

**DOUBLE-PORTED CONTROL VALVES TYPE Z<sup>®</sup>1B****APPLICATION AREA:**

Single-ported globe control valves type Z<sup>®</sup>1B are used in automatic and remote control installations 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, stellite, 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<sub>2</sub>S; 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.



Z<sup>®</sup> is a trademark registered with Republic of Poland Patent Office.

## DESIGN AND TECHNICAL SPECIFICATION:

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

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

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.

Connections:

- flanged: as per Table 1

- butt welding ends BW, as per Table 18 and 19

- socket welding ends SW, as per Table 20

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 <sup>3)</sup>        | D <sup>1)</sup>       | F <sup>1)</sup>      | -            |
| CL150; 300                                                                                                                                                                                                                      | B <sup>3)</sup>        | DL ( D1 <sup>2)</sup> | F ( F1 <sup>1)</sup> | J (RTJ)      |
| CL600; 900; 1500; 2500                                                                                                                                                                                                          | B <sup>3)</sup> (RF)   | DL (GF)               | F (FF)               | J (RTJ)      |
| <sup>1)</sup> - do PN160; <sup>2)</sup> - tylko dla CL300; <sup>3)</sup> - B1 - (Ra=12.5 mm, concentric surface structure "C"), B2 - (Ra as agreed with the customer);<br>( ) - 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%  $K_{vs}$

- enhanced: (class V)

- $3 \cdot 10^{-4} D \cdot \Delta p$  [cm<sup>3</sup>/min]

where D (mm) - is seat diameter as per Table 10

$\Delta p$  [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.

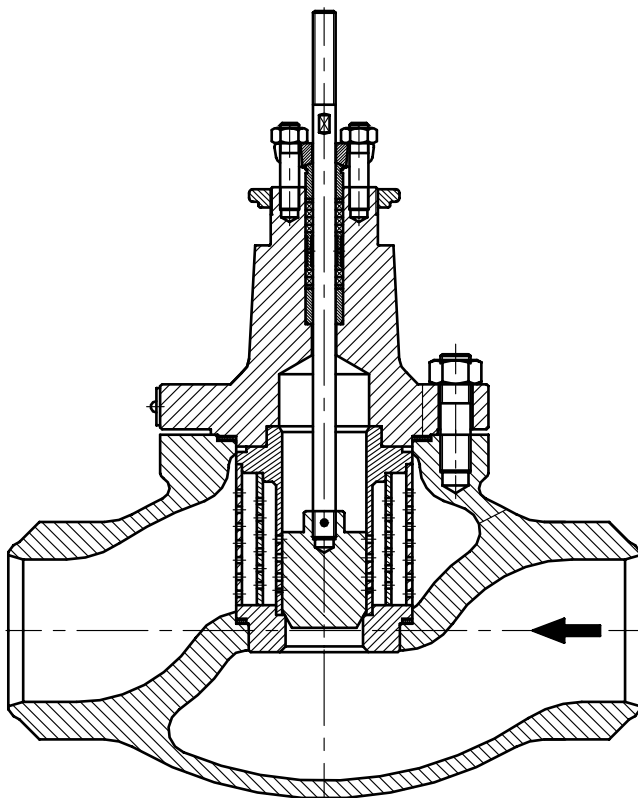


Fig. 1a. Valve Z1B - unbalanced plug.

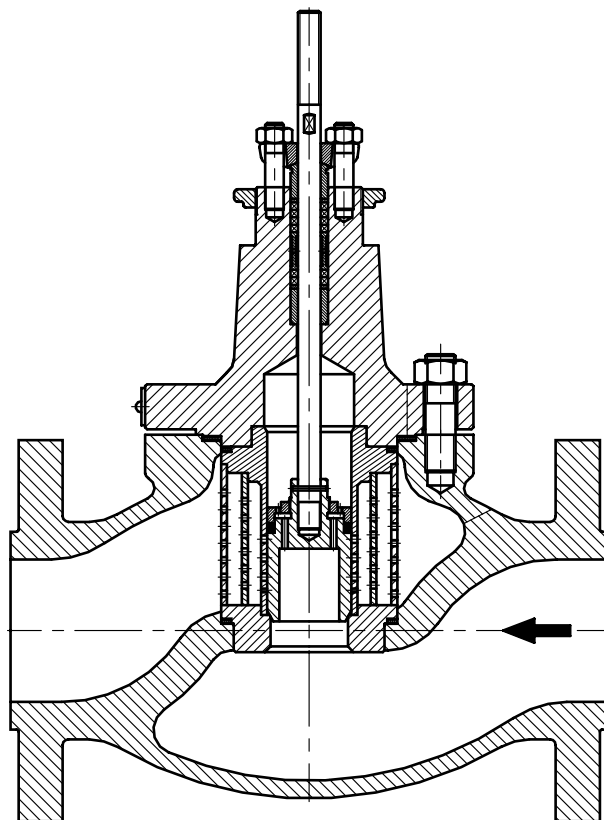


Fig. 1b. Valve Z1B - balanced plug.

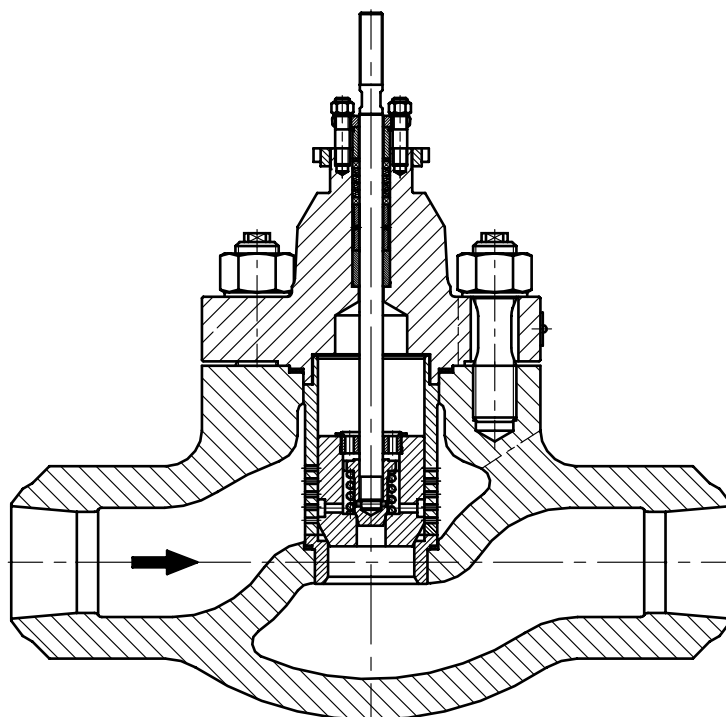


Fig. 1c. Valve Z1B - balanced plug with pilot.

