02 - 01.2

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Control valves
and steam-conditioning station
700 line

Kv coefficient calculation

Calculation itself is carried out with respect to conditions of regulating circuit and operating medium according to equations mentioned below. Control valve must be designed to be able to regulate maximal flow quantity at given operating conditions. At the same time it is necessary to check whether minimal flow quantity can be even regulated or not.
Because of eventual minus tolerance 10% of Kv_{100} against Kvs and requirement for possible regulation within range of maximal flow (decrement and increase of flow), producer recommends to select Kvs value higher than maximal operating Kv value:

$$Kvs = 1.2 \div 1.3\ Kv$$

It is necessary to take into account to which extent Q_{max} involve "precautionary additions" that could result in valve oversizing.

Relations of Kv calculation

		Pressure drop $p_2 > p_1/2$ $\Delta p < p_1/2$	Pressure drop $\Delta p \geqq p_1/2$ $p_2 \leqq p_1/2$
Kv =	Liquid	$\frac{Q}{100}\sqrt{\frac{\rho_1}{\Delta p}}$	
	Gas	$\frac{Q_n}{5141}\sqrt{\frac{\rho_n . T_1}{\Delta p . p_2}}$	$\frac{2.Q_n}{5141.p_1}\sqrt{\rho_n . T_1}$
	Superh. steam	$\frac{Q_m}{100}\sqrt{\frac{v_2}{\Delta p}}$	$\frac{Q_m}{100}\sqrt{\frac{2v}{p_1}}$
	Sat. steam	$\frac{Q_m}{100}\sqrt{\frac{v_2 . x}{\Delta p}}$	$\frac{Q_m}{100}\sqrt{\frac{2v.x}{p_1}}$

Above critical flow of vapours and gases

When pressure ratio is above critical ($p_2 / p_1 < 0.54$), speed of flow reaches acoustic velocity at the narrowest section. This event can cause higher level of noisiness and then it is convenient to use a throttling system ensuring low noisiness (multi-step pressure reduction, damping orifice plate at outlet).

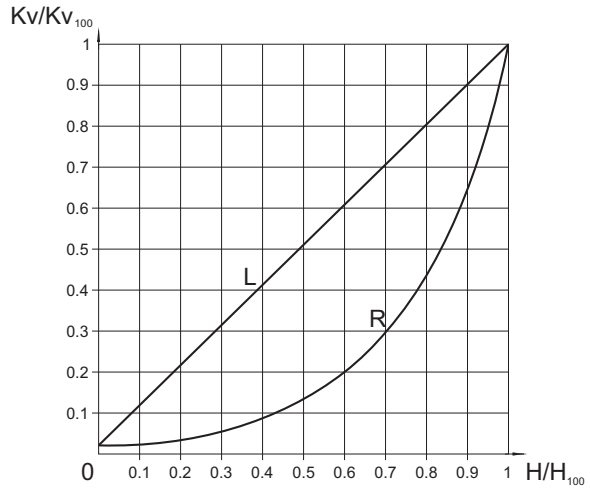
Cavitation

Cavitation is a phenomenon when there are steam bubbles creating and vanishing in shocks - generally at the narrowest section of flowing due to local pressure drop. This event expressively cuts down service life of inner parts and can result in creation of unpleasant vibrations and noisiness. In control valves it can happen on condition that

$$(p_1 - p_2) \geqq 0.6\ (p_1 - p_s)$$

Valve differential pressure should be set the way so that neither any undesired pressure drop causing cavitation can occur, nor liquid-steam(wet steam) mixture can create. Otherwise it must be taken into account when calculating Kv value. If the creation of cavitation still threatens, it is necessary to use a multi-step pressure reduction.

Valve flow characteristics



L - linear characteristic

$$Kv/Kv_{100} = 0.0183 + 0.9817 \cdot (H/H_{100})$$

R - equal-percentage characteristic (4-percentage)

$$Kv/Kv_{100} = 0.0183 \cdot E^{(4 \cdot H/H_{100})}$$

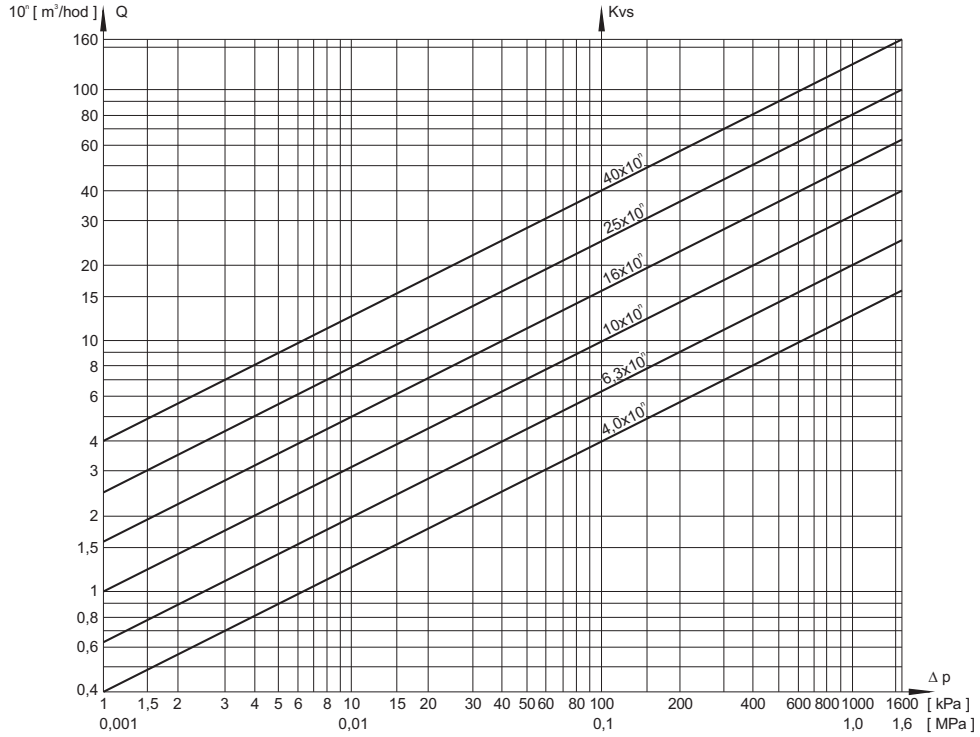
Rangeability

Rangeability is the ratio of the biggest value of flow coefficient to the smallest value. In fact it is the ratio (under the same conditions) of highest regulated flow rate value to its lowest value.
The lowest or minimal regulated flow rate is always higher than 0.

Dimensions and units

Marking	Unit	Name of dimension
Kv	m^3/hour	Flow coefficient under conditions of units of flow
Kv_{100}	m^3/hour	Flow coefficient at nominal stroke
Kvs	m^3/hour	Valve nominal flow coefficient
Q	m^3/hour	Flow rate in operating conditions (T_1, p_1)
Q_n	Nm^3/hour	Flow rate in normal conditions (0 °C, 0.101 MPa)
Q_m	kg/hour	Flow rate in operating conditions (T_1, p_1)
p_1	MPa	Upstream absolute pressure
p_2	MPa	Downstream absolute pressure
p_s	MPa	Absolute pressure of saturated steam at given temperature (T_1)
Δp	MPa	Valve differential pressure ($\Delta p = p_1 - p_2$)
ρ_1	kg/m^3	Process medium density in operating conditions (T_1, p_1)
ρ_n	kg/Nm^3	Gas density in normal conditions (0 °C, 0.101 MPa)
v_2	m^3/kg	Specific volume of steam when temperature T_1 and pressure p_2
v	m^3/kg	Specific volume of steam when temperature T_1 and pressure $p_1/2$
T_1	K	Absolute temperature at valve inlet ($T_1 = 273 + t_1$)
x	1	Proportionate weight volume of saturated steam in wet steam

Diagram for the valve Kvs value specification according to the required flow rate of water Q and the valve differential pressure Δp



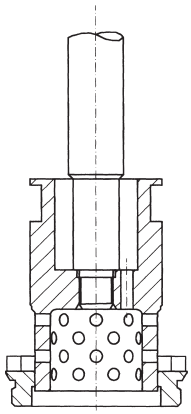
The diagram serves to specify the valve Kvs value regarding to the required flow rate of water at a given differential pressure. It can be also used for finding out the differential pressure value of the existing valve in behaviour with the flow rate. The diagram apllies to water with the density of 1000 kg/m^3.

For the value Q = q .10^n, it is necessary to calculate with Kvs = k .10^n. Example: water flow rate of 16 .10^{-1} = 1,6 m^3 /hour corresponds to Kv = 2,5 = 25. 10 when differential pressure 40kPa.

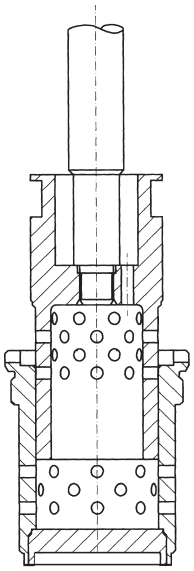
Application of multi-step pressure reduction

When the valves are designed for operation in above-critical differential pressure (p_2 /p_1 <0,54 when throttling steam and gases), or when diff. pressure value is higher than the recommended service diff. pressure, it is effectual to use a throttling system in two or three steps to prevent the cavitation from creating and to ensure both a long service life of the valve inner parts and low noisiness when operating.

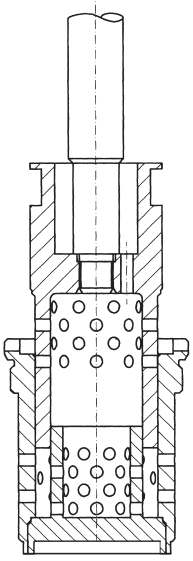
One-step pressure reduction



Two-step pressure reduction



Three-step pressure reduction



RV 701

Control valves
DN 25, 50, 80, 100, 125, 150, 250
PN 160 to 400

Description

The valves series RV 701 are single-seated control valves of a unit construction designed to fit in all demands of an appliance the valve is designed for. The pressure-balanced, multi-step throttling system is always designed with regard to the resistance to creation and effects of cavitation and noisiness. The valve is equipped with packing type “Live Loading”.

The valves are delivered with weld ends.

The valves are actuated with linear actuators. The connection is designed for using both domestic and foreign actuators of the following producers: ZPA Pečky, Regada Prešov, Auma, Schiebel and Flowserve.

Process media

The valves are especially designed for the flow and pressure control of the process medium without impurities, however they can be used for gases and vapours when inlet and outlet flow velocities are kept within the permissible range. The common process media are for example water, steam and other media with no special demands on the used type of material of the valve. The producer recommends to pipe a strainer into pipeline in front of the valve when impurities are present. Impurities can affect the quality and reliability of regulation and can cause a reduction of the valve service life.The valve application for any other media should be consulted with the producer because of the type of material that is in contact with the process medium.

Application

The sphere of application of these valves continues in the sphere of application for the valves series RV 501. They are especially designed for industry applications such as heating plants, power plants or regulation of technology processes. The max. permissible operating pressure values correspond to EN 12 516-1 see page 35 of this catalogue.

Installation

The valves must be piped the way so that the process medium flow will coincide with the arrows indicated on the valve body. They can be installed in horizontal, vertical or inclined pipeline in any position except the position when the actuator is under the valve body. The valves DN 250 can be piped in horizontal pipeline only. The actuator cannot be tilted.

Recommended differential pressures

In regard to the pressure balancing of the plug and to linear forces of usable actuators, the valves´ application in high differential pressures is not limited by the forces caused by process medium pressure but by the type of used throttling system. A recommended max. differential pressure for one step of a multi-step pressure reduction is 4.0 MPa when perforated plug and perforated cage are used and 2.0 MPa when a parabolic plug is used. It is recommended to consult the producer and discuss the concrete cases with regard to pressure ratio and service parametres of other equipment.

Technical data

Series	RV 701		
Type of valve	Control valve, single-seated, straight-through, with pressure-balanced plug		
Nominal size range	DN 25 to 250 *)		
Nominal pressure	PN 160, 250, 320, 400		
Body material	Carbon steel 1.0619 (GP 240 GH)	Alloy steel 1.7357 (G17CrMo5-5) Alloy steel 1.7379 (G17CrMo9-10)	Stainless steel 1.4931 (GX23CrMoV12-1)
Seat material	17 021.6 (1.4006); 42 2906.5 (1.4027) + stellited seat STELLIT 6		
Plug material	17 023.6 (1.4028) hardened		17021.6 (1.4006) + stellited seat STELLIT 6
Operating temp. range	-20 to 400°C	-20 to 550°C	-20 to 600°C
Weld ends	Acc. to ČSN 13 1075 (3/1991)		
Type of trim	One - three-step pressure reduction Perforated plug - seat(cage)		
Flow characteristic	Linear, equal-percentage		
Leakage rate	Acc. to ČSN EN 1349 (5/2001) Class III, execution with higher tightness - Class V		
Packing	Graphite - Live Loading		

*) For material 1.0619 DN 80 - 250 it is possible max. PN 320

Range of Kvs values

DN	25 **)	50	80	100	125	150	250
Multi-step press. reduction	Kvs values [m^3/h] - linear flow characteristic						
1	0.1 - 8.0	3.2 - 32	8 - 80	10 - 125	16 - 360 *)	16 - 360 *)	40 - 630
2	0.1 - 8.0	2.5 - 32	8 - 80	8.0 - 100	12.5 - 250	12.5 - 250	40 - 500
3	1.6 - 8.0	2.5 - 32	8 - 80	8.0 - 80	12.5 - 200	12.5 - 200	40 - 400
Multi-step press. reduction	Kvs values [m^3/h] - equal-percentage flow characteristic						
1	0.63 - 6.3	6.3 - 25	16 - 50	16 - 63	25 - 125	25 - 125	50 - 320
2	0.63 - 6.3	5.0 - 20	12.5 - 40	12.5 - 50	25 - 100	25 - 100	50 - 200
3	1.6 - 5.0	4.0 - 16	10 - 32	10 - 40	20 - 80	20 - 80	50 - 160

*) For PN 160 and 250 only, for PN 320 and 400 Kvs_{max} = 250 m^3/h

**) for Kvs 0,1 - 1,6 contoured plug

Nominal values of Kvs are understood as multiples of 10 of the progression of selected numbers R10 (1.0; 1.25;1.6; 2.0; 2.5; 3.2; 4.0; 5.0; 6.3; 8.0; 10.0). They are specified individually for every valve acc. to the customer´s requirements and value within the appropriate range showen in the table above.

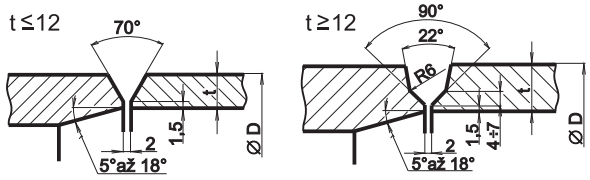
Dimensions and weights of RV 701 with weld ends

	PN 160	PN 250	PN 320*	PN 400*	PN 160 do 400							
DN	t	t	t	t	D	L	V_1	V_2	V_3	H	d	m
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]		[kg]
25	4	5	6	7.1	33.7	270	70	280	160	16	M16x1,5	28
50	6.3	8	10	14.2	60.3	390	110	320	160	25		85
80	8	12.5	14.2	19	88.9	480	145	356	160	40		115
100	10	14	16	20	114.3	580	170	405	160	40	M20x1,5	290
125	12.5	18	20	23	139.7	720	225	466	160	63		385
150	14	20	23	26	168.3	720	225	466	160	63		390
250	22	32	35	38	273	990	345	675	210	100		1500

* For PN 320, 400 - weld ends connection acc. to LDM execution.

