V46 Pressure-Actuated Water-Regulating Valve Product Bulletin

LIT-125687

2021-08-17

Introduction

The direct-acting V46 pressure-actuated modulating valves typically regulate refrigerant head pressure in water-cooled condensers.

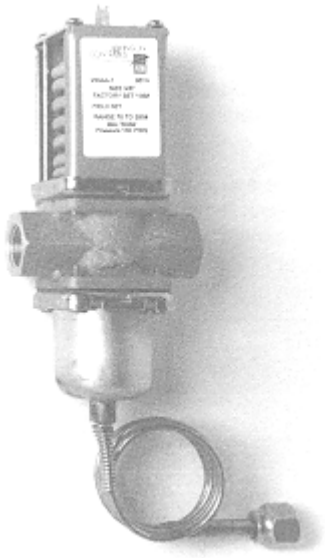
You can use commercial V46 valves with standard noncorrosive refrigerants. For applications where the coolant may be corrosive to the valve trim, maritime models are available, which have nickel copper MONEL® valve trim.

WARNING

Risk

This product is made of copper alloy, which contains lead. The product is therefore not to be used on drinking water.

Figure 1: V46 pressure-actuated water-regulating valve



Features and benefits

No close fitting or sliding parts in water passages

Provides robust control in non-ideal conditions.

Corrosion resistant material for parts that come in direct contact with water

Promotes longer valve life.

Accessible range spring

Facilitates easy manual flushing, if required.

Take-apart construction

Facilitates access to the interior of valves without removing the valve from the refrigeration system or pumping down.

Pressure-balanced design

Maintains a consistent setpoint against both gradual and sudden water pressure changes.

Application overview

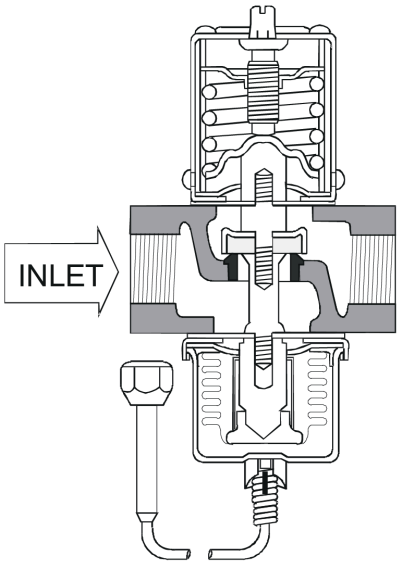
The V46 direct-acting models open on an increase in pressure. Use models A, B, and C typically to regulate water-cooled condensers, and use the low flow D model typically in ice machines.

Commercial V46 valves are available in 3/8 in. to 2 1/2 in. sizes. You can use commercial all-range models from 3/8 in. to 1 1/2 in. with standard noncorrosive refrigerants.

V46 Series valves also come in models for Navy or maritime salt water applications. These valve bodies are of bronze construction, and any metal parts that come into contact with salt water are of nickel copper MONEL construction, which withstands the corrosive action of salt water.

Important: The V46 pressure-actuated water-regulating valve is intended to control water flow under normal operating conditions. Where failure or malfunction of the V46 valve could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the V46 valve.

Figure 2: Threaded type direct-acting valve cross section



Selecting the valve size

To determine size requirements, follow Step 1 to Step 3. See the flowcharts in V46 flowcharts to locate a point on a flowchart that satisfies all the requirements.

1. Use tables that the manufacturer of the condensing unit provides to determine the maximum water flow that you need, or calculate the flow with the following formula:

$$\text{Flow (GPM)} = \frac{\text{Tons of Refrigeration x 15,000}}{\text{500 x (outlet - inlet temperature)}}$$

Note:

If you do not know the outlet water temperature, assume it to be 10°F below the condensing temperature.

Example: A 9-ton capacity system has an inlet water temperature of 65°F and an outlet water temperature of 95°F. The maximum required water flow is:

$$\text{Flow (GPM)} = \frac{\text{9 x 15,000}}{\text{500 x (95 - 65)}}$$

2. Determine the refrigerant head pressure rise above the valve opening point.
   a. To assure closure under all conditions, choose the valve closing point that is the equivalent refrigerant pressure to the highest ambient air temperature that the equipment experiences in the off cycle. Read this in psig from a saturated vapor table for the selected refrigerant.
   b. To determine the valve opening point, add approximately 7 psig (48 kPa) to the closing point.
   c. From the same table, read the operating head pressure that corresponds to the selected condensing temperature.
   d. Subtract the valve opening point from the operating head pressure. This gives the head pressure rise.
3. Determine the water pressure drop across the valve. This is the true pressure available to force water through the valve.
   a. Determine minimum water pressure available from city mains or other sources.
   b. From the condensing unit manufacturer's tables, read the pressure drop through the condenser that corresponds to the flow that you need.
   c. Add the estimated or calculated drop through installed piping to the value from the previous step.
   d. Subtract the total pressure drops in the condenser, piping, and static head if applicable, from the available water pressure value in 3a. This is the available pressure drop across the valve.
4. To select the correct valve size from the V46 flowcharts, locate a point on a chart that will satisfy the flow, the head pressure rise above opening point, and the pressure drop across the valve.

