 LDM, spol. s r.o. Czech Republic	INSTRUCTION FOR INSTALLATION AND MAINTENANCE	RV 701 RV 702
	CONTROL VALVES	PM - 077/17/10/GB

The instructions for installation and maintenance of valves RV 701, RV 702 (further in text only RV 70x) are binding for users to ensure proper function of valves. The user must keep the rules said here while installation, operation and maintenance. Technical details of individual type are specified in catalogue data sheets. If the usage of the valves is different from mentioned herein, the guarantee terms are not valid any more.

1. TECHNICAL DESCRIPTION AND VALVE FUNCTION

1.1 Description

Control valves RV 701 are one-seated valves designed to create a lot of combinations of controlling appliances. Valve is pressure balanced, with multi-step throttling system, designed to be cavitation and noise free.

Control valves RV 702 with extended outlet have multi-step throttling system (with orifice plate) designed to eliminate high differential pressures. Valve has pressure balanced throttling system, which assures low noise, low wearing during big pressure drop operation.

Control valves RV 70x have the packing set of "LIVE LOADING" type.

Valves are delivered with weld ends .

The valves can be actuated with electric actuators. Producers of actuators are for example ZPA Pečky, Regada Prešov, Auma, Schiebel, Flowserve.

Used actuators allow 3-point controlling or controlling by signal 0(4)-20mA or 0-10V. They can be equipped with the signalization of end positions and transmitter of position.

1.2 Application

Control valves RV 70x can have linear plug or equal percentage plug. It is especially designed for industrial applications, such as heating plants, power plants or control of technologic processes.

Recommended strainer dimensions:

For reliable function of the valves, the producer recommends to install the filter of mechanical impurities.

Installation of the filter is necessary for valve with micro-throttling system (Kvs≤0.16).

DN, Type	Recommended maximum mesh size
DN 25, Kvs≤0.16	0,25 mm
DN 25-65	0,6 mm
DN 80-200	1,0 mm
DN 250	1,6 mm

The max. permissible operating pressure values correspond to EN 12 516-1.

1.3 Technical data

Series	RV 701		
Type of valve	Control valve, one seat, straight-way, pressure balance plug		
Nominal diameter DN	DN 25 to 250 *		
Nominal pressure PN	PN 160, 250, 320, 400		
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)
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 temperature	-10 to 400°C	-10 to 550°C	-10 to 600°C
Weld ends	Acc. to ČSN 13 1075 (3/1991)		
Control system	One - three-step pressure reduction Perforated plug - seat (cage)		
Flow characteristic	Linear, equal-percentage		
Leakage	Acc. to ČSN EN 1349 (7/2012) Class III, execution with higher tightness-Class V		
Packing set	Graphite - Live Loading		

* For material 1.0619 DN80 - 250 max. PN320

Series	RV 702		
Type of valve	Control valve, single-seated, straight-through, with pressure-balanced plug, with extended outlet and orifice plate in extended outlet		
Nominal diameter DN	inlet DN 25 to 250; outlet DN 25 to 700		
Nominal pressure PN	inlet PN 160 to 320; outlet PN 16 to 250	inlet PN 160 to 400; outlet PN 16 to 320	
Body material	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) + stellite seat STELLIT 6		
Plug material	17 023.6 (1.4028) hardened		17021.6 (1.4006) + stellite seat STELLIT 6
Operating temperature	-10 to 400°C	-10 to 550°C	-10 to 600°C
Weld ends	Acc. to ČSN 13 1075 (3/1991)		
Control system	One or two-step pressure reduction		
	Perforated plug - seat (cage), orifice plate		
Flow characteristic	Linear, equal-percentage		
Leakage	Acc. to ČSN EN 1349 (7/2012) Class III, execution with higher tightness-Class V		
Packing set	Graphite - Live Loading		

1.4 Recommended differential pressures

Regarding to pressure balance plug and forces of used actuators, application of valve for high differential pressures is not limited by process medium pressure, but only by type of throttling system.

For valves series RV 701, maximum operating differential pressure is recommended to 4.0 MPa for one step reduction when perforated plug and perforated cage are used, and to 2.0 MPa for one step reduction when shaped plugs are used.

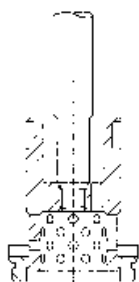
For valves series RV 702, maximum operating differential pressure is recommended to 5.0 MPa for one step reduction when perforated plug and perforated cage are used. Using for some other parameters should by consulted with producer.

1.5 Operating medium

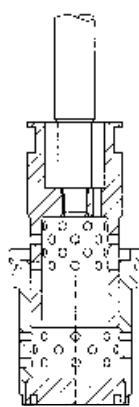
Valves are designed to regulate pressure and flow of liquids (RV 701), steams and gases (RV 702) without mechanical impurities. Sort of common operating medium can be water (RV 701), steam (RV 702) and other medium with no special demand on valve body material. Using for some other medium should by consulted with producer.

