Technical leaflet

Pressure and Temperature Regulators

January 1999

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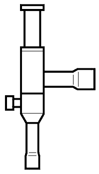
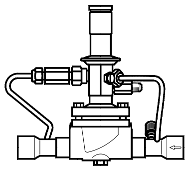
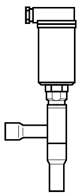
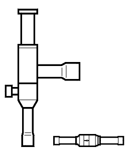


Evaporator Pressure Regulators







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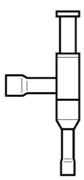
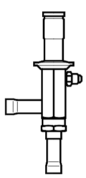
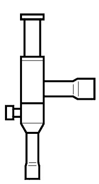
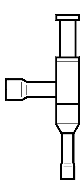


Hot Gas Bypass Capacity Regulators



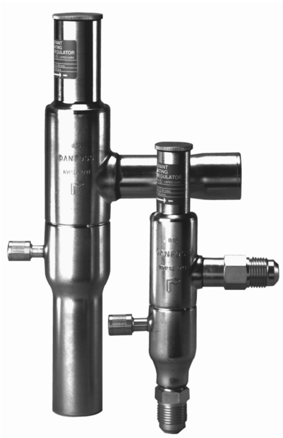


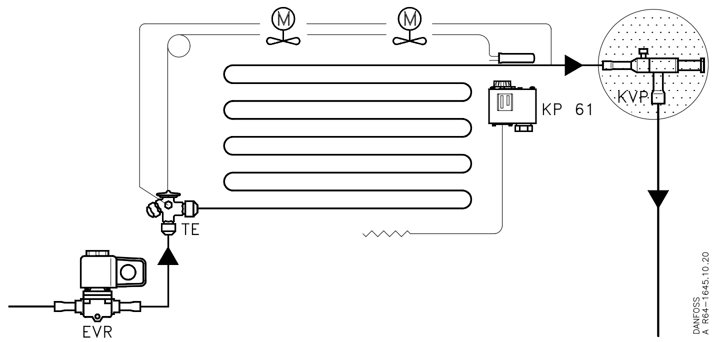
Crankcase Pressure Regulators



Receiver Pressure Regulators

Metric conversions
1 psi = 0.07 bar
$^{5}/_{9}$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm
1 ft = 0.3 m
1 lb = 0.454 kg
1 oz = 28.35 g
US gal/min = 0.86 m^3/h





Contents

Introduction

KVP evaporator pressure regulators are mounted in the suction line of refrigeration and air conditioning systems.
They are used to maintain a constant pressure corresponding to a constant temperature on the evaporator.
They also protect against too low an evaporating pressure by throttling down when pressure falls below the set value.
They are also used to differentiate the evaporating pressures in two or more evaporators in systems with one compressor.

Features

- *Accurate, adjustable pressure regulation*
- *Wide capacity and operating range*
- *Pulsation damping design*
- *Stainless steel bellows*
- *Compact angle design for easy installation in any position*
- *"Hermetic" brazed construction*
- *1/4 in. Schrader valve for pressure testing*
- *Available with flare and ODF solder connections*
- *For use with CFC, HCFC and HFC refrigerants*

Approvals

UL listed, file SA7200

CSA approved

Technical data

Refrigerants
CFC, HCFC, HFC

Regulation range
0 to 80 psig
Factory setting = 29 psig

Maximum working pressure
MWP = 200 psig

Maximum test pressure
KVP 12 to 22: p' = 410 psig
KVP 28 to 35: p' = 370 psig

Maximum temperature of medium: 212°F *)

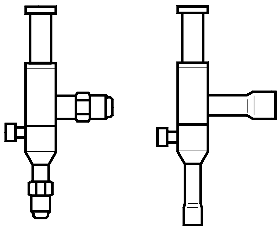
Minimum temperature of medium: – 40°F *)

P band (full valve stroke)
KVP 12 to 22 = 26 psi
KVP 28 to 35 = 40 psi

*) If the Schrader valve cone is removed and the connector is sealed with cap and nut, the maximum temperature is 300°F and the minimum temperature is – 330°F.

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C

Ordering



Type	Rated capacity [1]) tons				Flare connection [2])		Solder connection	
	R 22	R 134a	R 404A/R 507	R 407C	in.	**Code no**	in. ODF	**Code no**
KVP 12	1.3	0.9	1.2	1.2	1/2	**034L0021**	1/2	**034L0023**
KVP 15	1.3	0.9	1.2	1.2	5/8	**034L0022**	5/8	**034L0029**
KVP 22	1.3	0.9	1.2	1.2			7/8	**034L0025**
KVP 28	2.8	1.9	2.4	2.6			1 1/8	**034L0026**
KVP 35	2.8	1.9	2.4	2.6			1 3/8	**034L0032**

[1]) Rated capacity is based on:
Evaporating temperature t_e = 40°F
Condensing temperature t_c = 100°F
Pressure drop across regulator Δp = 2 psi
Offset (design evaporating pressure minus minimum allowable evaporator pressure) = 9 psi.

[2]) KVP supplied without flare nuts.
Separate flare nuts can be supplied:
1/2 in., code no **011L1103**
5/8 in., code no **011L1167**

Note: The connection dimensions chosen must not be too small, as gas velocities in excess of 130 ft/s at the inlet of the regulator can result in flow noise.

Capacity

R 22

Maximum regulator capacity Q_e[1])

Type	Pressure drop across regulator	Capacity Q_e in tons at evaporating temperature t_e °F									
	Δp psi	– 20	– 10	0	10	20	30	40	50	60	70
KVP 12	2	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.4	1.5	1.7
KVP 15	4	0.9	1.0	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4
KVP 22	6	1.0	1.2	1.3	1.5	1.7	1.9	2.2	2.4	2.6	2.9
	10	1.1	1.4	1.6	1.9	2.1	2.4	2.7	3.0	3.3	3.6
	20	1.1	1.4	1.8	2.2	2.6	3.0	3.5	3.9	4.4	4.9
KVP 28	2	1.4	1.6	1.8	2.0	2.3	2.5	2.8	3.1	3.4	3.7
KVP 35	4	1.9	2.2	2.5	2.8	3.1	3.5	3.9	4.3	4.7	5.2
	6	2.1	2.5	2.9	3.3	3.8	4.2	4.7	5.2	5.7	6.3
	10	2.4	2.9	3.5	4.0	4.6	5.2	5.8	6.5	7.2	7.9
	20	2.4	3.0	3.8	4.7	5.6	6.6	7.5	8.5	9.6	10.6

R 134a

Maximum regulator capacity Q_e[1])

Type	Pressure drop across regulator	Capacity Q_e in tons at evaporating temperature t_e °F						
	Δp psi	10	20	30	40	50	60	70
KVP 12	2	0.6	0.7	0.8	0.9	1.0	1.1	1.2
KVP 15	4	0.8	0.9	1.0	1.2	1.3	1.5	1.7
KVP 22	6	0.9	1.0	1.2	1.4	1.6	1.8	2.0
	10	1.0	1.2	1.5	1.7	2.0	2.2	2.5
	20	1.0	1.3	1.6	2.0	2.4	2.8	3.3
KVP 28	2	1.3	1.5	1.7	1.9	2.1	2.4	2.6
KVP 35	4	1.7	2.0	2.3	2.6	2.9	3.3	3.6
	6	2.0	2.3	2.7	3.1	3.5	3.9	4.4
	10	2.2	2.7	3.2	3.7	4.3	4.9	5.5
	20	2.2	2.8	3.5	4.4	5.2	6.1	7.1

[1]) The capacities are based on:
Liquid temperature ahead of expansion valve t_l = 100°F
Regulator offset Δp = 9 psi

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm

Capacity *(continued)*

R 404A and R 507

Maximum regulator capacity Q_e[1])

Type	Pressure drop across regulator Δp psi	Capacity Q_e in tons at evaporating temperature t_e °F										
		– 30	– 20	– 10	0	10	20	30	40	50	60	70
KVP 12 KVP 15 KVP 22	2	0.5	0.5	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.4	1.5
	4	0.6	0.7	0.8	0.9	1.1	1.3	1.4	1.6	1.8	1.9	2.2
	6	0.7	0.8	1.0	1.1	1.3	1.5	1.7	1.9	2.1	2.4	2.6
	10	0.8	1.0	1.2	1.3	1.6	1.9	2.0	2.4	2.8	3.0	3.4
	20	0.8	1.0	1.3	1.6	1.9	2.3	2.7	3.2	3.6	4.1	4.5
KVP 28 KVP 35	2	1.0	1.1	1.3	1.5	1.8	2.0	2.2	2.4	2.8	3.0	3.4
	4	1.3	1.5	1.8	2.0	2.4	2.7	3.1	3.4	3.9	4.3	4.8
	6	1.5	1.8	2.1	2.4	2.9	3.2	3.7	4.1	4.7	5.1	5.7
	10	1.7	2.1	2.5	2.9	3.5	4.1	4.6	5.2	5.9	6.5	7.2
	20	1.7	2.1	2.7	3.4	4.3	5.2	5.9	6.8	7.8	8.8	9.8

R 407C

Maximum regulator capacity Q_e[1])

Type	Pressure drop across regulator Δp psi	Capacity Q_e in tons at evaporating temperature t_e °F									
		– 20	– 10	0	10	20	30	40	50	60	70
KVP 12 KVP 15 KVP 22	2	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.4	1.7
	4	0.7	0.9	0.9	1.1	1.2	1.4	1.7	1.9	2.1	2.3
	6	0.8	1.0	1.1	1.3	1.5	1.7	2.0	2.3	2.5	2.8
	10	0.9	1.1	1.4	1.6	1.9	2.2	2.5	2.8	3.1	3.5
	20	0.9	1.1	1.5	1.9	2.3	2.7	3.2	3.7	4.2	4.8
KVP 28 KVP 35	2	1.1	1.3	1.5	1.7	2.0	2.3	2.6	2.9	3.2	3.6
	4	1.5	1.8	2.1	2.4	2.7	3.2	3.6	4.0	4.5	5.0
	6	1.7	2.1	2.5	2.8	3.3	3.8	4.3	4.9	5.4	6.1
	10	1.9	2.4	3.0	3.4	4.0	4.7	5.3	6.1	6.8	7.7
	20	1.9	2.5	3.2	4.0	4.9	5.9	6.9	8.0	9.1	10.3

[1]) The capacities are based on:
Liquid temperature ahead of expansion valve t_l = 100°F
Regulator offset Δp = 9 psi

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 22	0.82	0.85	0.88	0.92	0.96	1.0	1.05	1.10
R 134a	0.79	0.82	0.86	0.90	0.95	1.0	1.06	1.13
R 404A/R 507	0.71	0.75	0.80	0.85	0.92	1.0	1.10	1.24
R 407C	0.78	0.81	0.85	0.89	0.94	1.0	1.07	1.15

Correction factors for offset

Offset psi	3	6	9	12	15	18	21
KVP 12 KVP 15 KVP 22	2.5	1.4	1	0.77	0.67	0.59	
KVP 28 KVP 35		1.4	1	0.77	0.67	0.59	0.53

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Sizing

For optimum performance, it is important to select a KVP valve according to system conditions and application.
The following data must be used when sizing a KVP valve:

- Refrigerant - CFC, HCFC or HFC
- Evaporator capacity Q_e in tons
- Evaporating temperature (required temperature) t_e in °F
- Minimum evaporating temperature t_e in °F
- Liquid temperature ahead of expansion valve t_l in °F
- Connection type flare or solder
- Connection size in inches

Valve selection

Example

When selecting the appropiate valve it may be necessary to convert the actual evaporator capacity using a correction factor. This is required when your system conditions are different than the table conditions.
The selection is also dependant on the acceptable pressure drop across the valve.
The following example illustrates how this is done.

Refrigerant: R134a
Evaporator capacity: Q_e = 1.5 tons
Evaporating temperature: t_e = 40°F ~ 36 psig
Minimum evaporating temperature: 35°F ~ 30.5 psig
Liquid temperature ahead of expansion valve: t_l = 80°F
Connection type: Solder
Connection size: 5/8 in.

Step 1

Determine the correction factor for liquid temperature t_l ahead of the expansion valve.

From the correction factors table (see below) a liquid temperature of 80°F, R134a corresponds to a factor of 0.90.

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 22	0.82	0.85	0.88	0.92	0.96	1.0	1.05	1.10
R 134a	0.79	0.82	0.86	0.90	0.95	1.0	1.06	1.13
R 404A/R 507	0.71	0.75	0.80	0.85	0.92	1.0	1.10	1.24
R 407C	0.78	0.81	0.85	0.89	0.94	1.0	1.07	1.15

Step 2

Determine the correction factor for the valve offset.
The offset is defined as the difference between the design evaporating pressure and the minimum evaporating pressure (see page 7 for more information on offset).
From the offset correction factor table, an offset of 5.5 psi (36 – 30.5) corresonds to a factor of 1.4.

Correction factors for offset

Offset psi	3	6	9	12	15	18	21
KVP 12 KVP 15 KVP 22	2.5	1.4	1	0.77	0.67	0.59	
KVP 28 KVP 35		1.4	1	0.77	0.67	0.59	0.53

Step 3

Corrected evaporator capacity is
Q_e = 0.90 x 1.4 x 1.5 = 1.89 tons

Step 4

Now select the appropriate capacity table and choose the column for an evaporating temperature of t_e=40°F.

Using the corrected evaporator capacity, select a valve that provides an equivalent or greater capacity at an acceptable pressure drop.

KVP 12/15/22 delivers 2.0 tons at a 20 psi pressure drop across the valve.

KVP 28/35 delivers 1.9 tons at a 2 psi pressure drop across the valve.

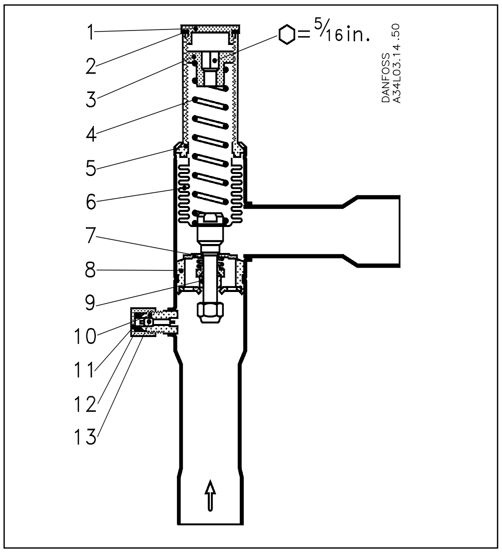
Based on the required connection size of 5/8 in., the KVP 15 is the proper selection for this example.

Step 5

KVP 15, $^5/_8$ in. solder connection:
code no. 034L0029, see Ordering on page 4.

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm

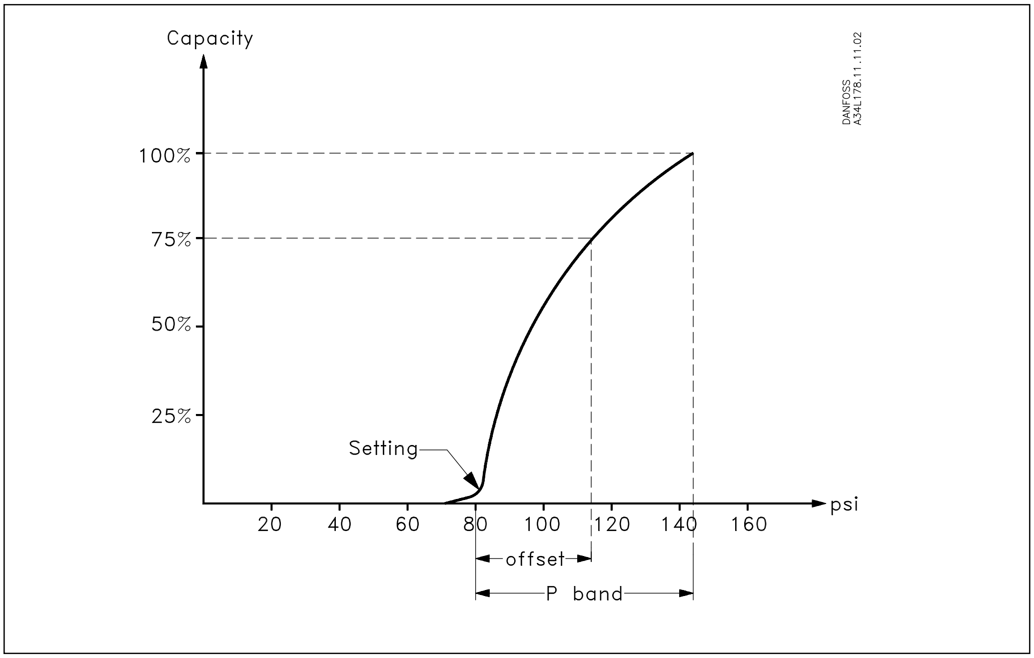
Design and Function



1. Protective cap
2. Gasket
3. Setting screw
4. Main spring
5. Valve body
6. Equalization bellows
7. Valve plate
8. Valve seat
9. Damping device
10. Pressure gauge connection
11. Cap
12. Gasket
13. Insert

Evaporator pressure regulator type KVP opens on a rise in pressure on the inlet side, i.e. when the pressure in the evaporator exceeds the set value.
Type KVP regulates on inlet pressure only. Pressure variations on the outlet side of the regulator do not affect the degree of opening as the valve is equipped with equalization bellows (6).
The bellows have an effective area corresponding to that of the valve seat neutralizing any affect to the setting. The regulator is also equipped with a damping device (9) providing protection against pulsations which can normally arise in a refrigeration system.
The damping device helps to ensure long life for the regulator without impairing regulation accuracy.

P-band and Offset



Proportional band
The proportional band or P-band is defined as the amount of pressure required to move the valve plate from closed to full open position.

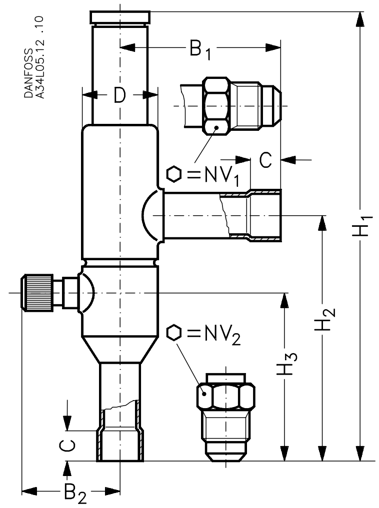
Example: If the valve is set to open at 58 psig and the valve p-band is 25 psi, the valve will give maximum capacity when the inlet pressure reaches 83 psig.

Offset
The offset is defined as the permissible pressure variation in evaporator pressure (temperature). It is calculated as the difference between the required working pressure and the minimum allowable pressure.
The offset is always a part of the P-band.

Example with R22:
A working temperature of 40°F ~ 70 psig is required, and the temperature must not drop below 33°F ~ 60 psig.
The offset will then be 10 psi.
When selecting a valve, be sure to correct the evaporator capacity based on the required offset.

