VG1600 Series
270° Six-Way Ball Valves

Product Bulletin

LIT-12012567
February 2021

VG1600 Series 270° Six-Way Ball Valves are designed to easily and efficiently regulate the flow of both hot and chilled water, in response to the demand of a controller in HVAC systems. The 270° Six-Way Valve substitutes either four two-way through valves or two through valves and one three-way change-over valve. The VG1600 is supplied with a variety of flow disks providing the right flow rate for a wide range of applications. Available in 1/2 inch and 3/4 inch sizes, the valve is operated by a 270° rotary proportional, non-spring return actuator. The valve-to-actuator mounting system is designed to provide an error free connection, ensuring quick installation while reducing the risk of installation mistakes.

U.S. Patent No. 9,677,717

Figure 1: VG1600 Series 270° Six-Way Ball Valves

Features and benefits

National Pipe Thread (NPT), British Standard Pipe Parallel (BSPP) and Sweat Union Fittings	Provides the right valve for a broad range of applications, reduces installation time and the need for adapters, and increases system reliability.
Forged brass body	Provides PN16 (232 psi) nominal pressure rating.
350kPa (50 psi) close off pressure rating	Provides tight shutoff and precise flow control.
Ethylene Propylene Diene Monomer (EPDM) double O-ring stem seal	Provides a leak-free seal; the valve assembly has been tested and is leak-free after 100,000 cycles in iron-oxide contaminated water.
Graphite-Reinforced Polytetrafluoroethylene (PTFE) seats	Includes 15% graphite-reinforced ball seats, providing better wear resistance.
Maintenance-free design	Performs without failure in excess of 100,000 full stroke cycles in iron-oxide contaminated water.
Wide selection of styles for a variety of applications	Offers various valve configurations with just one valve size.
Factory- mounted VA9905 Series Electric Actuator	Reduces installation time, thus reducing overall installation cost.

Product overview

Application

VG1600 Series 270° Six-Way Ball Valve is the easiest and the most efficient way to control both heating and cooling operational modes.

The true close-off feature, which is internal to the valve, isolates the Source 1 circuit from the Source 2 circuit. This eliminates up to four valves and two actuators or three valves and two actuators depending upon the terminal equipment system installation. By eliminating these components, this new technology lowers terminal equipment system installation cost.

