02 - 02.1

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Control valves and steam-conditioning station in angle way execution 900 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:

$$\mathbf{Kvs = 1.2 \div 1.3\ Kv}$$

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).

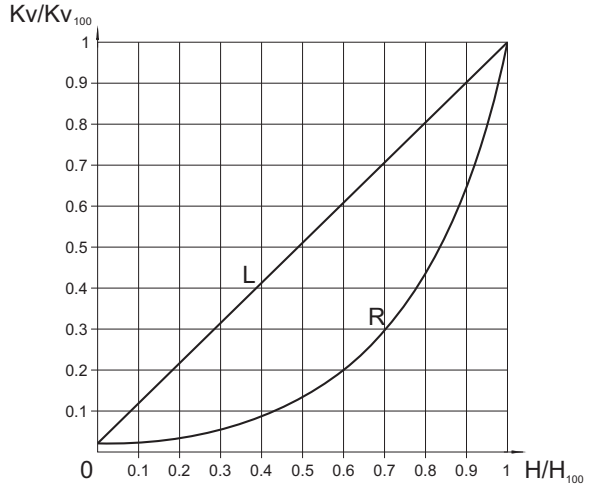
Cavitation

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

$$\mathbf{(p_1 - p_2) \geqq 0.6\ (p_1 - p_s)}$$

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
$Kv/Kv_{100} = 0.0183 + 0.9817 . (H/H_{100})$
R - equal-percentage characteristic (4-percentage)
$Kv/Kv_{100} = 0.0183 . E^{(4 . H/H_{100})}$

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.

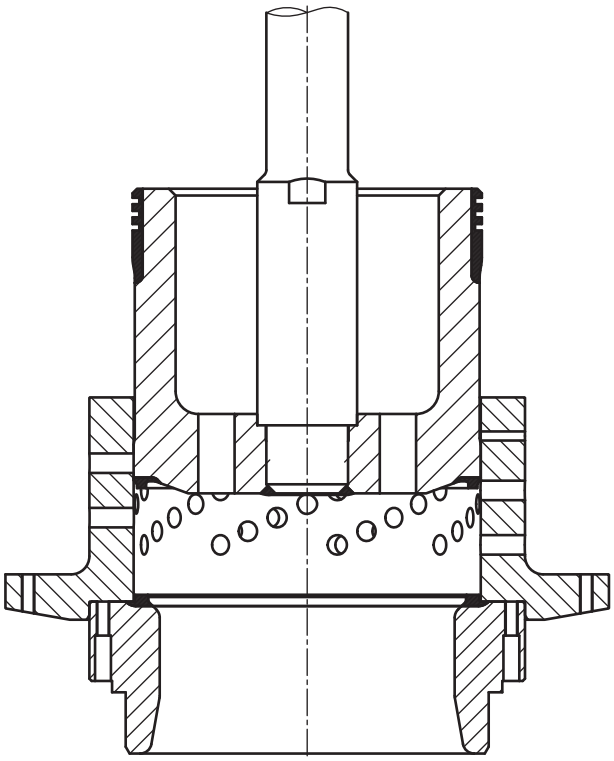
Dimensions and units

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

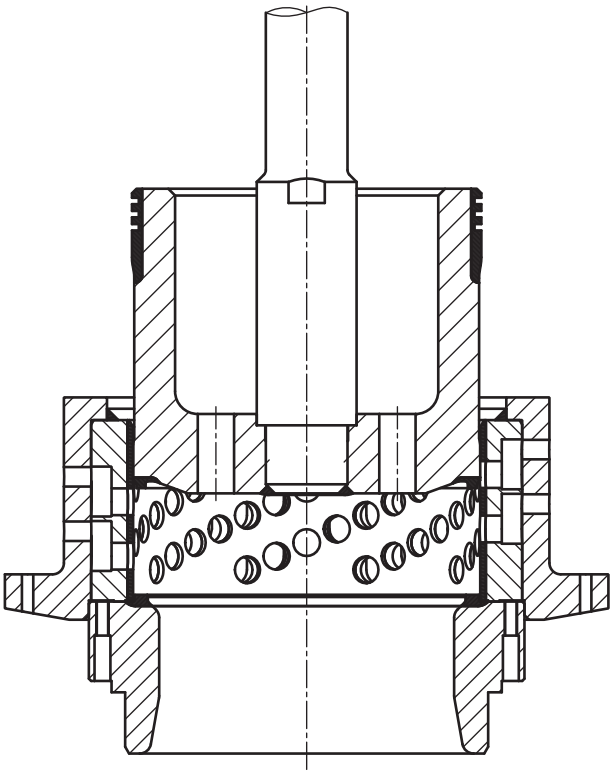
Application of multi-step pressure reduction