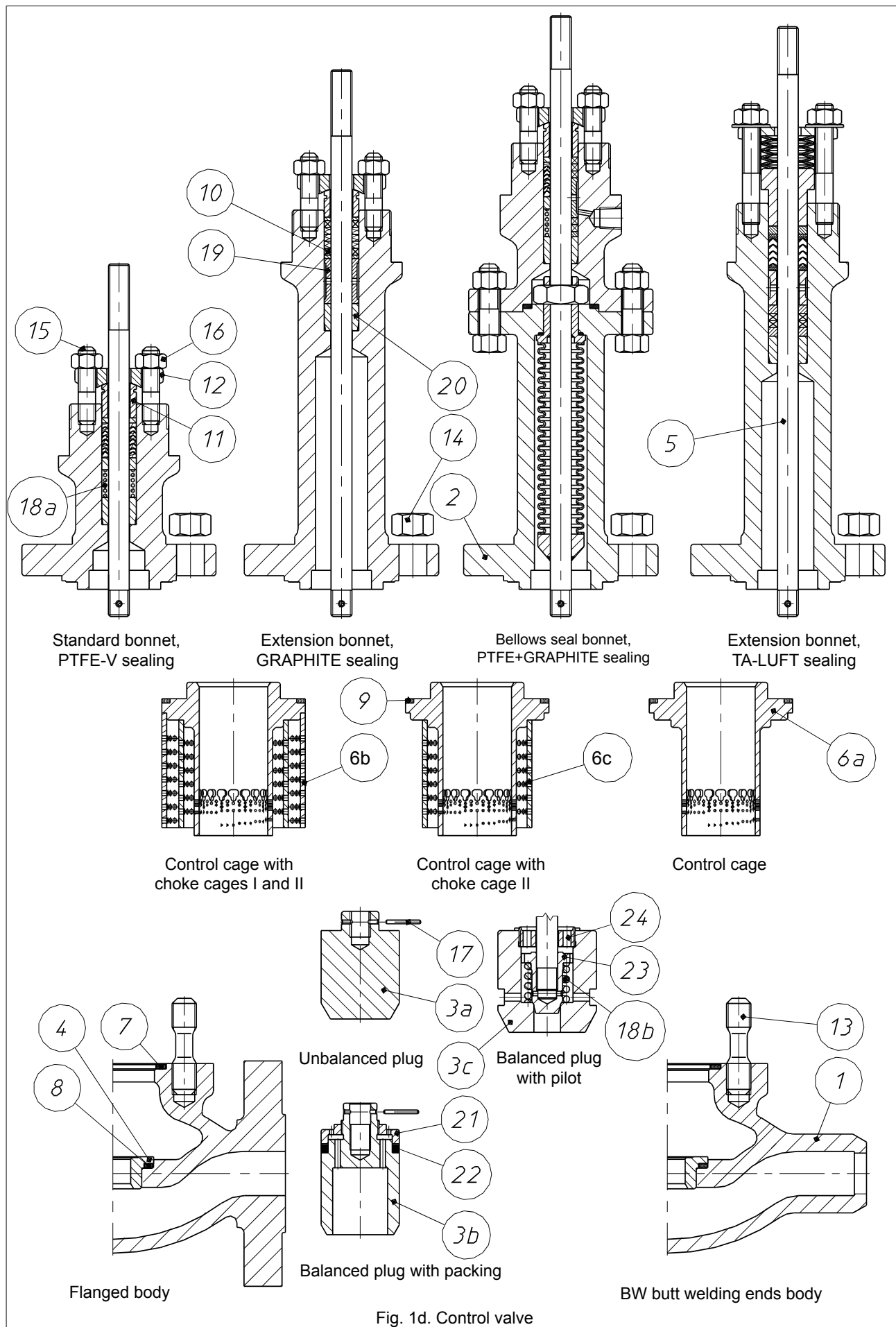


Table 2. Part list with materials

| Item                          | Part                                                      |               | Materials                                                                                                                 |                                |                                      |  |
|-------------------------------|-----------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------------|--|
| 1                             | Body                                                      |               | GP 240 GH ; (1.0619)<br>WCB                                                                                               | G17CrMo 9-10 ; (1.7379)<br>WC9 | GX5CrNiMo 19-11-2 ; (1.4408)<br>CF8M |  |
| 2                             | Bonnet                                                    | DN15...50     | S 355 J2G3 (1.0570)                                                                                                       | 13CrMo4-4 ; (1.7335)           | X6CrNiMoTi 17-12-2 ; (1.4571)        |  |
|                               |                                                           | DN80...250    | GP 240 GH ; (1.0619)<br>WCB                                                                                               | G17CrMo 9-10 ; (1.7379)<br>WC9 |                                      |  |
| 3a,b,c                        | Unbalanced plug<br>Balanced plug<br>Balanced plug (pilot) |               | X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN<br>X17CrNi 16-2 ; (1.4057) + heat treatment                                 |                                |                                      |  |
| 4                             | Seat                                                      |               | X6CrNiMoTi 17-12-2; (1.4571)<br>X6CrNiMoTi 17-12-2; (1.4571) + stellite<br>X17CrNi 16-2; (1.4057) + heat treatment        |                                |                                      |  |
| 5                             | Stem                                                      |               | X6CrNiMoTi 17-12-2; (1.4571)<br>X6CrNiMoTi 17-12-2; (1.4571) + stellite + CrN<br>X17CrNi 16-2 ; (1.4057) + heat treatment |                                |                                      |  |
| 6A                            | Control cage                                              |               | X6CrNiMoTi 17-12-2; (1.4571)<br>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<br>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

| 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 up to -40°C and cast acid proof steel up to -196°C, provided that working pressure is reduced respectively, working temperature impact tests are performed and cast is quenched. 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  $K_v$  and  $\Delta p$  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             | up to CL600 )*  | -46...+200       | -198...-46<br>+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...3000 for below seal bonnet )\*\* for welding ends valves

