

# V46 Pressure-Actuated Water-Regulating Valve

## Product Bulletin

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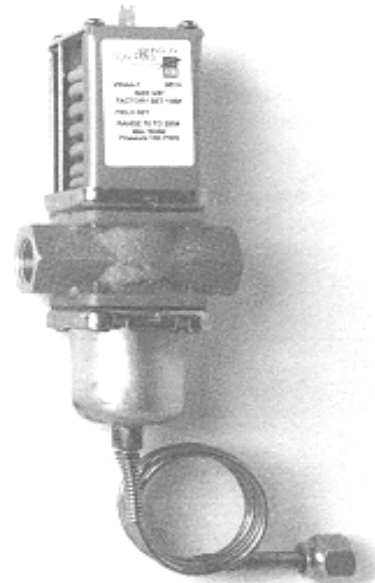
Refer to the [QuickLIT website](#) for the most up-to-date version of this document.

The V46 pressure-actuated modulating valves come in two types of control action: direct acting or reverse acting. Direct-acting V46 valves are typically used for regulating refrigerant head pressure in water-cooled condensers. Reverse-acting V46N valves are typically used for bypass service on refrigeration systems and heat pump applications.

Commercial V46 valves may be used with standard non-corrosive refrigerants. V46 models are also available for ammonia refrigerant. For applications where the coolant may be corrosive to the valve trim, maritime models are available, which have nickel copper (monel) valve trim.

### **WARNING**

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**

**Table 1: Features and Benefits**

Features	Benefits
No Close Fitting or Sliding Parts in Water Passages	Provides robust control in less than ideal conditions.
Corrosion Resistant Material for Parts that Come in Direct Contact with Water	Promotes longer valve life.
Accessible Range Spring	Allows easy manual flushing, if required.
Take-apart Construction	Allows access to interior of valves without removing the valve from refrigeration system or pumping down.
Pressure-balanced Design	Maintains consistent setpoint against both gradual and sudden water pressure changes.

## Application Overview

The V46 direct-acting models open on an increase in pressure. Models A, B, and C are typically used for regulating water-cooled condensers, while the low flow D model is generally used in ice machines. The reverse-acting V46N valve model closes on an increase in pressure and is typically used for bypass service on refrigeration systems and heat pumps that control water temperature.

Commercial V46 valves are available in 3/8 in. through 2-1/2 in. sizes. Commercial all range models (3/8 through 1-1/2 in.), may be used with standard non-corrosive refrigerants, or ammonia refrigerant applications, depending on the model.

V46 Series valves also come in models designed for Navy or maritime salt water applications. These valve bodies are constructed of bronze, and any metal parts that come into contact with salt water are constructed of nickel copper (monel), 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.

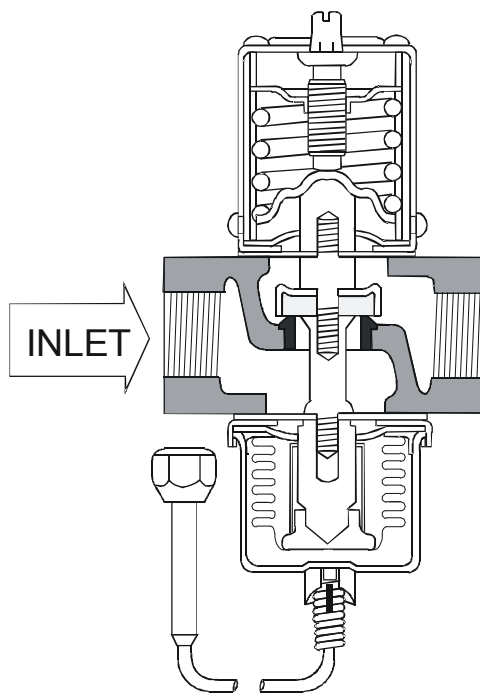


Figure 2: Threaded Type Direct-Acting Valve Cross Section

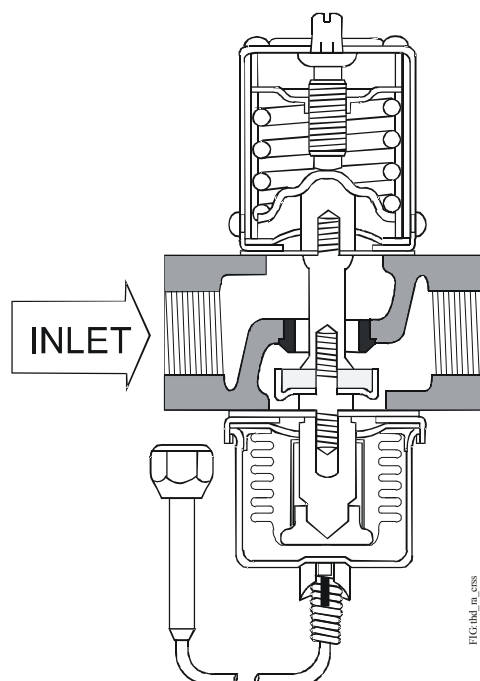


Figure 3: Threaded Type Reverse-Acting Valve Cross Section

## Valve Sizing

Follow Steps 1 through 3, and use the information obtained to locate a point on one of the flowcharts found under V46 Flowcharts that satisfies all three steps.

