Data sheet



Electric regulating valve

KVS

Description

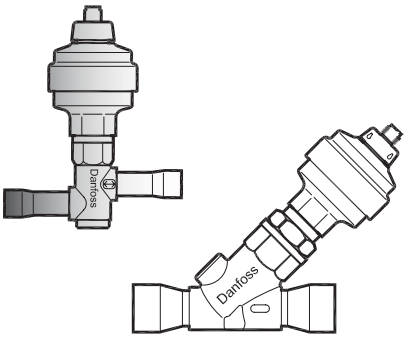
KVS is a series of electronic suction modulating valves for AC transport and refrigeration applications.
Accurate temperature or pressure control is obtained by modulating the refrigerant flow in the evaporator with a current or voltage driver.
With an EKC 368 controller (current driver) and an AKS sensor placed in the media to be controlled, an accuracy better than ± 0.5K can be obtained.
The balanced design provides bi–flow operation as well as solenoid shut-off function in both flow directions at MOPD 33 bar (478 psig).

Features & benefits

- Biflow
- High resolution for precise control
- Wide range for all common refrigerants R22, R134a, R404A, R407A, R407C, R407F, R422B, R422D, R438A, R448A, R449A, R450A, R452A, R507, R513A, R410A, R1234ze and other refrigerants
- Balanced port design (KVS 42)
- Solenoid tight shut-off
- Low power consumption
- Corrosion resistant design external as well as internal
- Cable and connector assemblies as accessories
- For manual operation and service of KVS valves an AST–g service driver is available, For further information please contact Danfoss (Commercial Refrigeration & Air Conditioning Controls)

Ordering

Product code numbers



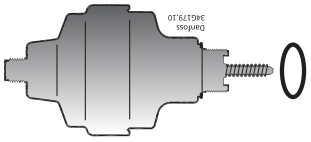
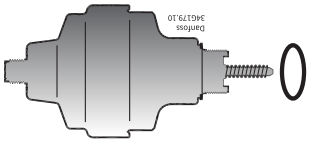
Product Type	Rated capacity R22 [kW]	Rated capacity R22 [TR]	Rated capacity R134a [kW]	Rated capacity R134a [TR]	Inlet size [mm]	Inlet size [in]	Code number
KVS 42	40.40	11.40	29.30	8.30	28.00	1 1/8 in	034G2850
KVS 42	40.40	11.40	29.30	8.30	35.00	1 3/8 in	034G2851
KVS 42	40.40	11.40	29.30	8.30		1 5/8 in	034G2852
KVS 42	40.40	11.40	29.30	8.30	22.00	7/8 in	034G2858
KVS 15	5.15	1.31	3.78	0.94		1/2 in	034G4251
KVS 15	5.15	1.31	3.78	0.94	16.00	5/8 in	034G4252
KVS 15	5.15	1.31	3.78	0.94	22.00	7/8 in	034G4253

Accessories code numbers

Cable	Cable length (L)	Insulation	Packing format	Code no.
PVC – black	2 m / 6.6 ft	SR–PVC	Single pack	034G7073
	8 m / 26.2 ft	SR–PVC	Single pack	034G7074

Spare parts code numbers

Actuator with integrated M12 connection

Items	Description	Quantity [pcs]	Code no.
	Actuator with integrated M12 with ceramic bearing (incl. metal gasket) for KVS 15	1	034G2088
	Actuator with integrated M12 with ceramic bearing (incl. metal gasket) for KVS 42	1	034G2087
	Metal gasket	1	034G2344