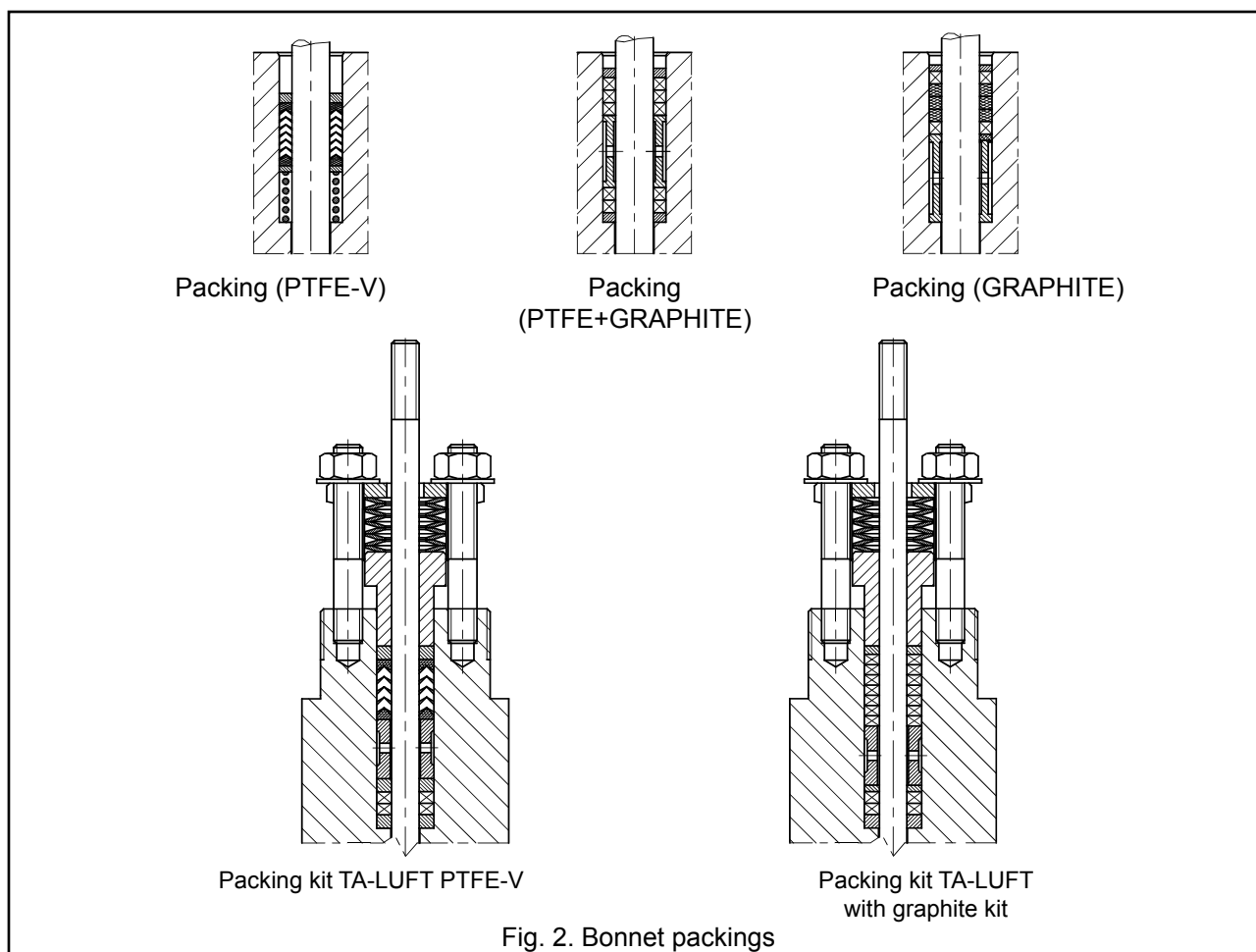


Table 11: Flow ratios  $Kv_s$ .

| Kvs                                                           |     | Stroke | Seat diameter<br>D | F <sub>D</sub> |         | Nominal size DN |      |      |      |     |     |     |     |    |
|---------------------------------------------------------------|-----|--------|--------------------|----------------|---------|-----------------|------|------|------|-----|-----|-----|-----|----|
|                                                               |     |        |                    | IV kl.         | V kl.   |                 |      |      |      |     |     |     |     |    |
| L                                                             | P   | [mm]   | [mm]               | [kN]           |         | 25              | 40   | 50   | 80   | 100 | 150 | 200 | 250 |    |
| 10                                                            | 20  | 20,64  | 0,33               | 2,1            | • K1**) | K2              | K2   |      |      |     |     |     |     |    |
| 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  | K2  |    |
| 200                                                           |     |        |                    |                |         |                 |      |      |      |     |     | K1  | K2  | K2 |
| 250                                                           | 63  | 107,92 | 1,7                | 11             |         |                 |      |      |      |     | K1  | K2  | K2  |    |
| 320                                                           |     |        |                    |                |         |                 |      |      |      |     | K1  | K2  | K2  |    |
| 500                                                           |     |        |                    |                |         |                 |      |      |      |     |     | K1  | K2  | K2 |
| 630                                                           | 100 | 158,72 | 2,5                | 16             |         |                 |      |      |      |     |     | K1  | K2  |    |
| 800                                                           |     | 203,2  | 3,2                | 21             |         |                 |      |      |      |     |     |     | K1  |    |
| -                                                             |     |        |                    |                |         |                 |      |      |      |     |     |     |     | K1 |
| Calculation coefficients                                      |     |        |                    |                |         |                 |      |      |      |     |     |     |     |    |
| F <sub>r</sub> =0,95 ; X <sub>r</sub> =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  $\Delta p$ .**

Pressure drops  $\Delta p$  [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.

