

## Selection

k <sub>VS</sub> [m <sup>3</sup> /h]	DN		Type			Suitable rotary actuators			
	mm	Inches	Internal thread	External thread	Flange	Modulating DC 0...10 V	3-point	Emerg. control function	
0.25	10	3/8"	R305K	R505K	-	TRD24-SR AC/DC 24 V	TRD24-3 AC 24 V		
0.4	10	3/8"	R306K	R506K	-				
0.63	10	3/8"	R307K	R507K	-				
1	10	3/8"	R308K	R508K	-				
0.63	15	1/2"	R309	R509	R709R	TR24-SR AC/DC 24 V	TR24-3 AC 24 V		
1	15	1/2"	R310	R510	-				
1.6	15	1/2"	R311	R511	R711R	LR24-SR AC/DC 24 V	NR24-3 AC 24 V		
2.5	15	1/2"	R312	R512	-				
4	15	1/2"	R313	R513	R713R	NR(Y)24-SR AC/DC 24 V	NR230-3 AC 230 V		
4	20	3/4"	R317	R517	-				
6.3	20	3/4"	R318	R518	R718R	LF24-SR AC/DC 24 V	AFR24-SR AC/DC 24 V		
6.3	25	1"	R322	R522	-				
10	25	1"	R323	R523	R723R				
10	32	1 1/4"	R329	R529	-				
16	32	1 1/4"	R331	R531	R731R				
16	40	1 1/2"	R338	R538	R738R				
25	50	2"	R348	R548	R748R				

## Technical data

Flow media	Cold and hot water, Water with max. 50% volume of glycol
Temperature of medium	+5 °C...+110 °C (lower or higher temperatures on request)
Rated pressure p <sub>s</sub>	See table below
Flow characteristic	Control path A-AB: equal percentage (to VDI/VDE 2173) DN 10...15* n(gl) = 3.2, optimized in opening range DN 20...50** n(gl) = 3.9, optimized in opening range Bypass B-AB: Linear, flow rate is 70% of k <sub>VS</sub> value
Rangeability	DN 10...15* Sv > 50 DN 20...50** Sv > 100
Leakage rate	Control path A-AB: Air bubble-tight (BO 1, DIN 3230 Part 3) Bypass B-AB: Approx. 1...2% of k <sub>VS</sub> value (in relation to the highest value within the DN (e.g. R313))
Pipe connector	R3.. Internal thread to ISO 7/1 R5.. External thread to ISO 228/1 R7.. Flange PN 6 to EN 1092/1
Differential pressure Δp <sub>max</sub>	350 kPa (200 kPa for low-noise operation)
Closing pressure Δp <sub>s</sub>	1400 kPa
Angle of rotation	90° (operating range of control path A-AB 15°...90° bypass B-AB 15°...70°)
Installation position	Upright to horizontal (in relation to the stem)
Maintenance	Maintenance-free

## Materials

Fitting	Forged, nickel-plated brass body
Valve cone	Stainless steel / R7.. chrome-plated brass
Seal	PTFE
Stem	Stainless steel / R7.. chrome-plated brass
Stem seal	EPDM
Flange ring	DN 15/20 Zinc-plated steel DN 25...80 Aluminum
Flange joint surface	Nickel-plated brass
Characterizing disk	TEFZEL

\* Up to k<sub>VS</sub> 2.5 \*\* And DN15 k<sub>VS</sub> > 4



3-way characterized control valves  
DN 10...50



For modulating control of cold and hot water

## Equal-percentage characteristic

## Applications

- Water-side control of air handling apparatus in ventilation and air-conditioning systems
- Water-side control in heating systems

## Mode of operation

The characterized control valve is operated by a rotary actuator. The actuators are controlled by a standard modulating or 3-point control system and move the ball of the valve – the mixing device – to the opening position dictated by the control signal.

## Product features

**Equal-percentage characteristic** of the flow rate ensured by the integral characterizing disc.

**Manual operation by lever** after disengaging the gearing latch on the Type TR..., LR.. or NR.. rotary actuator (manual operation not possible with LF../AFR..).

## Ordering

An order for an R3.. characterized control valve includes a suitable rotary actuator.