When the valves are designed for operation in above-critical differential pressure (p /p <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.

Jednostupňová redukce tlaku



Dvoustupňová redukce tlaku



RV 902

Control valves
Inlet DN 50 to 250
Outlet DN 80 to 700
PN 16 to 630

Description

The valves with extended outlet of series RV902 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 type “Live Loading”.
The valves are supplied in angle execution with weld ends connection and are actuated with both electric and pneumatic actuators. The connection is designed for using actuators of the following producers: ZPA Pečky, Regada Prešov, Auma, Schiebel and Flowserve. It is also possible to use fast acting electrohydraulic actuators for quick closing or opening.

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 valves of series RV902 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 12 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.

Recommended differential pressures

n 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 5.0 MPa. 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

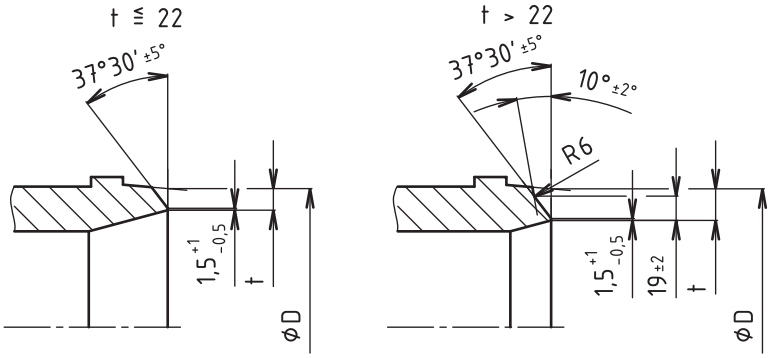
Series	RV 902
Type of valve	Control valve, single-seated, angle, with weld ends, with pressure-balanced plug, with extended outlet and orifice plate in extended outlet
Nominal size range	body: DN80, 150, 250; inlet: DN 50 to 250; outlet: DN 80 to 700
Nominal pressure	inlet PN 100 to 630; outlet PN 16 to 400
Body material (including weld ends)	1.0426 (P 280 GH) ... 20 to 500°C 1.7335 (13CrMo4-5) ... 20 to 550°C 1.7383 (11CrMo9-10) ... 20 to 600°C 1.4903 (P91, X10CrMoVNb 9-1) ... 20 to 600°C
Seat material	1.4923 + hard metal overlay
Plug material	1.4923 + hard metaly overlay
Weld ends	Dle EN 12627 (8/2000)
Trim	One or two step pressure reduction, optionaly with orifice plates in outlet
Flow characteristic	Linear, equal-percentage
Leakage rate	Acc. to EN 1349 (5/2001) Class III, IV, execution with higher tightness - Class V
Packing	Grafit - Live Loading

Range of Kvs values

DN	80	150	250
Multi-step press. reduction	Kvs values [m³ /hod] - linear flow characteristic		
1	8.0 - 80	16 - 250	40 - 500
2	8.0 - 40	16 - 125	40 - 250
Multi-step press. reduction	Kvs values [m³ /hod] - equal-percentage flow characteristic		
1	16 - 50	25 - 125	50 - 250
2	16 - 25	25 - 63	50 - 125

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.

