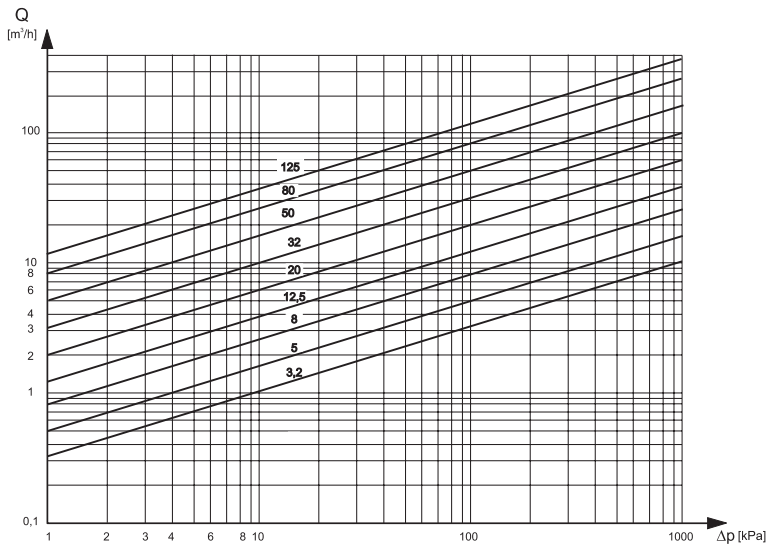
Regulator	ZSN 5.1	ZSN 5.2
VALVE (01)		
Body	grey iron EN-GJL-250 spheroidal iron EN-GJS-400-178LT carbon steel GP240GH (1.0619) stainless steel GX5CrNiMo 19-11-2 (1.4408)	
Plug and seat	X6CrNiMoTi 17-12-2 (1.4571)	
Guide sleeve		
Packing	EPDM[3]	
ACTUATOR (02)		
Housing	carbon steel S235JRG2C (1.0122)	stainless steel X6CrNiTi 18-10 (1.4541)
Stem	X17CrNi 16-2 (1.4057)	
Diaphragm	EPDM + polyester fabric[3]	
Packing	EPDM[3]	
Adjuster (03)		
Adjuster components	carbon steel C45 (1.0503)	
Springs	spring steel 60Si7	

[3] other materials, subject to medium type.

NOMINAL PRESSURE, WORKING TEMPERATURE AND WORKING PRESSURE



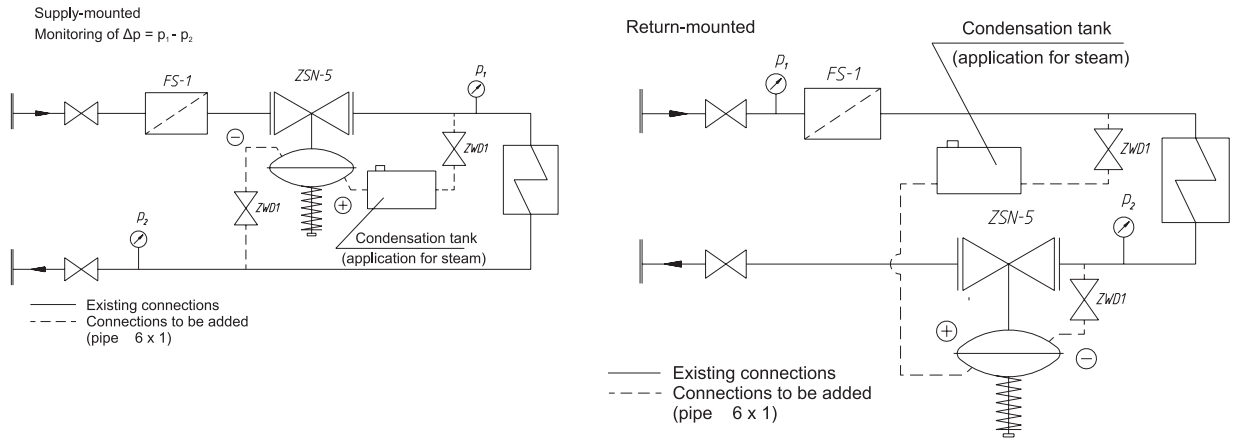
FLOW DIAGRAM FOR WATER



INSTALLATION

Regulator is to be installed on horizontal pipeline. Medium flow direction is to conform to arrow on body. At medium temperature lower than 130°C regulator position is optional, at higher temperatures it is recommended to install regulator with adjuster unit (03) down. To ensure reliable operation apply strainer FS1 upstream and needle valve ZWD 1 at impulse collection point. When applying regulator for steam installation of condensation tank is recommended.

INSTALLATION



ACCESSORIES

Delivered:
- nut and cutting ring for impulse tube,

Optional (ordered separately):
- strainer FS1,
- straight tube connection ∅ 6×1,
- connection stub NPT 1/4”
- impulse tube ∅ 6×1,
- adjustment wrench,
- condensation tank,
- needle valve ZWD 1.

ORDERING

In your order specify type and marking, ZSN 5.1 or ZSN 5.2, DN nominal diameter, PN nominal pressure, flow ratio K_{vs}, body material, spring range, closure type (only for tight execution).

Example of order:

ZSN 5.2 – DN 50; PN 16; Kvs 32; spheroidal iron; 40…160 kPa, tight

Revision: ZSN5/06/2013
Valid until the next revision.

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SELF-ACTUATING DIFFERENTIAL PRESSURE REDUCING REGULATORS WITH FLOW REDUCTION **TYPE ZSN6**

APPLICATION AREA:

Regulators ZSN6 are used to control preset pressure in process installations connected to regulator valve inlet. Regulators are applied in heating systems, in industrial processes with cold and hot water, steam, air and non-flammable gases. Using with other media subject to consulting with manufacturer.

DESIGN:

Regulator comprises three, temporary fastened main units: valve (01), actuator (02) and adjuster (03). valve single-ported with balanced plug and flow rate preset value adjuster in the form of gradually adjusted flap. Flanged connections of valve body with valve face as per
PN-EN 1092-1:2006 and PN-EN 1092-2:1999 for PN10; 16; 25; 40
PN-EN 1759-1:2005 for CL150; CL300.
Body length as per:
PN-EN 60534-3-1:2000 - Series 1 for PN10; 16; 25; 40;
Series 37 for CL150; Series 38 for CL300
Diaphragm actuator (diaphragm effective area 160 cm^2, 320 cm^2), with bolted housing.
Control pressure value adjuster with combination of three pre-tensioned springs, fixed coaxially with valve and actuator.

VARIANTS:

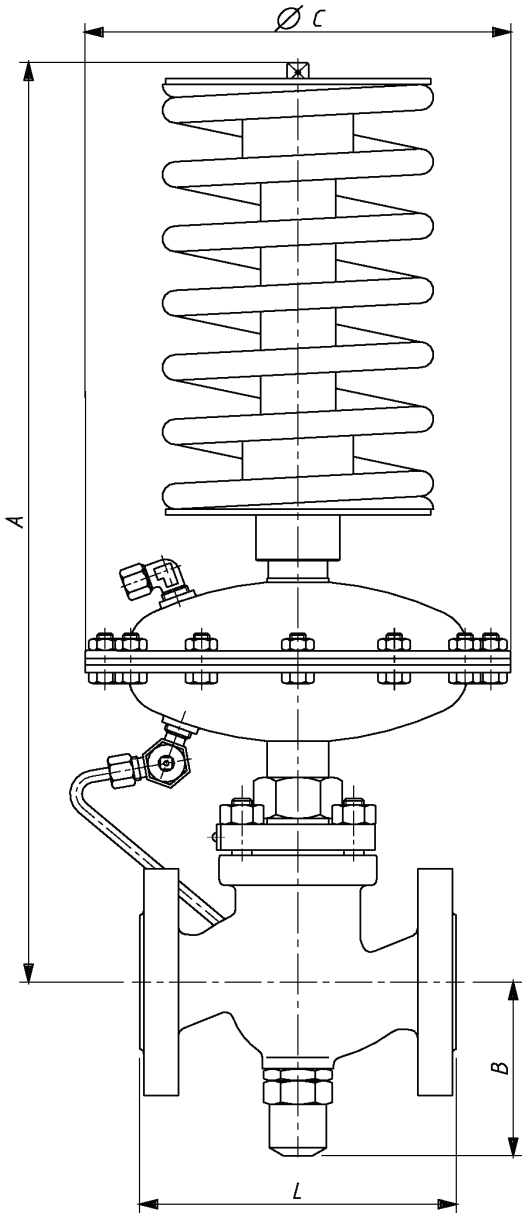
By valve leakage class:
- below 0.01%K_{vs} (class IV as per PN-EN 60534-4) - hard seat,
- bubble (class VI as per PN-EN 60534-4) – soft seat - PTFE or VMQ (ECOSIL).

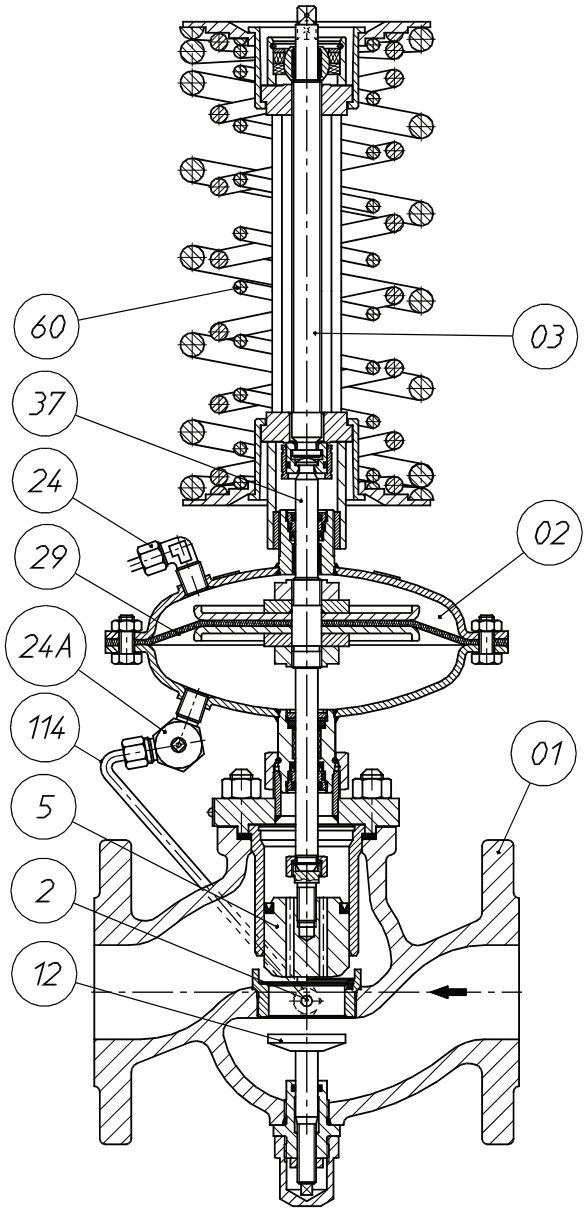
By corrosion-proofness of actuator components:
- standard (ZSN 6.1) – carbon steel with protection coatings,
- special (ZSN 6.2) – stainless steel.

OPERATING PRINCIPLE:

valve is open when no supply. Impulse of higher pressure of controlled pressure difference is collected upstream controlled installation, via impulse duct, through connection (24) and above diaphragm (29) of actuator (02). Impulse of lower pressure of controlled pressure difference is collected from behind the flow reduction flap (12) and transferred through opening in seat (2) via impulse duct (114) below actuator diaphragm. Increase in control pressure above preset value, set by tensioning of spring (60) in adjuster (03), causes deflection of diaphragm, movement of actuator stem (37) and closure of valve plug (5) until controlled pressure reaches value preset in adjuster.
Increase in flow above the preset value, set by adjuster flap (12), causes increase in packing gland resistance and increase in pressure difference in actuator chambers, which in turn causes deflection of diaphragm, movement of stem and closure of valve plug until flow value as set by flap is reached. Needle valve (24A) enables choking and cutting off control pressure impulse, deaeration of actuator chamber, as well as protects diaphragm against hydraulic impacts.

DIMENSIONS AND WEIGHTS





DN	A	L	Valve weight (01)
	[mm]		[kg]
15	470	130	4,0
20		150	5,1
25		160	5,6
32	485	180	8,5
40	490	200	10,6
50	495	230	14
65	605	290	23
80		310	29
100	615	350	44

Spring range [kPa]	C [mm]	Diaphragm effective area[cm²]	Weight		
			Actuator (02)	Adjuster (03)	
				DN 15...50	DN 65...100
10...40	282	320	9,1	2,4	2,8
20...80				3,2	3,6
40...160	215	160	4,4		
80...320				5,0	6,3

TECHNICAL SPECIFICATION

DN		15	20	25	32	40	50	65	80	100
K_{VS} [1] [m³/h]	full flow	3,2	5	8	12,5	20	32	50	80	125
	reduced flow	1 1,6 2,5	1,6 2,5 3,2	2,5 3,2 5	5	8	12,5	20	32	50
Stroke [mm]		6			8			12		14
Noise coefficient Z		0,65	0,6	0,55		0,45	0,4		0,35	
Control characteristics		proportional								
Spring range [kPa] [2]		10...40; 20...80; 40...160; 80...320								
Maximum pressure in actuator chamber [bar]		20								
Allowed pressure drop in valve [bar]		12						10		
Valve nominal pressure		valve body in grey iron						PN 16		
		valve body in spheroidal iron						PN 16; PN 25; PN 40		
		valve body in carbon steel and stainless steel						PN 16; PN 25; PN 40		
Maximum medium temperature [˚C]		steam						200		
		water								
		gases						80		

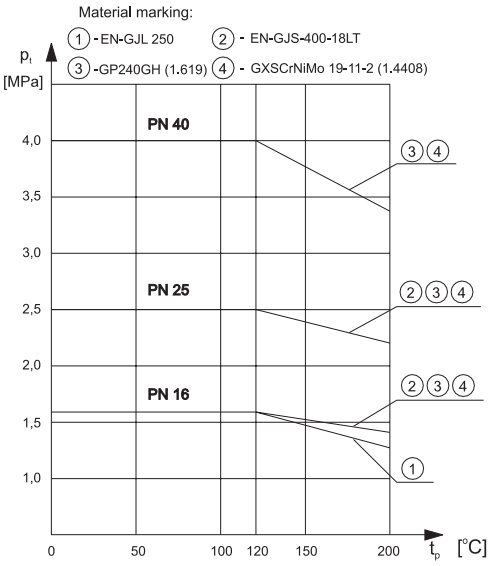
[1] other flow ratios K_{vs} subject to order specification.
[2] other ranges subject to order specification.

