V246 Series Two-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants Product Bulletin

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Description

The V246 Series 2-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants come with direct-acting control action. V246 valves regulate water flow to control refrigerant head pressure in systems with water-cooled condensers.

The V246 Series valves are available in 3/8 in. to 2 in. sizes and have a maximum allowable water pressure of 150 psi (10.3 bar). Direct acting V246 valves have an adjustable opening point in a refrigerant pressure range of 200 psi to 400 psi (13.8 bar to 27.6 bar). You can use V246 valves with standard noncorrosive 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

Warning

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

Figure 1: Figure 1: V246 Series valve



Features and benefits

No close fitting or sliding parts in water passages

Provides robust control in non-ideal conditions.

Accessible range spring

Allows easy manual flushing.

Take-apart construction

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

Pressure-balanced design

Resists changes to the setpoint caused by gradual or sudden water pressure changes.

Corrosion-resistant material for internal parts

Promotes long valve life.

Application

Important: The V246 Series 2-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants is intended to control water or coolant flow under normal operating conditions. Where failure or malfunction of the V246 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 V246 valve.

Operation

The V246 valve controls refrigerant head pressure by sensing the condensing pressure and adjusting water flow as the condenser requirements change.

Valve sizing

About this task:
Each application is unique and requires specific engineering data to correctly size and design a system to fulfill the appropriate requirements. Typically, you replace a valve with another valve of the same size in a correctly sized and engineered system.

To make a rough field estimate of the size of valve for an application, find the valve size that you need by locating a point on a flow chart that satisfies the following requirements. For the flowcharts, see Figure 6 to Figure 11.

Follow these steps, to determine the following values:

- Water flow that the condenser needs (Flow)
- Refrigerant head pressure rise (P_{RISE})
- Available water pressure (P_{AVAIL})

Use the information that you obtain to locate a point on one of the flowcharts that satisfies all three steps. For the flowcharts, see Figure 6 to Figure 11.

1. Refer to information from the manufacturer of the condensing unit for the water flow that the condenser needs (Flow). If the manufacturer's information is unavailable, use the following information and Figure 2 to make an approximation of water flow in gallons per minute (cubic meters per hour):

   Calculate the flow using the following values and formula:

   - System capacity (tons of refrigeration)
   - Outlet water temperature (Temp. $_{Outlet}$)
   - Inlet water temperature (Temp. $_{Inlet}$)

   Figure 2: Required flow

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

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

2. Use Figure 4 and the following steps to determine refrigerant head pressure rise above the valve opening point (P_{RISE}):

   a. The valve closing pressure (P_{CLOSE}) is equal to the refrigerant pressure at the highest ambient temperature that the refrigeration equipment experiences in the Off cycle. Use a pressure-temperature chart for the selected refrigerant to find this pressure.

   b. To approximate the valve opening pressure (P_{OPEN}), add approximately 10 psi (0.7 bar) to the valve closing pressure. See Figure 3.

      Note: Add about 20 psi (1.4 bar) for 3/8 in. valves.

   Figure 3: Valve opening pressure

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

   c. From the pressure-temperature chart for the selected refrigerant, read the refrigerant condensing pressure (P_{COND}), also known as the operating head pressure, that corresponds to the selected condensing temperature.

   d. Subtract the valve opening pressure from the refrigerant condensing pressure. This calculation gives the head pressure rise. See Figure 4.

   Figure 4: Refrigerant head pressure rise

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

3. Use the following steps and Figure 5 to determine the available water pressure to the valve (P_{AVAIL}). This is the actual water pressure available to force water through the valve.

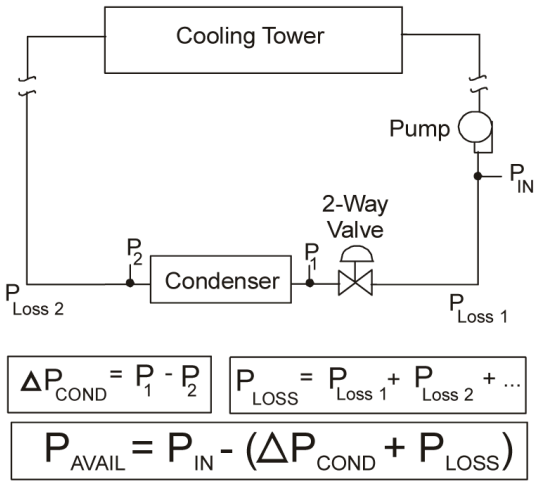
   a. Determine the inlet pressure (P_{IN}). This is the water pressure from city water mains, pumps, or other sources.