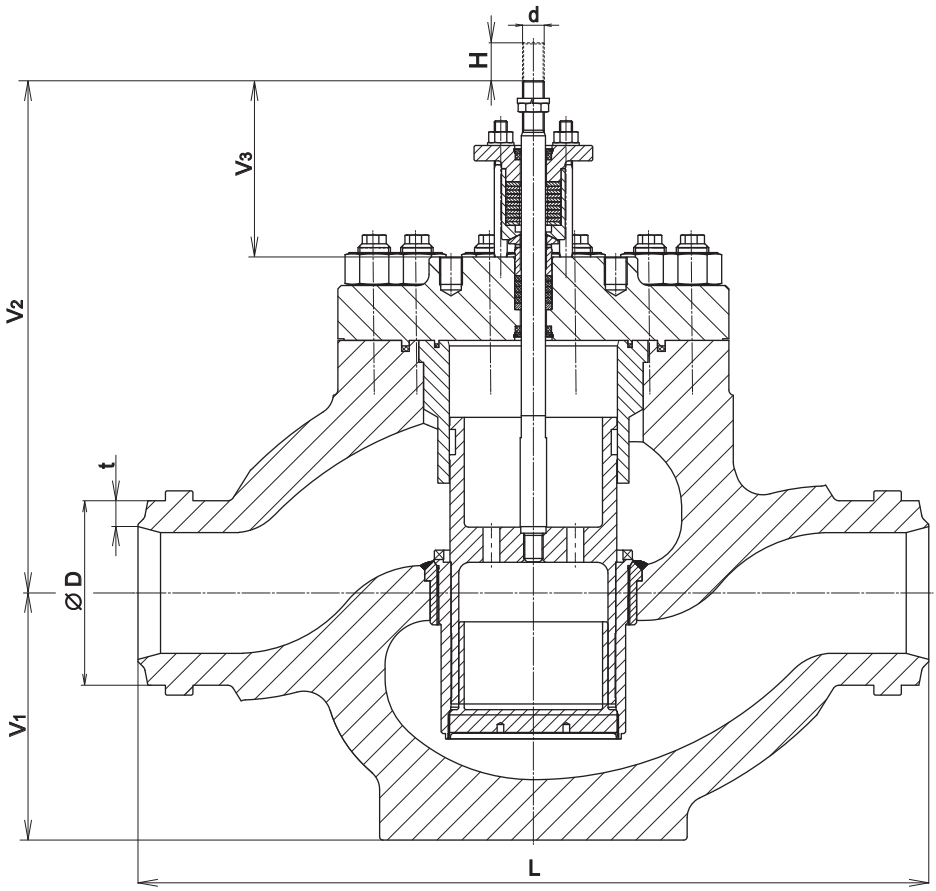
Note: The values of weight are approximate.

Connecting dimensions of weld ends can be modified on request by the customer.



Other shapes of weld ends after agreement with producer

Control valve RV 701 with weld ends



Valve complete specification No. for ordering RV 701

			XX	X X X	X X X	X X X X	X X		XXX	/	XXX	-	XXX
1. Type of valve	Control valve		RV										
2. Series	Control valve, straight-through			7 0 1									
3. Type of actuating	Electric actuator			E									
	Pneumatic actuator			P									
	Electric actuator Modact MTR [2]				E P D								
	Electric actuator Modact MTN Control [2]				E Y A								
	Electric actuator Modact MTP Control [2]				E Y A								
	Electric actuator Modact MTNED [2], MTPED [2]				E Y A								
	Electric actuator Modact MTN [2], MTP [2]				E Y B								
	Electric actuator ST 2 [2], STR 2 [2], STR 2PA [2]				E P M								
	Electric actuator Auma SA 07.6				E A E								
	Electric actuator Auma SA Ex 07.6				E A F								
	Electric actuator Auma SAR 07.6				E A G								
	Electric actuator Auma SAR Ex 07.6				E A H								
	Electric actuator Auma SA 10.2				E A I								
	Electric actuator Auma SA Ex 10.2				E A L								
	Electric actuator Auma SAR 10.2				E A J								
	Electric actuator Auma SAR Ex 10.2				E A K								
	Electric actuator Schiebel AB5				E Z E								
	Electric actuator Schiebel exAB5				E Z F								
	Electric actuator Schiebel rAB5				E Z G								
	Electric actuator Schiebel exrAB5				E Z H								
	Pneumatic actuator Flowserve PO 700 [1]				P F G								
	Pneumatic actuator Flowserve PO 1502 [1]				P F D								
4. Connection	Weld ends					4							
5. Body material *specified in parentheses) (operating temp. ranges are*	Cast steel 1.0619	(-20 to 400°C)				1							
	Stainless steel 1.4931	(-20 to 600°C)				5							
	Alloy steel 1.7379	(-20 to 550°C)				6							
	Alloy steel 1.7357	(-20 to 550°C)				7							
	Other material acc. to request					9							
6. Packing	Graphite - Live Loading					5							
7. Multi-step pressure red.	One-step pressure reduction					1							
	Two-step pressure reduction					2							
	Three-step pressure reduction					3							
8. Flow characteristic	Linear - Leakage rate class III.						L						
	Linear - Leakage rate class V.						D						
	Equal-percentage - Leakage rate class III.						R						
	Equal-percentage - Leakage rate class V.						Q						
9. No. of orifice plates	Without						0						
10. Nominal pressure	PN 160								160				
	PN 250								250				
	PN 320								320				
	PN 400								400				
11. Operating temperature °C	Acc. to process medium										XXX		
12. Nominal size	DN - acc. to the valve´s execution												XXX

[1] *Pneumatic actuators only for DN 150*

[2] *Applycable to max. DN 150*

Ordering example: Two-way, control valve DN 50, PN 160, with electric actuator Modact MTN Control, body material: cast steel, weld ends, packing Graphite, two-way pressure reduction, linear flow characteristic is specified as follows: **RV701 EYA 4152 L0 160/400-50**.

Note

Other type of actuator available on request.

RV 702

Control valves
Inlet DN 25, 50, 80, 100, 125, 150, 250
Outlet DN 25 to 700
PN 16 to 400

Description

The valves with extended outlet series RV 702 are single-seated control valves of a unit construction designed to fit in all demands of an appliance the valve is designed for. The pressure-balanced, multi-step throttling system is always designed to eliminate the valve´s high differential pressures with a high resistance to wearing caused by flow and effects of expanding steam. It also ensures a low noisiness level. The valve is equipped with packing "Live Loading".
The valves are delivered with weld ends.
The valves are actuated with linear actuators. The connection is designed for using both domestic and foreign actuators of the following producers: ZPA Nová Paka, ZPA Pečky, Regada Prešov, Auma, Schiebel, EMG-Drehmo, Flowserve.

Process media

The valves are especially designed to control the flow and pressure of vapours and gases without impurities. The producer recommends to pipe a strainer into pipeline in front of the valve when impurities are present. Impurities can affect the quality and reliability of regulation and can cause a reduction of the valve service life. The common process media are for example saturated or superheated steam and other media with no special demands on the used type of material of the valve. The valve application for any other media must be consulted with the producer because of the type of material that is in contact with the process medium.

Application

The sphere of application of these valves continues in the sphere for the valves series RV 502. They are especially designed for industry applications such as heating plants, power plants or regulation of technological processes. The max. permissible operating pressure values correspond to EN 12 516-1, see page 35 of this catalogue.

Installation

The valves must be piped the way so that the process medium flow will coincide with the arrows indicated on the valve body. They can be installed in horizontal, vertical or inclined pipeline in any position except the position when the actuator is under the valve body. The valves DN 250 can be piped in horizontal pipeline only. The actuator cannot be tilted.

Recommended differential pressures

In regard to the pressure balancing of the plug and to linear forces of usable actuators, the valves´ application in high differential pressures is not limited by the forces caused by process medium pressure but by the type of used throttling system. A recommended max. differential pressure for one step of multi-step pressure reduction is 5.0 MPa when perforated plug and perforated cage are used. It is recommended to consult the concrete cases with the producer with regard to pressure ratio and parametres of other equipment.

Technical data

Series	RV 702		
Execution	Control valve, single-seated, straight-through, with pressure-balanced plug, with extended outlet and orifice plate in extended outlet		
Range of nominal size	Inlet DN 25 to 250; outlet DN 25 to 700		
Nominal pressure	Inlet PN 160 to 320, outlet PN 16 to 250	Inlet PN 160 to 400,outlet PN 16 to 320	
Body material (including weld ends)	Cast steel 1.0619 (GP 240 GH)	Alloy steel 1.7357 (G17CrMo5-5) Alloy steel 1.7379 (G17CrMo9-10)	Stainless steel 1.4931 (GX23CrMoV12-1)
Material of weld ends	1.0425 (P 265 GH)	1.7380 (10CrMo9-10) 1.7335 (13CrMo4-5) 1.7383 (11CrMo9-10)	1.4922 (X20CrMoV 11-1) 1.4923 (X22CrMoV 12-1) 1.4903 (X10CrMoVNb 9-1)
Seat material	17 021.6 (1.4006); 42 2906.5 (1.4027) + stellited seat STELIT 6		
Plug material	17 023.6 (1.4028) hardened		17021.6 (1.4006) + stellited seat STELIT 6
Operating temp. range	-20 to 400°C	-20 to 550°C	-20 to 600°C
Weld ends	Acc. to ČSN 13 1075 (3/1991)		
Trim	One or two-step pressure reduction		
	Perforated plug - seat (cage), orifice plate		
Flow characteristic	Linear, equal-percentage		
Leakage rate	Acc. to ČSN EN 1349 (5/2001) Class III, execution with higher tightness Class V		
Packing	Graphite - Live Loading		

Range of Kvs values

DN	25/XXX	50/XXX	80/XXX	100/XXX	125/XXX	150/XXX	250/XXX
Multi-step press. reduction	Kvs values [m^3/h] - linear flow characteristic						
1	1.6 - 8.0	2.5 - 32	8 - 80	10 - 125	12.5 - 360 *)	12.5 - 360 *)	40 - 630
2	1.25 - 8.0	2.5 - 32	8 - 80	10 - 100	12.5 - 250	12.5 - 250	40 - 500
Multi-step press. reduction	Kvs values [m^3/h] - equal-percentage flow characteristic						
1	2.0 - 6.3	6.3 - 25	16 - 50	16 - 63	25 - 125	25 - 125	50 - 320
2	1.6 - 4.0	5.0 - 20	16 - 40	16 - 50	25 - 80	25 - 80	50 - 160

*) For PN 160 and 250 only, for PN 320 and 400 Kvs_{max} = 250 m^3/h

Nominal values of Kvs are understood as multiplies of 10 of the progression of selected number R10 (1.0; 1.25; 1.6; 2.0; 2.5; 3.2; 4.0; 5.0; 6.3; 8.0; 10.0).

They are specified individually for every valve acc. to the customer´s requirements and value within the appropriate range showen in the table above.

Dimensions and weights of RV 702 with weld ends *)

DN	V_1	V_2	V_3	L	H	d	m
	[mm]	[mm]	[mm]	[mm]	[mm]		[kg]
25/40	70	280	160	360	16	M16x1,5	---
50/100	110	320	160	635	25		---
80/150	145	356	160	---	40		---
100/200	170	405	160	880	40	M20x1,5	---
125/250	225	466	160	996	63		---
150/200	225	466	160	---	63		---
150/300	225	466	160	1015	63		---
250/500	345	675	210	---	100		---

*) There are only recommended combination of DN for inlet and outlet of RV 702 valve.

Note: Mentioned weights are approximate. The missing data are to be specified by the producer.

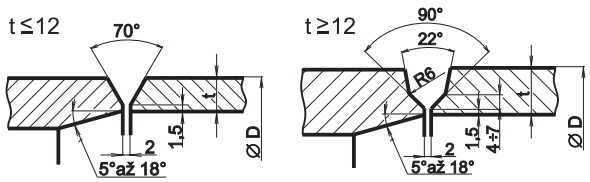
Connecting dimensions of weld ends

	PN							
	16 - 40	63	100	160	250	320**	400**	16-400
DN	t	t	t	t	t	t	t	D
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	2.6	2.6	2.9	4	5	6	7.1	33.7
40	2.6	2.9	3.6	5	7	6.8	11	48.3
50	2.9	3.2	4.5	6.3	8	10	14.2	60.3
65	3.2	3.6	5	7	10	13	17.5	76.1
80	3.6	4	5.6	8	12.5	14.2	19	88.9
100	4	5	7	10	14	16	20	114.3
125	4.5	5.6	8	12.5	18	20	23	139.7
150	5	7	10	14	20	23	26	168.3
200	6.3	8	12.5	18	25	28	32	219,1
250	7	10	16	22	32	35	38	273
300	8	12.5	18	25	---	---	---	323.9
350	9	12.5	20	28	---	---	---	355.6
400	11	14	20	32	---	---	---	406.4
500	14	18	25	---	---	---	---	508
600*	18	23	---	---	---	---	---	610
700*	23	---	---	---	---	---	---	721

* For DN 600 and 700 - weld ends connection acc. to LDM execution

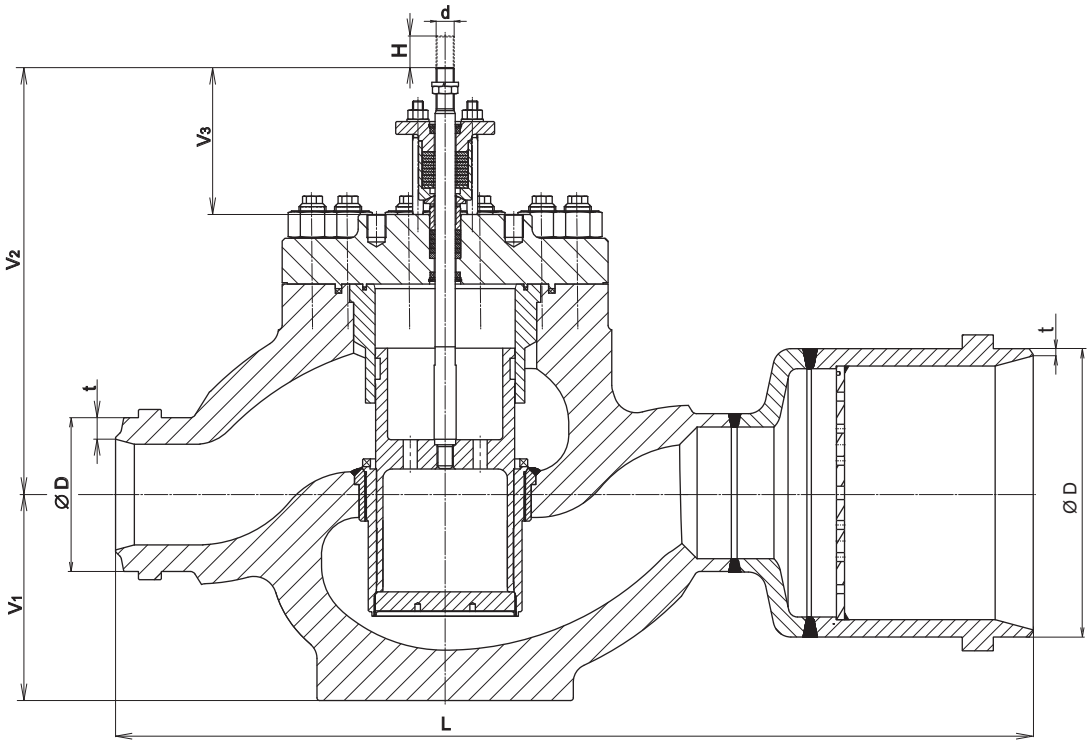
** For PN 320, 400 - weld ends connection acc. to LDM execution

Connecting dimensions of weld ends can be modified on request by the customer.