Example

About this task:
An installer determines that the flow that they need for a low-range system is 27 GPM. Condensing pressure is 125 psig, and they estimate the maximum ambient temperature at 86°F. City water pressure is 40 psig and the manufacturer's table gives a pressure drop through the condenser and the accompanying piping and valves at 15 psi. The drop through the installed piping is approximately 4 psi. The installer makes the following calculations:

1. 27 GPM
2. Closing point is the pressure of refrigerant corresponding to 86°F = 93 psig
   Opening point = 93+7 = 100 psig
   Operating head pressure = 125 psig
   Head pressure rise = 125-100 = 25 psi
3. Minimum pressure = 40 psig
   Pressure drop through condenser = 15 psi
   Combined pressure drop = 15+4 = 19 psi
   Pressure drop across valve = 40-19 = 21 psi
4. With a flow of 27 GPM, a head pressure rise of 25 psi, and a pressure drop across the valve of 21 psi, the only valve that satisfies all three criteria is a 1 1/4 in. valve.
   For the point on the flowchart that indicates the correct valve, see the 1 1/4 in. V46 - all range chart in V46 flowcharts.

V46 flowcharts

The maximum differential water pressure across a valve is 60 psi.

Figure 3: 3/8 in. V46 direct-acting low flow

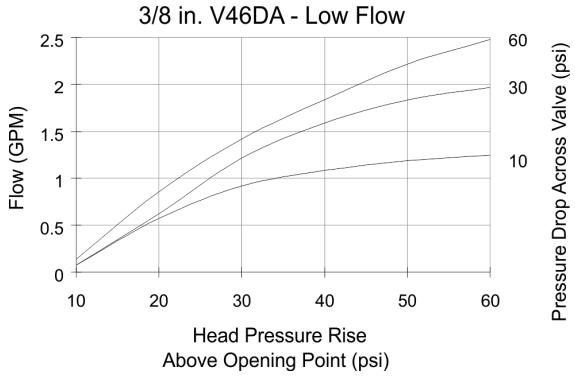


Figure 4: 3/8 in. V46 all range valve

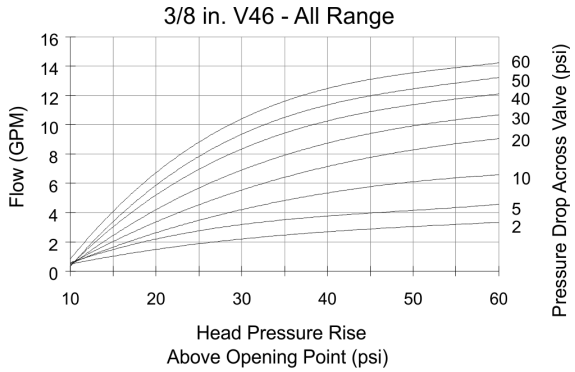


Figure 5: 1/2 in. V46 all range valve

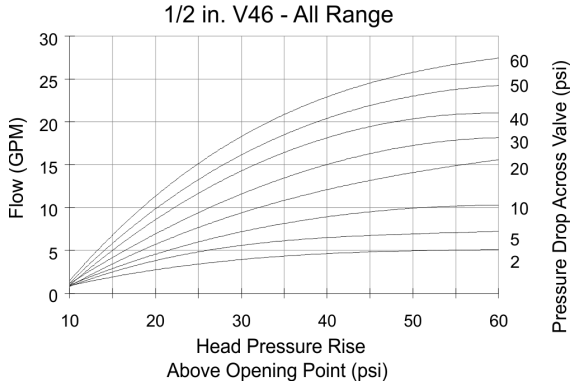


Figure 6: 3/4 in. V46 all range valve

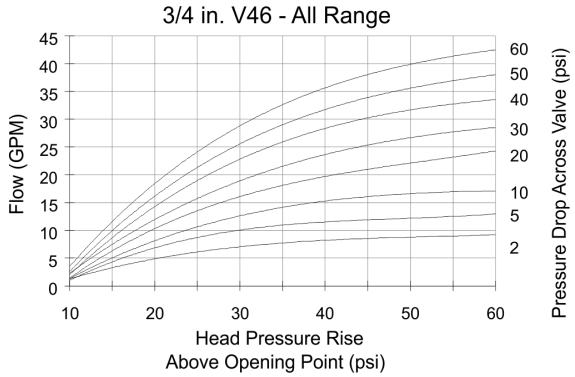


Figure 7: 1 in. V46 all range valve

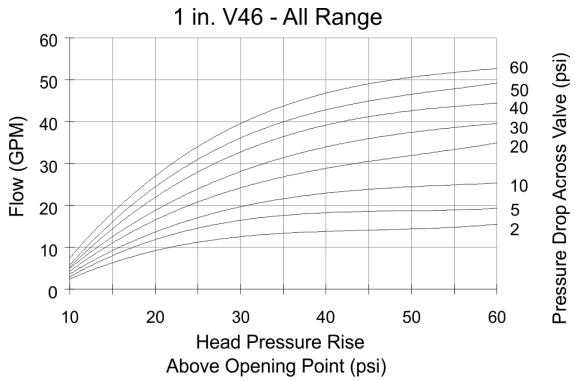


Figure 8: 1-1/4 in. V46 all range valve

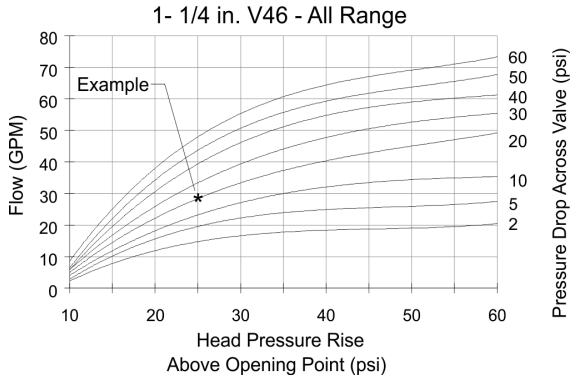


Figure 9: 1-1/2 in. V46 all range valve

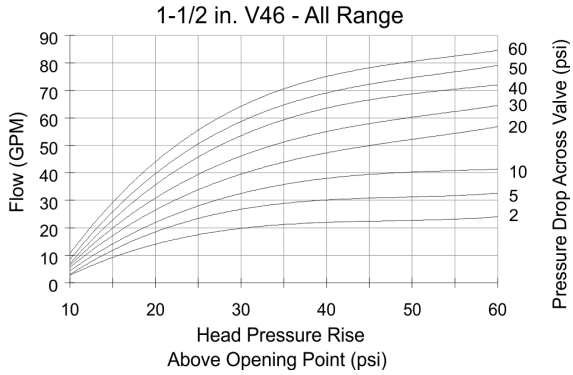


Figure 10: 2 in. V46 high range valve

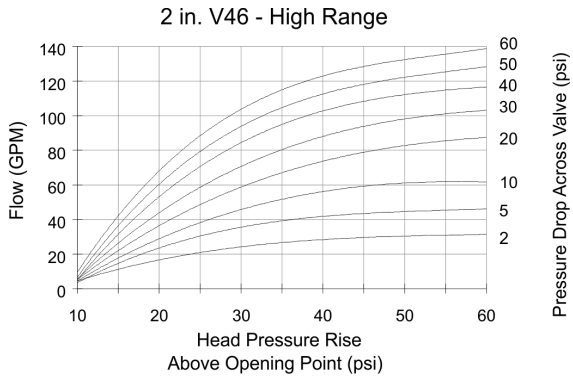


Figure 11: 2 in. V46 low range valve