   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 correct 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

About this task:
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 manufacturer's recommended condensing temperature is 105°F (41°C), which corresponds to a pressure of 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). The combined pressure loss due to 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 that the condenser requires. See Figure 2.

   Flow: According to the data provided, the required flow is 36 GPM (8.2 m^3/h).
2. Determine the 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 chart 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.

   - P_{IN}: Inlet water pressure = 40 psi (2.8 bar)
   - ΔP_{COND}: Pressure drop through the condenser = 15 psi (1 bar)
   - P_{LOSS}: Combined piping pressure loss = 4 psi (0.3 bar)
   - 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 meets all the criteria without being oversized is a 1 1/4 in. valve. See Figure 11.

   - Flow = 36 GPM (8.2 m^3/h)
   - P_{RISE} = a head pressure rise of 56 psi (3.9 bar)
   - P_{AVAIL} = available water pressure to the valve is 21 psi (1.4 bar)

V246 flowcharts

The maximum recommended differential water pressure across a valve is 60 psi (4.1 bar).

Figure 6: 3/8 in. direct acting low-flow valve flowchart

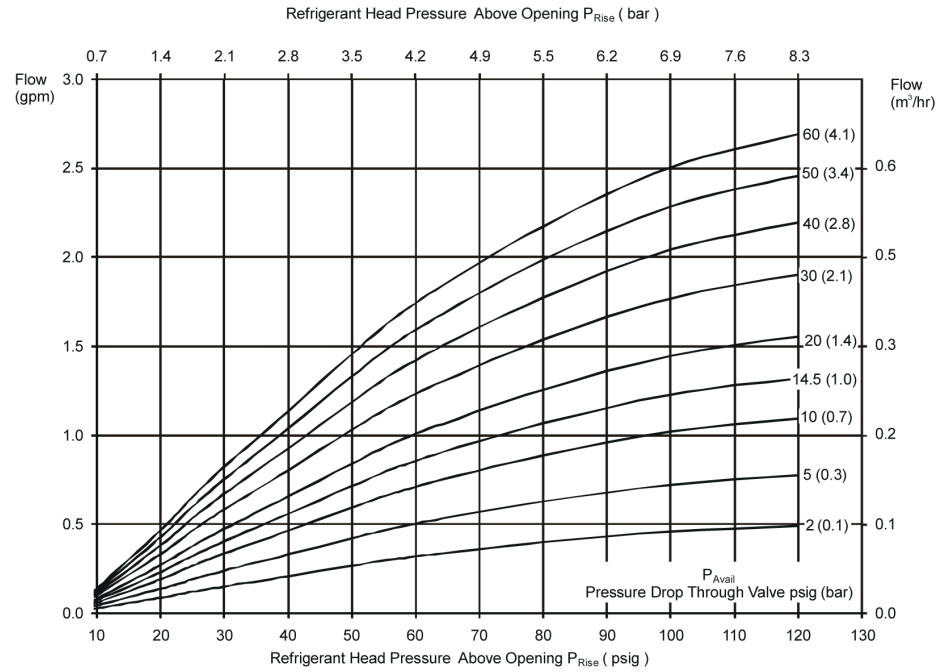


Figure 7: 3/8 in. direct acting valve flowchart

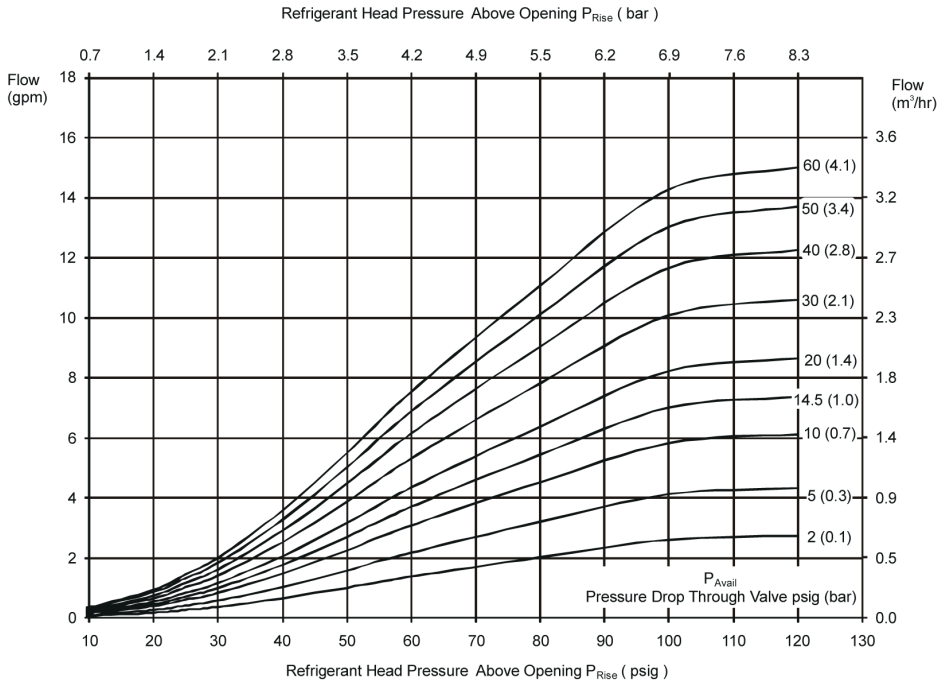


