Series V46

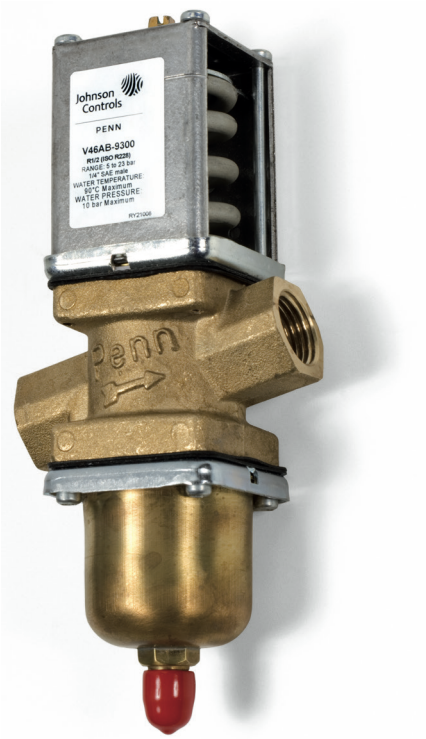
Pressure Actuated Modulating Valves

Product Bulletin

These Pressure Actuated Modulating Valves control the quantity of water to a condenser by directly sensing pressure changes in a refrigerant circuit.

The valves can be used in non-corrosive refrigerant systems. Ammonia power elements and valves designed for saltwater applications are available.

The valves have a quick opening characteristic and open on pressure increase (direct acting).
Reverse acting (close on pressure increase) is possible.



Features

- **Pressure balanced valve design**
  Setpoint is independent from water inlet pressure
- **High refrigerant pressure resistant bellows**
  Refrigeration pressure may increase up to 28 bar without bellows damage
- **Pressure actuated**
  Direct and fast response to pressure variations
- **3/8, 1/2, 3/4" are angled body type valves with high Kv value**
  Small dimensions with high flow capacity
- **3/8" up to 2" pressure valves "all range" types**
  Reduces stock. One valve for all non-corrosive refrigerants
- **Quick opening valve characteristics**
  Fast response to pressure increase
- **No close fitting or sliding parts in water passages**
  No hysteresis increase or stuck valve caused by contamination
- **Easy to disassemble. All parts can be replaced**
  Valve can easily be repaired "in line". Valve piece parts are available "world-wide"
- **Special bronze bodies and monel parts**
  Used for sea water applications
- **Power elements with stainless steel bellows available**
  For use on ammonia filled equipment
- **Wide range of pressure connection styles**
  Possibility to meet the legislation in your country
- **Nickel plated seats available for 3/8, 1/2, and 3/4" valves**
  High resistant against erosion/ corrosion and cavitation
- **Direct/reverse action**
  Control action can be (factory) changed

Note: All Series V46 Water Regulating Valves are designed for use only as operating devices. Where system closure, improper flow or loss of pressure due to valve failure can result in personal injury and/or loss of property, a separate pressure relief or safety shut off valve, as applicable, must be added by the user.

Description

A pressure-balanced design employing rubber sealing diaphragms correctly proportioned to the valve port area, balances valve against both gradual and sudden water pressure changes, and seals water away from range spring, guides and sliding parts so these are not submerged in water where they would be subject to sedimentation and corrosion. Only five metal parts, made of corrosion resistant material, come in contact with the water. These are the valve disc holder, the disc stud, the valve seat, the valve stem, and the body.

Adjustments

The pressure at which the valve starts to open (= opening point) can be adjusted by the adjusting screw located at the top of the range spring housing.
Valves may be adjusted with standard service valve wrenches or screwdrivers.
(Valves are not factory set at a certain value).

Manual Flushing

Valves may be manually flushed by lifting the lower spring guide with screwdrivers at two sides of the pressure plate to open valve. This does not affect valve adjustment.