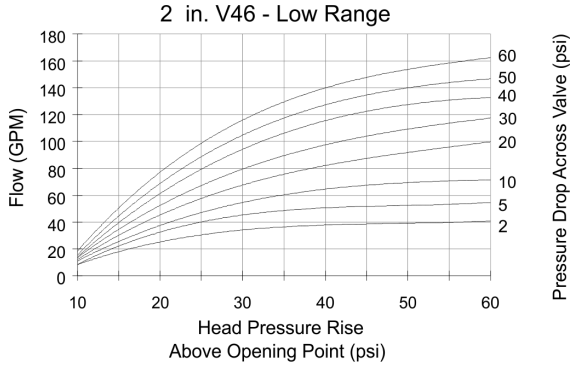


Figure 12: 2-1/2 in. V46 high range valve

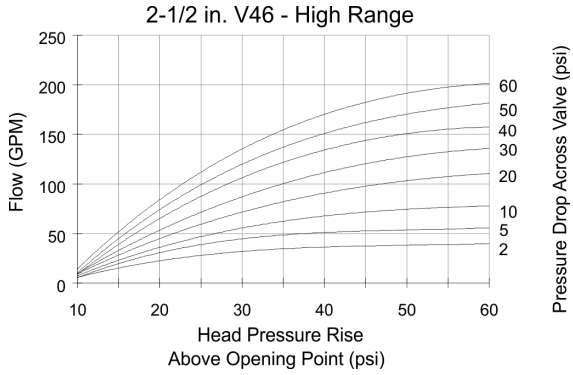
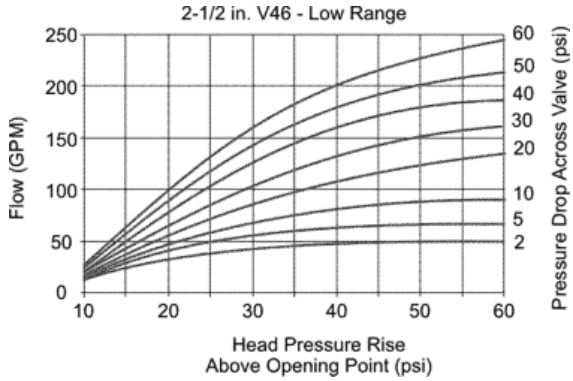
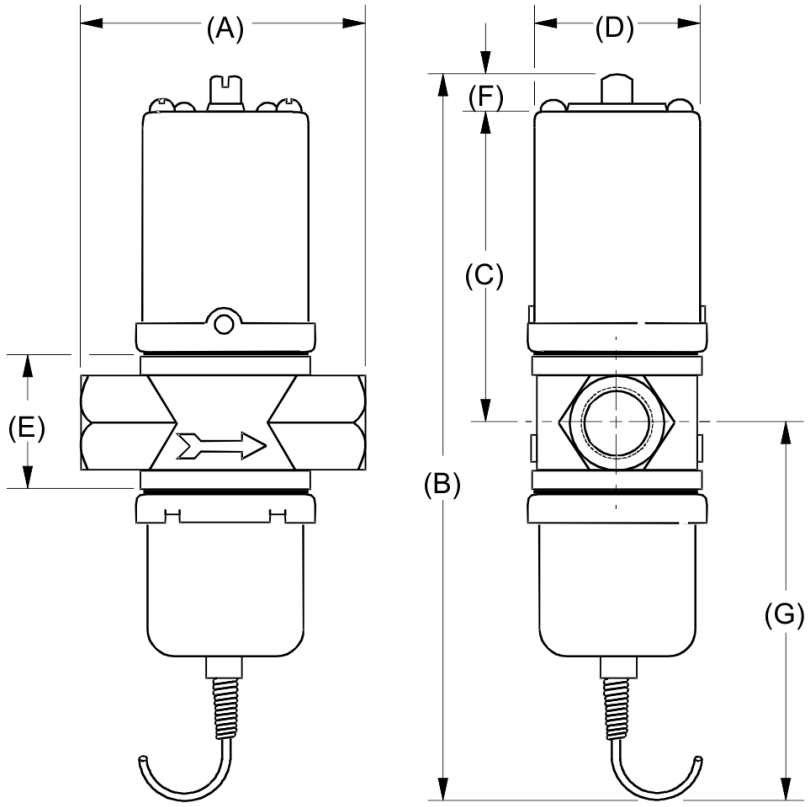


Figure 13: 2-1/2 in. V46 low range valve



Dimensions

Figure 14: Commercial service V46 threaded connection dimensions, in.



Threaded type dimensions, in.							
Valve size	**A**	**B**	**C**	**D**	**E**	**F**	**G**
3/8 in.	2 5/8	6 3/4	3 1/8	1 1/2	1 1/4	13/32	3 7/32
1/2 in.	3 1/8 (3 1/4)[1]	7 13/32	3 3/8	1 27/32	1 1/2	13/32	3 5/8
3/4 in.	3 3/8 (3 5/8)[1]	7 7/8	3 7/8	2 1/32	1 3/4	13/32	3 21/32
1 in.	4 1/2 (4 7/8)[1]	10 3/4	5 1/2	2 25/32	2	1/2	4 3/4
1 1/4 in.	4 7/8	11 1/8	5 3/4	2 5/8	2 3/8	1/2	4 29/32

1 Values in parenthesis are for maritime valves. All other dimensions remain the same.

Figure 15: Flange type valves

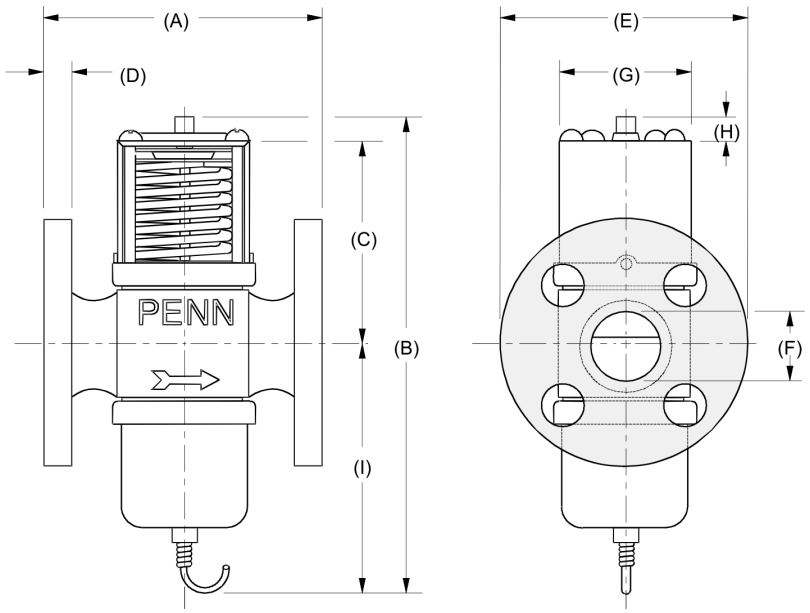


Table 1: Commercial service: V46 flange connection dimensions, in.