MATERIALS as per PN

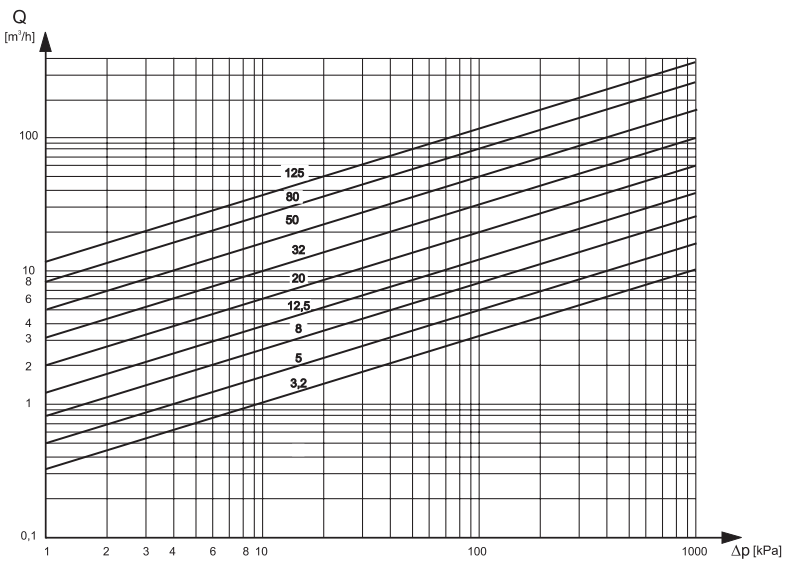
Regulator	ZSN 6.1	ZSN 6.2
VALVE (01)		
Body	grey iron EN-GJL-250 spheroidal iron EN-GJS-400-178LT carbon steel GP240GH (1.0619) stainless steel GX5CrNiMo 19-11-2 (1.4408)	
Plug and seat	X6CrNiMoTi 17-12-2 (1.4571)	
Guide sleeve		
Packing	EPDM[3]	
ACTUATOR (02)		
Housing	carbon steel S235JRG2C (1.0122)	stainless steel X6CrNiTi 18-10 (1.4541)
Stem	X17CrNi 16-2 (1.4057)	
Diaphragm	EPDM + polyester fabric[3]	
Packing	EPDM[3]	
Adjuster (03)		
Adjuster components	carbon steel C45 (1.0503)	
Springs	spring steel 60Si7	

[3] other materials, subject to medium type.

NOMINAL PRESSURE, WORKING TEMPERATURE AND WORKING PRESSURE



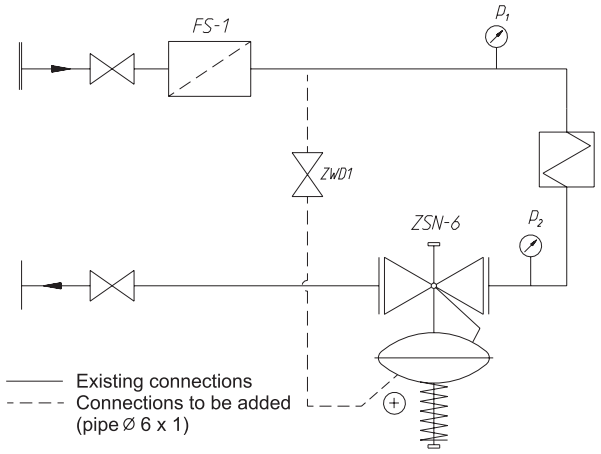
FLOW DIAGRAM FOR WATER



INSTALLATION

Regulator is to be installed on horizontal pipeline. Medium flow direction is to conform to arrow on body. At medium temperature lower than 130°C regulator position is optional, at higher temperatures it is recommended to install regulator with adjuster unit (03) down. To ensure reliable operation apply strainer FS1 upstream and needle valve ZWD 1 at impulse collection point.

EXAMPLES OF APPLICATION



ACCESSORIES

Delivered:
- nut and cutting ring for impulse tube,

Optional (ordered separately):
- strainer FS1,
- straight tube connection ∅ 6×1,
- connection stub NPT 1/4”
- impulse tube ∅ 6×1,
- adjustment wrench,
- needle valve ZWD 1.

ORDERING

In your order specify type and marking, ZSN 6.1 or ZSN 6.2, DN nominal diameter, PN nominal pressure, flow ratio K_{vs}, body material, spring range, closure type (only for tight executions).

Example of order:

ZSN 6.2 – DN 65; PN 16; Kvs 50; spheroidal iron; 40…160 kPa, tight.

Revision: ZSN6/06/2013
Valid until the next revision.

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SELF-ACTUATING DIFFERENTIAL PRESSURE RELIEF REGULATORS **TYPE ZSN7**

APPLICATION AREA:

Regulators ZSN7 are used to control preset pressure in process installations connected to regulator valve inlet. Regulators are applied in heating systems, in industrial processes with cold and hot water, steam, air and non-flammable gases. Using with other media subject to consulting with manufacturer.

DESIGN:

Regulator comprises three, temporary fastened main units: valve (01), actuator (02) and adjuster (03). Regulator valve single-ported with balanced plug. Flanged connections of valve body with valve face as per PN-EN 1092-1:2006 and PN-EN 1092-2:1999 for PN10; 16; 25; 40 PN-EN 1759-1:2005 for CL150; CL300.
Body length as per:
PN-EN 60534-3-1:2000 – Series 1 for PN10; 16; 25; 40;
Series 37 for CL150; Series 38 for CL300
Diaphragm actuator (diaphragm effective area 160 cm^2, 320 cm^2), with bolted housing.
Control pressure value adjuster with combination of three pre-tensioned springs, fixed coaxially with valve and actuator.

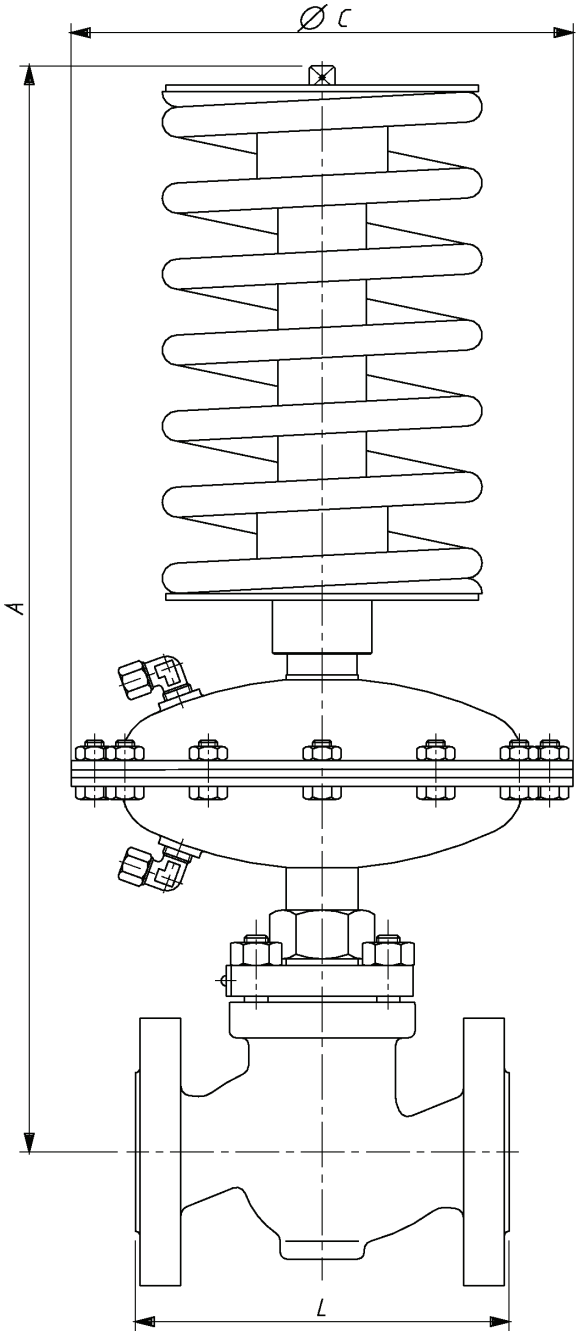
VARIANTS:

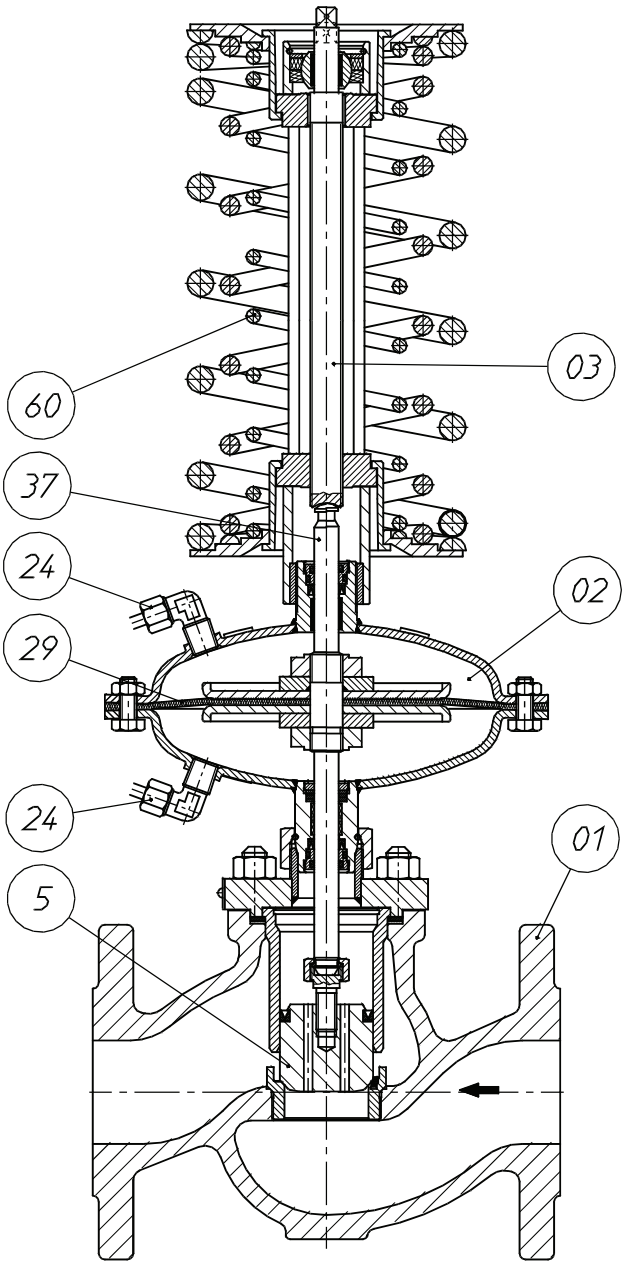
By corrosion-proofness of actuator components:
- standard (ZSN 7.1) - carbon steel with protection coatings,
- special (ZSN 7.2) stainless steel.

OPERATING PRINCIPLE:

Regulator valve is closed when no supply. Impulse of higher pressure of controlled pressure difference is fed via impulse duct through connection (24) and below diaphragm (29) of actuator (02) from valve (01) side. Impulse of lower pressure of controlled pressure difference is fed via impulse duct through connection (24) and above diaphragm. Increase in control pressure above preset value, set by tensioning of spring (60) in adjuster (03), causes deflection of diaphragm, movement of actuator stem (37) and closure of valve plug (5) until controlled pressure reaches value preset in adjuster. Impulse collection point for impulse of higher pressure of controlled pressure is to be located upstream regulator valve inlet and collection point of lower pressure impulse - downstream regulator valve outlet.

DIMENSIONS AND WEIGHTS





DN	A	L	Valve weight (01)
	[mm]		[kg]
15	470	130	4,0
20		150	5,1
25		160	5,6
32	485	180	8,5
40	490	200	10,6
50	495	230	14
65	605	290	23
80		310	29
100	615	350	44
125	special execution, technical data according to individual inquiries		
150			

Spring range [kPa]	C [mm]	Diaphragm effective area[cm²]	Weight		
			Actuator (02)	Adjuster (03)	
				DN 15...50	DN 65...100
10...40	282	320	9,1	2,4	2,8
20...80				3,2	3,6
40...160	215	160	4,4		
80...320				5,0	6,3
other spring ranges available on request					

TECHNICAL SPECIFICATIONS

DN		15	20	25	32	40	50	65	80	100	125	150
K_{VS} [1] [m³/h]	full flow	3,2	5	8	12,5	20	32	50	80	125	special execution technical data according to individual inquiries	
	reduced flow	1 1,6 2,5	1,6 2,5 3,2	2,5 3,2 5	5	8	12,5	20	32	50		
Stroke [mm]		6			8			12		14		
Noise coefficient Z		0,65	0,6	0,55		0,45	0,4		0,35			
Control characteristics		proportional										
Spring range [kPa] [2]		10...40; 20...80; 40...160; 80...320										
Maximum pressure in actuator chamber [bar]		20										
Allowed pressure drop in valve [bar]		12						10				
Valve nominal pressure		valve body in grey iron						PN 16				
		valve body in spheroidal iron						PN 16; PN 25; PN 40				
		valve body in carbon steel and stainless steel						PN 16; PN 25; PN 40				
Maximum medium temperature [°C]		steam						200				
		water										
		gases						80				

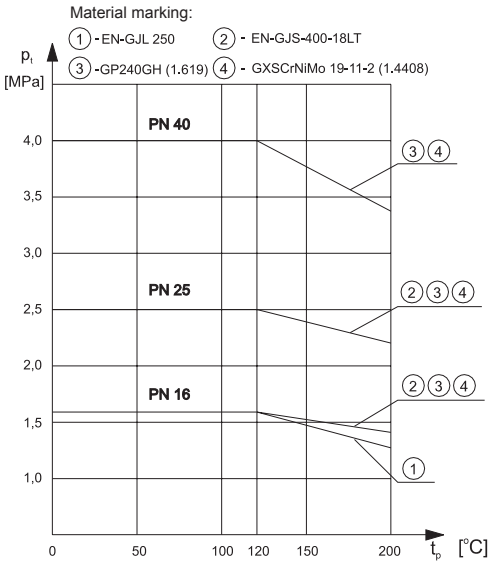
[1] other flow ratios K_{VS} subject to order specification.
[2] other ranges subject to order specification.

MATERIALS as per PN

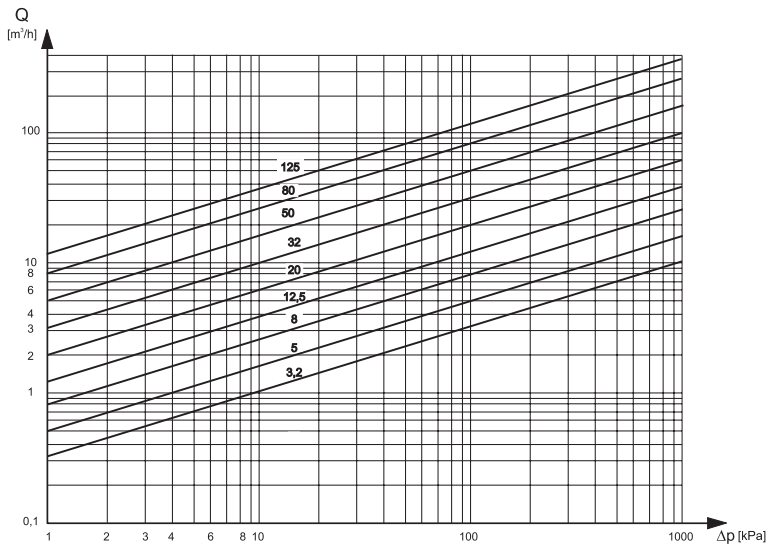
Regulator	ZSN 7.1	ZSN 7.2
VALVE (01)		
Body	grey iron EN-GJL-250 spheroidal iron EN-GJS-400-178LT carbon steel GP240GH (1.0619) stainless steel GX5CrNiMo 19-11-2 (1.4408)	
Plug and seat	X6CrNiMoTi 17-12-2 (1.4571)	
Guide sleeve		
Packings	EPDM[3]	
ACTUATOR (02)		
Housing	carbon steel S235JRG2C (1.0122)	stainless steel X6CrNiTi 18-10 (1.4541)
Stem	X17CrNi 16-2 (1.4057)	
Diaphragm	EPDM + polyester fabric[3]	
Packing	EPDM[3]	
Adjuster (03)		
Adjuster components	carbon steel C45 (1.0503)	
Springs	spring steel 60Si7	

[3] other materials, subject to medium type.