Other shapes of weld ends after agreement with producer

Control valve RV 702 with weld ends



Valve complete specification No. for ordering RV 702

			XX	X X X	X X X	X X X X	X X		XXxXX	/	XXX	-	XX/XX
1. Type of valve	Control valve		RV										
2. Series	Control valve, straight-through			7 0 2									
3. Type of actuating	Electric actuator				E								
	Pneumatic actuator				P								
	Electric actuator Modact MTR [2]				E P D								
	Electric actuator Modact MTN Control [2]				E Y A								
	Electric actuator Modact MTP Control [2]				E Y A								
	El. actuator Modact MTNED [2], MTPED [2]				E Y A								
	Electric actuator Modact MTN [2], MTP [2]				E Y B								
	El. actuator ST 2 [2], STR 2 [2], STR 2PA [2]				E P M								
	Electric actuator Auma SA 07.6				E A E								
	Electric actuator Auma SA Ex 07.6				E A F								
	Electric actuator Auma SAR 07.6				E A G								
	Electric actuator Auma SAR Ex 07.6				E A H								
	Electric actuator Auma SA 10.2				E A I								
	Electric actuator Auma SA Ex 10.2				E A L								
	Electric actuator Auma SAR 10.2				E A J								
	Electric actuator Auma SAR Ex 10.2				E A K								
	Electric actuator Schiebel AB5				E Z E								
	Electric actuator Schiebel exAB5				E Z F								
	Electric actuator Schiebel rAB5				E Z G								
	Electric actuator Schiebel exrAB5				E Z H								
	Pneumatic actuator Flowserve PO 700 [1]				P F G								
	Pneumatic actuator Flowserve PO 1502 [1]				P F D								
4. Connection	Weld ends					4							
5. Body material	Cast steel 1.0619	(-20 to 400°C)				1							
	Stainless stel 1.4931	(-20 to 600°C)				5							
	Alloy steel 1.7379	(-20 to 550°C)				6							
	Alloy steel 1.7357	(-20 to 550°C)				7							
	Other material acc. to request					9							
6. Packing	Grafit - Live Loading					5							
7. Multi-step pressure red.	One-step pressure reduction					1							
	Two-step pressure reduction					2							
8. Flow characteristic	Linear - Leakage rate class III.						L						
	Linear - Leakage rate class V.						D						
	Equal-percentage - Leakage rate class III.						R						
	Equal-percentage - Leakage rate class V.						Q						
9. No. of orifice plates	Max. 3						X						
10. Nominal pressure	PN inlet / outlet								XX/XX				
11. Operating temperature °C	Acc. to process medium										XXX		
12. Nominal size	DN - acc. to the valve´s execution												XX/XX

[1] *Pneumatic actuators only for DN 150*

[2] *Applycable to max. DN 150*

specified in parentheses) (operating temp. ranges are

Order example: Two-way, control valve DN 80, PN 160, with electric actuator Modact MTN Control, body material: cast steel, weld ends, packing Graphite, two-step pressure reduction, linear flow characteristic is specified as follows: **RV702 EYA 4152 L1 160x100/400-50/100**

Note

PN and DN of outlet, multi-step pressure reduction No. of orifice plate possibly different type of actuating is possible after the agreement with the producer.

RS 702

Steam-conditioning station
Inlet DN 50, 80, 100, 125, 150, 250
Outlet DN 100 to 700
PN 16 to 400

Description

Steam conditioning station RS 702 is single-seated control valve of a unit construction designed for water injection into the extended outlet. The pressure-balanced, multi-step throttling trim is designed to eliminate high differential pressures within the valve and ensure the low noisiness. It ensures a high resistance to wearing caused by medium flow and to effects of the expanding steam. Cooling water is injected into the extended outlet with a specially designed nozzle (VH or VHP) with changeable flow. The valve is equipped with "Live Loading" packing.

The valves are supplied with weld ends.

The valves are actuated with linear electric actuators. The connection is designed for both domestic and foreign actuators of the following producers: ZPA Nová Paka, ZPA Pečky, Regada, AUMA, Schiebel and EMG - Drehmo.

Process media

The valves are designed to regulate the pressure and temperature of water vapour without mechanical impurities. The producer recommends to pipe a strainer into pipeline in front of the valve when impurities are present. Impurities can affect the quality and reliability of regulation and can cause a reduction of the valve service life.The application for other process media must be considered with respect to used material that is in contact with the process medium and therefore its usage should be consulted with the producer.

Application

The valves are designed for simultaneous pressure and temperature reduction of steam. They are especially designed for industrial applications such as low-pressure steam production in heating, steam circuit in power plants or technological processes. The max. permissible operating pressures correspond to EN 12 516-1 mentioned on page 38.

Installation

The valves must be piped the way so that process medium flow will coincide with the arrows indicated on the valve body. They can be installed in horizontal, vertical or inclined pipeline in any position except the position when the actuator is under the valve body. The valves DN 250 can be piped in horizontal pipeline only. The actuator cannot be tilted.

Recommended differential pressures

In regard to the pressure balancing of the plug and to linear forces of usable actuators, the valves´ application in high differential pressures is not limited by the forces caused by process medium pressure but by the type of used throttling system. A recommended max. differential pressure for one step of multi-step pressure reduction is 5.0 MPa when perforated plug and perforated cage are used. It is recommended to consult the concrete cases with the producer with regard to pressure ratio and parametres of other equipment.

Technical data

Series	RS 702		
Execution	Control valve, single-seated, straight-through, with press.-bal. plug, with extended outlet and orifice plate at outlet, with water injection into outlet pipe		
Range of nominal size	Inlet DN 50 to 250; outlet DN 150 to 700		
Nominal pressure	Inlet PN 160 to 320, outlet PN 16 to 250	Inlet PN 160 to 400,outlet PN 16 to 320	
Body material (including weld ends)	Cast steel 1.0619 (GP 240 GH)	Alloy steel 1.7357 (G17CrMo5-5) Alloy steel 1.7379 (G17CrMo9-10)	Stainless steel 1.4931 (GX23CrMoV12-1)
Material of weld ends	1.0425 (P 265 GH)	1.7380 (10CrMo9-10) 1.7335 (13CrMo4-5) 1.7383 (11CrMo9-10)	1.4922 (X20CrMoV 11-1) 1.4923 (X22CrMoV 12-1) 1.4903 (X10CrMoVNb 9-1)
Seat material	17 021.6 (1.4028); 42 2906.5 (1.4027) + stellited seat STELIT 6		
Plug material	17 023.6 (1.4078) hardened		17021.6 (1.4006) + stellited seat STELIT 6
Operating temp. range	-20 to 400°C	-20 to 550°C	-20 to 600°C
Weld ends	Acc. to ČSN 13 1075 (3/1991)		
Trim	One or two-step pressure reduction		
	Perforated plug - seat (cage), orifice plate		
Flow characteristic	Linear, equal-percentage		
Leakage rate	Acc. to ČSN EN 1349 (5/2001) Class III, execution with higher tightness Class V		
Packing	Graphite - Live Loading		

Range of Kvs values

DN	50/XXX	80/XXX	100/XXX	125/XXX	150/XXX	250/XXX
Multi-step press. reduction	Kvs values [m³/h] - linear flow characteristic					
1	2.5 - 32	8 - 80	10 - 125	12.5 - 360 *)	12.5 - 360 *)	40 - 630 *)
2	2.5 - 32	8 - 80	10 - 100	12.5 - 250	12.5 - 250	40 - 500
Multi-step press. reduction	Kvs values [m³/h] - equal-percentage flow characteristic					
1	6.3 - 25	16 - 50	16 - 63	25 - 125	25 - 125	50 - 320
2	5.0 - 20	16 - 40	16 - 50	25 - 80	25 - 80	50 - 160

*) Only for PN 160 and 250, for PN 320 and 400 Kvs_{max} = 250 m³/h

Nominal values of Kvs are understood as multiplies of 10 of the basic figures mentioned in the following parenthesis R10 (1.0; 1.25; 1.6; 2.0; 2.5; 3.2; 4.0; 5.0; 6.3; 8.0; 10.0).

They are specified for every valve acc. to the customer´s requirements and value within the appropriate range showen in the table above.

Dimensions and weights for RS 702 with weld ends *)

DN	V_1	V_2	V_3	V_4	V_5	L	H	d	m
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]		[kg]
50/150	110	320	160	215	262	880	25	M16x1,5	---
80/150	145	356	160	215	262	---	40		---
100/200	170	405	160	215	262	1025	40		---
125/250	225	466	160	212	314	---	63		---
150/200	225	466	160	215	262	1145	63	M20x1,5	---
150/300	225	466	160	250	343	---	63		---
250/500	345	675	210	310	430	1680	100		---

*) There are only values of recommended combination of inlet and outlet dimensions mentioned in the table Note: The values of weight are approximate. For missing data contact the producer.

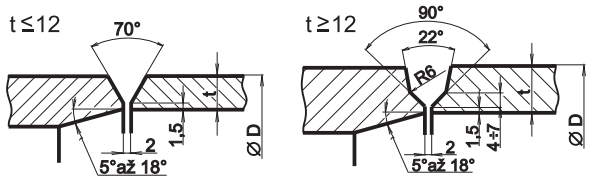
Weld ends connection dimensions

	PN							
	16 - 40	63	100	160	250	320**	400**	16-400
DN	t	t	t	t	t	t	t	D
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	2.6	2.6	2.9	4	5	6	7.1	33.7
40	2.6	2.9	3.6	5	7	6.8	11	48.3
50	2.9	3.2	4.5	6.3	8	10	14.2	60.3
65	3.2	3.6	5	7	10	13	17.5	76.1
80	3.6	4	5.6	8	12.5	14.2	19	88.9
100	4	5	7	10	14	16	20	114.3
125	4.5	5.6	8	12.5	18	20	23	139.7
150	5	7	10	14	20	23	26	168.3
200	6.3	8	12.5	18	25	28	32	219,1
250	7	10	16	22	32	35	38	273
300	8	12.5	18	25	---	---	---	323.9
350	9	12.5	20	28	---	---	---	355.6
400	11	14	20	32	---	---	---	406.4
500	14	18	25	---	---	---	---	508
600*	18	23	---	---	---	---	---	610
700*	23	---	---	---	---	---	---	721

* For DN 600 and 700 - weld ends connection acc. to LDM execution

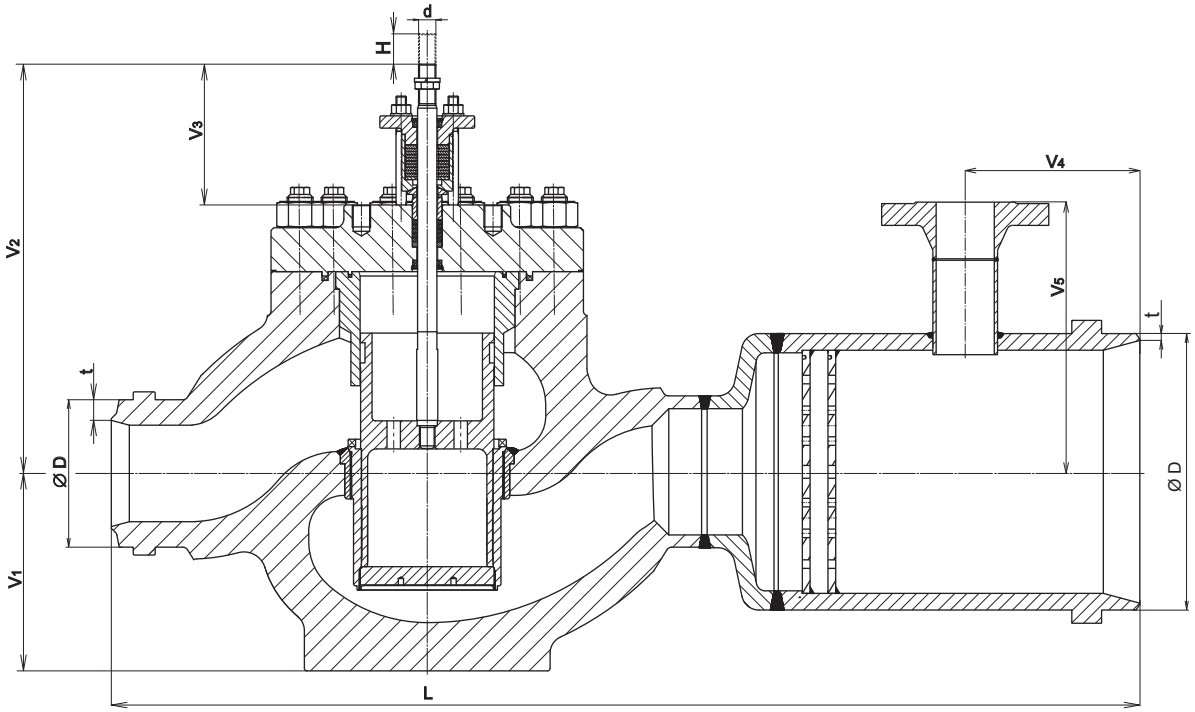
** For PN 320, 400 - weld ends connection acc. to LDM execution

Connecting dimensions of weld ends can be modified on request by the customer.



Other shapes of weld ends after agreement with producer

Steam-conditioning station RS 702 with weld ends



Valve complete specification No. for ordering RS 702

			XX	X X X	X X X	X X X X	X X		XXxXX	/	XXX	-	XX/XX
1. Type of valve	Control valve		RS										
2. Series	Control valve, straight-through			7 0 2									
3. Type of actuating	Electric actuator				E								
	Pneumatic actuator				P								
	Electric actuator Modact MTR [2]				E P D								
	Electric actuator Modact MTN Control [2]				E Y A								
	Electric actuator Modact MTP Control [2]				E Y A								
	El. actuator Modact MTNED [2], MTPED [2]				E Y A								
	Electric actuator Modact MTN [2], MTP [2]				E Y B								
	El. actuator ST 2 [2], STR 2 [2], STR 2PA [2]				E P M								
	Electric actuator Auma SA 07.6				E A E								
	Electric actuator Auma SA Ex 07.6				E A F								
	Electric actuator Auma SAR 07.6				E A G								
	Electric actuator Auma SAR Ex 07.6				E A H								
	Electric actuator Auma SA 10.2				E A I								
	Electric actuator Auma SA Ex 10.2				E A L								
	Electric actuator Auma SAR 10.2				E A J								
	Electric actuator Auma SAR Ex 10.2				E A K								
	Electric actuator Schiebel AB5				E Z E								
	Electric actuator Schiebel exAB5				E Z F								
	Electric actuator Schiebel rAB5				E Z G								
	Electric actuator Schiebel exrAB5				E Z H								
	Pneumatic actuator Flowserve PO 700 [1]				P F G								
	Pneumatic actuator Flowserve PO 1502 [1]				P F D								
4. Connection	Weld ends					4							
5. Body material	Cast steel 1.0619	(-20 to 400°C)				1							
	Stainless steel 1.4931	(-20 to 600°C)				5							
	Alloy steel 1.7357	(-20 to 550°C)				6							
	Alloy steel 1.7357	(-20 to 550°C)				7							
	Other material acc. to request					9							
6. Packing	Grafit - Live Loading					5							
7. Multi-step pressure red.	One-step pressure reduction					1							
	Two-step pressure reduction					2							
8. Flow characteristic	Linear - Leakage rate class III.						L						
	Linear - Leakage rate class V.						D						
	Equal-percentage - Leakage rate class III.						R						
	Equal-percentage - Leakage rate class V.						Q						
9. No. of orifice plates	Max. 3						X						
10. Nominal pressure	PN inlet / outlet								XX/XX				
11. Operating temperature °C	Acc. to process medium										XXX		
12. Nominal size	DN - acc. to the valve´s execution												XX/XX

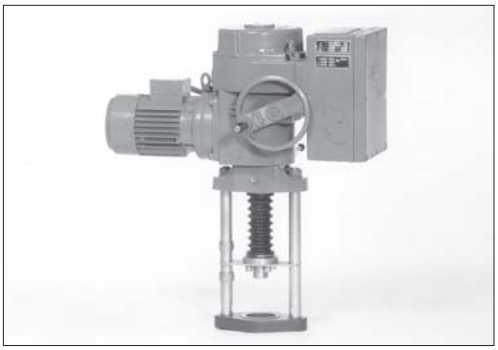
[1] *Pneumatic actuators only for DN 150*

[2] *Applycable to max. DN 150*

Ordering example: Steam-conditioning station with water injection, DN 80/150, PN 160/100, with electric actuator Modact MTN Control, body material: carbon steel, connection: weld ends, packing: graphite, two-step pressure reduction, one orifice plate at outlet, with linear flow characteristic is specified as follows:
RS702 EYA 4152 L1 160x100/400-80/150

Note

PN and DN of outlet, multi-step pressure reduction No. of orifice plate possibly different type of actuating is possible after the agreement with the producer.
Further it is necessary to specify in the order the parametres of injection water possibly the type of injection nozzle (VH) acc. to the data sheet No. 02-03.2 or (VHP) acc. to the data sheet No. 02-03.3



EYA
EYB

Electric actuators Modact MTN, MTP and Modact MTN, MTP Control, type 52 442 ZPA Pečky