Figure 2: VA9905 Electric Non-Spring Return Rotary Actuator

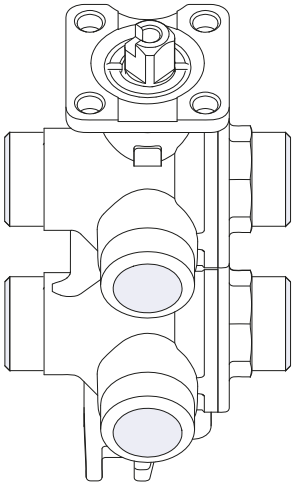


Figure 3: VG1600 270° Six-Way Valve

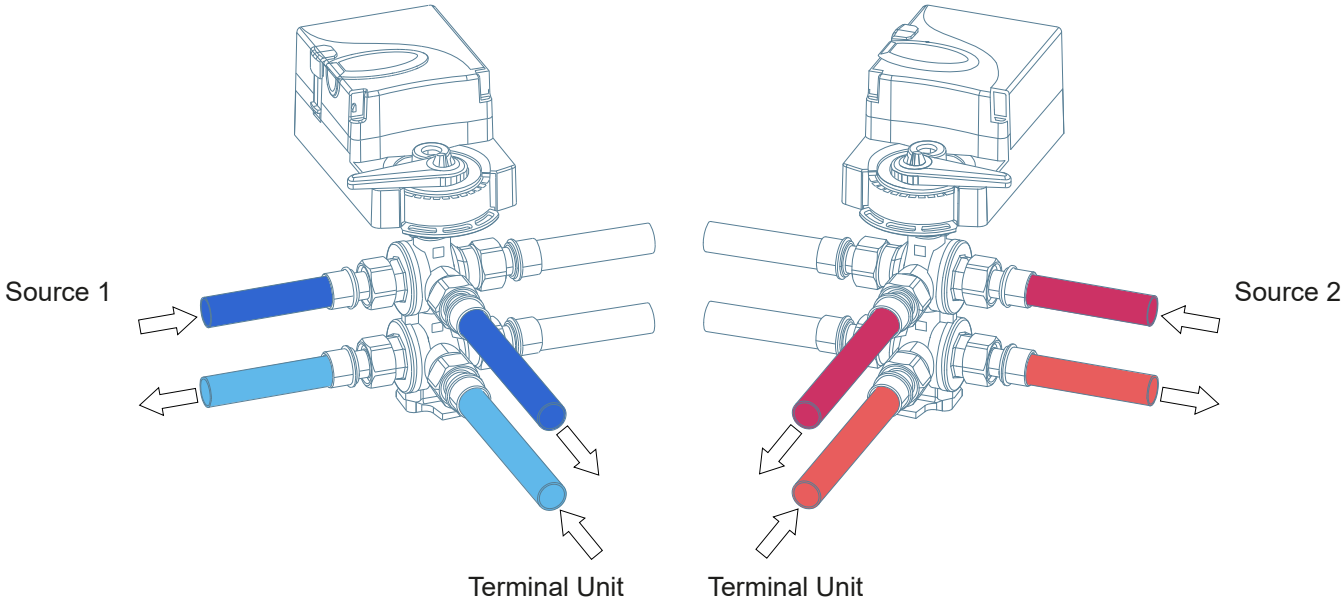


Figure 4: True close off

Kv value selection

In order to simplify the logistics and the installation in the building site, the valve is supplied from the factory with the maximum Kv/Cv configuration on both sides. Heating and cooling flow rates are different due to their different flow requirements. The VG1600 is supplied with changeable control flow disks, four each for heating and cooling.

The available control flow disks have a color code (red for heating source and blue for cooling source) that provides intuitive indications for use with the respective side of valve. Each disk is clearly marked with its corresponding Kv/Cv value. You can select the suitable Kv/Cv for each side by installing the appropriate disk. Install or remove the disks using the ring nut and key (wrench) provided in the kit. It is recommended to put the disks for Kv/Cv management on the return ways.

Once the appropriate disk is fitted in the valve, the rest of the flow control disks can be retained on the actuator or valve for any required change in the future. There is just one item per valve size and with the different disks, the combinations can cover any customer need, simplifying the valve choice and reducing the operational cost. The disk is held by a ring nut with the provided tool in the set. The flow control disks are also available as a separate accessory.