NOMINAL PRESSURE, WORKING TEMPERATURE AND WORKING PRESSURE



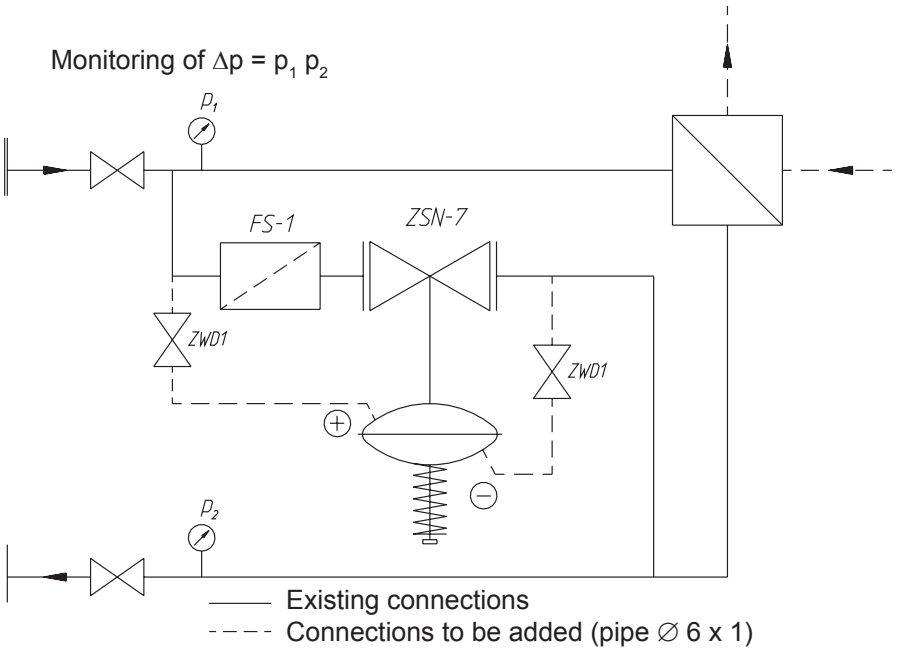
FLOW DIAGRAM FOR WATER



INSTALLATION

Regulator is to be installed on horizontal pipeline. Medium flow direction is to conform to arrow on body. At medium temperature lower than 130°C regulator position is optional, at higher temperatures it is recommended to install regulator with adjuster unit (03) down. To ensure reliable operation of regulator apply strainer FS1 upstream and needle valve ZWD 1 at impulse collection point. When applying regulator for steam installation of condensation tank is recommended.

EXAMPLES OF APPLICATION



ACCESSORIES

Delivered:
- nut and cutting ring for impulse tube,

Optional (ordered separately):
- strainer FS1,
- straight tube connection ∅ 6×1,
- connection stub NPT 1/4”
- impulse tube ∅ 6×1,
- adjustment wrench,
- condensation tank,
- needle valve ZWD 1.

ORDERING

In your order specify regulator type and marking, ZSN 7.1 or ZSN 7.2, DN nominal diameter, PN nominal pressure, flow ratio K_{vs}, body material, spring range.

Example of order:

Pressure regulator ZSN 7.1 – DN 15; PN 16; K_{vs} 32; spheroidal iron; 40…160 kPa.

Revision: ZSN7/06/2013
Valid until the next revision.

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SELF-ACTUATING FLOW REGULATORS **TYPE ZSN8**

APPLICATION AREA:

Regulators ZSN8 are used to control preset pressure in process installations. Regulators are applied in heating systems, in industrial processes with cold and hot water (150°C), air and non-flammable gases (80°C). Using with other media subject to consulting with manufacturer.

DESIGN:

Regulator comprises two main units: valve (01) and actuator (02). Regulator valve single-ported with balanced plug, and flow rate preset value adjuster in the form of gradually adjusted packing gland. Flanged connections of valve body with valve face as per
PN-EN 1092-1:2006 and PN-EN 1092-2:1999 for PN10; 16; 25; 40
PN-EN 1759-1:2005 for CL150; CL300.
Body length as per:
PN-EN 60534-3-1:2000 - Series 1 for PN10; 16; 25; 40;
Series 37 for CL150; Series 38 for CL300
Diaphragm actuator (diaphragm effective area 160 cm^2), with bolted housing and spring allowing to achieve preset pressure drop on adjuster packing gland of 20 [kPa] or 50 [kPa].

VARIANTS:

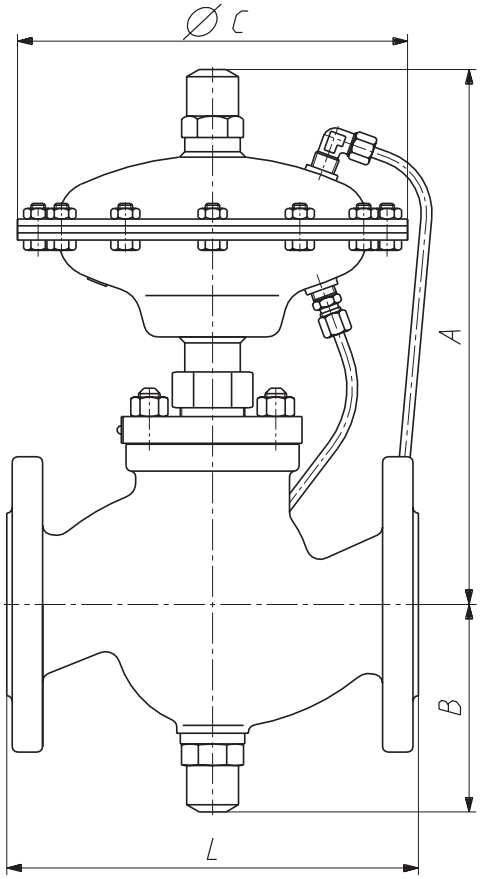
By valve leakage class:
- below 0.01%Kvs (class IV as per PN-EN 60534-4) - hard seat,
- bubble (class VI as per PN-EN 60534-4) – soft seat - PTFE or VMQ (ECOSIL).

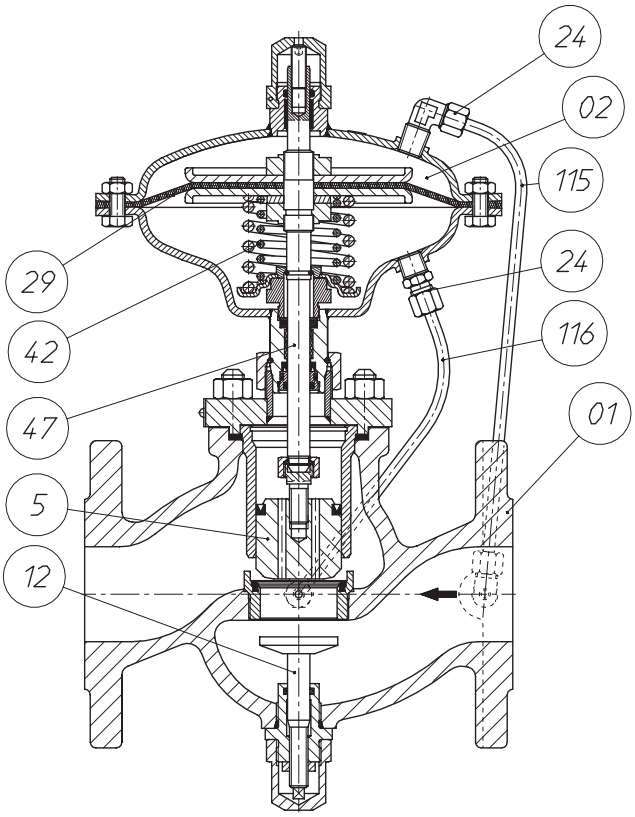
By corrosion-proofness of actuator components:
- standard (ZSN 8.1) – carbon steel with protection coatings,
- special (ZSN 8.2) – stainless steel.

OPERATING PRINCIPLE:

Regulator valve is open when no supply. Regulator operation consists in measurement and control of permanent pressure difference on the packing gland (12) of value preset by medium flow. Controlled pressure difference is transferred to actuator via impulse ducts (115) "+", (116) "-", generates a force on actuator diaphragm (29) corresponding to actual controlled value, compared on actuator stem (47) with spring tension force (42). With change in flow rate, and consequential change in value of controlled pressure difference, force generate don diaphragm shall move the stem (47) with attached plug (5) until spring (42) tension force is compensated. This way flow rate is kept on constant level. Regulator does not require any additional impulse ducts. Total pressure drop in valve comprises pressure drop on packing gland and on plug.

DIMENSIONS AND WEIGHTS





DN	A	B	C	Diaphragm effective area [cm²]	L	Valve weight (01)
	[mm]					[kg]
15	295	90	215	160	130	9,3
20					150	10,4
25					160	10,9
32	315	98			180	14
40	320	110			200	16,3
50	325	120			230	20,3
65	365	142			290	29,5
80		151			310	37
100	370	185			350	52,5

TECHNICAL SPECIFICATIONS

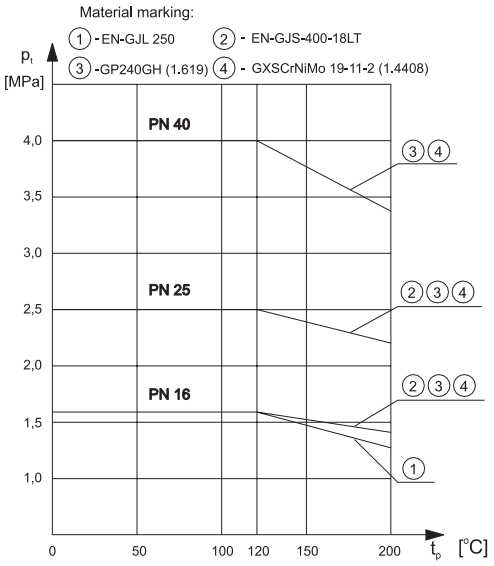
DN		15	20	25	32	40	50	65	80	100
K_{VS} [m³/h]	full flow	3,2	5	8	12,5	20	32	50	80	125
	reduced flow	1 1,6 2,5	1,6 2,5 3,2	2,5 3,2 5	5	8	12,5	20	32	50
Skok [mm]		6			8			12		14
Noise coefficient Z		0,65	0,6	0,55		0,45	0,4		0,35	
Control characteristics		proportional								
Spring range % K_{VS}	Δp = 20 [kPa]	4…40 %K_{VS}								
	Δp = 50 [kPa]	7…70 %K_{VS}								
Maximum pressure in actuator chamber [bar]		20								
Allowed pressure drop in valve [bar]		12						10		
Minimum pressure drop in valve [bar]		2 Δp (0,4 lub 1)								
Valve nominal pressure		valve body in grey iron						PN 16		
		valve body in spheroidal iron						PN 16; PN 25; PN 40		
		valve body in carbon steel and stainless steel						PN 16; PN 25; PN 40		
Maximum medium temperature [°C]		steam						150		
		water								
		gases						80		

MATERIALS as per PN

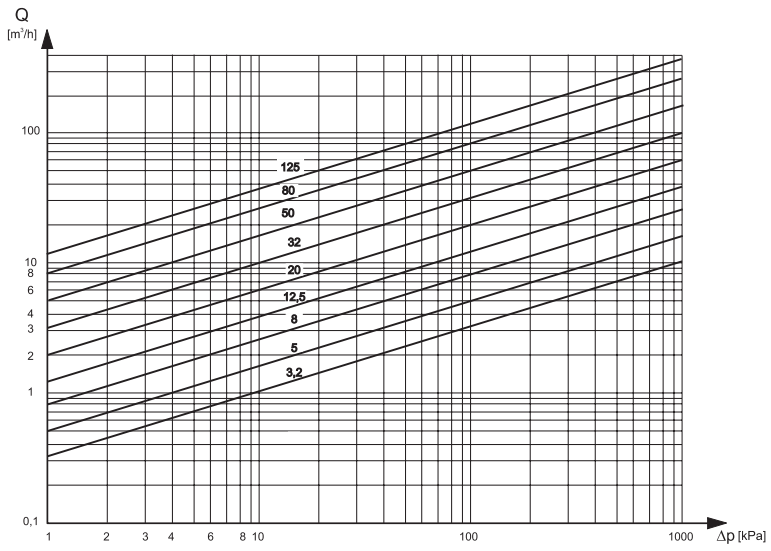
Regulator	***ZSN 8.1***	***ZSN 8.2***
VALVE (01)		
Body	grey iron EN-GJL-250 spheroidal iron EN-GJS-400-178LT carbon steel GP240GH (1.0619) stainless steel GX5CrNiMo 19-11-2 (1.4408)	
Plug and seat	X6CrNiMoTi 17-12-2 (1.4571)	
Guide sleeve		
Packings	EPDM[1)]	
ACTUATOR (02)		
Housing	carbon steel S235JRG2C (1.0122)	stainless steel X6CrNiTi 18-10 (1.4541)
Stem	X17CrNi 16-2 (1.4057)	
Spring	sprign steel 60Si7	
Diaphragm	EPDM + polyester fabric[1)]	
Packing	EPDM[1)]	

[1)] other materials, subject to medium type.

NOMINAL PRESSURE, WORKING TEMPERATURE AND WORKING PRESSURE



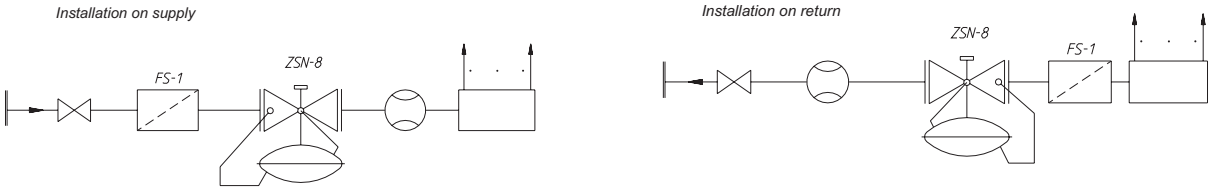
FLOW DIAGRAM FOR WATER



INSTALLATION

Regulator is to be installed on horizontal pipeline. Medium flow direction is to conform to arrow on body. At medium temperature lower than 130°C regulator position is optional, at higher temperatures it is recommended to install regulator with adjuster unit (03) down. To ensure reliable operation of regulator apply strainer FS1 upstream.

EXAMPLES OF APPLICATION



ACCESSORIES

Delivered:
- nut and cutting ring for impulse tube,

Optional (ordered separately):
- strainer FS1.

ORDERING

In your order specify type and marking, ZSN 8.1 or ZSN 8.2, DN nominal diameter, PN nominal pressure, flow ratio K_{vs}, body material, pressure drop on packing gland (20 or 50 [kPa]), closure type (only for tight executions).

Example of order:

ZSN 8.1 – DN 40; PN 25; K_{vs} 20; spheroidal iron; 20 [kPa], tight.

Revision: ZSN8/06/2013
Valid until the next revision.

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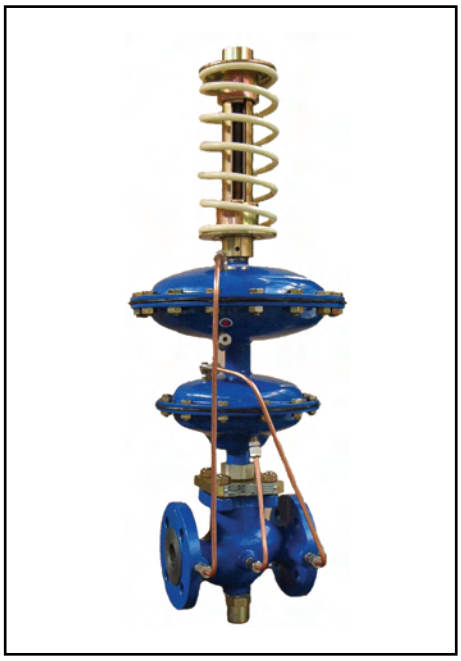
SELF-ACTUATING DIFFERENTIAL PRESSURE AND FLOW REGULATORS **TYPE ZSN91; 92**

APPLICATION AREA:

Regulators ZSN91; 92 are used to control preset pressure difference and flow in process installations connected to inlet or outlet of regulator valve. Regulators are applied in heating systems, in industrial processes with cold and hot, steam, air, and non-flammable gases. Using with other media subject to consulting with manufacturer.