Technical data

Type	Modact MTN Control	Modact MTN	Modact MTP Control	Modact MTP
Marking in valve specification No.	EYA	EYB	EYA	EYB
Voltage	3 ~ 230 V / 400 V			
Frequency	50 Hz			
Motor power	See specification table			
Control	3 - position, with regulator ZP2.RE5			
Nominal force	15 and 25 kN			
Travel	10 to 100 mm			
Enclosure	IP 55		IP 67	
Process medium max. temp.	Acc. to used valve			
Ambient temperature range	-25 to 55°C			
Ambient humidity range	5 - 100 % with condensation			
Weight	33 kg			

Note:
Detailed technical informations and wiring diagrams can be found in producer's datasheet or on the webside **www.zpa-pecky.cz.**

Specification of actuators Modact MTN, MTP and Modact MTN, MTP Control

Basic equipment	2 power switches MO, MZ	1 position transmitter - resist. 2x100 Ω or current
	2 limit switches PO, PZ	1 anti-condensation heater
	2 limit and signalisation switches SO, SZ	1 three phase asynchronous motor

Basic technical parameters

Type	Power switch setting range kN	Direct power kN	Resetting speed mm.min^{-1}	Travel mm	Power W	Electric motor			Weight	Specification No.	
						RPM 1/min	In (400V) A	Iz / In	Aluminium [kg]	Basic	Additional [2]
MTN 15 MTP 15	11,5 - 15	17	50	10 - 100	180	850	0.74	2.3	33	52 442	XX0XXM
			80		180	850	0.74	2.3			XX1XXM
			125		250	1350	0.77	3.0			XX3XXM
			36		120	645	0.51	2.2			XX2XXM
			27		120	645	0.51	2.2			XXAXXM
MTN 25 MTP 25	15 - 25	32,5	50	10 - 100	180	835	0.74	2.3	33		XX4XXM
			80		180	835	0.74	2.3			XX5XXM
			125		250	1350	0.77	3.0			XX6XXM
			36		120	645	0.51	2.2			XX7XXM
			27		120	645	0.51	2.2			XX8XXM

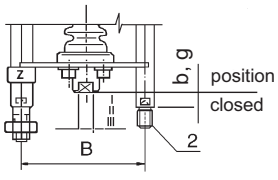
Execution, electric connection	
Via terminal board	6XXXXM
With conector HARTING	7XXXXM
Execution Modact MTN; Modact MTN Control ... enclosure IP55	XXXXNM
Execution Modact MTP; Modact MTP Control ... enclosure IP67	XXXXPM

		Current transmitter CPT without source	Current transmitter DCPT with source
Position transmitter	current 4 - 20 mA	XXX0XM	XXXRXM
	current 4 - 20 mA with BMO	XXX1XM	XXXSXM
	resistance transmitter 2x 100 Ω	XXX2XM	
	resistance transmitter 2x 100 Ω s BMO	XXX3XM	
	without transmitter, with BMO	XXXPXM	
	without transmitter, without BMO	XXXZXM	

Additional electric equipment [1]			Resistance transmitter 2x 100 ohm	Current transmitter CPT without source	Current transmitter DCPT with source
Modact Control execution (with built-in contactor combination)	without BMO	Without brake BAM and positioner	XXX4XM	XXXAXM	XXXKXM
		With brake BAM, without positioner	XXX5XM	XXXBXM	XXXLXM
		With brake BAM and with positioner		XXXCX5M [3]	
	with BMO	Without brake BAM and positioner	XXX7XM	XXXDXM	XXXMXM
		With brake BAM, without positioner	XXX8XM	XXXEXM	XXXNXM
		With brake BAM and with positioner		XXXFX5M [3]	

Notes:
[1] When execution with blinker is requested, specify this requirment in writing: Execution with blinker
[2] Design without force locking after reversation have at end position capital letter M (for example: 52442.6M51)
[3] For actuators MODACT MTN Control s with position controllers ZP2.RE5 specify number 5 on place 11 (for example: 52442.6M5FN5M)

Connection dimensions - details of additional specification No. 52 442

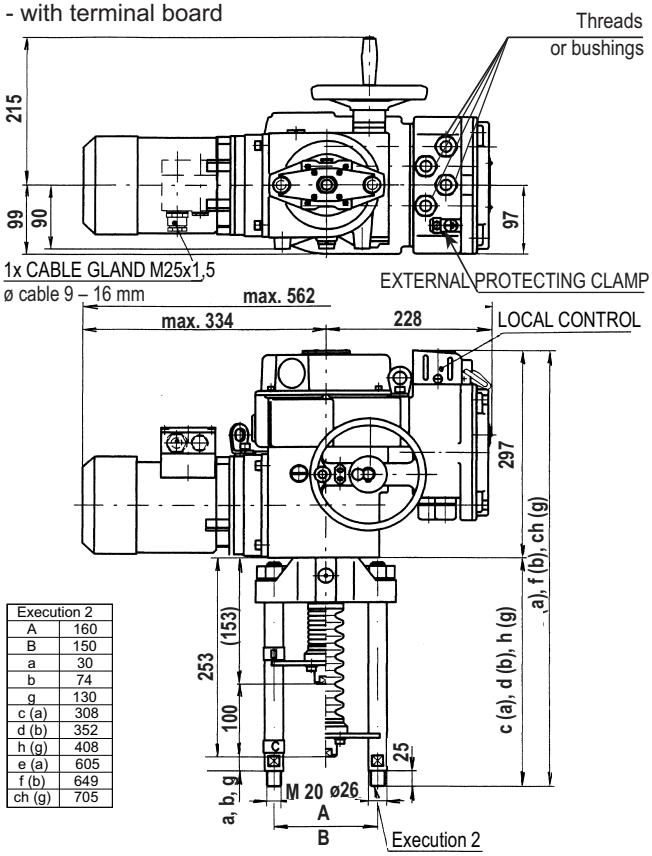


Pitch of columns	B	150
Position "closed"	b	74
	g	130
Clutch thread	I	M 20x1,5
	II	M 16x1,5
	III	M 10x1

Execution	Specification No.		For valves
	basic	additional	
Bg2II	52 442	XYXXXM	RV, RS 70x DN 40 to 80
Bg2III	52 442	XYXXXM	RV, RS 70x DN 25
Bg2I	52 442	XRXXXM	RV, RS 70x DN 100 to 150

Dimensions of actuator Modact MTN, MTP

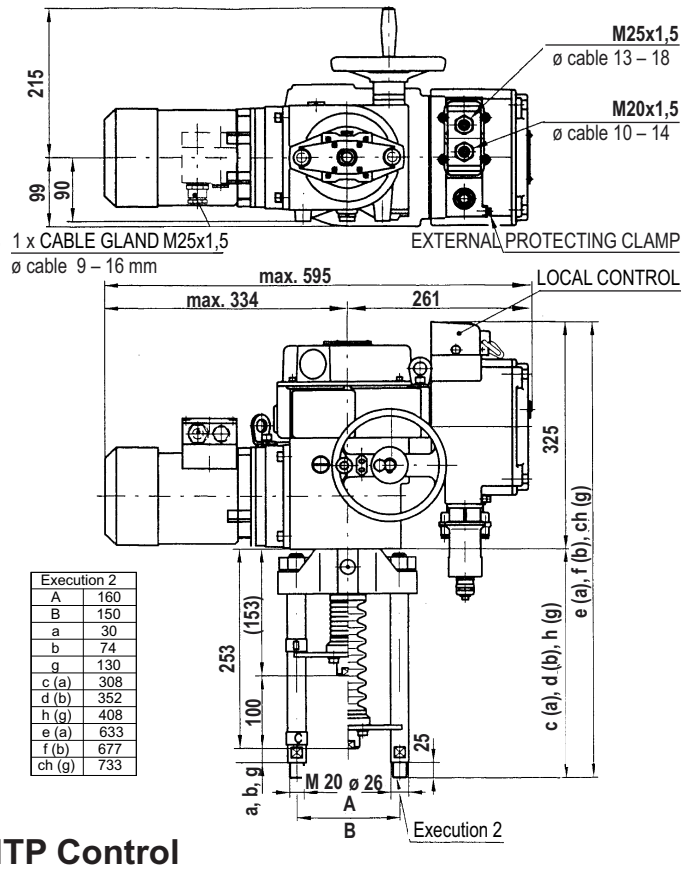
- with terminal board



Execution 2	
A	160
B	150
a	30
b	74
g	130
c (a)	308
d (b)	352
h (g)	408
e (a)	605
f (b)	649
ch (g)	705

Dimensions of actuator Modact MTN, MTP and Modact MTN, MTP Control

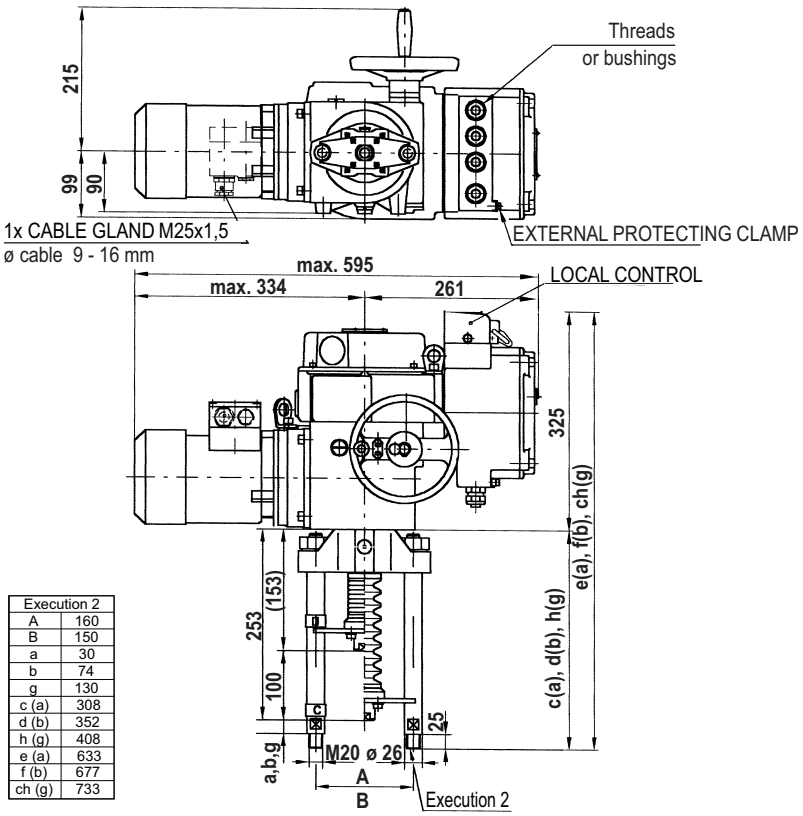
- with conector



Execution 2	
A	160
B	150
a	30
b	74
g	130
c (a)	308
d (b)	352
h (g)	408
e (a)	633
f (b)	677
ch (g)	733

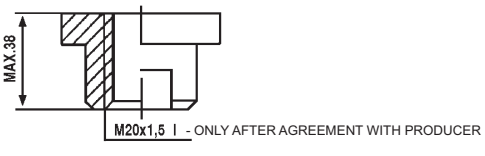
Dimensions of actuator Modact MTN, MTP Control

- with terminal board

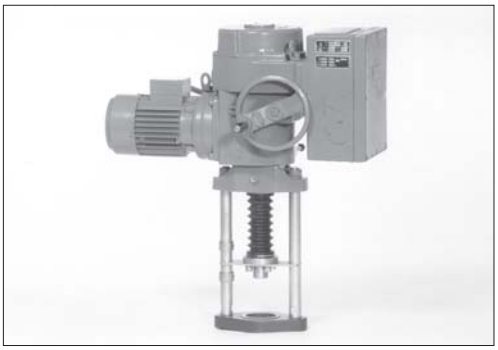


Execution 2	
A	160
B	150
a	30
b	74
g	130
c (a)	308
d (b)	352
h (g)	408
e (a)	633
f (b)	677
ch (g)	733

Detail of coupling



EYA



Electric actuators Modact MTNED and Modact MTPED, typ 52 442 ZPA Pečky

Technical data

Type	Modact MTNED	Modact MTPED
Marking in valve specification No.	EYA	
Execution	The actuator equiped with electronic system DMS2 or DMS2 ED	
Voltage	3 ~ 230 V / 400 V	
Frequency	50 Hz	
Motor power	See specification table	
Control	3 - position, or continuous	
Nominal force	15 to 25 kN	
Travel	10 to 100 mm	
Enclosure	IP 55	IP 67
Process medium max. temp.	Acc. to used valve	
Ambient temperature range	-25 to 55°C	
Ambient humidity range	5 - 100 % with condensation	
Weight	33 kg	

Note: Detailed technical informations and wiring diagrams can be found in producer's datasheet or on the webside **www.zpa-pecky.cz.**

Electric equipment

System DMS2 ED
The more simple system DMS2 ED substitutes electromechanical parts and/or provides for controlling the electric actuator by input analog signal as in the version Control.

Basic equipment	
Control unit	It also contains the sensor of position of the output shaft, 4 push-buttons and 3 signal LEDs for setting and checking the actuator.
Torque-limit unit	
Source unit	Contacts of seven relays (MO, MZ, PO, PZ, SO, SZ, READY) are connected to the terminal board; state of each relay is signalized by LED. The unit enables the heating resistor to be connected and controlled by the thermostat.
Optional equipment	
Feedback signal	4-20 mA
Analog regulator	
Position Indicator	LED display
Relay control or contactless control unit	
Electronic brake	

System DMS2
The system DMS2 enables the electric actuator to be used for two-position and three-position regulation or to be connected to the industrial bus bar Profibus.

Basic equipment	
Control unit	It also includes a sensor of the output shaft position 2 signal LED
Torque-limit unit	
Source unit	- 2 relays for electric motor control - Relay *Ready* with change-over contact connected to the terminal board - Signalling relays 1 - 4 with one pole of the switching contact connected to the terminal board Second poles of the switching contacts of relays 1 - 4 are interconnected and brought out to the terminal COM Heating resistor switched by a thermostat is connected to the unit The unit controls power switches of the electric motor (reversing relay) To the unit can be connected an electronic brake
Unit of display	Two-row display, 2 x 12 alpha-numeric characters
Unit of push-buttons	Push-buttons *"Open", "Close", "Stop";* Selector switch *"Local", "Remote", "Stop"*
Recommended equipment	
Electronic brake	After switching-off the motor reduces running down and precises the control
Optional equipment *(the electric actuator must be fitted with one of these units)*	
Unit of two- and three-position control	Control of the electric actuator by shifting to position Open and Close or by analog signal 0(4) - 20 mA
Unit of connection Profibus	Control of the electric actuator by industrial bus bar Profibus

Note: The electronic control DMS2 checks, within its function, sequence and fall-out of phases of supply voltage.

Specification of actuators Modact MTNED a MTPED

Basic technical parameters

Type	Power switch setting range kN	Direct power kN	Resetting speed mm.min^{-1}	Travel mm	Power W	Electric motor			Weight	Specification No.	
						RPM 1/min	In (400V) A	Iz / In	Aluminium [kg]	Basic	Additional
MTNED 25 MTPED 25	15 - 25	32,5	50	10 - 100	180	835	0.74	2.3	33	52 442	XX4XXED
			80		180	835	0.74	2.3			XX5XXED
			125		250	1350	0.77	3.0			XX6XXED
			36		120	645	0.51	2.2			XX7XXED
			27		120	645	0.51	2.2			XX8XXED
Execution Modact MTNED ... enclosure IP55											XXXXNED
Execution Modact MTPED ... enclosure IP67											XXXXPED

Execution, circuity, electronic equipment

	Terminal board	Conector	Terminal board, brake	Conector, brake
DMS2, ED electronics	EXXXXED	FXXXXED	HXXXXED	KXXXXED
DMS2, Profibus electronics	PXX0XED	TXX0XED	UXX0XED	YXX0XED
DMS2, 2-position or 3-position control *)	RXX0XED	VXX0XED	WXX0XED	1XX0XED

*) Producer will set in production 2- or 3- position control. If not specified in the order, the gearmotor is set to 3-position control (signal control 4-20 mA).

