V248 Series 3-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants

Product Bulletin

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The V248 Series 3-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants regulate water flow to control refrigerant head pressure in systems with single or multiple water-cooled condensers.

V248 valves have an adjustable opening point in a refrigerant pressure range of 200 to 400 psi (13.8 to 27.6 bar). V248 valves are available in 1/2 in. through 1-1/2 in. size for use with standard, non-corrosive, high-pressure refrigerants.

Maritime models, which have nickel copper (Monel®) internal parts, are available for applications where the media may be corrosive to the internal parts.

⚠ WARNING

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

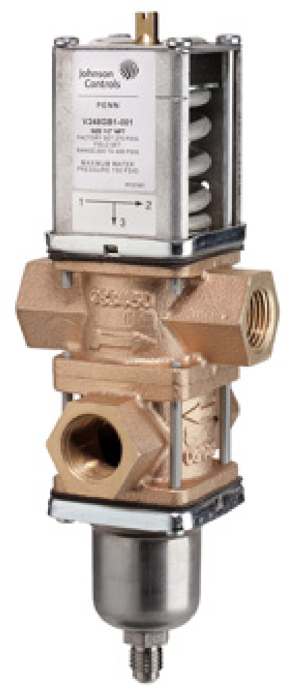

Figure 1: V248 Series Valve

Table 1: Features and Benefits

Features	Benefits
No Close Fitting or Sliding Parts in Water Passages	Provides robust control in less than ideal conditions.
Accessible Range Spring	Allows easy manual flushing.
Take-Apart Construction	Allows access to valve interior without removing valve from refrigeration system or pumping down the system.
Pressure-Balanced Design	Resists changes to setpoint caused by gradual or sudden water pressure changes.
Corrosion-Resistant Material for Internal Parts	Promotes long valve life.

Application

> **IMPORTANT:** The V248 Series 3-Way Pressure-Actuated Water-Regulating Valve for High-Pressure Refrigerants is intended to control water or coolant flow under normal operating conditions. Where failure or malfunction of the V248 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 V248 valve.

Operation

The V248 valve controls refrigerant head pressures by sensing the condensing pressure and adjusting water flow to meet cooling demand as the condenser requirements change. The 3-way design modulates water between the condenser and the bypass line.

Valve Sizing

Each application is unique and requires specific engineering data to properly size and design a system to fulfill the appropriate requirements. Typically, a valve is replaced with another valve of the same size in a properly sized and engineered system.

To make a rough field estimate of the size of valve for an application, find the valve size needed by locating a point on a flow chart (see Figure 6 through Figure 9) that satisfies these requirements:

- water flow required by the condenser (**Flow**)
- refrigerant head pressure rise ($\mathbf{P_{RISE}}$)
- available water pressure ($\mathbf{P_{AVAIL}}$)

Follow these steps, and use the information obtained to locate a point on one of the flowcharts (see Figure 6 through Figure 9) that satisfies all three steps.

1. Take the water flow required by the condenser **(Flow)** from information provided by the manufacturer of the condensing unit. If the manufacturer's information is unavailable, use the following information to make a rough approximation of water flow in gallons per minute (gpm) [cubic meters per hour (m^3/hr)] using Figure 2:

- System Capacity (**Tons of Refrigeration**)
- Outlet Water Temperature (**Temp.** $_{\mathbf{Outlet}}$)
- Inlet Water Temperature (**Temp.** $_{\mathbf{Inlet}}$)

Calculate the flow using the following formula:

$$\text{Flow} = \frac{\text{Tons of Refrigeration x 30}}{(\text{Temp.}_{\text{Outlet}} - \text{Temp.}_{\text{Inlet}})}$$

FIG:flw_eqn

Figure 2: Flow Required

Note: If the outlet temperature is unknown, assume it to be 10F° (6C°) above the inlet temperature.

