

Data sheet

# Hot gas bypass regulator

## Type KVC



KVC hot gas bypass 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 or ODF solder connections
- May be used in the following EX range: Category 3 (Zone 2)

## Data sheet | Hot gas bypass regulator, type KVC

### Approvals

UL LISTED, file SA7200  
EAC

### Technical data

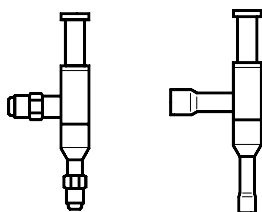
Metric conversions:  
1 psi = 0.07 bar  
 $\frac{5}{9}(t_1 - 32) = t_2$  °C  
1 TR = 3.5 kW

Refrigerants	R22, R134a, R290, R404A, R407A, R407C, R407F, R407H, R448A, R449A, R449B, R450A, R452A, R454A, R454C, R455A, R507A, R513A, R515B, R516A, R600, R600a, R1234ze(E), R1234yf, R1270
Regulating range	Pe = 3.00 – 87.00 psig Factory setting = 29 psig
Maximum working pressure	MWP = 406 psig
Maximum test pressure	Pe = 450 psig
Medium temperature range	-49 – 266 °F
Maximum P-band	29 psi

This product is approved for R290, R454A, R454C, R455A, R600, R600a, R1234ze(E), R1234yf, R1270 by ignition source assessment in accordance with standard EN ISO80079-36. Flare connections are only approved for A1 and A2L refrigerants.

For complete list of approved refrigerants, visit [www.products.danfoss.com](http://www.products.danfoss.com) and search for individual code numbers, where refrigerants are listed as part of technical data.

### Ordering



Type	Rated capacity <sup>1)</sup> [TR]				Flare connection <sup>2)</sup> [in]	Code no.	Solder connection	Code no.
	R22	R134a	R404A/R507	R407C			[in]	
KVC 12	2.14	1.36	2.02	2.31	½	034L0141	½	034L0143
KVC 15	4.17	2.65	3.93	4.50	¾	034L0142	¾	034L0147
KVC 22	5.35	3.41	5.04	5.78	–	–	¾	034L0144

<sup>1)</sup> Rated capacity is based on:  
Suction gas temperature  $t_s = 14$  °F  
Condensing temperature  $t_c = 77$  °F  
Offset  $\Delta p = 10$  psi

<sup>2)</sup> KVC are delivered without flare nuts. Separate flare nuts can be supplied:  
½ in code no 011L1103  
¾ 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 recommended 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)**
**R22**

Type	Offset $\Delta p$ [psi]	Regulator capacity $Q_e$ 1) [TR] 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

Metric conversions:  
 1 psi = 0.07 bar  
 $\frac{5}{9}(t_1 \text{ °F} - 32) = t_2 \text{ °C}$   
 1 TR = 3.5 kW  
 1 in = 25.4 mm

1) The capacities are based on: Condensing temperature  $t_c = 77 \text{ °F}$

Correction factors for condensing temperature  $t_c$ .  
 When liquid temperature  $t_l$  is other than  $77 \text{ °F}$ ,  
 adjust the table capacities by multiplying them  
 by the appropriate correction factor found in the  
 following table.

**Correction factors for condensing temperature  $t_c$** 

$t_l$ [°F]	50	59	68	77	86	95	104	113	122
R22	0.9	0.93	0.96	1.00	1.05	1.1	1.13	1.18	1.24

System capacity  $\times$  correction factor = table capacity

**Replacement capacity  
(continued)**
**Maximum regulator capacity  $Q_e$  <sup>1)</sup>**
**R134a**

Type	Offset $\Delta p$ [psi]	Regulator capacity $Q_e$ <sup>1)</sup> [TR] suction gas temperature $t_s$ after pressure / temperature reduction [°F]						
		-50	-40	-25	-10	10	30	50
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
KVC 15	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

Metric conversions:  
 1 psi = 0.07 bar  
 $\frac{5}{9}(t_1 \text{ } ^\circ\text{F} - 32) = t_2 \text{ } ^\circ\text{C}$   
 1 TR = 3.5 kW  
 1 in = 25.4 mm

<sup>1)</sup> The capacities are based on: Condensing temperature  $t_c = 77 \text{ } ^\circ\text{F}$

Correction factors for condensing temperature  $t_c$ .  
 When liquid temperature  $t_l$  is other than  $77 \text{ } ^\circ\text{F}$ ,  
 adjust the table capacities by multiplying them  
 by the appropriate correction factor found in the  
 following table.