DESIGN:



Regulator comprises three, temporarily connected, main units: valve (01), actuators (02A and 02B), and adjuster (03). Regulator valve single-ported with balanced plug, and flow rate preset value adjuster in the form of gradually adjusted packing gland. Flanged connections of valve body with valve face as per
PN-EN 1092-1:2010 and PN-EN 1092-2:1999 for PN10; 16; 25; 40
PN-EN 1759-1:2005 for CL150; CL300.
Body length as per:
PN-EN 60534-3-1:2000 – Series 1 for PN10; 16; 25; 40;
Series 37 for CL150; Series 38 for CL300
Diaphragm actuator (diaphragm effective area 160/160 cm^2 or 160/320 cm^2), with bolted housing, where comparison of pressure difference impulses from controlled flow rate and controlled pressure difference is held.
Control pressure value adjuster with combination of three pre-tensioned springs, fixed coaxially with valve and actuator.

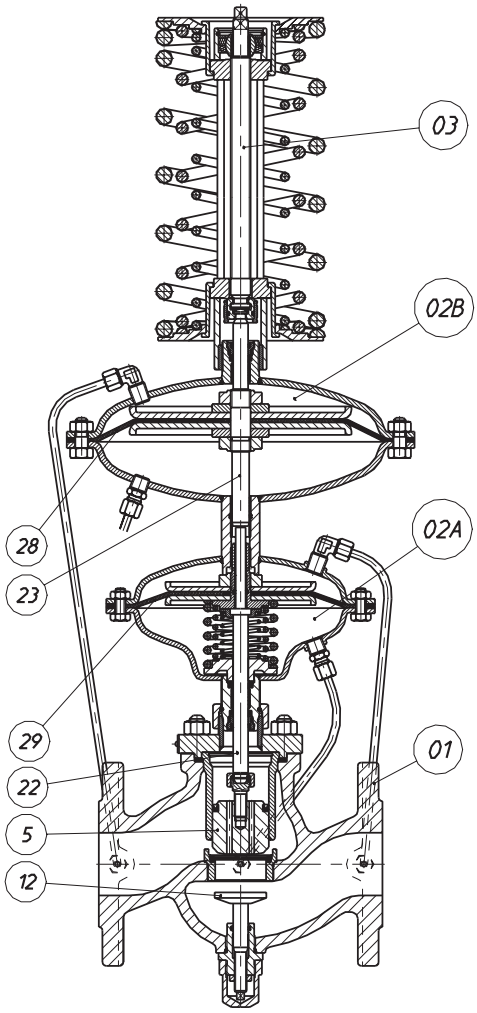
VARIANTS:

By application:
- on the supply side ZSN 91
- on the return side ZSN 92

By corrosion-proofness of actuator components:
- standard (ZSN 91.1; ZSN 92.1) - carbon steel with protection coatings,
- special (ZSN 91.2; ZSN 92.2) - stainless steel.

By pressure drop on packing gland:
- Δp_D = 20 [kPa]
- Δp_D = 50 [kPa]

OPERATING PRINCIPLE:



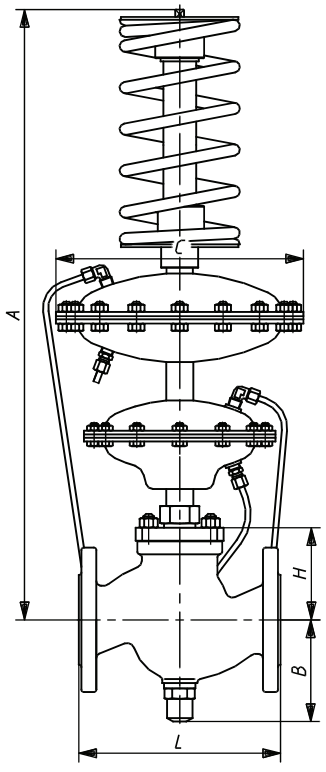
Regulator valve is open when no supply. Regulator controls flow comparing it with preset packing gland (12) value, and pressure difference, comparing it to preset adjuster (03) value. Both control systems – flow and pressure difference – operate independently. Plug position is determined by the value which deviates more from preset value. Flow control consists in presetting constant pressure difference of Δp_D=20 kPa or Δp_D=50 kPa, corresponding to desired flow, in packing gland (12), and transferring this pressure difference via impulse ducts to actuator (02A). Each change in flow rate exceeding desired value shall cause change in pressure difference regarding packing gland value and pro rata change in plug position, until flow rate reaches desired value.

Control of pressure difference Δp_R is achieved by presetting desired value of controlled pressure difference in adjuster (03) and transferring it via impulse ducts from measurement point to actuator (02B).

Each deviation from flow rate regarding adjuster value shall cause pro rata change in plug position, until controlled pressure difference reaches preset value.

Regulator only requires impulse tube for connection to lower or higher pressure, regarding installation method on supply or return pipeline, as per the diagram illustrating application examples hereinafter.

DIMENSIONS AND WEIGHTS



DN	Actuator type (02A and 02B)	A	B	C	H	L	Valve weight(01)
		[mm]					[kg]
15	160-160	655	90	215	80	130	4,2
20						150	5,3
25						160	5,9
32		670	98		95	180	8,9
40		675	110		100	200	11,2
50		680	120		105	230	15,4
65	160-320	735	142	282	145	290	24,4
80			151			310	31,9
100		740	185		150	350	47,7

Spring range [kPa]	Actuator (02A - 02B) Diaphragm effective area[cm^2]	Weight		
		Actuator (02A - 02B)	Adjuster (03)	
			DN 15...50	DN 65...100
40...160	160-160	10	3,2	3,6
80...320			5,0	6,3
120…480			7,4	9
10...40	160-320	15	2,4	2,8
20...80			3,2	3,6

TECHNICAL SPECIFICATIONS

DN		15	20	25	32	40	50	65	80	100
K_{VS} [1] [m³/h]	full flow	3,2	5	8	12,5	20	32	50	80	125
Skok [mm]		6			8			12		14
Noise coefficient Z		0,65	0,6	0,55		0,45	0,4		0,35	
Control characteristics		proportional								
Spring range [kPa] [2]		10...40; 20...80; 40...160; 80...320, 120…480								
Flow values for pressure drop in packing gland [bar]		12						10		
Seeting ranges for flow rates by pressure drop in packing gland	Δp_D = 20 [kPa]	4…45% K_{VS}								
	Δp_D = 50 [kPa]	7…75% K_{VS}								
Valve nominal pressure	valve body in grey iron	PN 16								
	valve body in spheroidal iron	PN 16; PN 25; PN 40								
	valve body in carbon steel and stainless steel	PN 16; PN 25; PN 40								
Maximum medium temperature [˚C]	steam, water	150								
	gases	80								
Minimum pressure drop in valve		$\Delta p_z = \Delta p_D + (\frac{Q^2}{Kv^2})$								

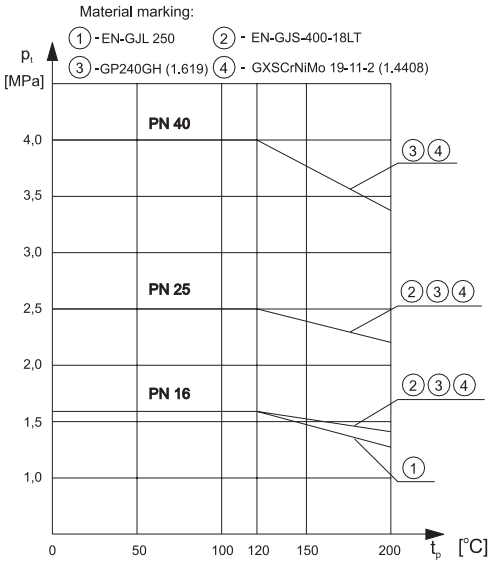
[1] other K_{VS} ratios subjecto to order specification.
[2] other ranges subject to order specification.

MATERIALS as per PN

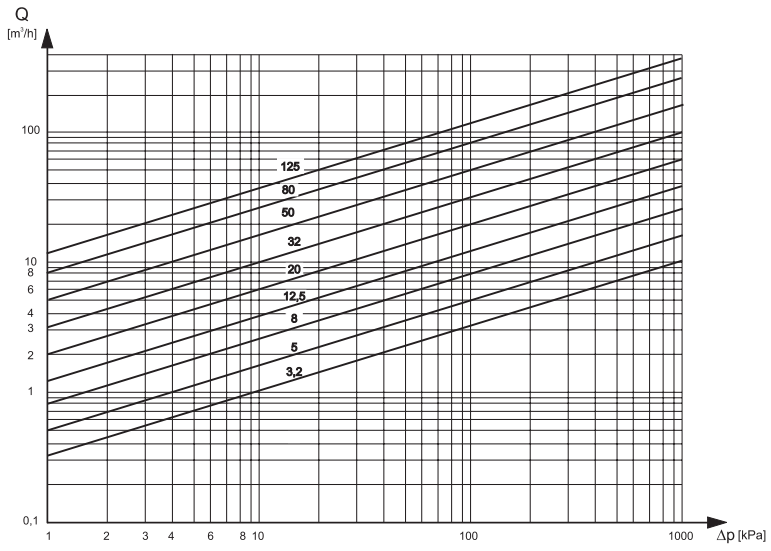
Regulator	**ZSN 91**	**ZSN 92**
VALVE (01)		
Body	grey iron EN-GJL-250 spheroidal iron EN-GJS-400-178LT carbon steel GP240GH (1.0619) stainless steel GX5CrNiMo 19-11-2 (1.4408)	
Plug and seat	X6CrNiMoTi 17-12-2 (1.4571)	
Guide sleeve		
Packings	EPDM[3]	
ACTUATOR (02)		
Housing	carbon steel S235JRG2C (1.0122)	stainless steel X6CrNiTi 18-10 (1.4541)
Stem	X17CrNi 16-2 (1.4057)	
Diaphragm	EPDM + polyester fabric3[3]	
Packing	EPDM[3]	
Adjuster (03)		
Adjuster components	Carbon steel C45 (1.0503)	
Springs	Spring steel 60Si7	

[3] other materials, subject to medium type.

NOMINAL PRESSURE, WORKING TEMPERATURE AND WORKING PRESSURE



FLOW DIAGRAM FOR WATER



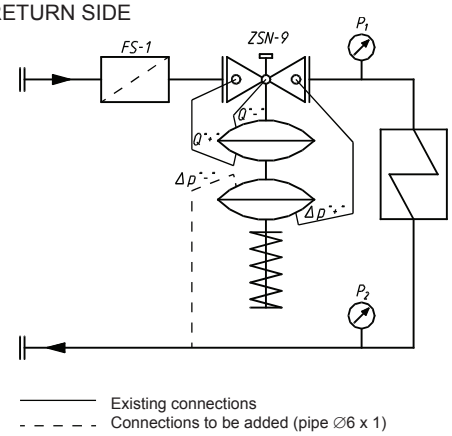
INSTALLATION

Regulator is to be installed on horizontal pipeline. Medium flow direction is to conform to arrow on body. At medium temperature lower than 100°C regulator position is optional, at higher temperatures it is recommended to install regulator with adjuster unit (03) down. To ensure reliable operation of regulator apply strainer FS1 upstream.

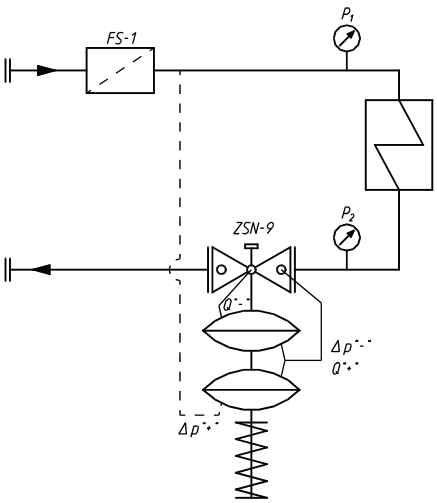
EXAMPLES OF APPLICATION

Monitoring $\Delta p = p_1 - p_2$ and V restriction

RETURN SIDE



SUPPLY SIDE



ACCESSORIES

Delivered:
- nut and cutting ring for impulse tube,

Optional (ordered separately):
- strainer FS1,
- straight connection pipe ∅ 6×1,
- elbow connection pipe ∅ 6×1,
- connection stub NPT 1/4”,
- impulse tube ∅ 6×1,
- adjustment wrench,

ORDERING

In your order specify type and marking, ZSN91.1; ZSN91.2 or ZSN92.1 or ZSN92.2, DN nominal diameter, PN nominal pressure, flow ratio K_{vs}, packing gland pressure drop value, body material, spring range, closure type (only for tight executions).

Example of order:

ZSN91.2 - DN 50; PN 16; Kvs 32; 20 [kPa], spheroidal iron; 40…160 [kPa], tight.

Revision: ZSN91; 92/06/2013
Valid until the next revision.

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STRAINERS FOR HEATING SYSTEMS **TYPE FS-1**

APPLICATION AREA:

The strainers are to be installed upstream the control appliance to purify fluids that flow through the circuits. They may be applied to heating systems as well as other industrial sectors.

DESIGN:

Strainers incorporate the following major components (Fig. 1): body (1), strainer insert (of mesh type) (2) and strainer cover (3). The upper part of the cylindrically wound insert, is introduced into the strainer body whereas its lower part rests on the strainer cover that acts simultaneously as a dirt trap. Both bodies and covers of the strainers are made of grey or spheroidal iron. The inserts (of mesh type) represent a unit that is composed of an enclosure, made of stainless steel and a mesh, weaved of stainless steel wires.

TECHNICAL PARAMETERS:

Flow coefficient K_{VS} vs. nominal diameter of the unit:

DN	[mm]	15	20	25	32	40	50	65	80	100	125	150	200
Kvs	[m³/h]	7	11	12,5	20	32	50	82	125	190	320	500	800

Note: The flow coefficient does not depend on the strainer, as the free-flow are is constants (mesh wires with various diameters are used) .

Marking of nominal pressure:

PN10; 16 - grey iron
PN10; 16; 25- spheroidal iron,

Strainer mesh/cm²:	15	25	45	100	230	300	400	600
Mesh size ⍁ [mm]	2	1,5	1	0,63	0,4	0,32	0,32	0,25

DIMENSIONS:

DN	A	B	D_z		D		n x d_0		L	Weight
			PN16	PN25	PN16	PN25	PN16	PN25		
[mm]										kg
15	85	130	95		65		4x14		130 ± 1	3
20	113	155	105		75		4x14		150 ± 1	4
25	113	155	115		85		4x14		160 ± 1	5
32	115	183	140		100		4x18		180 ± 1	6
40	134	216	150		110		4x18		200 ± 1.5	7
50	147	246	165		125		4x18		230 ± 1.5	10
65	228	328	185		145		4x18	8x18	290 ± 1.5	17
80	240	400	200		160		8x18		310 ± 1.5	22
100	280	480	220	235	180	190	8x18	8x22	350 ± 1.5	33
125	310	550	250	270	210	220	8x18	8x26	400 ± 1.5	40
150	350	600	285	300	240	250	8x22	8x26	480 ± 1.5	62
200	420	680	340	360	295	310	12x22	12x26	600 ± 1.5	140

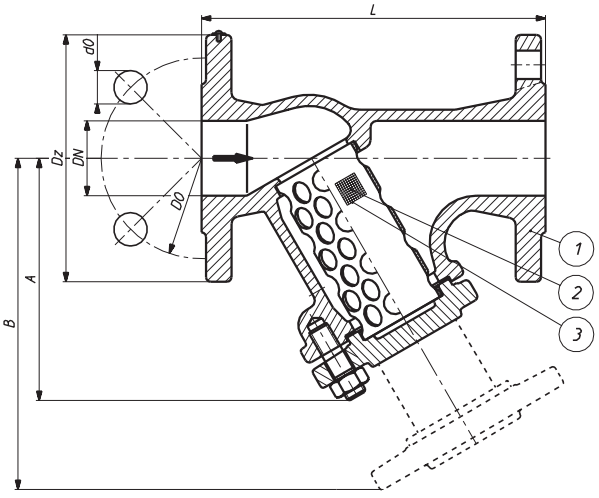

Fig. 1 Design and dimensions of the strainer

INSTALLATION

The strainers should be installed on a horizontal section of pipeline, flow direction must match the arrow on the strainer body. Installation on a vertical pipeline is allowed, when the handled fluid flows downwards.
For DN200 its possible to produce PN10 (n=8, do=22) acc. to fig. 1.