1. Determine maximum water flow required using tables provided by the manufacturer of the condensing unit, or calculate the flow using the following formula:

$$\text{Flow (GPM)} = \frac{\text{Tons of Refrigeration} \times 15,000}{500 \times (\text{outlet} - \text{inlet temperature})} \quad \text{FIG 4 eqn}$$

**Figure 4: Flow Equation**

**Note:** If the outlet water temperature is unknown, 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:

$$\text{Flow (GPM)} = \frac{9 \times 15,000}{500 \times (95 - 65)} \quad \text{FIG 5 example}$$

**Figure 5: Example**

2. Determine refrigerant head pressure rise above the valve opening point.
  - a. Valve closing point (to assure closure under all conditions) must be the refrigerant pressure equivalent to the highest ambient air temperature the equipment will be subjected to in the off cycle. Read this in psig from a Saturated Vapor Table for the refrigerant selected.
  - b. To determine the valve opening point, add about 7 psig (48 kPa) to the closing point.
  - c. From the same table, read the operating head pressure corresponding to the selected condensing temperature.
  - d. Subtract the valve opening point from the operating head pressure. This gives the head pressure rise.

3. Determine water pressure drop across the valve. This is the pressure actually available to force water through the valve.
  - a. Determine minimum water pressure available from city mains or other sources.
  - b. From condensing unit manufacturer's tables, read the pressure drop through condenser corresponding to the required flow.
  - c. To the value found in 3b, add the estimated or calculated drop through installed piping.
  - d. Subtract the total condenser, piping, and static head (if applicable) pressure drop from the available water pressure found in 3a. This is the available pressure drop across the valve.
4. Select the proper valve size from the V46 flowcharts by locating 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: The required flow for a low-range system is found to be 27 GPM. Condensing pressure is 125 psig, and the maximum ambient temperature is estimated 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. Drop through the installed piping is approximately 4 psi.

Step 1: 27 GPM

Step 2: Closing point is 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

Step 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

Using 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. See the 1-1/4 in. V46 - All Range chart on the next page.