**Correction factors for condensing temperature  $t_c$** 

$t_l$ [°F]	50	59	68	77	86	95	104	113	122
<b>R134a</b>	0.88	0.92	0.96	1.00	1.05	1.1	1.16	1.23	1.31

System capacity  $\times$  correction factor = table capacity

Replacement capacity  
(continued)

Maximum regulator capacity  $Q_e$  <sup>1)</sup>

R404A/R507

Type	Offset $\Delta p$	Regulator capacity $Q_e$ <sup>1)</sup> [TR] suction gas temperature $t_s$ after pressure / temperature reduction [°F]						
	[psi]	-50	-40	-25	-10	10	30	50
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

Metric conversions:  
 1 psi = 0.07 bar  
 $\frac{5}{9}(t_1 \text{ °F} - 32) = t_2 \text{ °C}$   
 1 TR = 3.5 kW  
 1 in = 25.4 mm

<sup>1)</sup> The capacities are based on: Condensing temperature  $t_c = 77 \text{ °F}$

Correction factors for condensing temperature  $t_c$ .  
 When liquid temperature  $t_l$  is other than 77 °F,  
 adjust the table capacities by multiplying them  
 by the appropriate correction factor found in the  
 following table.

Correction factors for condensing temperature  $t_c$

$t_l$ [°F]	50	59	68	77	86	95	104	113	122
R404A/R507	0.84	0.89	0.94	1.00	1.07	1.06	1.26	1.4	1.57

System capacity  $\times$  correction factor = table capacity

Replacement capacity  
(continued)

Maximum regulator capacity  $Q_e$  <sup>1)</sup>

R407C

Type	Offset $\Delta p$	Regulator capacity $Q_e$ <sup>1)</sup> [TR] suction gas temperature $t_s$ after pressure / temperature reduction [°F]						
	[psi]	-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
KVC 15	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

Metric conversions:  
 1 psi = 0.07 bar  
 $\frac{5}{9}(t_1 \text{ °F} - 32) = t_2 \text{ °C}$   
 1 TR = 3.5 kW  
 1 in = 25.4 mm

<sup>1)</sup> The capacities are based on: Condensing temperature  $t_c = 77 \text{ °F}$

Correction factors for condensing temperature  $t_c$ .  
 When liquid temperature  $t_l$  is other than  $77 \text{ °F}$ ,  
 adjust the table capacities by multiplying them  
 by the appropriate correction factor found in the  
 following table.

Correction factors for condensing temperature  $t_c$

$t_l$ [°F]	50	59	68	77	86	95	104	113	122
R407C	0.88	0.91	0.95	1.00	1.05	1.11	1.18	1.26	1.35

System capacity  $\times$  correction factor = table capacity

## Data sheet | Hot gas bypass regulator, type KVC

### 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: HCFC, HFC and HC
- Suction temperature at maximum compressor / evaporator load  $t_s$  in [°F] / [psig]
- Minimum suction temperature  $t_s$  in [°F] / [psig]
- Compressor capacity in [TR]
- Evaporating load in [TR]
- Condensing temperature  $t_c$  in [°F]
- Connection type: flare or solder
- Connection size [in]

Metric conversions:

1 psi = 0.07 bar  
 $\frac{5}{9}(t_1 \text{ } ^\circ\text{F} - 32) = t_2 \text{ } ^\circ\text{C}$   
 1 TR = 3.5 kW  
 1 in = 25.4 mm

### Valve selection Example

**Note:**  
When selecting the appropriate valve, it may be necessary to convert the actual capacity using a correction factor for condensing 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
  - Suction temperature at maximum compressor / evaporator load  $t_s$ : 0 °F ~ 7 psi.
  - Minimum suction temperature  $t_s$ : 10 °F ~ 12 psi.
  - Compressor capacity at 10 °F: 4.4 TR
  - Evaporating load at 10 °F: 2.85 TR
  - Condensing temperature  $t_c$ : 95 °F
  - Connection type: solder
  - Connection size:  $\frac{5}{8}$  in

**Step 1:**  
Determine the correction factor for the condensing temperature  $t_c$ .

From the correction factors table (see below) a condensing temperature of 95 °F, R134a corresponds to a factor of 1.1.

