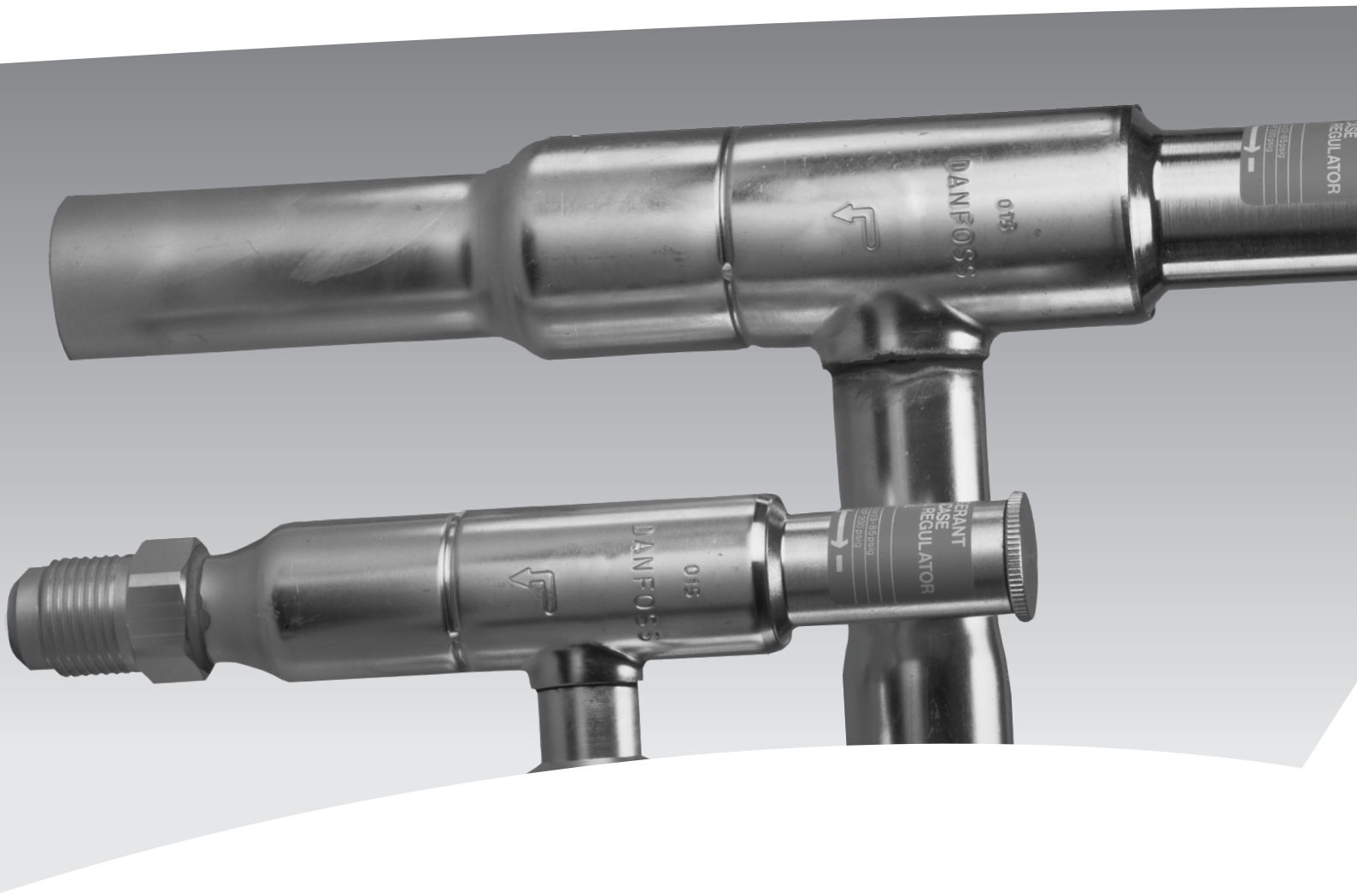


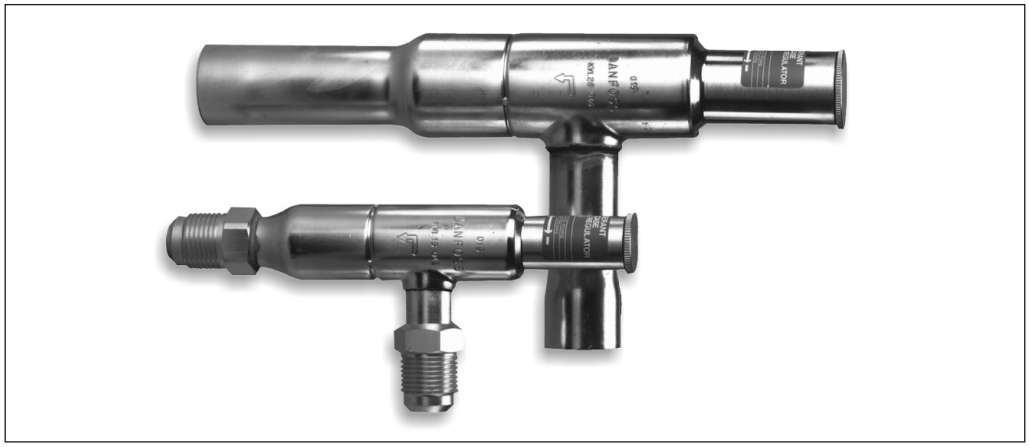
Capacity regulator (hot gas bypass), type KVC

REFRIGERATION AND AIR CONDITIONING

Technical leaflet

Technical leaflet **Capacity regulator (hot gas bypass), type KVC**

Introduction



KVC is a capacity regulator applied for the adaption of the compressor capacity to the actual evaporator load. Placed in a bypass between high- and low pressure sides of the refrigeration system, KVC imposes a lower limit on the compressor suction pressure by supplying the low pressure side with replacement capacity in the form of hot gas/cool gas from the high pressure side.

Features

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

Approvals

cULus listed, file SA7200

Technical data

Refrigerants
CFC, HCFC and HFC

Regulating range
0.2 → 6.0 bar
Factory setting = 2 bar

Maximum working pressure
PS = 28 bar

Maximum test pressure
p' = 31 bar

Maximum temperature of medium
130°C

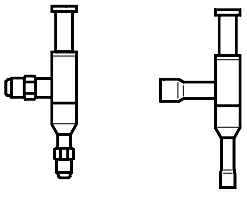
Minimum temperature of medium
–45°C

Maximum P band
2.0 bar

k_V - value at maximum P band[1)]
KVC 12 = 0.68 m^3/h
KVC 15 = 1.25 m^3/h
KVC 20 = 1.85 m^3/h

1) The k_v value is the flow of water in m^3/h at a pressure drop across valve of 1 bar, ρ = 1000 kg/m^3.

Ordering



Type	Rated capacity [1)] KW				Flare connection [2)]		Code no.	Solder connection		Code no.
	R 22	R 134a	R404A / R 507	R 407C	in.	mm		in.	mm	
KVC 12	7.6	4.8	6.9	8.4	1/2	12	**034L0141**	1/2		**034L0143**
									12	**034L0146**
KVC 15	14.9	9.4	13.6	16.4	5/8	16	**034L0142**	5/8	16	**034L0147**
KVC 22	19.1	12.0	17.4	21.0				7/8	22	**034L0144**