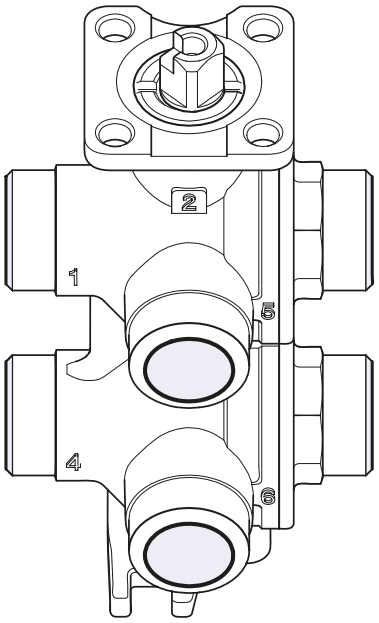


Figure 5: VG1600 Series Valve

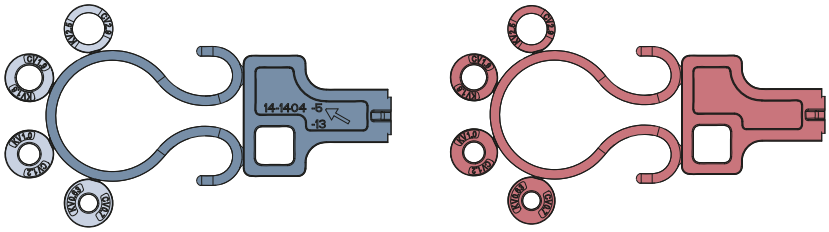


Figure 6: 1/2 in. Flow Disk Sets

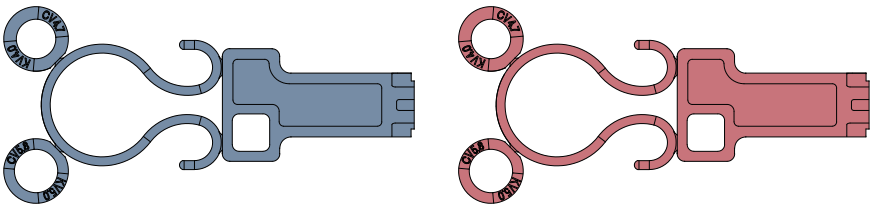


Figure 7: 3/4 in. Flow Disk Sets

Tools Required

8mm (5/16 in) slotted screwdriver

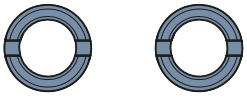
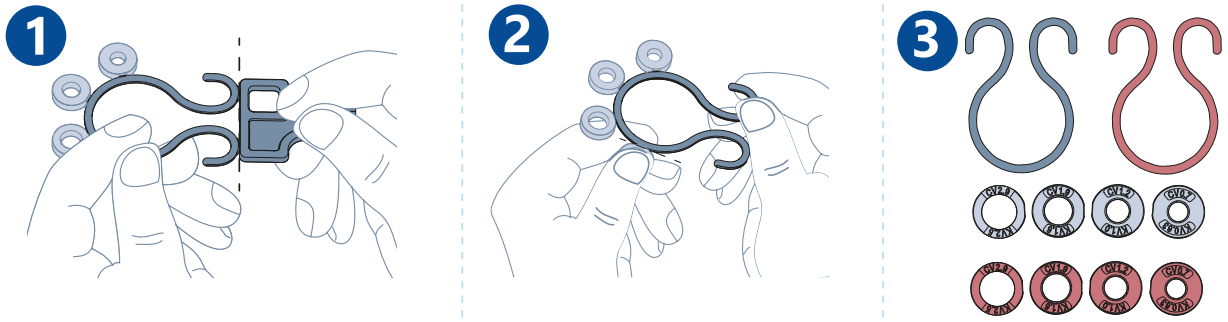


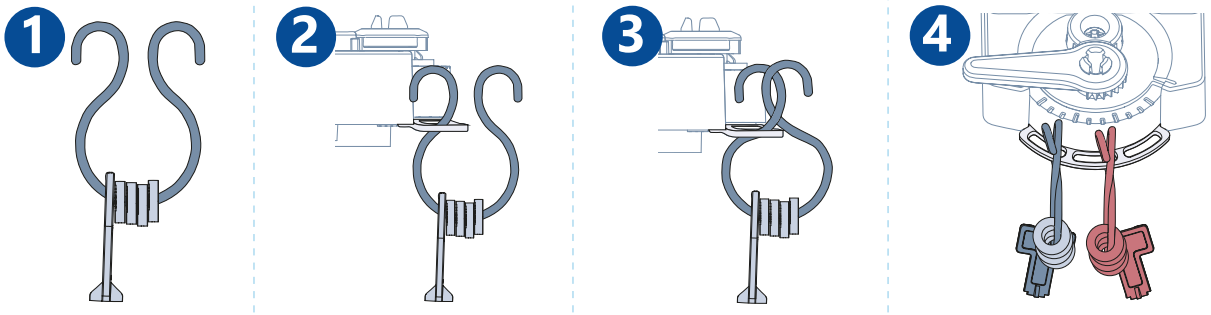
Figure 8: Two Ring Nuts

Flow disk set

Disassembly



Disk storage



Installation

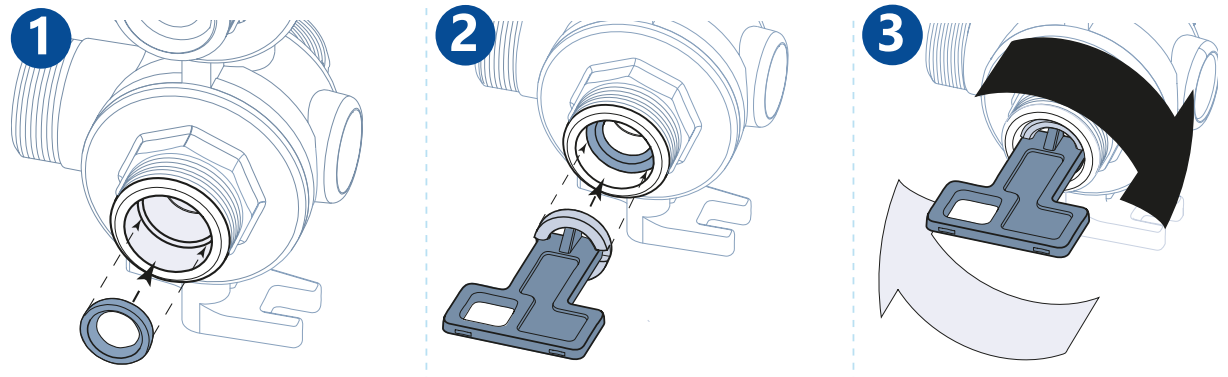
Note: Use blue restriction disks with cold water only, and red disks with hot water only.