Connection acc. to EN 12627



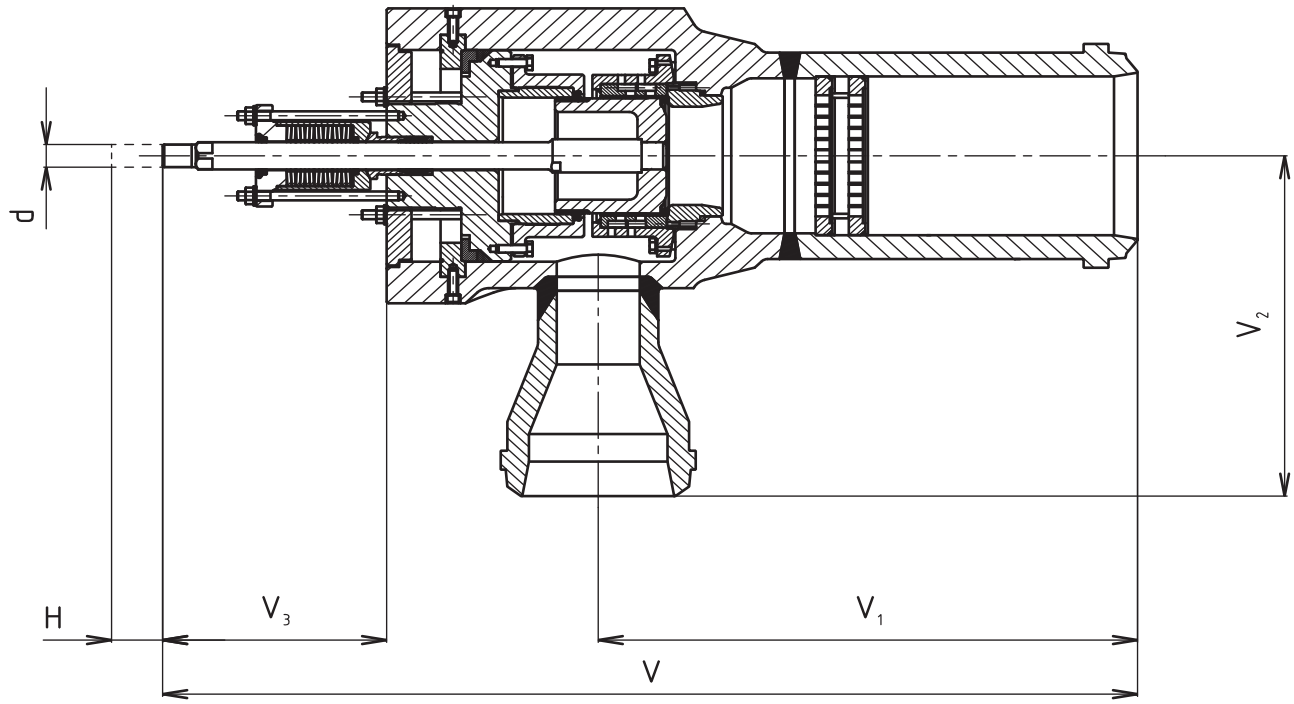
Other shapes of weld ends after agreement with producer

Dimensions of weld ends

	PN					
	16-40	63	100	160	250	16-250
DN	t	t	t	t	t	D
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
50	2.9	3.2	4.5	6.3	8	60.3
65	3.2	3.6	5	7	10	76.1
80	3.6	4	5.6	8	12.5	88.9
100	4	5	7	10	14	114.3
125	4.5	5.6	8	12.5	18	139.7
150	5	7	10	14	20	168.3
200	6.3	8	12.5	18	25	219,1
250	7	10	16	22	32	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

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

Control valve RV 902



Dimensions and weights of RV 902 with weld ends

DN			V	V_1	V_2	V_3	H	d	m
Body	Inlet	Outlet	[mm]	[mm]	[mm]	[mm]	[mm]		[kg]
80	50-100	80-200					40	M20x1,5	
		300							
150	80-200	150-400	1175	650	400	270	63	M30x2	450
		500-700	1325	800	400	270			
250	150-250	250-500					100	M42x2	
		700							

Note: Missing data on request.
The values of weight are approximate (depends on diameter of weld ends).