1) Rated capacity is the regulator capacity at evaporating temperature t_e = –10°C, condensing temperature t_c = +25°C, offset = 0.7 bar

2) KVC is supplied without flare nut. Separate flare nuts can be ordered: 1/2 in./12 mm, **code no. 011L1103**, 5/8 in./16 mm, **code no. 011L1167**

The connection dimensions chosen must not be too small, since gas velocities in excess of 40 m/s at the inlet of the regulator can give flow noise.

If the discharge tube temperature becomes too high in relation to the compressor specification, the installation of an injection valve in a bypass between liquid line and compressor suction line is recommended.

Replacement capacity

Type	Offset Δp bar	Q [1] kW suction gas temperature t_s after pressure/temperature reduction °C						
		–45	–40	–30	–20	–10	0	+10
R 22								
KVC 12	0.10		2.3	2.4	2.5	2.5	2.6	2.6
	0.15		3.5	3.6	3.7	3.8	3.9	4.0
	0.20		4.5	4.7	4.8	4.9	5.0	5.1
	0.30		5.9	6.1	6.3	6.4	6.5	6.7
	0.50		6.6	6.8	7.1	7.2	7.3	7.5
	0.70		7.0	7.2	7.4	7.6	7.8	7.9
	1.00		7.6	7.9	8.1	8.3	8.5	8.6
	1.20		8.2	8.5	8.7	8.9	9.1	9.3
KVC 15	0.10		3.5	3.6	3.7	3.8	3.9	4.0
	0.15		4.5	4.7	4.8	4.9	5.0	5.1
	0.20		5.9	6.1	6.3	6.4	6.5	6.7
	0.30		8.2	8.5	8.7	8.9	9.1	9.3
	0.50		11.7	12.1	12.4	12.7	13.0	13.2
	0.70		13.7	14.2	14.6	14.9	15.2	15.5
	1.00		15.6	16.2	16.7	17.0	17.3	17.7
	1.20		16.8	17.4	17.9	18.3	18.7	19.0
KVC 22	0.10		3.7	3.8	3.9	4.0	4.1	4.2
	0.15		5.1	5.2	5.4	5.5	5.6	5.7
	0.20		6.8	7.0	7.3	7.4	7.5	7.7
	0.30		8.4	8.6	8.9	9.1	9.3	9.5
	0.50		14.1	14.5	15.0	15.3	15.6	15.9
	0.70		17.6	18.1	18.7	19.1	19.5	19.9
	1.00		21.4	22.4	23.1	23.6	24.1	24.5
	1.20		23.8	24.6	25.4	25.9	26.4	26.9