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

where  $\Delta p$  [bar] - calculated pressure drop  
 $F_s$  [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;<br>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  $\Delta p$  value can be calculated using above formula and data from Table 11, taking nominal load capacity as available force  $F_s$ , as per actuator data sheet.

Table 13: Pressure drops  $\Delta p$  [bar] for valves with pneumatic actuators, leakage class class IV and V

| Valve seat diameter<br>[mm] | Actuator size | Air-to-close<br>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<br>40...200 | 60...140 | 80...240 | 120...280 | 180...380 | 20...100           | 40...120<br>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)

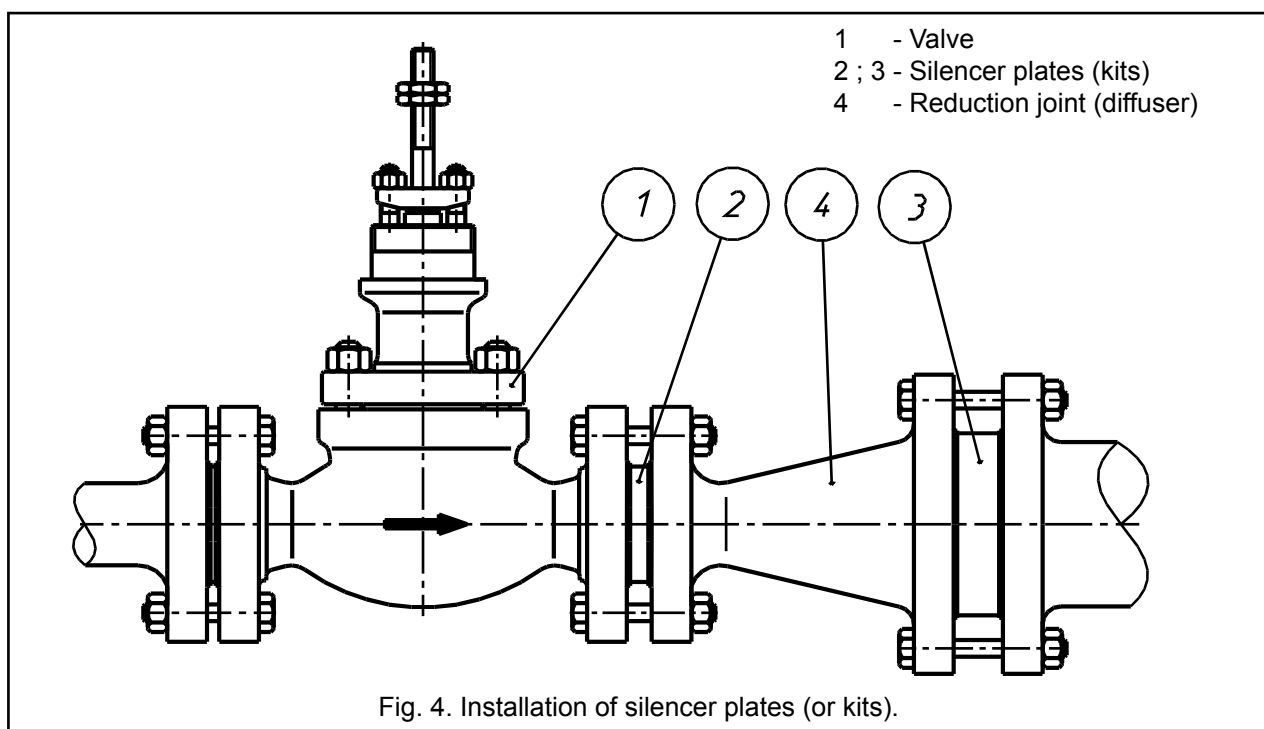
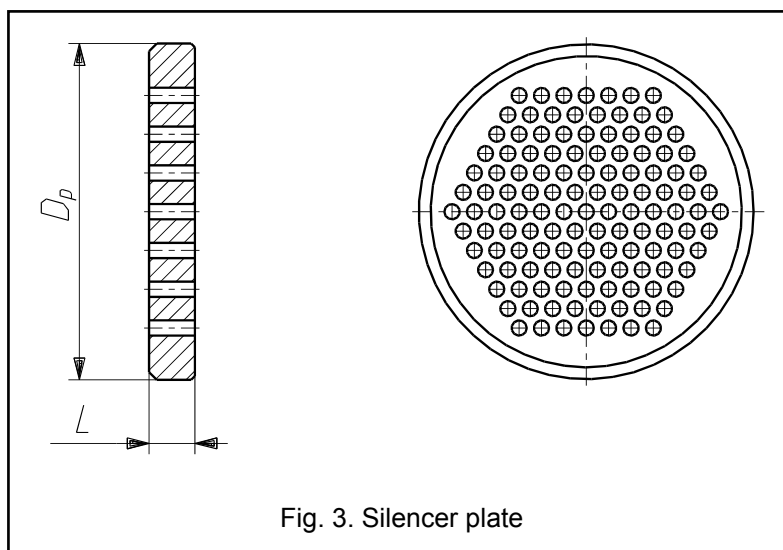