The valve complete specification No. for ordering RV 902

			XX	XXX	XXX	XXXX	XX	XX	/	XXX	-	XXX	x	XXX	x	XXX	/	X
1. Type of valve	Control valve		RV															
2. Series	Control valve, angle,extended outlet			902														
3. Type of actuating	Electric actuator				E													
[1] *Application only for DN80 body*	Pneumatic actuator				P													
	Electric actuator Modact MTR [1]				EPD													
	Electric actuator Modact MTN Control [1]				EYA													
	El. actuator Modact MTP Control [1]				EYA													
	El. actuator Modact MTNED [1],MTPED [1]				EYA													
	El. actuator Modact MTN [1], MTP [1]				EYB													
	El. actuator Regada STR 2 [1], STR 2PA [1]				EPM													
	Electric actuator Auma SAR 7.6 [1]				EAG													
	Electric actuator Auma SAR Ex 7.6 [1]				EAH													
	Electric actuator Auma SAR 10.2				EAJ													
	Electric actuator Auma SAR Ex 10.2				EAK													
	Electric actuator Auma SAR 14.2				EAM													
	Electric actuator SAR Ex 14.2				EAM													
	Electric actuator SAR 14.6				EAO													
	Electric actuator Auma SAR Ex 14.6				EAP													
	Electric actuator Schiebel rAB5				EZG													
	Electric actuator Schiebel exrAB5				EZH													
	Electric actuator Schiebel rAB8				EZK													
	Electric actuator Schiebel exrAB8				EZL													
	Pneumatic actuator Flowserve PO 1502 [1]				PFD													
4. Connection	Weld ends					4												
5. Body material	Cast steel 1.0426	(20 to 500°C)				1												
(operating temp. ranges are specified in parentheses)	Stainless stel 1.4903	(20 to 600°C)				5												
	Alloy steel 1.7383	(20 to 600°C)				6												
	Alloy steel 1.7335	(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 IV.						N											
	Linear - Leakage rate class V.						D											
	Equal-percentage - Leakage rate class III.						R											
	Equal-percentage - Leakage rate class IV.						E											
	Equal-percentage - Leakage rate class V.						Q											
9. No. of orifice plates	Max. 3						X											
10. Nominal pressure	PN inlet outlet	PN16 0						XX										
		PN25 1																
		PN40 2																
		PN63 3																
		PN100 4																
		PN160 5																
		PN250 6																
		PN320 7																
		PN400 8																
		PN630 9																
11. Operating temperature °C	Acc. to process medium									XXX								
12. Nominal size	DN	Inlet										XXX						
		Body												XXX				
		Outlet														XXX		
13. Accessories	Body warming-through connection																	H
	Body drainage																	D

Order example: Two-way, control valve DN 80/150, body: DN80, PN 160/100, 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: **RV902 EYA 4152 L1 54/400-080x080x150**

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 902

Steam conditioning station
Inlet DN 50 to 250
Outlet DN 150 to 700
PN 16 to 630

Description
Steam conditioning stations of series RS902 are single-seated control valves 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 ensure a high resistance to wearing caused by medium flow and to effects of the expanding steam. A low noisiness level can be also eliminated with orifice plates in extended outlet. Cooling water is injected into the extended outlet behind the throtling trim through a specially designed nozzle (VH, VHP or CHR) with changeable flow. The valve is equipped with packing of type "LiveLoading".
The valves are supplied in angle execution with weld ends connection.
The valves are actuated with both electric and pneumatic actuators. The connection is designed for using actuators of the following producers: ZPA Pečky, Regada Prešov, Auma, Schiebel and Flowserve. It is also possible to use fast acting electrohydraulic actuators for quick closing or opening.

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 valves of series RS902 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, by-pass stations or technological processes.
The max. permissible operating pressure values correspond to EN 12 516-1 see page 12 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.

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 5.0 MPa. 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