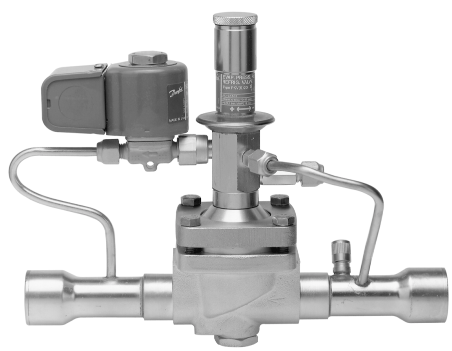
Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C

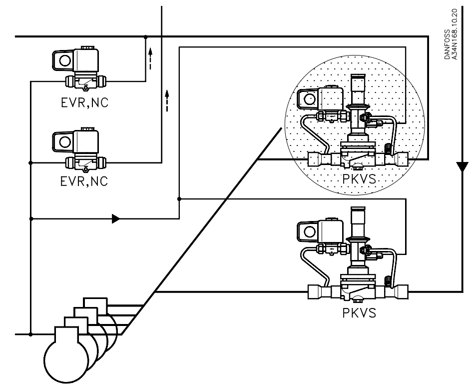
Dimensions and weights



Type	Connection		NV_1	NV_2	H_1	H_2	H_3	B_1	B_2	C	dia. D	Weight
	Flare	Solder ODF										
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	lbs.
KVP 12	1/2	1/2	0.748	0.945	7.047	3.898	2.598	2.520	1.614	0.394	1.181	0.9
KVP 15	5/8	5/8	0.748	0.945	7.047	3.898	2.598	2.520	1.614	0.472	1.181	0.9
KVP 22		7/8	0.945	0.945	7.047	3.898	2.598	2.520	1.614	0.669	1.181	0.9
KVP 28		1 1/8	0.945	0.945	10.197	5.945	4.055	4.134	1.890	0.787	1.693	2.0
KVP 35		1 3/8			10.197	5.945	4.055	4.134	1.890	0.984	1.693	2.0

Metric conversions
1 in. = 25.4 mm
1 lb = 0.454 kg





Contents

Introduction

PKV is a servo-operated, evaporator pressure regulator that operates with minimum pressure drop in the suction line.
When designing refrigeration systems, it is important to minimize the pressure drop in the suction line, because increased pressure drop reduces compressor capacity, resulting in longer running times and higher energy costs.

PKV has been specifically developed for low temperature systems where pressure drop has the greatest effect.
PKVS is fitted with an EVR 3 solenoid valve for use in systems with hot gas defrost and where positive shut-off is required.

Features

- *Accurate, adjustable pressure regulation*
- *Wide capacity and operating ranges*
- *Control by high side pressure results in minimal suction line pressure drop*
- *Two versions, PKV and PKVS; PKVS is fitted with an EVR 3 NC pilot solenoid valve*
- *$^1/_4$ in. Schrader valve for pressure testing*
- *Installs in either horizontal or vertical position*
- *For use with CFC, HCFC and HFC refrigerants*

Approvals

UL listed, file SA7200

CSA certified, LR 92682

Technical data

Refrigerants
CFC, HCFC, HFC

Regulating range
0 to 86 psig

Maximum working pressure
MWP = 305 psig

Maximum test pressure
p' = 405 psig

Maximum media temperature
PKV: 220°F
PKVS: 190°F

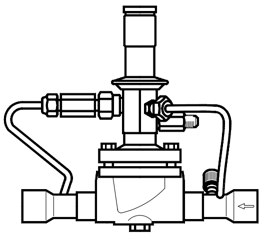
Minimum media temperature
PKV/PKVS: – 40°F

Minimum opening differential pressure
0 psi

Differential pressure between pilot pressure and suction pressure
50 to 305 psi

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C

Ordering



Type	Rated capacity 1) tons				Connection solder ODF	Code no.
	R 22	R 134a	R 404A/R507	R407C	in.	
PKV 12	5.2	3.8	4.4	4.8	1⅛	**034N1051**
PKV 15	8.3	6.1	7.0	7.7	1⅜	**034N1052**
PKV 20	13.5	10.1	11.4	12.6	1⅝	**034N1053**
PKVS 12	5.2	3.8	4.4	4.8	1⅛	**034N1080** 2)
PKVS 15	8.3	6.1	7.0	7.7	1⅜	**034N1081** 2)
PKVS 20	13.5	10.1	11.4	12.6	1⅝	**034N1082** 2)

1) Rated capacity is based on:
Evaporating temperature t_e = 40°F
Liquid temperature t_l = 100°F
Pressure drop across valve Δp = 2 psi
2) With 115 V coil

Note: Type PKVS is supplied with an EVR 3 NC solenoid valve (**032F1155**) fitted in the vent line. EVR 3 is supplied without coil and must be ordered seperately.

Capacity

R 22

Maximum regulator capacity Q_e 1)

Type	Pressure drop across regulator Δp psi	Capacity Q_e in tons at evaporating temperature t_e °F: – 20	– 15	– 10	0	5	10	15	20	30	40
PKV 12 PKVS 12	0.5	1.3	1.4	1.5	1.7	1.8	1.9	2.0	2.1	2.3	2.6
	1	1.9	2.0	2.1	2.4	2.5	2.6	2.9	3.0	3.3	3.6
	2	2.6	2.8	3.0	3.3	3.5	3.7	4.0	4.2	4.7	5.2
	5	3.9	4.2	4.5	5.2	5.5	5.8	6.2	6.5	7.3	8.0
	10	5.0	5.4	5.8	6.8	7.4	7.8	8.4	8.9	10.0	11.1
PKV 15 PKVS 15	0.5	2.1	2.3	2.4	2.8	2.9	3.1	3.2	3.4	3.7	4.2
	1	3.0	3.2	3.4	3.9	4.1	4.3	4.5	4.7	5.3	5.8
	2	4.2	4.4	4.7	5.4	5.6	6.1	6.4	6.7	7.5	8.3
	5	6.3	6.7	7.2	8.1	8.7	9.2	9.8	10.3	11.6	12.9
	10	8.0	8.7	9.5	10.9	11.7	12.5	13.3	14.2	16.0	17.7
PKV 20 PKVS 20	0.5	3.5	3.7	4.0	4.4	4.7	5.0	5.3	5.5	6.2	6.8
	1	4.8	5.2	5.5	6.3	6.6	7.0	7.4	7.8	8.7	9.3
	2	6.8	7.3	7.7	8.7	9.2	9.8	10.3	11.0	12.2	13.5
	5	10.1	10.9	11.8	13.4	14.3	15.2	16.1	16.9	18.9	21.0
	10	13.0	14.2	15.4	17.8	19.1	20.5	21.8	23.2	26.1	29.0

1) The capacities are based on:
Liquid temperature ahead of expansion valve t_l = 100°F

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 22	0.82	0.85	0.88	0.92	0.96	1.0	1.05	1.10

Metric conversions
1 psi = 0.07 bar
5/9 (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm

Capacity *(continued)*

R 134a

Maximum regulator capacity Q_e[1])

Type	Pressure drop across regulator Δp psi	Capacity Q_e in tons at evaporating temperature t_e °F – 20	– 15	– 10	0	5	10	15	20	30	40
PKV 12 PKVS 12	0.5	1.0	1.1	1.1	1.2	1.3	1.4	1.4	1.6	1.8	1.9
	1	1.3	1.4	1.6	1.8	1.9	1.9	2.2	2.3	2.5	2.8
	2	1.9	2.0	2.2	2.4	2.6	2.8	2.9	3.1	3.5	3.8
	5	2.6	2.9	3.6	3.6	3.8	4.2	4.4	4.6	5.3	5.9
	10	3.0	3.4	3.7	4.6	5.0	5.4	5.9	6.2	7.1	8.0
PKV 15 PKVS 15	0.5	1.6	1.7	1.8	2.0	2.2	2.3	2.4	2.5	2.8	3.1
	1	2.2	2.3	2.5	2.8	3.0	3.1	3.4	3.5	4.0	4.3
	2	3.0	3.2	3.4	3.8	4.1	4.4	4.7	4.9	5.5	6.1
	5	4.3	4.7	5.0	5.9	6.2	6.6	7.1	7.6	8.5	9.5
	10	4.9	5.5	6.1	7.4	8.0	8.6	9.4	10.0	11.4	12.4
PKV 20 PKVS 20	0.5	2.5	2.8	2.9	3.4	3.5	3.7	3.8	4.1	4.5	5.0
	1	3.5	3.8	4.1	4.6	4.9	5.2	5.5	5.8	6.5	7.2
	2	4.9	5.3	5.6	6.4	6.7	7.2	7.7	8.3	9.0	10.1
	5	7.0	7.6	8.3	9.5	10.2	10.9	11.6	12.4	13.9	15.5
	10	8.0	9.0	10.1	12.0	13.1	14.2	15.2	16.3	18.9	21.0

R 404A/R 507

Maximum regulator capacity Q_e[1])

Type	Pressure drop across regulator Δp psi	Capacity Q_e in tons at evaporating temperature t_e °F – 30	– 20	– 15	– 10	0	5	10	20	30	40
PKV 12 PKVS 12	0.5	0.9	1.1	1.1	1.2	1.3	1.4	1.5	1.8	2.0	2.2
	1	1.3	1.4	1.5	1.7	1.9	2.0	2.2	2.4	2.9	3.1
	2	1.7	2.1	2.2	2.3	2.6	2.9	3.0	3.5	4.0	4.4
	5	2.5	3.0	3.3	3.6	4.1	4.4	4.7	5.4	6.1	6.9
	10	3.3	4.0	4.4	4.7	5.5	6.0	6.5	7.4	8.3	9.5
PKV 15 PKVS 15	0.5	1.4	1.7	1.8	1.9	2.2	2.3	2.4	2.9	3.2	3.5
	1	1.9	2.3	2.5	2.6	3.1	3.2	3.4	4.0	4.4	4.9
	2	2.8	3.2	3.5	3.7	4.3	4.5	4.8	5.5	6.3	7.0
	5	4.2	4.9	5.3	5.6	6.6	7.1	7.6	8.6	9.8	10.9
	10	5.2	6.4	6.9	7.6	8.9	9.6	10.2	11.8	13.4	15.1
PKV 20 PKVS 20	0.5	2.3	2.7	3.0	3.1	3.5	3.7	4.0	4.6	5.2	5.7
	1	3.2	3.8	4.1	4.4	5.0	5.4	5.7	6.4	7.2	8.1
	2	4.5	5.3	5.6	6.1	6.9	7.6	8.0	9.1	10.2	11.4
	5	6.7	7.9	8.6	9.3	10.8	11.5	12.3	14.1	15.9	17.9
	10	8.5	10.4	11.5	12.4	14.5	15.7	16.8	19.2	21.8	24.8

[1]) The capacities are based on:
Liquid temperature ahead of expansion valve t_l = 100°F

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 134a	0.79	0.82	0.86	0.90	0.95	1.0	1.06	1.13
R 404A/R 507	0.71	0.75	0.80	0.85	0.92	1.0	1.10	1.24

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm

Capacity *(continued)*

R 407C

Maximum regulator capacity Q_e[1])

Type	Pressure drop across regulator	Capacity Q_e in tons at evaporating temperature t_e °F									
	Δp psi	– 20	– 15	– 10	0	5	10	15	20	30	40
PKV 12 PKVS 12	0.5	1.1	1.2	1.3	1.5	1.6	1.7	1.8	1.9	2.1	2.4
	1	1.6	1.7	1.8	2.1	2.2	2.3	2.6	2.7	3.0	3.3
	2	2.2	2.4	2.6	2.8	3.0	3.3	3.6	3.7	4.3	4.8
	5	3.2	3.5	3.8	4.5	4.8	5.1	5.5	5.8	6.6	7.4
	10	4.2	4.5	4.9	5.8	6.4	6.9	7.5	7.9	9.1	10.3
PKV 15 PKVS 15	0.5	1.7	1.9	2.0	2.4	2.5	2.7	2.8	3.0	3.4	3.9
	1	2.5	2.7	2.9	3.4	3.6	3.8	4.0	4.2	4.8	5.4
	2	3.5	3.7	4.0	4.6	4.9	5.4	5.7	6.0	6.8	7.7
	5	5.2	5.6	6.1	7.0	7.6	8.1	8.6	9.2	10.6	12.0
	10	6.6	7.3	8.1	9.4	10.2	11.0	11.8	12.6	14.6	16.5
PKV 20 PKVS 20	0.5	2.9	3.1	3.4	3.8	4.1	4.4	4.7	4.9	5.6	6.3
	1	4.0	4.4	4.7	5.4	5.7	6.2	6.6	6.9	7.9	8.6
	2	5.6	6.1	6.5	7.5	8.0	8.6	9.2	9.8	11.1	12.6
	5	8.4	9.2	10.0	11.5	12.4	13.4	14.3	15.0	17.2	19.5
	10	10.8	11.9	13.1	15.3	16.6	18.0	19.4	20.6	23.8	27.0

[1]) The capacities are based on:
Liquid temperature ahead of expansion valve t_l = 100°F

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 407C	0.78	0.81	0.85	0.89	0.94	1.0	1.07	1.15

Sizing
Example

For optimum performance, it is important to select a PKV/PKVS valve according to system conditions and application.
The selection is also dependant on the acceptable pressure drop across the valve.
The following data must be used when sizing a PKV/PKVS valve:

- Refrigerant - CFC, HCFC or HFC
- Evaporator capacity Q_e in tons
- Evaporating temperature (required temperature) t_e in °F
- Liquid temperature ahead of expansion valve t_l in °F
- Connection type flare or solder
- Connection size in inches

Valve selection
Example

When selecting the appropiate valve it may be necessary to convert the actual evaporator capacity using a correction factor. This is required when your system conditions are different than the table conditions.
The following example illustrates how this is done.

Refrigerant: R134a
Evaporator capacity: Q_e = 7.4 tons
Evaporating temperature: t_e = 40°F ~ 36 psig
Liquid temperature ahead of expansion valve t_l = 80°F
Connection size: $1^5/_8$ in.

Step 1

Determine the correction factor for liquid temperature t_l ahead of the expansion valve.

From the correction factors table (see below) a liquid temperature of 80°F, R134a corresponds to a factor of 0.90.

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 22	0.82	0.85	0.88	0.92	0.96	1.0	1.05	1.10
R 134a	0.79	0.82	0.86	0.90	0.95	1.0	1.06	1.13
R 404A/R 507	0.71	0.75	0.80	0.85	0.92	1.0	1.10	1.24
R 407C	0.78	0.81	0.85	0.89	0.94	1.0	1.07	1.15

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm

Sizing *(continued)*
Step 2

Corrected evaporator capacity is
Q_e = 7.4 x 0.90 = 6.66 tons

Step 3

Select the approprate capacity table and choose the column for evaporating temperature t_e = 40°F.
Note that the regulator capacity must be equal to or slightly more than the corrected evaporator capacity.

In this example PKV 20 or PKVS 20 will be suitable since the capacity (7.2 tons at a pressure drop across the regulator of 1 psi) and the connection size fullfill the conditions.

Step 4

PKV 20, **code no 034N1053**
PKVS 20, **code no 034N1082** (see Ordering on page10).

Function

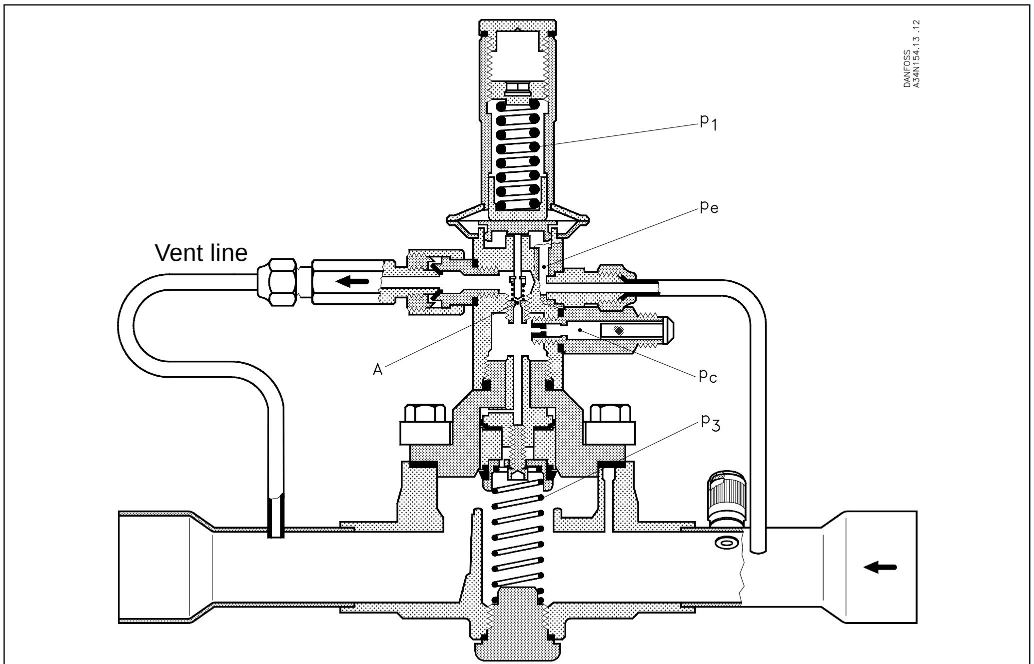


Fig. 1 PKV

PKV is a normally-open servo-operated pressure regulator designed to maintain a constant evaporating pressure.
PKV uses pressure p_c from the high pressure side of the system to close the valve and spring pressure p_3 to open the valve (when pressure is relieved through the vent line). Therefore, pressure drop is not necessary to maintain the valve`s open position.

The evaporating pressure is set by adjusting spring pressure p_1 which then balances evaporating pressure p_e.

For type PKVS, which is fitted with a solenoid valve in the vent line, the valve functions as described above, except when positive shut.off is required, as for a hot gas defrost. When a defrost is called for, the pilot solenoid is de-energized, closing the high side vent line. High side pressure builds rapidly in the chamber above the piston and closes the valve immediately.
A falling evaporating pressure will result in p_e becoming lower than the set pressure p_1.
The set spring will begin to close the pilot port where high pressure p_c will begin to build over the valve piston, becoming greater than p_3, and thus begin closing the valve.

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm

Function *(continued)*

Bleed flow
When the valve is completely open, there is flow through bleed orifice(A).
The table gives resulting capacity reduction in percent. Table values are given for a pressure drop of 1 psi across the valve.
If the pressure drop across the valve is greater than 1 psi, the percentage capacity reduction becomes smaller.

Percentage reduction of full capacity

Refrigerant	Valve type		
	PKV 12	PKV 15	PKV 20
R 22	0.5	0.3	0.2
R134a	0.4	0.3	0.2
R 404A/R 507	0.5	0.3	0.2
R 407C	0.5	0.3	0.2

As can be seen from the table, the capacity reduction is insignificant. When the valve is closed, bleed flow is zero.
When PKV regulates the evaporating pressure, i.e. when the valve is partly open, bleed flow will be at a point between zero and the values stated in the table.

Application

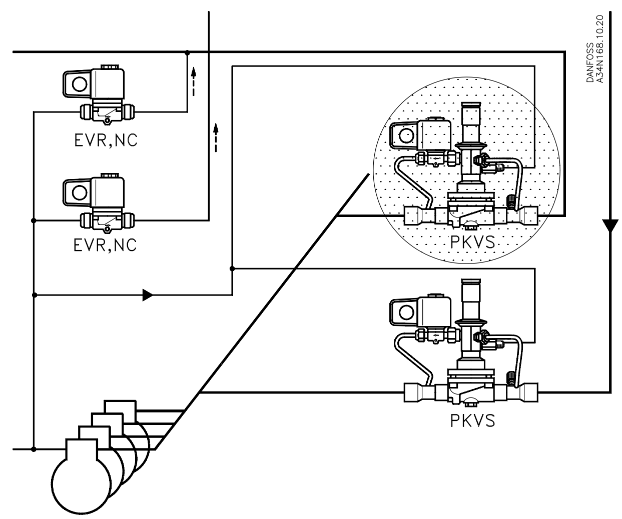


Fig. 2 Application with PKVS

PKV is fitted in the suction line of a system containing several evaporators and a common suction manifold. PKV maintains a set evaporating pressure for the circuit.

PKVS, which is fitted with a solenoid valve, is used for positive shut-off and hot gas defrost.