1.6 Multi-step pressure reduction

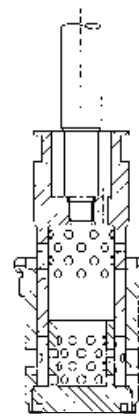
For valves working with above-critical differential pressure ($p_2/p_1 < 0.54$) or with pressure drop higher then recommended is useful to use two-step or three-step reduction to lower noise, ensure long service life of valve inner parts and prohibit them from cavitation.



One - step reduction



Two - step reduction



Three - step reduction

1.7 Application of orifice plates (RV 702)

In case of above-critical flow, the producer recommends to install one or more orifice plates at the valve outlet to stream-line the process medium flow and to lower the noisiness. The concrete valve execution (No. of orifice plates) is designed according to pressure ratio and it is recommend to consult it with the producer.

2. DIRECTIONS FOR INSTALLATION AND OPERATING OF VALVE

2.1 Preparation before installation

The valves are delivered from the company assembled, adjusted and tested. Before valve’s installation into pipeline you must check the data on the name-plate with data mentioned in accompanying documentation. Then check if the valve or the actuator are not damaged and dirty. Pay attention especially to inner spaces and packing surfaces of valve.

The chemicals are applied during the manufacturing, to preserve the valves prior the corrosion. The protecting solution “Konkor” (oil base) is used at inner surface. The grease is applied at flange's faces or welding ends.

In case, the preserving agent should contaminate the medium, it is necessary to rinse/clean the valve with suitable cleaning agent/solution.

The flange's faces and welding ends must be prior the installation always degreased.

2.2 Installation of valve into pipeline

The valve must be installed in such direction, that the arrows on the valve body correspond to the process medium flow.

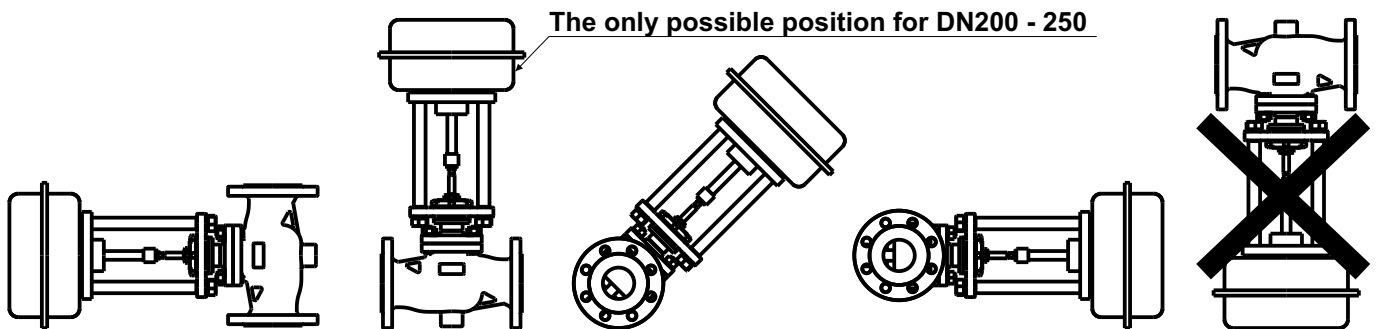
The valves with inlet DN 15 – 150 can be installed in any position, except the position with actuator under the valve.

For valves with inlet DN 200 and higher, the only possible position is with stem in vertical position and actuator on the top.

Protection of actuator against the radiant heat can be necessary in case of high temperature application. As a basic provision can be made pipeline insulation, actuator turning aside from vertical position, etc.. When the valve is installed into pipeline and actuator is turned aside from vertical position then it is necessary to ensure suitable supporting of actuator.

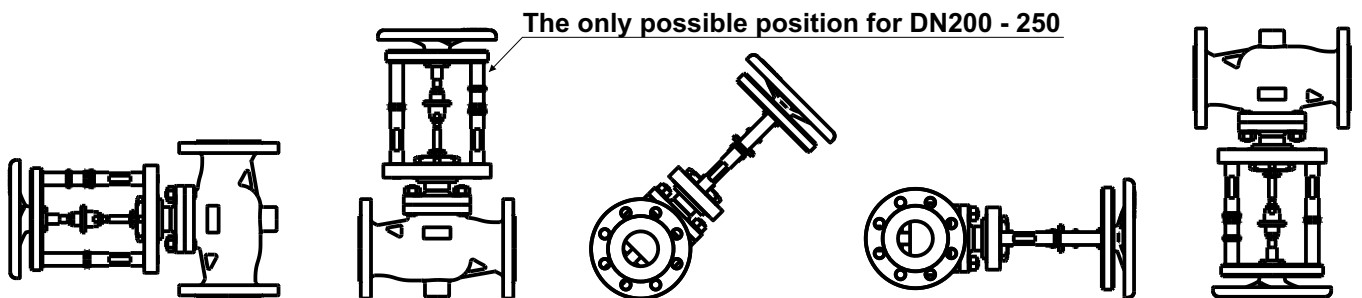
For proper function of control valve, below-mentioned instructions must be obeyed:

- no excessive forces can be transferred from pipeline to valve.
- the pipeline must be cleaned from dirt before valve installation.
- the valve can not be installed just behind the bend. Pipeline should be straight min. 6x DN in front of the valve. For 702 RV, the length of straight outlet section shall be 20 times the outlet DN, but in all cases a minimum of 4m.
- the inlet valve DN 150 until 250 must be adapted to the space above the valve, so that it was possible to use the lifting device.
- it is recommended to keep clean space around the valve for easy manipulation and service.
- installation itself must be done precisely.