Valve Size Selection

The valve size is determined by three data:

- The required maximum flow (quantity of liquid = Q) that must pass the valve (in m^3/h).
- The maximum allowed pressure drop (= Δ P) across the valve (in bar).
- The head pressure rise (= HPR) which is the difference between the pressure where the valve starts to open and the condenser operating pressure.

Note: At a certain pressure the valve starts to open. If the pressure decreases, the valve will close again at a ≈ 0,5 bar lower pressure than the pressure where the valve starts to open.

Note: If the compressor operates in a high ambient temperature, the refrigerant pressure may at times remain high enough to cause the valve to partly open when the compressor is idle. In such conditions the valve opening point should be raised just enough to cause the valve to close during compressor standby periods. Take this into account when the head pressure rise (HPR) is calculated.

The valve size can be selected by the use of:

- The diagram *(see Page 3 and 4)*.
- Kv factors and calculation formulae *(see Page 3)*. This can only be used when the allowed head pressure rise is 3 bar or higher. At lower head pressure rises the diagram has to be used.

Valve Size Selection by the use of the Diagram (Page 4)

Q The quantity of water (m^3/h) is indicated on the left side of the upper diagram (= scale A).

Δ P The curves for the pressure drop across the valve are indicated in the lower diagram (0,1 up to 4 bar, *see Scale C*).

HPR The head pressure rise above the valve opening point is indicated at the left side of the lower diagram (max. 4 bar, *see Scale B*).

Note: There are two vertical head pressure rise scales. The left side for range 5/18 bar valves and the right side for high ranges 5/23 and 10/23 bar valves.

Valve Size

The valve size can be read from the right side of the upper diagram.

Valve Size Selection Example

Q 6,5 m^3/h

HPR 2,7 bar

ΔP 0,5 bar

a. Draw a horizontal line through the 6,5 m^3/h point of Scale A *(see A)*.

b. Draw a horizontal line through the 2,7 bar of scale B *(see B)*. The intersection of this horizontal line with the delta P curve of 0,5 bar is used to draw a vertical line from this intersection point up to the horizontal line in Scale A *(see C)*.

c. The intersection point of this vertical line with the horizontal line in scale A indicates the valve size. If the point falls on a size curve, this is the valve size needed. If it is between two sizes always take the largest valve size. In this example it is between size 1¼" and 1½". The selected valve is 1½".

Of course the same diagram can be used to read the pressure drop across a valve or to find the maximum capacity of a valve.

E.g. Pressure drop.

Q needed is 6 m^3/h.
HPR is 2,5 bar.
The valve size available is ¾".
What will be the pressure drop?

Solution:

a. Draw a horizontal line through 6 m^3/h *(Scale A)* and determine the intersection of this line with the ¾" valve curve.

b. Draw a vertical line from this intersection point to the 2,5 bar HPR line.

c. The found part is between the 2 and 3 bar pressure drop curves. Interpolate the point which gives 2,3 bar.

If this is acceptable the valve can be used.

E.g. Maximum flow.

Valve size is 1"
HPR = 3 bar
Maximum Δ P = 2 bar
What is maximum Q?

Solution:

a. Draw a horizontal line at 3 bar HPR *(Scale B)* till intersection with 2 bar delta P curve.

b. Draw a vertical line from this intersection point to the 1" valve curve.

c. Draw from this point a horizontal line to the water flow Scale A. You find 9 m^3/h.