**Correction factors for condensing temperature  $t_c$**

$t_c$ [°F]	50	59	68	77	86	95	104	113	122
R 134a	0.88	0.92	0.96	1.00	1.05	1.1	1.16	1.23	1.31
R22	0.9	0.93	0.96	1.00	1.05	1.1	1.13	1.18	1.24
R404A/R507	0.84	0.89	0.94	1.00	1.07	1.16	1.26	1.4	1.57
R407C	0.88	0.91	0.95	1.00	1.05	1.11	1.18	1.26	1.35

**Step 2:**  
The required replacement capacity is defined as the (compressor capacity – the evaporator load) divided by the correction factor is equal:  
 $(4.4 - 2.85) / 1.1 = 1.41$  TR

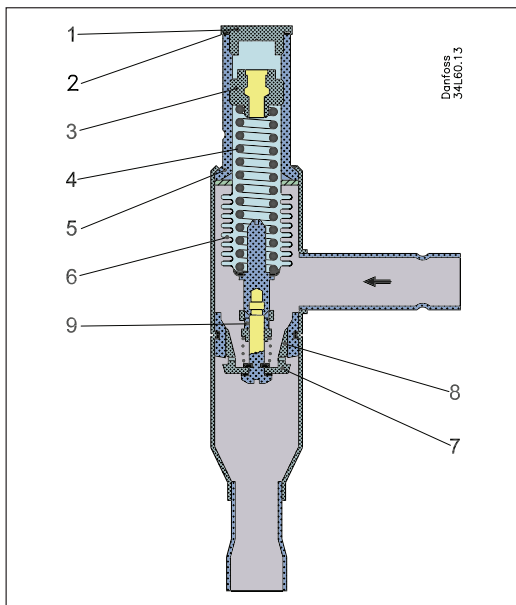
**Step 3:**  
Now select the appropriate capacity table and choose the column for minimum suction temperature  $t_s = 10$  °F.  
Using the corrected replacement capacity, select a valve that provides an equivalent or greater capacity than required.  
From the correction factors table (see below) a condensing temperature of 95 °F, R134a corresponds to a factor of 1.1.

KVC 15 delivers 1.79 TR at an offset of 5 psi. Based on the required connection size of  $\frac{5}{8}$  in ODF, the KVC 15 is the proper selection for this example.

**Step 4:**  
KVC 15,  $\frac{5}{8}$  in ODF  
Code no **034L0147**.

Design / Function

KVC



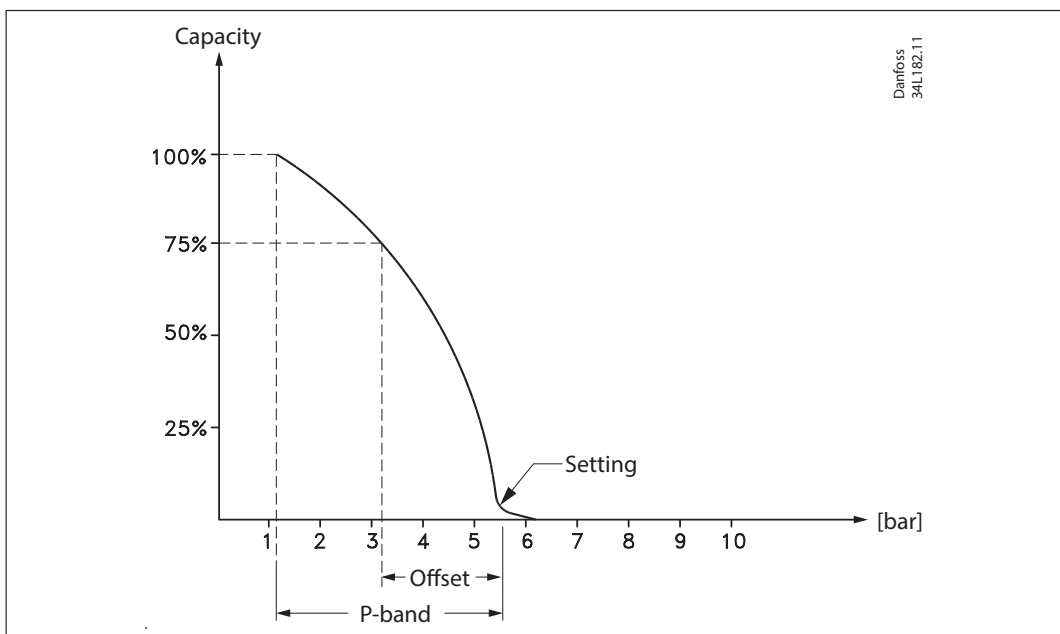
- 1. Protective cap
- 2. Gasket
- 3. Setting screw
- 4. Main spring
- 5. Valve body
- 6. Equalization bellows
- 7. Valve plate
- 8. Valve seat
- 9. Damping device

Hot gas bypass 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 80 psig and the p-band is 29 psi, the pressure at which the valve gives maximum capacity will be 51 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.