## V46 Flowcharts

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

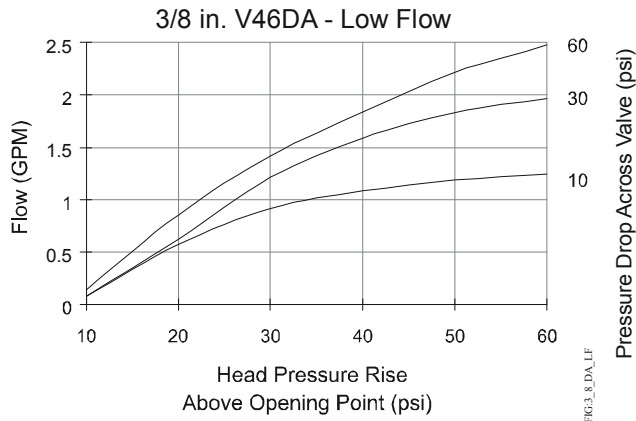


Figure 6: 3/8 in. V46 Direct-Acting Low Flow

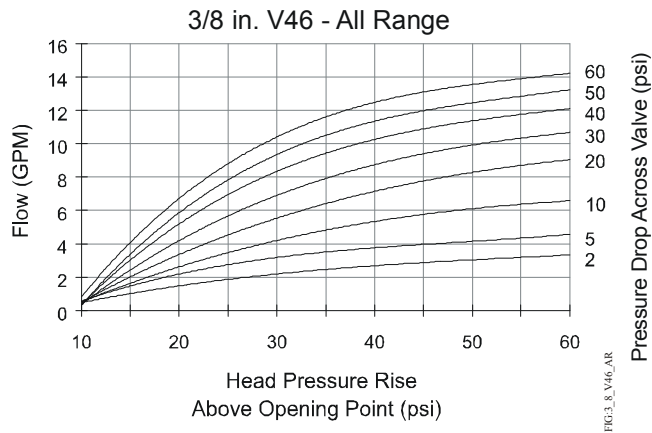


Figure 7: 3/8 in. V46 All Range Valve

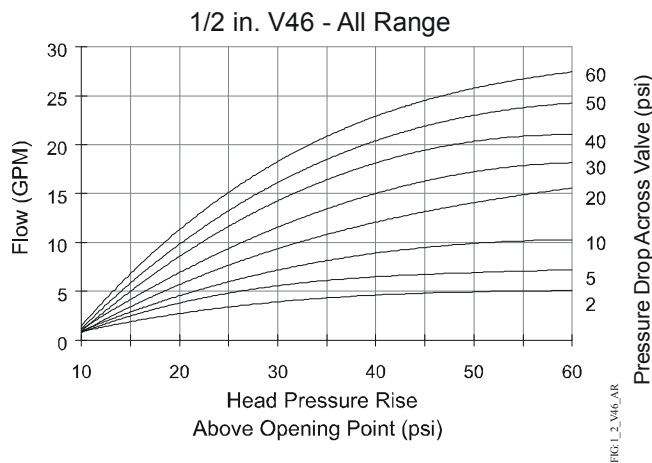


Figure 8: 1/2 in. V46 All Range Valve

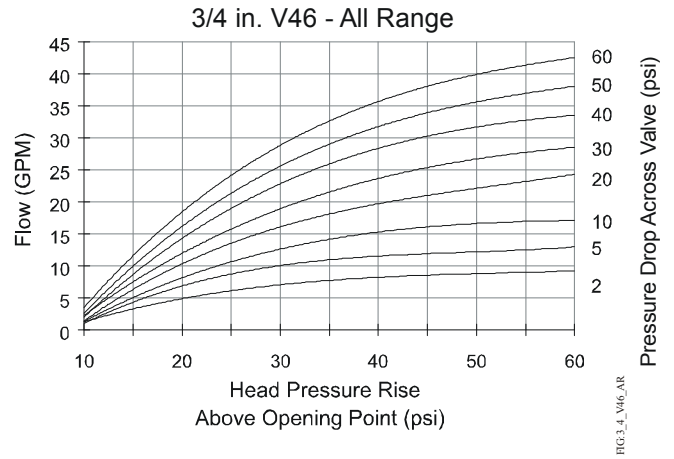


Figure 9: 3/4 in. V46 All Range Valve

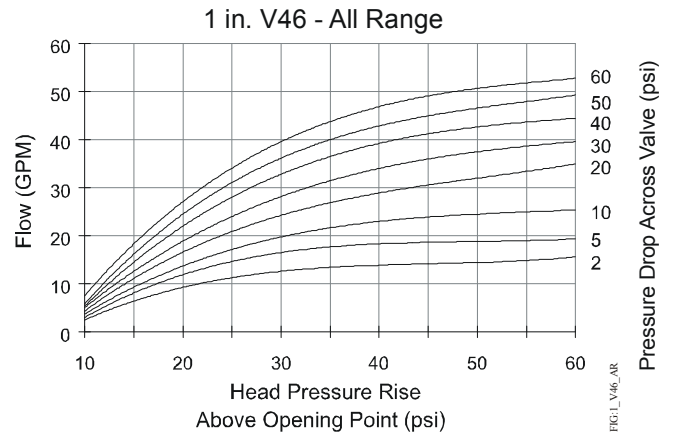


Figure 10: 1 in. V46 All Range Valve

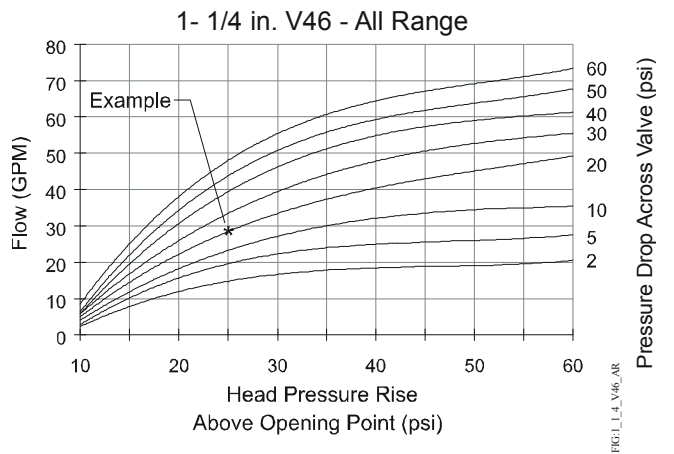
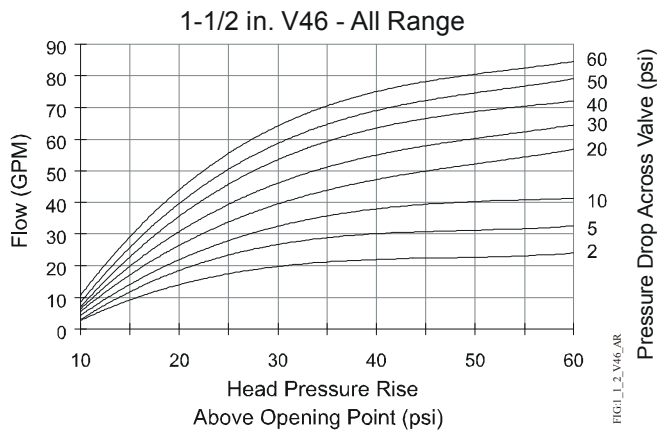
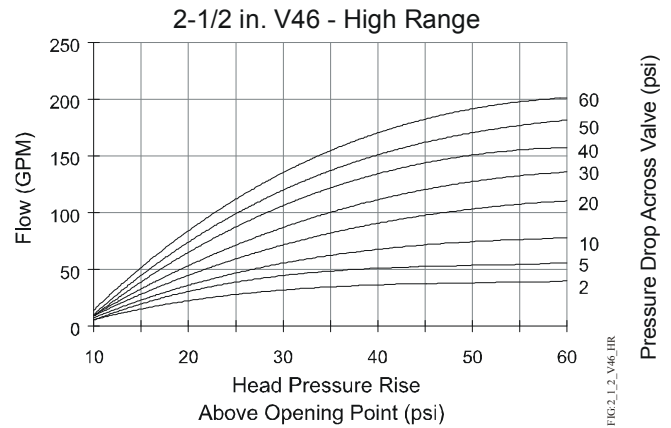