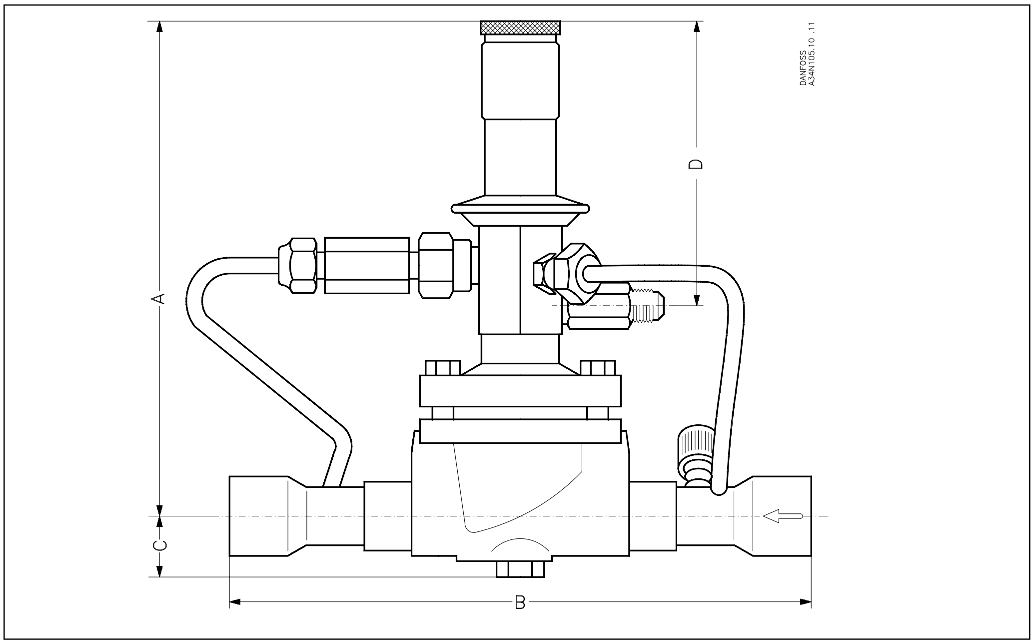
Fig. 2 shows a typical hot gas piping layout and the location of a PKVS.

Pilot pressure for the PKVS valves comes from the high pressure side. When defrost is required, the pilot valve must be closed, resulting in a pressure build up over the piston immediately closing the valve.

The EVR hot gas solenoid valve is then opened to allow hot gas to flow into the evaporator.
At the end of the defrost cycle, the hot gas solenoid is closed and the pilot valve on the PKVS must be opened to allow normal evaporator regulation.

Metric conversions
1 psi = 0.07 bar

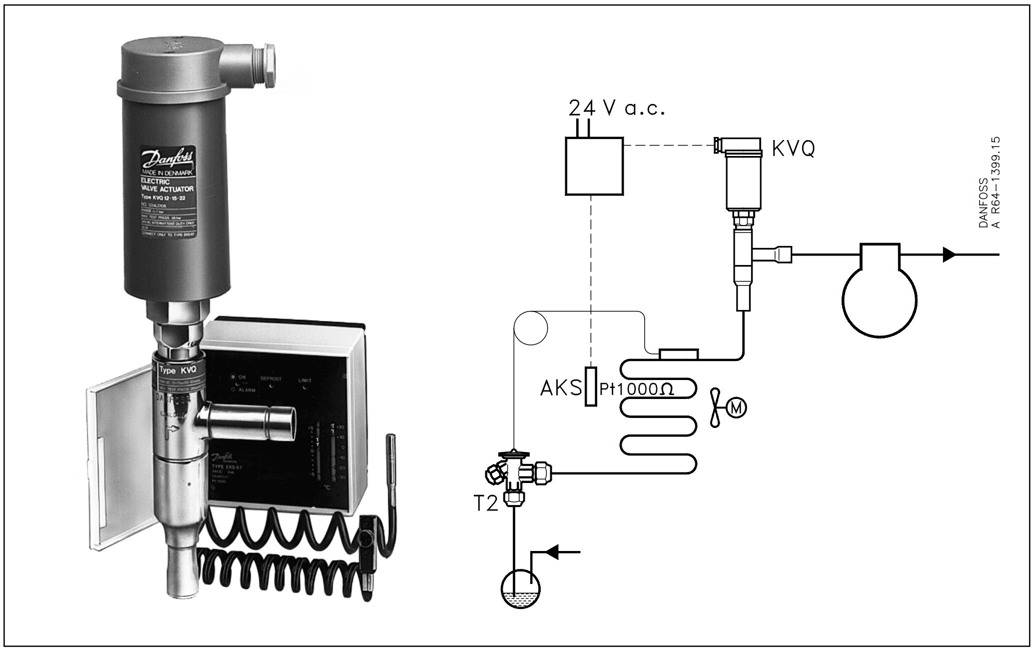
Dimensions and weights



Type	A in.	B in.	C in.	D in.	Weight [1]) lbs
PKV 12 (PKVS 12)	7.165	8.465	0.827	4.252	5.1
PKV 15 (PKVS 15)	7.480	11.220	1.260	4.252	7.7
PKV 20 (PKVS 20)	7.992	11.220	1.102	4.252	8.6

[1]) Without solenoid valve

Metric conversions
1 in. = 25.4 mm
1 lb = 0.454 kg



Contents

Introduction

Actuator and valve KVQ + controller EKS 67 + sensor AKS combine to form an electronic system that, by controlling evaporating pressure regulates the temperature of the medium in systems where precise temperature regulation is required.

The KVQ + EKS 67 regulates the temperature of the medium so that the required temperature is maintained to an accuracy of ± 1°F or less.

KVQ + EKS 67 is especially suited for use in display cases which require a high humidity and exact temperature control.

Features

Apart from its normal regulating function, the KVQ and EKS 67 electronic system contains a defrost function and an alarm function. It also has facilities for a series of supplementary functions:

- *Remote setting of reference temperature*
- *Temperature readout on external display*
- *Temperature diagnosis*
- *Evaporating pressure limiter*

Defrost, external alarm, and supplementary functions require the connection of extra equipment.

Approvals

UL listed, file SA7200

CSA certified, LR 92682

Technical data

Actuator and valve, KVQ

Regulating range	p_e = 0 to 100 psig		
Refrigerent temperature in regulating range	Refrigerant	p_e = 0 psig	p_e = 100 psig
	R 22	– 42°F	59°F
	R 134a	– 15°F	87°F
	R 404A	– 50°F	48°F
	R 407C	– 32°F	63°F
	R 507	– 52°F	46°F
Refrigerants	HFC, HCFC and CFC Other fluorinated refrigerants can be used at the stated temperatures and pressures		
Maximum ambient temperature	During operation: – 50 to 105°F During transport: – 60 to 150°F		
Maximum working pressure MWP	310 psig		
Maximum test pressure p'	400 psig		
Supply voltage	24 V pulsating a.c. from EKS 67 controller		
Consumption	30 VA / 24 V a.c.		
Enclosure	NEMA; IP 54 to IEC 529		
Cable entry	Pg 13.5		
During forced closing by hot-gas defrosting:			
Maximum closing pressure	250 psig		
Maximum hot gas temperature	250°F		

Controller EKS 67

Regulating range	– 30 to 77°F REF The unit regulates with an accuracy ≤ ± 1°F
Functions	1. *LIMIT (alarm limit):* 2 to 9°F ± 1°F on both sides of REF 2. *DELAY (alarm delay):* 15 to120 min. 3. *DEFROST (defrost stop):* 0 to 45°F
Regulating principle	PI, proportional, integral.
Regulation parameters	Proportional amplification: K_p = 2 to 6 Factory setting: K_p = 4 Integral time: T_n = 2 to 6 min. Factory setting: T_n = 4 min.
Ambient temperature Ambient temperature at transport	– 4°F to 104°F (for plastic case) – 4 °F to 113°F (for silumin case) – 4 °F to 122°F (for panel mounting) – 40°F to 140°F
Supply voltage	24 V a.c. +10% to –15%, 50/60 Hz
Consumption	2 VA at 24 V a.c.
Alarm	Alarm is indicated by ON/ALARM lamp being out Alarm output voltage falls to 0 V a.c.
Cable entry	Pg 9 (plastic case) Pg 13,5 (silumin case)
Enclosure	NEMA 2; IP 41 to IEC 529 (plastic case) NEMA 3; IP 54 to IEC 529 (silumin case)
Alarm output	Triac, 24 V a.c., maximum load 0.5 A
Defrost output	Triac, 24 V a.c., maximum load 0.5 A

Technical data and code nos.

Sensor type Pt 1000 ohm
Application range and enclosure

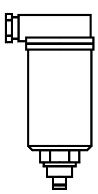
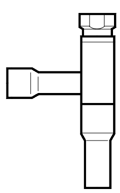
Sensor type	Application range	Enclosure	**Code no.**
Pt 1000 ohm surface sensor, type AKS 21A with 8 ft cable	– 95 to 320°F	NEMA 4; IP 67 to IEC 529	**084N2007**
Pt 1000 ohm media sensor, type AKS 21M with 8 ft cable	– 95 to 320°F	NEMA 4; IP 67 to IEC 529	**084N2003**
Pt 1000 ohm immersion sensor, type AKS 21W with terminal box	– 95 to 320°F	NEMA 3; IP 56 to IEC 529	**084N2016**
Pt 1000 ohm immersion sensor, type AKS 21W with pocket and 8 ft cable	– 95 to 320°F	NEMA 3; IP 56 to IEC 529	**084N2017**

Time constants

Sensor type	Time constant maximum sec.	Object of measurement
AKS 21A	14	Fixed on copper tube
AKS 21W	18	Water flow
AKS 21M	35	Air at velocity of 4 m / sec.
AKS 21M	6	Water flow

Cable cross section	0.2 mm^2

Ordering

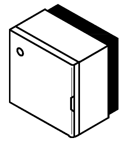
Valve / actuator type KVQ

Type	Rated capacity 1) tons				Connection	Valve	Actuator
						Code no.	**Code no.**
	R 22	R 134a	R 404A/R 507	R 407C	in.		
KVQ 15	3.0	2.3	2.7	2.9	$^{5}/_{8}$	**034L0117**	**034L0105**
KVQ 22	3.0	2.3	2.7	2.9	$^{7}/_{8}$	**034L0114**	**034L0105**
KVQ 28	7.2	5.5	6.4	6.8	$1^{1}/_{8}$	**034L0115**	**034L0106**
KVQ 35	7.2	5.5	6.4	6.8	$1^{3}/_{8}$	**034L0120**	**034L0106**

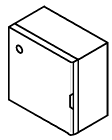
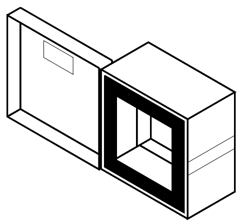
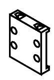
1) Rated capacity is based on:
evaporating temperature t_e = 40°F
condensing temperature t_c = 100°F
pressure drop across valve Δp = 3 psi

Ordering *(continued)*

Controller type EKS 67

Symbol	EKS 67 complete controller	**Code no.**
	Complete controller incl. base with triac module and mounting brackets	**084B1020**

Components for controller type EKS 67

Symbol	EKS 67 components	**Code no.**
	Controller insert	**084B1021**
	Multipurpose case (silium case) incl. base with triac module and mounting bracket	**084B1035**
		**084B3161**

Sensor type AKS, Pt 1000 ohm
Technical data, code nos., dimension and weights, see section "Sensors, type AKS" in this catalogue.

Capacity

R 22

Maximum regulator capacity Q_e[1])

Type	Pressure drop across regulator	Capacity Q_e in tons at evaporating temperature t_e °F										
	Δp psi	– 30	– 20	– 10	0	10	20	30	40	50	60	70
KVQ 15 KVQ 22	1	0,8	0,9	1,0	1,2	1,3	1,5	1,6	1,8	2,0	2,2	2,4
	3	1,3	1,5	1,7	2,0	2,2	2,5	2,8	3,0	3,4	3,7	4,0
	5	1,5	1,8	2,1	2,4	2,8	3,1	3,5	3,9	4,3	4,7	5,2
	7	1,6	2,0	2,4	2,8	3,2	3,6	4,0	4,5	5,0	5,5	6,0
	10	1,7	2,1	2,6	3,1	3,6	4,1	4,7	5,2	5,8	6,5	7,1
KVQ 28 KVQ 35	1	1,9	2,2	2,4	2,8	3,1	3,4	3,8	4,2	4,6	5,1	5,6
	3	3,0	3,5	4,0	4,6	5,2	5,8	6,5	7,2	7,9	8,7	9,5
	5	3,6	4,3	5,0	5,7	6,5	7,3	8,2	9,1	10,1	11,1	12,2
	7	3,9	4,7	5,6	6,5	7,5	8,5	9,5	10,6	11,8	13,0	14,3
	10	3,9	5,0	6,1	7,3	8,5	9,7	11,0	12,3	13,7	15,2	16,8

Capacity *(continued)*

R 134a

Maximum regulator capacity Q_e 1)

Type	Pressure drop across regulator	Capacity Q_e in tons at evaporating temperature t_e °F										
	Δp psi	– 30	– 20	– 10	0	10	20	30	40	50	60	70
KVQ 15	1					1,0	1,1	1,2	1,4	1,5	1,7	1,9
KVQ 22	3					1,6	1,8	2,0	2,3	2,6	2,9	3,3
	5					1,9	2,2	2,5	2,9	3,3	3,7	4,1
	7					2,1	2,5	2,9	3,3	3,8	4,3	4,8
	10					2,2	2,7	3,2	3,8	4,3	4,9	5,6
KVQ 28	1					2,2	2,6	2,9	3,2	3,6	4,1	4,5
KVQ 35	3					3,7	4,2	4,8	5,5	6,1	6,9	7,7
	5					4,4	5,2	6,0	6,8	7,7	8,7	9,7
	7					4,9	5,8	6,8	7,8	8,9	10,1	11,3
	10					5,2	6,4	7,6	8,9	10,2	11,6	13,1

R 404A/R 507

Maximum regulator capacity Q_e 1)

Type	Pressure drop across regulator	Capacity Q_e in tons at evaporating temperature t_e °F										
	Δp psi	– 30	– 20	– 10	0	10	20	30	40	50	60	70
KVQ 15	1	0,6	0,7	0,9	1,0	1,1	1,3	1,4	1,6	1,8	2,0	2,2
KVQ 22	3	1,0	1,2	1,4	1,6	1,9	2,1	2,4	2,7	3,0	3,4	3,7
	5	1,3	1,5	1,8	2,1	2,4	2,7	3,1	3,4	3,8	4,3	4,8
	7	1,4	1,7	2,0	2,4	2,7	3,1	3,5	4,0	4,5	5,0	5,6
	10	1,5	1,8	2,2	2,7	3,1	3,6	4,1	4,7	5,3	5,9	6,6
KVQ 28	1	1,5	1,7	2,0	2,3	2,6	3,0	3,3	3,7	4,1	4,6	5,1
KVQ 35	3	2,5	2,9	3,4	3,9	4,4	5,0	5,7	6,4	7,1	7,9	8,8
	5	3,0	3,5	4,2	4,8	5,6	6,3	7,2	8,1	9,1	10,1	11,2
	7	3,3	4,0	4,7	5,5	6,4	7,3	8,3	9,4	10,6	11,8	13,1
	10	3,4	4,3	5,3	6,3	7,3	8,5	9,7	11,0	12,4	13,9	15,5

R 407C

Maximum regulator capacity Q_e 1)

Type	Pressure drop across regulator	Capacity Q_e in tons at evaporating temperature t_e °F										
	Δp psi	– 30	– 20	– 10	0	10	20	30	40	50	60	70
KVQ 15	1	0,7	0,8	0,9	1,1	1,2	1,4	1,5	1,7	1,9	2,1	2,3
KVQ 22	3	1,1	1,3	1,5	1,7	2,0	2,3	2,6	2,9	3,2	3,6	4,0
	5	1,2	1,5	1,8	2,1	2,5	2,9	3,2	3,7	4,1	4,6	5,1
	7	1,3	1,6	2,0	2,4	2,8	3,3	3,7	4,2	4,8	5,3	5,9
	10	1,3	1,7	2,2	2,7	3,2	3,7	4,3	4,9	5,6	6,2	7,0
KVQ 28	1	1,6	1,9	2,2	2,5	2,8	3,2	3,6	4,0	4,5	5,0	5,5
KVQ 35	3	2,5	3,0	3,5	4,1	4,7	5,4	6,1	6,8	7,6	8,5	9,4
	5	2,9	3,6	4,3	5,1	5,9	6,7	7,6	8,6	9,7	10,8	12,0
	7	3,0	3,9	4,8	5,7	6,7	7,7	8,8	10,0	11,2	12,6	14,0
	10	3,0	4,0	5,1	6,3	7,5	8,8	10,1	11,6	13,1	14,7	16,4

Sizing
KVQ valve

For optimum performance, it is important to select a KVQ valve according to system conditions and application.
The selection is also dependant on the acceptable pressure drop across the valve.
The following data must be used when sizing a KVQ valve:

- Refrigerant - CFC, HCFC or HFC
- Evaporator capacity Q_e in tons
- Evaporating temperature (required temperature) t_e in °F
- Minimum evaporating temperature t_e in °F
- Liquid temperature ahead of expansion valve t_l in °F
- Connection type flare or solder
- Connection size in inches

Valve selection
Example

When selecting the appropriate valve, it may be necessary to convert the actual evaporator capacity using a correction factors.
This is required when your system conditions are different than the table conditions.
The following example illustrates how this is done.

Refrigerant: R 22
Evaporator capacity Q_e = 7.6 tons
Evaporating temperature t_e = 30°F
Liquid temperature ahead of expansion valve
t_l = 110°F
Connection size: 1 1/8 in.

Step 1

Determine the corrections factor for the liquid temperature t_l ahead of the expansion valve.

From the correction factor table (see below), a liquid temperature of 110 °F, R 22 corresponds to a factor of 1.05.

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 22	0.82	0.85	0.88	0.92	0.96	1.0	1.05	1.10
R 134a	0.79	0.82	0.86	0.90	0.95	1.0	1.06	1.13
R 404A/R 507	0.71	0.75	0.80	0.85	0.92	1.0	1.10	1.24
R 407C	0.78	0.81	0.85	0.89	0.94	1.0	1.07	1.15

Step 2

Corrected evaporator capacity is
1.05 x 7.6 = 8.0 tons.

Step 3

Now select the appropriate capacity table and choose the column for an evaporating temperature of te = 30°F.

Using the corrected evaporator capacity, select a valve that provides an equivalent or greater capacity at an acceptable pressure drop.

KVQ 28/35 delivers 8,2 tons at a 5 psi pressure drop across the valve.

Based on the required connection size of 1 1/8 in., the KVQ 28 is the proper selection for this example.

Step 4

KVQ 28, 1 1/8 in. solder connection,
code no 034L0115 and actuator,
code no 034L0106 (see Ordering on page20).

Selection of transformer

The choice of transformer depends on the total power consumption.

KVQ + EKS 67	DEFROST	ALARM	Total consumption VA
32 VA/ 24 V a.c.			32
32 VA/ 24 V a.c.	24 VA/ 24 V a.c.		56
32 VA/ 24 V a.c.	24 VA/ 24 V a.c.	12 VA/ 24 V a.c.	68

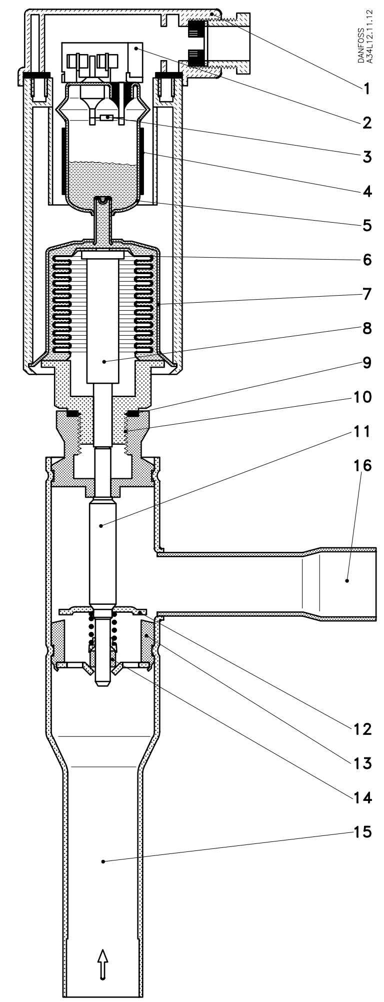
Total power consumption = sum of the individual power consumptions.
A class II transformer should be used according to CEE 15.