2. Determine refrigerant head pressure rise above the valve opening point ($\mathbf{P_{RISE}}$) using Figure 4 and the following steps:

   a. The **Valve Closing Pressure** ($\mathbf{P_{CLOSE}}$) is equal to the refrigerant pressure at the highest ambient temperature the refrigeration equipment experiences in the Off cycle. Use a Pressure-Temperature Chart for the refrigerant selected to find this pressure.

   b. To approximate the **Valve Opening Pressure** ($\mathbf{P}_{\text{OPEN}}$), add about 10 psi (0.7 bar) to the Valve Closing Pressure.

$$P_{\text{OPEN}} = P_{\text{CLOSE}} + 10 \text{ psi (0.7 bar)}$$

FIG:eqn_opn_pressr

Figure 3: Valve Opening Pressure

   c. From the Pressure-Temperature Chart for the refrigerant selected, read the **Refrigerant Condensing Pressure** ($\mathbf{P_{COND}}$) (operating head pressure) corresponding to the selected condensing temperature.

   d. Subtract the Valve Opening Pressure from the Refrigerant Condensing Pressure. This gives the head pressure rise. See Figure 4.

$$P_{\text{RISE}} = P_{\text{COND}} - P_{\text{OPEN}}$$

FIG:eqn_hd_pressr_rs

Figure 4: Refrigerant Head Pressure Rise

3. Determine the available water pressure to the valve (P_{AVAIL}) using the following steps and Figure 5. This the actual water pressure available to force water through the valve.
    a. Determine the minimum inlet pressure (P_{IN}). This is the water pressure from city water mains, pumps, or other sources.
    b. Pressure drop through condenser (ΔP_{COND}) is the difference in water pressure between the condenser inlet and the condenser outlet. Obtain this information from the condenser manufacturer.
    c. Estimate or calculate the pressure drop through all associated piping (P_{LOSS}).
    d. Subtract the ΔP_{COND} and P_{LOSS} from P_{IN}. The result is P_{AVAIL}.

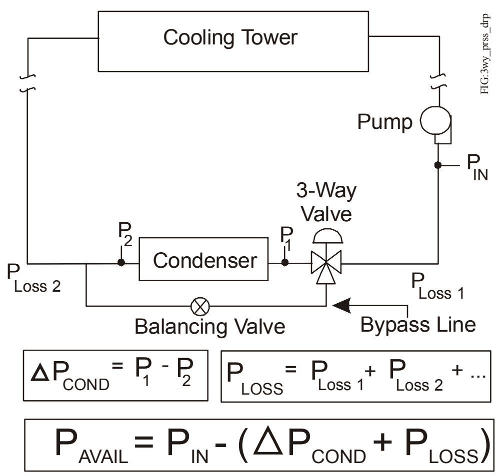

Figure 5: Available Water Pressure

4. Select the proper valve size from the flowcharts by locating a point on a chart that satisfies the flow, the head pressure rise above opening point, and the pressure drop across the valve.

Metric Conversions

Use these equations to convert between U.S. and S.I. units.

- 1 dm^3/s = 3.6 m^3/h = 15.9 U.S. gal. /min. = 13.2 U.K. gal. /min.
- 1 bar = 100 kPa = 0.1 MPa = 1.02 kg/cm^2 = 0.987 atm = 14.5 psi

Valve Sizing Example

A 12-ton capacity R410A system has an inlet water temperature of 85°F (29°C) and an outlet water temperature of 95°F (35°C).

The required flow for an R410A system is found to be 30 GPM (6.8 m^3/h). The manufacturer's recommended condensing temperature is 105°F (41°C), and the corresponding condensing pressure is 340 psi (23.4 bar). The maximum ambient temperature is estimated at 90°F (32°C).

City water pressure is 40 psi (2.8 bar) and the manufacturer's table gives a pressure drop through the condenser at 15 psi (1 bar). Drop through the installed piping is approximately 4 psi (0.3 bar).

Use the valve sizing process to find the correctly sized valve for this application:

1. Find or calculate the water flow required by the condenser. See Figure 2.
    - **Flow**: According to the data provided, the required flow is 30 GPM (6.8 m^3/h).
2. Determine refrigerant head pressure rise above the valve opening point**.** See Figure 3 and Figure 4.
    - P_{CLOSE}: Closing point is refrigerant pressure corresponding to 90°F (32°C) = 274 psi (18.9 bar). Using a refrigerant pressure-temperature charts for the refrigerant (R410A), the refrigerant is 274 psi at 90°F (18.9 bar at 32°C).
    - P_{OPEN}: Opening point = 274 psi + 10 psi = 284 psi (18.9 bar + 0.7 bar = 19.6 bar)
    - P_{COND}: Condensing pressure = 340 psi (23.4 bar)
    - P_{RISE}: Head pressure rise = 340 psi -284 psi = 56 psi (23.4 bar - 19.6 bar = 3.9 bar)