Valve Size Selection by the use of the Kv Factors and Calculation Formulae

For water:

The following Kv values can be used:

$$K_v = \frac{Q}{\sqrt{p}}$$

$$\Delta P = \left(\frac{Q}{K_v}\right)^2$$

$$Q = K_v \cdot \sqrt{p}$$

Valve size	K_v value
3/8"	1.8
1/2"	2.7
3/4"	4.5
1"	6.5
1¼"	9
1½"	10.5
2"	18 (Low Range)
2"	17 (High Range)
2½"	22 (Low Range)
2½"	20 (High Range)

Q Quantity of liquid (in m^3/h)

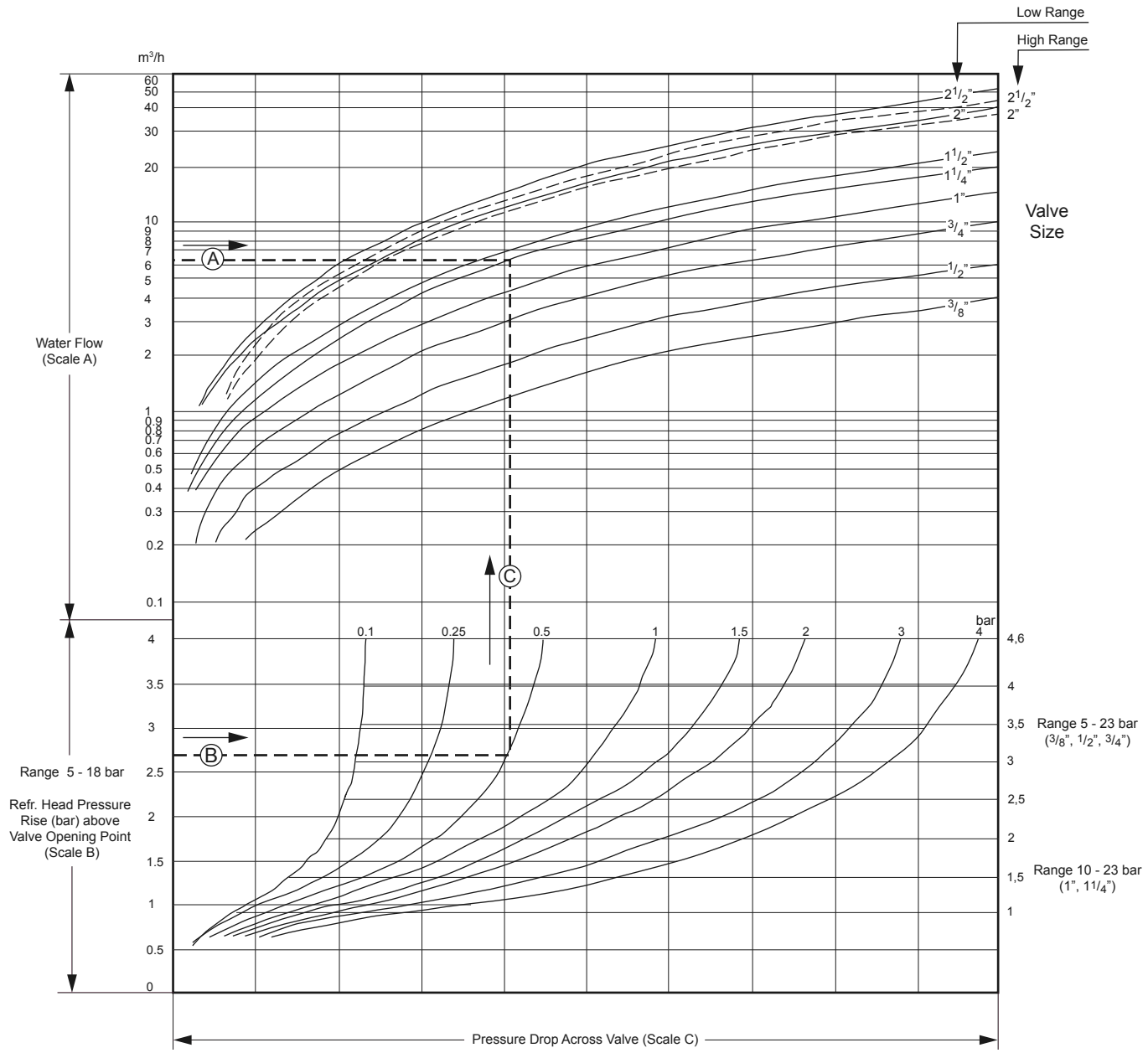
ΔP Pressure drop across valve (in bar)

K_v Valve flow coefficient

The K_v factor is the quantity of 20°C water that will pass through the valve at one bar pressure drop and a valve opening which belongs by 3 bar head pressure rise (HPR) above the valve opening point.