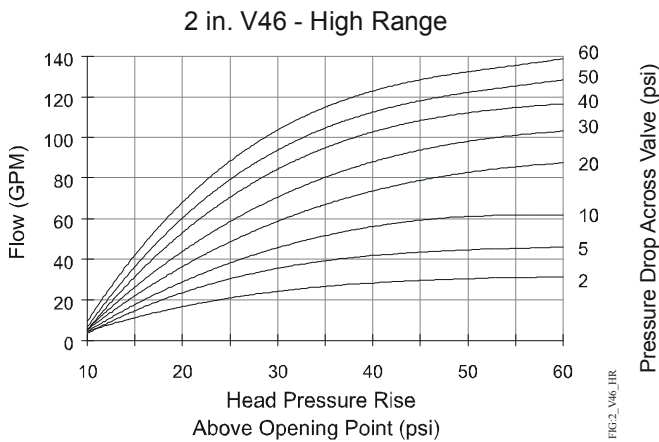
Figure 11: 1-1/4 in. V46 All Range Valve



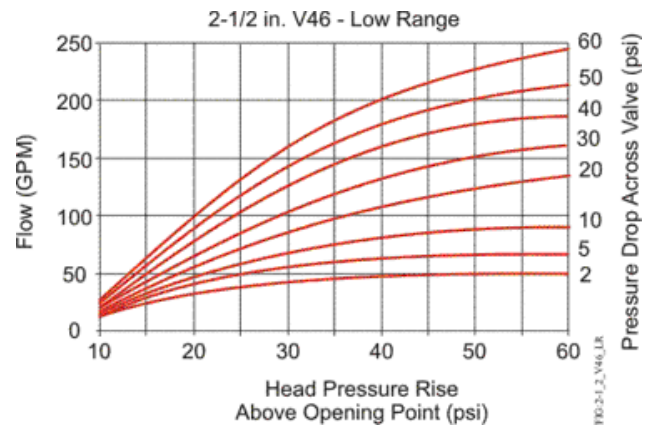
**Figure 12: 1-1/2 in. V46 All Range Valve**