Example

Psc.	Connections	Consumption VA
2	KVQ + EKS 67 à 32 VA/24 V a.c.	64
2	ALARM à 12 VA/24 V a.c.	24
1	DEFROST à 24 VA/24 V a.c.	24
Total consumption		112

In this example the choice is a transformer sized to suit the power consumption:
115 VA / 24 V a.c., 50/60 Hz or greater

Design



1. Cover
2. Connection terminals
3. NTC resistor
4. Heating element
5. Pressure reservoir
6. Bellows
7. Bellows capsule
8. Pressure pin
9. Gasket
10. Threaded connection
11. Guide pin
12. Valve plate
13. Orifice
14. Damping device
15. Inlet
16. Outlet

KVQ

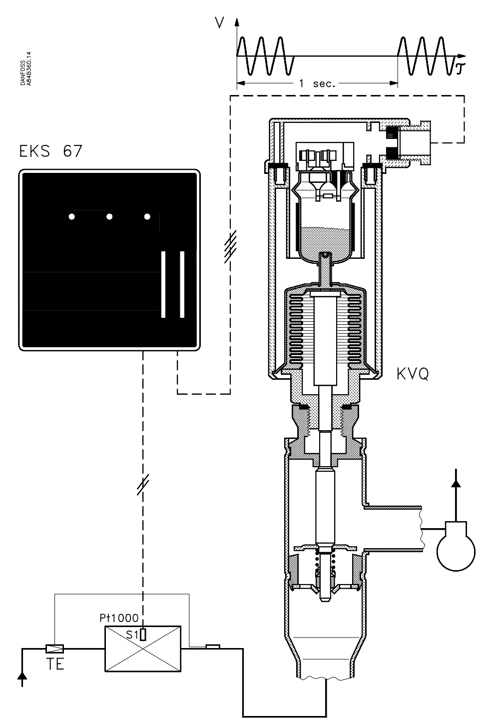
Function

On deviations between the required and registered temperature the EKS 67 instantaneously sends more or fewer pulses to the actuator to counteract the error. The pressure in the actuator changes slightly so that the valve moves in the opening or closing direction.
Changes in the suction pressure have no influence because the bellows area is the same as the orifice area.

In the event of current failure, the valve will be fully open.

EKS 67 defrost function
The EKS 67 controller has two defrost modes, hot-gas defrost and electric defrost, selectable by a switch. The system has built in defrost stop by temperature and time delay. The defrost must be started from an external timer (clock).
During defrosting, the temperature rises above the set alarm LIMIT. This cuts in the controller DELAY function, i.e. the timer that delays alarm release.
If the temperature setting for defrost function cut-off is reached before the delay time has elapsed, the controller cuts off defrosting. At the same time DELAY is set at zero.
If the selected ALARM delay is exceeded during a defrost period, defrosting is stopped by the ALARM delay and the alarm is activated (lamp goes out) until the temperature of the medium is again within the alarm limit.

Hot-gas defrosting
Defrosting with hot-gas is initiated by an external defrost timer and KVQ is forced closed by the EKS 67.
As soon as EKS 67 registers that KVQ is closed, the lamp "DEFROST" lights up and voltage is applied to the triac output.
The solenoid valve opens so that hot gas is able to flow into the evaporator. A defrost sensor, S2, is placed at the point on the evaporator where ice disappears last. When the temperature at sensor S2 reaches the temperature set on the EKS 67, defrosting is stopped. The solenoid valve closes and the lamp "DEFROST" goes out. After defrost, the KVQ valve opens slowly to avoid liquid hammer.

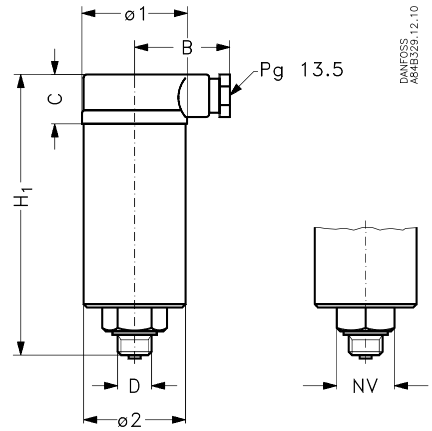


Regulation of KVQ with electronic controller EKS 67
The form of regulation is pulse cascades of a.c. supply voltage

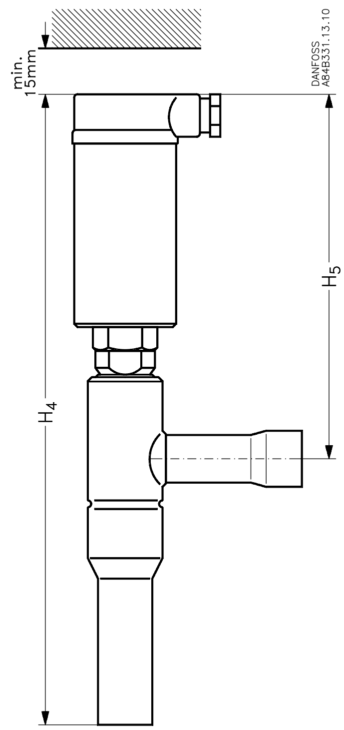
Electric defrosting
Electric defrosting is also started by a signal from an external defrost timer.
The lamp "DEFROST" lights up and voltage is applied to the triac output.
The solenoid valve ahead of the thermostatic expansion valve closes.
The heating element is cut in without the KVQ valve being previously closed.
When the temperature on the evaporator rises, the KVQ valve will be fully open.
Electric defrosting is cut off when defrost sensor S2 measures a temperature corresponding to the stop temperature set on the EKS 67. The solenoid valve ahead of the thermostatic expansion valve opens.
There are facilities for forced defrosting of the system.

Dimensions and weights

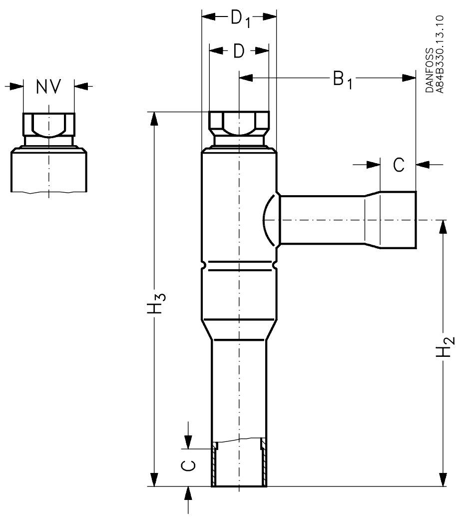
Valve/Actuator type KVQ



KVQ actuator



Complete KVQ



KVQ valve

Complete KVQ

Type	H_4 in.	H_5 in.	Weight lbs
KVQ 15-22	11.929	8.031	2.0
KVQ 28-35	14.409	8.307	2.9

KVQ actuator

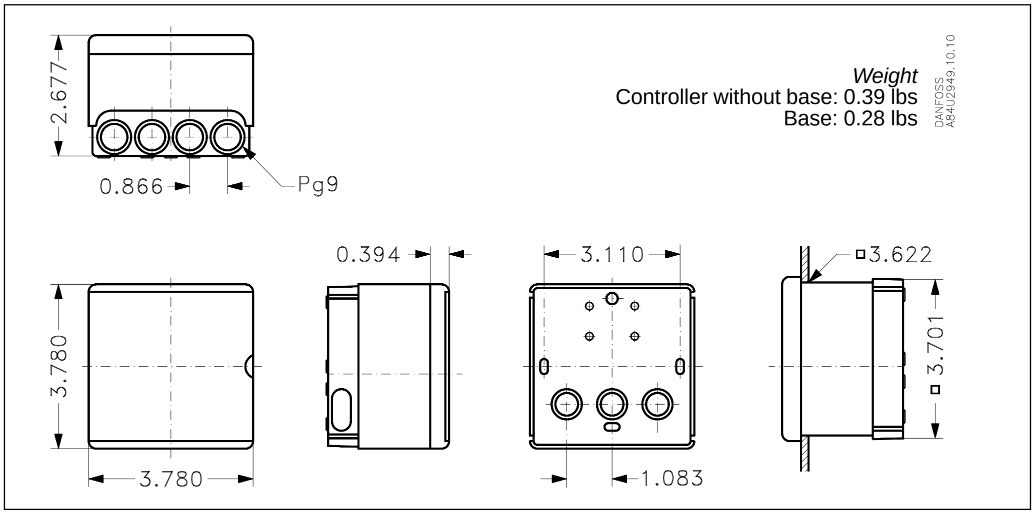
Type	H_1 in.	B in.	C in.	NV in.	D in.	dia. 1 in.	dia. 2 in.	Weight lbs
KVQ 15 - 22	6.398	2.126	1.063	1.260	M16 × 1.5	2.480	2.362	1.1
KVQ 28 - 35	6.398	2.126	1.063	1.260	M18 × 1.5	2.480	2.362	1.1

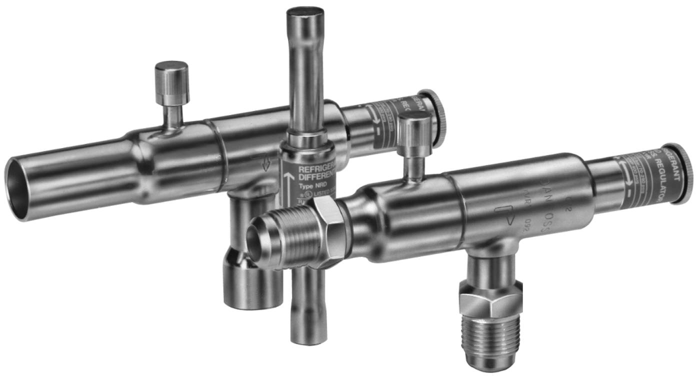
KVQ valve

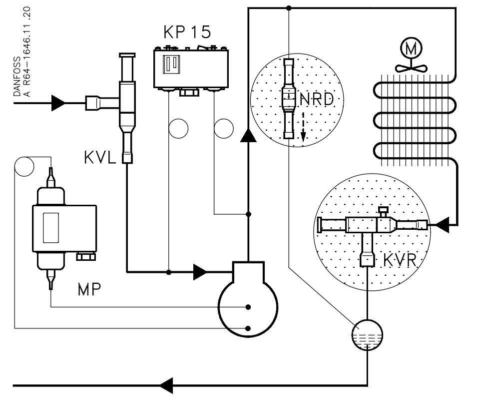
Type	Connection in.	H_2 in.	H_3 in.	B_1 in.	C in.	D in.	D_1 in.	NV in.	Weight lbs
KVQ 15	5/8	3.898	5.984	2.520	0.472	1.181	1.102	0.945	0.9
KVQ 22	7/8	3.898	5.984	2.520	0.472	1.181	1.102	0.945	0.9
KVQ 28	1 1/8	6.102	8.465	4.134	0.866	1.693	1.378	1.181	1.8
KVQ 35	1 3/8	6.102	8.465	4.134	0.985	1.693	1.378	1.181	1.8

Dimensions and weights
(continued)

Controller type EKS 67







Contents

Introduction

KVR condenser regulators can be mounted in either the gas or liquid side of the condenser in refrigeration and air conditioning systems. They are used to maintain a constant and sufficiently high condensing pressure with systems using air-cooled condensers.

They can also be used with valve types NRD or KVD to assure that adequate pressure is maintained on the receiver.

Features

- *Accurate, adjustable pressure regulation*
- *Wide capacity and operating range*
- *Pulsation damping design*
- *Stainless steel bellows*
- *Compact angle design for easy installation in any position*
- *"Hermetic" brazed construction*
- *¹/₄ in. Schrader valve for pressure testing*
- *Available with flare and ODF solder connections*
- *For use with CFC, HCFC and HFC refrigerants*
- *Can be used as a relief valve from high pressure to suction side*

Approvals

UL listed, file SA7200

CSA approved

Technical data

Refrigerants
CFC, HCFC, HFC

Regulation range
70 to 250 psig
Factory setting = 145 psig

Maximum working pressure
KVR: MWP = 400 psig
NRD: MWP = 400 psig

Maximum test pressure
KVR: p' = 450 psig
NRD: p' = 530 psig

Maximum temperature of medium
KVR: 212°F *)
NRD: 275°F

Minimum temperature of medium
– 40°F

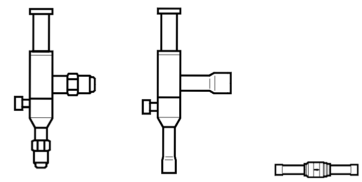
P band (full valve stroke)
KVR 12 to 22: 90 psi
KVR 28 to 35: 72.5 psi

Opening differential pressure for NRD
Fully open: Δp = 43 psi

*) If the Schrader valve cone is removed and the connector is sealed with cap and nut, the maximum temperature is 265°F.

Metric conversions
1 psi = 0.07 bar
$^5/_9\,(t_1°F - 32) = t_2°C$

Ordering



Type	Rated liquid capacity[1] (evaporator capacity) tons				Rated hot gas capacity[1] (evaporator capacity) tons				Flare connection[2]		Solder connection	
	R 22	R 134a	R 404A/R 507	R 407C	R 22	R 134a	R 404A/R 507	R 407C	in.	**Code no.**	in.	**Code no.**
KVR 12	12.7	11.8	8.2	13.8	4.13	3.03	3.27	4.50	1/2	**034L0091**	1/2	**034L0093**
KVR 15	12.7	11.8	8.2	13.8	4.13	3.03	3.27	4.50	5/8	**034L0092**	5/8	**034L0097**
KVR 22	12.7	11.8	8.2	13.8	4.13	3.03	3.27	4.50			7/8	**034L0094**
KVR 28	32.6	30.2	20.9	35.5	10.93	8.04	8.66	11.91			1 1/8	**034L0095**
KVR 35	32.6	30.2	20.9	35.5	10.93	8.04	8.66	11.91			1 3/8	**034L0100**
NRD											1/2	**020 -1132**

[1])Rated capacity is based on:
Evaporating temperature t_e = 40°F
Condensing temperature t_c = 110°F
Pressure drop across valve Δp = 3 psi for liquid capacity
Δp = 6 psi for hot gas capacity

[2]) KVR are delivered without flare nuts. Separate flare nuts can be supplied:
1/2 in. code no **011L1103**
5/8 in. code no **011L1167**

Note: The connection dimensions chosen must not be too small, as gas velocities in excess of 130 ft/s at the inlet of the regulator can result in flow noise.

Capacity

Maximum regulator capacity Q_e[1])

Type	Condensing temperature t_c °F	**Liquid capacity** in tons (evaporator capacity) Offset 45 psi, Pressure drop Δ psi					**Hot gas capacity** in tons (evaporator capacity) Offset 45 psi, Pressure drop Δp psi				
		1.5	3	6	10	25	1.5	3	6	10	25
						R 22					**R 22**
KVR 12 KVR 15 KVR 22	50	13.1	17.6	25.2	32.9	52.6	1.81	2.47	3.52	4.51	6.86
	70	11.9	16.0	23.0	30.0	48.0	1.92	2.62	3.75	4.83	7.44
	90	10.6	14.4	20.8	27.0	43.2	2.04	2.76	3.96	5.12	7.94
	110	9.2	12.7	18.4	23.9	38.2	2.13	2.89	4.13	5.36	8.34
	130	7.8	11.0	16.0	20.7	33.1	2.20	2.98	4.27	5.54	8.64
KVR 28 KVR 35	50	33.5	45.0	64.4	84.2	134.6	4.77	6.50	9.31	11.95	18.15
	70	30.4	41.1	58.9	76.8	122.8	5.11	6.93	9.92	12.79	19.66
	90	27.1	37.0	53.2	69.2	110.6	5.42	7.34	10.48	13.54	20.98
	110	23.6	32.6	47.2	61.3	97.8	5.67	7.65	10.93	14.16	22.06
	130	20.0	28.0	40.9	53.0	84.6	5.79	7.83	11.23	14.60	22.85

[1]) The capacities are based on:
Evaporating temperature t_e = 40°F
For other evaporating temperatures, see correction table.

Correction factors (evaporating temperature)

t_e °F	–40	–20	0	20	40	50
R 22	0.89	0.92	0.95	0.97	1.0	1.02

System capacity × correction factor = table capacity.

Metric conversions
1 psi = 0.07 bar
5/9 (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm

Capacity *(continued)*

Maximum regulator capacity Q_e[1])

Type	Condensing temperature t_c °F	Liquid capacity Q_e tons (evaporator capacity) Offset 45 psi, Pressure drop Δ psi: 1.5	3	6	10	25	Hot gas capacity Q_e tons (evaporator capacity) Offset 45 psi, Pressure drop Δp psi: 1.5	3	6	10	25
		R 134a					**R 134a**				
KVR 12	50	12.0	16.9	24.0	31.0	49.1	1.40	1.97	2.75	3.50	5.15
KVR 15	70	11.9	16.0	23.0	30.0	48.0	1.92	2.62	3.75	4.83	7.44
KVR 22	90	9.6	13.6	19.2	24.8	39.3	1.50	2.12	2.97	3.80	5.75
	110	8.4	11.8	16.7	21.6	34.2	1.53	2.15	3.03	3.87	5.92
	130	7.1	10.0	14.2	18.3	29.0	1.52	2.14	3.01	3.86	5.95
KVR 28	50	30.7	43.4	61.3	79.2	126.0	3.72	5.24	7.31	9.26	13.60
KVR 35	70	27.6	39.1	55.3	71.4	113.0	3.87	5.44	7.63	9.71	14.49
	90	24.5	34.7	49.1	63.4	100.0	3.99	5.62	7.89	10.07	15.22
	110	21.4	30.2	42.8	55.3	87.5	4.06	5.71	8.04	10.28	15.69
	130	18.1	25.6	36.3	46.9	74.2	4.03	5.68	8.00	10.25	15.77
		R 404A/R 507					**R 404A/R 507**				
KVR 12	50	9.2	12.4	17.6	23.0	37.0	1.63	2.09	2.99	3.84	5.87
KVR 15	70	8.1	10.9	15.7	20.4	32.7	1.60	2.17	3.10	4.00	6.17
KVR 22	90	7.0	9.6	13.8	17.9	28.7	1.65	2.25	3.21	4.15	6.45
	110	5.9	8.2	11.8	15.4	24.5	1.68	2.28	3.27	4.24	6.60
	130	4.8	6.8	10.0	13.0	20.6	1.69	2.31	3.34	4.34	6.78
KVR 28	50	23.6	31.7	45.2	59.0	94.5	4.06	5.52	7.89	10.15	15.48
KVR 35	70	20.8	27.9	40.1	52.2	83.6	4.24	5.74	8.20	10.58	16.32
	90	17.9	24.5	35.2	45.9	73.4	4.41	5.96	8.50	10.99	17.06
	110	15.1	20.9	30.3	39.3	62.7	4.88	6.06	8.66	11.22	17.49
	130	12.3	17.4	25.7	33.1	52.7	4.49	6.12	8.82	11.45	17.92
		R 407C					**R 407C**				
KVR 12	50	4.2	19.0	27.2	35.5	56.8	1.96	2.67	3.80	4.87	7.41
KVR 15	70	12.9	17.3	24.8	32.4	51.8	2.07	2.83	4.05	5.22	8.04
KVR 22	90	11.5	15.6	22.5	29.2	46.7	2.20	2.98	4.28	5.53	8.58
	110	10.0	13.8	20.1	26.1	41.6	2.32	3.15	4.50	5.84	9.09
	130	8.6	12.1	17.6	22.8	36.4	2.42	3.28	4.70	6.09	9.50
KVR 28	50	36.2	48.6	69.6	90.9	145.4	5.15	7.02	10.06	12.91	19.60
KVR 35	70	32.8	44.4	63.6	82.9	132.6	5.52	7.48	10.71	13.81	21.23
	90	29.3	40.0	57.5	74.7	119.5	5.85	7.93	11.32	16.62	22.66
	110	25.7	35.5	51.5	66.8	106.6	6.18	8.34	11.91	15.43	24.05
	130	22.0	30.8	45.0	58.3	93.1	6.37	8.61	12.35	16.06	25.14

[1]) The capacities are based on:
Evaporating temperature t_e = 40°F
For other evaporating temperatures, see correction table.