Flow restriction disks have markings that indicate the rate of restriction they provide. Using the supplied restriction disks, you can set the following flow rates in ports 4 and 6:

Table 1: Flow rates

Valve Size	Disk Opening	Smallest	Small	Medium	Largest	No disk
1/2 in.	Cv	0.9[5]	1.2[4]	1.6[3]	2.2[2]	2.7[1]
	Kv	0.8	1.0	1.4	1.9	2.3
3/4 in.	Cv	4.1[3]	-	-	4.7[2]	5.2[1]
	Kv	3.5	-	-	4.1	4.5

Note: 1/2" 1 - No Cv disc; 2 - use 2.9 Cv disc; 3 - use 1.9 Cv disc; 4 - use 1.2 Cv disc; 5 - use 0.7 Cv disc.
3/4" 1 - No Cv disc; 2 - Use 5.8 Cv disc; 3 - Use 4.7 Cv disc.



Pipe sizes

Table 2: 1/2 inch pipe size

Kv [m3/h] Source 1	Kv [m3/h] Source 2	Cv [gpm] Source 1	Cv [gpm] Source 2
2.3	2.3	2.7	2.7[1]
	1.9		2.2[2]
	1.4		1.6[3]
	1.0		1.2[4]
	0.8		0.9[5]
1.9	2.3	2.2	2.7[1]
	1.9		2.2[2]
	1.4		1.6[3]
	1.0		1.2[4]
	0.8		0.9[5]
1.4	2.3	1.6	2.7[1]
	1.9		2.2[2]
	1.4		1.6[3]
	1.0		1.2[4]
	0.8		0.9[5]
1.0	2.3	1.2	2.7[1]
	1.9		2.2[2]
	1.4		1.6[3]
	1.0		1.2[4]
	0.8		0.9[5]
0.8	2.3	0.9	2.7[1]
	1.9		2.2[2]
	1.4		1.6[3]
	1.0		1.2[4]
	0.8		0.9[5]

Note: 1 - No Cv disc; 2 - use 2.9 Cv disc; 3 - use 1.9 Cv disc; 4 - use 1.2 Cv disc; 5 - use 0.7 Cv disc.

Table 3: 3/4 inch pipe size

Kv [m3/h] Source 1	Kv [m3/h] Source 2	Cv [gpm] Source 1	Cv [gpm] Source 2
4.5	4.5	5.2	5.2[1]
	4.1		4.7[2]
	3.5		4.1[3]
4.1	4.5	4.7	5.2[1]
	4.1		4.7[2]
	3.5		4.1[3]
3.5	4.5	4.1	5.2[1]
	4.1		4.7[2]
	3.5		4.1[3]

Note: 1 - No Cv disc; 2 - use 5.8 Cv disc; 3 - use 4.7 Cv disc.

Note: Just one item code covers 25 types of applications for 1/2 inch and 9 types of applications for 3/4 inch.

Mode of operation

Figure 9 illustrates the input and output flows for the Six-Way valve. Use this diagram as a guide on how to install the Six-Way valve to your system.

Note: Valve port 2 must only be used as coil supply. Valve 3 must only be used as coil return.