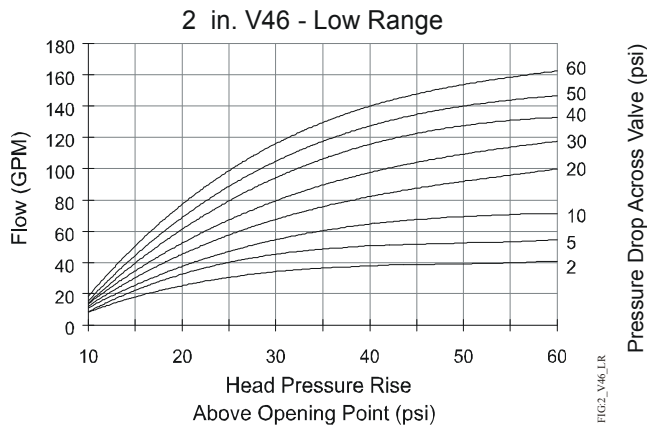
**Figure 15: 2-1/2 in. V46 High Range**



**Figure 13: 2 in. V46 High Range Valve**

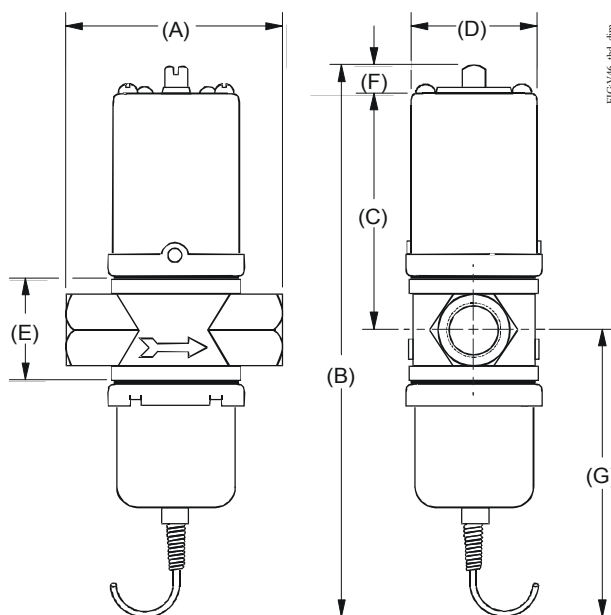


**Figure 16: 2-1/2 in. V46 Low Range**



**Figure 14: 2 in. V46 Low Range Valve**

## Dimensions



**Figure 17: Threaded Type Valves**

**Table 2: Commercial Service V46 Threaded Connection Dimensions**

Dimensions in Inches							
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) <sup>1</sup>	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) <sup>1</sup>	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) <sup>1</sup>	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.

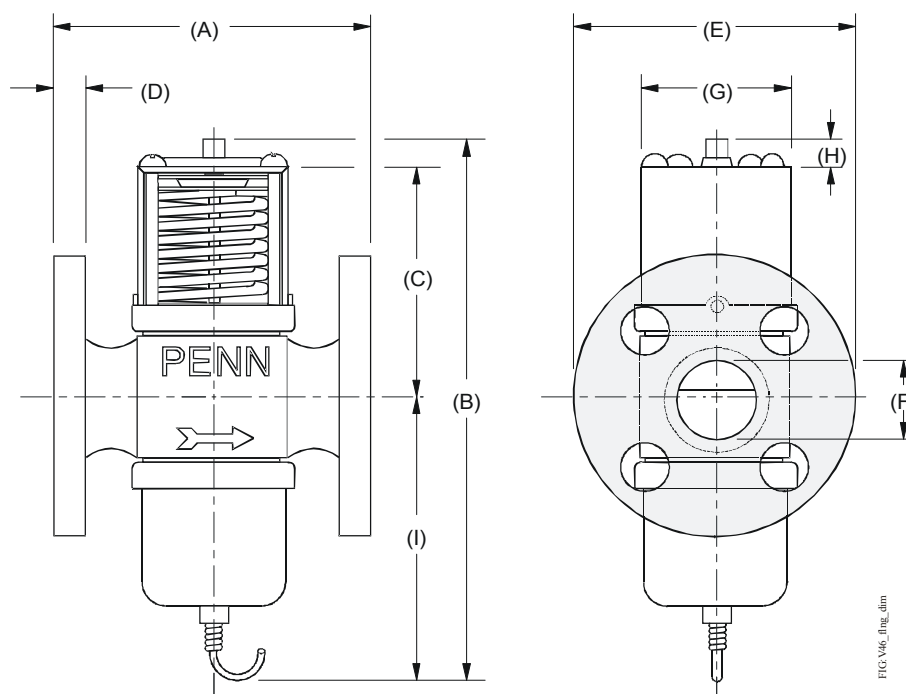


Figure 18: Flange Type Valves

Table 3: Commercial Service: V46 Flange Connection Dimensions

Dimensions in Inches									
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
Flange Specifications									
Valve Size	Number of Holes			Hole Size			Bolt Circle		
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 4: Maritime Service: ASME Flange Connection Dimensions

Dimensions									
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
Maritime Service: ASME Flange Specifications									
Valve Size	Number of Holes			Hole Size			Bolt Circle		
1-1/2 in.	4			5/8			3-7/8		


**Table 4: Maritime Service: ASME Flange Connection Dimensions**

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**

Dimensions in Inches									
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
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
Navy Flange Specifications									
Valve Size	Number of Holes		Hole Size		Bolt Circle				
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



**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 spring housing up. If it is necessary to keep the condenser flooded with coolant, the valve can be mounted on the outlet side. When mounting the valve in a position other than vertical, follow the instructions of the equipment in

which the valve will be installed. Make refrigerant head pressure connection to bellows. If additional capillary tubing is required, use 1/4 in. O.D. tubing or larger.

## Adjustment

Valves may be adjusted with standard service valve wrenches or screwdrivers; see Table 6. All range valve settings can be changed 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 adjusting screw, located at the top of range spring housing, counterclockwise. See Table 6 and Figure 19. Turn the adjusting screw clockwise to lower the opening point. Exact settings can be made using a pressure gauge in the refrigerant line to determine the throttling point. Put the system under normal operating load and adjust to the desired operating pressure. See Table 15 for pressure range specifications.