Correction factors (evaporating temperature)

t_e °F	–40	–20	0	20	40	50
R 134a	0.82	0.86	0.91	0.96	1.0	1.04
R 404A	0.76	0.82	0.88	0.94	1.0	1.05
R 407C	0.83	0.87	0.92	0.96	1.0	1.04
R 507	0.74	0.81	0.88	0.94	1.0	1.06

System capacity × correction factor = table capacity.

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Sizing

For optimum performance, it is important to select a KVR valve according to system conditions and application.
The following data must be used when sizing a KVR valve:

- Refrigerant: CFC, HCFC or HFC
- Evaporating capacity Q_e in tons
- Evaporating temperature t_e in °F
- Condensing temperature t_c in °F
- Connection type flare or solder
- Connection size in inches

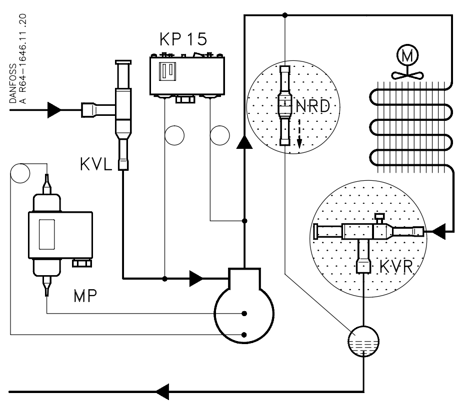
Valve selection

Example

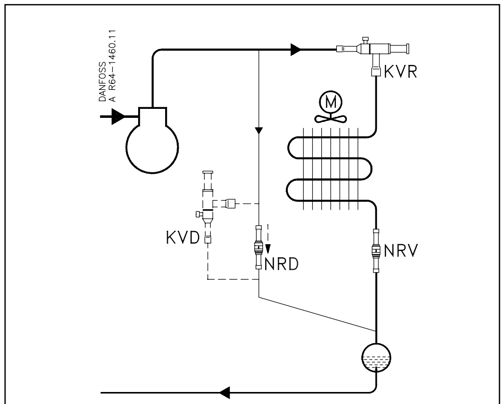
When selecting the appropiate valve it may be necessary to convert the actual evaporator capacity using a correction factors. This is required when your system conditions are different than the table conditions.
The selection is also dependant on the acceptable pressure drop across the valve.
The following example illustrates how this is done.

KVR in a liquid capacity application
Refrigerant: R 22
Evaporating capacity Q_e = 28.7 tons
Evaporating temperature t_e = – 40°F ~ 21 psig
Condensing temperature t_c = 90°F ~ 170 psig
Connection type: Solder
Connection size: 5/8 in.

Application example



Capacity application



Hot gas capacity application

Step 1

Determine the correction factor for evaporating temperature t_e.
From the correction factors table an evaporating temperature of – 40°F, R 22 corresponds to a factor of 0.89.

Correction factors (evaporating temperature)

t_e °F	– 40	– 20	0	20	40	50
R 22	0.89	0.92	0.95	0.97	1.0	1.02
R 134a	0.82	0.86	0.91	0.96	1.0	1.04
R 404A/ R 507	0.76	0.82	0.88	0.94	1.0	1.05
R 407C	0.83	0.87	0.92	0.96	1.0	1.04

Step 2

Corrected evaporator capacity is
Q_e = 28.7 x 0.89 = 25.5 tons

Step 3

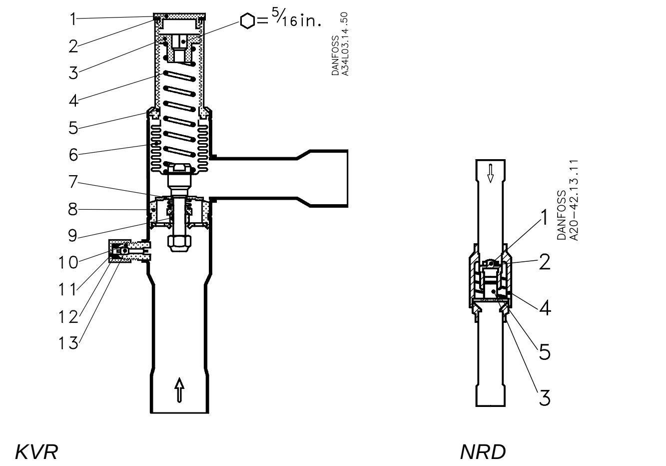
Now select the appropriate capacity table and choose the line for a condensing temperature t_c = 90°F.
Using the corrected evaporator capacity, select a valve that provides an equivalent or greater capacity at an acceptable pressure drop.

KVR 12/15/22 delivers 27.0 tons at a 10 psi pressure drop across the valve.
Based on the required connection size of 5/8 in. ODF, the KVR 15 is the proper selection for this example.

Step 4

KVR 15, 5/8 in. solder connection:
code no. 034L0097 (see Ordering on page 28)

Design and Function



KVR
1. Seal cap
2. Gasket
3. Setting screw
4. Main spring
5. Valve body
6. Equalizing bellows
7. Valve plate
8. Valve seat
9. Damping device
10. Manometer connection
11. Cap
12. Gasket
13. Insert

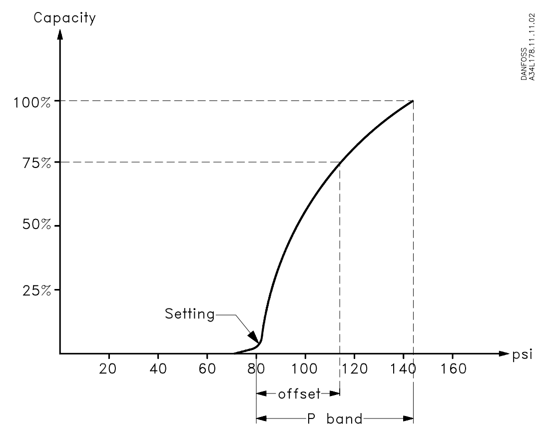
NRD
1. Piston
2. Valve plate
3. Piston guide
4. Valve body
5. Spring

Regulator type KVR opens on a rise in pressure on the inlet side, i.e. when the pressure in the condenser reaches the set value.
KVR regulates on the inlet pressure only. Pressure variations on the outlet side of the regulator do not affect the degree of opening, as the valve is equipped with equalization bellows (6). The bellows has an effective area corresponding to that of the valve seat neutralizing any affect to the setting.

The regulator is also equipped with a damping device (9) providing protection against pulsations which can normally arise in a refrigeration system. The damping device helps to ensure long life for the regulator without impairing regulation accuracy.

Differential valve type NRD begins to open when the pressure drop across the valve is 20 psig. The valve is fully open when the pressure drop reaches 43 psig.

P-band and Offset



Proportional band
The proportional band or P-band is defined as the amount of pressure required to move the valve plate from closed to full open position.

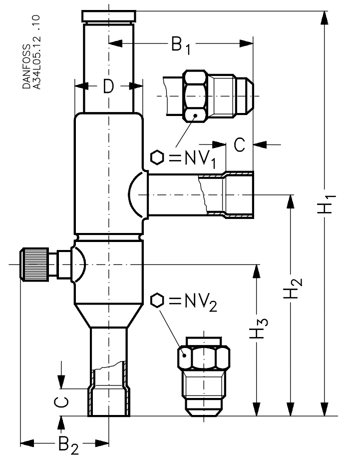
Example: If the valve is set to open at 120 psig and the valve p-band is 90 psi, the valve will give maximum capacity when the inlet pressure reaches 210 psig.

Offset
The offset is defined as the permissible pressure variation in condenser pressure (temperature). It is calculated as the difference between the required working pressure and the minimum allowable pressure.
The offset is always a part of the P-band.

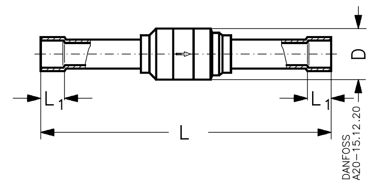
Example with R22:
A working temperature of 110°F ~ 230 psig is required, and the temperature must not drop below 100°F ~ 200 psig.
The offset will then be 30 psi.

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C

Dimensions and weights



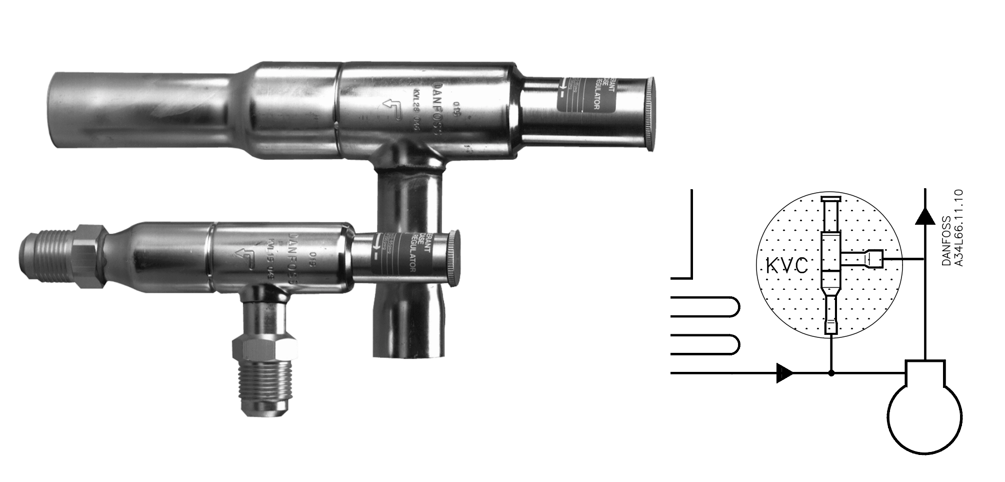
KVR



NRD

Type	Connection in		NV_1 in.	NV_2 in.	H_1 in.	H_2 in.	H_3 in.	L in.	L_1 in.	B_1 in.	B_2 in.	C in.	dia.D in.	Weight lbs.
	Flare	Solder ODF												
KVR 12	1/2	1/2	0.748	0.945	7.045	3.898	2.598			2.520	1.614	0.394	1.181	0.88
KVR 15	5/8	5/8	0.945	0.945	7.045	3.898	2.598			2.520	1.614	0.472	1.181	0.88
KVR 22		7/8			7.045	3.898	2.598			2.520	1.614	0.669	1.181	0.88
KVR 28		1 1/8			10.197	5.945	4.055			4.134	1.890	0.787	1.693	2.20
KVR 35		1 3/8			10.197	5.945	4.055			4.134	1.890	0.984	1.693	2.20
NRD		1/2						5.157	0.394				0.866	0.22

Metric conversions
1 in. = 25.4 mm
1 lb = 0.454 kg



Contents

Introduction

KVC capacity regulators are used to adapt compressor capacity to actual evaporator load by supplying a replacement capacity in form of hot/cool gas.

It is installed in a bypass line between the high and low pressure sides of the refrigeration system and is designed for direct gas injection into the suction line

Features

- *Accurate, adjustable pressure regulation*
- *Wide capacity and operating range*
- *Pulsation, damping design*
- *Stainless steel bellows*
- *Compact angle design for easy installation*
- *"Hermetic" brazed construction*
- *Available with flare and ODF solder connections*
- *For CFC, HCFC and HFC refrigerants*

Approvals

UL listed, file SA7200

CSA approved

Technical data

Refrigerants
CFC, HCFC, HFC

Regulation range
3 to 85 psig
Factory setting = 29 psig

Maximum working pressure
MWP = 400 psig

Maximum test pressure
p' = 450 psig

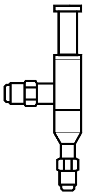
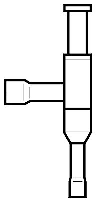
Maximum temperature of medium
300°F

Minimum temperature of medium
– 40°F

Maximum P-band
29 psi

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Ordering

Type	Rated capacity[1]) tons				Flare connection[2])		Solder connection	
	R 22	R 134a	R 404A/R 507	R 407C	in.	**Code no.**	in. ODF	**Code no.**
KVC 12	2.14	1.36	2.02	2.31	$^{1}/_{2}$	**034L0141**	$^{1}/_{2}$	**034L0143**
KVC 15	4.17	2.65	3.93	4.50	$^{5}/_{8}$	**034L0142**	$^{5}/_{8}$	**034L0147**
KVC 22	5.35	3.41	5.04	5.78			$^{7}/_{8}$	**034L0144**

[1]) Rated capacity is based on:
Suction gas temperature t_s = 10°F
Liquid temperature t_l = 100°F
Offset Δp = 10 psi

[2]) KVC are delivered without flare nuts. Separate flare nuts can be supplied:
1/2 in. code no **011L1103**
5/8 in. code no **011L1167**

Note: The connection dimensions chosen must not be too small, as gas velocities in excess of 130 ft/s at the inlet of the regulator can result in flow noise.

If the temperature in the discharge gas line is too high according to the compressor specifications, it is recommanded to install a liquid injection valve in a bypass from the liquid line to the suction line.

Replacement capacity

Maximum regulator capacity Q_e[1])

R 22

Type	Offset Δp psi	Regulator capacity Q tons Suction gas temperature t_s after pressure/temperature reduction °F: – 50	– 40	– 25	– 10	10	30	50
KVC 12	1.5		0.68	0.70	0.71	0.73	0.75	0.77
	2.0		0.93	0.95	0.97	1.00	1.03	1.05
	3.0		1.33	1.36	1.39	1.43	1.47	1.51
	5.0		1.75	1.79	1.83	1.88	1.93	1.98
	7.5		1.93	1.97	2.01	2.07	2.12	2.18
	10.0		2.00	2.04	2.08	2.14	2.20	2.26
	15.0		2.19	2.24	2.28	2.35	2.41	2.48
	20.0		2.62	2.67	2.72	2.80	2.87	2.94
KVC 15	1.5		1.01	1.03	1.06	1.09	1.12	1.15
	2.0		1.20	1.23	1.25	1.29	1.32	1.35
	3.0		1.73	1.77	1.80	1.85	1.90	1.95
	5.0		2.64	2.69	2.75	2.83	2.90	2.98
	7.5		3.39	3.46	3.54	3.63	3.73	3.83
	10.0		3.90	3.98	4.06	4.17	4.28	4.39
	15.0		4.76	4.66	4.75	4.88	5.01	5.14
	20.0		5.05	5.16	5.27	5.42	5.57	5.72
KVC 22	1.5		1.09	1.12	1.14	1.17	1.21	1.24
	2.0		1.38	1.41	1.44	1.48	1.52	1.56
	3.0		1.89	1.93	1.97	2.02	2.07	2.12
	5.0		2.88	2.94	3.00	3.08	3.16	3.24
	7.5		4.02	4.11	4.19	4.31	4.43	4.54
	10.0		4.98	5.09	5.20	5.35	5.50	5.64
	15.0		6.35	6.49	6.63	6.82	7.01	7.20
	20.0		7.10	7.25	7.40	7.60	7.79	7.99

[1]) The capacities are based on:
Liquid temperature ahead of the expansion valve t_l = 100°F

Correction factors for liquid temperature t_l
When liquid temperature t_l ahead of the evaporator is other than 100°F, adjust the table capacities by multiplying them by the appropriate correction factor found in the following table.

t_l °F	60	70	80	90	100	110	120
R 22	0.60	0.71	0.80	0.90	1.0	1.11	1.22

System capacity x correction factor = table capacity

Metric conversions
1 psi = 0.07 bar
$^{5}/_{9}$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm

Replacement capacity *(continued)*

Maximum regulator capacity Q_e[1])

Type	Offset Δp psi	– 50	– 40	– 25	– 10	10	30	50
		Regulator capacity Q tons, Suction gas temperature t_s after pressure/temperature reduction °F						
R 134a								
KVC 12	1.5			0.41	0.43	0.46	0.48	0.50
	2.0			0.58	0.60	0.62	0.66	0.70
	3.0			0.83	0.86	0.91	0.95	1.00
	5.0			1.09	1.14	1.20	1.25	1.31
	7.5			1.20	1.25	1.31	1.37	1.44
	10.0			1.25	1.30	1.36	1.42	1.49
	15.0			1.36	1.42	1.49	1.56	1.63
	20.0			1.62	1.69	1.78	1.86	1.94
KVC15	1.5			0.62	0.65	0.68	0.72	0.76
	2.0			0.74	0.78	0.82	0.86	0.90
	3.0			1.08	1.13	1.18	1.24	1.28
	5.0			1.64	1.72	1.79	1.87	1.96
	7.5			2.12	2.21	2.30	2.41	2.51
	10.0			2.45	2.54	2.65	2.77	2.88
	15.0			2.87	2.96	3.11	3.25	3.40
	20.0			3.13	3.26	3.44	3.61	3.79
KVC 22	1.5			0.67	0.70	0.73	0.78	0.82
	2.0			0.86	0.90	0.94	0.97	1.02
	3.0			1.18	1.22	1.28	1.33	1.39
	5.0			1.80	1.86	1.96	2.04	2.12
	7.5			2.52	2.62	2.74	2.87	2.99
	10.0			3.13	3.25	3.41	3.55	3.71
	15.0			4.00	4.15	4.34	4.54	4.74
	20.0			4.43	4.61	4.82	5.05	5.28
R 404A/R 507								
KVC 12	1.5	0.57	0.58	0.62	0.64	0.67	0.70	0.74
	2.0	0.79	0.81	0.85	0.88	0.92	0.97	1.01
	3.0	1.16	1.19	1.23	1.28	1.34	1.40	1.46
	5.0	1.54	1.58	1.64	1.69	1.77	1.85	1.93
	7.5	1.68	1.73	1.79	1.86	1.96	2.05	2.13
	10.0	1.74	1.78	1.85	1.93	2.02	2.11	2.21
	15.0	1.89	1.94	2.01	2.10	2.20	2.31	2.41
	20.0	2.27	2.33	2.42	2.51	2.62	2.74	2.85
KVC 15	1.5	0.86	0.89	0.92	0.96	1.01	1.06	1.10
	2.0	1.05	1.07	1.11	1.16	1.21	1.27	1.32
	3.0	1.51	1.55	1.61	1.66	1.74	1.82	1.90
	5.0	2.29	2.34	2.44	2.53	2.65	2.77	2.89
	7.5	2.94	3.01	3.14	3.26	3.42	3.58	3.74
	10.0	3.38	3.47	3.61	3.75	3.93	4.11	4.30
	15.0	3.95	4.06	4.22	4.39	4.61	4.82	5.04
	20.0	4.36	4.48	4.66	4.85	5.09	5.34	5.58
KVC 22	1.5	0.92	0.96	0.99	1.02	1.08	1.12	1.18
	2.0	1.19	1.22	1.27	1.31	1.38	1.44	1.51
	3.0	1.71	1.75	1.83	1.89	1.98	2.08	2.17
	5.0	2.63	2.71	2.81	2.92	3.06	3.20	3.34
	7.5	3.58	3.67	3.82	3.96	4.17	4.35	4.54
	10.0	4.33	4.46	4.63	4.81	5.04	5.28	5.51
	15.0	5.49	5.64	5.86	6.08	6.39	6.69	6.99
	20.0	6.31	6.49	6.74	7.01	7.35	7.70	8.04

[1]) The capacities are based on: Liquid temperature ahead of the expansion valve t_l =100°F

Correction factors for liquid temperature t_l
When liquid temperature t_l ahead of the evaporator is other than 100°F, adjust the table capacities by multiplying them by the appropriate correction factor found in the following table.