The only possible position for DN200 - 250

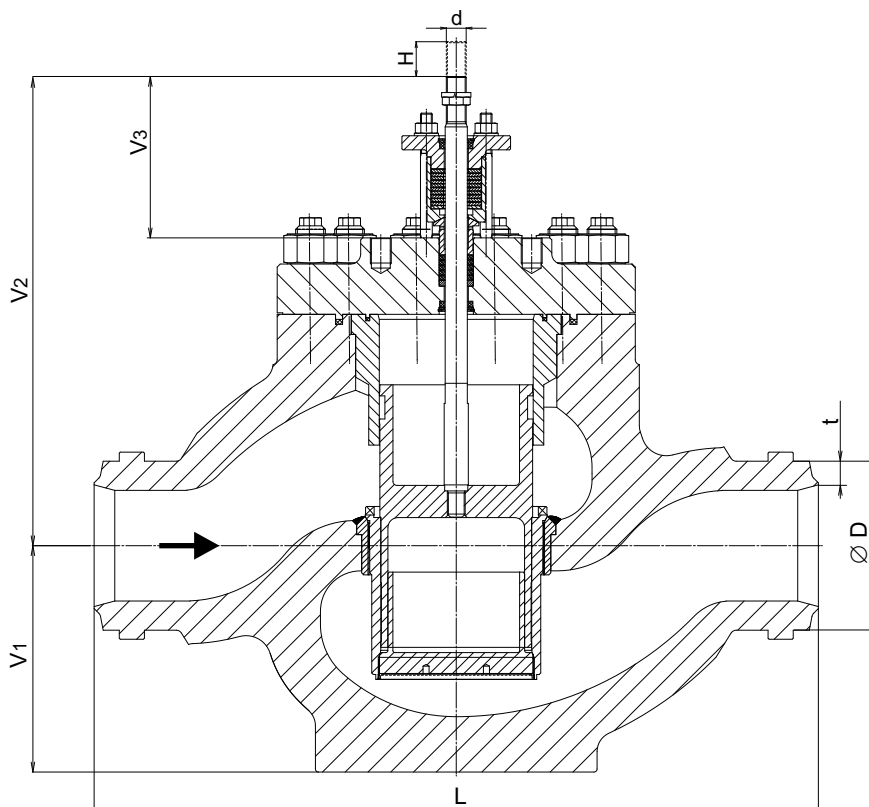
Installation position for valves with electro- or pneumatic actuators



The only possible position for DN200 - 250

Installation position for valves with hand wheel

Control valve RV 701 - weld ends

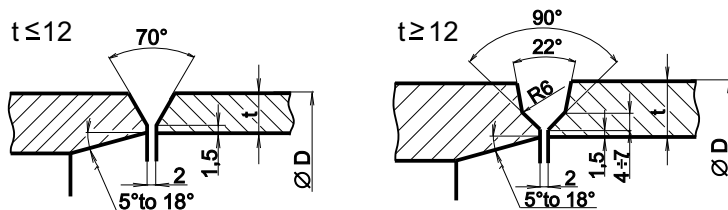


Dimensions and weights of valve RV 701, weld ends connections

DN	PN160 PN250 PN320* PN400*				PN 160 - 400							
	t [mm]	t [mm]	t [mm]	t [mm]	D [mm]	L [mm]	V ₁ [mm]	V ₂ [mm]	V ₃ [mm]	H [mm]	d	m [kg]
25	4	5	6	7.1	33.7	270	70	280	160	16	M16x1,5	40
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		420
150	14	20	23	26	168.3	720	225	466	160	63		420
200	18	25	28	32	219.1	820	290	600	210	80		912
250	22	32	35	38	273	990	345	675	210	100		1500