Type	Offset Δp bar	Q [1] kW suction gas temperature t_s after pressure/temperature reduction °C						
		–45	–40	–30	–20	–10	0	+10
R 134a								
KVC 12	0.10			1.4	1.4	1.5	1.7	1.7
	0.15			2.1	2.3	2.4	2.5	2.6
	0.20			2.9	3.0	3.1	3.2	3.4
	0.30			3.7	3.9	4.1	4.3	4.5
	0.50			4.2	4.3	4.5	4.8	4.9
	0.70			4.4	4.5	4.8	5.0	5.2
	1.00			4.8	5.0	5.2	5.5	5.8
	1.20			5.1	5.4	5.6	5.8	6.1
KVC15	0.10			2.1	2.3	2.4	2.5	2.6
	0.15			2.9	3.0	3.1	3.2	3.4
	0.20			3.7	3.9	4.1	4.3	4.5
	0.30			5.1	5.4	5.6	5.8	6.1
	0.50			7.4	7.7	8.0	8.4	8.7
	0.70			8.7	9.1	9.4	9.9	10.2
	1.00			9.9	10.2	10.7	11.3	11.7
	1.20			10.6	11.1	11.6	12.2	12.6
KVC 22	0.10			2.3	2.4	2.5	2.6	2.8
	0.15			3.2	3.3	3.5	3.6	3.7
	0.20			4.3	4.4	4.6	4.9	5.1
	0.30			5.2	5.5	5.7	6.0	6.3
	0.50			8.9	9.3	9.7	10.1	10.5
	0.70			11.0	11.6	12.0	12.6	13.1
	1.00			13.7	14.3	14.9	15.6	16.3
	1.20			15.0	15.7	16.3	17.2	17.8

[1] The capacities are based on liquid temperature ahead of evaporator t_l = 25°C

Correction factors

When selecting, the required capacity is to be multiplied by a correction factor dependent on the liquid temperature. The corrected capacity can then be found from the table.

Correction factors for liquid temperature can be found in section "selection"

Replacement capacity *(continued)*

Type	Offset Δp bar	Q [1] kW suction gas temperature t_s after pressure/temperature reduction °C						
		–45	–40	–30	–20	–10	0	+10
R 404A / R 507								
KVC 12	0.10		1.9	2.0	2.1	2.2	2.3	2.4
	0.15		3.0	3.1	3.3	3.4	3.5	3.6
	0.20		3.9	4.1	4.2	4.5	4.7	4.7
	0.30		5.1	5.4	5.6	5.8	6.0	6.1
	0.50		5.7	6.0	6.4	6.6	6.8	7.0
	0.70		6.0	6.4	6.6	6.9	7.2	7.3
	1.00		6.6	6.9	7.2	7.5	7.8	8.0
	1.20		7.0	7.4	7.7	8.0	8.4	8.5
KVC15	0.10		3.0	3.1	3.3	3.4	3.5	3.6
	0.15		3.9	4.1	4.2	4.5	4.7	4.7
	0.20		5.1	5.4	5.6	5.8	6.0	6.1
	0.30		7.0	7.4	7.7	8.0	8.4	8.5
	0.50		10.1	10.6	11.1	11.6	12.0	12.3
	0.70		11.8	12.5	13.0	13.6	14.1	14.4
	1.00		13.5	14.2	14.8	15.5	16.1	16.4
	1.20		14.5	15.3	16.0	16.6	17.3	17.7
KVC 22	0.10		3.2	3.3	3.5	3.6	3.7	3.8
	0.15		4.3	4.6	4.8	5.0	5.2	5.3
	0.20		5.8	6.1	6.4	6.7	7.0	7.1
	0.30		8.2	8.6	8.9	9.3	9.8	9.9
	0.50		12.1	12.8	13.4	13.9	14.4	14.7
	0.70		15.2	16.0	16.6	17.4	18.1	18.4
	1.00		18.8	19.8	20.7	21.5	22.4	22.8
	1.20		20.5	21.6	22.6	23.5	24.5	25.0