**Table 6: Range Adjustment Screw**

Valve Size (in.)	Range Adjusting Screw
3/8, 1/2, 3/4	1/4 in. square head adjusting screw with a screwdriver slot



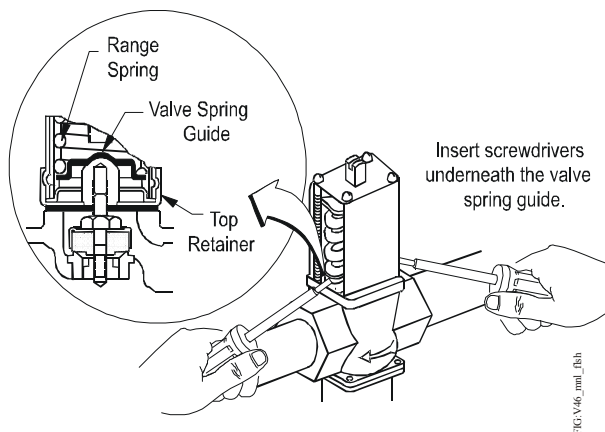
**Table 6: Range Adjustment Screw**

1, 1-1/4, 1-1/2	5/16 in. square head adjusting screw
2, 2-1/2	1/2 in. square head adjusting 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, the opening point of the valve should be raised just enough to cause the valve to close during compressor standby periods. This will also raise the throttling point.

## Manual Flushing

To clear any sediment that might accumulate, valves may be manually flushed. Insert screwdrivers under both sides of the valve spring guide and lift upwards to flush the valve. See Figure 19. Manual flushing does not affect valve adjustment.



**Figure 19: Manual Flushing**

## Repair Data

Replacement of the sensing element, internal parts, and the rubber diaphragm can be made. For a replacement valve or replacement parts kit, contact the nearest Johnson Controls/PENN® distributor. For replacement part kit numbers, see Table 9 through Table 14. For replacement kit instructions and details refer to the following bulletins:

- V46, V47, V48, and V49 Sensing Element Replacement Technical Bulletin, LIT-121700
- V46, V47, 246, and 247 Repair Parts and Service Instructions Repair Bulletin, LIT-121695

## Ordering Information

When ordering water valves, specify the following:

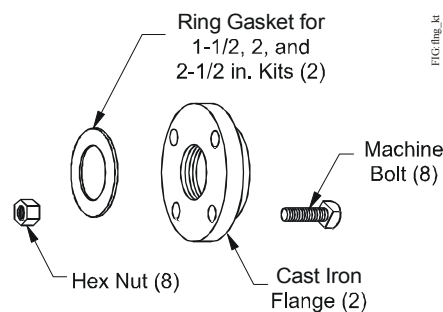
- Complete product number.
- If product number is not known, answer the following questions and select a valve using Table 10 through Table 14.
  - What is the valve size needed? See [Valve Sizing](#) section.
  - What refrigerant will be used in the system? See Table 15.

**Note:** 3/8 in. through 1-1/2 in. valves are supplied with all range construction, allowing a single valve to be used for either low or high range refrigerants.

- Is a standard open high, or reverse action close high valve required? See Table 8.
  - Is a commercial, maritime, or Navy service valve needed? Maritime and Navy valves have bronze bodies and monel internal parts.
- Companion flange kit by part number, if required. See [Companion Flanges and Gaskets](#).
  - Mounting bracket (3/8 in. and 1/2 in. valve sizes only) if required, and its position on valve. See [Mounting Bracket](#).

## Companion Flanges and Gaskets

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



**Figure 20: Flange Kit**

**Table 7: 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 Table 10 through Table 14, Table 8 can be used 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. For more information, contact Application Engineering at (414) 274-5535.