Figure 8: 1/2 in. direct acting valve flowchart

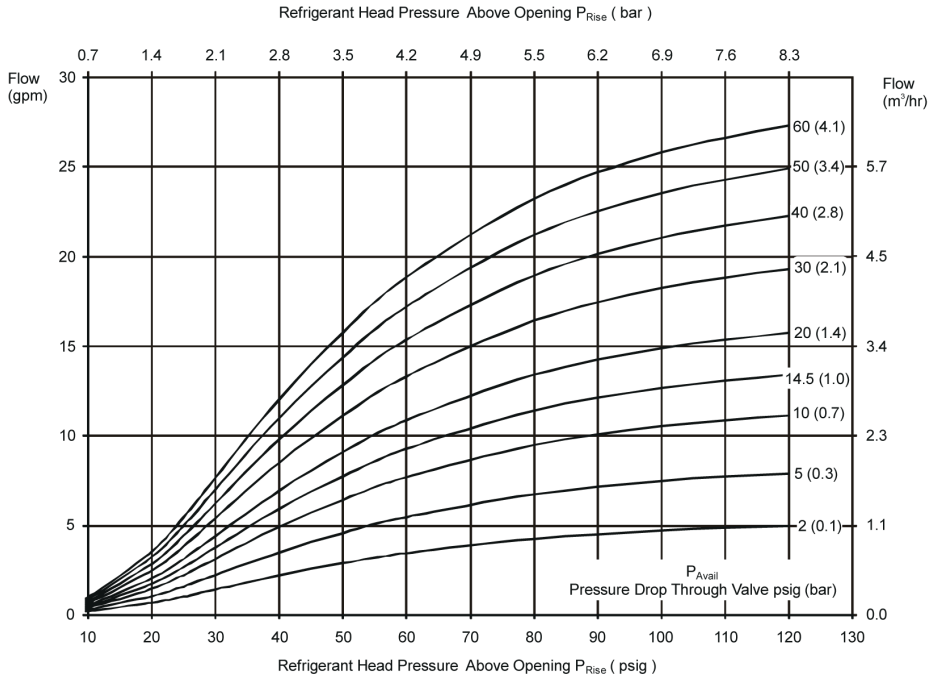


Figure 9: 3/4 in. direct acting valve flowchart

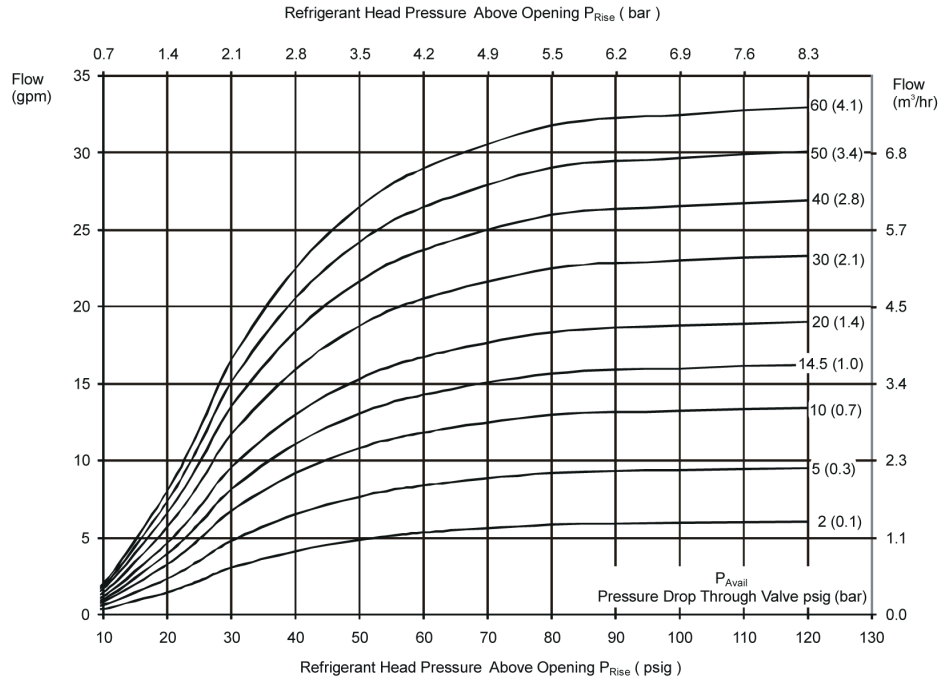


Figure 10: 1 in. direct acting valve flowchart

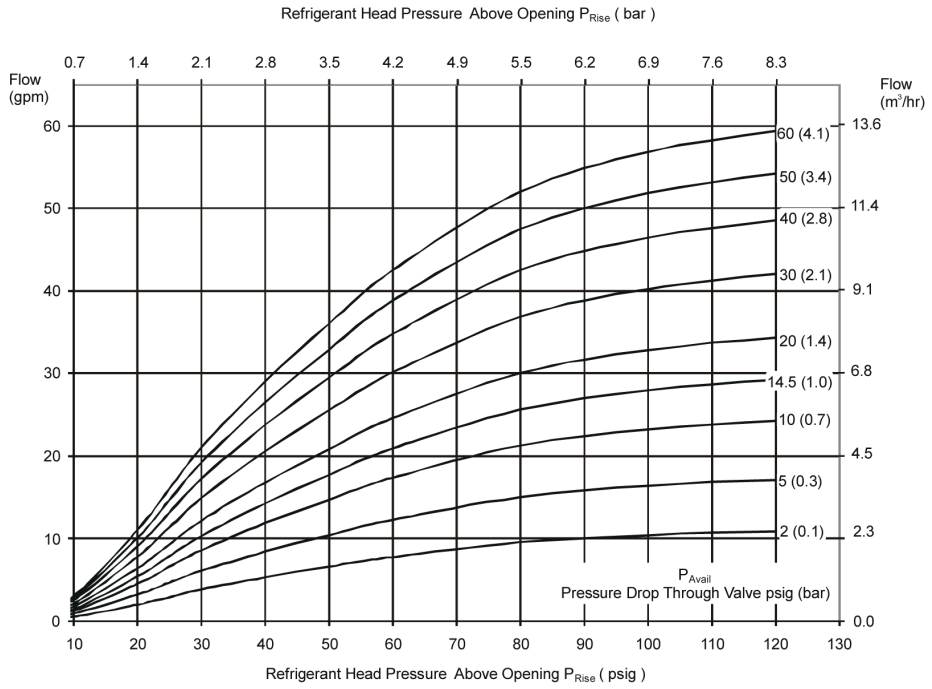


Figure 11: 1 1/4 in. direct acting valve flowchart

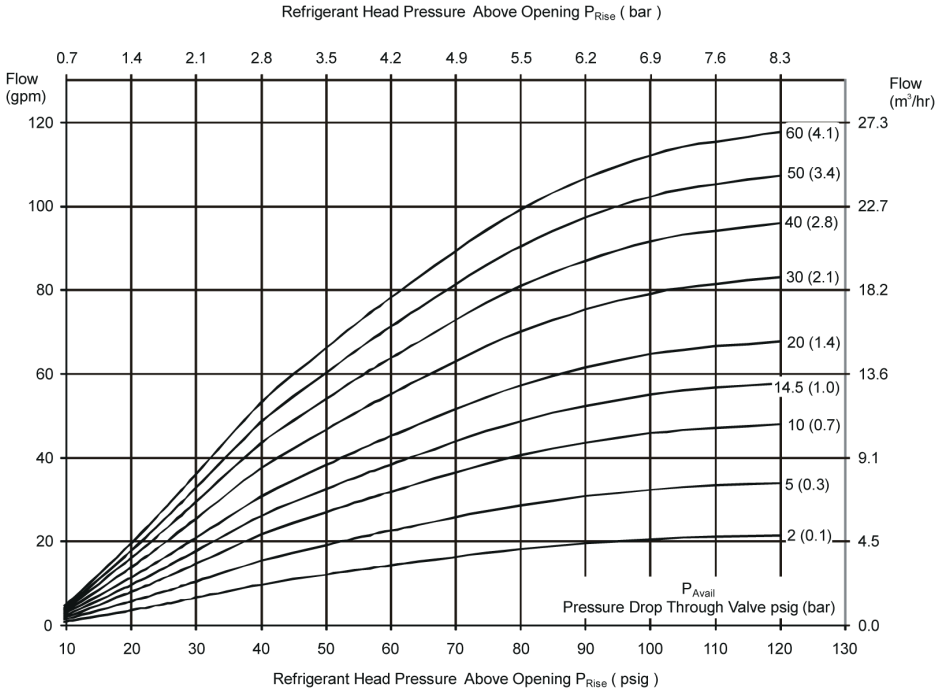


Figure 12: 1 1/2 in. direct acting valve flowchart

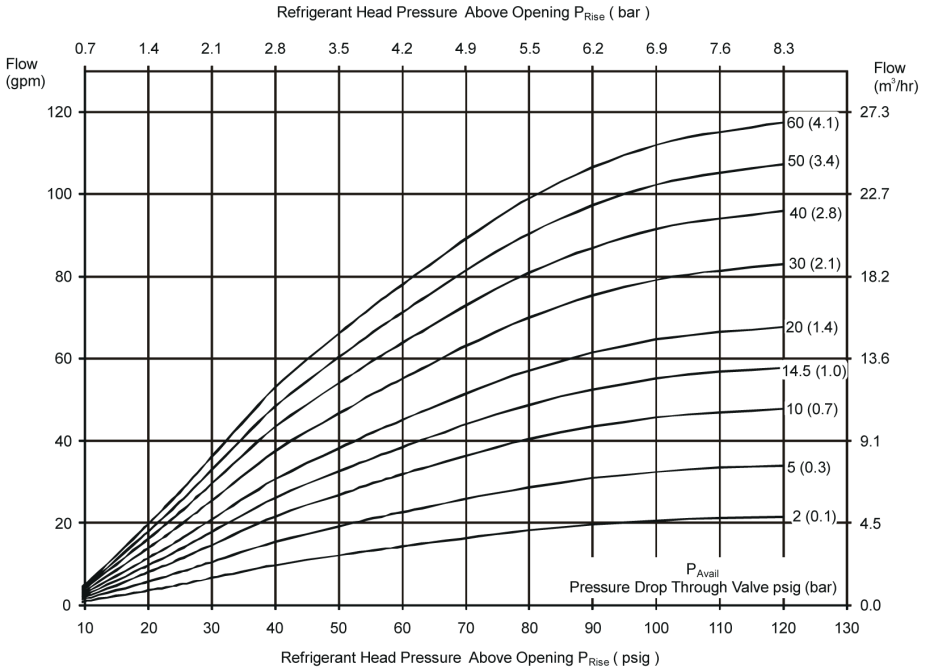
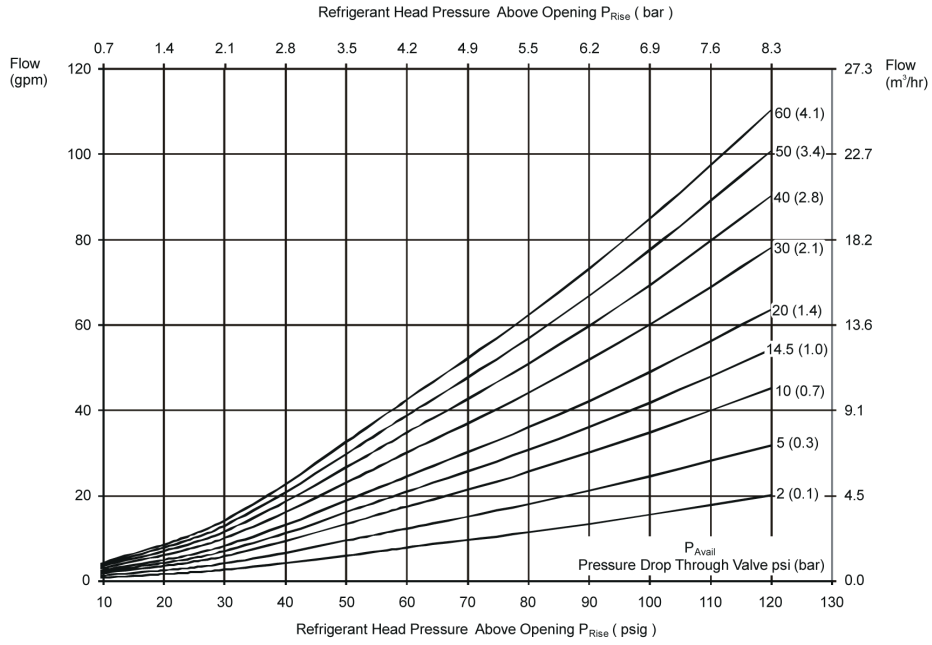