Table 1. Material options

Body, cover	PN10…16	EN-GJL 250
	PN10…25	EN-GJS-400-15
Strainer mesh	-	X5CrNiMo17-12-2; (1.4401)
Insert enclosure	-	X5CrNiMo18-10; (1.4301)
Body gasket	to 250˚C	graphite + KEVLAR (NOVATEC PREMIUM)
	to 350˚C	graphite + steel sheet (1.4571) (SIGRAFLEX HOCHDRUCK)
Protective paint coating	to 150˚C	blue paint
	to 350˚C	silver paint

Table 2 and 3. Allowable working pressures

Table 2. Material: EN-GJL 250 as per PN-EN 1092-2

PN	Temperature [˚C]						
	-10…120	150	180	200	230	250	300
	Allowable working pressure [bar]						
PN10	10	9	8,4	8	7,4	7	6
PN16	16	14,4	13,4	12,8	11,8	11,2	9,6

Table 3. Material: EN-GJS 400-15 as per PN-EN 1092-2

PN	Temperature [˚C]					
	-10…120	150	200	250	300	350
	Allowable working pressure [bar]					
PN10	10	9,7	9,2	8,7	8	7
PN16	16	15,5	14,7	13,9	12,8	11,2
PN25	25	24,3	23	21,8	20	17,5

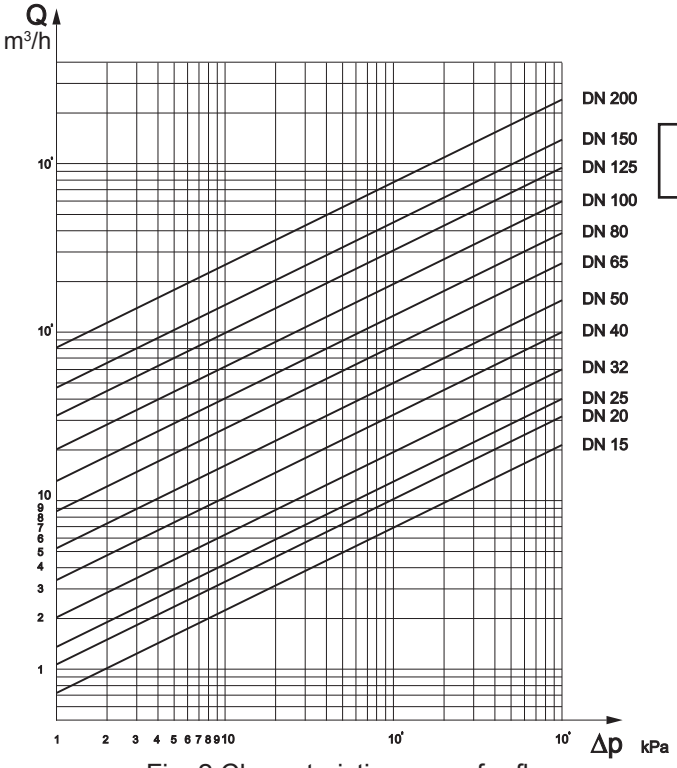

Fig. 2 Characteristic curves for flow

PRODUCT CODE: ☐ - ☐ - ☐ - ☐ - ☐ - ☐

Strainer type:

mesh strainer	FS-1
with a draining valve in the strainer cover	FS-1S

Nominal diameter DN:
15; 20; 25; 32; 40; 50; 65; 80; 100; 125; 150; 200

Nominal pressure PN:
PN10; PN16; PN25

Body material:

- grey iron	**Z**
- spheroidal iron	**ZS**

Strainer mesh:
15; 25; 45; 100; 230; 300; 400; 600

Working temperature:

up to 150°C	**1**
over 150°C	**2**

Example:
Strainer with a draining valve in the strainer cover, DN50, nominal pressure PN16, strainer mesh: 300 meshes/ cm², material: spheroidal iron, working temperature below 150°C

FS-1S-DN50-PN16-ZS-300-2-1

ORDER PLACEMENT:
Orders must contain complete information that is necessary to select the strainer in accordance with the technical data questionnaire. To find out the most suitable strainer please refer to the staff of the Marketing and Sales Departments and Technical Department for assistance.

Revision: FS-1/06/2013
Valid until the next revision

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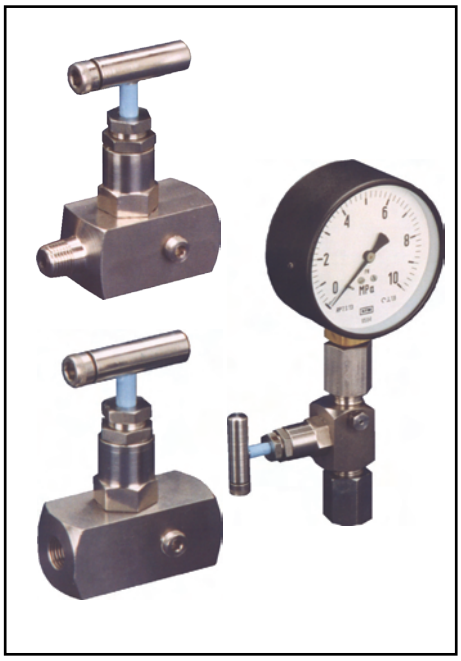
NEEDLE VALVES **TYPE ZA**

APPLICATION AREA:

The needle valves are designed for installation, startup and maintenance of pressure /flow converters, pressure gauges and other fittings and supplementary equipment in industrial automatic systems.
Depending on their design version, the needle valve can be used for the following operations and procedures: on site or remote adjustment of instruments, enabling /disabling of flow, draining, venting or calibration of instruments, air purging of pipelines to expel contaminations.

FEATURES:



- high parameters of operating pressure and temperature,
- high tightness and reliability of valve closure,
- high resistance to external leaks,
- easy operation,
- purposeful selection of materials for parts and sealing to achieve versatility of application,
- wide choice of connection and design options,
- securing of the valve stem against sliding out during operation.

DESIGN:

Body - material:
  • carbon steel S355J2G3 (1.0570),
  • stainless steel X6CrNiMoTi 17-12-2 (1.4571),
- inlet port (pipeline side):
  • connecting nozzle - internal pipe thread
  • connecting nozzle - external pipe thread,
- outlet port (instrument side):
  • direct connection (flange),
  • connecting nozzle - internal pipe thread,
  • connecting nozzle - internal metric thread,
- thread sizes:
  • basic: NPT 1/4 "; 3/8"; 1/2",
  • M 20 x 1,5,

other diameters and thread sizes - upon request.

Gland - material - the same as the valve body,

Stem - acid resistant, burnished on the sealing surface, with rolled screw thread in the area where no contact with the handled utilities is anticipated, polished.

Needle - two options: a hard one - stainless steel with further quenching or a soft one, made of PTFE, secured against revolving when engaged into the valve seat.

Gland sealing - spring gasket made of acid resistant spiral tape and graphite.

Stem sealing - PTFE packing, graphite; o-ring of EPDM - depending on specific application.

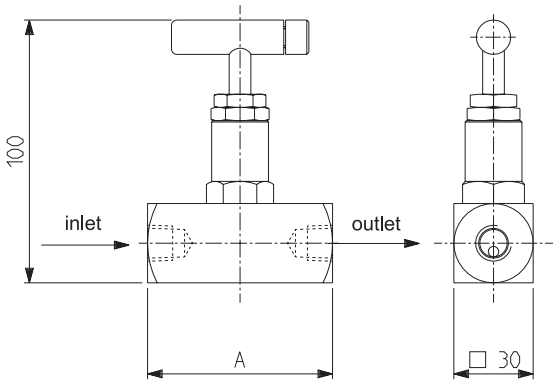
Protective sleeve – made of plastic for temperatures up to +150°C, it protects stem's thread from pollution and is used for marking the function of the valve: blue – a cutting-off valve; red – an air discharge valve.

Knob – rod type, acid-resistant: for temperatures up to +150°C, there are grooves cut on the knob.

TECHNICAL PARAMETERS

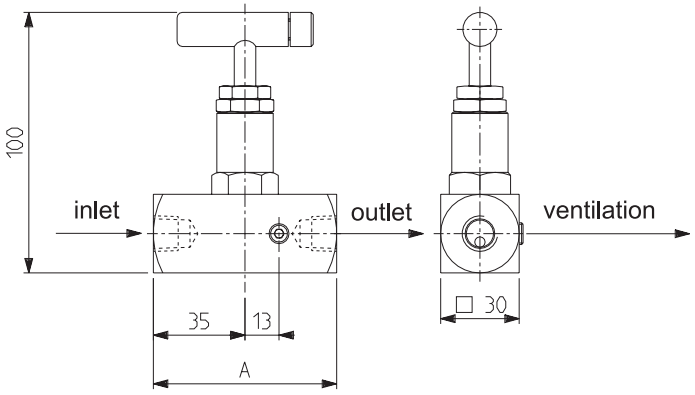
Maximum working pressure	- 400 bar.	
Throughout orifice diameter	- 4 mm.	
Maximum working temperature with regard to the type of sealing		
	- EPDM	150°C,
	- PTFE; VITON	200°C,
	- Graphite	500°C.

DESIGN OPTIONS:



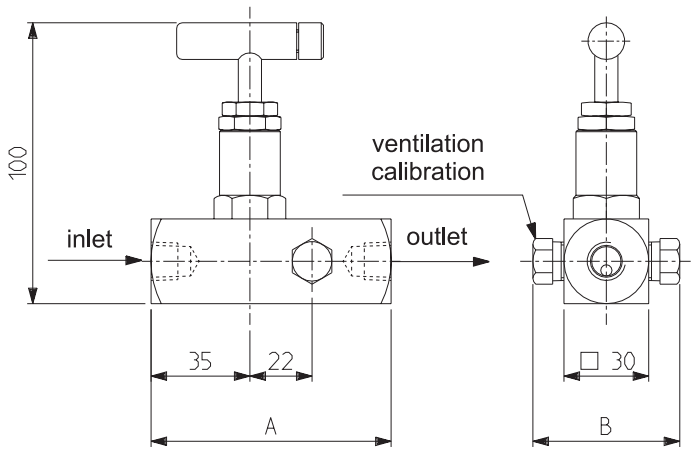
Inlet	Outlet	A
NPT 1/4”	NPT 1/4”	60
NPT 3/8”	NPT 3/8”	60
NPT 1/2”	NPT 1/2”	70
NPT 1/2”	M20x1,5	70

ZA - 11 - the single, 2-port needle valve, On/Off type with internal threads at both inlet and outlet.



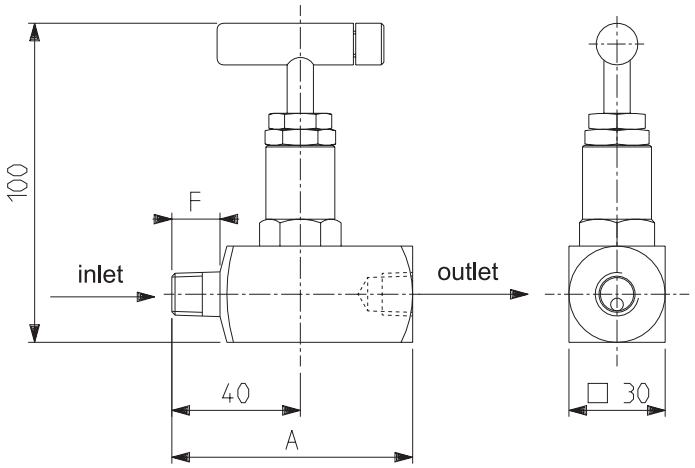
Inlet	Outlet	A
NPT 1/4”	NPT 1/4”	65
NPT 3/8”	NPT 3/8”	65
NPT 1/2”	NPT 1/2”	75
NPT 1/2”	M20x1,5	75

ZA - 12 - the needle valve (same as ZA-11) with vent



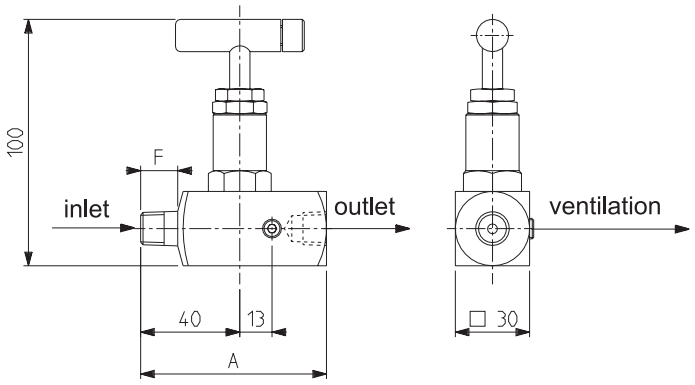
Inlet	Outlet	A	B
NPT 1/4”	NPT 1/4”	80	50
NPT 3/8”	NPT 3/8”	80	50
NPT 1/2”	NPT 1/2”	90	60

ZA - 13 - the needle valve (same as ZA - 11) with vent and calibration.



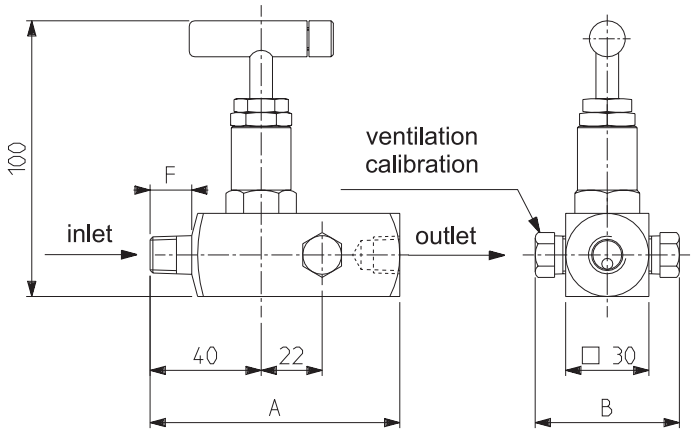
Inlet	Outlet	A	F
NPT 1/4”	NPT 1/4”	70	15
NPT 3/8”	NPT 3/8”	70	15
NPT 1/2”	NPT 1/2”	75	20
NPT 1/2”	M20x1,5	75	20

ZA - 14 - the single, 2-port, needle valve, On/Off type with an externally tapped nozzle at inlet and internal thread at outlet



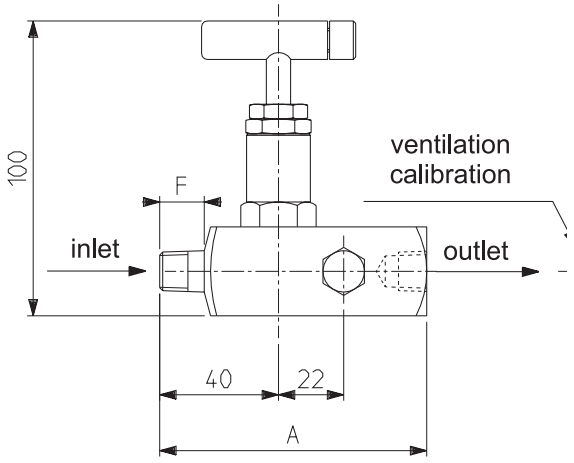
Inlet	Outlet	A	F
NPT 1/4”	NPT 1/4”	75	15
NPT 3/8”	NPT 3/8”	75	15
NPT 1/2”	NPT 1/2”	80	20
NPT 1/2”	M20x1,5	80	20

ZA - 15 - the needle valve (same as ZA-14) with.