Equipment of DMS2ED electronics

Equipment		Character at the 9. position (52 442 xxxXxED)																						
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	H	J	K	L	M	N	P	R
Local control			x		x		x		x		x		x		x		x		x		x		x		x
Display				x	x			x	x			x	x			x	x			x	x			x	x
Relay						x	x	x	x					x	x	x	x					x	x	x	x
Analog module	Transmitter									x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Regulator																	x	x	x	x	x	x	x	x

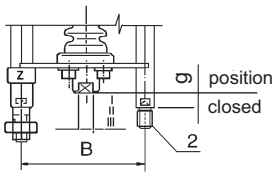
Note: In the case of using an electronic DMS2 is the character at the 9. position 0

Ambient temperature (°C)	Actuator type				Marking
	MTNED		MTPED		
	DMS2 ED	DMS2	DMS2 ED	DMS2	
-25 +70	YES	YES	NO	NO	---
-40 +60	YES	YES	YES	YES	F1
-25 +60	---	---	YES	YES	---

Note: YES - supplied
NO - not available

Relative humidity from 10% to 100% with condensation.

Connection dimensions - details of additional specification No. 52 442

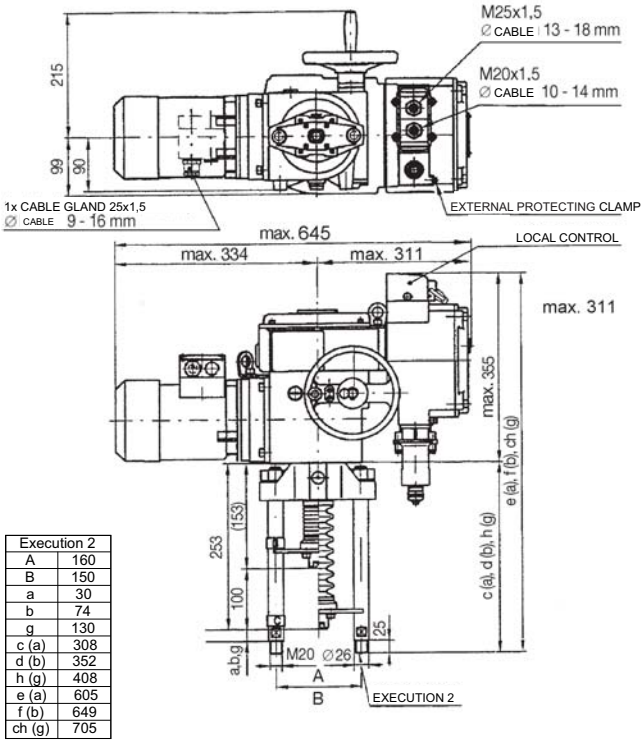


Pitch of columns	B	150
Position "closed"	g	130
Clutch thread	I	M 20x1,5
	II	M 16x1,5
	III	M 10x1

Execution	Specification No.		For valves
	basic	additional	
Bg2II	52 442	XYXXXED	RV, RS 70x DN 40 to 80
Bg2III	52 442	XYXXXED	RV, RS 70x DN 25
Bg2I	52 442	XRXXXED	RV, RS 70x DN 100 to 150

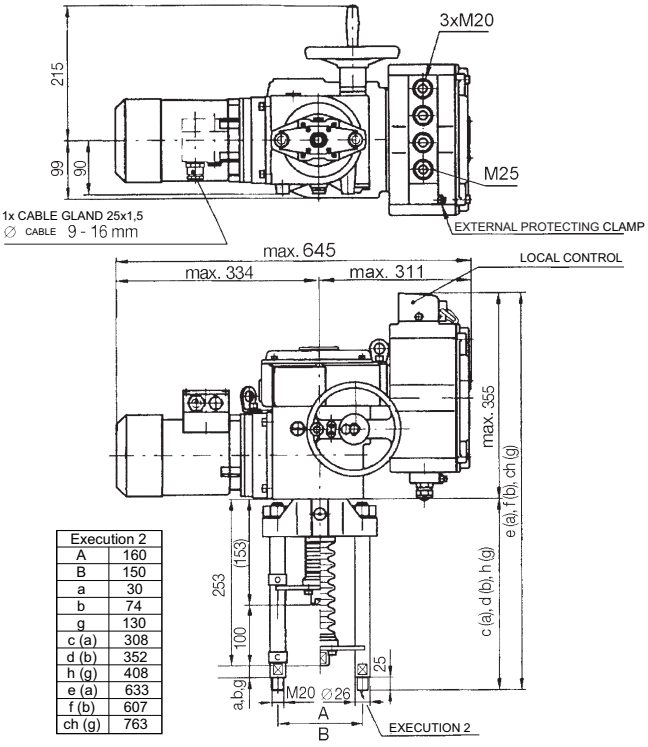
Dimensions of actuator Modact MTNED/MTPED

- with conector



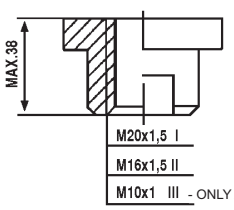
Execution 2	
A	160
B	150
a	30
b	74
g	130
c (a)	308
d (b)	352
h (g)	408
e (a)	605
f (b)	649
ch (g)	705

- with terminal board



Execution 2	
A	160
B	150
a	30
b	74
g	130
c (a)	308
d (b)	352
h (g)	408
e (a)	633
f (b)	607
ch (g)	763

Detail of coupling



EPD

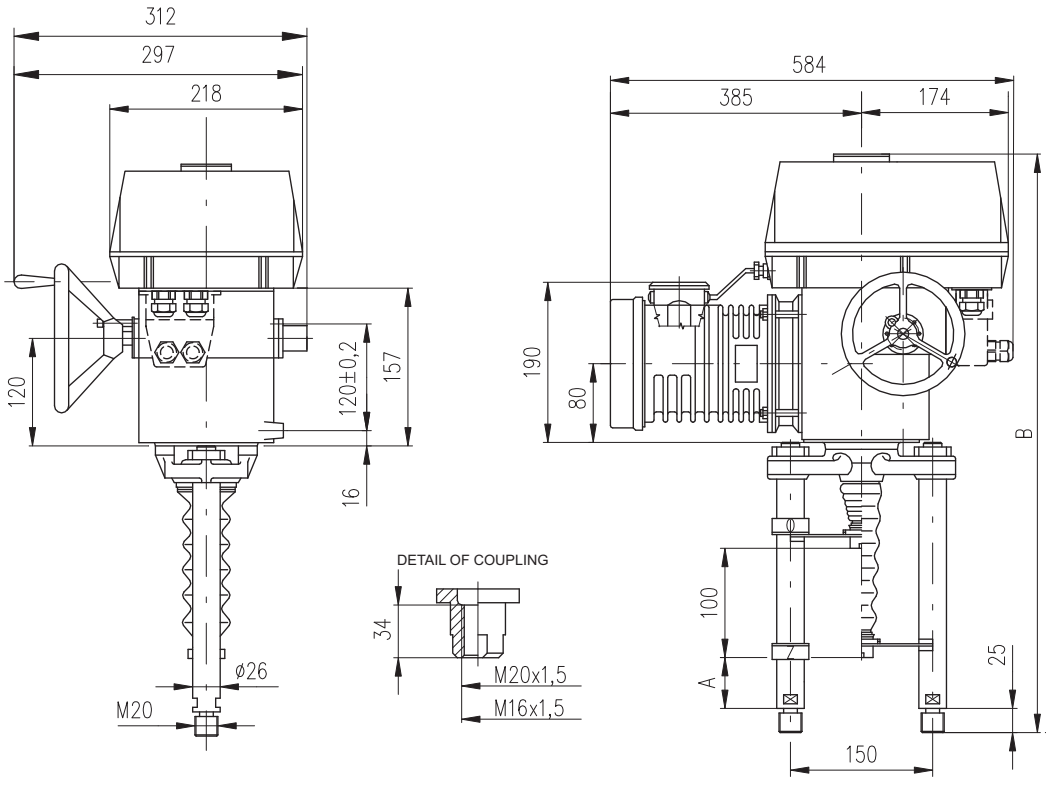
Electric actuator Modact MTR Regada

Technical data

Type	Modact MTR
Marking in valve specification No.	EPD
Voltage	230 V AC
Frequency	50 Hz
Motor power	16 or 25 W
Control	3 - pos. c. (in connection with NOTREP positioner - continuous)
Nominal force	16, 25 kN
Travel	12,5 to 100 mm
Enclosure	IP 55 / IP 67
Process medium max. temperature	Acc. to used valve
Ambient temperature range	-25 to 55°C
Ambient humidity limit	90 %
Weight	27 to 31 kg

Note: Detailed technical informations can be found in producer's data sheet or on the webside **www.regada.sk**

Dimensions of actuator Modact MTR



columns	with acme thread		for valves
verze	A	B	
P-1045a/H	130	702	RV, RS 70x DN 25 -150

#) RV, RS 70x, DN 100 to 150
##) RV, RS 70x, DN 80, 50, 25

Specification of Modact MTR

Electric actuator MTR, linear		52 420.	X	-	X	X	X	X	X	/	X	X
Mild up to hot dry with temperature range (-25 °C to +50 °C)	Enclosure IP 55		0									
	Enclosure IP 67		1									

Electric conection	Voltage									
To terminal board	230 V AC		9							
To connector			8							

Screw version		Switching-off thrust 1) 2)	Rated operating speed	Operating speed	Electric motor Power	Speed	Current								
ball screw	16 000/32-G	10.0 - 16.0 kN	32 mm/min.	38 - 32 mm/min.	16 W	1 150	0.31 A			E					
	25 000/32-G	10.0 - 25.0 kN	32 mm/min.	38 - 32 mm/min.	25 W	1 250	0.41 A			G					
	16 000/50-G	10.0 - 16.0 kN	50 mm/min.	60 - 50 mm/min.						H					

Control board version	Operating stroke								
Electromechanical control board - without local control	16 mm				B				
	25 mm				C				
	40 mm				E				
	63 mm				F				

Transmitter		Connection	Output									
Without transmitter		—	—					A				
Resistive	Single	—	1x100 Ω					B				
	Double		2x100 Ω					C				
	Single		1x2000 Ω					F				
	Double		2x2000 Ω					P				
Resistive with current converter	Without power supply	2-wire	4 - 20 mA					S				
	With power supply							Q				
	Without power supply	3-wire	0 - 20 mA					T				
	With power supply							U				
	Without power supply		4 - 20 mA					V				
	With power supply							W				
	Without power supply		0 - 5 mA					Y				
	With power supply							Z				
Capacitive CPT	Without power supply	2-wire	4 - 20 mA					I				
	With power supply							J				

Mechanical connection	Connecting hight / stroke	Pillar spacing / Bore of flange	Thread of stem 3)	Dimensional drawing								
Columns	130/100	150/ —	M20x1.5 M16x1.5, M10x1	P-1045a/H					C			

Additional equipment			
	Without additional equipment; adjusted max. switching-off thrust from range	0	1
A	2 additional position switches S5,S6	0	2
B	Adjustment of switching-off thrust for required value	0	3

Possible combinations and execution: A+B = 07

Notes:

1) State the switching-off thrust in your order by words. If not stated it is adjusted to the maximum rate of the corresponding range. The load torgue equals minimally the maximum switching-off thrust of the choosing range multiplied by 1.3.
2) The maximum load thrust equals the max. Switching-off thrust multiplied by:
   - 0.8 for duty cycle S2-10 min., or S4-25%, 6 - 90 cycles per hour
   - 0.6 for duty cycle S4-25%, 90 - 1200 cycles per hour
3) The thread in the coupling is to be specified in the order by words.

EPM

Electric actuators ST 2, STR 2 Regada

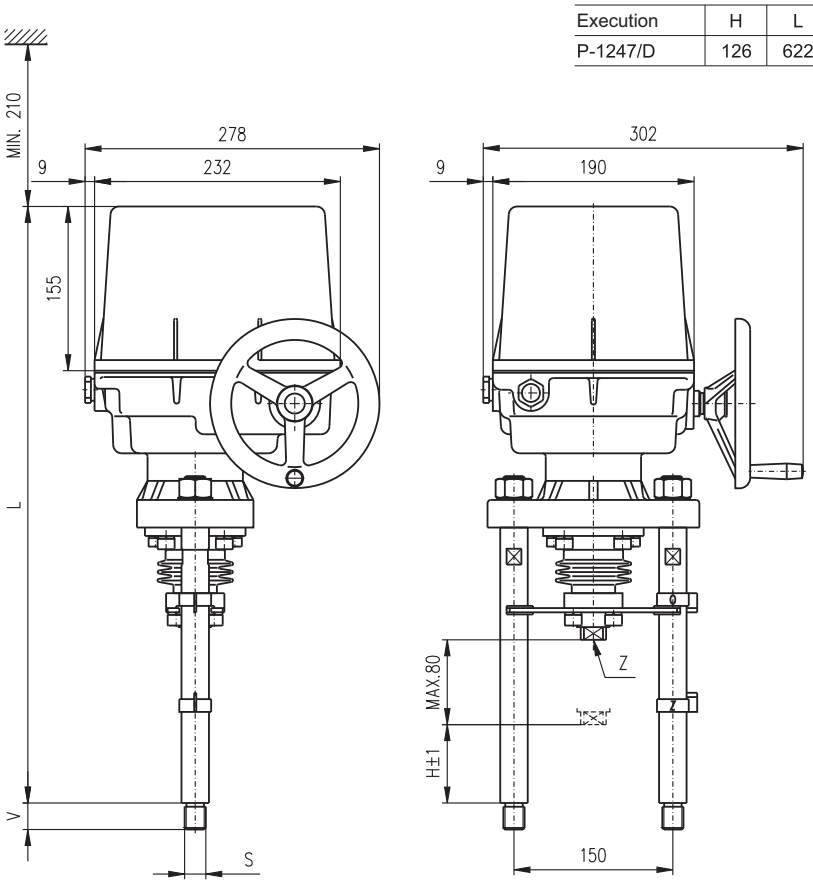
Technical data

Type	ST 2, STR 2
Marking in valve specification No.	EPM
Voltage	1 ~ 230 V AC, 3 ~ 400 V AC
Frequency	50 Hz
Motor power	*see specification table*
Control	3 - position control with positioner 0 - 10 V, (0) 4 - 20 mA
Nominal force	16 a 25 kN
Travel	16, 25, 40 and 64 mm
Enclosure	IP 65 / IP 67
Proces medium max. temperature	Acc. to used valve
Ambient temperature range	-25 to 55°C
Ambient humidity range	5 - 100% with condensation
Weight	17 to 21,5 kg

Note: Detailed technical informations can be found in producer's data sheet or on the webside **www.regada.sk**

Dimensions of actuators

Execution	H	L	S	V	Z	
P-1247/D	126	622	M20	25	M10 x 1,0; M16 x 1,5 M20 x 1,5	RV, RS 70x DN 25 to 150



Specification of actuator ST 2, STR 2

Electric actuator ST 2, STR 2				492.	X	-	X	X	X	X	X	/	X	X
Resistance to surroundings	Standard	IP 65	Without positioner (ST 0.1)		0									
		IP 67			1									
	Tropical	IP 67			6									
	Standard	IP 65	With positioner (STR 0.1)	Resistive feedback	A									
		IP 65		Current feedback	C									
	Tropical	IP 67		Resistive feedback	G									
		IP 67		Current feedback	J									
Electric connection	To terminal board		Wiring diagram	24 V DC			A							
				230 V AC			0							
				3x400 V AC 1)			2							
				24 V AC			3							
				3x400 V AC			9							
	To connector			24 V DC			C							
				230 V AC			5							
				24 V AC			8							
				3x400 V AC 1)			6							
				3x400 V AC			7							
230 V AC		3x400 V AC												
Nominal force[N]	Výkon elektromotoru	Nominal force[N]	Motor power	Running speed										
25 000	20 W	---	90 W	10 mm/min				A						
16 000								J						
25 000	60 W	25 000		20 mm/min				B						
16 000		16 000						L						
25 000		25 000		40 mm/min				C						
16 000		16 000						R						
---		25 000		60 mm/min				D						
16 000		---						V						
---		16 000						W						
16 000		---		80 mm/min				E						
---		16 000						Y						
		16 000		100 mm/min				Z						
Operating stroke	Max. Without transmitter 2) ... 80 mm	With transmitter		16 mm					D					
				25 mm					F					
				40 mm					H					
				64 mm					J					
Remote position transmitter	Without transmitter									A				
	Resistance	Single	Connection / Feedback	1 x 100 Ω						B				
				1 x 2000 Ω						F				
		Double		2 x 100 Ω						K				
				2 x 2000 Ω						P				
	Electronic - current	Without its source	2-wire	4 - 20 mA						S				
			3-wire	0 - 20 mA						T				
				4 - 20 mA						V				
		With its source 3)	2-wire	4 - 20 mA						Q				
			3-wire	0 - 20 mA						U				
				4 - 20 mA						W				
	Capacity	Without its source	2-wire	4 - 20 mA						I				
		With its source 3)								J				
Mechanical connection 4)	DN 25, clutch M10x1, DN 40 - 80, clutch M16x1,5										M			
	DN 100 - 150, clutch M20x1,5													
Accessories	A	2 auxiliary position switches											0	0
	E	Space heater with terminal switch											0	2
	C	Manual control											0	7
	D	Space heater											1	5
	G	Adjustment of switch-off thrust to the required value											2	5