Figure 13: 2 in. direct acting valve flowchart



Dimensions

Figure 14: V246 screw connection valves dimensions

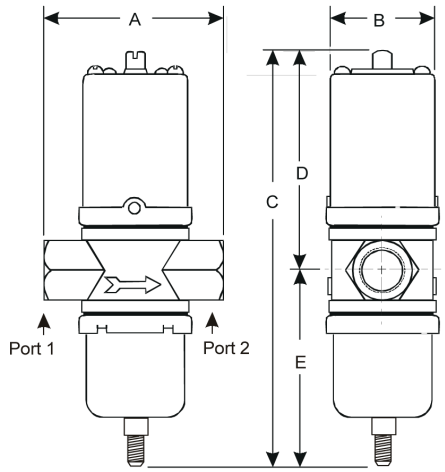


Figure 15: V246 angle-body screw connection valves dimensions

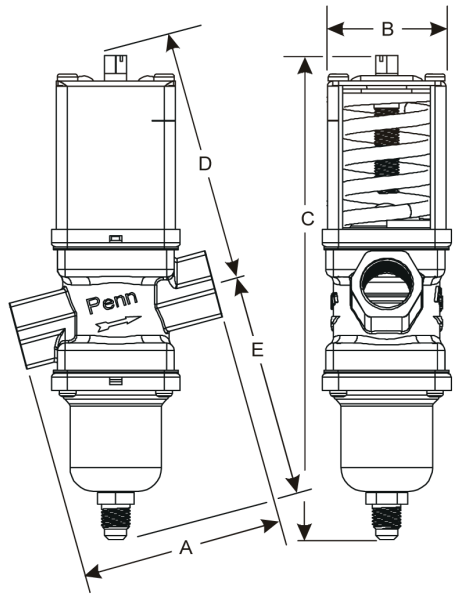


Table 1: V246 screw connection valves dimensions

Valve size	Dimensions, in. (mm)				
	A	B	C	D	E
3/8 in.	2 5/8 (67)	1 5/8 (41)	6 1/2 (166)	3 1/2 (89)	3 (77)
1/2 in.	3 1/16 (78)	2 (51)	7 3/16 (182)	3 13/16 (96)	3 3/8 (86)
3/4 in.	3 3/8 (86)	2 3/16 (55)	8 (203)	4 3/16 (106)	3 13/16 (98)
1 in.	4 3/4 (121)	2 13/16 (71)	10 1/2 (267)	5 15/16 (151)	4 9/16 (116)
1 1/4 in.	4 3/4 (121)	2 13/16 (71)	10 7/8 (276)	6 1/8 (156)	4 3/4 (121)

Table 2: V246 angle-body screw connection valves dimensions

Valve size	Dimensions, in. (mm)				
	A	B	C	D	E
3/8 in.	2 3/4 (70)	1 5/8 (41)	6 15/16 (176)	3 5/8 (92)	3 1/8 (80)
1/2 in.	3 1/8 (80)	2 (51)	7 1/2 (191)	3 7/8 (98)	3 1/2 (88)
3/4 in.	3 9/16 (90)	2 1/8 (55)	8 9/16 (217)	4 5/16 (110)	4 (101)

Figure 16: V246 union sweat connection valves dimensions

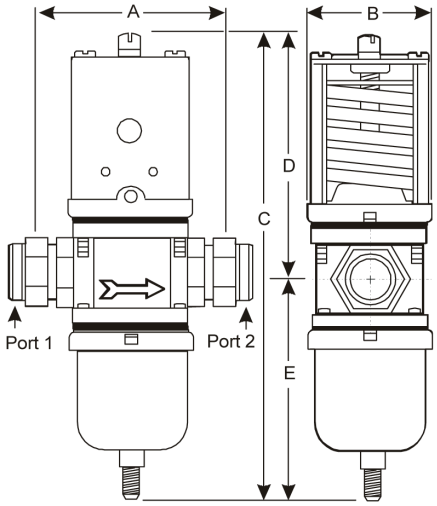


Table 3: V246 union sweat connection valves dimensions

Valve size	Dimensions, in. (mm)				
	A	B	C	D	E
1 1/4 in.	4 3/4 (121)	2 13/16 (71)	10 7/8 (276)	6 1/8 (156)	4 3/4 (121)