Table 14: Dimensions and flow ratios for silencer plates

| 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

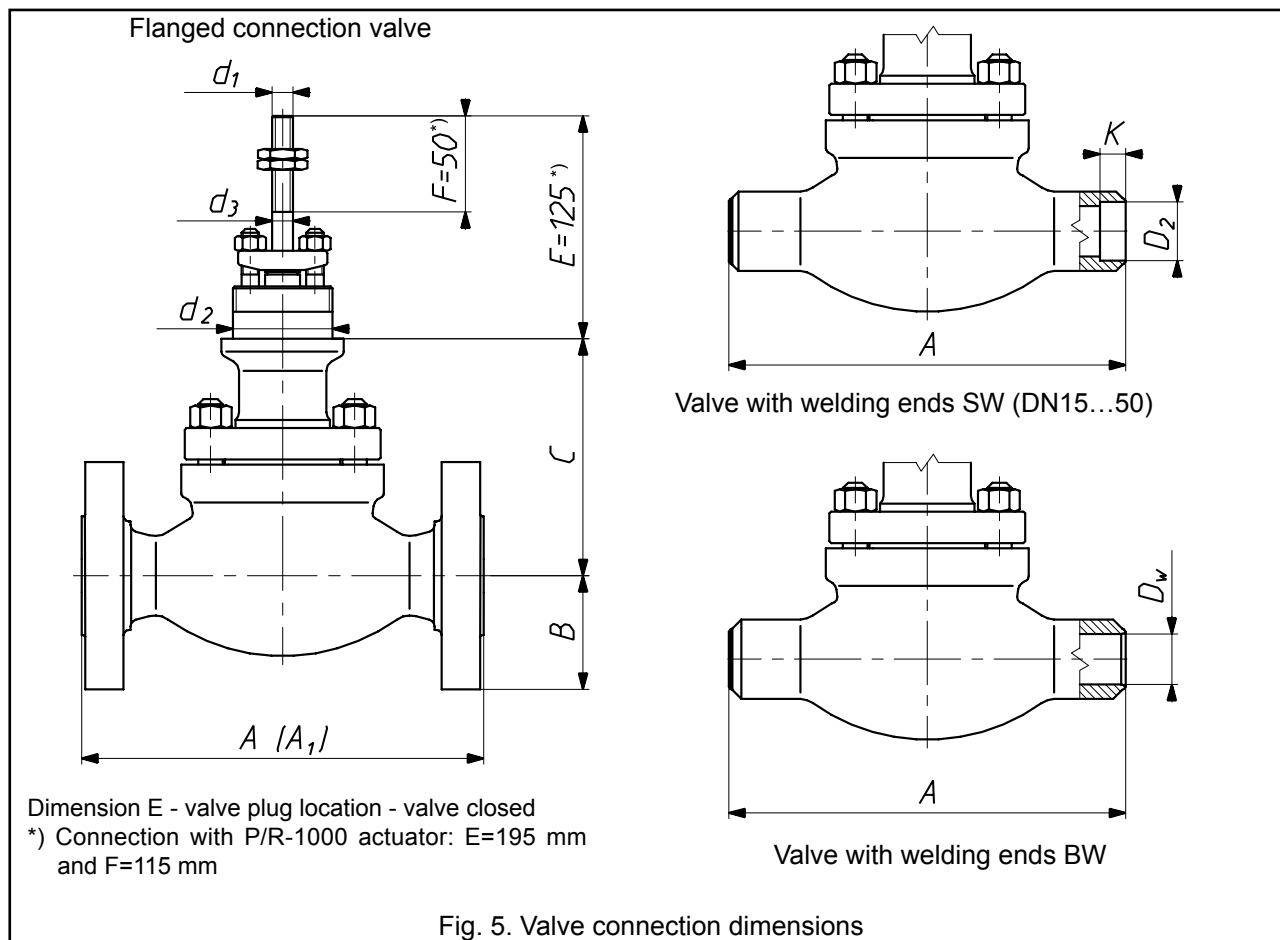


Table 15a: Control valves connection dimensions

| DN          | 25               |                  |                 |                  |       |                  | 40               |                  |                 |                  |       |                  | 50               |                  |                 |                  |       |                  |
|-------------|------------------|------------------|-----------------|------------------|-------|------------------|------------------|------------------|-----------------|------------------|-------|------------------|------------------|------------------|-----------------|------------------|-------|------------------|
| PN/CL       | PN10...<br>CL300 | PN63...<br>CL600 | CL900;<br>PN160 | PN250;<br>CL1500 | PN320 | PN400;<br>CL2500 | PN10...<br>CL300 | PN63...<br>CL600 | CL900;<br>PN160 | PN250;<br>CL1500 | PN320 | PN400;<br>CL2500 | PN10...<br>CL300 | PN63...<br>CL600 | CL900;<br>PN160 | PN250;<br>CL1500 | PN320 | PN400;<br>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              |                  | 175              | 237             |                  | 105   | 118              |
|             | DW               | 306              | 320             | 364              |       | 306              | 348              | 385              |                 | 326              | 345   | 402              |                  | 345              | 402             |                  | 105   | 118              |
|             | 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...<br>CL300 | PN63...<br>CL600 | CL900;<br>PN160 | PN250;<br>CL1500 | PN320 | PN400;<br>CL2500 | PN10...<br>CL300 | PN63...<br>CL600 | CL900;<br>PN160 | PN250;<br>CL1500 | PN320 | PN400;<br>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   |                  | 287          | 365          |             |
|             | DW               | 375              | 402             | 447              |       | 407              | 442              | 498              |                 | 426              | 483   |                  | 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 |  |
| B max       | 190          |  | 235          |  |
| C           | 439          |  | 458          |  |
|             | 539          |  | 558          |  |
|             | 580          |  | 660          |  |
| Weight [kg] | 195          |  | 220          |  |

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 <sub>1</sub>               | M12x1,25              |               |     |               | M16x1,5 |              |                        |              | M20x1,5  |               | M16x1,5               |                       | M20x1,5               |               | M24x1,5       |               |
| d <sub>2</sub> <sup>1)</sup> | 57,15 / 2 1/4"-16UN2A |               |     |               |         |              | 84,15 / 3 5/16"-18NS2A |              |          |               | 95,25 / 3 3/4"-12UN2A |                       |                       |               |               |               |
| d <sub>3</sub>               | 12                    |               | 16  |               |         |              | 20                     |              |          |               | 24                    |                       |                       |               |               |               |
| Actuator                     | 160                   | 630<br>R-630T | 160 | 630<br>R-630T | 630     | 1000<br>1500 | 630                    | 1000<br>1500 | 1000     | 1500<br>1500T | 1000<br>1500          | 1000<br>1500<br>1500T | 1000<br>1500<br>1500T | 1500<br>1500T | 1500<br>1500T | 1500<br>1500T |
|                              | 250                   |               | 250 |               | 1000    |              | 1500                   |              |          |               |                       |                       |                       |               |               |               |
|                              | 400                   |               | 400 |               | 1000    |              | 1500                   |              |          |               |                       |                       |                       |               |               |               |
|                              | 630                   |               | 630 |               | 1500    |              | 1500T                  |              |          |               |                       |                       |                       |               |               |               |

NOTE:

1) For DN80 and DN100 valves with TA-LUFT packing d<sub>2</sub> = 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 |
| 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   | -     | -      | -      |