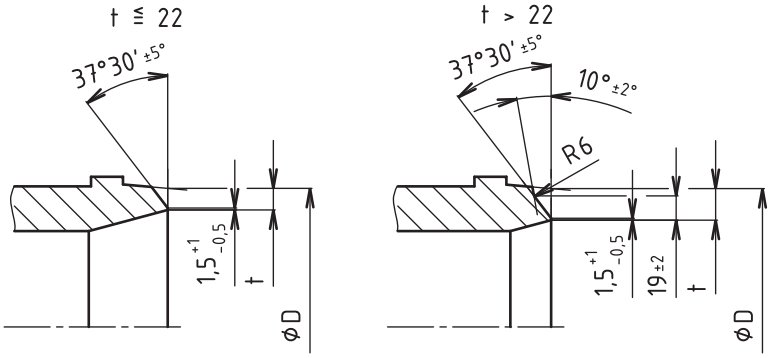
Series	RS 902
Type of valve	Control valve, single-seated, angle, with weld ends, with pressure-balanced plug, with extended outlet, orifice plate, connection to injection head (VH, VHP or CHR)
Nominal size range	body: DN80, 150, 250; inlet: DN 50 to 250; outlet: DN 80 to 700
Nominal pressure	inlet PN 100 to 630; outlet PN 16 to 400
Body material (including weld ends)	1.0426 (P 280 GH) ... 20 to 500°C 1.7335 (13CrMo4-5) ... 20 to 550°C 1.7383 (11CrMo9-10) ... 20 to 600°C 1.4903 (P91, X10CrMoVNb 9-1) ... 20 to 600°C
Seat material	1.4923 + hard metal overlay
Plug material	1.4923 + hard metal overlay
Weld ends	Dle ČSN EN 12627 (8/2000)
Trim	One or two step pressure reduction, optionaly with orifice plates in outlet
Flow characteristic	Lineární, rovnoprocentní
Leakage rate	Acc. to ČSN EN 1349 (5/2001) Class III, IV, execution with higher tightness - Class V
Packing	Grafit - Live Loading

Range of Kvs values

DN tělesa	80	150	250
Multi-step press. reduction	Kvs values [m³ /hod] - linear flow characteristic		
1	8.0 - 80	16 - 250	40 - 500
2	8.0 - 40	16 - 125	40 - 250
Multi-step press. reduction	Kvs values [m³ /hod] - equal-percentage flow characteristic		
1	16 - 50	25 - 125	50 - 250
2	16 - 25	25 - 63	50 - 125

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.