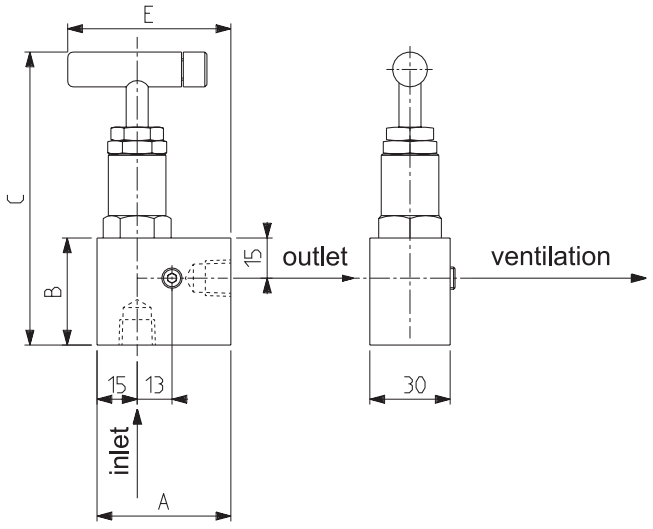
Inlet	Outlet	A	B	F
NPT 1/4”	NPT 1/4”	90	50	15
NPT 3/8”	NPT 3/8”	90	50	15
NPT 1/2”	NPT 1/2”	100	60	20

ZA - 16 - the needle valve (same as ZA-14) with vent and calibration.



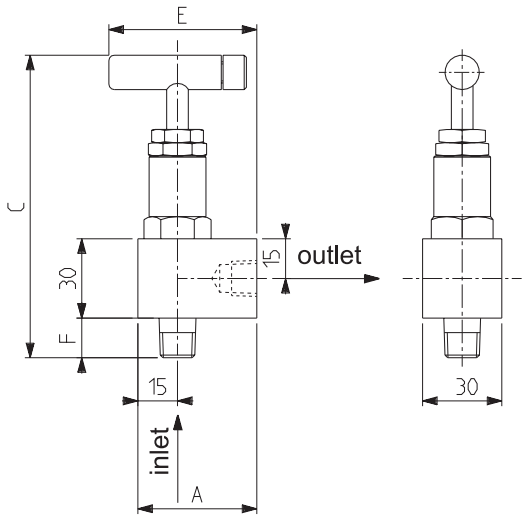
Inlet	Outlet	A	B	C	E
NPT 1/4”	NPT 1/4”	45	110	56	40
NPT 3/8”	NPT 3/8”	45	110	56	40
NPT 1/2”	NPT 1/2”	50	115	61	45
NPT 1/2”	M20x1,5	50	115	61	45

ZA - 17 - the single, 2-port, angular, needle valve, On/Off type with internal thread at both inlet and outlet.



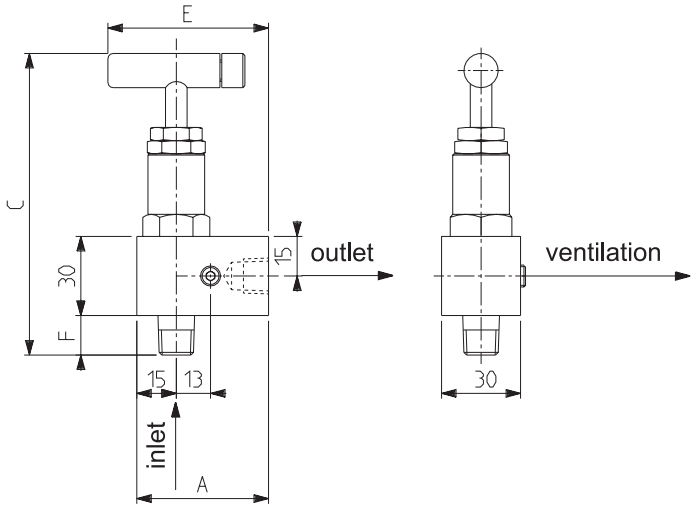
Inlet	Outlet	A	B	C	E
NPT 1/4”	NPT 1/4”	50	40	112	61
NPT 3/8”	NPT 3/8”	50	40	110	61
NPT 1/2”	NPT 1/2”	55	45	115	66
NPT 1/2”	M20x1,5	55	45	115	66

ZA - 18 - the needle valve, same as (ZA-17) with vent.



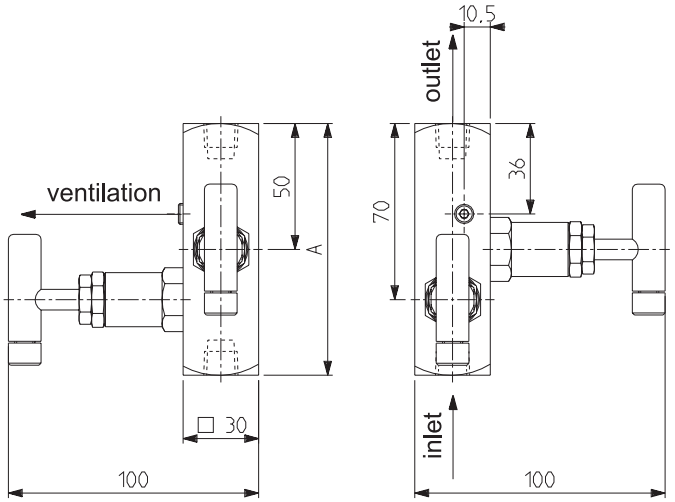
Inlet	Outlet	A	C	E	F
NPT 1/4”	NPT 1/4”	45	115	56	15
NPT 3/8”	NPT 3/8”	45	115	56	15
NPT 1/2”	NPT 1/2”	50	120	61	20
NPT 1/2”	M20x1,5	50	120	61	20

ZA - 19 - the single, 2-port, angular needle valve, On/Off type with an externally tapped nozzle at inlet and internal thread at outlet



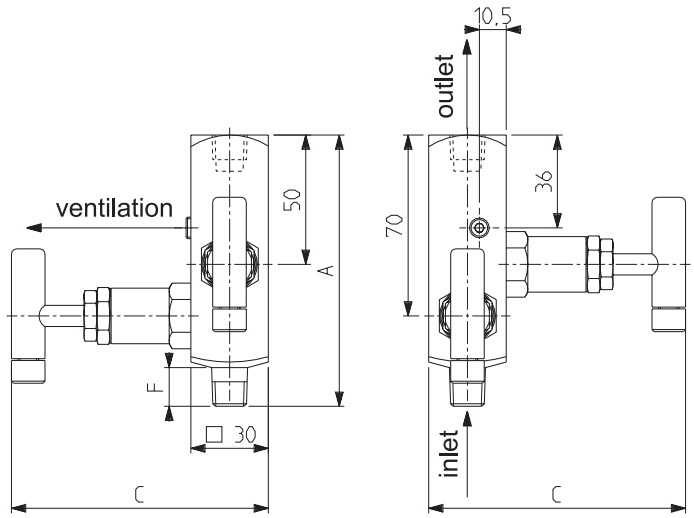
Inlet	Outlet	A	C	E	F
NPT 1/4”	NPT 1/4”	50	115	61	15
NPT 3/8”	NPT 3/8”	50	115	61	15
NPT 1/2”	NPT 1/2”	55	120	66	20
NPT 1/2”	M20x1,5	55	120	66	20

ZA - 20 - the needle valve (same as ZA-19) with vent.



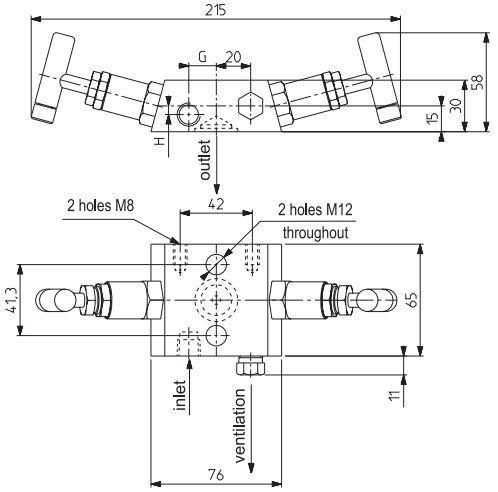
Inlet	Outlet	A
NPT 1/4”	NPT 1/4”	100
NPT 3/8”	NPT 3/8”	100
NPT 1/2”	NPT 1/2”	105

ZA - 21 - the double needle valve with On/Off and venting function, with linear characteristic curve and internal threads at both inlet and outlet



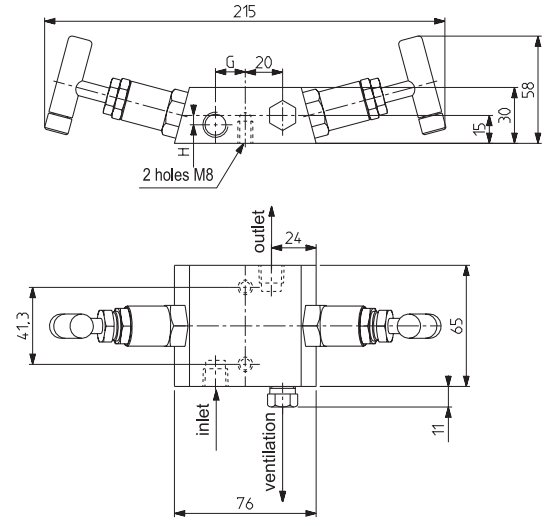
Inlet	Outlet	A	F
NPT 1/4”	NPT 1/4”	105	15
NPT 3/8”	NPT 3/8”	105	15
NPT 1/2”	NPT 1/2”	110	20

ZA - 22 - the needle valve (same as ZA-21) with an externally tapped nozzle at inlet and internal thread at outlet,



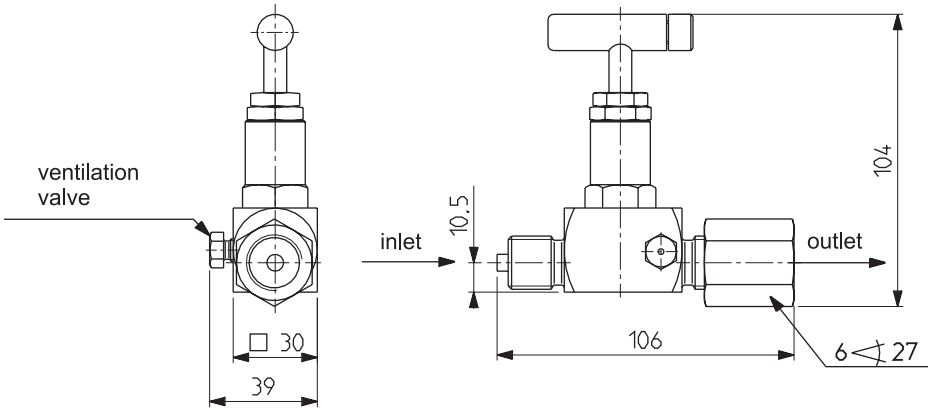
Inlet	Outlet	G	H
NPT 1/4”	flanged	16	5
NPT 1/2”		20	3

ZA - 23 - the double needle valve with On/Off and venting function, manifold type, with internal thread at inlet flange connection at outlet.



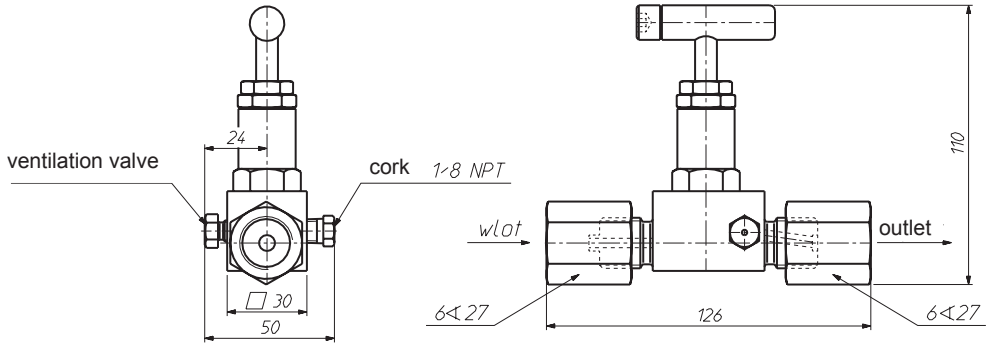
Inlet	Outlet	G	H
NPT 1/4”	NPT 1/4”	16	5
NPT 1/2”	NPT 1/2”	20	3

ZA - 24 - the needle valve (same as ZA-23) with internal thread at both inlet and outlet.



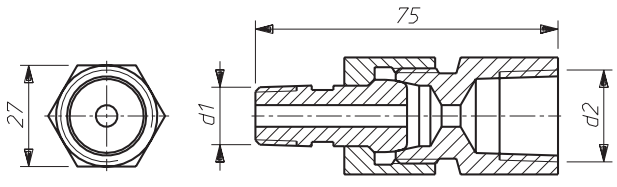
Inlet	Outlet
G 1/2”	G 1/2”
M20x1,5	M20x1,5

ZA - 25 - the single needle valve, throughout, On/Off, with externally tapped nozzle at inlet and internal thread at outlet, with vent



Inlet	Outlet
G 1/2”	M20x1,5

ZA - 26 -the single needle valve, throughout, On/Off, with externally tapped nozzle at inlet and outlet, with vent and cork.

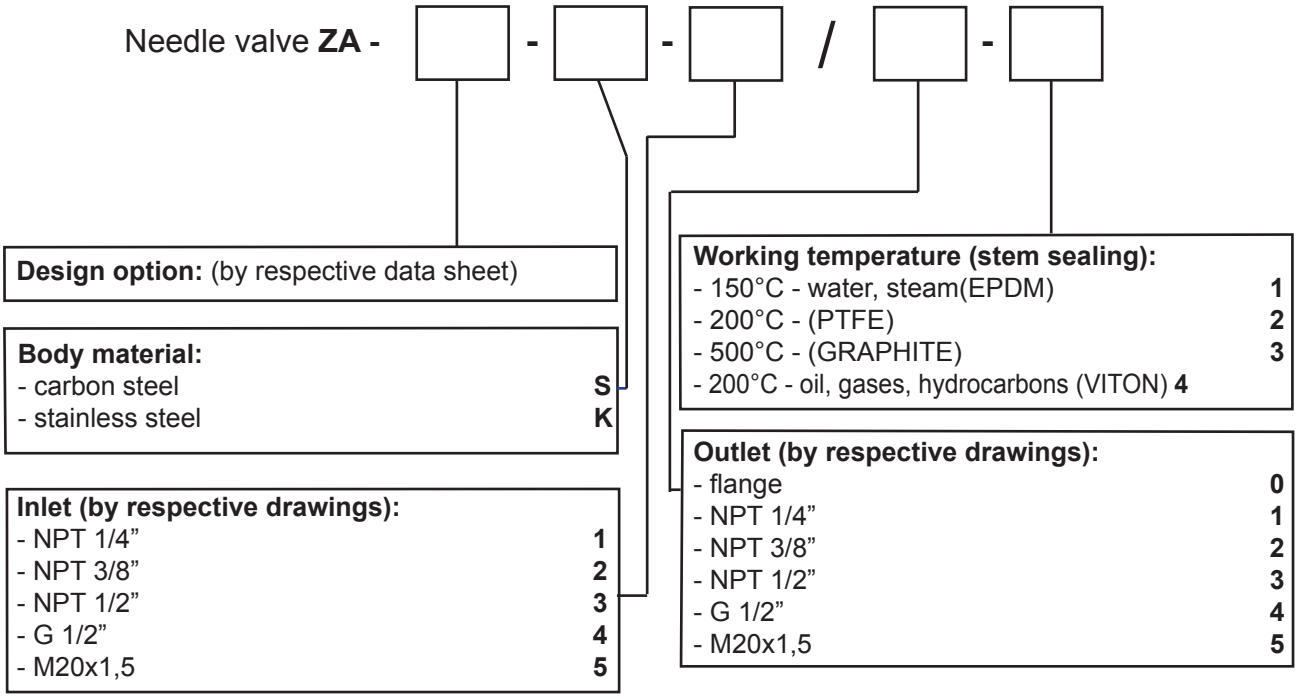


d_1	d_2
NPT 1/4”	NPT 1/4”
	NPT 3/8”
	NPT 1/2”
	M20x1,5

ZA - 33 - adapter

NOTE: Connecting parts as well as the adapter are not supplied.valves. Please order separately. Complete with needle valves.