Valve size	A	B	C	D	E	F	G	H	I
1 1/2 in.	5 5/16	11 1/8	5 3/4	9/16	5	1 7/8	2 5/8	1/2	4 29/32
2 in.	6 5/8	13	6 15/32	5/8	6	2 1/4	3 1/2	1/2	6 1/8
2 1/2 in.	6 3/4	13 1/2	6 3/8	3/4	7	2 23/32	3 1/2	1 1/32	6 3/32

Table 2: Commercial service: V46 flange specifications

Valve size	Number of holes	Hole size, in.	Bolt circle, in.
1 1/2 in.	4	5/8	3 7/8
2 in.	4	3/4	4 3/4
2 1/2 in.	4	3/4	5 1/2

Table 3: Maritime service: American Society of Mechanical Engineers (ASME) flange connection dimensions, in.

Valve size	A	B	C	D	E	F	G	H	I
1 1/2 in.	5 5/16	10 1/2	5 5/8	9/16	5	1 7/8	2 5/8	1/2	5
2 in.	6 3/8	13 1/8	6 1/2	1/2	6	2 3/4	3 1/2	5/8	6
2 1/2 in.	6 3/4	13 1/8	6 1/2	11/16	7	2 3/4	3 1/2	5/8	6

Table 4: Maritime service: ASME flange specifications

Valve size	Number of holes	Hole size, in.	Bolt circle, in.
1 1/2 in.	4	5/8	3 7/8
2 in.	4	3/4	4 3/4
2 1/2 in.	4	3/4	5 1/2

Table 5: Navy BuShips service: Navy flange connection dimensions, in.

Valve size	A	B	C	D	E	F	G	H	I
3/4 in.	4 3/16	7 3/4	4	7/16	3 13/16	1 1/8	2 1/32	1/2	3 5/16
1 in.	5 5/16	9	4 1/2	1/2	4 1/4	1 1/4	2 5/8	1/2	4
1 1/4 in.	5 5/16	9 11/32	4 11/16	1/2	4 1/2	1 5/8	2 5/8	1/2	4 5/32

Table 5: Navy BuShips service: Navy flange connection dimensions, in.

Valve size	A	B	C	D	E	F	G	H	I
1 1/2 in.	5 5/16	10 7/32	5 3/4	1/2	5 1/16	1 7/8	2 5/8	1/2	4
2 in.	6 3/8	14 1/8	6 13/32	1/2	5 9/16	2 3/4	3 1/2	7/16	7 9/32
2 1/2 in.	6 3/8	14 5/16	6 1/2	1/2	6 1/8	2 3/4	3 1/2	5/8	7 3/16

Table 6: Navy BuShips service: Navy flange specifications

Valve size	Number of holes	Hole size, in.	Bolt circle, in.
3/4 in.	4	9/16	2 11/16
1 in.	4	9/16	3 1/8
1 1/4 in.	4	9/16	3 3/8
1 1/2 in.	6	9/16	3 15/16
2 in.	6	9/16	4 7/16
2 1/2 in.	6	9/16	5

Mounting the valve

⚠ CAUTION

Risk of environmental and property damage

Coil and secure excess capillary tubing away from contact with sharp or abrasive objects or surfaces. Vibration or sharp or abrasive objects in contact with capillary tubes can cause damage that may result in loss of element charge, which may result in damage to the environment or property.

⚠ CAUTION

Risk of environmental and property damage

Avoid sharp bends in the capillary tubes. Sharp bends can weaken or kink capillary tubes, which may result in refrigerant leaks or restrictions of flow.

Flush water lines to clear any foreign matter that may interfere with valve operation. Mount valves vertically on the inlet side of the condenser with the spring housing up. If it is necessary to keep the condenser flooded with coolant, you can mount the valve on the outlet side. When mounting the valve in a position other than vertical, follow the instructions of the equipment in which you plan to install the valve. Make the refrigerant head pressure connection to the bellows. If you need additional capillary tubing, use 1/4 in. O.D. tubing or larger.

Adjustments to the valve

You can adjust valves with standard service valve wrenches or screwdrivers. For an illustration of this, see Table 7. You can change all range valve settings quickly from low-range refrigerants, such as R134, to high-range refrigerants, such as R22, or from high range refrigerants to low-range refrigerants. To raise the valve opening point, turn the adjustment screw located at the top of the range spring housing counterclockwise. See Table 7 and Figure 16. Turn the adjustment screw clockwise to lower the opening point. You can make exact settings with a pressure gauge in the refrigerant line to determine the throttling point. Put the system under normal operating load and adjust to the operating pressure that you need. See Table 15 for pressure range specifications.