Connection acc. to ČSN EN 12627



Other shapes of weld ends after agreement with producer

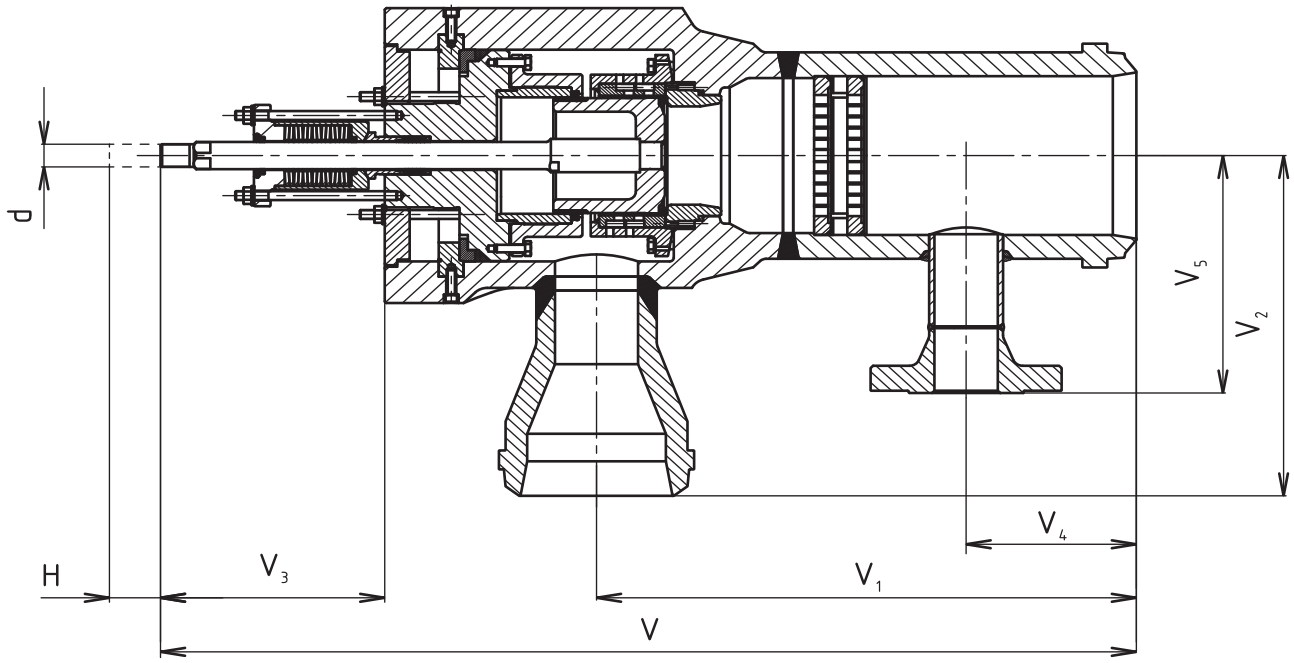
Dimensions of weld ends

	PN					
	16-40	63	100	160	250	16-250
DN	t	t	t	t	t	D
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
50	2.9	3.2	4.5	6.3	8	60.3
65	3.2	3.6	5	7	10	76.1
80	3.6	4	5.6	8	12.5	88.9
100	4	5	7	10	14	114.3
125	4.5	5.6	8	12.5	18	139.7
150	5	7	10	14	20	168.3
200	6.3	8	12.5	18	25	219,1
250	7	10	16	22	32	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

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

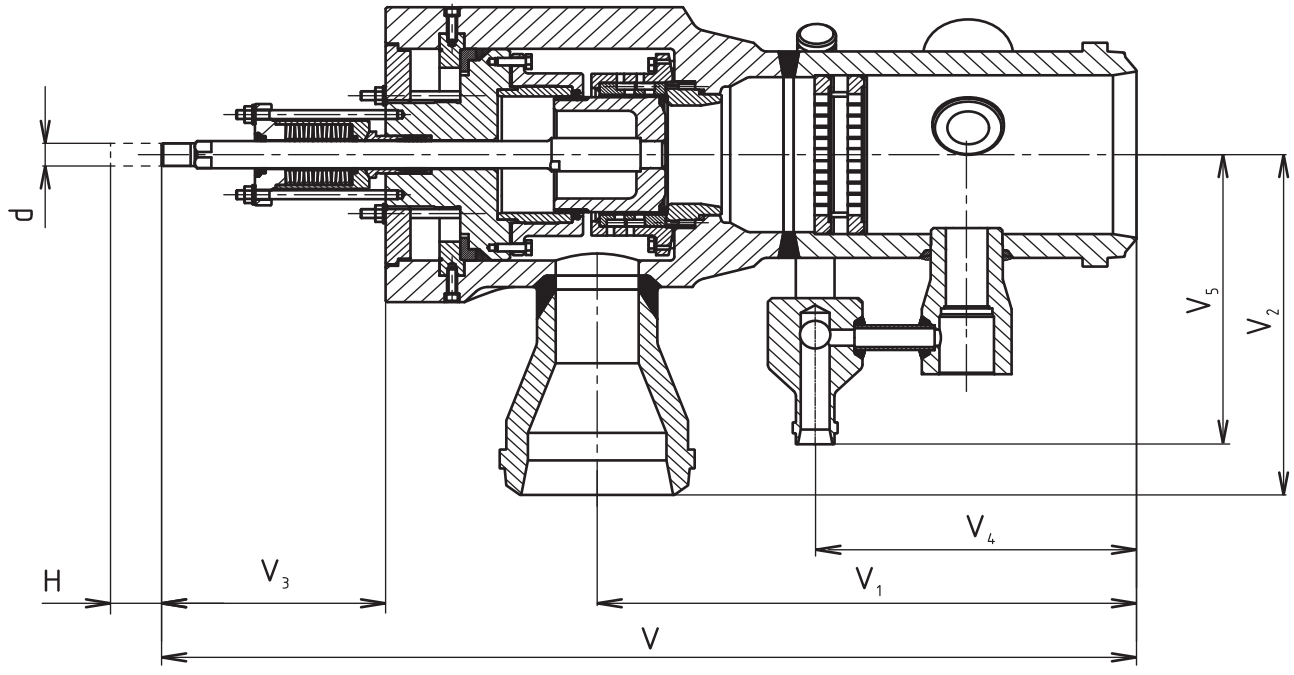
Steam conditioning station RS902 /Ax

- connection to VH or VHP (injection at the axis of outlet)