3. Determine the available water pressure to the valve. See Figure 5.
    - $\mathbf{P_{IN}}$: Inlet water pressure = 40 psi (2.8 bar)
    - $\Delta \mathbf{P_{COND}}$: Pressure drop through the condenser = 15 psi (1 bar)
    - $\mathbf{P_{LOSS}}$: Combined piping pressure loss = 4 psi (0.3 bar)
    - $\mathbf{P_{AVAIL}}$: Available water pressure to the valve = 40 psi - (15 psi + 4 psi) = 21 psi (2.8 bar - [1 bar + 0.3 bar] = 1.4 bar)

4. Using the following data and the flowcharts, the only valve that comes close to meeting all the criteria (without being oversized) is a 1 in. valve. See Figure 8.
    - **Flow** = 30 GPM (6.8 m^3/h)
    - $\mathbf{P_{RISE}}$ = a head pressure rise of 56 psi (3.9 bar)
    - $\mathbf{P_{AVAIL}}$ = available water pressure to the valve is 21 psi (1.4 bar)

V248 Flowcharts

The maximum recommended differential water pressure across a valve is 20 psi (1.4 bar).

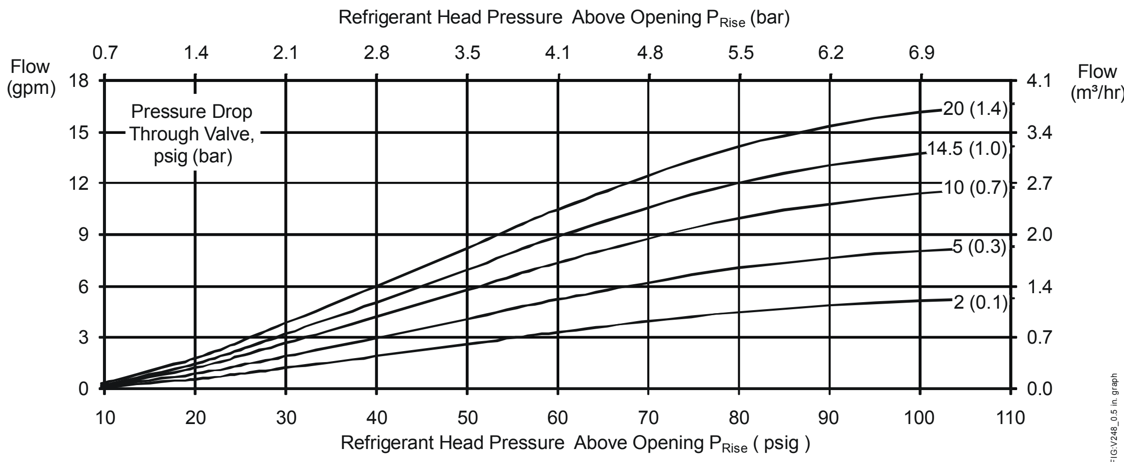

Figure 6: 1/2 in. Direct Acting Valve Flowchart

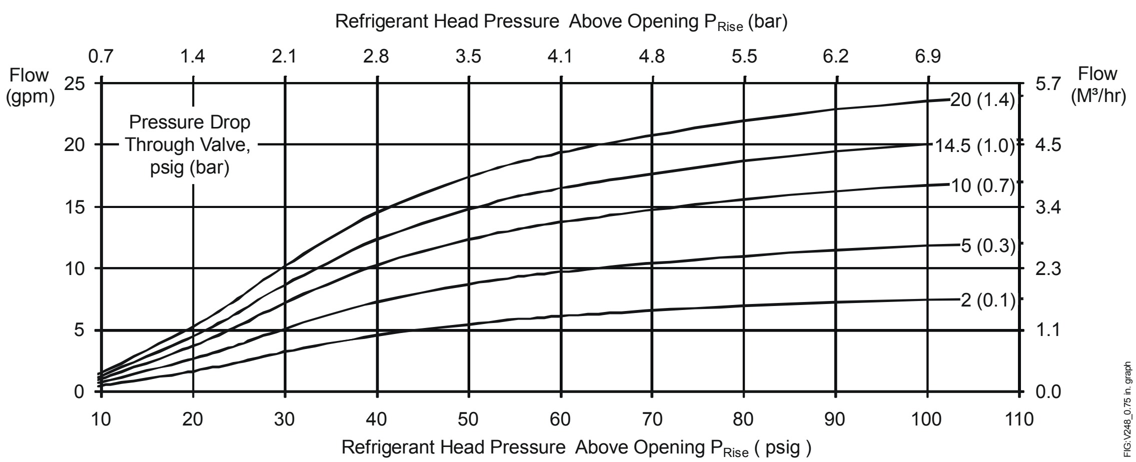

Figure 7: 3/4 in. Direct Acting Valve Flowchart

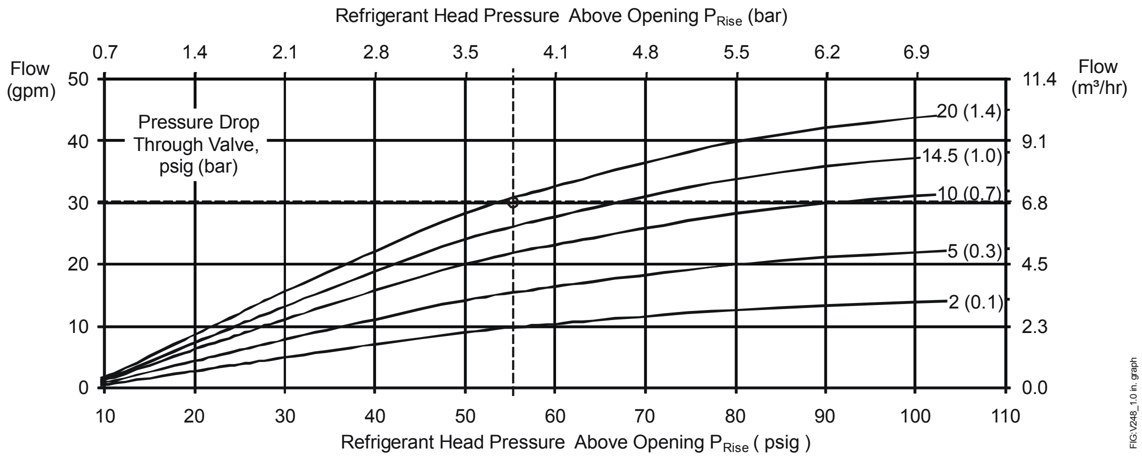

Figure 8: 1 in. Direct Acting Valve Flowchart

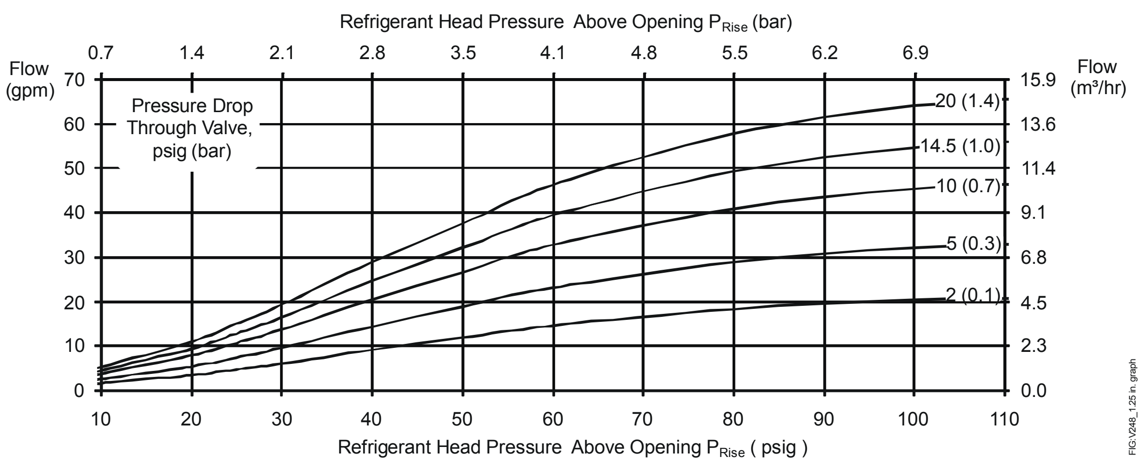

Figure 9: 1-1/4 in. Direct Acting Valve Flowchart

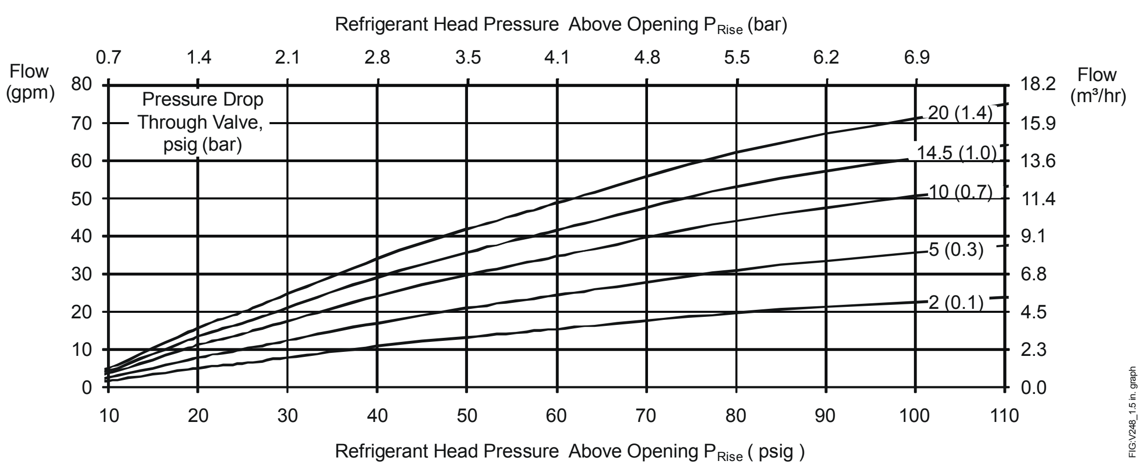

Figure 10: 1-1/2 in. Direct Acting Valve Flowchart