Table 7: Range adjustment screw

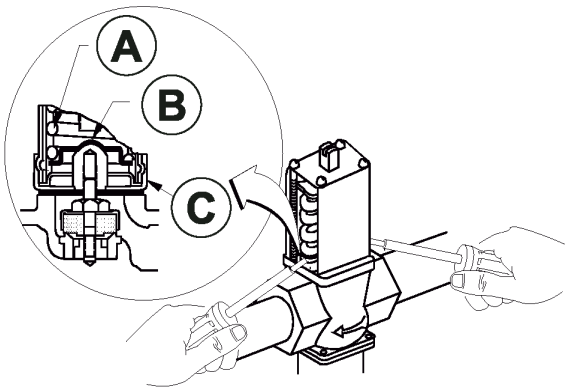
Valve size, in.	Range adjustment screw
3/8, 1/2, 3/4	1/4 in. square head adjustment screw with a screwdriver slot
1, 1 1/4, 1 1/2	5/16 in. square head adjustment screw
2, 2 1/2	1/2 in. square head adjustment screw and a slotted cam

If the compressor operates in high ambient temperatures, head pressures may remain high enough during off cycles to prevent the valve from closing completely. In such instances, raise the opening point of the valve just enough to cause the valve to close during compressor standby periods. This also raises the throttling point.

Manually flushing the valve

To clear any sediment that might accumulate, you can manually flush valves. Insert screwdrivers under both sides of the valve spring guide and lift it upwards to flush the valve. See the following figure. Manual flushing does not affect valve adjustment.

Figure 16: Manual flushing



Callout	Description
A	Range spring
B	Valve spring guide
C	Top retainer

Repair data

You can replace the sensing element, internal parts, and rubber diaphragm. For a replacement valve or replacement parts kit, contact the nearest Johnson Controls®/Penn distributor. For replacement part kit numbers, see Product number selection and Selection charts. For replacement kit instructions and details refer to the following bulletins:

- *V46, V47, V48, and V49 Sensing Element Replacement Technical Bulletin, LIT-121700*
- *V46 and V47 Repair Parts and Service Instructions Installation Guide, LIT-121695*

Ordering information

When you order water valves, specify the following:

1. The complete product number.
    1. If you do not know the product number, determine the following list of information and see Selection charts to select a valve.
        - To determine the valve size that you need, see Selecting the valve size.
        - To determine the refrigerant to use in the system, see Table 15.

            Note: 3/8 in. to 1 1/2 in. valves are supplied with all-range construction. You can use a single valve for either low or high range refrigerants.

        - To determine if you need a standard open high valve, see Table 9.
        - If you need a valve with a bronze body and MONEL internal parts, you need a Navy or maritime service valve.
2. To determine the companion flange kit by part number, see Companion flanges and gaskets.
3. If you need a mounting bracket for 3/8 in. and 1/2 in. valve sizes only, to determine its position on the valve, see Options.

Companion flanges and gaskets

Kits are available, at additional cost, for 1 1/2, 2, and 2 1/2 in. ASME specification flange-connection valves only. Each flange kit contains two ring gaskets, two cast iron flanges, eight machine bolts, and eight hex nuts.

Figure 17: Flange kit

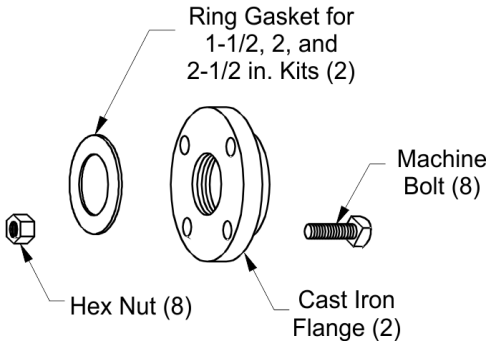


Table 8: Companion flange kits

Kit number	Water valve size
KIT 14A-612	1 1/2 in.
KIT 14A-613	2 in.
KIT 14A-614	2 1/2 in.

Product number selection

For applications that call for valves not listed in Selection charts, use Table 9 to specify a custom valve. For example, to order a direct-acting, commercial valve with a 1 1/4 in. NPT threaded connection, specify a V46AE.

Table 9: Type number selection matrix

Product code			Description
V46	A		Open on rise, commercial
	B		Open on rise, maritime
	C		Open on rise, Navy
	D		Open on rise, commercial low flow
	E		Open on rise, commercial with high pressure bellows
	F		Open on rise, maritime with high pressure bellows
	G		Open on rise, Navy with high pressure bellows
	L		Open on rise, commercial low flow, no repair
		A	3/8 in. NPT threaded
		B	1/2 in. NPT threaded
		C	3/4 in. NPT threaded
		D	1 in. NPT threaded
		E	1 1/4 in. NPT threaded
		F	1 1/2 in. NPT threaded
		G	9/16–18 threaded
		H	3/8 in. sweat
		J	1/2 in. sweat
		K	3/4 in. sweat
		L	1 in. sweat
		M	1 1/4 in. sweat
		N	3/4 in. flange
		P	1 in. flange
		Q	1 1/4 in. flange
		R	1 1/2 in. flange
		S	2 in. flange
		T	2 1/2 in. flange

Table 10: Pressure connection styles

Valve	Style number	Description
Commercial service: Noncorrosive refrigerant		
1 1/2 in. and smaller	45	30 in. (762 mm) copper capillary with 1/4 in. flare nut and valve depressor
	5[1]	1/4 in. male flare fitting
	34[1]	30 in. (762 mm) copper capillary with 1/4 in. section for sweat or flare connection
2 in. and 2 1/2 in.	5	1/4 in. male flare fitting
Navy and marine service		
All sizes	34	30 in. (762 mm) copper capillary with 1/4 in. section for sweat or flare connection

1 Optional; quantity orders only.

Options

Capillary tubing length

Standard length is 30 in. on valves 1 1/2 in. and smaller. Optional 48 in. (1,219 mm) capillary is available at additional cost, if you specify.