Diagram for Selecting the Valve Size Corresponding *(Information on Page 3)*

Note: Use dotted curves for high range 2" and 2½" valves



Note:

1 dm^3/s = 3.6 m^3/h = 15.8 U.S. gal./min. = 13.2 U.K. gal./min.
1 bar = 100 kPa = 0.1 MPa ≈ 1.02 kp/cm^2 = 1.02 at ≈ 14.5 psi.

Figure 1

Ammonia (NH_3) Applications

For all larger valve types an ammonia element is available. These elements have style 15 pressure connection and consist of a stainless steel bellow in a steel cup (coated). The existing element can be replaced by this ammonia element. The pressure range does not change.

For the high range valves (V46AS/AT/BS/BT) the spring inside the power element has to be placed in the ammonia element. If low pressure is needed this spring can be removed. For low quantities you have to order the selected valve and separate ammonia replacement power element *(See Valve Selection Table)*.

For quantity orders a special valve type can be set up. Then please contact the JC sales office in your region.

Repair and Replacement

Diaphragm kits can be ordered for all valves.
Also the complete power element can be replaced.
For a total revision of the valve a renewal kit can be ordered.

For type numbers of replacement power elements, renewal kits and diaphragm kits see valve selection table.

If a replacement is ordered a “repair parts and service instruction” sheet will be included in which a step by step description is given to disassemble/assemble the valve.

Renewal KITs

Note: Each KIT contains parts as indicated in the table below.
The complete KIT must be ordered that contains part required.

Valve Type	KIT Number	Disc Cup	Valve Disc	Plunger Disc	Seat Guide	Disc Stud	Valve Stem	Valve Disc Holder	Extention Sleeve	Valve Seat	Diaphragms	Gasket	Valve Seat Wrench	Screw	Seal Ring
V46AA	**STT002N600R**	1	1	-	1	1	1	-	-	1	4	1	1	-	1
V46AB	**STT003N600R**	1	1	-	1	1	1	-	-	1	4	1	1	-	1
V46AC	**STT004N600R**	1	1	-	1	1	1	-	-	1	4	1	1	-	1
V46AS	**STT18A600R**	-	1	1	-	-	-	1	1	1	5	1	-	1	1
V46AT	**STT18A601R**	-	1	1	-	-	-	1	1	1	5	1	-	1	1
V46BE	**STT17A612R**	1	1	-	1	1	1	-	-	1	5	-	1	-	-
V46BR	**STT17A612R**	1	1	-	1	1	1	-	-	1	5	-	1	-	-
V46BS	**STT18A602R**	-	1	1	-	-	-	1	1	1	5	-	-	1	-
V46BT	**STT18A602R**	-	1	1	-	-	-	1	1	1	5	-	-	1	-

Pressure Connections

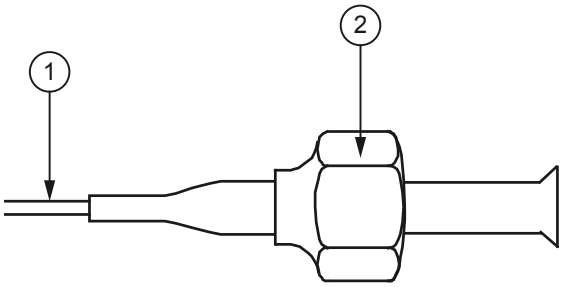


Figure 2
Style 13 (excl. valve depressor)