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<sub>1</sub> 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                       | Pressure CL | DN       | A <sub>1</sub>               |
|----------------------------------------------------|-------------|----------|------------------------------|
| PN / ANSI                                          |             |          |                              |
| With groove<br>DL / (GF)<br>With races<br>F / (FF) | CL300       | 25...250 | A <sub>1</sub> = A + 5 x 2   |
|                                                    | CL600       |          | A <sub>1</sub> = A - 1,5 x 2 |
|                                                    | CL900       |          |                              |
|                                                    | CL1500      |          |                              |
|                                                    | CL2500      |          |                              |
| With ring-joint<br>J / (RTJ)                       | CL150       | 25...250 | A <sub>1</sub> = A + 6,5 x 2 |
|                                                    | CL300       | 25...40  |                              |
|                                                    | CL300       | 50...250 |                              |
|                                                    | CL600       | 25...40  | A <sub>1</sub> = A           |
|                                                    | CL900       |          |                              |
|                                                    | CL1500      |          |                              |
|                                                    | CL2500      | 25       | A <sub>1</sub> = A + 1,5 x 2 |
|                                                    | CL600       | 50...250 |                              |
|                                                    | CL900       | 50...100 |                              |
|                                                    | CL900       | 150      |                              |
|                                                    | CL2500      | 80       | A <sub>1</sub> = A + 3 x 2   |
|                                                    |             | 100      | A <sub>1</sub> = A + 4,5 x 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              | -             | -              |

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   |     |
|     | 42,4    | 7,1    | 19,5 •  |              |    |    |    |    |     |     |     |     | x   |
| 40  | 48,3    |        | 28,2    |              |    |    |    |    |     |     |     |     | x   |
|     |         | 2,6    | 43,1    | x            | x  | x  | x  |    |     |     |     |     |     |
|     |         | 2,9    | 42,5    |              |    |    |    | x  | x   |     |     |     |     |
|     |         | 3,6    | 41,1    |              |    |    |    |    |     | x   |     |     |     |
|     |         | 5      | 38,3    |              |    |    |    |    |     |     | x   |     |     |
| 50  | 60,3    | 6,3    | 35,7    |              |    |    |    |    |     |     |     | x   |     |
|     |         | 10     | 28,3    |              |    |    |    |    |     |     |     |     | x   |
|     |         | 2,9    | 54,5    | x            | x  | x  | x  | x  |     |     |     |     |     |
|     |         | 3,2    | 53,9    |              |    |    |    |    | x   |     |     |     |     |
|     |         | 4      | 52,3    |              |    |    |    |    |     | x   |     |     |     |
| 80  | 88,9    | 6,3    | 47,7    |              |    |    |    |    |     |     | x   |     |     |
|     |         | 8      | 44,3    |              |    |    |    |    |     |     |     | x   |     |
|     |         | 12,5   | 35,3    |              |    |    |    |    |     |     |     |     | x   |
|     |         | 3,2    | 82,5    | x            | x  | x  | x  |    |     |     |     |     |     |
|     | 114,3   | 3,6    | 81,7 •  |              |    |    |    | x  |     |     |     |     |     |
| 100 | 114,3   | 4      | 80,9 •  |              |    |    |    |    | x   |     |     |     |     |
|     |         | 6,3    | 76,3    |              |    |    |    |    |     | x   |     |     |     |
|     |         | 11     | 66,9    |              |    |    |    |    |     |     | x   |     |     |
|     |         | 12,5   | 63,9    |              |    |    |    |    |     |     |     | x   |     |
|     |         | 17,5   | 53,9 •  |              |    |    |    |    |     |     |     |     | x   |
| 150 | 168,3   |        | 79,3    |              |    |    |    |    |     |     |     |     | x   |
|     |         | 3,6    | 107,1   | x            | x  | x  | x  |    |     |     |     |     |     |
|     |         | 4      | 106,3   |              |    |    |    |    | x   |     |     |     |     |
|     |         | 5      | 104,3   |              |    |    |    |    |     | x   |     |     |     |
|     |         | 8      | 98,3 •  |              |    |    |    |    |     |     | x   |     |     |
| 200 | 219,1   | 14,2   | 85,9    |              |    |    |    |    |     |     |     | x   |     |
|     |         | 16     | 82,3    |              |    |    |    |    |     |     |     |     | x   |
|     |         | 22,2   | 69,9 •  |              |    |    |    |    |     |     |     |     | x   |
|     |         | 20     | 99,7    |              |    |    |    |    |     |     |     |     | x   |
|     | 244,5   | 12,5   | 219,5   |              |    |    |    |    |     | x   |     |     |     |
| 250 | 273     | 6,3    | 260,4   | x            | x  |    |    |    |     |     |     |     |     |
|     |         | 7,1    | 258,8   |              |    |    | x  |    |     |     |     |     |     |
|     |         | 8,8    | 255,4   |              |    |    |    | x  |     |     |     |     |     |
|     |         | 12,5   | 248     |              |    |    |    |    | x   |     |     |     |     |

| 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     |        |        |

where:

D<sub>z</sub> [mm]D<sub>w</sub> [mm]

t [mm]

- pipe external diameter,

- pipe internal diameter,

- 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  $\varnothing B_{\min} / \varnothing A_{\max}$  (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    | 50  |
|     | 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    | 75  |
|     | PN 160, CL 900             | 80    | 50    |     |
|     | PN 250...400, CL 1500,2500 | 92    | 42    |     |
|     | PN 10...40, CL 150, 300    | 110   | 82    |     |
| 80  | PN 63...100, CL 600        | 122   | 82    | 75  |
|     | PN 160, CL 900             | 111   | 76    |     |
|     | PN 250...400, CL 1500,2500 | 127   | 56    |     |
|     | PN 10...100, CL 150...600  | 144   | 102   |     |
| 100 | PN 160, CL 900             | 144   | 102   | 100 |
|     | PN 250...400, CL 1500,2500 | 165   | 81    |     |
|     | PN 10...40, CL 150, 300    | 183   | 160   |     |
|     | PN 63...100, CL 600        | 196   | 160   |     |
| 150 | PN 160, CL 900             | 217   | 154   | 150 |
|     | PN 10...40, CL 150, 300    | 243   | 200   |     |
|     | PN 63...100, CL 600        | 248   | 200   |     |
|     | PN 10...40, CL 150, 300    | 291   | 248   |     |
| 250 | PN 63...100, CL 600        | 346   | 248   |     |