Dimensions

V248 Screw Connection Valves

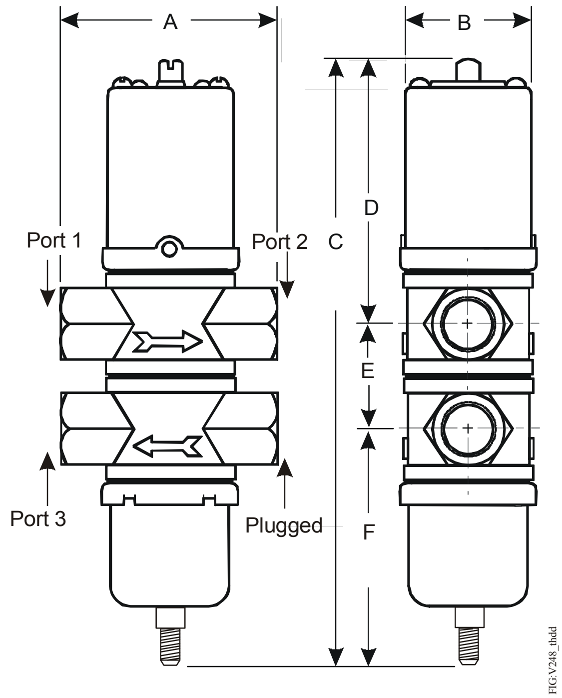

Figure 11: 1/2 in. Through 1-1/4 in. V248 Screw Connection Valves Dimensions

Table 2: 1/2 in. Through 1-1/4 in. V248 Screw Connection Valves Dimensions

Valve Size	Dimensions in Inches (Millimeters)					
	A	**B**	**C**	**D**	**E**	**F**
1/2 in.	3-1/16 (78)	2 (51)	8-11/16 (220)	3-13/16 (96)	1-1/2 (38)	3-3/8 (86)
3/4 in.	3-3/8 (86)	2-3/16 (55)	9-3/4 (248)	4-3/16 (106)	1-3/4 (44)	3-13/16 (98)
1 in.	4-3/4 (121)	2-13/16 (71)	12-1/2 (318)	5-15/16 (151)	2-1/16 (52)	4-1/2 (114)
1-1/4 in.	4-3/4 (121)	2-13/16 (71)	13-1/4 (336)	6-1/8 (156)	2-3/8 (60)	4-3/4 (121)