1. 75 cm capillary
2. 7/16-20 UNF flare nut

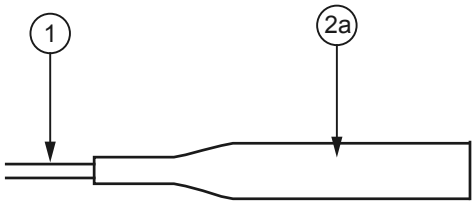


Figure 3
Style 34

1. 75 cm capillary
2. 1/4" tube for braze connection

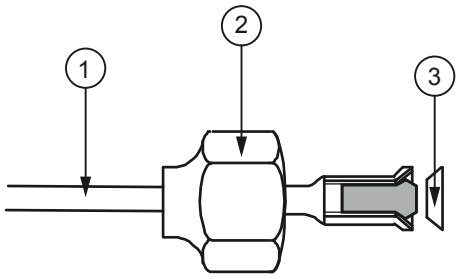


Figure 4
Style 50 (incl. valve depressor mounted into machined flare)

1. 75 cm capillary
2. 7/16-20 UNF flare nut
3. Copper sealring

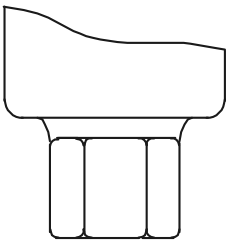


Figure 5
Style 15
1/4-18NPT (female)

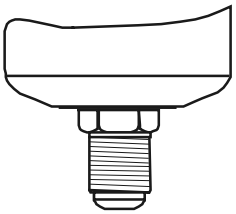


Figure 6
Style 5
7/16-20 UNF

Dimensions *(in mm)*

Angled Type

For Valve Type see Technical Specifications on the last page.

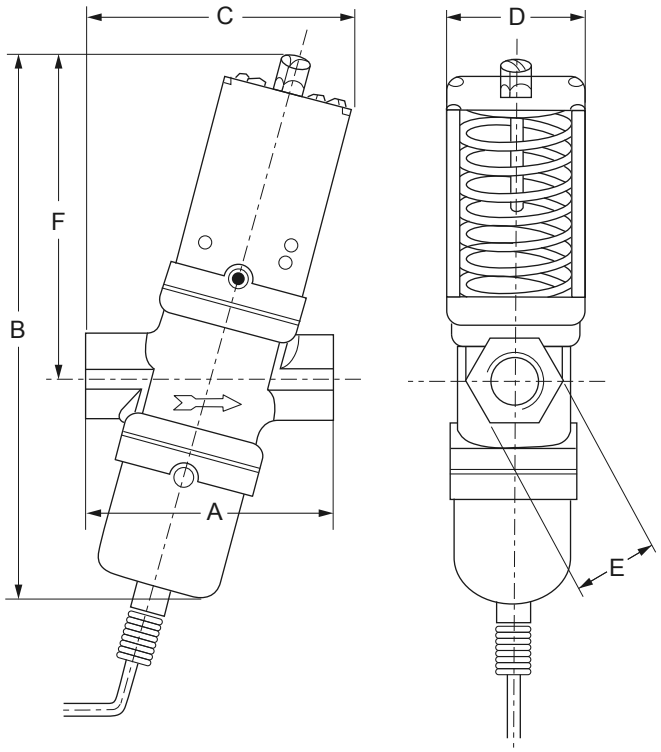


Figure 7

Commercial Types

Valve Type	Valve Size	Dimensions in mm					
		A	B	C	D	E	F
V46AA	3/8"	70	150	75	41	24	92
V46AB	1/2"	80	166	86	51	27	98
V46AC	3/4"	90	181	97	55	36	110

Dimensions *(in mm)*

Straight Type

For Valve Type see Technical Specifications on the last page.