Figure 17: V246 flange valve dimensions

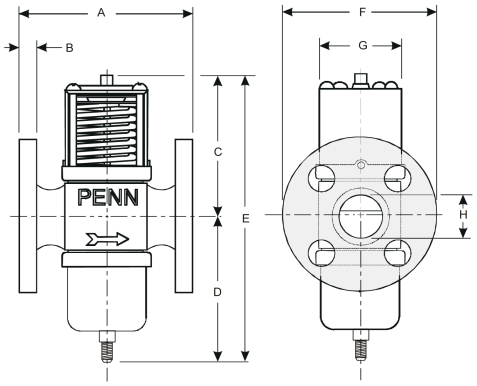


Table 4: V246 flange valve, commercial service - dimensions

Valve size	Dimensions, in. (mm)							
	A	B	C	D	E	F	G	H
1 1/2 in.	5 5/16 (135)	9/16 (14)	6 1/8 (156)	4 3/4 (121)	10 7/8 (276)	5 1/4 (133)[1]	2 5/8 (67)	1 7/8 (48)
2 in.	6 5/8 (168)	5/8 (16)	7 1/8 (181)	6 1/8 (156)	13 1/4 (336)	6 3/16 (157)[2]	3 1/2 (89)	2 1/4 (57)

1 The dimensions on the European versions are 5 29/32 in. (150 mm).
2 The dimensions on the European versions are 6 1/2 in. (165 mm).

Table 5: V246 flange valve, commercial service - flange specifications

Valve size	Regional version	Number of holes	Hole size	Bolt circle
1 1/2 in.	North American	4	5/8 in. (16 mm)	3 7/8 in. (98 mm)
2 in.			3/4 in. (19 mm)	4 3/4 in. (121 mm)
1 1/2 in.	European, DIN2533 flanges	4	18 mm	110 mm
2 in.				125 mm

Table 6: V246 flange valve, maritime service - dimensions

Valve Size	Dimensions, in. (mm)							
	A	B	C	D	E	F	G	H
1 1/2 in.	5 5/16 (135)	9/16 (14)	6 1/8 (156)	4 3/4 (121)	10 7/8 (276)	5 1/4 (133)[1]	2 5/8 (67)	1 7/8 (48)
2 in.	6 3/8 (162)	5/8 (16)	7 1/8 (181)	6 1/8 (156)	13 1/4 (337)	6 (152)[2]	3 1/2 (89)	2 3/4 (70)

1 The dimensions on the European versions are 5 29/32 in. (150 mm).
2 The dimensions on the European versions are 6 1/2 in. (165 mm).

Table 7: V246 flange valve, maritime service - flange specifications

Valve size	Regional version	Number of holes	Hole size	Bolt circle
1 1/2 in.	North American	4	5/8 in. (16 mm)	3 7/8 in. (98 mm)
2 in.			3/4 in. (19 mm)	4 3/4 in. (121 mm)
1 1/2 in.	European, DIN86021 flanges	4	18 mm	110 mm
2 in.				125 mm

Stock models

When ordering V246 valves, specify the complete product code number. See Table 8 and Table 9.

Table 8: North American standard production models

Product code	Construction	Range, psi (bar)	Valve size and connection	Element style	Shipping weight, lb (kg)
V246GA1-001C	Direct acting, commercial	200 to 400 (13.8 to 27.6)	3/8 in. NPT screw	Style 5	1.8 (0.8)
V246GB1-001C			1/2 in. NPT screw		3.0 (1.4)
V246GC1-001C			3/4 in. NPT screw		3.7 (1.7)
V246GD1-001C			1 in. NPT screw		9.3 (4.2)
V246GE1-001C			1 1/4 in. NPT screw		10 (4.5)
V246GM1-001C			1 1/4 in. union sweat		10 (4.5)
V246GR1-001C			1 1/2 in. flange		13.6 (6.2)
V246GS1-001C			2 in. flange		27 (12.3)
V246HA1-001C	Direct acting, maritime		3/8 in. NPT screw		1.8 (0.8)
V246HB1-001C			1/2 in. NPT screw		3.0 (1.4)
V246HC1-001C			3/4 in. NPT screw		4.3 (2.0)
V246HD1-001C			1 in. NPT screw		9.5 (4.3)
V246HE1-001C			1 1/4 in. NPT screw		10.3 (4.7)
V246HR1-001C			1 1/2 in. American Society of Mechanical Engineers (ASME) flange		13.6 (6.2)
V246HS1-001C			2 in. ASME flange		27 (12.3)