**Ordering examples:** (with NR24-SR)

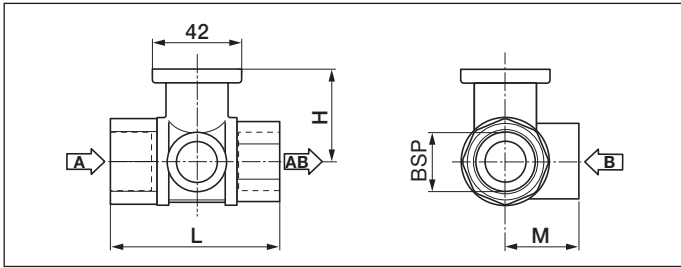
- R318 characterized control valve with NR24-SR
  - Rotary actuator fitted
  - Order code: R318+NR24-SR
- R318 characterized control valve and NR24-SR
  - Rotary actuator supplied separately
  - Order code: R318/NR24-SR

## Important

- **Sizing diagram for characterized control valves:** page 7
- **Dimensions:** pages 12, 33, 34 and 36
- **Installation instructions:** pages 33, 34, 36
- **Please note the information provided on pages 2 and 38 to 40 regarding use, installation, project design, commissioning and maintenance**
- **Pipe connectors can be supplied as an accessory:** page 13

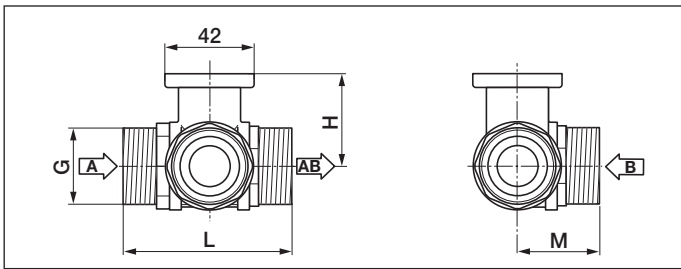
Type	Rated pressure p <sub>s</sub> [kPa]
R305.. – R329	4140
R505.. – R529	4140
R331 – R348	2760
R531 – R548	2760
R709R – R748R	600

## 3-way ball valves with internal thread



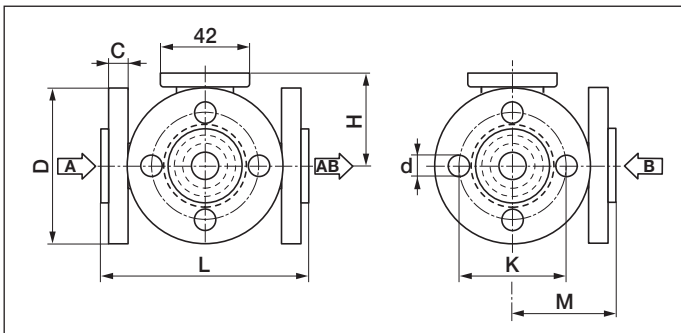
DN	Dimensions			Thread		Weight [kg]
	L	H	M	BSP	Max. screwing depth	
[mm]	[mm]	[mm]	[mm]	[Inches]	[mm]	
10	52	35	28	3/8"	10	0.35
15	67	45	39	1/2"	13	0.45
20	78	47.5	41.5	3/4"	13	0.6
25	87	47.5	45	1"	17	0.9
32	105	47.5	55.5	1 1/4"	19	1.2
32	105	52	55.5	1 1/4"	19	1.3
40	111	52	56	1 1/2"	19	1.5
50	125	58	68	2"	22	2.4

## 3-way ball valves with external thread



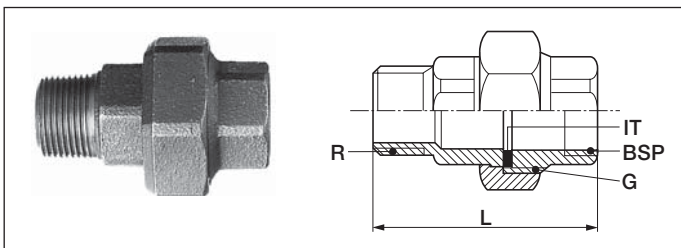
DN	Dimensions			Thread	Weight [kg]
	L	H	M	G	
[mm]	[mm]	[mm]	[mm]	[Inches]	
10	69	31.5	34	3/4"	0.4
15	74	44	38	1"	0.7
20	85.5	46	42.5	1 1/4"	1.0
25	84.5	46	47.5	1 1/2"	1.1
32	103.5	46	56	2"	1.7
32	108	50.5	56	2"	1.8
40	114	50.5	60.5	2 1/4"	2.3
50	131.5	56	71.5	2 3/4"	3.8