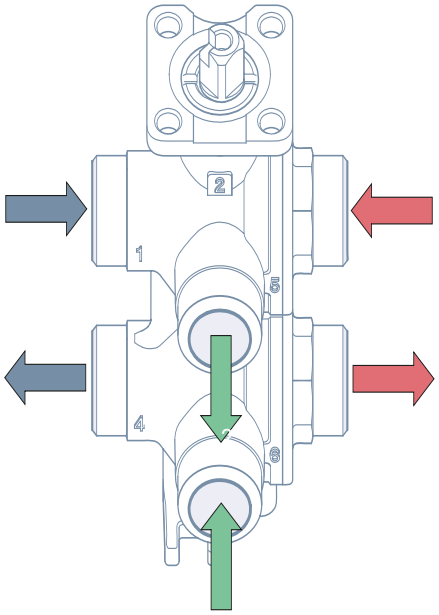


Figure 9: Input and output flows

Table 4: Input and output flows

Valve port	Description	Analog input control
1	Source 1 supply	Controlled by the gray wire
2	Coil supply	
3	Coil return	
4	Source 1 return	Controlled by the gray wire
5	Source 2 supply	Controlled by the orange wire
6	Source 2 return	Controlled by the orange wire

Note: Source 1 and 2 can be used for hot or cold water.

Over pressure system

The 270° Six-Way Control Valve is designed to prevent any damage to the terminal unit circuit.

When the valve is in the close position (for both cooling and heating operating modes), the trapped fluid may vary its pressure due to changes in ambient temperature. The pressure compensation system relieves such pressure changes. In order to connect the terminal unit circuit with either the sequence 1 or 2 circuit (expansion vessel), the upper valve chamber is purposely designed without a gasket, while the lower valve provides a true close off. When the valve is in the closed position, any increase in water volume flows through the upper ball, and water is purged to the inlet of the terminal unit since, by design, there is no gasket to prevent it.

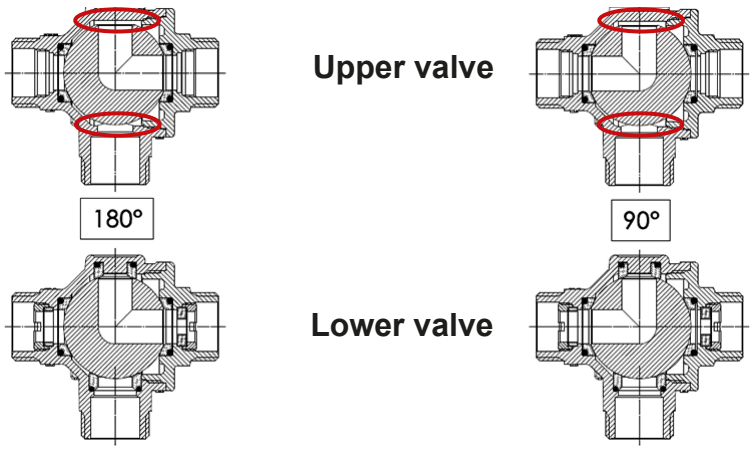


Figure 10: Upper and lower valves

Overall dimensions

The diagrams below illustrate the model dimensions of the VG1600 Valve Series.

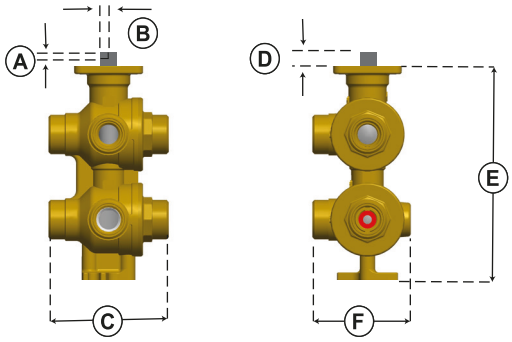


Figure 11: BSPP external threads

Table 5: Dimensions

	VG1611AF 1/2 in. mm (in)	**VG1611BL 3/4 in.** mm (in)
A	4 (0.16)	4 (0.16)
B	4.5 (0.17)	4.5 (0.17)
C	63 (2.48)	85(3.35)
D	9 (0.35)	9 (0.35)
E	113.5 (4.43)	139 (5.47)
F	51.8 (2.39)	73.0 (2.87)

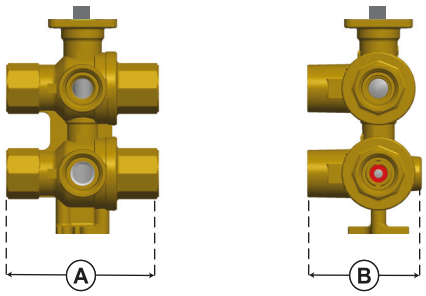


Figure 12: NPT internal threads

Table 6: Dimensions

	VG1671AF 1/2 in. mm (in)	**VG1671BL 3/4 in.** mm (in)
A	80 (3.15)	100 (3.94)
B	60.3 (2.37)	75 (2.95)