Table 9: European standard production models

Product code	Construction	Valve size and connection	Element style	Shipping weight, kg (lb)
V246GA1A001C	Direct acting, commercial	3/8 in. British standard pipe parallel (BSPP) screw, ISO 228	Style 5	0.8 (1.8)
V246GB1A001C		1/2 in. BSPP screw, ISO 228		1.4 (3.0)
V246GC1A001C		3/4 in. BSPP screw, ISO 228		1.7 (3.7)
V246GD1B001C		1 in. British standard pipe taper (BSPT) screw, ISO 7		4.2 (9.3)
V246GE1B001C		1 1/4 in. BSPT screw, ISO 7		4.5 (10)
V246GR1B001C		1 1/2 in. flange, DIN2533		6.2 (13.6)
V246HA1B001C	Direct acting, maritime	3/8 in. BSPP screw, ISO 228		0.8 (1.8)
V246HC1B001C		3/4 in. BSPP screw, ISO 228		2.0 (4.3)
V246HD1B001C		1 in. BSPP screw, ISO 228		4.3 (9.5)
V246HE1B001C		1 1/4 in. BSPP screw, ISO 228		4.7 (10.3)
V246HR1B001C		1 1/2 in. flange, DIN86021		6.2 (13.6)
V246HS1B001C		2 in. flange, DIN86021		12.3 (27)

Repair information

You can make repairs. Replacement sensing elements, internal parts, and diaphragms are available for order. To obtain replacement parts kit 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 10. For European replacement parts kits product code numbers, see Table 11.

Table 10: North American replacement parts kits

Nominal valve size	Valve type	Seat replacement parts kit product code	Diaphragm replacement parts kit product code	Sensing element replacement parts kit product code
3/8 in.	Commercial	STT14A-600R	DPM14A-600R	SEP93A-600R
	Maritime/Navy	STT14A-601R		
3/8 in. Low Flow	Commercial	STT14A-603R	DPM14A-600R	SEP93A-600R
	Maritime/Navy	Not Applicable		
1/2 in.	Commercial	STT15A-602R	DPM15A-602R	SEP93A-601R
	Maritime/Navy	STT15A-603R		
3/4 in.	Commercial	STT16A-601R	DPM16A-601R	SEP93A-602R
	Maritime/Navy	STT17A-613R		
1 in.	Commercial	STT17A-609R	DPM17A-600R	SEP93A-603R
	Maritime/Navy	STT17A-611R		
1 1/4 in.	Commercial	STT17A-610R	DPM17A-600R	SEP93A-603R
	Maritime/Navy	STT17A-612R		
1 1/2 in.	Commercial	STT17A-610R	DPM17A-600R	SEP93A-603R
	Maritime/Navy	STT17A-612R		
2 in.	Commercial	STT18A-620R	DPM17A-601R	SEP93A-604R
	Maritime/Navy	STT18A-622R		

Table 11: European replacement parts kits

Nominal valve size	Valve type	Seat replacement parts kit product code	Diaphragm replacement parts kit product code	Sensing element replacement parts kit product code
3/8 in.	Commercial	STT002N600R	DPM14A-600R	SEP93A-600R
	Maritime/Navy	STT14A-601R		
1/2 in.	Commercial	STT003N600R	DPM15A-602R	SEP93A-601R
	Maritime/Navy	STT15A-603R		
3/4 in.	Commercial	STT004N600R	DPM16A-601R	SEP93A-602R
	Maritime/Navy	STT17A-613R		
1 in.	Commercial	STT17A-609R	DPM17A-600R	SEP93A-603R
	Maritime/Navy	STT17A-611R		
1 1/4 in.	Commercial	STT17A-610R	DPM17A-600R	SEP93A-603R
	Maritime/Navy	STT17A-612R		
1 1/2 in.	Commercial	STT17A-610R	DPM17A-600R	SEP93A-603R
	Maritime/Navy	STT17A-612R		
2 in.	Commercial	STT18A-620R	DPM17A-601R	SEP93A-604R
	Maritime/Navy	STT18A-622R		

Materials

Table 12: North American V246 materials

Nominal valve size / Material		3/8 in. to 3/4 in., commercial	1 in. to 2 in., commercial	Maritime, all sizes
Body		Cast 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

Table 13: European V246 materials

Nominal valve size / Material		3/8 in. to 3/4 in., commercial	1 in. to 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

Table 14: V246 Series 2-Way Pressure-Actuated Water-Regulating Valves for High-Pressure Refrigerants

Factory-set opening point	200 psi (13.8 bar)
Maximum working pressure	630 psi (43.4 bar)
Opening point adjustment range	200 psi to 400 psi (13.8 bar to 27.6 bar)
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
Compliance	United States: cULus Listed; UL 207 File SFJQ.SA45221
c UL us LISTED	Canada: cULus Listed; UL 207 File SFJQ7.SA45221
	Applies to: • V246GA1-001C • V246GB1-001C • V246HA1-001C • V246HB1-001C **Note:** • The valve body and internal parts are not compatible with ammonia (R717). • The design pressure marked on these components shall not be less than the installed system working pressure or less than the values outlined in ASHRAE 15 for the charged refrigerant. After charging, mark the installed equipment with the refrigerant type and oil used.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, contact 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.

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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