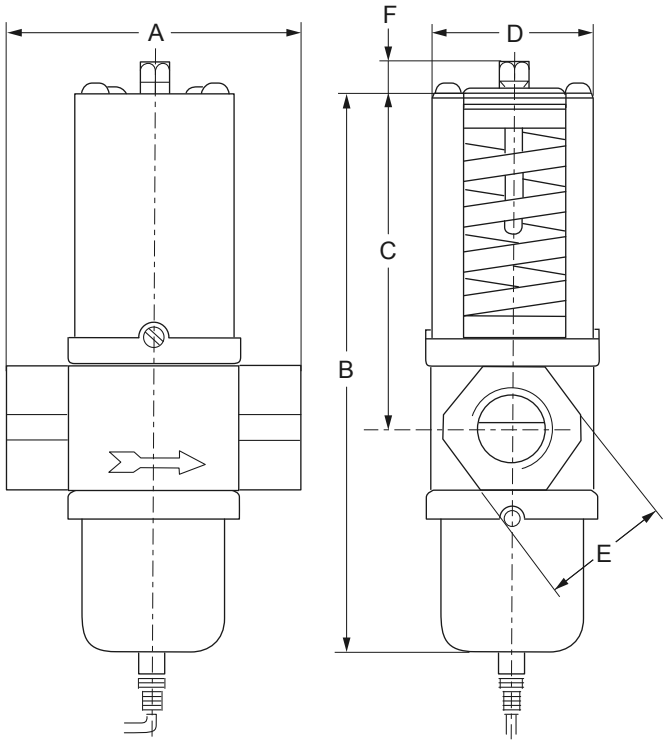


Figure 8

Commercial Types

Valve Type	Valve Size	Dimensions in mm					
		A	B	C	D	E	F
Commercial Types							
V46AD	1"	124	233	138	71	48	13
V46AE	1¼"	126	242	144	71	57	13
Sea-Water Types							
V46BA	3/8"	67	136	79	41	24	10
V46BB	1/2"	80	153	86	51	29	10
V46BC	3/4"	86	163	96	55	35	10
V46BD	1"	124	233	138	71	52	13
V46BE	1¼"	124	242	144	71	62	13

Dimensions *(in mm)*

Flange Type

For Valve Type see Technical Specifications on the last page.