**Table 8: Type Number Selection Matrix**

<b>V46</b>	<b>A</b>	Open on Rise, Commercial
	<b>B</b>	Open on Rise, Maritime
	<b>C</b>	Open on Rise, Navy
	<b>D</b>	Open on Rise, Commercial Low Flow
	<b>E</b>	Open on Rise, Commercial with High Pressure Bellows
	<b>F</b>	Open on Rise, Maritime with High Pressure Bellows
	<b>G</b>	Open on Rise, Navy with High Pressure Bellows
	<b>L</b>	Open on Rise, Commercial Low Flow No-Repair
	<b>N</b>	Open on Fall, Commercial
	<b>P</b>	Open on Fall, Maritime
	<b>Q</b>	Open on Fall, Commercial Low Flow with High Pressure Bellows
	<b>A</b>	3/8 in. NPT Threaded
	<b>B</b>	1/2 in. NPT Threaded
	<b>C</b>	3/4 in. NPT Threaded
	<b>D</b>	1 in. NPT Threaded
	<b>E</b>	1-1/4 in. NPT Threaded
	<b>F</b>	1-1/2 in. NPT Threaded
	<b>G</b>	9/16–18 Threaded
	<b>H</b>	3/8 in. Sweat
	<b>J</b>	1/2 in. Sweat
	<b>K</b>	3/4 in. Sweat
	<b>L</b>	1 in. Sweat
	<b>M</b>	1-1/4 in. Sweat
	<b>N</b>	3/4 in. Flange
	<b>P</b>	1 in. Flange
	<b>Q</b>	1-1/4 in. Flange
	<b>R</b>	1-1/2 in. Flange
	<b>S</b>	2 in. Flange
	<b>T</b>	2-1/2 in. Flange

**Table 9: Pressure Connection Styles**

<b>Commercial Service: Non-corrosive Refrigerant</b>		
<b>Valve</b>	<b>Style No.</b>	<b>Description</b>
	45	30 in. (762 mm) copper capillary with 1/4 in. flare nut and valve depressor
<b>1-1/2 in. and</b>	5 <sup>1</sup>	1/4 in. male flare fitting
<b>Smaller</b>	34 <sup>1</sup>	30 in. (762 mm) copper capillary with 1/4 in. section for sweat or flare connection
<b>2 in. and 2-1/2 in.</b>	5	1/4 in. male flare fitting
<b>Commercial Service: Ammonia</b>		
<b>1/2 in. to 2-1/2 in.</b>	15	1/4 in. female NPT
<b>Navy and Marine Service</b>		
<b>All Sizes</b>	34	30 in. (762 mm) copper capillary with 1/4 in. section for sweat or flare connection

1. Optional, quantity orders only.

## Options

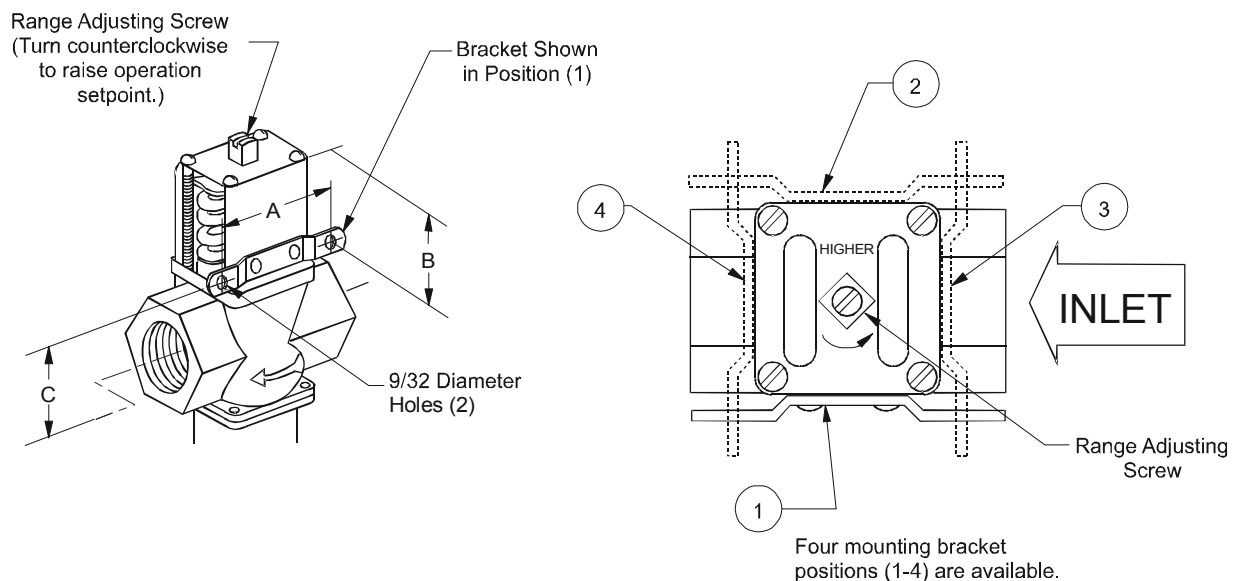
### Capillary Tubing Length

Standard length is 30 in. on valves 1-1/2 in. and smaller. Optional 48 in. (1,219 mm) capillary can be furnished at additional cost, when specified.

### Mounting Bracket

A mounting bracket as illustrated in Figure 21, is available on 3/8 in. and 1/2 in. valves only when specified. Desired bracket position must also be specified.

Other styles of brackets on 3/8 in. and 1/2 in. valves available on quantity orders. For more information, contact Application Engineering at (414) 274-5535.