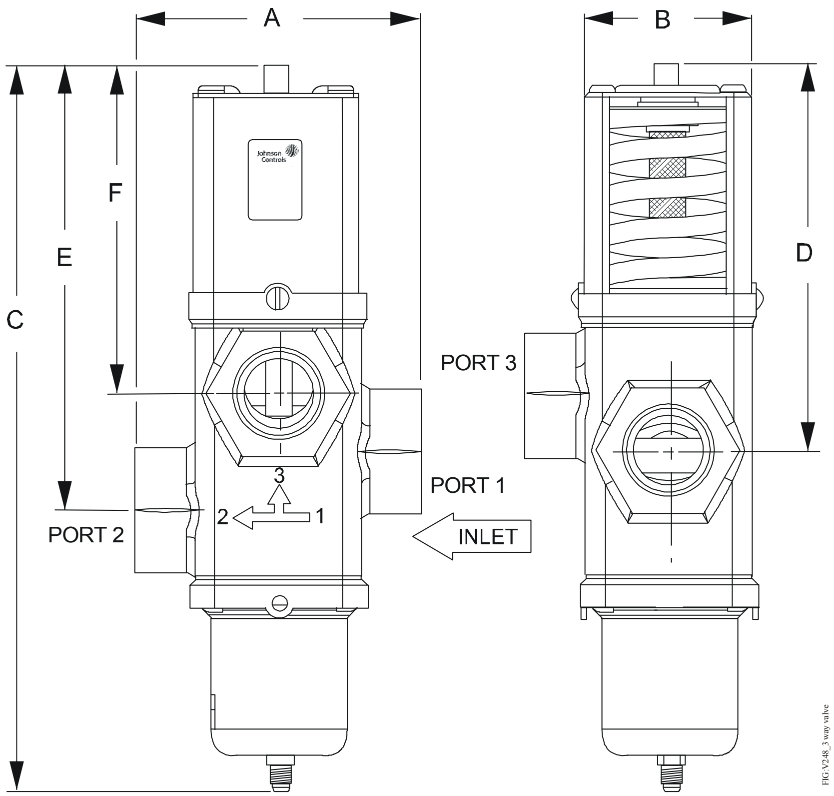

Figure 12: 1-1/2 in. V248 Screw Connection Valves Dimensions

Table 3: 1/2 in. V248 Screw Connection Valves Dimensions

Valve Size	Dimensions in Inches (Millimeters)					
	A	B	C	D	E	F
1-1/2 in.	6 (152)	3-1/2 (89)	15-1/4 (382)	8 (203)	9-5/16 (237)	6-7/8 (175)

V248 Union Sweat Connection Valves

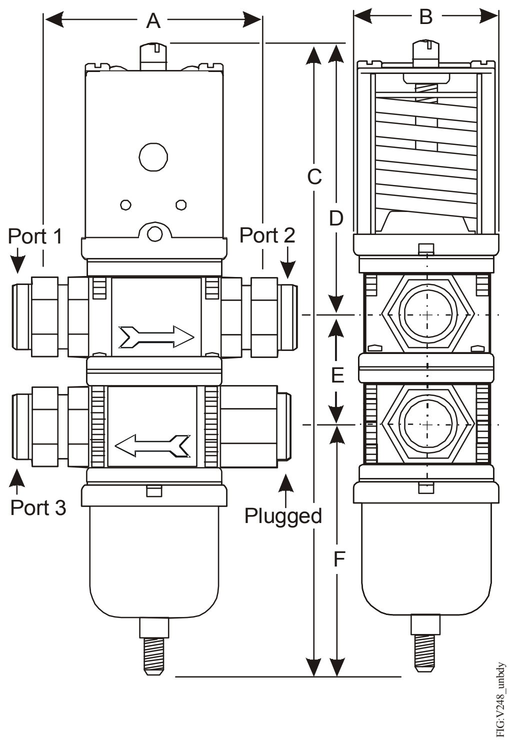

Figure 13: V248 Union Sweat Connection Valves Dimensions

Table 4: V248 Union Sweat Connection Valves Dimensions

Valve Size	Dimensions in Inches (Millimeters)					
	A	**B**	**C**	**D**	**E**	**F**
3/4 in.	3-3/8 (86)	2-3/16 (55)	9-3/4 (248)	4-3/16 (106)	1-3/4 (44)	3-13/16 (98)
1 in.	4-3/4 (121)	2-13/16 (71)	12-1/2 (318)	5-15/16 (151)	2-1/16 (52)	4-1/2 (114)
1-1/4 in.	4-3/4 (121)	2-13/16 (71)	13-1/4 (336)	6-1/8 (156)	2-3/8 (60)	4-3/4 (121)

Selection

Stock Models

When ordering V248 valves, specify the complete product code number. See Table 5 and Table 6.