t_l °F	60	70	80	90	100	110	120
R 134a	0.60	0.70	0.80	0.90	1.0	1.10	1.21
R 404A/R 507	0.69	0.79	0.87	0.94	1.0	1.05	1.09

System capacity x correction factor = table capacity

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Replacement capacity
(continued)

R 407C

Type	Offset Δp psi	Regulator capacity Q tons, suction gas temperature t_s after pressure/temperature reduction °F: – 50	– 40	– 25	– 10	10	30	50
KVC 12	1.5		0.73	0.76	0.77	0.79	0.81	0.83
	2.0		1.00	1.03	1.05	1.08	1.11	1.13
	3.0		1.44	1.47	1.50	1.54	1.59	1.63
	5.0		1.89	1.93	1.98	2.03	2.08	2.14
	7.5		2.08	2.13	2.17	2.24	2.29	2.35
	10.0		2.16	2.20	2.25	2.31	2.38	2.44
	15.0		2.37	2.42	2.46	2.54	2.60	2.68
	20.0		2.83	2.88	2.94	3.02	3.10	3.18
KVC15	1.5		1.09	1.11	1.14	1.18	1.21	1.24
	2.0		1.30	1.33	1.35	1.39	1.43	1.46
	3.0		1.87	1.91	1.94	2.00	2.05	2.11
	5.0		2.85	2.91	2.97	3.06	3.13	3.22
	7.5		3.66	3.74	3.82	3.92	4.03	4.14
	10.0		4.21	4.30	4.38	4.50	4.62	4.74
	15.0		4.92	5.03	5.13	5.27	5.41	5.55
	20.0		5.45	5.57	5.69	5.85	6.02	6.18
KVC 22	1.5		1.18	1.21	1.23	1.26	1.31	1.34
	2.0		1.49	1.52	1.56	1.60	1.64	1.68
	3.0		2.04	2.08	2.13	2.18	2.24	2.29
	5.0		3.11	3.18	3.24	3.33	3.41	3.50
	7.5		4.34	4.44	4.53	4.65	4.78	4.90
	10.0		5.38	5.50	5.62	5.78	5.94	6.09
	15.0		6.86	7.01	7.16	7.37	7.57	7.78
	20.0		7.67	7.83	7.99	8.21	8.41	8.63

[1]) The capacities are based on: Liquid temperature ahead of the expansion valve t_l = 100°F

Correction factors for liquid temperature t_l
When liquid temperature t_l ahead of the evaporator is other than 100°F, adjust the table capacities by multiplying them by the appropriate correction factor found in the following table.

t_l °F	60	70	80	90	100	110	120
R 407C	0.66	0.74	0.82	0.91	1.0	1.09	1.17

Sizing

For optimum performance, it is important to select a KVC valve according to system conditions and application.
The following data must be used when sizing a KVC valve:

- Refrigerant: CFC, HCFC or HFC
- Minimum suction temperature t_s in °F/psig
- Compressor capacity in tons
- Evaporating load in tons
- Liquid temperature ahead of expansion valve t_l in °F
- Connection type flare or solder
- Connection size in inches

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Valve selection
Example

Note: When selecting the appropriate valve, it may be necessary to convert the actual capacity using a correction factor for liquid temperature. This is due to differences between the table rated conditions and the design conditions. The following example illustrates how this is done.

Conditions:
Refrigerant type: R134a
Minimum suction temperature t_s: 10°F ~ 12 psi.
Compressor capacity at 10°F: 4.4 tons
Evaporating load at 10°F: 2.85 tons
Liquid temperature ahead of expansion valve t_l: 80°F
Connection type: solder
Connection size: 5/8 in.

Step 1

Determine the correction factor for the liquid temperature ahead of the expansion valve t_l.

From the correction factors table (see below) a liquid temperature of 80°F, R 134a corresponds to a factor of 0.90.

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 22	0.82	0.85	0.88	0.92	0.96	1.0	1.05	1.10
R 134a	0.79	0.82	0.86	0.90	0.95	1.0	1.06	1.13
R 404A/R 507	0.71	0.75	0.80	0.85	0.92	1.0	1.10	1.24
R 407C	0.78	0.81	0.85	0.89	0.94	1.0	1.07	1.15

Step 2

The required replacement capacity is defined as the (compressor capacity – the evaporator load) divided by the correction factor =
4.4 – 2.85 / 0.90 = 1.72 tons

Step 3

Now select the appropriate capacity table and choose the column for minimum suction temperature t_s = – 10°F.
Using the corrected replacement capacity, select a valve that provides an equivalent or greater capacity than required.

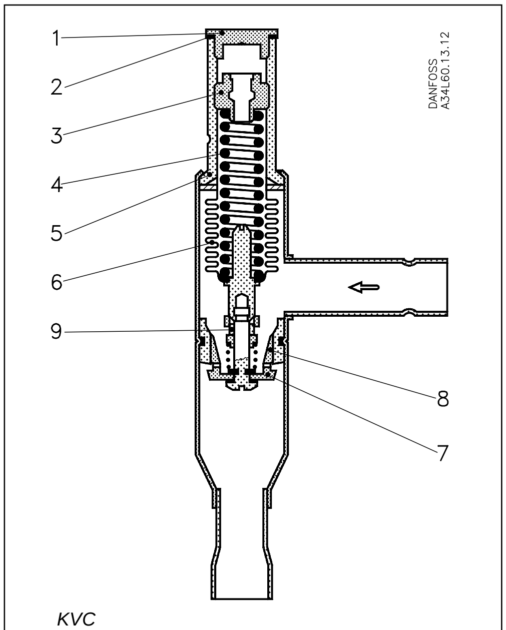
KVC 15 delivers 1.79 tons at an offset of 5 psi. Based on the required connection size of 5/8 in. ODF, the KVC 15 is the proper selection for this example.

Step 4

KVC 15, 5/8 in. ODF solder connection:
Code no 034L0147 (see Ordering page 34)

Metric conversions
1 psi = 0.07 bar
$5/9\ (t_1°F – 32) = t_2°C$
1 ton = 3.5 kW

Design and Function



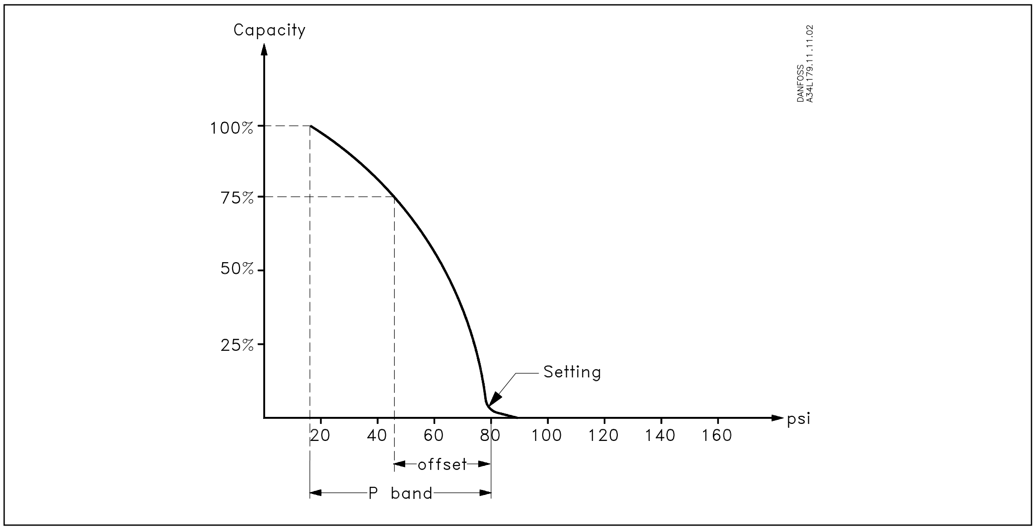
KVC

1. Protective cap
2. Gasket
3. Setting screw
4. Main spring
5. Valve body
6. Equalization bellows
7. Valve plate
8. Valve seat
9. Damping device

Capacity regulator type KVC opens on a fall in pressure on the outlet side, i.e. when the pressure in the evaporator reaches the set value.

Type KVC regulates on outlet pressure (suction pressure) only. Pressure variations on the inlet side of the regulator do not affect the degree of opening as the valve is equipped with equalization bellows (6).
The bellows has an effective area corresponding to that of the valve seat neutralizing any affect to the setting.
The regulator is also equipped with a damping device (9) providing protection against pulsations which can normally arise in a refrigeration system. The damping device helps to ensure long life for the regulator without impairing regulation accuracy.

P-band and Offset

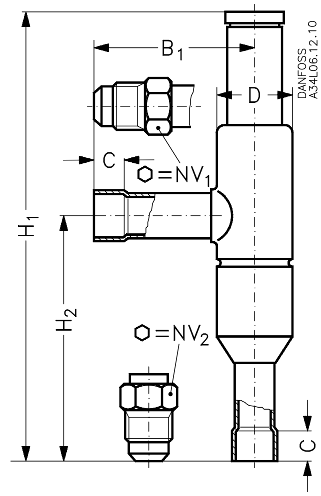


Proportional band
The proportional band or P-band is defined as the amount of pressure required to move the valve plate from closed to full open position.
If the setting is 58 psig and the p-band is 22 psi, the pressure at which the valve gives maximum capacity will be 36 psig.

Offset
The offset is defined as the permissible pressure variation in suction line pressure (temperature). It is calculated as the difference between the required working pressure and the minimum allowable pressure.
The offset is always a part of the P-band.

Example with R 404A:
A suction temperature ahead of the compressor of 25°F ~ 61 psig is required, and the temperature must not drop below
14°F ~ 48 psig.
The offset will then be 13 psi.

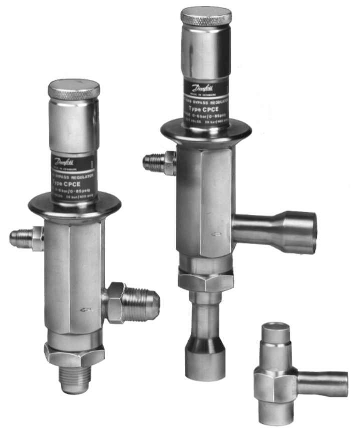
Dimensions and weights

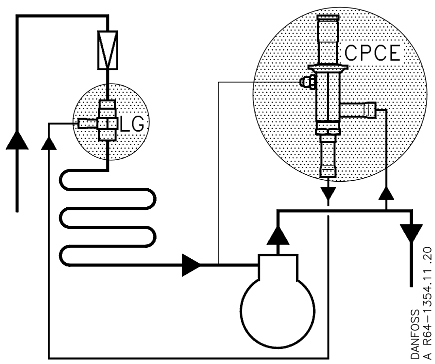


KVC

Type	Connection		NV1	NV2	H1	H2	B1	C	dia D	Weight
	Flare in.	Solder ODF in.	in.	in.	in.	in.	in.	in.	in.	lbs.
KVC 12	1/2	1/2	3/4	15/16	7.047	3.898	2.520	0.394	1.181	0.88
KVC 15	5/8	5/8	15/16	15/16	7.047	3.898	2.520	0.472	1.181	0.88
KVC 22		7/8			7.047	3.898	2.520	0.669	1.181	0.88

Metric conversions
1 in. = 25.4 mm
1 lb = 0.454 kg





Contents

Introduction

CPCE capacity regulator are used to adapt compressor capacity to actual evaporator load. It is installed in a bypass line between the high and low pressure sides of the refrigeration system and is designed for hot gas injection into the evaporator just after the expansion valve.

Liquid-gas mixer type LG can be used at the point of injection to assure a proper mixture.

Features

CPCE Hot gas capacity valve

- *Superior control accuracy*
- *Provides protection against too low an evaporator temperature*
- *Direct connection to system suction line*
- *For use with CFC, HCFC and HFC refrigerants*

LG Liquid gas mixer

- *LG provides homogenous mixture of liquid and hot gas refrigerant in the evaporator*
- *Can be used for hot gas defrosting or reverse cycle systems*

Approvals

UL listed, file SA7200

CSA approved

Technical data

Refrigerants
CFC, HCFC, HFC

Regulation range
p_e = 0 to 85 psig
Factory setting = 5.8 psig

Maximum working pressure
MWP = 310 psig

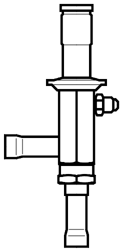
Maximum test pressure
p’ = 400 psig

Maximum media temperature
285° F

Minimum media temperature
– 50°F

Metric conversions
1 psi = 0.07 bar
$^5/_9\ (t_1°F - 32) = t_2°C$

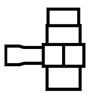
Ordering



Capacity regulator

Type	Connection		Rated capacity [1]) tons				Code no.
	Flare in.	Solder ODF in.	R 22	R 134a	R 404A/R 507	R 407C	
CPCE 12	1/2		6.2	4.3	6.3	6.7	**034N0081**
CPCE 12		1/2	6.2	4.3	6.3	6.7	**034N0082**
CPCE 15		5/8	9.2	6.3	9.1	9.9	**034N0083**
CPCE 22		7/8	12.2	8.4	12.1	13.2	**034N0084**

[1]) Rated capacity is based on:
Minimum suction temperature t_s = 15° F
Condensing temperature t_c = 100° F
Superheat of expansion valve Δt_s = 7° F.



Liquid - gas mixer

Type	Connection			Code no.
	For expansion valve in. ODM	For hot gas in. ODF	For liquid distributor in. ODF	
LG 12-16	5/8	1/2	5/8	**069G4001**
LG 12-22	7/8	1/2	7/8	**069G4002**
LG 16-28	1 1/8	5/8	1 1/8	**069G4003**
LG 22-35	1 3/8	7/8	1 3/8	**069G4004**

Sizing

For optimum performance, it is important to select a CPCE valve according to system conditions and application.
The following data must be used when sizing a CPCE valve:

- Refrigerant: CFC, HCFC or HFC
- Minimum suction temperature t_s in °F
- Compressor capacity at minimum suction temperature Q_1 in tons
- Evaporator load at minimum suction temperature Q_2 in tons
- Superheat setting of expansion valve in °F
- Condensing temperature t_c in °F
- Connection type flare or solder

Selection
Example

When selecting the appropriate valve it may be necessary to convert the actual capacity using a corrections factors. This is required when your system conditions are different than the table conditions.
The following examples illustrate how this is done.

Refrigerant: R 404A
Minimum suction temperature t_s: – 20°F
Compressor capacity at minimum suction temperature Q_1: 22.5 tons
Evaporator load at minimum suction temperature Q_2: 17 tons
Superheat setting of expansion valve: 9°F
Condensing temperature t_c: 90°F
Connection type: solder

Step 1

Determine the replacement capacity. This is done by taking the compressor capacity at minimum suction temperature Q_1 minus evaporator load at minimum suction temperature Q_2.
$Q_1 – Q_2$ = 22.5 – 17 = 5.5 tons.

Metric conversions
1 psi = 0.07 bar
5/9 (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Selection *(continued)*

Step 2

Determine the corrections factor for the expansion valve superheat setting.

From the correction factors table (see below) a superheat setting of 9°F, R 404A corresponds to a factor of 1.3.

Correction factors

Suction temperature t_s after reduction °F	Refrigerant	Superheat of expansion valve Δt_s °F						
		1	3	5	7	9	11	13
50	R 134a	0.1	0.5	0.9	1.0	1.0	1.0	1.0
	R 22, R 404A, R 407C, R 507	0.3	0.9	1.0	1.0	1.0	1.0	1.0
30	R 134a	0.1	0.3	0.7	1.0	1.0	1.0	1.0
	R 22, R 404A, R 407C, R 507	0.2	0.9	1.0	1.0	1.0	1.0	1.0
15	R 134a	0.1	0.3	0.6	1.0	1.3	1.4	1.4
	R 22, R 404A, R 407C, R 507	0.1	0.5	1.0	1.0	1.0	1.0	1.0
– 5	R 134a	0.1	0.3	0.6	1.0	1.5	2.2	2.4
	R 22, R 404A, R 407C, R 507	0.1	0.3	0.7	1.0	1.0	1.0	1.0
– 20	R 134a	0.1	0.3	0.6	1.0	1.5	2.2	2.9
	R 22, R 404A, R 407C, R 507	0.1	0.3	0.6	1.0	1.3	1.4	1.4
– 40	R 22, R 404A, R 407C, R 507	0.1	0.3	0.6	1.0	1.5	2.0	2.2

Step 3

Corrected replacement capacity is
Q = 1.3 x 5.5 = 7.2 tons

Step 4

Now select the appropriate capacity table and choose the column for minimum suction temperature t_s and the column for condensing temperature t_c.
Using the corrected replacement capacity, select a valve that provides an equivalent or greater capacity.

A CPCE 22 delivers a replacement capacity of 8.0 ton at a minimum suction temperature of – 20°F and a condensing temperature of 90°F.

Step 5

CPCE 22, $^7/_8$ in. solder connection,
code no 034N0084 (see Ordering page 42).

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Capacity

Type	Minimum suction temperature t_S after pressure/temperature reduction °F	Regulator capacity Q tons at condensing temperature t_c °F 70	90	100	120	140

R 22

Type	°F	70	90	100	120	140
CPCE 12	50	2.2	4.6	6.1	7.6	9.5
	30	3.7	4.9	6.2	7.7	
	15	3.9	4.9	6.2	7.8	
	– 5	3.9	5.0	6.3	7.9	
	– 20	2.3	3.1	4.2	5.3	
	– 40	1.2	1.6	2.2		
CPCE 15	50	3.3	6.8	9.0	11.2	13.9
	30	5.3	7.2	9.1	11.3	
	15	5.7	7.3	9.2	11.4	
	– 5	5.7	7.3	9.3	11.6	
	– 20	3.3	4.5	6.0	7.7	
	– 40	1.7	2.2	3.0		
CPCE 22	50	4.3	9.0	11.9	14.9	18.4
	30	7.1	9.5	12.0	15.0	
	15	7.5	9.7	12.2	15.2	
	– 5	7.6	9.7	12.2	15.3	
	– 20	4.4	6.0	8.0	10.2	
	– 40	2.3	3.0	4.1		

R 134a

Type	°F	70	90	100	120	140
CPCE 12	50	0.9	4.2	5.8	7.2	9.1
	30	3.1	4.5	5.8	7.3	9.1
	15	2.3	3.2	4.3	5.8	7.3
	- 5	1.4	1.8	2.5	3.3	4.2
	- 20	0.9	1.1	1.5	2.0	2.5
CPCE 15	50	0.9	6.1	8.5	10.7	13.4
	30	4.6	6.7	8.5	10.7	13.4
	15	3.3	4.7	6.3	8.5	10.7
	- 5	1.9	2.7	3.5	4.8	6.1
	- 20	1.1	1.4	2.0	2.6	3.2
CPCE 22	50	1.3	8.2	11.2	14.1	17.7
	30	6.1	8.9	11.3	14.1	17.7
	15	4.4	6.1	8.4	11.2	14.1
	- 5	2.6	3.5	4.7	6.3	8.2
	- 20	1.5	2.0	2.8	3.6	4.5

R 404A/R 507

Type	°F	70	90	100	120	140
CPCE 12	50	2.2	4.6	6.2	7.7	9.6
	30	3.6	5.0	6.2	7.7	
	15	3.9	5.0	6.3	7.7	
	– 5	4.0	5.0	6.3		
	– 20	3.1	4.2	5.4		
	– 40	1.7	2.2	2.9		
CPCE 15	50	3.3	6.8	9.1	11.3	14.1
	30	5.4	7.3	9.1	11.3	
	15	5.7	7.3	9.1	11.3	
	– 5	5.7	7.3	9.1		
	– 20	4.5	6.1	7.9		
	– 40	2.4	3.2	4.1		
CPCE 22	50	4.4	9.0	12.1	15.0	18.7
	30	7.2	9.6	12.1	15.0	
	15	7.6	9.6	12.1	15.1	
	– 5	7.6	9.8	12.1		
	– 20	5.9	8.0	10.5		
	– 40	3.2	4.3	5.4		