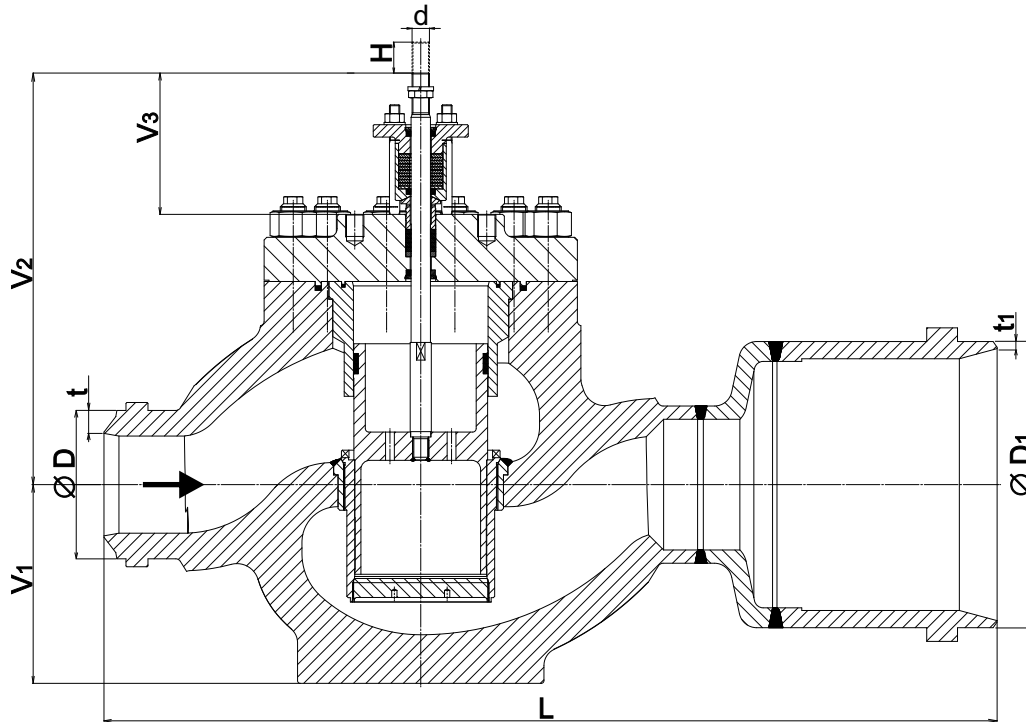
Note: Specified weights should be considered as approximate.

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



Other shapes of weld ends according to customer requirements.

Control valve RV 702 - weld ends



Dimensions of valves RV 702, weld ends connection

DN	V ₁ [mm]	V ₂ [mm]	V ₃ [mm]	L [mm]	H [mm]	d
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	976	63	
150/300	225	466	160	1015	63	
200/350	290	600	210	---	80	
250/500	345	675	210	1630	100	

V tabulce jsou uvedeny pouze doporučené kombinace vstupní a výstupní DN

Pozn: Chybějící údaje upřesní výrobce.

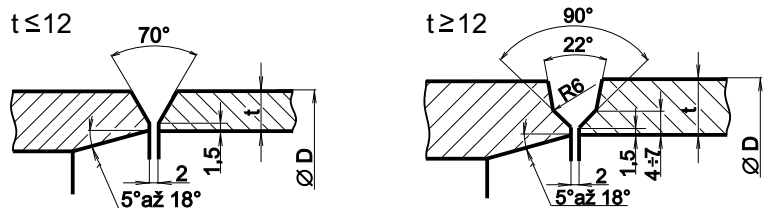
Weld ends connection dimensions

DN	PN 40	PN 63	PN100	PN160	PN250	PN320*	PN400*	PN16-400
	t [mm]	t [mm]	t [mm]	t [mm]	t [mm]	t [mm]	t [mm]	D [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	---	---	---	---	503
600**	18	23	---	---	---	---	---	610
700**	23	---	---	---	---	---	---	721

Note: Dimensions for PN 15, 25 correspond with PN 40.

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

**For DN 600, 700 - Dimensions weld ends acc. to LDM.



Other shapes of weld ends according to customer requirements.

2.2.1 Actuator's connection to electric network

These works can be done only by the experienced workers. It is necessary to keep all safety rules. It is also necessary to follow instructions for installation, operating and service of electric actuator published by producer. Transmitter of position and signalization switches are placed under the cover of actuator, in the case they are as part of the delivery.

In regard of the valve being delivered assembled together with its actuator from the company, basic adjusting and setting of actuator is carried out. The valve is adjusted in closed position by torque switch (so that the valve will be really tight closed) meanwhile the switching off the actuator is adjusted in open position by limit switch. In case the actuator is dismantled from the valve body for any reason such as the valve installation into pipeline etc., it is necessary to check the setting again after the assembly possibly to carry out the complete setting of actuator again. Producer does not take over the guarantee if the damage was caused by improper setting or adjusting of the actuator. In case of need, it is possible to ask for such service from service organization of the producer.

The length of the cables to actuator should be selected so that the actuator could be disassembled from the valve without any need for the cables unplugging from the actuator's terminal board.

WARNING: It's necessary to observe the mechanical stroke indicator placed at actuator's yoke or directly at the electromotor, if the valve is operated (opened or closed) by hand wheel. The extra care must be taken near to OPEN and CLOSE position. Neither position nor torque switches are in function in such case and there is a danger of valve or actuator serious damage. It's strongly prohibited to use any mechanical tools (force boosters) for hand wheel operation.