Mounting bracket

A mounting bracket as illustrated in Figure 18, is available on 3/8 in. and 1/2 in. valves only if you specify. You must also specify the bracket position that you need.

Other styles of brackets on 3/8 in. and 1/2 in. valves are available on quantity orders.

Figure 18: Mounting bracket for 3/8 in. and 1/2 in. valves

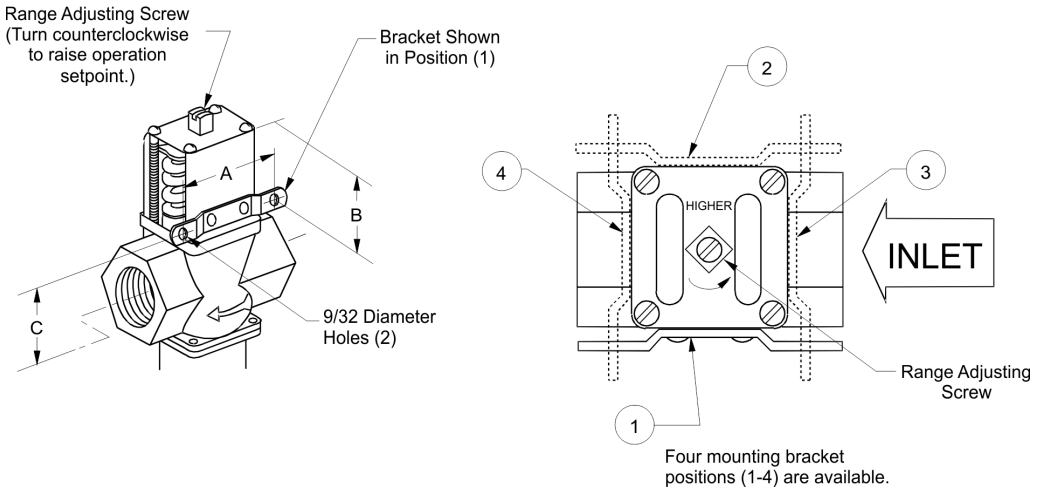


Table 11: Dimensions, in. (mm)

Valve size	A	B	C
3/8	2 (51)	1.25 (32)	1.38 (35)
1/2	2 (52)	1.85 (47)	1.52 (39)

Selection charts

Table 12: Direct-acting commercial type - noncorrosive refrigerants

Product	Size, in.	Inlet and outlet	Service	Element style	Shipping weight, lb (kg)	Seat repair kit	Replacement power element
V46AA-1	3/8 NPT	Threaded	All range	45	2.3 (1.0)	STT14A-600R	SEP91A-600R and SEC37A-601R[1]
V46DA-2	3/8 NPT	Threaded	Extended all range[2]	45	2.3 (1.0)	STT14A-603R	SEP91A-600R and SEC37A-601R[1]
V46AB-1	1/2 NPT	Threaded	All range	45	3.3 (1.5)	STT15A-602R	SEP91A-602R and SEC37A-602R[1]
V46AC-1	3/4 NPT	Threaded	All range	45	4.3 (2.0)	STT16A-601R	SEP91A-601R and SEC37A-602R[1]
V46AD-1	1 NPT	Threaded	All range	45	9.3 (4.0)	STT17A-609R	SEP91A-603R and SEC37A-600R[1]
V46AE-1	1-1/4 NPT	Threaded	All range	45	10.0 (4.5)	STT17A-610R	SEP91A-603R and SEC37A-600R[1]
V46AR-1	1-1/2 NPT	4-hole ASME flange	All range	45	13.1 (6.0)	STT17A-610R	SEP91A-603R and SEC37A-600R[1]
V46AS-1	2	4-hole ASME flange	Low range	5	25.5 (11.6)	STT18A-600R	SEP81A-602R[3]
V46AS-2	2	4-hole ASME flange	High range	5	25.5 (11.6)	STT18A-600R	SEP81A-601R
V46AT-1	2 1/2	4-hole ASME flange	Low range	5	29.5 (11.6)	STT18A-601R	SEP81A-602R[3]
V46AT-2	1/2	4-hole ASME flange	High range	5	29.5 (11.6)	STT18A-601R	SEP81A-601R

1 Replacement element supplied with 1/4 in. SAE connector. Order SEC37A capillary kit with flare nuts separately, if needed. Use only on valves specified.
2 Maximum opening point of 70 psi to 300 psi (483 kPa to 2,068 kPa), maximum permissible refrigerant pressure of 440 psi (3,034 kPa).
3 Non-stock item, built to order.