Type	Offset Δp bar	Q [1] kW suction gas temperature t_s after pressure/temperature reduction °C						
		–45	–40	–30	–20	–10	0	+10
R 407C								
KVC 12	0.10		2.4	2.6	2.7	2.8	2.9	3.0
	0.15		3.7	3.9	4.0	4.2	4.3	4.6
	0.20		4.8	5.0	5.2	5.4	5.6	5.8
	0.30		6.3	6.5	6.9	7.0	7.2	7.6
	0.50		7.0	7.3	7.7	7.9	8.1	8.6
	0.70		7.4	7.7	8.1	8.4	8.7	9.0
	1.00		8.1	8.5	8.8	9.1	9.4	9.8
	1.20		8.7	9.1	9.5	9.8	10.1	10.6
KVC 15	0.10		3.7	3.9	4.0	4.2	4.3	4.6
	0.15		4.8	5.0	5.2	5.4	5.6	5.8
	0.20		6.3	6.5	6.9	7.0	7.2	7.6
	0.30		8.7	9.1	9.5	9.8	10.1	10.6
	0.50		12.4	12.9	13.5	14.0	14.4	15.0
	0.70		14.5	15.2	15.9	16.4	16.9	17.7
	1.00		16.5	17.3	18.2	18.7	19.2	20.2
	1.20		17.8	18.6	19.5	20.1	20.8	21.7
KVC 22	0.10		3.9	4.1	4.3	4.4	4.6	4.8
	0.15		5.4	5.6	5.9	6.1	6.2	6.5
	0.20		7.2	7.5	8.0	8.1	8.3	8.8
	0.30		8.9	9.2	9.7	10.0	10.3	10.8
	0.50		14.9	15.5	16.4	16.8	17.3	18.1
	0.70		18.7	19.4	20.4	21.0	21.6	22.7
	1.00		22.7	24.0	25.2	26.0	26.8	27.9
	1.20		25.2	26.3	27.7	28.5	29.3	30.7

[1] The capacities are based on liquid temperature ahead of evaporator t_l = 25°C

Correction factors

When selecting, the required capacity is to be multiplied by a correction factor dependent on the liquid temperature. The corrected capacity can then be found from the table.

Correction factors for liquid temperature can be found in section "selection"

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 °C/bar
- Compressor load in kW
- Evaporator load in kW
- Liquid temperature ahead of expansion valve t_l in °C
- 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
Minimum suction temperature t_s = –12°C ~ 0.9 bar
Compressor capacity at –12°C = 15.4 kW
Evaporator load at –12°C = 10.0 kW
Liquid temperature ahead of expansion valve: t_l = 35°C
Connection type: Solder
Connection size: $^5/_8$ in.

Step 1

Determine the correction factor for liquid temperature t_l.

From the correction factors table (see below) a liquid temperature of 35°C, R134a corresponds to a factor of 1.10.

Correction factors for condensing temperature t_l

t_l °C	10	15	20	25	30	35	40	45	50
R 134a	0.88	0.92	0.96	1.0	1.05	1.10	1.16	1.23	1.31
R 22	0.90	0.93	0.96	1.0	1.05	1.10	1.13	1.18	1.24
R 404A/ R 507	0.84	0.89	0.94	1.0	1.07	1.16	1.26	1.40	1.57
R 407C	0.88	0.91	0.95	1.0	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 =
15.4 – 10.0 / 1.10 = 4.9 kW

Step 3

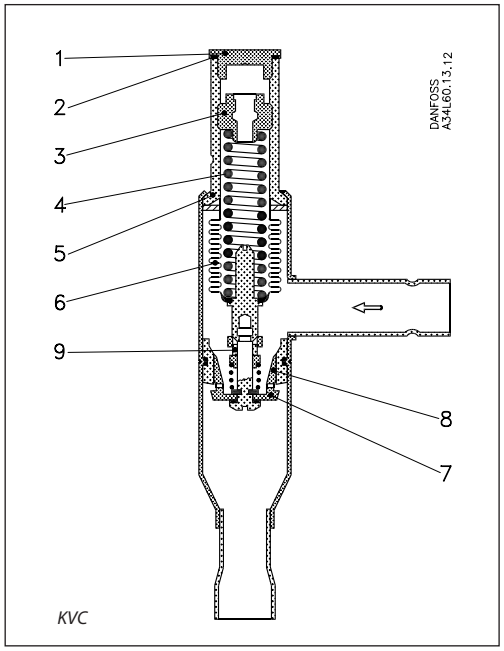
Now select the appropriate capacity table and choose the column for minimum suction temperature t_s = – 20°C.
Using the corrected replacement capacity, select a valve that provides an equivalent or greater capacity than required.