2.2.2 Pneumatic actuator connection

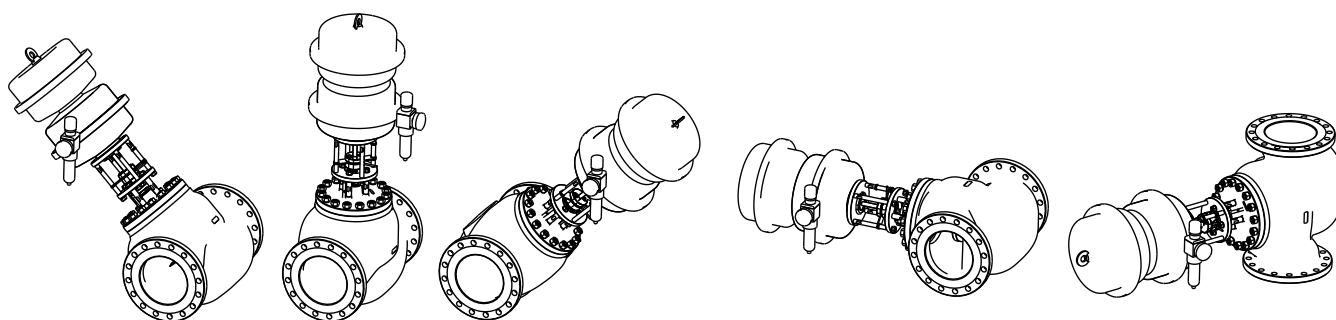
These work may be carried out by trained personnel only. It is necessary to follow instructions for installation, operation and maintenance of pneumatic actuators issued by the producer of the actuator.

Connection of pneumatic actuator to air supply is done by plastic, copper or stainless-steel tubes, recommended dimension is 8x1 mm. The 12x1 mm tubes are recommended for the actuators with membrane area larger than 600 cm² or in case the length of air pipeline is more than 10m.

Before valve commissioning, the data, given in the actuator and positioner ID plate (especially air supply maximum pressure), should be checked/compared with given specification. If the pressure of air supply is higher, the pressure reduction valve must be used.

As the valve is supplied with actuator as a complet, the basic setting is also carried out. In case the actuator was removed from the valve, it is necessary to check this setting or set the actuator once again. The producer does not take over the damage caused by wrong setting of the actuator. In case of need, the assistance of our subsidiary LDM Service can be required.

In case of pressure air regulator (air supply to pneumatic actuator) fixed directly on the valve/actuator yoke, the regulator must be placed in vertical position (draincock/draincup down), see picture. If the valve mounting position is known during the valve-actuator assembly, the right position is set on the production line/during final test.



Examples of filter/regulator position

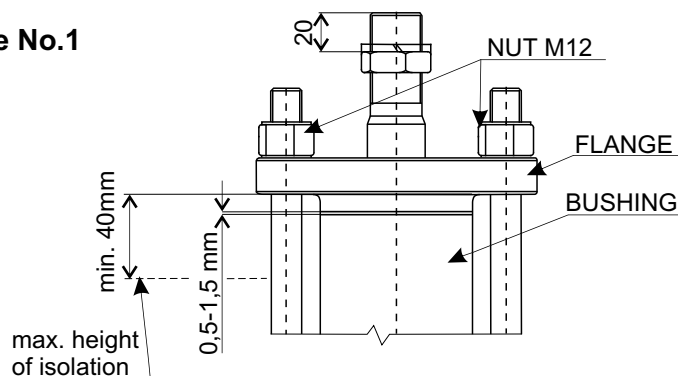
2.2.3 Checking after installation

Piping system should be pressured after valve installation and then checked if there is no leak. Check the packing set tightness as well. Then check the proper function of actuator by doing a few strokes.

2.3 Operating and Service

The valves are equipped with graphite packing rings. The packing set is loaded with system of disc springs "LIVE LOADING". During the operation, it is **necessary** to maintain the gap between the flange and packing bushing in the range **0,5 - 1,5mm** (pic. No.1). From the factory, the value of 0,5 mm is set. The tightening is carried out by four nuts M12. The producer recommends to check this value more often (about twice a month) after starting new packing set. Later, once a half of year is enough.

Picture No.1



2.3.1 Exchange of packing set

If there is a need to exchange the packing because of worse tightness, it's recommended to ask LDM service company for technical instructions for dismantling and assembly of the "LIVE LOADING" packing or to ask them for a exchange of it.

2.3.2 Electric actuators

Electric actuators have to be operated according to instructions given in „Actuator manual“. In case of malfunction of actuator, see the instructions or ask for professional repair man.

2.3.3 Warming-through and putting fittings out of operation

Warming-through fittings:

Fittings have to be filled and warmed-through by regulating the steam supply and drainage so that the trend of the temperature increase is observed, i.e. so that the increase in the temperature of fittings does not exceed the given temperature jump per minute (see the table). After the required temperature is reached, the operation of the steam piping is regulated depending on the need of the given appliance.

Valve	Carbon material of body	Alloy material of body
DN 15-150, PN 16-160	6°C/min	4°C/min
DN 15-65, PN 160-400		
DN 80-250, PN 160-400	5°C/min	3°C/min

If the required temperature of the fitting needs to be reached faster, it is necessary to secure permanent warming-through, e.g. by means of a by-pass.

Putting fittings out of operation:

If possible, the decline of the temperature of alloy steel fittings that are cooling down is to be as slow as the temperature increase in warming-through. If a faster temperature decline is detected, the decline has to be slowed down until the temperature drops to 300 °C; then the piping is let cool down without any intervention. The cooling rate does not have to be monitored in fittings made of carbon steels.