Overview

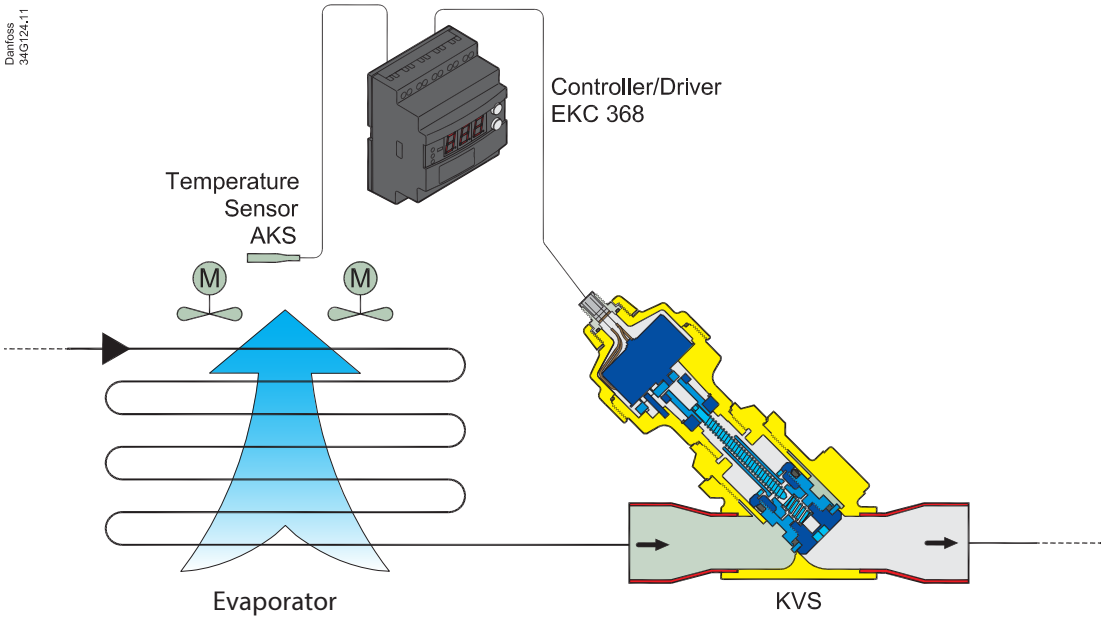
Product portfolio

Related products

			 Code no. 034G0013
EKD 316 driver	EKC 368 controller	AKS 11 / AKS 12 temperature sensor AKS pressure transmitter	AST-G service driver

Application examples

Valve application



Functions

Operation

The KVS valves operate modulating by electronically controlled activation of the AST stepper motor. The motor is a type 2-phase bipolar, which stays in position, unless power pulses from a driver initiate the two discrete sets of motor stator windings for rotation in either direction.

The direction of the rotation of the spindle depends on the phase relationship of the power pulses. This is decisive for the travel of the piston.

The motor is operating the spindle, whose rotating movements are transformed into linear motion by the transmission in the cage assembly. The AST motor housing has an integrated M12 connector.

The KVS 42 valves have a pressure slide port respectively exponential cone, combining the best performance qualities at part load conditions as well as providing a zero-resistance at maximum capacity.

The piston design is fully power balanced, giving identical bi-flow performance capabilities and nearby identical maximum capacities.

Closing the valve by overdriving, ensures that the reference number in steps is always correct.

Operating the KVS series requires a controller with either 12 V dc voltage drive (5.5 W) or using chopper drive (100 mA RMS).

Danfoss EKC 368 in an example of a qualified controller.

Note:

Cable length between driver and actuator exceeding 10 m (30 feet) can set off self-induction with reduction in the transmitted power and irregularity in the sequences as consequence.

This may result in loss of steps now and again or more permanent inadequate power supply to the step motor.

The driver circuit as well as the cable specifications are part of this interference.

Please contact Danfoss for further information and possible countermeasures.