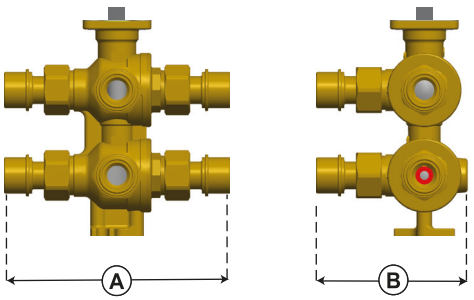


Figure 13: BSPP external threads with 6x Sweat Union Fittings

Table 7: Dimensions

	VG1641AF 1/2 in. mm (in)	**VG1641BL 3/4 in.** mm (in)
A	119 (7.19)	152 (5.98)
B	79.8 (3.14)	106.5 (4.19)

Clearance required

The diagrams below illustrate the clearance required to install an actuator to the VG1600 Valve Series.

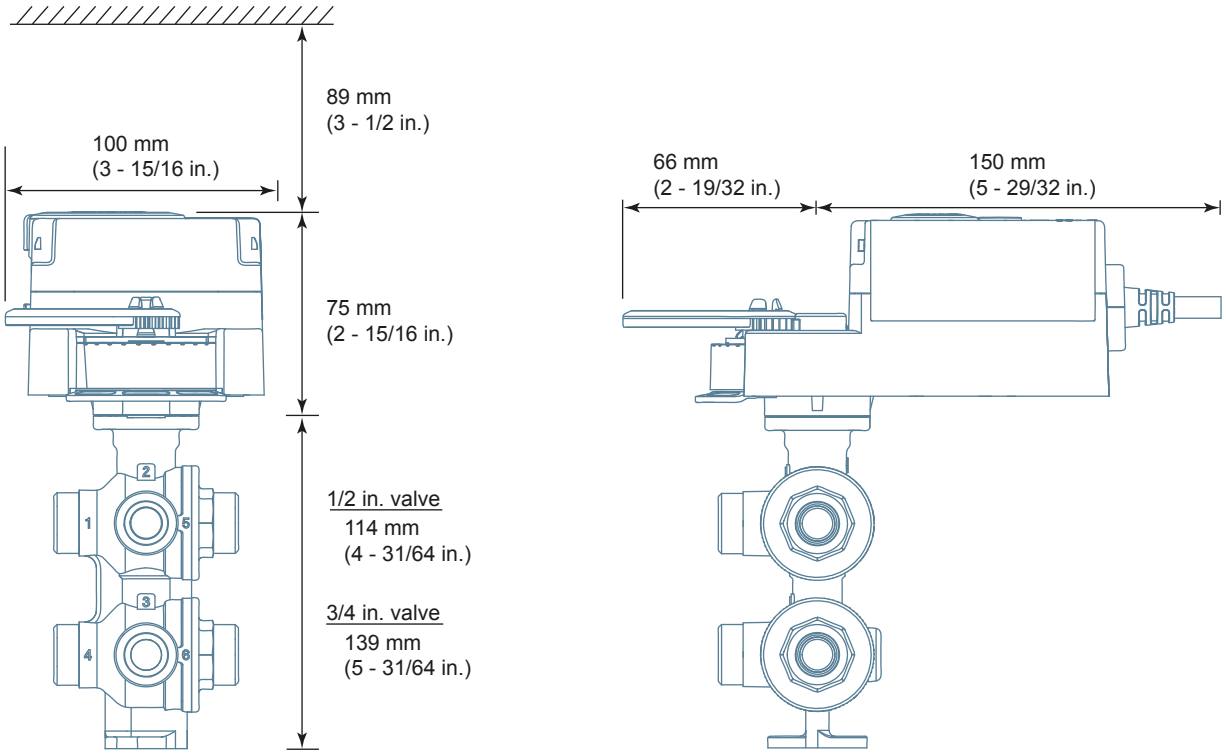


Figure 14: Clearance required

Table 8: Valves ordering codes

Code number	Name	Description
VG1611AF	½” BSPP external threads	Europe / Asia
VG1641AF	½” NPT internal threads	North America
VG1671AF	½” BSPP external threads + 6x Sweat Union Fitting	North America
VG1611BL	¾” BSPP external threads	Europe / Asia
VG1641BL	¾” NPT internal threads	North America
VG1671BL	¾” BSPP male + 6x Sweat Union Fittings	North America