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)

FIG. 21-10

**Figure 21: Mounting Bracket for 3/8 in. and 1/2 in. Valves**

**Table 10: Direct-Acting Commercial Type - Non-corrosive Refrigerants**

Product	Size (in.)	Inlet and Outlet	Service	Element Style	Shipping Weight lb (kg)	Seat Repair Kit	Replacement Power Element
<b>V46AA-1</b>	3/8 NPT	Threaded	All Range	45	2.3 (1.0)	STT14A-600R	SEP91A-600R and SEC37A-601R <sup>1</sup>
<b>V46DA-2</b>	3/8 NPT	Threaded	Extended All Range <sup>2</sup>	45	2.3 (1.0)	STT14A-603R	SEP91A-600R and SEC37A-601R <sup>1</sup>
<b>V46AB-1</b>	1/2 NPT	Threaded	All Range	45	3.3 (1.5)	STT15A-602R	SEP91A-602R and SEC37A-602R <sup>1</sup>
<b>V46AC-1</b>	3/4 NPT	Threaded	All Range	45	4.3 (2.0)	STT16A-601R	SEP91A-601R and SEC37A-602R <sup>1</sup>
<b>V46AD-1</b>	1 NPT	Threaded	All Range	45	9.3 (4.0)	STT17A-609R	SEP91A-603R and SEC37A-600R <sup>1</sup>
<b>V46AE-1</b>	1-1/4 NPT	Threaded	All Range	45	10.0 (4.5)	STT17A-610R	SEP91A-603R and SEC37A-600R <sup>1</sup>
<b>V46AR-1</b>	1-1/2 NPT	4 Hole ASME Flange	All Range	45	13.1 (6.0)	STT17A-610R	SEP91A-603R and SEC37A-600R <sup>1</sup>
<b>V46AS-1</b>	2	4 Hole ASME Flange	Low Range	5	25.5 (11.6)	STT18A-600R	SEP81A-602R <sup>3</sup>
<b>V46AS-2</b>	2	4 Hole ASME Flange	High Range	5	25.5 (11.6)	STT18A-600R	SEP81A-601R
<b>V46AT-1</b>	2-1/2	4 Hole ASME Flange	Low Range	5	29.5 (11.6)	STT18A-601R	SEP81A-602R <sup>3</sup>
<b>V46AT-2</b>	2-1/2	4 Hole ASME Flange	High Range	5	29.5 (11.6)	STT18A-601R	SEP81A-601R

**Table 15: Pressure Range Specifications**

Refrigerant	Maximum Opening Point, psig (kPa) <sup>1</sup>	Modulation Start Point, psig (kPa) <sup>1</sup>	Maximum Permissible Pressure psig (kPa)	
	V46A, B, C, D	V46N	Water	Refrigerant
All Range R12, R22, R134a, R502, R404a, R507	70 to 260 (483 to 1,793)	90 to 280 (621 to 1,931) 40 to 100 (276 to 690) <sup>2</sup>	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 R12, R134a	70 to 170 (483 to 1,172)	100 to 200 (690 to 1,379)	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)	180 to 280 (1241 to 1,931)	150 (1,034)	320 (2,206)
Ammonia R717	100 to 200 (690 to 1,379)	130 to 230 (896 to 1,586)	150 (1,034)	320 (2,206)

1. V46A, B, C direct acting valve ranges indicate the valve opening point. V46N reverse acting valve ranges indicates the modulation start point.
2. For heat pump applications (3/8 in. through 1-1/2 in. sizes only).

## Technical Specifications

### V46 Pressure-Actuated Water-Regulating Valve

Product	V46 Series Pressure Actuated Valve
Body Material	<b>Commercial:</b> 3/8, 1/2, or 3/4 in. Sizes Have Cast Brass Bodies, Other Commercial Types Have Cast Iron Bodies with Rust Resisting Finish <b>Navy and Maritime:</b> Cast Naval Bronze
Extension Sleeve, Disc,	<b>Commercial:</b> Brass; Monel is Available at Additional Cost
Stud, Disc Holder Material	<b>Navy and Maritime:</b> Monel
Valve Seat Material	<b>Commercial:</b> Aluminum Bronze; Monel is Available at Additional Cost <b>Navy and Maritime:</b> 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
Sensing Element	<b>Non-corrosive Refrigerants:</b> Brass and Phosphor Bronze Bellows in Brass Cup <b>Navy and Maritime:</b> Monel Bellows in Brass Cup <b>2 and 2-1/2 in. High Range Service:</b> Monel Bellows in Brass Cup <b>Ammonia Service:</b> Stainless Steel Bellows in Brass Cup
Pressure Range	See Table 15.
Shipping Weight	See Table 10 through Table 14.
Product	V46 Series Pressure Actuated Valve

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.



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