KVC 15 delivers 5.4 kW at an offset of 0.3 bar. 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. solder connection:
code no. 034L0147, see ordering list.

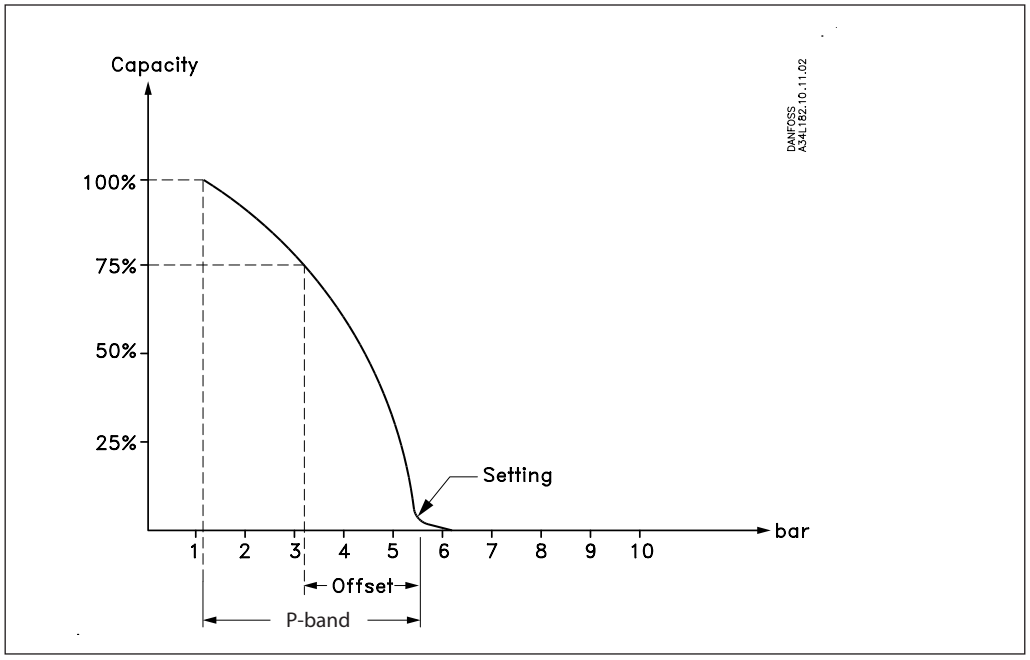
Design
Function



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

Capacity regulator KVC opens at a fall in pressure on the outlet side, i.e. when the pressure in the evaporator is beyond the set value. KVC regulates only in dependence on the outlet pressure. Pressure variations on the inlet side of the regulator do not affect the degree of opening since KVC is equipped with an equalization bellows (6). This bellows has an effective area corresponding to that of the valve seat.
The regulator is also equipped with an effective damping device (9) against pulsations which can normally arise in a refrigeration plant.
The damping device helps to ensure long life for the regulator without impairing regulation accuracy.

P-band and Offset



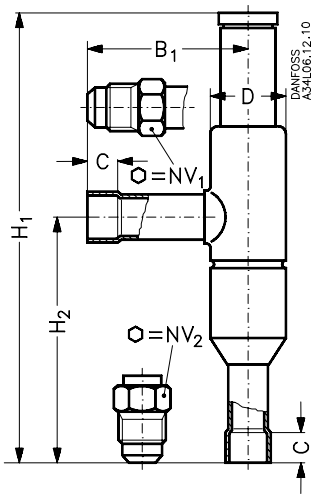
Proportional band
The proportional band or P-band is defined as the amount of pressure required to move the valve plate from closed to full open position.

Example: If the valve is set to open at 4 bar and the valve p-band is 2, the valve will give maximum capacity when the discharge pressure reaches 2 bar.

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 5°C ~ 6 bar is required, and the temperature must not drop below
0°C ~ 5 bar.
The offset will then be 1 bar.

Dimensions and weifgts



Type	Connection				NV_1	NV_2	H_1	H_2	B_1	C solder	dia. D	Weight
	Flare		Solder ODF									
	in.	mm	in.	mm	mm	mm	mm	mm	mm	mm	mm	kg
KVC 12	1/2	12	1/2	12	19	24	179	99	64	10	30	0.4
KVC 15	5/8	16	5/8	16	24	24	179	99	64	12	30	0.4
KVC 22			7/8	22			179	99	64	17	30	0.4