Table 9: Acessories ordering codes

Code number	Name	Description
VG1600-01	½” Mounting Bracket	Europe / North America / Asia
VG1600-02	½” Flow Disk Kit (2 x flow disk sets + 2 x ring nut)	Europe / North America / Asia
VG1600-03	½” Insulation Shell	Europe / North America / Asia
VG1600-04	½” Sweat Union Fitting kits (6x Sweat Union Fitting)	North America
VG1600-05	¾” Flow Disk Kit (2 x flow disk sets + 2 x ring nut)	Europe / North America / Asia
VG1600-06	¾” Insulation Shell	Europe / North America / Asia
VG1600-07	¾” Sweat Union Fitting kits (6x Sweat Union Fitting)	North America

Technical Specifications

	VG16x1AF	VG16x1BL
Total operation angle	270°	
Sequence 1	0°...>90°	
Dead band	>90°…<180°	
Sequence 2	>180°…270°	
Characteristic curve	Linear	
ID	10.5 mm	15 mm
Fluid type	Water, glycol solutions (max 50%) for HVAC applications	
Fluid temperature	5°C to 95 °C (41°F to 203 °F)	
Nominal pressure	PN16 (232 psi)	
Close off pressure	350 kPa (50 psi)	
Max. differential pressure	240 kPa (35 psi)	
Rangeability	100:1	
Max. Kv (Cv)	2.3 (2.7) 1/2 in. pipe size	4.5 (5.2) 3/4 in. pipe size
Body	Brass CW 617N (UNI EN 12420)	
End connection	Brass CW 617N (UNI EN 12420)	
Balls	Brass chrome plated	
Stems	Brass chrome plated	
Ball seat	PTFE 15% graphite filled	
O-ring	EPDM PEROX	
Ring nut	Brass CW 614N (UNI EN 12164 – UNI EN 12168)	
Connections	Valve body with male 1/2 inch BSPP thread (external) Valve body with female 1/2 inch NPT thread (internal) 1/2 in. sweat union fitting kit	Valve body with male 3/4 inch BSPP thread (external) Valve body with female 3/4 inch NPT thread (internal) 3/4 in. sweat union fitting kit
Shipping weight	VG1611AF: 0.7 Kg (1.55 lbs) VG1641AF: 0.8 Kg (1.85 lbs) VG1671AF: 1 Kg (2.20 lbs)	VG1611BL: 1.4 Kg (3.01 lbs) VG1641BL: 1.7 Kg (3.69 lbs) VG1671BL: 1.9 Kg (4.13 lbs)
Flow coefficient	Flow control disk	
Leakage rate	A, 100,000 cycles in iron-oxide contaminated water and air-bubble-tight (EN 12266-1)	
Water quality	Refer to the VDI 2035 Guideline for recommended proper water treatment	
Maintenance	Maintenance free	
Warranty	Minimum 5 years to our customer	

The performance specifications are nominal and conform to acceptable industry standard. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.

Product warranty

This product is covered by a limited warranty, details of which can be found at www.johnsoncontrols.com/buildingswarranty.

Software terms

Use of the software that is in (or constitutes) this product, or access to the cloud, or hosted services applicable to this product, if any, is subject to applicable end-user license, open-source software information and other terms set forth at www.johnsoncontrols.com/techterms. Your use of this product constitutes an agreement to such terms.

Patents

Patents: https://jcipat.com

Single point of contact

APAC	Europe	NA/SA
JOHNSON CONTROLS C/O CONTROLS PRODUCT MANAGEMENT NO. 32 CHANGJIJANG RD NEW DISTRICT WUXI JIANGSU PROVINCE 214028 - CHINA	JOHNSON CONTROLS WESTENDHOF 3 45143 ESSEN GERMANY	JOHNSON CONTROLS 507 E MICHIGAN ST MILWAUKEE WI 53202 USA

Contact information

Contact your local branch office: www.johnsoncontrols.com/locations

Contact Johnson Controls: www.johnsoncontrols.com/contact-us

Building Technologies & Solutions
Headquarters: Milwaukee, Wisconsin, USA
Branch Offices: Principal Cities World-wide