PRODUCT CODE:



EXAMPLE OF THE PRODUCT CODE:
The double needle valve with linear characteristics, with NPT 1/4” internal threads at both inlet and outlet, stainless steel, for working temperature below 200°C:

ZA-21-K-1/1-2

ORDER PLACEMENT:
Orders must contain product codes in accordance with OEM data sheets, working parameters: pressures and temperatures of handled utilities.

Please do not hesitate to refer to the Marketing and Sales Department as well as the Technical Department for assistance to choose valves that suit your needs.

Revision: ZA/03/2011
Valid until the next revision.

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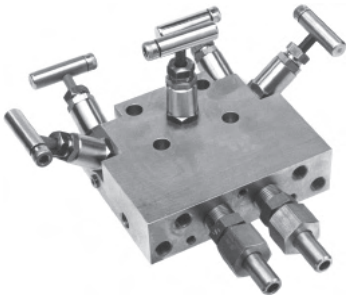
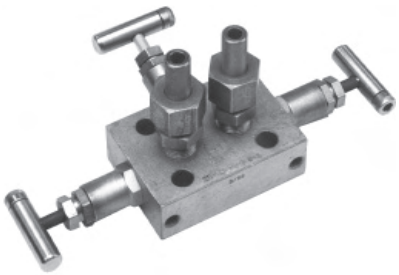
MANIFOLD VALVES **TYPE ZB**

APPLICATION AREA:
The manifold valves are designed for installation, startup and maintenance of pressure /flow converters, pressure gauges and other fittings and supplementary equipment in industrial automatic and tuning systems, thermal power engineering and other applications. They are used to connect instruments and fittings by means of pulse tubes and make it possible to cutoff (disable) hydraulic or pneumatic impulses, balancing (zeroing) or ventilation of instruments and purging of pipeline systems.





FEATURES:
- high parameters of operating pressure and temperature,
- high tightness and reliability of valve closure,
- easy operation,
- purposeful selection of materials for parts and sealing to achieve versatility of application,
- direct installation of instruments brings down total cost of the system and reduces number of locations with possible leaks,
- wide choice of connection,
- securing of the valve stem against sliding out during operation,
- possibility to connect heating appliances,
- distinguishable marking of on/of valves functionalities with colours,
- compact design owing to combining all the functions in a single unit.

DESIGN

Body

- material:	carbon steel S355J2G3 (1.0570) stainless steel X6CrNiMoTi 16-12-2 (1.4571)
- number of on/off valves	3 or 5
- connecting ports	direct (flanged) tubular via a straight connector
- facilities for heating	with /without an opening for heating appliances
Bonnet	- the same as the valve body,
Stem	- acid resistant, burnished on the sealing surface, with rolled screw thread in the area where no contact with the handled utilities is anticipated, polished.
Needle	-two options: a hard one – stainless steel with further quenching or a soft one, made of PTFE, secured against revolving when engaged into the valve seat.
Bonnet sealing	- spring gasket made of acid resistant spiral tape and graphite
Stem sealing	- PTFE packing, graphite; o-ring – depending on specific application
Handwheel	- T-shaped, stainless steel.
Protective sleeve	– made of plastic for temperatures up to +150°C, it protects stem's thread from pollution and is used for marking the function of the valve: blue – a cutting-off valve; red – an air discharge valve.
Knob	– rod type, acid-resistant: for temperatures up to +150°C, there are grooves cut on the knob.

DIMENSIONS

Table 1. Values of “A” for design options as on drawings 1÷4

A	54	55,6	56,2	57,2

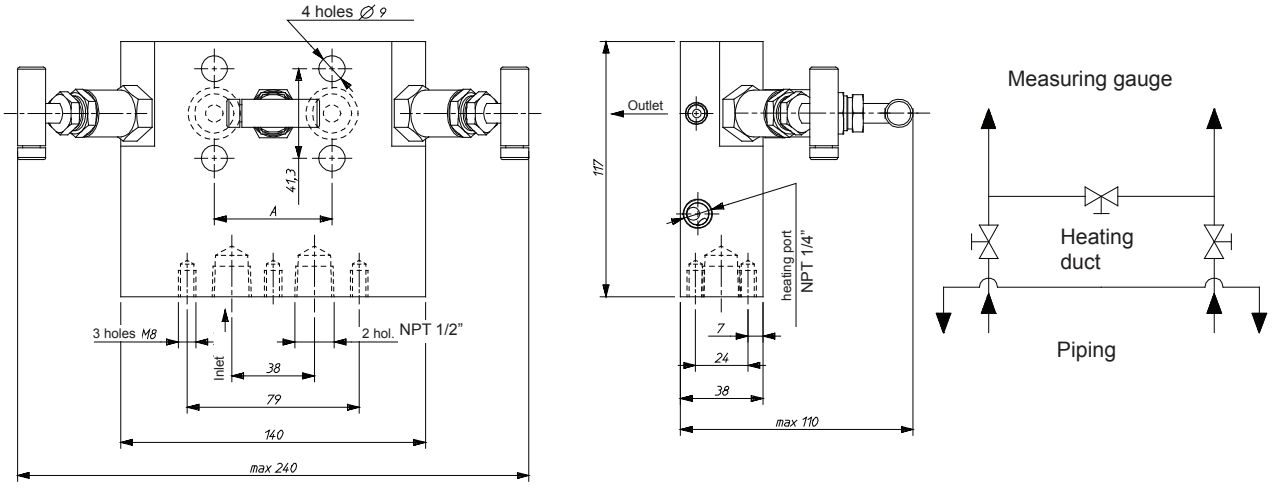


Fig. 1 The 3-way valve with a flanged connection of a heating port

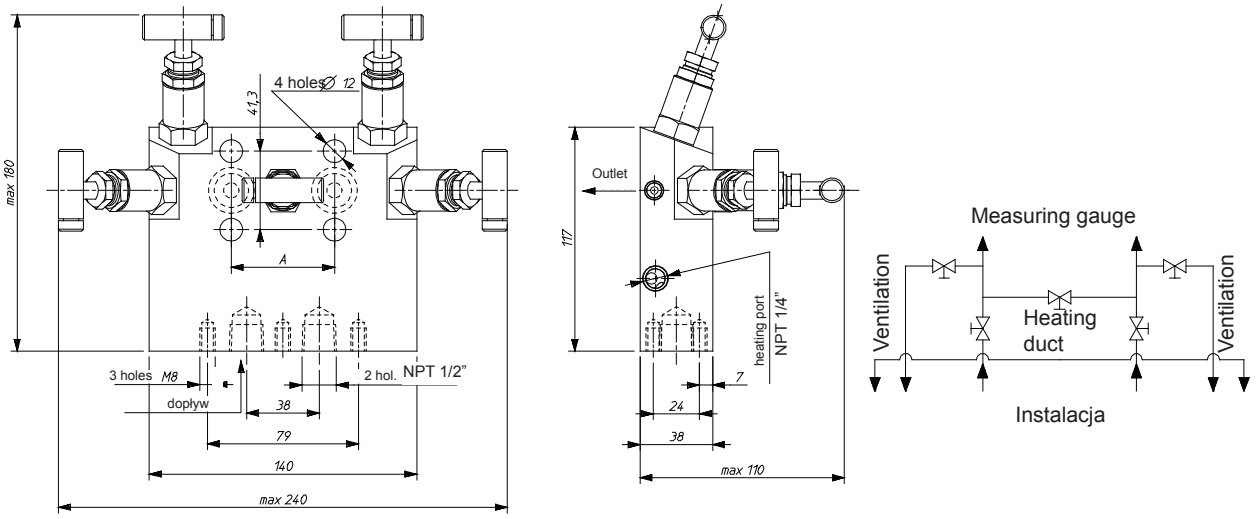


Fig. 2 The 5-way valve with a flanged connection of a heating port

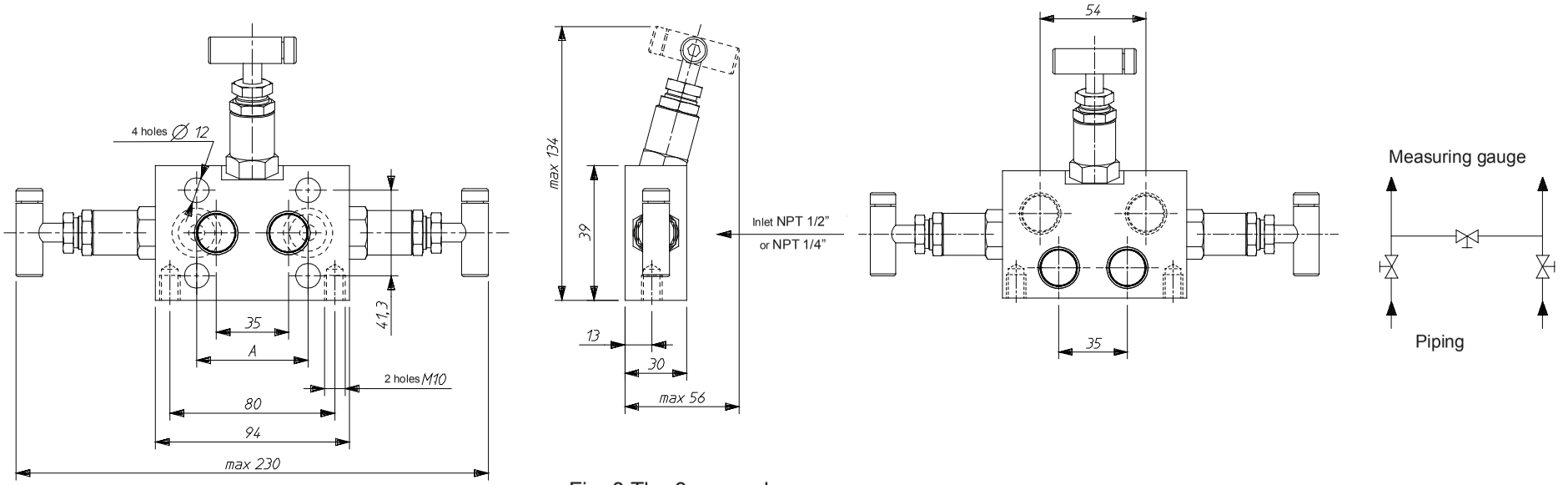


Fig. 3 The 3-way valve

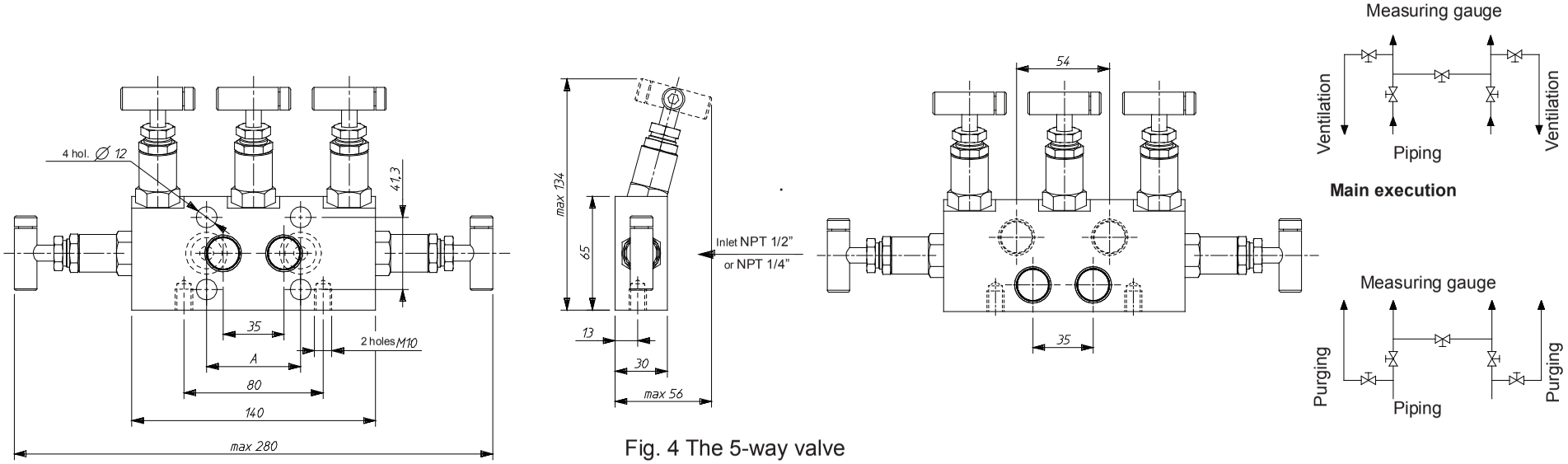


Fig. 4 The 5-way valve

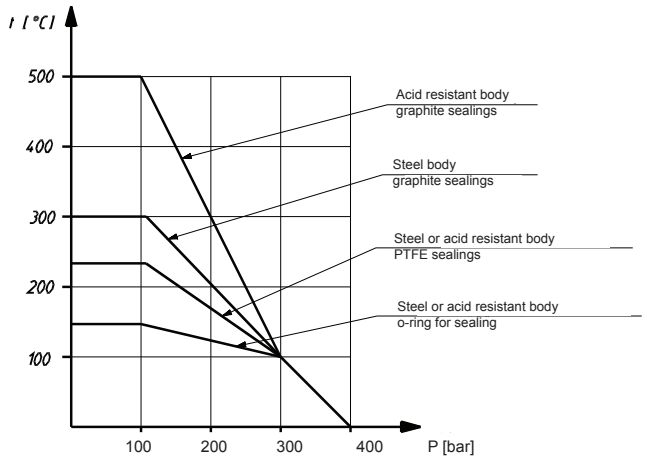


Fig. 5 Working pressure vs. working temperature

RECOMMENDED APPLICATION

The recommended design of cartridge valves: acid resistant materials for bodies, stem sealing of PTFE. Graphite sealing should be used only for the working temperature range +200 … 500°C. Stem sealing with use of an o-ring as well as soft needle are recommended only for gaseous utilities.

The connected instrument should be sealed with use of either PTFE or graphite (for temperature range +200 … 500°C) sealing. All the fixing parts to attach the cartridge valve to the instrument (bolts, gaskets) are supplied upon separate order. The valve is attached to a piping component with use of mounting holes 3 x M8 (valves with a heating port) or 2 x M10 (other valves).