## 3-way ball valves with flanges



DN	Dimensions			Flange				Weight [kg]
	L	H	M	D	C	K	d	
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
15	101.5	45	73	80	15	55	4 x 11	1.8
20	112	47.5	79	90	15	65	4 x 11	2.4
25	132	47.5	92	100	20	75	4 x 11.5	2.5
32	143.5	52	102.5	120	17	90	4 x 14	3.4
40	149.5	52	105	130	18	100	4 x 14	4
50	165	58	121	140	18	110	4 x 14	5.6

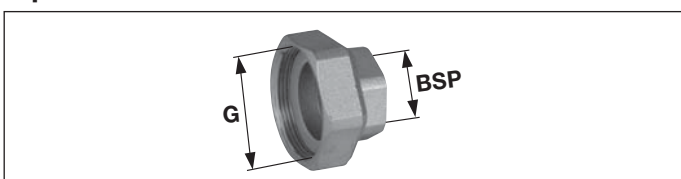
## Pipe connectors (accessory)



Included in scope of delivery of ZR23...: 1 male part (R thread),  
1 union nut (G thread),  
1 female part (BSP thread),  
1 flat gasket (IT)

Type	DN	Dim. L	Weight [kg]
	[mm]	[mm]	
ZR2310	10	58	0.1
ZR2315	15	66	0.2
ZR2320	20	72	0.35
ZR2325	25	80	0.45
ZR2332	32	90	0.8
ZR2340	40	95	0.9
ZR2350	50	107	1.4