Allowed combination of accessories and codes:
A+E=04, A+C=08, C+E=10, A+C+E=12, A+D=16, C+D=17, A+C+D=18, A+G=26, E+G=27, C+G=28, D+G=29, A+E+G=30, A+C+G=31, A+D+G=32, C+E+G=33,C+D+G=34, A+D+E+G=35, A+C+D+G=36

1) Version with reverse contacts
2) The version without any transmitter can have adjusted its stroke from 0 up to 80 mm
3) Active position transmitter for version 24 V DC only after agreement with producer
4) Coupling thread must be specified verbally

EPM

Electric actuators
STR 2PA
Regada

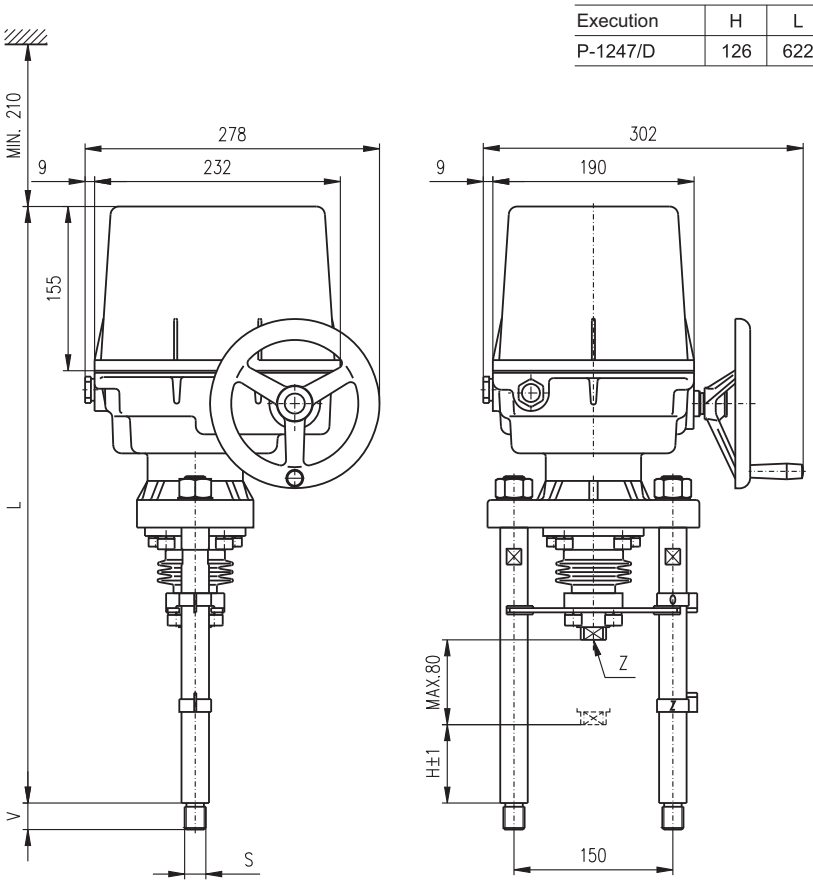
Technical data

Type	STR 2PA
Marking in valve specification No.	EPM
Voltage	1 ~ 230 V AC, 3 ~ 400 V AC
Frequency	50 Hz
Motor power	*see specification table*
Control	3 - position control with positioner 0 - 10 V, (0) 4 - 20 mA
Nominal force	16 a 25 kN
Travel	16, 25, 40 and 64 mm
Enclosure	IP 67
Proces medium max. temperature	Acc. to used valve
Ambient temperature range	-25 to 55 ℃
Ambient humidity range	5 - 100% with condensation
Weight	17 to 21 kg

Note: Detailed technical informations can be found in producer's data sheet or on the webside **www.regada.sk**

Dimensions of actuators

Execution	H	L	S	V	Z	
P-1247/D	126	622	M20	25	M10 x 1,0; M16 x 1,5 M20 x 1,5	RV, RS 70x DN 25 to 150



Specifikace pohonu STR 2PA

Elektrický servomotor STR 2PA				432.	X	-	X	X	X	X	X	/	X	X
Resistance to surroundings	IP 67				1									
Electric connection	Terminal board	Voltage	230 V AC				0							
			3 ~ 400 V AC				2							
Nominal force [N] 230 V AC	Nominal force [N] 3 ~ 400 V AC	Running speed												
25 000	---	10 mm/min						A						
16 000								J						
25 000	25 000	20 mm/min						B						
16 000	16 000							L						
25 000	25 000	40 mm/min						C						
16 000	16 000							R						
---	25 000	60 mm/min						D						
16 000	---							V						
---	16 000							W						
16 000	---	80 mm/min						E						
---	16 000							Y						
	16 000	100 mm/min						Z						
Travel		10-80 mm							K					
Control board: DMS3 ED	Control: ON - OFF by feeding power supply 230 V AC		Feedback: 4 - 20 mA pasive							N				
Control board: DMS3	Control: ON - OFF and inching	24 V DC	Feedback: ---							F				
	Control: Modulating 0/4 - 20 mA	ON - OFF and inching 24 V DC	Feedback: 4 - 20 mA pasive							G				
	Control: Modulating 0/2 - 10 V									H				
Mechanical connection [1)]	DN 25, clutch M10x1, DN 40 - 80, clutch M16x1,5										M			
	DN 100 - 150, clutch M20x1,5													
Accessories		None												
	A	Adjustment of operating stroke to the required value											0	1
	B	Adjustment of switch-off thrust to the required value											0	3
	D	Additional relays R3, R4, R5											0	5
	F	Manual control for actuators with DMS3 a LCD system											0	7
	G	Manual control for actuators with DMS3 ED system											0	8

Allowed combination of accessories and codes:
A+B=20, A+D=22, A+F=24, A+G=25, A+B+D=52, A+B+F=54, A+B+G=55, A+B+D+F=114, A+B+D+G=115, A+D+F=63, A+D+G=64, B+D=29, B+F=31, B+G=32, B+D+F=80, B+D+G=81, D+F=40, D+G=41

1) Coupling thread must be specified verbally

EAE, EAF, EAG, EAH
EAI, EAL, EAJ, EAK, EAM

Electric actuators
SA (Ex) 07.6, SAR (Ex) 07.6
SA (Ex) 10.2, SAR (Ex) 10.2
SAR 14.2
Auma

Technical data

Type	SA 07.6	SA Ex 07.6	SAR 07.6	SAR Ex 07.6	SA 10.2	SA Ex 10.2	SAR 10.2	SAR Ex 10.2	SAR 14.2
Marking in valve specification No.	EAE	EAF	EAG	EAH	EAI	EAL	EAJ	EAK	EAM
Voltage	1 ~ 230 V AC; 3 ~ 380 or 400 V AC								
Frequency	50 Hz								
Motor power	See specification table								
Control	3 - position control or with signal 4 - 20 mA								
Nominal force	60 Nm ~ 30 kN; 30 Nm ~ 15 kN; 40 Nm ~ 20 kN					60 Nm ~ 16 kN; 80 Nm ~ 21 kN			
Travel						100 Nm ~ 27 kN; 120 Nm ~ 32 kN			
Enclosure	16, 25, 40, 63, 100 mm								
Process medium max. temperat.	IP 67								
Ambient temperature range	acc. to used valve								
Ambient humidity limit	-40 to 80°C	-20 to 60°C	-40 to 60°C	-20 to 60°C	-40 to 80°C	-20 to 60°C	-40 to 60°C	-20 to 60°C	
Weight	100 %								
	1-phase motor 45 kg; 3-phase motor 21 kg					1-phase motor 49 kg; 3-phase motor 25 kg			

Note: Detailed technical informations can be found in producer's data sheet or on the webside **www.auma.com**

Specification of Auma actuators

		SA	X	XX		XX.X
Type		SA				
Duty	Control		R			
Execution	Non-explosive			Ex		
	Standard					
Actuator´s size	07.6					07.6
	10.2					10.2
	14.2					14.2

Output shaft type A (thread TR 36x6 LH, flange F10)

Output speed (rpm)		Tripping torgue	SA (Ex) 10.2 SAR (Ex) 10.2	Motor power [kW]	SA 10.2, SA Ex 10.2, SAR 10.2, SAR Ex 10.2
	4				0,06
	5,6				0,06
	8				0,12
	11		60-120 Nm		0,12
	16				0,25
	22				0,25
	32				0,4
	45				0,4

Output shaft type A (thread TR 20x4 LH, f F10)

Output speed (rpm)		Tripping torgue	SA 07.6 SAR (Ex) 07.6	Motor power [kW]	SA 7.6, SA Ex 7.6, SAR 7.6, SAR Ex 7.6
	4				0,03
	5,6				0,03
	8				0,06
	11		30-60 Nm		0,06
	16				0,12
	22				0,12
	32				0,2
	45				0,2

Accessories

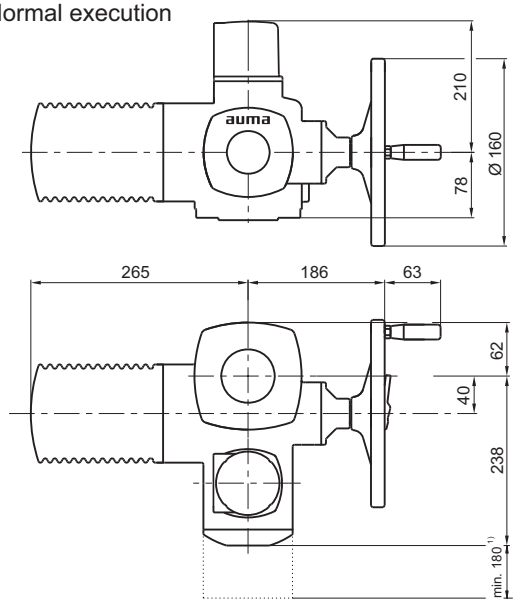
2 TANDEM switches
Gearing for signalisation of position
Mechanical position indicator
Potentiometer 1x200 Ω
Electronic position transmitter RWG (potentiometer included), 4 - 20 mA, 2-wire
Electronic position transmitter RWG (potentiometer included), 4 - 20 mA, 3/4-wire
Inductive position transmitter IWG, 4 - 20 mA
MATIC - for continuous control (specification of accessories acc. to catalogue of producer)
AUMATIC - for continuous control (specification of accessories acc. to catalogue of producer)

Other accessories acc. to catalogue of producer of actuators.

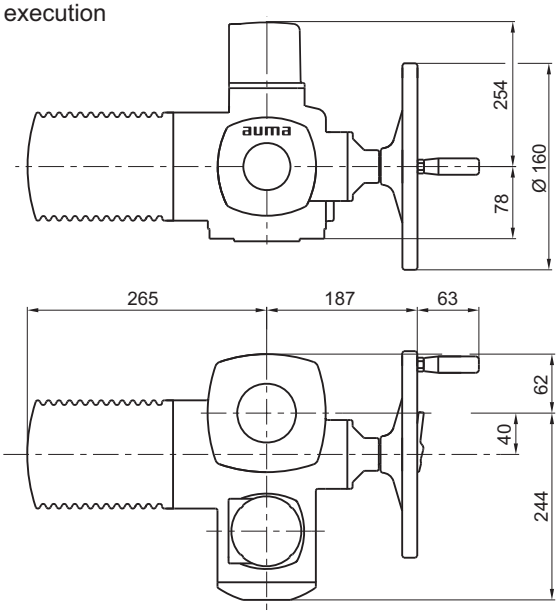
Dimension of Auma actuators 07.6

3-phase execution only, for dimensions of 1-phase execution see in producer's data sheet or on the webside **www.auma.com**

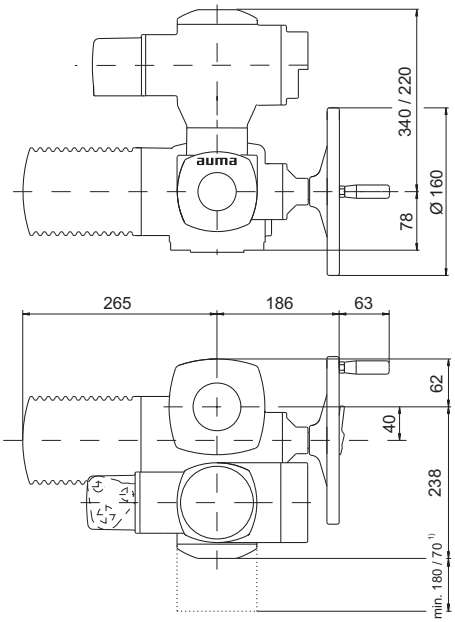
Normal execution



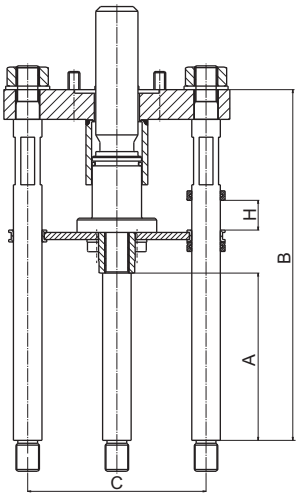
Ex execution



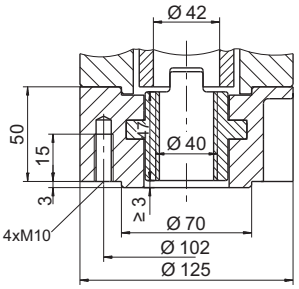
Version MATIC / AUMATIC



Connection acc. to ISO 5210
Output drive, F10, Tr36x6-LH



Output drive A, F10

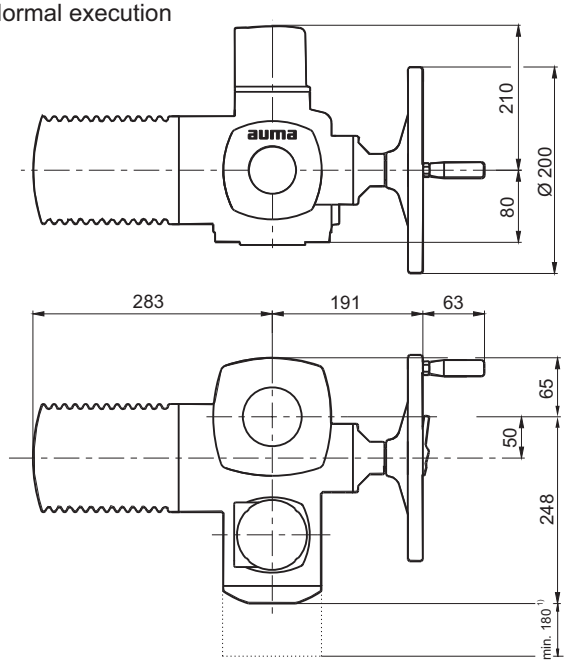


For valves	Number of columns	A	B	H	C	Weight
RV, RS 70x DN 25	4	149	295	16	150	~ 12 kg
RV, RS 70x DN 40 - 65	4	141	295	25	150	~ 12 kg
RV, RS 70x DN 80, 100	4	141	310	40	150	~ 13 kg
RV, RS 70x DN 125, 150	4	143	365	63	150	~ 15 kg
RV, RS 70x DN 250	4	180	480	100	200	~ 20 kg