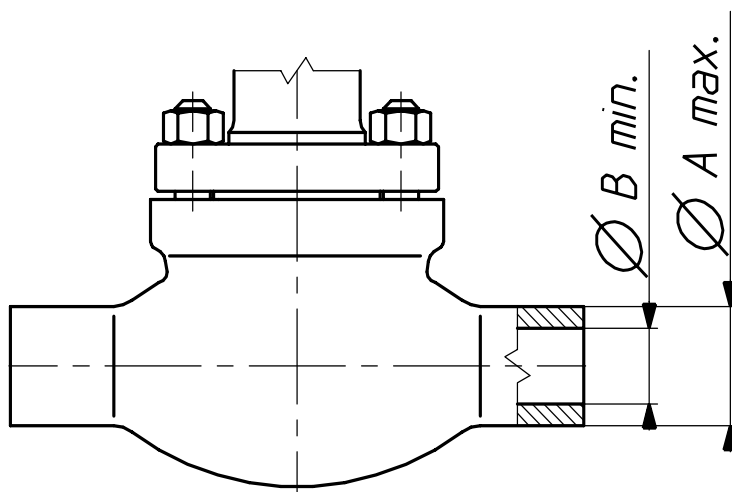


Fig. 6. Dimension of butt welding ends executed as cast

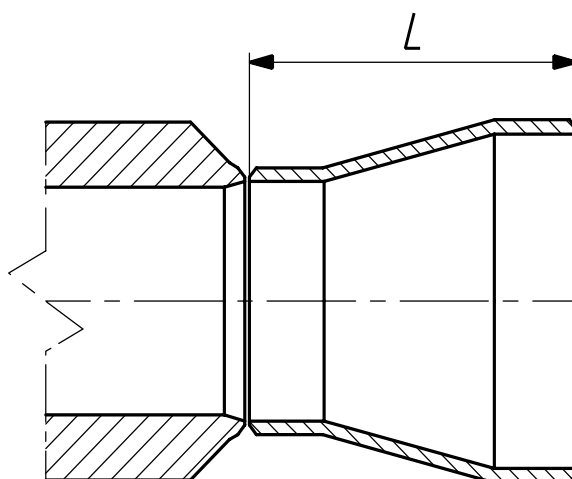


Fig. 7. Reduction stub

Table 21: SW socket welding ends.

| DN | D <sub>2</sub> | 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 [cm <sup>2</sup> ] | Stroke [mm]             | Revolutions per stroke |
|----------------------------------|-----------|---------------------------------------------|-------------------------|------------------------|
| P/R ; PN/RN                      | 160       | 160                                         | 20                      | 5                      |
|                                  | 250       | 250                                         |                         |                        |
|                                  | 400       | 400                                         |                         |                        |
| P1/R1 ; P/R ;<br>P1B/R1B ; PN/RN | 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 handwheel for R-630T

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

| Actuator size | D <sub>1</sub> | D <sub>2</sub> | H <sub>1</sub> | H <sub>2</sub> | 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         | -     |

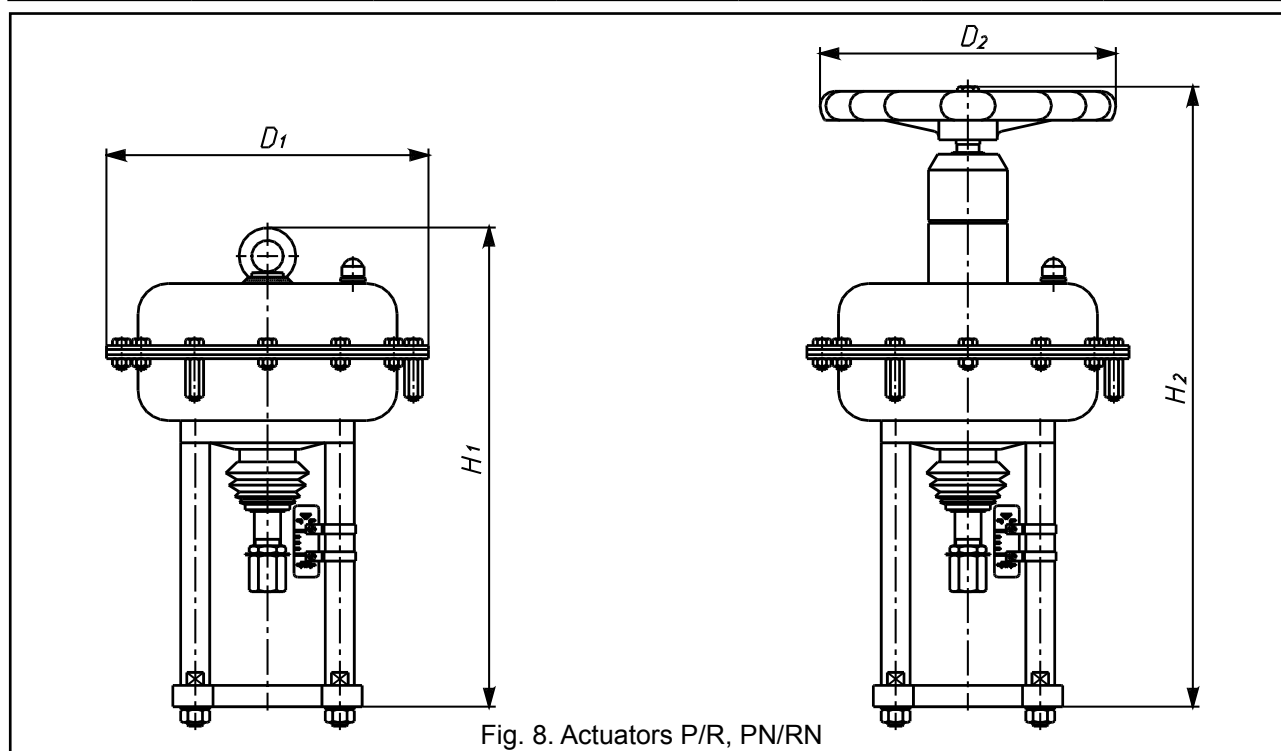
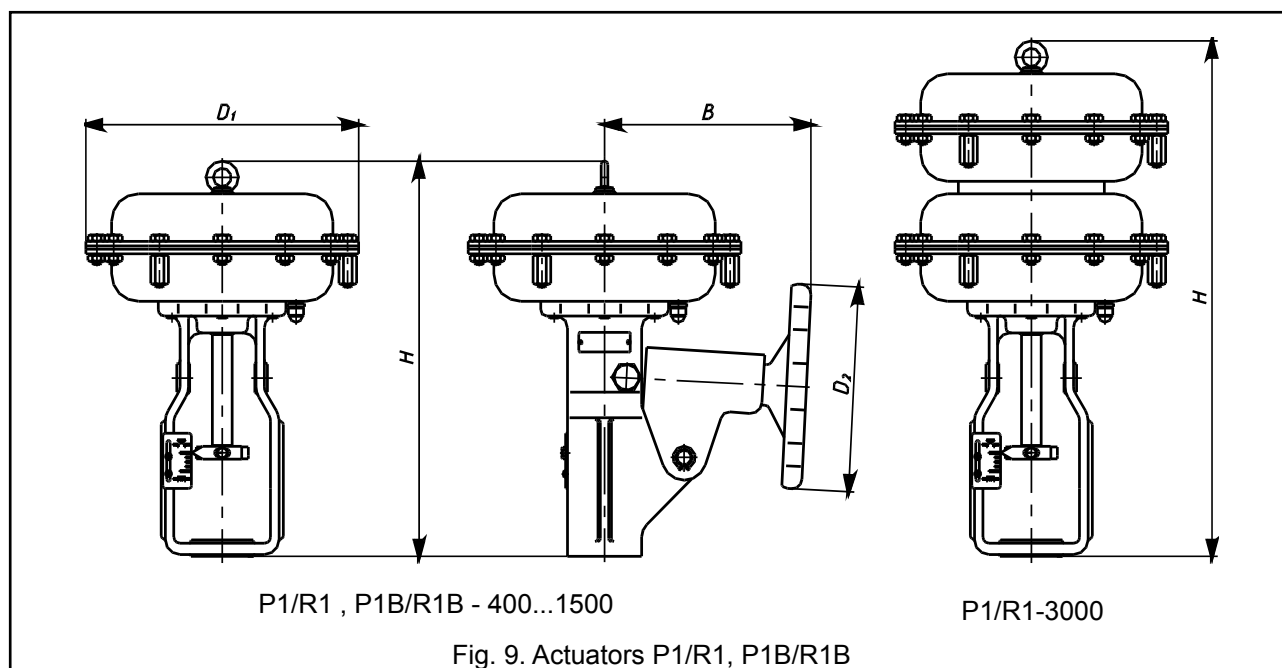