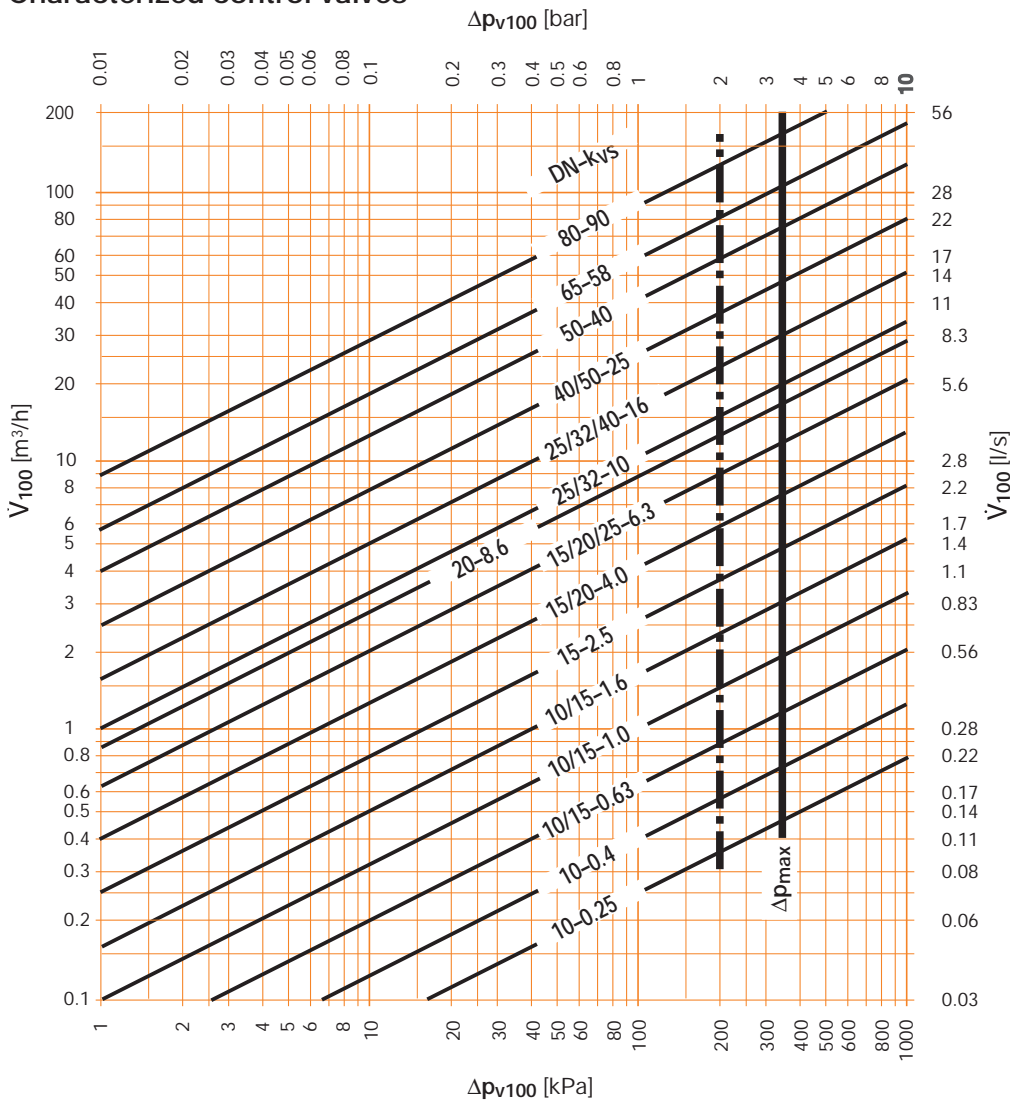
## Pipe connectors for ball valve



Included in scope of delivery of ZR45...: Female part, union nut,  
flat gasket

Type	DN	Dim. G	Dim. BSP
	[mm]		
ZR4510	10	G 3/4"	3/8"
ZR4515	15	G 1"	1/2"
ZR4520	20	G 1 1/4"	3/4"
ZR4525	25	G 1 1/2"	1"
ZR4532	32	G 2"	1 1/4"
ZR4540	40	G 2 1/4"	1 1/2"
ZR4550	50	G 2 3/4"	2"

## Sizing diagram Characterized control valves



### Legend

- $\Delta p_{max}$   
Maximum permitted pressure difference for a long service life across control path A-AB referred to the whole range of opening
- $\Delta p_{max}$   
For low-noise operation
- $\Delta p_{v100}$   
Pressure difference with ball valve fully open
- $\dot{V}_{100}$   
Nominal flow rate with  $\Delta p_{v100}$

### Formula $k_{vs}$

$$k_{vs} = \sqrt{\frac{\dot{V}_{100}}{\frac{\Delta p_{v100}}{100}}}$$

$k_{vs}$  [m<sup>3</sup>/h]  
 $\dot{V}_{100}$  [m<sup>3</sup>/h]  
 $\Delta p_{v100}$  [kPa]

### Definition of $\Delta p_s$

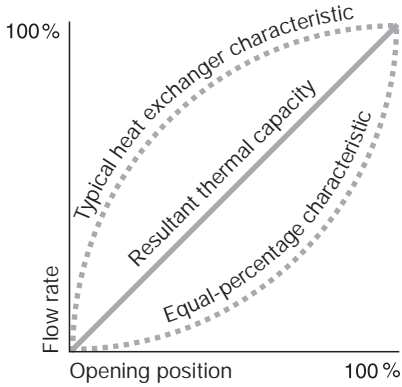
Closing pressure at which the actuator can still seal the valve tightly allowing for the appropriate leakage rate

## Sizing table Open-close ball valves

Differential pressure $\Delta p_{v100}$ [kPa]	Connection				$k_{vs}$ [m <sup>3</sup> /h]	DN [mm]	2-way 	3-way 
	0.1	1	3	10				
Flow rate $\dot{V}_{100}$ [m <sup>3</sup> /h]	0.27	0.86	1.49	2.72	8.6	15	R215 R415 R615R	R315 R515 R715R
	0.66	2.1	3.6	6.6	21	20	R220 R420 R620R	R320 R520 R720R
	0.82	2.6	4.5	8.2	26	25	R225 R425 R625R	R325 R525 R725R
	0.51	1.6	2.77	5.06	16	32	R230 R430	R330 R530
	1.01	3.2	5.54	10.12	32	32	R232 R432 R632R	R332 R532 R732R
	1.01	3.2	5.54	10.12	32	40	R240 R440 R640R	R340 R540 R740R
	1.55	4.9	8.49	15.5	49	50	R250 R450 R650R	R350 R550 R750R
	5.05	16	27.73	50.63	160	65	R665R	-
	5.05	16	27.73	50.63	160	80	R680R	-

## Ordinary ball valves are unsuitable as control devices

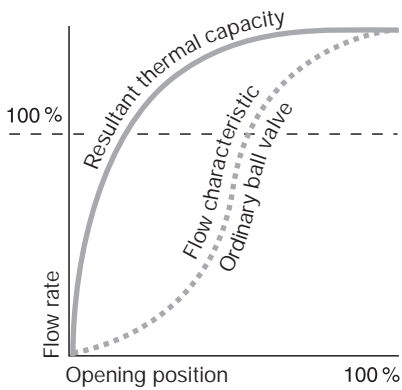
In order to ensure good stability of control, a hydraulic final controlling element must possess a flow characteristic that supplements the non-linear characteristic of the heat exchanger in the HVAC system.