2.3.4 Thermal and acoustic insulation

The type and dimensions of the insulation are as stated in the design. Only the insulation above the cover of the fitting has to have its height adjusted to provide a free access for monitoring the compression of the packing or for tightening (see point 2.3, pic. 1).

2.4 Elimination of defects and malfunctions

If a defect is detected on the valve (leakage, leakage of packing or bonnet sealing, etc.), it is necessary to ensure its repair immediately otherwise a permanent damage may occur to sealing surfaces and other parts exposed to effects of leaking medium.

Prior to any repair work on the valve, make sure that piping system is free of pressure!

Defect	Possible cause	Elimination of defect
Valve leakage	- insufficient linear force of the actuator	- check the function and setting of the actuator possibly positioner
	- seizure of impurity in seat area	- open and close the valve fully
	- damaged sealing surfaces of the plug and seat	- it is necessary to lap plug and seat or replace damaged parts - requires trained personnel
Packing leakage	- sealing force of graphite packing is too low	- tighten the graphite packing or add another sealing ring (see 2.3)
	- packing is worn or damaged	- change the whole packing set (see 2.3.1) - requires trained personnel
	- damaged stem	- replace packing and stem - requires trained personnel
Leakage of bonnet	- low adherence pressure to gasket - damaged gasket	- tighten screws - to change bonnet gasket - requires trained personnel
Leakage of body	- damage caused by aggressiveness, abrasion, or erosion of media	- it is need to change of body - trained personnel required
Increased noise	- exceeding of operating parameters - presence of undesirable particle in throttling system	- must be consulted with the producer - it is necessary to disassemble valve, clean the throttling system, eventually change the damaged parts - requires trained personnel
Stem won't move	- no supply to actuator (electric or pneumatic)	- electric actuators: check supply and feeding voltage - pneumatic actuators: check supply and feeding pressure
	- actuator control signal failure	- measure the value of input control signal
	- the defect of actuator or its accessories	- follow the instructions for actuator or require trained personnel
	- graphite packing tightened too much	- loosen the packing and retighten it just to ensure tightness
	- seizure inside the valve due to impurities	- it is necessary to dismantle the valve and replace damaged parts - trained personnel required
Stem jerky movement	- insufficient actuator force	- compare parameters of the product with the real parameters - if OK, ensure responsible service personnel
	- damaged positioner	- follow the instructions issued by its producer, possibly ensure trained service personnel
Valve won't move in full range of its stroke	- wrong setting of end position switches	- check the setting of the switches
	- pneumatic and electrohydraulic actuators: hand wheel got stuck in wrong position	- adjust the hand wheel into its basic position
	- pneumatic actuators: feeding pressure is too low	- ensure the required pressure of supply air
	- pneumatic actuators wrongly adjusted or defected positioner	- readjust the positioner acc. to instructions issued by its producer
	- impurities inside the valve	- close and open the valve fully, possibly ensure trained service personnel

If the valve is in guarantee period, it is necessary to ensure authorised service for all service except tightening of graphite packing!

2.5 Spare parts

Spare parts are not part of valve delivery. They must be ordered separately. For the spare parts order, following data must be written: type of a valve, nominal diameter DN, Serial valve´s number, name of a spare part.

Recommend spare parts for 3 and 5 years of operation:

Parts for 3 years of operation	Additional parts for 5 years of operation *)
<ul style="list-style-type: none"> - packing set (stuffing box complete) - bonnet gasket - bonnet gasket-inner - plug's sealing rings (only for balanced plug with graphite rings sealing) - plug's wiping rings 	<p><u>balanced plug's sealing – graphite rings</u></p> <ul style="list-style-type: none"> - plug with stem (welded assembly) - seat (seat cage) - plug's guide <p><u>balanced plug's sealing – metal U-ring seal</u></p> <ul style="list-style-type: none"> - plug with stem (welded assembly) - seat (seat cage) - insert - metal U-ring seal

*) It's recommended for 5-years spare parts ordering to order 2 sets for 3-years operation and 1 set of additional parts for 5-years operation.

2.6 Guarantee conditions

The producer does not guarantee the operation and safety of the product under conditions different from data given in the catalogue data sheet. Any using of the valve under different conditions shall be consulted with the producer. Defects of the valve caused by impurities in process medium shall be considered as out of guarantee terms. The producer does not take over the guarantee if any change was made by the user without prior written consent from the producer (except the packing tightening).