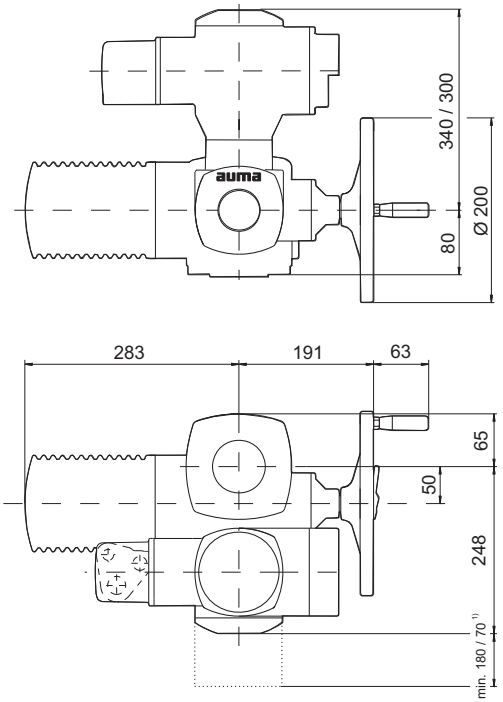
[1)] Space needed for opening the cover

Dimension of Auma actuators 10.2

Normal execution

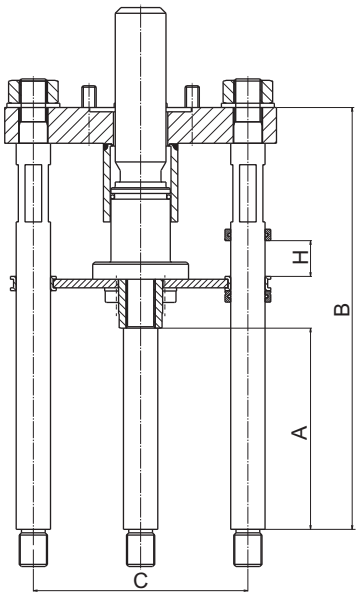


Execution MATIC / AUMATIC

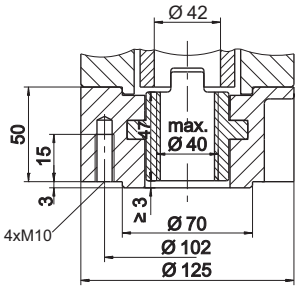


1) Space needed for opening the cover

Connection acc. to ISO 5210
Output drive, F10, Tr36x6-LH



Output drive A, F10



For valves	Number of columns	A	B	H	C	Weight
RV, RS 70x DN 25	4	149	295	16	150	~ 12 kg
RV, RS 70x DN 40 - 65	4	141	295	25	150	~ 12 kg
RV, RS 70x DN 80	4	141	310	40	150	~ 13 kg
RV, RS 70x DN 125, 150	4	141	295	25	150	~ 15 kg
RV, RS 70x DN 80	4	141	310	40	150	~ 20 kg

Dimensions of actuators Auma 14.2

icluding connection according to ISO 5210, Output drive A, F14 - on request from the producer

EZE, EZF
EZG, EZH

Electric actuators ...AB5
Schiebel

Technical data

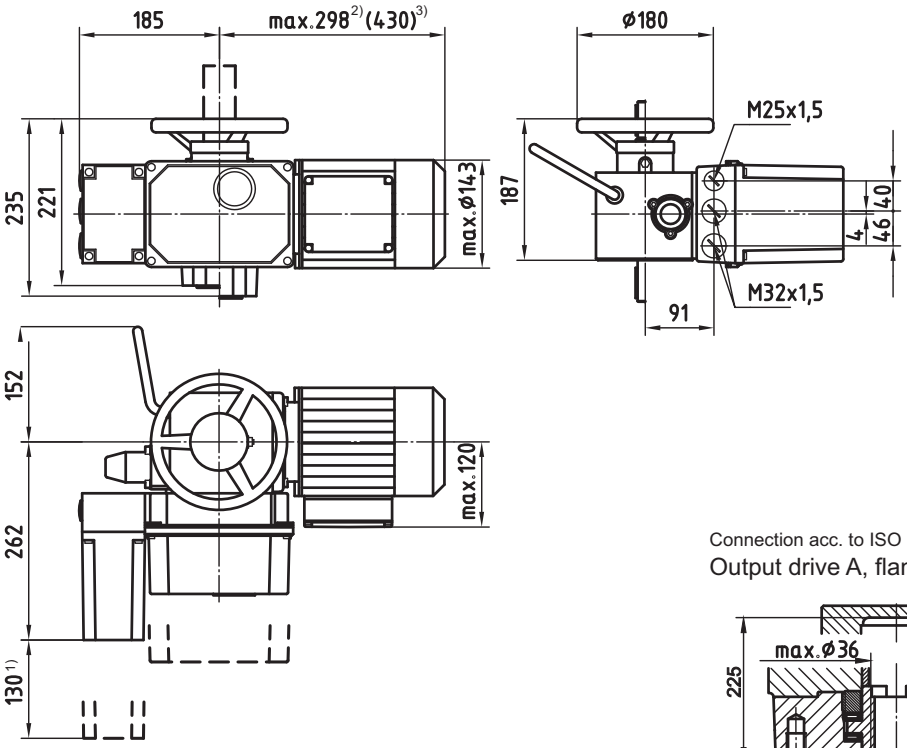
Typ	AB5	exAB5	rAB5	exrAB5
Označení v typovém čísle ventilu	EZE	EZF	EZG	EZH
Napájecí napětí AC	400 / 230 V; 230 V	400 / 230 V	400 / 230 V; 230 V	400 / 230 V
Frekvence	50 Hz			
Výkon	See specification table			
Řízení	3 - position control or with signal 4 - 20 mA			
Jmenovitá síla	30 Nm ~ 15 kN; 40 Nm ~ 20 kN; 60 Nm ~ 30 kN			
Zdvih	Acc. to valve's stroke 16, 25, 40 mm			
Krytí	IP 66	IP 65	IP 66	IP 65
Maximální teplota média	Acc. to used valve			
Přípustná teplota okolí	-25 to 80 °C	-20 to 40 °C	-25 to 60 °C	-20 to 40 °C
Přípustná vlhkost okolí	90 % (tropical version 100 % with condensation)			
Hmotnost	16 - 20 kg			

Note: Detailed technical informations can be found in producer's data sheet or on the webside **www.schiebel.com**

Specification of actuators

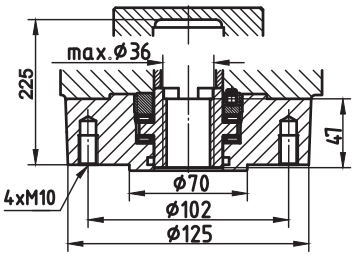
												XX	X	XXX	X	X	+	XXX
Execution					Non-explosive							Ex						
					Standard													
Duty					Control								R					
					ON - OFF													
Actuator´s torque														AB5				
Output shaft (thread TR 16x4 LH, flange F07 ... DN 15 to 25; thread TR 20x4 LH, flange F10 ... DN 40 to 150)															A			
Output speed (rpm)		Tripping torgue	AB5 exAB5	rAB5 exrAB5	Motor power [kW]	AB5		rAB5		exAB5	exrAB5							
						400/230V	230V	400/230V	230V	400/230V	400/230V							
	2,5		10-60 Nm	Tripping 30 - 60 Nm Loading 15 - 30 Nm		0,09	0,09	0,09	0,09	0,09	0,09					2,5		
	5					0,06	0,12	0,06	0,12	0,12	0,12					5		
	7,5					0,09	0,09	0,09	0,18	0,09	0,09					7,5		
	10					0,09	0,18	0,09	0,37	0,09	0,09					10		
	15					0,18	0,18	0,18	0,37	0,18	0,18					15		
	20					0,18	0,55	0,18	0,75	0,18	0,18					20		
	30					0,37	0,55	0,37	1,10	0,37	0,37					30		
	40					0,37	0,55	0,37	1,10	0,37	0,37					40		
Accessories					Potentiometer 1x1000 Ω													F
					Double potentiometer													FF
					Electronic transmitter 4 - 20 mA													ESM21
					Positioner ACTUMATIC R													CMR
					SMARTCON control unit													CSC

Dimensions of actuators ...AB5

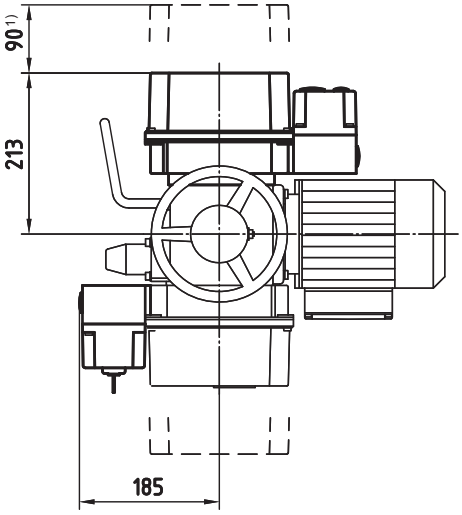


1) space needed for opening the cover
2) execution without brake
3) execution with brake

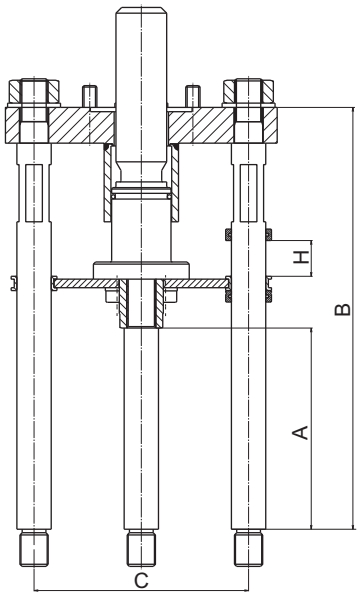
Connection acc. to ISO 5210
Output drive A, flange F10



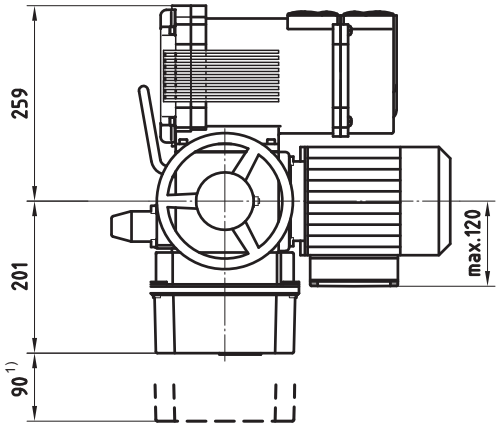
With positioner ACTUMATIC R



Connection acc. to ISO 5210
Output drive, F10, Tr36x6-LH



With control unit SMARTCON



For valves	Number of columns	A	B	H	C	Weight
RV, RS 70x DN 25	4	149	295	16	150	~ 12 kg
RV, RS 70x DN 40 - 65	4	141	295	25	150	~ 12 kg
RV, RS 70x DN 80	4	141	310	40	150	~ 13 kg

EZK

Electric actuators ...AB8
Schiebel

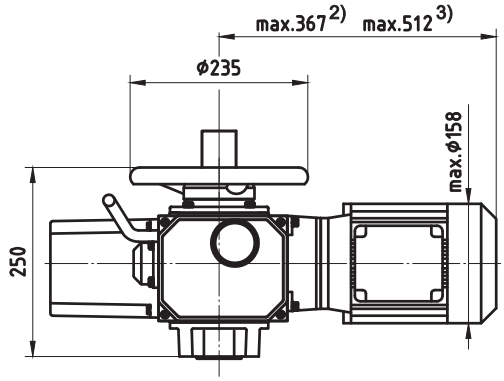
Technical data

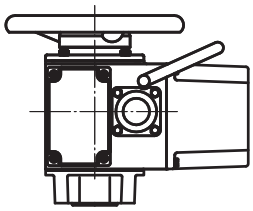
Type	rAB8
Marking in valve´s specification No.	EZK
Voltage	400 / 230 V; 230 V
Frequency	50 Hz
Motor power	See specification table
Control	3 - position or with signal of 4 - 20 mA
Nominal force	100 Nm ~ 27 kN; 120 Nm ~ 32 kN
Stroke	40, 63, 100 mm
Enclosure	IP 66
Process medium max. temp.	Acc. to used valve
Ambient temperature range	-25 to 60°C
Ambient temperature limit	90 % (tropical version 100 % with condensation)
Weight	24 to 35 kg

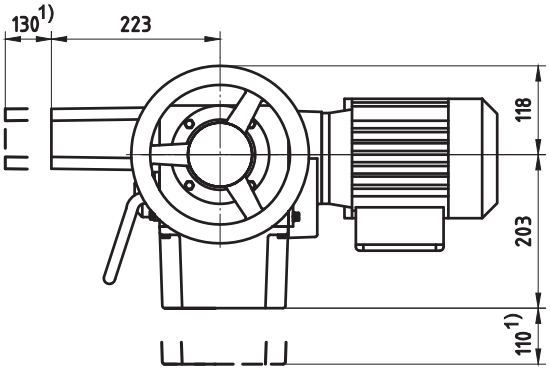
Specification of actuator

							XX	X	AB8	A	X	+	XXX
Execution				normal									
Duty				control				r					
Actuator size									AB8				
Output shaft type (connection flange size F10, thread 36x6)										A			
Output speed }rpm]		Tripping torque	rAB8	Motor power[kW]	rAB8 400/230V	rAB8 230V							
	2,5	tripping 50 - 120 Nm			0,06	0,12					2,5		
	5				0,12	0,25					5		
	7,5				0,18	0,37					7,5		
	10				0,18	0,75					10		
	15	loading 30 - 80 Nm			0,37	0,75					15		
	20				0,37	1,10					20		
	30				0,75	1,10					30		
	40				0,75	1,10					40		
Accessories				Potentiometer 1x1000 Ω									F
				Double potentiometer									FF
				Electronic transmitter 4 - 20 mA									ESM21
				Positioner ACTUMATIC R									CMR
				SMARTCON control unit									CSC

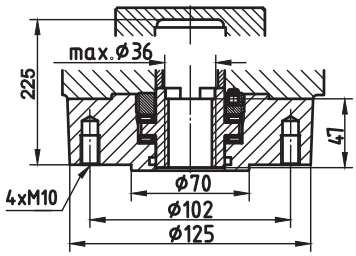
Dimensions of actuators ...AB8



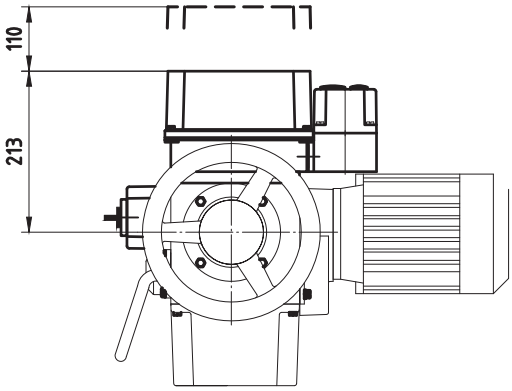




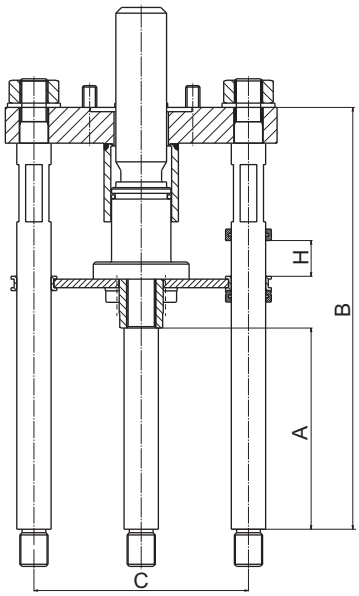
Connection acc. to ISO 5210
Output drive A, flange F10