Table 5: North American Standard Production Models - Range 200 to 400 psi

Product Code Number	Construction	Valve Size and Connection	Element Style	Shipping Weight, lb (kg)
V248GB1-001C	Direct Acting, Commercial	1/2 in. NPT Screw	Style 5	5.0 (2.3)
V248GC1-001C	Direct Acting, Commercial	3/4 in. NPT Screw	Style 5	6.5 (3.0)
V248GD1-001C	Direct Acting, Commercial	1 in. NPT Screw	Style 5	12.0 (5.4)
V248GE1-001C	Direct Acting, Commercial	1-1/4 in. NPT Screw	Style 5	16.0 (7.2)
V248GF1-001C	Direct Acting, Commercial	1-1/2 in. NPT Screw	Style 5	25.0 (11.3)
V248GK1-001C	Direct Acting, Commercial	3/4 in. Union Sweat	Style 5	7.0 (3.2)
V248GL1-001C	Direct Acting, Commercial	1 in. Union Sweat	Style 5	12.0 (5.4)
V248GM1-001C	Direct Acting, Commercial	1-1/4 in. Union Sweat	Style 5	13.7 (6.2)

Table 6: European Standard Production Models - Range 13.8 to 27.8 bar

Product Code Number	Construction	Valve Size and Connection	Element Style	Shipping Weight, lb (kg)
V248GB1B001C	Direct Acting, Commercial	1/2 in. BSPT Screw, ISO 7	Style 5	5.0 (2.3)
V248GC1B001C	Direct Acting, Commercial	3/4 in. BSPT Screw, ISO 7	Style 5	6.5 (3.0)
V248GD1B001C	Direct Acting, Commercial	1 in. BSPT Screw, ISO 7	Style 5	12.1 (5.5)
V248GE1B001C	Direct Acting, Commercial	1-1/4 in. BSPT Screw, ISO 7	Style 5	16.0 (7.2)
V248GF1B001C	Direct Acting, Commercial	1-1/2 in. BSPT Screw, ISO 7	Style 5	25 (11.3)
V248HC1B001C	Direct Acting, Maritime	3/4 in. BSPP Screw, ISO 228	Style 5	6.5 (3.0)

Custom Versions

For applications that call for valves not listed in Standard Production Models, use Table 7 through Table 13 to specify a custom valve.

Table 7: V248 Valves Selection Chart

<table>
<tr><td>V</td><td>2</td><td>4</td><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">Three-Way refrigeration water valves with projection-welded sensing elements</td><td>Construction - See Table 8</td><td>Valve Size and Connection Type - See Table 9</td><td>Element Style - See Table 10</td><td>Body Style - See Table 11</td><td colspan="3">Model - See Table 12</td><td colspan="2">Packaging - See Table 13</td></tr>
</table>

Table 8: Construction (Body, Style, and Pressure Range)

Symbol	Construction (Body, Style, and Pressure Range)
G	Direct Acting, Commercial, High Pressure Range 200 to 400 psi (13.8 to 27.6 bar)
H	Direct Acting, Maritime, High Pressure Range 200 to 400 psi (13.8 to 27.6 bar)
V	Other

Table 9: Valve Size and Connection Type

Symbol	Valve Size and Connection Type
B	1/2 in. Screw Connection
C	3/4 in. Screw Connection
D	1 in. Screw Connection
E	1-1/4 in. Screw Connection
F	1-1/2 in. Screw Connection
J	1/2 in. Sweat Connection
K	3/4 in. Sweat Connection
L	1 in. Union, Sweat Connection
M	1-1/4 in. Union, Sweat Connection
V	Other

Table 10: Element Style

Symbol	Element Style	Description
1	Style 5	1/4 in. male flare (7/16 - 20 UNF)
7	Other	Reference Custom Model Number for information

Table 11: Body Style

Symbol	Body Style
--	Inches, Straight Body
B	Metric, Straight Body

Table 12: Model

Symbol	Model
001	Standard Construction
002 (and above)	Deviation from Standard

Table 13: Packaging

Symbol	Packaging
C	Individual
D	Bulk (quantity varies by valve size)

Repair Information

Repairs can be made. Replacement sensing elements, internal parts and diaphragms are available. To obtain replacement parts kits instructions and details:

- In North America, contact Johnson Controls® Product Sales Operations Team at 1-800-275-5676.
- In Europe, contact your local sales office.

For North American replacement parts kits product code numbers, see Table 14. For European replacement parts kits product code numbers, see Table 15.