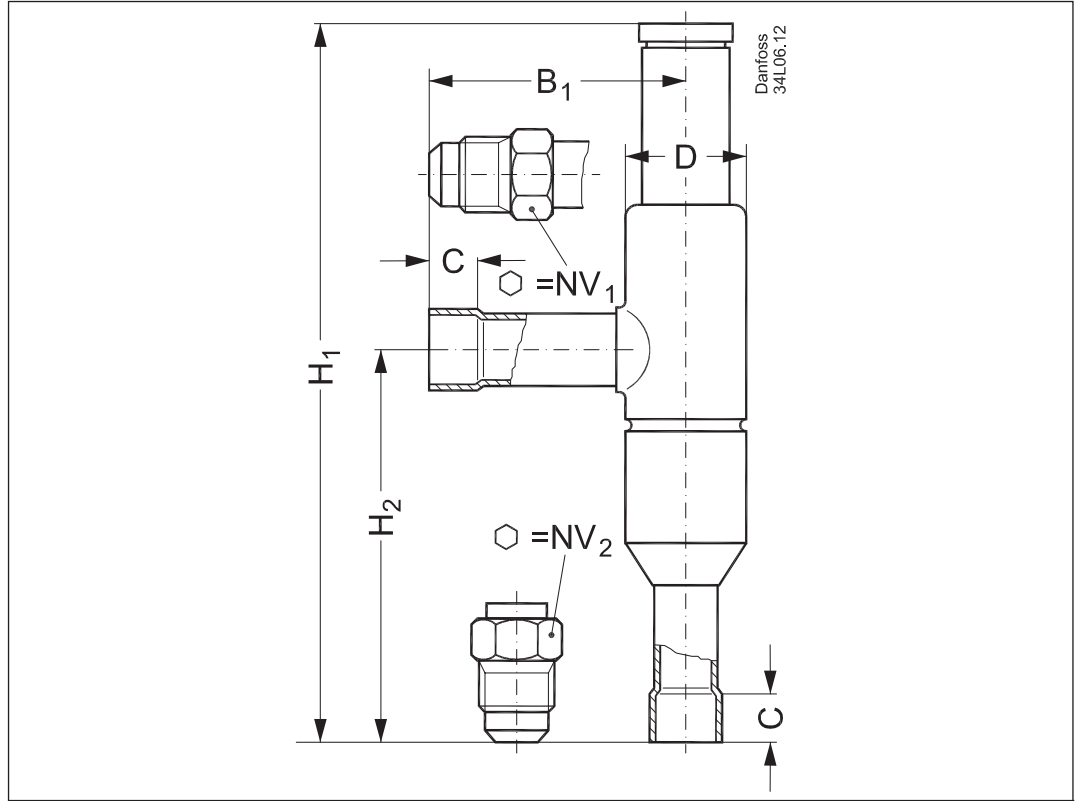
**Example with R 404A:**

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		NV <sub>1</sub>	NV <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>	B <sub>1</sub>	C solder	øD	Net weight
	Flare	Solder ODF								
	[in]	[in]								
KVC 12	½	½	¾	1 <sup>5</sup> / <sub>16</sub>	7.047	3.898	2.520	0.394	1.181	0.88
KVC 15	5/8	5/8	1 <sup>5</sup> / <sub>16</sub>	1 <sup>5</sup> / <sub>16</sub>	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

Danfoss can accept no responsibility for possible errors in catalogues, brochures and other printed material. Danfoss reserves the right to alter its products without notice. This also applies to products already on order provided that such alterations can be made without subsequential changes being necessary in specifications already agreed. All trademarks in this material are property of the respective companies. Danfoss and the Danfoss logotype are trademarks of Danfoss A/S. All rights reserved.