Steam conditioning station RS902 /Rx

- connection to CHR (injection perpendicular to the axis of outlet)



Dimensions and weights of RS 902 with weld ends

DN			V	V_1	V_2	V_3	V_4	H	d	m
Těleso	Vstup	Výstup	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]		[kg]
80	50-100	150-200						40	M20x1,5	
		300								
150	80-200	150-400	1175	650	400	270	205	63	M30x2	460
		500-700	1325	800	400	270				
250	150-250	250-500						100	M42x2	
		700								

Note: Missing data on request. The values of weight are approximate (depends on diameter of weld ends).

The valve complete specification No. for ordering RS 902

			XX	XXX	XXX	XXXX	XX	XX	/	XXX	-	XXX	x	XXX	x	XXX	/	XXX
1. Type of valve	Steam conditioning station		RS															
2. Series	Control valve, angle, extended outlet with cooling water connection			902														
3. Type of actuating	Electric actuator				E													
1) Application only for DN80 body	Pneumatic actuator				P													
	Electric actuator Modact MTR 1)				EPD													
	Electric actuator Modact MTN Control 1)				EYA													
	El. actuator Modact MTP Control 1)				EYA													
	El. actuator Modact MTNED 1),MTPED 1)				EYA													
	El. actuator Modact MTN 1), MTP 1)				EYB													
	El. actuator Regada STR 2 1), STR 2PA 1)				EPM													
	Electric actuator Auma SAR 7.6 1)				EAG													
	Electric actuator Auma SAR Ex 7.6 1)				EAH													
	Electric actuator Auma SAR 10.2				EAJ													
	Electric actuator Auma SAR Ex 10.2				EAK													
	Electric actuator Auma SAR 14.2				EAM													
	Electric actuator SAR Ex 14.2				EAM													
	Electric actuator SAR 14.6				EAO													
	Electric actuator Auma SAR Ex 14.6				EAP													
	Electric actuator Schiebel rAB5				EZG													
	Electric actuator Schiebel exrAB5				EZH													
	Electric actuator Schiebel rAB8				EZK													
	Electric actuator Schiebel exrAB8				EZL													
	Pneumatic actuator Flowserve PO 1502 1)				PFD													
4. Connection	Weld ends					4												
5. Body material	Cast steel 1.0426	(20 to 500°C)				1												
(operating temp. ranges are specified in parentheses)	Stainless stel 1.4903	(20 to 600°C)				5												
	Alloy steel 1.7383	(20 to 600°C)				6												
	Alloy steel 1.7335	(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 IV.						N											
	Linear - Leakage rate class V.						D											
	Equal-percentage - Leakage rate class III.						R											
	Equal-percentage - Leakage rate class IV.						E											
	Equal-percentage - Leakage rate class V.						Q											
9. No. of orifice plates	Max. 3						X											
10. Nominal pressure	PN inlet outlet	PN16 0						XX										
		PN25 1																
		PN40 2																
		PN63 3																
		PN100 4																
		PN160 5																
		PN250 6																
		PN320 7																
		PN400 8																
		PN630 9																
11. Operating temperature °C	Acc. to process medium									XXX								
12. Nominal size	DN	Inlet										XXX						
		Body												XXX				
		Outlet														XXX		
13. Accessories	Connection to VH/VHP																	A
	Connection to CHR																	R
	Number of cooling inputs																	X
	Body warming-through connection																	H
	Body drainage																	D

Ordering example: Steam conditioning station DN 80/150, body DN80, PN 160/100, with electric actuator Modact MTN Control, body material: cast steel, weld ends, packing: Graphite - Live Loading, two-step pressure reduction, one orifice plate at outlet, linear characteristic, adapted to connection on one VH and with body warming is specified as follows: **RS902 EYA 4152 L1 54/400-080x080x150/A1H**

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. Type of mechanical injection head (VH) acc. to calatlogue sheet 02-03.2 or drive-steam injection head (VHP) acc. to catalogu sheet 02-03.3.