The capacities are based on:
Liquid temperature ahead of expansion valve t_l = 100°F

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

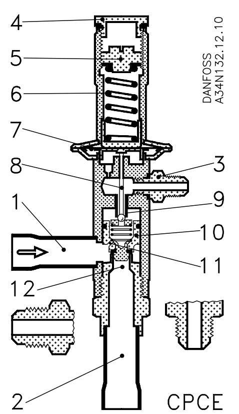
Capacity *(continued)*

R 407C

Type	Minimum suction temperature t_s after pressure/temperature reduction °F	Regulator capacity Q tons at condensing temperature t_c °F 70	90	100	120	140
CPCE 12	50	2.4	5.0	6.6	8.2	10.3
	30	4.0	5.3	6.7	8.3	
	15	4.2	5.3	6.7	8.4	
	– 5	4.2	5.4	6.8	8.5	
	– 20	2.5	3.3	4.5	5.7	
	– 40	1.3	1.7	2.4		
CPCE 15	50	3.6	7.3	9.7	12.1	15.0
	30	5.7	7.8	9.8	12.2	
	15	6.2	7.9	9.9	12.3	
	– 5	6.2	7.9	10.0	12.5	
	– 20	3.6	4.9	6.5	8.3	
	– 40	1.8	2.4	3.2		
CPCE 22	50	4.6	9.7	12.9	16.1	19.9
	30	7.7	10.3	13.0	16.2	
	15	8.1	10.5	13.2	16.4	
	– 5	8.2	10.5	13.2	16.5	
	– 20	4.8	6.5	8.6	11.0	

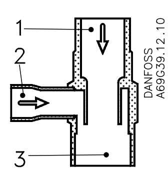
The capacities are based on:
Liquid temperature ahead of expansion valve t_l = 100°F

Design and Function



CPCE

1. Inlet
2. Outlet
3. Pilot pressure connection
4. Protective cap
5. Setting screw
6. Main spring
7. Diaphragm
8. Pressure pin
9. Pilot orifice
10. Servo piston
11. Pressure equalizing hole
12. Main orifice



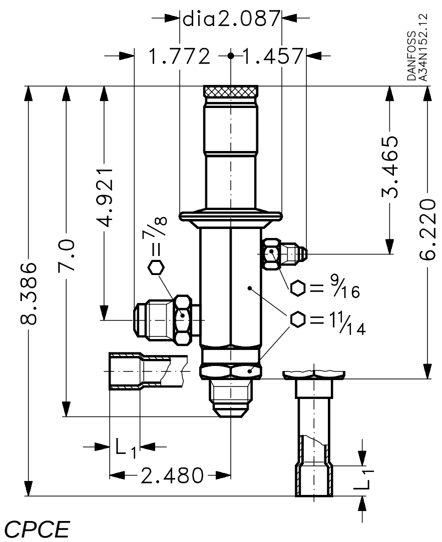
LG

1. Liquid inlet
2. Hot gas inlet
3. Outlet

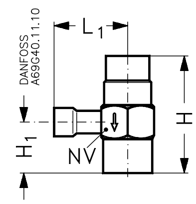
Capacity regulator type CPCE is a servo-operated valve. The diaphram (7) is acted on by two forces: The spring force (6) and the force created from the pilot pressure (3) (suction pressure). When the pilot pressure falls below the valves setting, the throttling ball (6) is forced away from the pilot orifice (9) by the spring pressure transfered through the pressure pin (8).
The pressure over the servo piston (10) is then relieved through the pilot connection allowing the differential pressure across the inlet and outlet to open the valve allowing the flow of hot gas into the evaporator.
When the pilot pressure (suction pressure) rises above the valves setting, the throttling ball seals off the piston chamber where high pressure begins to build through the equalization hole (11) causing the valve to close.

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Dimensions and weights



CPCE

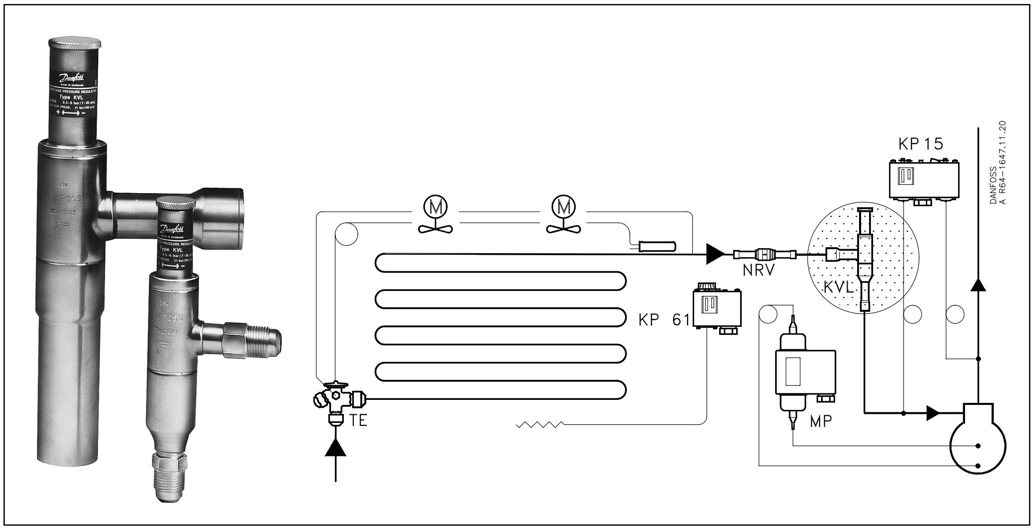


LG

Type	L_1 in.	Weight lbs
CPCE 12	0.375	2
CPCE 15	0.5	2
CPCE 22	0.669	2

Type	H in.	H_1 in.	L_1 in.	NV in.	Weight lbs
LG 12-16	2.125	0.875	1.563	0.938	0.2
LG 12-22	2.438	1.031	1.688	1.125	0.4
LG 16-28	3.125	1.375	1.875	1.438	0.7
LG 22-35	3.500	1.563	2.625	1.625	0.9

Metric conversions
1 in. = 25.4 mm
1 lb = 0.454 kg



Contents

Introduction

KVL cranckcase pressure regulators are used to protect the compressor motor against overload experienced during startup after long off periods or just after defrost periods.

They are installed in the suction line of refrigeration systems.

Features

- *Accurate, adjustable pressure regulation*
- *Wide capacity and operating range*
- *Pulsation damping design*
- *Stainless steel bellows*
- *Compact angle design for easy installation in any position*
- *"Hermetic" brazed construction*
- *Available with flare and ODF solder connections*
- *For use with CFC, HCFC and HFC refrigerants*

Approvals

UL listed, file SA7200

CSA approved

Technical data

Refrigerants
CFC, HCFC, HFC

Regulation range
3 to 85 psig
Factory setting = 29 psig

Maximum working pressure
KVL 12 to 22: MWP = 200 psig
KVL 28 to 35: MWP = 200 psig

Maximum test pressure
KVL 12 to 22: p' = 405 psig
KVL 28 to 35: p' = 370 psig

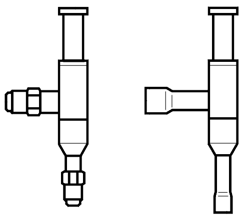
Maximum temperature of medium
300°F

Minimum temperature of medium
– 325°F

Maximum P-band
KVL 12 to 22: 29 psi
KVL 28 to 35: 22 psi

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Ordering



Type	Rated capacity 1) tons				Flare connection 2)		Solder connection	
	R 22	R 134a	R 404A/R 507	R 407C	in.	**Code no**	in. ODF	**Code no**
KVL 12	1.2	0.8	1.0	1.1	1/2	**034L0041**	1/2	**034L0043**
KVL 15	1.2	0.8	1.0	1.1	5/8	**034L0042**	5/8	**034L0049**
KVL 22	1.2	0.8	1.0	1.1			7/8	**034L0045**
KVL 28	4.1	2.6	3.4	3.8			1 1/8	**034L0046**
KVL 35	4.1	2.6	3.4	3.8			1 3/8	**034L0052**

1) Rated capacity is based on:
Maximum suction pressure p_s = 70 psig
Suction temperature t_s = 10°F
Condensing temperature t_c = 100°F
Pressure drop across regulator Δp = 2 psi

2) KVL are supplied without flare nuts. Separate flare nuts can be supplied:
1/2 in., code no **011L1103**
5/8 in., code no **011L1167**.

Note: The connection dimensions chosen must not be too small, as gas velocities in excess of 130 ft/s at the inlet of the regulator can result in flow noise.

Metric conversions
1 psi = 0.07 bar
5/9 (t_1°F – 32) = t_2°C
1 ton = 3.5 kW
1 in. = 25.4 mm

Capacities

R 22

Maximum regulator capacity Q_e[1]) at condensing temperature t_c = 100°F

Type	Pressure drop across regulator Δ p	Maximum suction pressure p_s	Capacity Q_e tons at suction temperature t_s after the regulator, °F										
	psi	psig	– 30	– 20	– 10	0	**10**	20	30	40	50	60	70
KVL 12 KVL 15 KVL 22	2	10	0.3										
		20	0.7	0.6	0.3								
		30	0.8	0.9	0.9	0.5							
		40	0.8	0.9	1.0	1.0	0.7						
		50	0.8	0.9	1.0	1.1	1.2	0.8					
		60	0.8	0.9	1.0	1.1	1.2	1.3	0.6				
		70	0.8	0.9	1.0	1.1	1.2	1.4	1.4	0.2			
		80	0.8	0.9	1.0	1.1	1.2	1.4	1.5	1.3			
		90	0.8	0.9	1.0	1.1	1.2	1.4	1.5	1.6	0.9		
	3	10	0.4										
		20	0.9	0.8	0.4								
		30	0.9	1.1	1.0	0.7							
		40	0.9	1.1	1.2	1.3	0.9						
		50	0.9	1.1	1.2	1.3	1.5	0.9					
		60	0.9	1.1	1.2	1.3	1.5	1.6	0.8				
		70	0.9	1.1	1.2	1.3	1.5	1.7	1.7	0.3			
		80	0.9	1.1	1.2	1.3	1.5	1.7	1.8	1.6			
		90	0.9	1.1	1.2	1.3	1.5	1.7	1.8	2.0	1.1		
	4	10	0.5										
		20	1.0	0.9	0.4								
		30	1.1	1.2	1.2	0.8							
		40	1.1	1.2	1.4	1.5	1.0						
		50	1.1	1.2	1.4	1.6	1.7	1.1					
		60	1.1	1.2	1.4	1.6	1.7	1.9	0.9				
		70	1.1	1.2	1.4	1.6	1.7	1.9	2.0	0.3			
		80	1.1	1.2	1.4	1.6	1.7	1.9	2.1	1.9			
		90	1.1	1.2	1.4	1.6	1.7	1.9	2.1	2.3	1.3		
KVL 28 KVL 35	2	10	0.8	1.6									
		20	2.0	2.7	0.7								
		30	2.5	2.9	2.3	1.2							
		40	2.5	2.9	3.2	3.0	1.6						
		50	2.5	2.9	3.2	3.6	3.5	1.8					
		60	2.5	2.9	3.2	3.6	4.1	3.8	1.4				
		70	2.5	2.9	3.2	3.6	4.1	4.5	3.9	0.4			
		80	2.5	2.9	3.2	3.6	4.1	4.5	5.0	3.4			
		90	2.5	2.9	3.2	3.6	4.1	4.5	5.0	5.5	2.0		
	3	10	0.9										
		20	2.4	1.9	0.8								
		30	3.1	3.4	2.8	1.5							
		40	3.1	3.5	4.0	3.6	2.0						
		50	3.1	3.5	4.0	4.5	4.3	2.2					
		60	3.1	3.5	4.0	4.5	5.0	4.7	1.8				
		70	3.1	3.5	4.0	4.5	5.0	5.5	4.7	0.5			
		80	3.1	3.5	4.0	4.5	5.0	5.5	6.1	4.2			
		90	3.1	3.5	4.0	4.5	5.0	5.5	6.1	6.7	2.5		
	4	10	1.1										
		20	2.8	2.2	0.9								
		30	3.6	3.9	3.3	1.8							
		40	3.6	4.1	4.6	4.2	2.3						
		50	3.6	4.1	4.6	5.2	4.9	2.5					
		60	3.6	4.1	4.6	5.2	5.8	5.4	2.0				
		70	3.6	4.1	4.6	5.2	5.8	6.4	5.5	0.6			
		80	3.6	4.1	4.6	5.2	5.8	4.5	7.1	4.8			
		90	3.6	4.1	4.6	5.2	5.8	4.5	7.1	7.7	2.9		

[1]) The capacities are based on Liquid temperature t_l = 100°F

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 22	0.82	0.85	0.88	0.92	0.96	1.0	1.05	1.10

System capacity × correction factor = table capacity

Metric conversions

1 psi = 0.07 bar

$^5/_9$ (t_1°F – 32) = t_2°C

1 ton = 3.5 kW

Capacities *(continued)*

R 134a

Maximum regulator capacity Q_e at condensing temperature t_c = 100°F

Type	Pressure drop across regulator Δ p	Maximum suction pressure p_s	Capacity Q_e tons at suction temperature t_s after the regulator, °F										
	psi	psig	– 30	– 20	– 10	0	**10**	20	30	40	50	60	70
KVL 12 KVL 15 KVL 22	2	10	0.4	0.5	0.4	0.3							
		20	0.4	0.5	0.6	0.6	0.4						
		30	0.4	0.5	0.6	0.7	0.7	0.6					
		40	0.4	0.5	0.6	0.7	**0.8**	0.9	0.7				
		50	0.4	0.5	0.6	0.7	**0.8**	0.9	1.0	0.8			
		60	0.4	0.5	0.6	0.7	**0.8**	0.9	1.0	1.1	1.0		
		70	0.4	0.5	0.6	0.7	**0.8**	0.9	1.0	1.1	1.3	1.2	
		80	0.4	0.5	0.6	0.7	**0.8**	0.9	1.0	1.1	1.3	1.4	1.5
		90	0.4	0.5	0.6	0.7	**0.8**	0.9	1.0	1.1	1.3	1.4	1.5
	3	10	0.5	0.6	0.6	0.4							
		20	0.6	0.6	0.7	0.7	0.5						
		30	0.6	0.6	0.7	0.8	0.9	0.7					
		40	0.6	0.6	0.7	0.8	1.0	1.0	0.8				
		50	0.6	0.6	0.7	0.8	1.0	1.1	1.2	1.0			
		60	0.6	0.6	0.7	0.8	1.0	1.1	1.2	1.4	1.3		
		70	0.6	0.6	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.5	
		80	0.6	0.6	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.7	1.8
		90	0.6	0.6	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.7	1.9
	4	10	0.6	0.7	0.6	0.5							
		20	0.7	0.8	0.8	0.8	0.6						
		30	0.7	0.8	0.9	1.0	1.0	0.8					
		40	0.7	0.8	0.9	1.0	1.1	1.2	1.0				
		50	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.2			
		60	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.5		
		70	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.8	1.8	
		80	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.8	2.0	2.1
		90	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.8	2.0	2.2
KVL 28 KVL 35	2	10	1.3	1.3	1.1	0.7							
		20	1.5	1.7	1.7	1.5	1.0						
		30	1.5	1.7	2.0	2.2	1.9	1.3					
		40	1.5	1.7	2.0	2.3	**2.6**	2.5	1.7				
		50	1.5	1.7	2.0	2.3	**2.6**	3.0	3.1	2.1			
		60	1.5	1.7	2.0	2.3	**2.6**	3.0	3.3	3.7	2.7		
		70	1.5	1.7	2.0	2.3	**2.6**	3.0	3.3	3.7	4.2	3.4	
		80	1.5	1.7	2.0	2.3	**2.6**	3.0	3.3	3.7	4.2	4.7	4.1
		90	1.5	1.7	2.0	2.3	**2.6**	3.0	3.3	3.7	4.2	4.7	5.2
	3	10	1.6	1.5	1.4	0.9							
		20	1.9	2.1	2.1	1.8	1.2						
		30	1.9	2.1	2.5	2.7	2.4	1.6					
		40	1.9	2.1	2.5	2.8	3.2	3.1	2.1				
		50	1.9	2.1	2.5	2.8	3.2	3.6	3.8	2.6			
		60	1.9	2.1	2.5	2.8	3.2	3.6	4.1	4.6	3.3		
		70	1.9	2.1	2.5	2.8	3.2	3.6	4.1	4.6	5.1	4.1	
		80	1.9	2.1	2.5	2.8	3.2	3.6	4.1	4.6	5.1	5.7	5.1
		90	1.9	2.1	2.5	2.8	3.2	3.6	4.1	4.6	5.1	5.7	6.3
	4	10	1.8	1.8	1.6	1.0							
		20	2.2	2.4	2.4	2.1	1.4						
		30	2.2	2.5	2.9	3.1	2.8	1.8					
		40	2.2	2.5	2.9	3.3	3.7	3.5	2.4				
		50	2.2	2.5	2.9	3.3	3.7	4.2	4.4	3.0			
		60	2.2	2.5	2.9	3.3	3.7	4.2	4.7	5.3	3.8		
		70	2.2	2.5	2.9	3.3	3.7	4.2	4.7	5.3	5.9	4.8	
		80	2.2	2.5	2.9	3.3	3.7	4.2	4.7	5.3	5.9	6.6	5.9
		90	2.2	2.5	2.9	3.3	3.7	4.2	4.7	5.3	5.9	6.6	7.3

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 134a	0.79	0.82	0.86	0.90	0.95	1.0	1.06	1.13

System capacity × correction factor = table capacity

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Capacities *(continued)*

Maximum regulator capacity Q_e[1]) at condensing temperature t_c = 100°F

R 404A/R507

Type	Pressure drop across regulator Δ p	Maximum suction pressure p_s	Capacity Q_e tons at suction temperature t_s after the regulator, °F										
	psi	psig	– 30	– 20	– 10	0	10	20	30	40	50	60	70
KVL 12 KVL 15 KVL 22	2	10											
		20	0.5	0.3									
		30	0.6	0.6	0.5								
		40	0.6	0.7	0.8	0.6							
		50	0.6	0.7	0.8	0.9	0.7						
		60	0.6	0.7	0.8	0.9	1.0	0.7					
		70	0.6	0.7	0.8	0.9	1.0	1.1	0.5				
		80	0.6	0.7	0.8	0.9	1.0	1.1	1.1				
		90	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.1			
	3	10											
		20	0.6	0.3									
		30	0.8	0.8	0.6								
		40	0.8	0.9	0.9	0.7							
		50	0.8	0.9	1.0	1.1	0.8						
		60	0.8	0.9	1.0	1.1	1.2	0.8					
		70	0.8	0.9	1.0	1.1	1.3	1.4	0.6				
		80	0.8	0.9	1.0	1.1	1.3	1.5	1.5				
		90	0.8	0.9	1.1	1.2	1.3	1.5	1.6	1.3			
	4	10											
		20	0.7	0.4									
		30	0.9	0.9	0.7								
		40	0.9	1.0	1.1	0.9							
		50	0.9	1.0	1.1	1.3	1.0						
		60	0.9	1.0	1.1	1.3	1.4	1.0					
		70	0.9	1.0	1.1	1.4	1.5	1.7	0.7				
		80	0.9	1.0	1.1	1.4	1.5	1.7	1.7				
		90	0.9	1.1	1.2	1.4	1.5	1.7	1.9	1.5			
KVL 28 KVL 35	2	10											
		20	1.2	0.6									
		30	2.0	1.7	1.1								
		40	2.0	2.3	2.2	1.5							
		50	2.0	2.4	2.7	2.8	1.7						
		60	2.1	2.4	2.7	3.1	3.2	1.6					
		70	2.1	2.4	2.7	3.1	3.4	3.3	1.1				
		80	2.1	2.4	2.7	3.1	3.4	3.9	3.2				
		90	2.1	2.4	2.7	3.1	3.5	3.9	4.3	2.6			
	3	10	0.1										
		20	1.4	0.7									
		30	2.5	2.1	1.3								
		40	2.6	3.0	2.9	1.9							
		50	2.6	3.0	3.2	3.4	2.1						
		60	2.6	3.0	3.2	3.8	3.9	2.1					
		70	2.6	3.0	3.2	3.9	4.3	4.2	1.3				
		80	2.6	3.0	3.2	3.9	4.3	4.8	4.0				
		90	2.6	3.1	3.3	3.9	4.3	4.8	5.4	3.3			
	4	10	0.1										
		20	1.7	0.8									
		30	2.8	2.5	1.5								
		40	3.0	3.4	3.3	2.1							
		50	3.0	3.4	3.9	4.0	2.4						
		60	3.0	3.4	3.9	4.3	4.4	2.4					
		70	3.0	3.4	4.0	4.4	4.9	4.8	1.7				
		80	3.0	3.4	4.0	4.4	4.9	5.5	4.6				
		90	3.1	3.5	4.0	4.4	4.9	5.6	6.2	3.7			