Characteristics of an ideal hydraulic final controlling element

An equal-percentage valve characteristic is desirable in order to produce a linear relationship between the thermal output and the opening position of the final controlling element. This means that the flow rate increases very slowly as the final controlling element begins to open.

Unfortunately, this characteristic is severely distorted in ordinary ball valves.



Characteristic of an ordinary ball valve

The reason for this is that an ordinary ball valve has an extremely high flow coefficient ( $k_{VS}$  value) compared with its nominal size, several times that of a comparable globe valve.

Therefore, an ordinary ball valve is not very suitable for performing control functions:

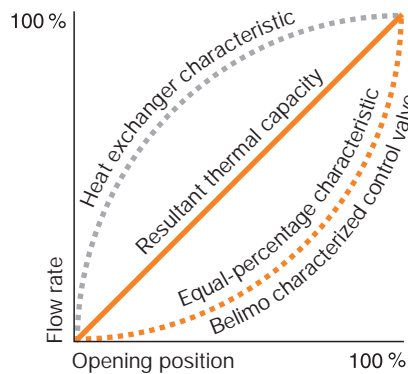
- Flow coefficient excessive due to the design
- Flow control inadequate in the part-load range

## Belimo adds "characterized control" to ball valves

Belimo has succeeded in solving the problem of the distorted flow characteristic of ordinary ball valves.

A so-called "characterizing disc" in the inlet of the characterized control valve converts the valve's characteristic to the equal-percentage kind.

The side of the characterizing disc facing the ball is concave and in contact with the surface of the ball. Thus, the actual flow is regulated by the hole in the ball and by the V-shaped aperture in the characterizing disc.

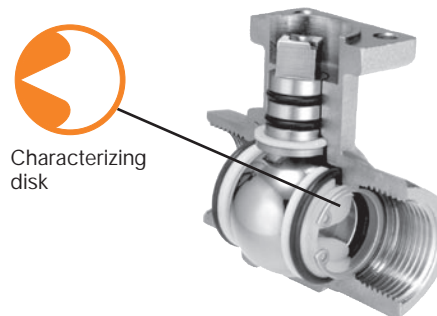


Characteristic of a Belimo characterized control valve

The  $k_{VS}$  value is reduced and corresponds approximately to that of a globe valve of comparable size. In order to avoid having to fit pipe reducers in the majority of cases, each valve size is also available with an appropriate choice of  $k_{VS}$  values.

## Advantages of the Belimo characterized control valve

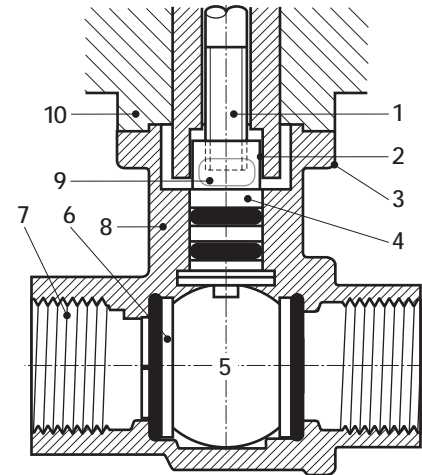
- Equal-percentage characteristic
- No initial jump in flow on opening
- Excellent stability of control thanks to the characterizing disc



- $k_{VS}$  values similar to those of globe valves of comparable size
- Fewer pipe reducers needed
- Better part-load characteristics and less prone to vibration, greater stability of control
- Tight-sealing (2-way)

## Elements of the characterized control valve

- 1 Simple direct mounting using a central screw. The rotary actuator can be mounted in four different positions
- 2 Square stem head for form-fit attachment of the rotary actuator
- 3 Identical mounting flange for all sizes
- 4 Stem with two O-ring seals for a long service life
- 5 Ball and stem made of stainless steel



- 6 Characterizing disc produces equal-percentage flow characteristic
- 7 Internal thread connection (ISO 7/1)
- 8 Forged fitting, nickel-plated brass body
- 9 Vent window to prevent the accumulation of condensation
- 10 Thermal decoupling of the actuator from the ball valve

## Optimum choice of $k_{VS}$ valves of identical size

- Better controllability
- Lower installation costs

The Belimo range of characterized control valves includes 2-way and 3-way types. These are available in a variety of sizes and with a choice of  $k_{VS}$  values.

A characterized control valve is supplied as a unit complete with a suitable Belimo rotary actuator.