2.7 Transportation and storage

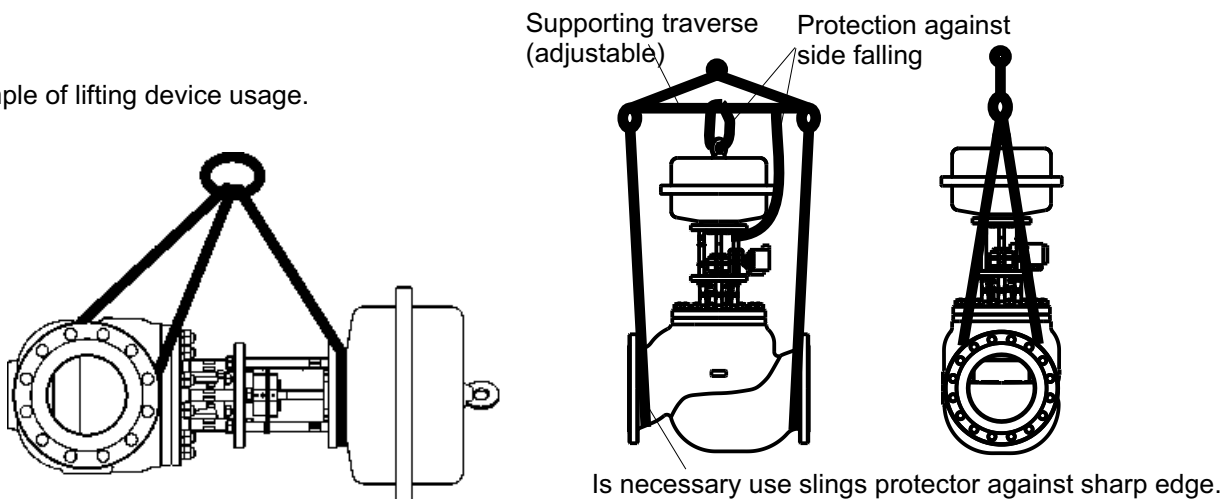
During transport and storage, the valve must not be exposed to water or placed in environment with relative humidity exceeding 90 %.

With respect to used actuators, the temperature during transport and storage shall be within the range of -20 to 55°C. Weld ends must be protected with blinds (these are part of delivery).

Suitable tools/devices should be used for valve lifting during the transport and installation (e.g. lifting harness entwined around weld ends, actuator yoke etc.).

Never lift the valve by the lifting device fixed on the actuator only!

Example of lifting device usage.



It is necessary to make sure the valve can not be damaged during transport. **Special attention shall be paid to the valve stem, stroke indicator and outside accessories fixed to the actuator.** If the valves are stored for more than 3 years, the producer recommends to carry out professional inspection of the valves.

2.8 Waste disposal

Packaging and the valves (after their scrapping) shall be disposed off in the common way, e.g. by handing over to a specialized company for a disposal (body and metal parts - metal scrap, packaging + other non-metallic parts - communal waste).

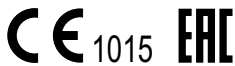
Valve complete specification No. for ordering RV 70x

		XX	X X X	X X X	X X X X	XX	XX	X X X	XX
1.Valve	Control valve	RV							
2.Type of valve	Control valve, straight-way		701						
	Cont.valve, straight-way with extended outlet		702						
3.Actuator ¹⁾ Pneu.actuator only to DN 150 ²⁾ Use only to DN 150	Electric actuator			E					
	Pneumatic actuator			P					
	Electric actuator Modact MTR ²⁾			EYA					
	Electric actuator Modact MTN Control ²⁾			EYA					
	Electric actuator Modact MTP Control ²⁾			EYA					
	Electric actuator Modact MTN, MTP ²⁾			EYB					
	Electric actuator Modact MTN ²⁾			EYB					
	Electric actuator ST 2, STR 2, STR 2PA ²⁾			EPM					
	Electric actuator AUMA SA 07.6			EAE					
	Electric actuator AUMA SA Ex 07.6			EAF					
	Electric actuator AUMA SAR 07.6			EAG					
	Electric actuator AUMA SAR Ex 07.6			EAH					
	Electric actuator AUMA SA 10.2			EAI					
	Electric actuator AUMA SA Ex 10.2			EAL					
	Electric actuator AUMA SAR 10.2			EAJ					
	Electric actuator AUMA SAR Ex 10.2			EAK					
	Electric actuator Schiebel AB5			EZE					
	Electric actuator Schiebel exAB5			EZF					
	Electric actuator Schiebel rAB5			EZG					
	Electric actuator Schiebel exrAB5			EZH					
Pneumatic actuator Flowserve PB 700 ¹⁾			PFC						
Pneumatic actuator Flowserve PO 1502 ¹⁾			PFD						
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 1.7379 (-20 to 550°C)				6				
	Alloy steel 1.7357 (-20 to 550°C)				7				
	Other material				9				
6.Packing set	Graphite - LIVE LOADING				5				
7.Multi-step reduction	One-step reduction				1				
	Two-step reduction				2				
	Three-step reduction				3				
8.Flow characteristic	Linear - leakage class III.					L			
	Equal percentage - leakage class III.					R			
	Linear - leakage class V.					D			
	Equal percentage - leakage class V.					Q			
9.Number of orifice plates	RV 701 - 0						X		
	RV 702 - max.3								
10.Nominal pressure PN (e.g.)	PN 160								
	PN 250								
	PN 320								
	PN 400								
11.Operating temper. °C	According to sort of medium							XXX	
12.Nominal diameter	DN - on request								XX

Ordering example: Two-way control valve DN 50, PN 320, with electric actuator Modact MT Control, body mat. cast steel, weld ends, packing seat: graphite, two-step pressure reduction, linear characteristic, leakage class III., is marked as: **RV 701 EYA 4152 L0 320/400-50**