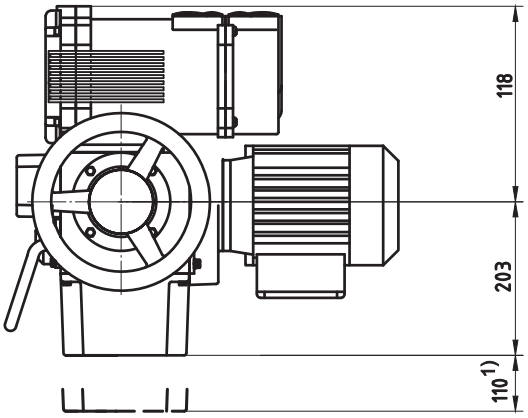
With positioner ACTUMATIC R



Connection acc. to ISO 5210
Output drive A, F10, TR36x6-LH



With control unit SMARTCON



1) space needed for opening the cover
2) execution without brake
3) execution with brake

For valves	Number of columns	A	B	H	C	Weight
RV, RS 70x DN 100	4	141	310	40	150	~ 13 kg
RV, RS 70x DN 125,150	4	141	365	63	150	~ 15 kg
RV, RS 70x DN 250	4	180	480	100	200	~ 20 kg

PFD
PFG

Pneumatic actuators Flowserve

Technical data

Type	PO 700		PO 1502	
Marking in valve specification No.	PFG		PFD	
Feeding pressure	pmax = 0,6 Mpa, pmin-viz tab.			
Function	drect	indirect	direct	indirect
Control	Pneumatic signal 20 - 100 kPa			
	Current signal of 0(4) - 20 mA			
Nominal force	According to table of nominal force values			
Stroke	20,40,60 mm		60,80 mm	
Enclosure	IP 54			
Process medium max. temperature	According to used valve			
Ambient temperature range	-40 to 80℃			
Ambient humidity limit	95 %			
Weight	See table of dimensions			

Accessories

Electropneumatic positioner (analogous) type SRI 990	Device with electric input of 4 to 20 mA and outlet of controllling air into actuator. It is adjusted by switches and potentiometers.
Electropneumatic positioner (inteligent) type SRD 991	Device with electric input of 4 to 20 mA and outlet of controllling air into actuator. It is adjusted by PC and special software. Comunication HART, Fieldbus Foundation, PROFIBUS.
Electropneumatic positioner (digital) type SRD 991 - D	Device with electric input of 4 to 20 mA and outlet of contr. air into actuator. It is adjusted by a local keyboard and diods, possibly on display.
Pneumatic positioner type SRP 981	Device with pneumatic input of 20 to 100 kPa to control the pneumatic actuators with pneumatic control signal
Signalisation switches type SGE 985	Adjustable end position switches
Air set type A 3420	Reduces control air pressure to a value requied
Electropneumatic positioner type SRI 986	Analog positioner with input signal of 4 (0) - 20 mA
Electropneumatic positioner SIPART PS2	Digital with input signal of 4(0) – 20 mA
Volume Booster-valve, type EIL 100	Flow air volume increaser
Solenoid valve, standard type SC G327A001	Direct operated electromagnetic valve, execution 3/2, function U (universal), G 1/4“
Air lock valve, type EIL 200	Retaining device for closing of air pipeline on a pressure drop

Operating conditions

Pneumatic actuators Flowserve can operate with extremely high ambient temperatures with unique resistance to shock loads. They excel with resistance to vibrations and reached 10^6 of cycles in operation. It is possible to deliver the actuator with both fail to open and fail to close function, possibly with a position blocking (air lock) upon feeding pressure air supply failure. Various accessories can be delivered together with the actuator.

Direct and indirect functions

Direct function ensures that actuator´s stem retracts upon control air supply failure (valve opens).
Indirect function ensures that actuator´s stem extends upon control air supply failure (valve closes).

Dimensions and weights for Flowserve actuators

DN	Actuator	H	A	B	G	M	V1	V2	V3	øDs	m [kg]	m (s RK)
25	PO 700	16	405	150	M10x1	160	278	227	325	350	65	82
50	PO 700	25	405	150	M16x1,5	160	278	227	325	350	65	82
100	PO 1502	40	550	150	M20x1,5	160	324	409	---	---	148	---
125, 150	PO 1502	63	550	150	M20x1,5	160	337	409	---	---	148	---

Note: Dimensions in [mm]

Valve specification No. of Flowserve actuators

		PO XXXX	X	XX	X	X	X
Type of actuator		PO 700					
		PO 1502					
		PB 1502					
Colour	bílá		B				
Spring range [bar]	2,0 - 3,5			FS			
	1,8 - 2,7			JC			
	1,5 - 2,7			VC			
	1,5 - 3,8			VI			
Hand wheel	Without wheel				O		
	Heavy wheel [1]				H		
	Side wheel [2]				S		
Function	direct					A	
	indirect					Z	
Stroke [mm]	20						A
	40						B
	60						C
	80						D

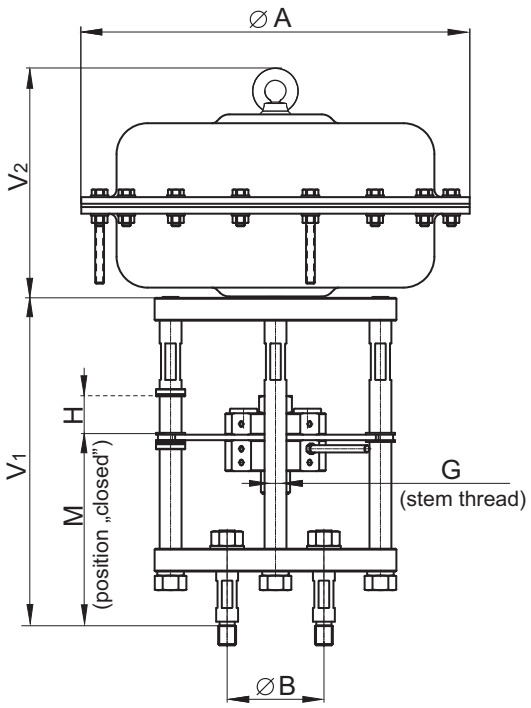
[1] only for actuator PO 700
[2] only for actuator PO 1502, with spring 1,5 - 2,7 bar

DN	Actuator type	Function	Stroke actuator [mm]	Stroke valve [mm]	Spring range [bar]	Setting of spring [bar]	Feeding pressure min. [bar]
25	PO 700 BJCxZA	closing NC	20	16	1,8 - 2,7	1,98 - 2,7	4,8
	PO 700 BJCxAA	opening NO	20	16	1,8 - 2,7	1,8 - 2,55	4,5
50	PO 700 BVIxZB	closing NC	40	25	1,5 - 3,8	2,36 - 3,8	5,3
	PO 700 BVIxAB	opening NO	40	25	1,5 - 3,8	1,5 - 2,93	5,3
80	PO 700 BVIxZC	closing NC	60	40	1,5 - 3,8	2,26 - 3,8	5,5
	PO 700 BVIxAC	opening NO	60	40	1,5 - 3,8	1,5 - 3,03	5,5
100	PO 1502 BFSOZC	closing NC	60	40	2 - 3,5	2,5 - 3,5	5
	PB 1502 BVCSZC	closing NC	60	40	1,5 - 2,7	1,9 - 2,7	5
	PO 1502 BFSOAC	opening NO	60	40	2 - 3,5	2 - 3	4,5
	PB 1502 BVCSAC	opening NO	60	40	2 - 3,5	2 - 3	4,5
125, 150	PO 1502 BFSOZD	closing NC	80	63	1,5 - 2,7	1,5 - 2,3	5
	PB 1502 BVCSZD	closing NC	80	63	1,5 - 2,7	1,75 - 2,7	5
	PO 1502 BFSOAD	opening NO	80	63	2 - 3,5	2 - 3,18	5
	PB 1502 BVCSAD	opening NO	80	63	1,5 - 2,7	1,5 - 2,45	5

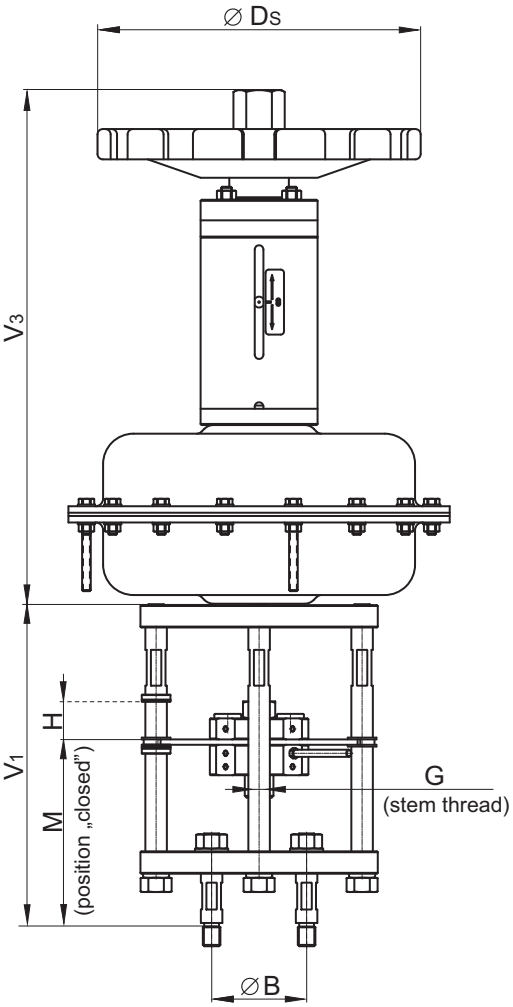
Note: Appoint insted of „x": O - without hand wheel, H - with heavy wheel, S - with side wheel

Dimensions of Flowserve actuators

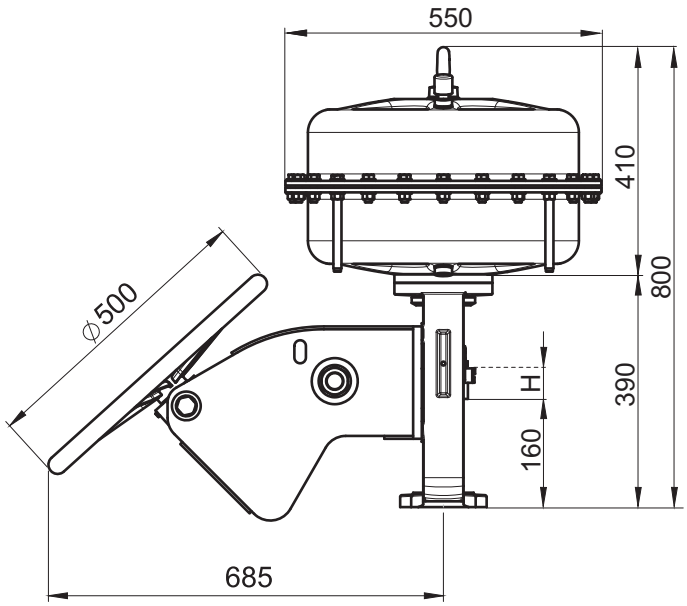
PO 700, 1502



PO 700 with hand wheel (heavy)



PO 1502 s hand wheel (side)



Maximal permissible overpressures [MPa]

Material	PN	Temperature [°C]											
		100	150	200	250	300	350	400	450	500	550	575	600
Cast steel 1.0619	160	13.6	12.7	11.4	10.4	9.40	8.80	8.40	---	---	---	---	---
	250	21.3	19.8	17.8	16.2	14.7	13.7	13.2	---	---	---	---	---
	320	27.2	25.4	22.8	20.8	18.8	17.6	16.8	---	---	---	---	---
	400	34.1	31.7	28.4	26.0	23.5	21.9	21.1	---	---	---	---	---
Alloy steel 1.7357	160	16.3	15.8	14.9	14.3	13.3	12.3	11.5	10.7	8.90	3.50	---	---
	250	25.4	24.8	23.3	22.3	20.8	19.3	18.0	16.7	13.9	5.50	---	---
	320	32.6	31.6	29.8	28.6	26.6	24.6	23.0	21.4	17.8	7.00	---	---
	400	40.7	39.6	37.4	35.7	33.3	30.9	28.9	26.7	22.3	8.80	---	---
Alloy steel 1.7379	160	16.3	15.8	15.4	14.6	13.5	12.7	11.5	10.7	8.90	4.90	3.40	---
	250	25.4	24.8	24.1	22.9	21.1	19.8	18.0	16.7	13.9	7.70	5.40	---
	320	32.6	31.6	30.8	29.2	27.0	25.4	23.0	21.4	17.8	9.80	6.80	---
	400	40.7	39.6	38.5	36.6	33.8	31.8	28.9	26.7	22.3	12.3	8.60	---
Alloy steel 1.7380	160	16.3	15.8	15.4	14.6	13.5	12.7	11.5	10.7	8.90	4.90	3.40	---
	250	25.4	24.8	24.1	22.9	21.1	19.8	18.0	16.7	13.9	7.70	5.40	---
	320	32.6	31.6	30.8	29.2	27.0	25.4	23.0	21.4	17.8	9.80	6.80	---
	400	40.7	39.6	38.5	36.6	33.8	31.8	28.9	26.7	22.3	12.3	8.60	---
Alloy steel 1.7383	160	16.3	15.8	14.9	14.3	13.3	12.3	11.5	10.7	8.90	4.90	3.40	---
	250	25.4	24.8	23.3	22.3	20.8	19.3	18.0	16.7	13.9	7.70	5.40	---
	320	32.6	31.6	29.8	28.6	26.6	24.6	23.0	21.4	17.8	9.80	6.80	---
	400	40.7	39.6	37.4	35.7	33.3	30.9	28.9	26.7	22.3	12.3	8.60	---
Stainless Steel 1.4931	160	16.3	15.8	15.4	14.6	13.5	12.7	11.5	10.7	8.90	7.90	4.30	4.30
	250	25.4	24.8	24.1	22.9	21.1	19.8	18.0	16.7	13.9	12.3	6.70	6.70
	320	32.6	31.6	30.8	29.2	27.0	25.4	23.0	21.4	17.8	15.8	8.60	8.60
	400	40.7	39.6	38.5	36.6	33.8	31.8	28.9	26.7	22.3	19.7	10.6	10.6

LDM, spol. s r.o.
Litomyšlská 1378
560 02 Česká Třebová
Czech Republic

tel.: +420 465 502 511
fax: +420 465 533 101
E-mail: sale@ldm.cz
http://www.ldm.cz

LDM, spol. s r.o.
Office in Prague
Podolská 50
147 01 Praha 4

tel.: 241087360
fax: 241087192
E-mail: tomas.suchanek@ldm.cz

LDM, spol. s r.o.
Office in Ústí nad Labem
Ladova 2548/38
400 11 Ústí nad Labem
- Severní Terasa

tel.: 602708257
E-mail: tomas.kriz@ldm.cz

LDM servis, spol. s r.o.
Litomyšlská 1378
560 02 Česká Třebová
Czech Republic

tel.: +420 465 502 411-3
fax: +420 465 531 010
E-mail: servis@ldm.cz

LDM, Polska Sp. z o.o.
Modelarska 12
40 142 Katowice
Poland

tel.: +48 32 730 56 33
fax: +48 32 730 52 33
mobile: +48 601 354 999
E-mail: ldmpolska@ldm.cz

LDM Bratislava s.r.o.
Mierová 151
821 05 Bratislava
Slovakia

tel.: +421 2 43415027-8
fax: +421 2 43415029
E-mail: ldm@ldm.sk
http://www.ldm.sk

LDM - Bulgaria - OOD
z. k. Mladost 1
bl. 42, floor 12, app. 57
1784 Sofia
Bulgaria

tel.: +359 2 9746311
fax: +359 2 9746311
mobile: +359 888 925 766
E-mail: ldm.bg@ldmvalves.com

OOO "LDM Promarmatura"
Jubilejniy prospekt,
dom.6a, of. 601
141400 Khimki Moscow Region
Russian Federation

tel.: +7 4957772238
fax: +7 4956662212
mobile: +7 9032254333
E-mail: inforus@ldmvalves.com

TOO “LDM”
Lobody 46/2
Office No. 4
100008 Karaganda
Kazakhstan

tel.: +7 7212 566 936
fax: +7 7212 566 936
mobile: +7 701 738 36 79
E-mail: sale@ldm.kz
http://www.ldm.kz

LDM Armaturen GmbH
Wupperweg 21
D-51789 Lindlar
Germany

tel.: +49 2266 440333
fax: +49 2266 440372
mobile: +49 177 2960469
E-mail: ldmarmaturen@ldmvalves.com
http://www.ldmvalves.com

Your partner