Table 24: Sizes and weights of pneumatic actuators P1/R1 and P1B/R1B - Fig. 9

| Actuator size | B   | D <sub>1</sub> | D <sub>2</sub> | 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     |



Control air connections:

- tube diameters:

- spring ranges:

1/4" NPT ; Rc 1/2"

6x1 ; 8x1 ; 12x1

20...100kPa ; 40...120kPa ; 60...140kPa

40...200kPa ; 80...240kPa ; 120...280kPa

180...380kPa

- 3 springs

- 6 springs

- 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 <sub>1</sub> | d <sub>2</sub> | 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          | M16x1,5        | 57,15          | 265 | 298 | 15         | 10          |  |  |  |
| 20-38-57-M16  |             |                | 84,15          |     |     |            |             |  |  |  |
| 20-38-84-M16  |             |                | 95,25          |     |     |            |             |  |  |  |
| 20-38-95-M16  |             |                | 57,15          |     |     |            |             |  |  |  |
| 20-50-57-M16  | 50          | M16x1,5        | 84,15          | 385 | 457 | 16         | 16          |  |  |  |
| 20-50-84-M16  |             |                | 95,25          |     |     |            |             |  |  |  |
| 20-50-95-M16  |             |                | 84,15          |     |     | 20         |             |  |  |  |
| 20-63-84-M20  | 63          | M20x1,5        | 95,25          | 385 | 457 |            |             |  |  |  |
| 20-63-95-M20  |             |                | 84,15          |     |     |            |             |  |  |  |
| 20-80-84-M20  | 80          | M20x1,5        | 95,25          | 533 | 610 | 19         | 24          |  |  |  |
| 20-80-95-M20  |             |                | 84,15          |     |     |            |             |  |  |  |
| 20-100-95-M24 | 100         | M24x1,5        | 95,25          | 533 | 610 | 19         | 24          |  |  |  |

Marking:

Example: 20-38-57-M16 - manual drive type 20; stroke - 38mm;  $d_2=57,15\text{mm}$ ;  $d_1=M16x1,5$

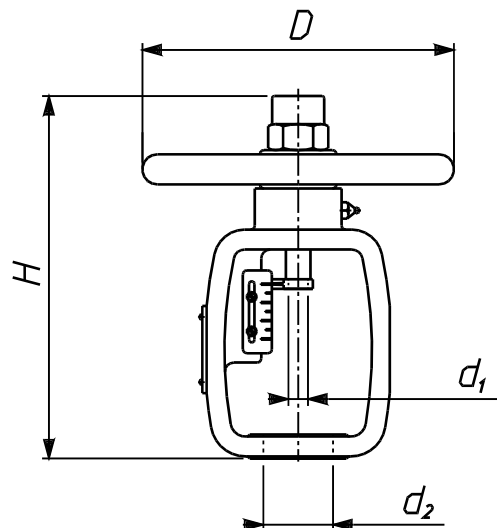


Fig. 10. Manual drive type 20.

#### 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:

|  |   |            |   |  |  |  |  |  |  |  |
|--|---|------------|---|--|--|--|--|--|--|--|
|  | - | <b>Z1B</b> | - |  |  |  |  |  |  |  |
|--|---|------------|---|--|--|--|--|--|--|--|

### 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.

Additionally, 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.