[1]) The capacities are based on:
Liquid temperature t_l = 100°F

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 404A/R 507	0.71	0.75	0.80	0.85	0.92	1.0	1.10	1.24

System capacity × correction factor = table capacity

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Capacities *(continued)*

R 407C

Maximum regulator capacity Q_e at condensing temperature t_c = 100°F

Type	Pressure drop across regulator Δ p	Maximum suction pressure p_s	Capacity Q_e tons at suction temperature t_s after the regulator, °F										
	psi	psig	– 30	– 20	– 10	0	**10**	20	30	40	50	60	70
KVL 12 KVL 15 KVL 22	2	10	0.2										
		20	0.6	0.5	0.3								
		30	0.7	0.8	0.8	0.4							
		40	0.7	0.8	0.9	0.9	0.6						
		50	0.7	0.8	0.9	1.0	**1.1**	0.7					
		60	0.7	0.8	0.9	1.0	**1.1**	1.2	0.6				
		70	0.7	0.8	0.9	1.0	**1.1**	1.3	1.3	0.2			
		80	0.7	0.8	0.9	1.0	**1.1**	1.3	1.4	1.2			
		90	0.8	0.9	0.9	1.0	**1.1**	1.3	1.4	1.5	0.9		
	3	10	0.3										
		20	0.8	0.7	0.3								
		30	0.8	1.0	0.9	0.6							
		40	0.8	1.0	1.1	1.2	0.8						
		50	0.8	1.0	1.1	1.2	1.4	0.8					
		60	0.8	1.0	1.1	1.2	1.4	1.5	0.7				
		70	0.8	1.0	1.1	1.2	1.4	1.6	1.6	0.3			
		80	0.8	1.0	1.1	1.2	1.4	1.6	1.7	1.5			
		90	0.9	1.0	1.1	1.2	1.4	1.6	1.7	1.9	1.0		
	4	10	0.4										
		20	0.9	0.8	0.3								
		30	1.0	1.0	1.0	0.7							
		40	1.0	1.1	1.3	1.4	0.9						
		50	1.0	1.1	1.3	1.4	1.5	1.0					
		60	1.0	1.1	1.3	1.5	1.6	1.7	0.8				
		70	1.0	1.1	1.3	1.5	1.6	1.8	1.8	0.3			
		80	1.0	1.1	1.3	1.5	1.6	1.8	2.0	1.8			
		90	1.0	1.1	1.3	1.5	1.6	1.8	2.0	2.2	1.2		
KVL 28 KVL 35	2	10	0.7										
		20	1.7	2.3	0.6								
		30	2.2	2.5	2.0	1.0							
		40	2.2	2.6	2.9	2.7	1.4						
		50	2.3	2.6	2.9	3.2	3.2	1.6					
		60	2.3	2.6	2.9	3.3	3.7	3.5	1.3				
		70	2.3	2.7	2.9	3.3	3.8	4.1	3.6	0.4			
		80	2.3	2.7	3.0	3.4	3.8	4.2	4.7	3.2			
		90	2.4	2.7	3.0	3.4	3.9	4.2	4.7	5.2	1.9		
	3	10	0.7										
		20	2.0	1.6	0.7								
		30	2.7	3.0	2.4	1.3							
		40	2.8	3.1	3.6	3.2	1.8						
		50	2.8	3.2	3.6	4.1	3.9	2.0					
		60	2.8	3.2	3.6	4.1	4.6	4.3	1.6				
		70	2.9	3.2	3.7	4.1	4.6	5.1	4.3	0.5			
		80	2.9	3.3	3.7	4.2	4.7	5.1	5.7	3.9			
		90	2.9	3.3	3.8	4.2	4.7	5.2	5.7	6.3	2.4		
	4	10	0.9										
		20	2.4	1.9	0.8								
		30	3.1	3.4	2.9	1.6							
		40	3.2	3.7	4.1	3.7	2.1						
		50	3.2	3.7	4.1	4.7	4.4	2.3					
		60	3.3	3.7	4.2	4.7	5.3	4.9	1.8				
		70	3.3	3.8	4.2	4.8	5.3	5.9	2.1	0.6			
		80	3.4	3.8	4.3	4.8	5.4	6.0	6.6	4.5			
		90	3.4	3.9	4.3	4.9	5.5	6.0	6.7	7.2	2.7		

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 407C	0.78	0.81	0.85	0.89	0.94	1.0	1.07	1.15

System capacity × correction factor = table capacity

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

Sizing

For optimum performance, it is important to select a KVL valve according to system conditions and application.
The following data must be used when sizing a KVL valve:

- Refrigerant: CFC, HCFC or HFC
- Evaporating capacity Q_e in tons
- Liquid temperature ahead of expansion valve t_l in °F
- Suction temperature ahead of compressor t_s in °F
- Maximum suction pressure downstream regulator p_s in psig
- Connection type flare or solder
- Connection size in inches

Valve selection

Example

When selecting the appropiate valve it may be necessary to convert the actual evaporator capacity using a correction factors. This is required when your system conditions are different than the table conditions.
The selection is also dependant on the acceptable pressure drop across the valve.
The following example illustrates how this is done.

Refrigerant: R404A
Evaporating capacity Q_e = 0.7 tons
Liquid temperature ahead of expansion valve t_l = 120°F
Compressor suction temperature t_s = – 20°F
Maximum suction temperature after the regulator p_s = 30 psig
Connection type: solder
Connection size: 5/8 in.

Step 1

Determine the correction factor for liquid temperature t_l ahead of the expansion valve.

From the correction factors table (see below) a liquid temperature of 120°F, R 404A corresponds to a factor of 1.24.

Correction factors for liquid temperature t_l

t_l °F	50	60	70	80	90	100	110	120
R 22	0.82	0.85	0.88	0.92	0.96	1.0	1.05	1.10
R 134a	0.79	0.82	0.86	0.90	0.95	1.0	1.06	1.13
R 404A/R 507	0.71	0.75	0.80	0.85	0.92	1.0	1.10	1.24
R 407C	0.78	0.81	0.85	0.89	0.94	1.0	1.07	1.15

Step 2

Corrected evaporator capacity is
Q_e = 1.24 x 0.7 = 0.87 tons

Step 3

Now select the appropriate capacity table and choose the column for a suction temperature t_s = – 20°F.
Using the corrected evaporator capacity, select a valve that provides an equivalent or greater capacity at an acceptable pressure drop.

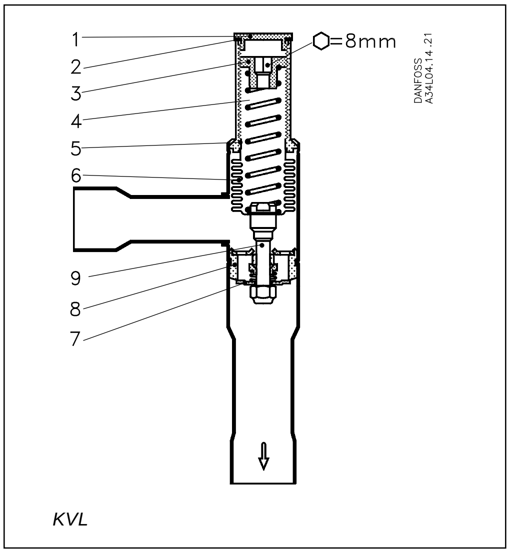
KVL 12/15/22 delivers an evaporator capacity up to 0.9 tons at a maximum suction pressure of 30 psig and a 4 psi pressure drop across the valve.
Based on the required connection size of 5/8 in. ODF, the KVL 15 is the proper selection for this example.

Step 4

KVL 15, 5/8 in. solder connection:
code no 034L0049 (see Ordering page 48)

Metric conversions
1 psi = 0.07 bar
5/9 (t_1°F – 32) = t_2°C
1 ton = 3.5 kW

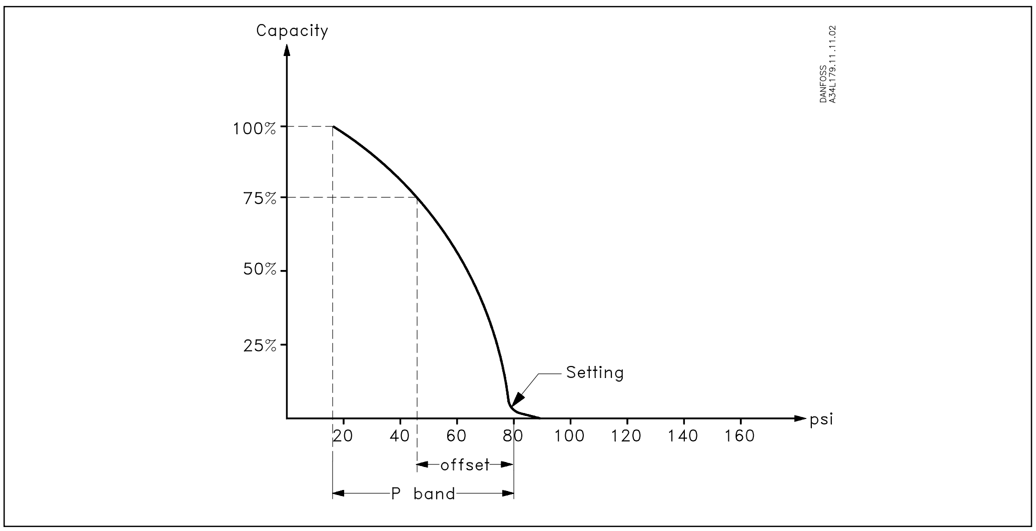
Design and function



1. Protective cap
2. Gasket
3. Setting screw
4. Main spring
5. Valve body
6. Equalization bellows
7. Valve plate
8. Valve seat
9. Damping device

Crankcase pressure regulator type KVL opens on a fall in pressure on the outlet side, i.e. when the suction pressure falls below the set value.
Type KVL regulates on outlet pressure only. Pressure variations on the inlet side of the regulator do not affect the degree of opening as the valve is equipped with equalization bellows (6).
The bellows has an effective area corresponding to that of the valve seat neutralizing any affect to the setting.
The regulator is also equipped with a damping device (9) providing protection against pulsations which can normally arise in a refrigeration system. The damping device helps to ensure long life for the regulator without impairing regulation accuracy.

P-band and offset



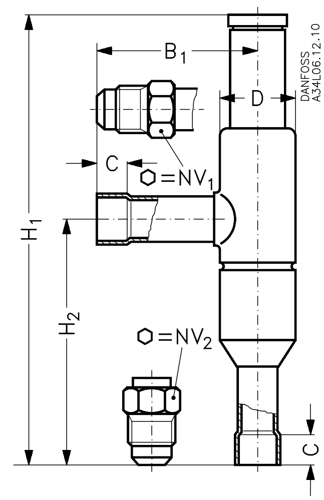
Proportional band
The proportional band or P-band is defined as the amount of pressure required to move the valve plate from closed to full open position.
If the setting is 58 psig and the p-band is 22 psi, the pressure at which the valve gives maximum capacity will be 36 psig.

Offset
The offset is defined as the permissible pressure variation in evaporator pressure (temperature). It is calculated as the difference between the required working pressure and the minimum allowable pressure.
The offset is always a part of the P-band.

Note: Offset is not used together with KVL due to the valve operation.

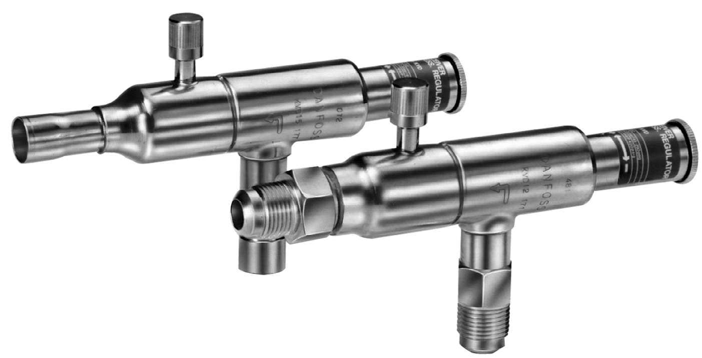
Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C

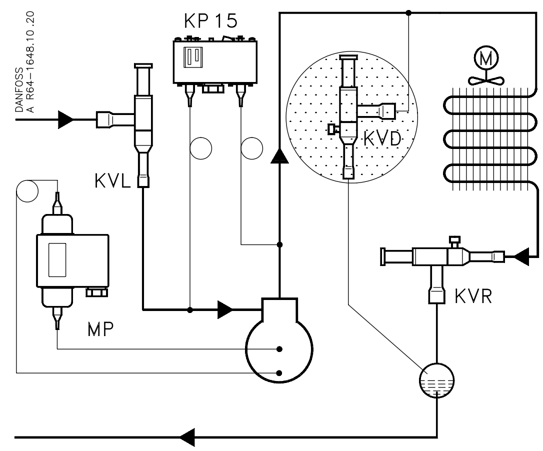
Dimensions and weights



Type	Connection (in.)		H_1	H_2	B_1	C	dia. D	Weight
	Flare	Solder ODF	in.	in.	in.	in.	in.	lbs.
KVL 12	1/2	1/2	7.047	3.898	2.520	0.375	1.181	0.9
KVL 15	5/8	5/8	7.047	3.898	2.520	0.5	1.181	0.9
KVL 22		7/8	7.047	3.898	2.520	0.625	1.181	0.9
KVL 28		1 1/8	10.197	5.945	4.134	0.875	1.693	2.0
KVL 35		1 3/8	10.197	5.945	4.134	1.0	1.693	2.0

Metric conversions
1 in. = 25.4 mm
1 lb = 0.454 kg





Contents

Introduction

KVD is a modulating pressure regulator. It opens on falling receiver pressure and bypasses hot gas to maintain the receiver pressure at the regulator setting (adjustable).

KVD and KVR form a regulating system, used to maintain constant and adequately high condensing and receiver pressure in systems with heat-recovery, and in refrigeration and air conditioning systems with air-cooled condensers.

Features

- *Accurate, adjustable pressure regulation*
- *Wide operating range*
- *Pulsation damping design*
- *Stainless steel bellows*
- *Compact angle design for easy installation in any position*
- *"Hermetic" brazed construction*
- *$^1/_4$ in. access valve for pressure testing*
- *Available with flare and ODF solder connections*
- *For use with CFC, HCFC, HFC refrigerants*

Approval

UL listed, file SA7200

CSA approved

Technical data

Refrigerants
CFC, HCFC, HFC

Regulating range
45 to 290 psig
Factory setting = 145 psig

Maximum working pressure
MWP = 400 psig

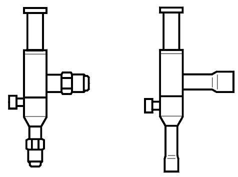
Maximum test pressure
p' = 450 psig

Maximum temperature of medium
212°F

Minimum temperature of medium
– 40°F

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 in. = 25.4 mm

Ordering

Symbol	Type	Flare connection[1]		Solder connection	
		in.	**Code no.**	in.	**Code no.**
	KVD 12	$^1/_2$	**034L0171**	$^1/_2$	**034L0173**
	KVD 15	$^5/_8$	**034L0172**	$^5/_8$	**034L0177**

[1]) KVD supplied without flare nuts. Separate flare nuts can be supplied: 1/2 in., code no **011L1103.**

The size of connection must not be chosen too small since gas velocities of more than 40 m/s in the inlet can cause flow noise.

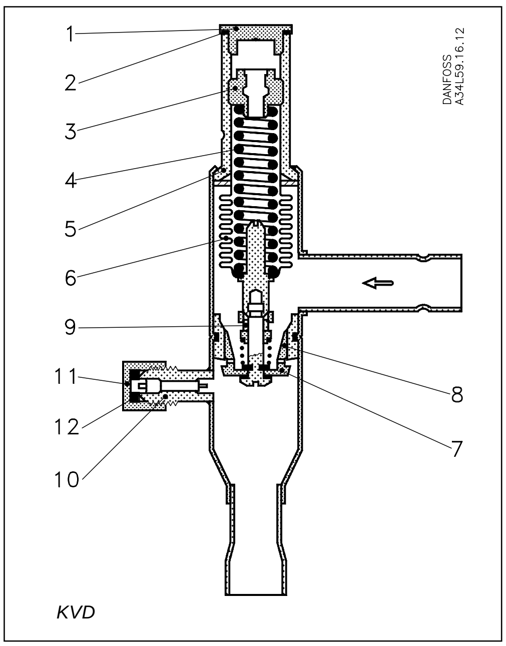
Selection

According to the system piping.

Sizing

No sizing is needed because the KVD valve is used to maintain a constant receiver pressure only.

Design Function

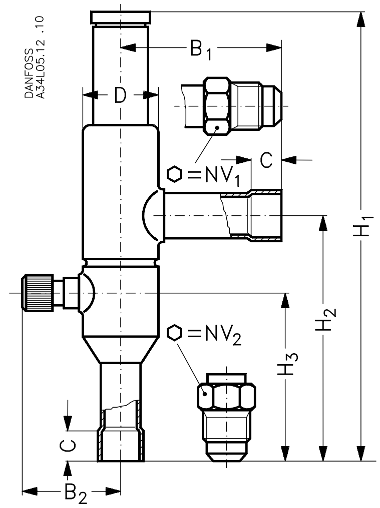


1. Protective cap
2. Gasket
3. Setting screw
4. Main spring
5. Valve body
6. Equalization bellows
7. Valve plate
8. Valve seat
9. Damping device
10. Pressure gauge connection
11. Cap
12. Gasket

Receiver pressure regulator type KVD opens on a fall in pressure on the outlet side, i.e. when the receiver pressure falls below the set value.
Type KVD regulates on outlet pressure only. Pressure variations on the inlet side of the regulator do not affect the degree of opening as the valve is equipped with an equalization bellows (6).
This bellows has an effective area corresponding to that of the valve seat neutralizing any affect to the setting.
The regulator is also equipped with a damping device (9) providing protection against pulsations which can normally arise in a refrigeration system. The damping device helps to ensure long life for the regulator without impairing regulation accuracy.

Metric conversions
1 psi = 0.07 bar
$^5/_9$ (t_1°F – 32) = t_2°C
1 in. = 25.4 mm
US gal/min = 0.86 m^3/h

Dimensions and weights



Type	Connection		NV_1	NV_2	H_1	H_2	H_3	B_1	B_2	C	dia. D	Weight
	Flare	Solder ODF										
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	lbs.
KVD 12	1/2	1/2	0.748	0.945	7.047	3.898	2.598	2.520	1.614	0.394	1.181	0.9
KVD 15	5/8	5/8	0.945	0.945	7.047	3.898	2.598	2.520	1.614	0.472	1.181	0.9

ISO 9001 quality approval

ISO 9001

Refrigeration and Air Conditioning Controls, part of the Danfoss concern, is certified in accordance with international standard ISO 9001. This means that Danfoss fulfils the international standard in respect of product development, design, production and sale.

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