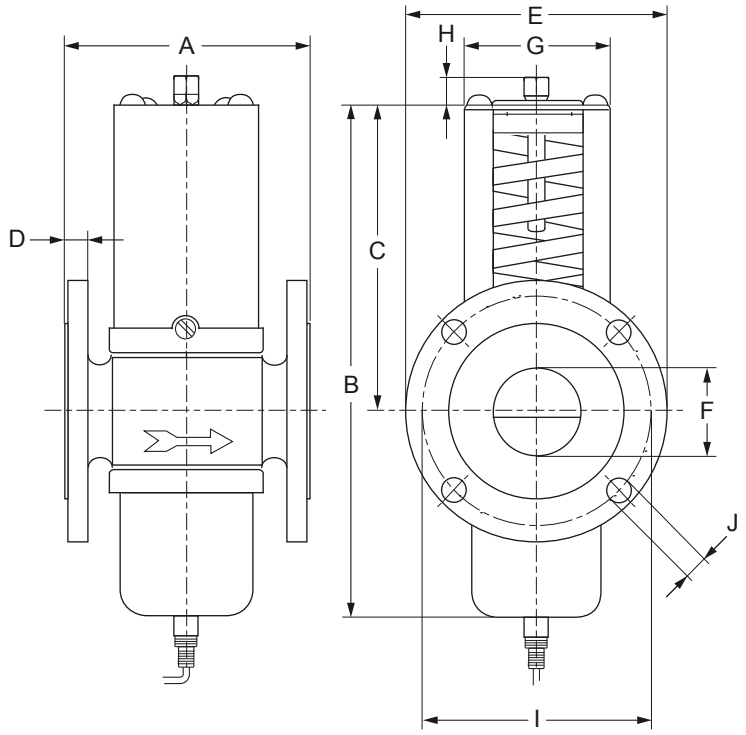


Figure 9

Valve Type	Valve Size	Dimensions in mm									
		A	B	C	D	E	F	G	H	I	J
Commercial Types											
V46AR	1½"	137	242	144	18	150	47	67	13	110	18
V46AS	2"	168	299	164	20	165	57	89	16	125	18
V46AT	2½"	172	299	164	20	185	70	89	16	145	18
Sea-Water Types											
V46BR	1½"	135	242	144	14	150	47	67	13	110	18
V46BS	2"	162	299	164	16	165	57	89	16	125	18
V46BT	2½"	172	299	164	16	185	70	89	16	145	18

Valve Selection Table

Commercial Types

Item	Size *(inch)*	Range Bar	Refrigeration Connection Style	Capillary Length *(m)*	Connection Thread / Flange	Replacements			Ammonia Element Type	Weight Single Pack *(kg)*	Quantity per Box	Weight per Box *(kg)*
						Power Element	Renewal Kit	Diaphragm Kit				
V46AA-9300	3/8	5/23	5	---	ISO 228 - G 3/8	---	STT002N600R	---	---	0.9	24	22.0
V46AA-9301												
V46AA-9510			50	0.75								
V46AA-9600		5/18	13									
V46AA-9602*				1.00								
V46AA-9606*		5/23		0.75								
V46AA-9608		5/18										
V46AA-9609		5/23										
V46AA-9951		5/18	34									
V46AA-9950*												
V46AB-9300	1/2	5/23	5	---	ISO 228 - G 1/2	---	STT003N600R	KIT016N601 (100)	---	1.3	18	24.0
V46AB-9510			50	0.75								
V46AB-9600		5/18	13			246-824R						
V46AB-9605*		5/23										
V46AB-9950		5/18	34			---						
V46AB-9951*		5/23										
V46AC-9300	3/4	5/23	5	0.75	ISO 228 - G 3/4	---	STT004N600R	---	---	1.7	14	25.5
V46AC-9510			50									
V46AC-9600		5/18	13			246-825R						
V46AC-9605*		5/23										
V46AC-9951		5/18	34			-						
V46AD-9300	1	5/18	5	---	ISO 7 - Rc 1	246-675R	---	---	246-667R	3.5	1	3.5
V46AD-9510			50	0.75		-						
V46AD-9511		10/23										
V46AD-9600		5/18	13			246-925R						
V46AE-9300	1 1/4	5/18	5	---	ISO 7 - Rc 1 1/4	246-675R	---	---	246-667R	3.8	1	3.8
V46AE-9510			50	0.75		-						
V46AE-9512		10/23										
V46AE-9600		5/18	13			246-925R						
V46AR-9300	1 1/2	5/18	5	---	Flange 1 1/2 DIN2533	246-675R	---	---	246-925R	7.5	1	7.5
V46AR-9600			13	0.75		246-925R						
V46AS-9300	2	5/11.5	5	---	Flange 2 DIN2533	246-671R	STT18A600R	KIT016N604 (25)	246-781R	13.0	1	13.0
V46AS-9301		11/18				246-758R						
V46AT-9300	2 1/2	5/11.5	5	---	Flange 2 1/2 DIN2533	246-671R	STT18A601R	KIT016N604 (25)	246-781R	14.0	1	14.0
V46AT-9301		11/18				246-758R						