PRODUCT CODE

Manifold valve ZB □ □ – □ □ / □ – □ – □

Valve design:	
3-way	**3**
5-way	**5**

Body material:	
carbon steel (1.0570)	**S**
acid resistant steel (1.4571)	**K**

Connection to the instrument:	
flanged: spacing [mm]	
54	**01**
55,6	**02**
56,2	**03**
57,2	**04**
pipe thread:	
NPT 1/4”	**05**
NPT 1/2”	**06**
with a straight connector for welding:	
∅12	**07**
∅14	**08**
with a straight connector and a notching ring:	
∅ 12	**09**
∅ 14	**10**

Medium and maximum working temperature::	
150 °C - water, steam (o-ring, EPDM)	**1**
200 °C - (PTFE)	**2**
500 °C - (Grafit)	**3**
200°C - oil, gases, hydrocarbons (o-ring, VITON)	**4**

Versions	
basic design	**0**
with a heating port	**1**
with purge function	**2**

Connection to the piping:	
pipe thread:	
NPT 1/4”	**1**
NPT 1/2”	**2**
with a straight connector for welding:	
∅ 12	**3**
∅ 14	**4**
with a straight connector and a cutting ring:	
∅ 12	**5**
∅ 14	**6**

Revision: ZB/06/2013
Valid until the next revision

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NEEDLE VALVES, **TYPE ZWD1**

APPLICATION AREA:
The needle valves are used in measuring systems, appliances for city heat engineering and industrial automatic systems. They enable pressure chocking, adjustment of flow intensity up to complete cutoff of the handled fluids.

DESIGN:
The valves are offered as either steel or corrosion resistant devices. They have the same connections, with notching rings for pipes of outer diameter ∅6, ∅8 or ∅10 and wall thickness 1 mm at both inlet and outlet, or alternatively they may be equipped with a ball ending ∅12 x 1.5 at the inlet and a connection for aforementioned pipes at the outlet. The valve bonnet is welded to the valve body. In case of the steel body the body seat is surfaced with use of an stainless steel electrode, which improves the valve durability and prolongs its lifetime. The valve stem with the plug is made of stainless steel with further heat treatment (quenching). The parts that are exposed to the risk of corrosion are protected by appropriate coatings. The handwheel is made of a steel sheet and painted with epoxy, which facilitates quick operation of the valve.

TECHNICAL PARAMETERS:

Working temperature:	-10…300 [°C] - for the steel body,
	-196…400 [°C] - for the acid resistant body,
Maximum pressure:	16 [bar] - for copper pipes
	25 [bar] - for steel and stainless steel pipes
Throughout orifice diameter:	6 [mm]
Weight:	0,3 [kg]
Flow characteristic:	linear
Flow coefficient Kvs:	~1,0 [m^3/h]

PRODUCT CODE:

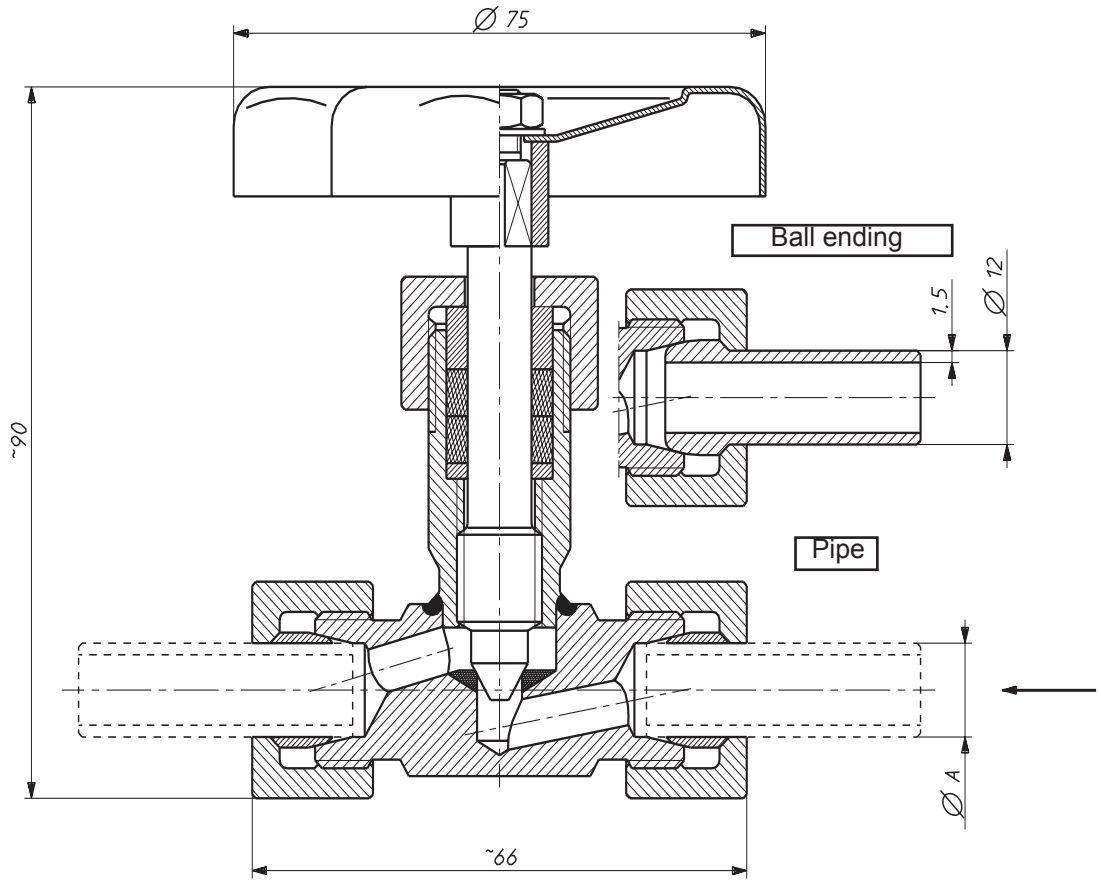
ZWD1 – [ ] – [ ] – [ ]

Pipe diameter ∅A:	
- 6 x 1	**6**
- 8 x 1	**8**
- 10 x 1	**10**

Valve body version	
steel	**S**
stainless steel	**N**

Type of inlet:	
- pipe (∅ 6 x 1)	**R6**
- pipe (∅ 8 x 1)	**R8**
- pipe (∅ 10 x 1)	**R10**
- ball ending (∅ 12 x 1)	**K**

Example of the product code:
The steel needle valve for a pipe ∅6 x 1 at the outlet and the ball ending ∅12 x 1.5 the inlet:
ZWD1 - 6 - K - S



Design and dimensions of the valve

ORDER PLACEMENT:
Orders must contain full name of the valve and its product code, e.g. Needle valve **ZWD1 - 6 - R6 - N**

Revision: ZWD1/06/2013
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NEEDLE VALVES, **TYPE ZWZ 11 and ZWZ 12**

APPLICATION AREA:

The needle valves are used in measuring systems of level gauges, flow meters and other industrial automatic applications.
For instance, they can be used to disconnect the measuring circuit right at the tank where fluid level is measured inside or cutoff the measuring tube.

DESIGN:

The bodies of cut-off valves are manufactured in two material variations: carbon steel (1.0570 – ZWZ 11 and ZWZ 12) and acid-resistant steel (1.4571 – ZWZ 11). In ZWZ 11 valves, the body is welded together with a bonnet, while in ZWZ 12 valves, the body with bonnet is made from a forging.
Internal parts of cut-off valves in the carbon steel manufacture are made of stainless steel, and in acid-resistant valves, the parts directly coming into contact with an aggressive medium are made of acid-resistant steel, with the exception of the needle made of stainless steel, which is quenched and tempered.

In ZWZ 11 valves in the steel version, the seat is padded with the use of an acid-resistant electrode, and in ZWZ 12 valves, the seat is made of acid-resistant steel, quenched and tempered, and then screwed in the body.
The parts that are exposed to the risk of corrosion are protected by appropriate coatings. Ball endings of valves and connecting stubs are suitable for welding to pressurized pipes ∅12 x 2 mm (ZWZ 11) i ∅16 x 3 mm (ZWZ 12). The ergonomic handwheel are die pressed from steel sheets, which facilitates valve operation.

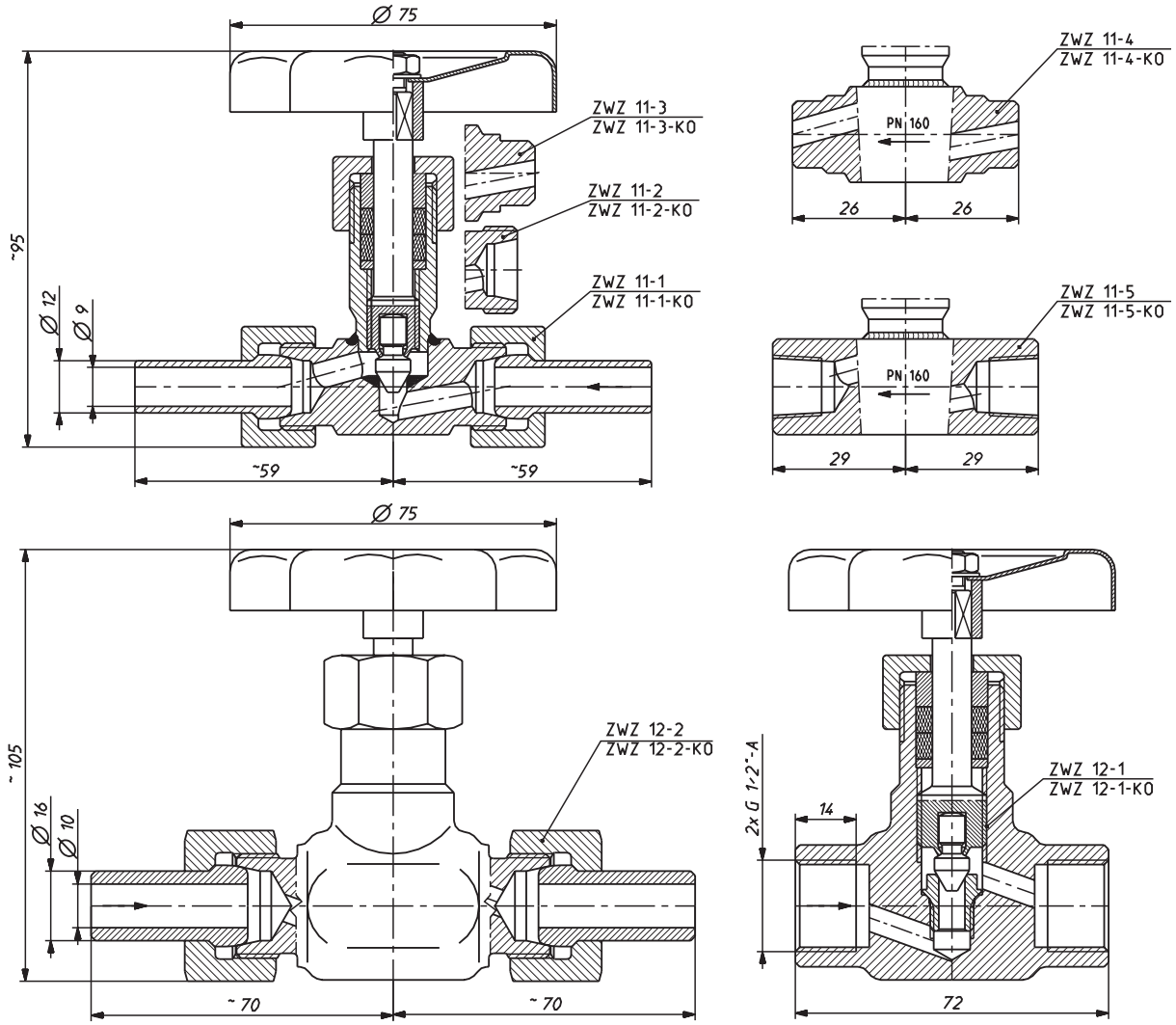
TECHNICAL PARAMETERS:

Working temperature: -10…+300 [°C] - for the steel body - S355J2G3 (1.0570),
-196…+400 [°C] - for the acid resistant body - X6CrNiMoTi 17-12-2 (1.4571)

Material: S355J2G3 (1.0570) wg PN-EN 1092-1									
PN	Temperature [°C]								
	20	50	100	150	200	250	300	350	400
	Allowed working pressure [bar]								
PN160	160	160	148,5	140,9	133,3	121,9	110,4	-	-
PN320	320	320	297,1	281,9	266,6	243,8	220,9	-	-
PN350	400	400	325	308,3	291,6	266,6	241,6	-	-
Material: X6CrNiMoTi 17-12-2 (1.4571) wg PN-EN 1092-1									
PN	Temperature [°C]								
	20	50	100	150	200	250	300	350	400
	Allowed working pressure [bar]								
PN160	160	160	160	156,9	149,3	141,7	133,3	128,7	124,9
PN320	320	320	320	313,9	298,6	283,4	266,6	257,5	249,9
PN350	350	350	350	343,3	326,6	309,9	291,6	281,6	273,3

Working pressures and nominal pressures for materials in table have been calculated interpolation method.

Nominal pressure: 160 bar - ZWZ 11,
350 bar - ZWZ 12-1,
320 bar - ZWZ 12-2,
Diameter passage: 6 [mm]
Weight: 0,4 [kg] - ZWZ 11; 0,7 [kg] - ZWZ 12



Design and dimensions of the valve

Design options for the needle valve

Material for the valve body	Valve type (product code)	Type of connecting nozzles	
		Inlet	Outlet
Carbon steel	ZWZ 11-1	with a ball ending and a nut	with a ball ending and a nut
	ZWZ 11-2	for a ball ending	
	ZWZ 11-3	for welding	
	ZWZ 11-4	for welding	for welding
	ZWZ 11-5	with internal thread NPT 1/4”	with internal thread NPT 1/4”
	ZWZ 12-1	with internal thread G 1/2”	with internal thread G 1/2”
	ZWZ 12-2	with a ball ending and a nut	with a ball ending and a nut
Stainless steel	ZWZ 11-1-KO	with a ball ending and a nut	with a ball ending and a nut
	ZWZ 11-2-KO	for a ball ending	
	ZWZ 11-3-KO	for welding	
	ZWZ 11-4-KO	for welding	for welding
	ZWZ 11-5-KO	with internal thread NPT 1/4”	with internal thread NPT 1/4”
	ZWZ 12-1-KO	with internal thread G 1/2””	with internal thread G 1/2””
	ZWZ 12-2-KO	with a ball ending and a nut	with a ball ending and a nut

ORDER PLACEMENT:
Orders must contain full name of the valve and its product code, e.g. needle valve **ZWZ 11 - 1 - KO**

Revision: ZWZ/06/2013
Valid until the next revision.

Certificate

Quality-Assurance System

acc. to Directive 97/23/EC

Certificate no.:	**01 202 PL/Q-02 0003**
Name and address of the manufacturer:	**Zakłady Automatyki POLNA S. A.** **ul. Obozowa 23** **37-700 Przemyśl** **Poland**

Herewith we certify that the above mentioned manufacturer operates a quality system according to the European Directive 97/23/EC. The manufacturer has the permission to affix the following CE marking to pressure equipment described and manufactured in accordance to the scope covered by this Quality-Assurance System:

CE 0035

Tested acc. to Directive 97/23/EC:	**QS-System (Modul H)** (die QS-Module E1, E, D1 and D are performed by Modul H)
Audit report no.:	210/A11/2756
Area of validity:	Industrial valves and accessories, see annex to certificate
Manufacturing plant:	**Zakłady Automatyki POLNA S. A.** **ul. Obozowa 23** **37-700 Przemyśl** **Poland**
Valid until:	**September 30, 2014**

Cologne, September 29, 2011

Dr.-Ing. W. Wichert

TÜV Rheinland® 0035 Notified Body

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TÜV Rheinland Industrie Service GmbH
Notified Body, ID-No. 0035
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E-014-Rev7

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