Data for an actuator specification

The valves are designed to be actuated with linear or multi-turn electric actuators of the following producers as Auma, Schiebel, ZPA Pečky, Regada Prešov or pneumatic actuators Flowserve. In case of request for quick running they could be also equipped with fast acting electrohydraulic actuators. Valves are adjusted with actuators so that in the closed position, i.e. when closing to the seat, the torque switch turns off. In the open position they are adjusted so that the position switch turns off (the torque switch for open position is adjusted as a safety switch to protect the valve against its damage only).
Connecting flange of an actuator is designed to allow rotation of the drive of 45°.

Assigning of multi-turn actuators to a valve

DN	Stroke [mm]	rpm / stroke [n]	Min. modulating torque [Nm]	Max. tripping torque [Nm]	Trapezoidal thread	Valve attachment EN ISO 5210
80	40	10	30	60	Tr 20x4 LH	F10 / typ A
150	63	10,5	75	250	Tr 36x6 LH	F14 / typ A
250	100	14,3	120	500	Tr 40x7 LH	F14 / typ A

Assigning of linear actuators to a valve

DN	Stroke [mm]	Min. nominal thrust [kN]	Max. tripping thrust [kN]	Thread of stem
80	40	15	30	M20x1,5

Maximal permissible overpressures [Mpa]

Material	PN	Temperature [°C]										
		100	150	200	250	300	350	400	450	500	550	600
Cast steel 1.0426	100	10,0	10,0	10,0	9,70	8,88	8,16	7,44	4,53	2,19	---	---
	160	16,0	16,0	16,0	15,5	14,2	13,0	11,9	72,6	3,50	---	---
	250	25,0	25,0	25,0	24,2	22,2	20,4	18,6	11,3	5,47	---	---
	320	32,0	32,0	32,0	31,0	28,4	26,1	23,8	14,5	7,0	---	---
	400	40,0	40,0	40,0	38,8	35,5	32,6	29,7	18,1	8,75	---	---
	630	63,0	63,0	63,0	61,1	55,9	51,4	46,9	28,6	13,8	---	---
Alloy steel 1.7335	100	10,0	10,0	10,0	10,0	10,0	9,31	8,53	7,89	6,24	2,93	---
	160	16,0	16,0	16,0	16,0	16,0	14,9	13,6	12,6	9,99	4,70	---
	250	25,0	25,0	25,0	25,0	25,0	23,2	21,3	19,7	15,6	7,34	---
	320	32,0	32,0	32,0	32,0	32,0	29,8	27,3	25,2	19,9	9,39	---
	400	40,0	40,0	40,0	40,0	40,0	37,2	34,1	31,5	24,9	11,7	---
	630	63,0	63,0	63,0	63,0	63,0	58,7	53,8	49,7	39,3	18,5	---
Alloy steel 1.7383	100	10,0	10,0	10,0	10,0	10,0	9,38	8,53	7,89	6,58	3,52	1,49
	160	16,0	16,0	16,0	16,0	16,0	15,0	13,6	12,6	10,5	5,63	2,39
	250	25,0	25,0	25,0	25,0	25,0	23,4	21,3	19,7	16,4	8,80	3,73
	320	32,0	32,0	32,0	32,0	32,0	30,0	27,3	25,2	21,0	11,2	4,78
	400	40,0	40,0	40,0	40,0	40,0	37,5	34,1	31,5	26,3	14,0	5,98
	630	63,0	63,0	63,0	63,0	63,0	59,1	53,8	49,7	41,5	22,2	9,40
Steinless steel 1.4903	100	10,0	10,0	10,0	10,0	10,0	9,38	8,53	7,89	6,58	5,82	5,0
	160	16,0	16,0	16,0	16,0	16,0	15,0	13,6	12,6	10,5	9,32	8,0
	250	25,0	25,0	25,0	25,0	25,0	23,4	21,3	19,7	16,4	14,5	12,5
	320	32,0	32,0	32,0	32,0	32,0	30,0	27,3	25,2	21,0	18,6	16,0
	400	40,0	40,0	40,0	40,0	40,0	37,5	34,1	31,5	26,3	23,3	20,0
	630	63,0	63,0	63,0	63,0	63,0	59,1	53,8	49,7	41,5	36,7	31,5

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.
ul. Bednorza 1
40-384 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

Váš partner