Note
* Nickel plated seat

Valve Selection Table

Sea-Water Types

Item	Size *(Inch)*	Range Bar	Refrigeration Connection Style	Capillary Length *(m)*	Connection Thread / Flange	Replacements			Ammonia Element Type	Weight Single pack *(kg)*	Quantity per Box	Weight per Box *(kg)*
						Power Element	Renewal Kit	Diaphragm Kit				
V46BA-9510	3/8	5/23	50	0.75	ISO 228 - $G^3/_8$	---	---	---	---	0.8	24	20.0
V46BA-9600		5/18	13									
V46BB-9510	1/2	5/23	50	0.75	ISO 228 - $G^1/_2$			KIT016N601 (100)	---	1.3	18	24.0
V46BB-9600		5/18	13			246-824R						
V46BC-9510	3/4	5/23	50	0.75	ISO 228 - $G^3/_4$	---	---	---		1.7	14	25.0
V46BC-9511		5/23	50	1.40								
V46BC-9600		5/18	13	0.75		246-825R						
V46BD-9510	1	10/23	50	0.75	ISO 228 – G1	---		---	246-667R	4.0	1	4.0
V46BD-9600		5/18	13			246-925R						
V46BE-9510	$1^1/_4$	5/18	50	0.75	ISO 228 – $G1^1/_4$	---	STT17A612R		246-667R	4.5	1	4.5
V46BE-9511		10/23	50	1.50								
V46BE-9600		5/18	13	0.75		246-925R						
V46BR-9510	$1^1/_2$	5/18	50	0.75	Flange $1^1/_2$ DIN86021	---	STT17A612R		246-667R	7.5	1	7.5
V46BR-9600		5/18	13			246-925R						
V46BS-9300	2	5/11.5	5	---	Flange 2 DIN86021	246-758R	STT18A602R	KIT016N604 (25)	246-781R	13.5	1	13.5
V46BS-9301		11/18										
V46BT-9300	$2^1/_2$	5/11.5	5		Flange $2^1/_2$ DIN86021	246-758R	STT18A602R	KIT016N604 (25)	246-781R	14.5	1	14.5
V46BT-9301		11/18								15.0		15.0

Technical Specification

Size	3/8" - 3/4"	1" - 1 1/4"	1 1/2"	2" - 2 1/2"	2" - 2 1/2"
Operating Range *(Bar)*	5-18 / 5-23	5-18 / 10-23	5-18	5-11,5	11-18
Max. Refrigeration Overrun Pressure *(Bar)*	28				
Max. Water Supply Press. *(Bar)*	10				
Max. Water Supply Temperature	90 °C				
Min. Water Supply Temperature*	-20 °C				
Valve Hysteresis *(Bar)*	~ 0,5				
Pressure Connection Style	*(See Valve Selection Table)*				
Capillary Length	*(See Valve Selection Table)*				
Ammonia Element Style 15 Pressure Connection	Stainless steel bellows in steel cup				
Shipping Weights	*(See Valve Selection Table)*				
Commercial					
Valve Body Style *Angled:*	•	-	-	-	-
Straight:	-	•	•	•	•
Pipe Connection** *Thread ISO 228:*	•	-	-	-	-
Thread ISO 7 - Rc:	-	•	-	-	-
Flange DIN 2533:	-	-	•	•	•
Material *Body:*	Hot Forged Brass	Cast Iron***			
Disc Stud / Disc Cup:	Brass				
Seat:	Alum. Bronze				
Diaphragms:	BUNA-N				
Bellows:	Ph. Bronze			Tombac	Monel
Stem / Extension Sleeve:	Brass				
Disc:	BUNA-N				
Sea-Water					
Valve Body Style *Straight:*	•	•	•	•	•
Pipe Connection** *Thread ISO 228:*	•	•	-	-	-
Flange DIN 86021:	-	-	•	•	•
Material *Body:*	Bronze				
Disc Stud / Disc Cup:	Monel				
Seat:	Monel				
Diaphragms:	BUNA-N				
Bellows:	Ph. Bronze			Monel	
Stem / Extension Sleeve:	Monel				
Disc:	BUNA-N				

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

Note

* Care should be taken the valve does not freeze up.

** Thread ISO 7 - Rc = DIN2999-RC thread/ISO 228 = DIN259-Rp thread

*** Cast iron bodies are executed with rust resisting finish

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