Table 13: Maritime type - noncorrosive refrigerants

Product	Size, in.	Inlet and outlet	Service	Element style	Shipping weight, lb (kg)	Seat repair kit	Replacement Power Element
V46BA-2[1]	3/8 NPT	Threaded	All range	34	2.3 (1.0)	STT14A-601R	SEP13A-602R
V46BB-2[1]	1/2 NPT	Threaded	All range	34	3.3 (1.5)	STT15A-603R[1]	SEP13A-600R[1]
V46BC-2	3/4 NPT	Threaded	All range	34	4.3 (2.0)	STT17A-613R	SEP13A-603R
V46BD-2	1 NPT	Threaded	All range	34	9.5 (4.3)	STT17A-611R[1]	SEP50A-600R
V46BE-2	1 1/4 NPT	Threaded	All range	34	10.3 (4.7)	STT17A-612R	SEP50A-600R
V46BS-4	2	4-hole ASME flange	High range	34	25.5 (11.6)	STT18A-602R	SEP50A-601R[1]
V46BT-4[1]	2 1/2	4-hole ASME flange	High range	34	29.5 (13.4)	STT18A-602R	SEP50A-601R[1]

1 Non-stock item, built to order.

Table 14: Navy type - Noncorrosive refrigerants

Product	Size, in.	Inlet and outlet	Service	Element style	Shipping weight, lb (kg)	Seat repair kit	Replacement Power Element
V46CJ-2[1]	1/2	Sweat connector	All range	34	3.6 (1.6)	STT15A-603R[1]	SEP13A-600R[1]
V46CN-2[1]	3/4	4-hole Navy flange	All range	34	7.1 (3.2)	STT17A-613R	SEP13A-603R
V46CP-2[1]	1	4-hole Navy flange	All range	34	12.0 (5.4)	STT17A-611R[1]	SEP50A-600R
V46CQ-2[1]	1 1/4	4-hole Navy flange	All range	34	10.3 (4.7)	STT17A-612R	SEP50A-600R
V46BR-2[1]	1 1/2	6-hole Navy flange	All range	34	13.5 (6.1)	STT17A-612R	SEP50A-600R
V46CR-2[1]	1 1/2	6-hole Navy flange	All range	34	13.8 (6.3)	STT17A-612R	SEP50A-600R
V46BS-3[1]	2	6-hole Navy flange	Low range	34	25.5 (11.6)	STT18A-602R	SEP50A-601R[1]
V46CS-3[1]	2	6-hole Navy flange	Low range	34	24.4 (11.1)	STT18A-602R	SEP50A-601R[1]
V46BT-3[1]	2 1/2	6-hole Navy flange	Low range	34	29.5 (13.4)	STT18A-602R	SEP50A-601R[1]
V46CT-3[1]	2 1/2	6-hole Navy flange	Low range	34	25.5 (11.6)	STT18A-602R	SEP50A-601R[1]
V46CT-4[1]	2 1/2	6-hole Navy flange	High range	34	25.5 (11.6)	STT18A-602R	SEP50A-601R[1]

1 Non-stock item, built to order.

Table 15: Pressure range specifications

Refrigerant	Maximum opening point, psig (kPa)[1]	Maximum permissible pressure, psig (kPa)	
	V46A, B, C, D	Water	Refrigerant
All range R12, R22, R134a, R502, R404a, R507	70 to 260 (483 to 1,793)	150 (1,034)	320 (2,206)
All range with high overpressure	70 to 260 (483 to 1,793)	150 (1,034)	370 (2,551)
3/8 in. extended all range	70 to 300 (483 to 2,068)	150 (1,034)	440 (3,034)
2 and 2-1/2 in. low range R134a	70 to 170 (483 to 1,172)	150 (1,034)	230 (1,586)
2 and 2-1/2 in. high range R22, R502, R404a, R507	160 to 260 (1,103 to 1,793)	150 (1,034)	320 (2,206)

1 V46A, B, C direct acting valve ranges indicate the valve opening point.

Technical specifications

Table 16: V46 pressure-actuated water-regulating valve

Specification	Description
Product	V46 Series Pressure Actuated Valve
Body material	**Commercial:** 3/8, 1/2, or 3/4 in. sizes have cast brass bodies, other commercial types have cast iron bodies with rust resisting finish **Navy and maritime:** Cast Naval bronze
Extension sleeve, disc, stud, disc holder material	**Commercial:** Brass; MONEL is available at additional cost **Navy and maritime:** MONEL
Valve seat material	**Commercial:** Aluminum bronze; MONEL is available at additional cost **Navy and maritime:** MONEL
Valve disc	Buna-N
Diaphragm	Nylon reinforced Buna-N
Water supply pressure	150 psig (1034 kPa) maximum
Water supply temperature	170°F (77°C) maximum

Table 16: V46 pressure-actuated water-regulating valve

Specification	Description
Sensing element	**Noncorrosive refrigerants:** Brass and phosphor bronze bellows in brass cup **Navy and maritime:** MONEL bellows in brass cup **2 and 2 1/2 in. high range service:** MONEL bellows in brass cup
Pressure range	See Table 15
Shipping weight	See Selection charts

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 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.

Single point of contact

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