Table 14: North American Replacement Parts Kits

Nominal Valve Size	Valve Type	Seat Replacement Parts Kit Product Code Number	Diaphragm Replacement Parts Kit Product Code Number	Sensing Element Replacement Parts Kit Product Code Number
1/2 in.	Commercial	STT15A-605R	DPM15A-605R	SEP93A-601R
3/4 in.	Commercial	STT16A-604R	DPM16A-604R	SEP93A-602R
1 in.	Commercial	STT17A-616R	DPM17A-616R	SEP93A-603R
1-1/4 in.	Commercial	STT17A-617R	DPM17A-609R	SEP93A-603R
1-1/2 in.	Commercial	STT17A-605R	DPM17A-604R	SEP93A-604R

Table 15: European Replacement Parts Kits

Nominal Valve Size	Valve Type	Seat Replacement Parts Kit Product Code Number	Diaphragm Replacement Parts Kit Product Code Number	Sensing Element Replacement Parts Kit Product Code Number
1/2 in.	Commercial	STT15A-605R	DPM15A-605R	SEP93A-601R
3/4 in.	Commercial	STT16A-604R	DPM16A-604R	SEP93A-602R
	Maritime/Navy	STT16A-605R		
1 in.	Commercial	STT17A-616R	DPM17A-616R	SEP93A-603R
1-1/4 in.	Commercial	STT17A-617R	DPM17A-609R	SEP93A-603R
1-1/2 in.	Commercial	STT17A-605R	DPM17A-604R	SEP93A-604R

Materials

Table 16: North American V248 Materials

Nominal Valve Size: Material:	3/8 in. to 3/4 in. (Commercial)	1 in. to 1 1/2 in. (Commercial)	Maritime (All Sizes)
Body	Cast Brass	Cast Iron/Rust Resisting Finish	Cast Bronze
Seat	Aluminum Bronze	Aluminum Bronze	Monel

Table 16: North American V248 Materials

Nominal Valve Size: / Material:		3/8 in. to 3/4 in. (Commercial)	1 in. to 1 1/2 in. (Commercial)	Maritime (All Sizes)
Disc		BUNA-N	BUNA-N	BUNA-N
Disc Cup		Brass	Brass	Monel
Disc Stud		Brass	Brass	Monel
Stem/Extension Sleeve		Brass	Brass	Monel
Diaphragms		Nylon Reinforced BUNA-N	Nylon Reinforced BUNA-N	Nylon Reinforced BUNA-N
Refrigerant Contact				
Pressure Element	**Cup**	300 Series Stainless Steel	300 Series Stainless Steel	300 Series Stainless Steel
	Bellows	300 Series Stainless Steel	300 Series Stainless Steel	300 Series Stainless Steel
	Bellows Ring	Steel/Nickel Plated	Steel/Nickel Plated	Steel/Nickel Plated

Table 17: European V248 Materials

Nominal Valve Size: / Material:		3/8 in. to 3/4 in. (Commercial)	1 in. to 1 1/2 in. (Commercial)	Maritime (All Sizes)
Body		Hot Forged Brass	Cast Iron/Rust Resisting Finish	Cast Bronze
Seat		Aluminum Bronze	Aluminum Bronze	Monel
Disc		BUNA-N	BUNA-N	BUNA-N
Disc Cup		Brass	Brass	Monel
Disc Stud		Brass	Brass	Monel
Stem/Extension Sleeve		Brass	Brass	Monel
Diaphragms		Nylon Reinforced BUNA-N	Nylon Reinforced BUNA-N	Nylon Reinforced BUNA-N
Refrigerant Contact				
Pressure Element	**Cup**	300 Series Stainless Steel	300 Series Stainless Steel	300 Series Stainless Steel
	Bellows	300 Series Stainless Steel	300 Series Stainless Steel	300 Series Stainless Steel
	Bellows Ring	Steel/Nickel Plated	Steel/Nickel Plated	Steel/Nickel Plated

Technical Specifications

V248 Series Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants

Maximum Working Pressure	630 psi (43.4 bar)
Factory-Set Opening Point (Port 1 to Port 2)	275 psi (19.0 bar)
Opening Point Adjustment Range (Port 1 to Port 2)	200 to 400 psi (13.8 to 27.6 bar)
Throttling Range	120 psi (8.3 bar) for 1/2 in. size 100 psi (6.9 bar) for 3/4 in., 1 in., and 1-1/4 in. sizes 140 psi (9.6 bar) for 1-1/2 in. size
Media	150 psi (10.3 bar) Maximum, -4°F to 170°F (-20°C to 77°C) glycol/water or liquids with low freezing points that are compatible with valve materials

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult local Johnson Controls/PENN Refrigeration Technical Support at 1-800-275-5676. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.