Maximum permissible working pressure according to EN 12516-1[MPa]

Material	PN	Temperature [°C]											
		100	150	200	250	300	350	400	450	500	550	575	600
Cast steel 1.0619	160	14.98	14.21	13.45	12.29	11.14	10.37	9.60	5.89	---	---	---	---
	250	23.41	22.21	21.01	19.21	17.41	16.20	15.00	9.20	---	---	---	---
	320	29.97	28.43	26.89	24.59	22.28	20.75	19.21	11.78	---	---	---	---
	400	37.45	32.53	33.61	30.73	27.85	25.93	24.01	14.73	---	---	---	---
Alloy steel 1.7357	160	16.00	16.00	16.00	16.00	16.00	14.91	13.66	12.62	9.99	4.70	---	---
	250	25.00	25.00	25.00	25.00	25.00	23.29	21.34	19.72	15.60	7.34	---	---
	320	32.00	32.00	32.00	32.00	32.00	29.81	27.32	25.25	19.98	9.39	---	---
	400	40.00	40.00	40.00	40.00	40.00	37.26	34.14	31.56	24.97	11.74	---	---
Alloy steel 1.7379	160	16.00	16.00	16.00	16.00	16.00	15.02	13.66	12.62	10.53	5.63	5.51	2.39
	250	25.00	25.00	25.00	25.00	25.00	23.47	21.34	19.72	16.45	8.80	8.60	3.73
	320	32.00	32.00	32.00	32.00	32.00	30.04	27.32	25.25	21.07	11.27	11.01	4.78
	400	40.00	40.00	40.00	40.00	40.00	37.55	34.14	31.56	26.33	14.09	13.76	5.98
Alloy steel 1.7380	160	16.00	16.00	16.00	16.00	16.00	15.02	13.66	12.62	10.53	5.63	5.51	2.39
	250	25.00	25.00	25.00	25.00	25.00	23.47	21.34	19.72	16.45	8.80	8.60	3.73
	320	32.00	32.00	32.00	32.00	32.00	30.04	27.32	25.25	21.07	11.27	11.01	4.78
	400	40.00	40.00	40.00	40.00	40.00	37.55	34.14	31.56	26.33	14.09	13.76	5.98
Alloy steel 1.7383	160	16.00	16.00	16.00	16.00	16.00	15.02	13.66	12.62	10.53	5.63	5.51	2.39
	250	25.00	25.00	25.00	25.00	25.00	23.47	21.34	19.72	16.45	8.80	8.60	3.73
	320	32.00	32.00	32.00	32.00	32.00	30.04	27.32	25.25	21.07	11.27	11.01	4.78
	400	40.00	40.00	40.00	40.00	40.00	37.55	34.14	31.56	26.33	14.09	13.76	5.98
Stainless steel 1.4931	160	16.00	16.00	16.00	16.00	16.00	15.02	13.66	12.62	10.53	9.32	7.13	4.18
	250	25.00	25.00	25.00	25.00	25.00	23.47	21.34	19.72	16.45	14.56	11.14	6.54
	320	32.00	32.00	32.00	32.00	32.00	30.04	27.32	25.25	21.07	18.64	14.26	8.37
	400	40.00	40.00	40.00	40.00	40.00	37.55	34.14	31.56	26.33	23.29	17.82	10.46



ADDRESS OF FACTORY

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.ldmvalves.com>

REGIONAL OFFICES

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

tel.: +420 241087360
fax: +420 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
Czech Republic

tel.: +420 602708257
E-mail: tomas.kriz@ldm.cz

SERVICE ORGANIZATION

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

tel: +420 465502411-13
fax: +420 465531010
E-mail: servis@ldm.cz

LDM SUBSIDIARIES ABROAD

OOO "LDM Promarmatura"
Jubilejnyi prospekt, dom.6a, of. 601
141407 Khimki
Moscow Region
Russia

tel.: +7 495 7772238
fax: +7 495 7772238
mobile: +7 9032254333
e-mail: inforus@ldmvalves.com

TOO "LDM"
Shakirova 33/1, kab. 103
100012 Karaganda
Kazachstan

tel.: +7 7212566936
fax: +7 7212566936
mobile: +7 7017383679
e-mail: sale@ldm.kz

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

tel: +421 243415027-8
fax: +421 243415029
E-mail: ldm@ldm.sk
<http://www.ldm.sk>

LDM Armaturen GmbH
Wupperweg 21
D-51789 Lindlar
Deutschland

tel: +49 2266 440333
fax: +49 2266 440372
mobile: +49 1772960469
E-mail: ldmarmaturen@ldmvalves.com

LDM, Polska Sp. z o.o.
ul. Bednorza 1
40-384 Katowice
Polska

tel: +48 327305633
fax: +48 327305233
mobile: +48 601354999
E-mail: ldmpolska@ldm.cz

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

tel: +359 2 9746311
fax: +359 2 8771344
mobile: +359 888925766
E-mail: ldm.bg@ldmvalves.com

www.ldmvalves.com

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