Presettings

Valve sizing

For optimum performance, it is important to take into consideration all system conditions and requirements. Selection is also dependent on an acceptable pressure drop across the valve.
The following information will be needed when sizing a KVS valve:

- Refrigerant
- Evaporator capacity Q_e in kW or TR
- Evaporating temperature t_e in °C or °F
- Liquid temperature ahead of expansion valve t_l in °C or °F
- Max. acceptable pressure drop in the KVS valve in bar or psig
- Connection size

Correction factor table in SI units:

t_1 °C	10	15	20	25	30	35	40	45	50
R134a	0.88	0.92	0.96	**1.0**	1.05	1.10	1.16	1.23	1.31
R22	0.90	0.93	0.96	**1.0**	1.05	1.10	1.13	1.18	1.24
R404A / R507	0.84	0.89	0.94	**1.0**	1.07	1.16	1.26	1.40	1.57
R407C	0.88	0.91	0.95	**1.0**	1.05	1.11	1.18	1.26	1.35

Correction factor table in US units:

t_1 °F	50	60	70	80	90	100	110	120
R134a	0.79	0.82	0.86	0.90	0.95	**1.0**	1.06	1.13
R22	0.82	0.85	0.88	0.92	0.96	**1.0**	1.05	1.10
R404A / R507	0.71	0.75	0.80	0.85	0.92	**1.0**	1.10	1.24
R407C	0.78	0.81	0.85	0.89	0.94	**1.0**	1.07	1.15

Valve selection:

Example

In valve selection it may be necessary to apply a correction factor to the actual evaporator capacity. This correction is required when system conditions are different than table conditions. Selection also depends on having an acceptable pressure drop across the valve.
The following example illustrates correct sizing.

- Refrigerant: R 404A
- Evaporator capacity: Q_e = 20 kW / 5.7 TR
- Evaporating temperature: t_e = –10 °C ~ 3.4 bar / 14 °F ~ 49.3 psig
- Liquid temperature ahead of expansion valve: t_l = 25 °C / 77 °F
- Max. pressure drop in the valve Δp = 0.2 bar / 2.9 psig
- Connection type: Solder
- Connection size: 1⅛ in.

Step 1
Determine the correction factor for liquid temperature t l ahead of expansion valve.
From the correction factors table (see below) a liquid temperature of 25 °C / 100 °F, R404A corresponds to a factor of 1.0.
Correction factors for liquid temperature t_l

t_l °C	10	15	20	25	30	35	40	45	50
R134a	0.88	0.92	0.96	**1.0**	1.05	1.10	1.16	1.23	1.31
R22	0.90	0.93	0.96	**1.0**	1.05	1.10	1.13	1.18	1.24
R404A / R507	0.91	0.93	0.94	**1.0**	1.07	1.16	1.26	1.40	1.57
R407C	0.88	0.91	0.95	**1.0**	1.05	1.11	1.18	1.26	1.35

Step 2

Corrected evaporator capacity is Q_e = 20 ´ 1.0 = 20 kW / 5.7 ´ 1.0 = 5.7 TR

Step 3

Now select the appropriate capacity table, R404A, and choose the column for an evaporating temperature of t_e = –10 °C / 14 °F.

Using the corrected evaporator capacity, select a valve that provides an equivalent or greater capacity at an acceptable pressure drop across the valve of 0.2 bar / 2.9 psig.

KVS 42 delivers 33.32 kW / 9.5 TR at a 0.2 bar / 2.9 psig pressure drop across the valve.

Based on the required connection size of 1⅛ in, the KVS 42 is the proper selection for this example.

Rated Capacity (kW)

	t_e	Rated capacity [kW]											
		KVS 15						KVS 42					
		Pressure drop Δp [bar]						Pressure drop Δp [bar]					
	[°C]	0.05	0.1	0.2	0.3	0.5	0.7	0.05	0.1	0.2	0.3	0.5	0.7
R404A	10	3.30	4.65	6.52	7.93	10.1	11.7	25.5	36.0	50.5	61.4	78.1	91.0
	0	2.71	3.81	5.34	6.47	8.18	9.46	21.0	29.6	41.4	50.1	63.7	73.3
	-10	2.20	3.09	4.30	5.19	6.49	7.43	17.0	23.9	33.3	40.2	50.3	57.5
	-20	1.75	2.45	3.39	4.06	5.00	5.61	13.6	19.0	26.3	31.5	38.7	43.5
	-30	1.37	1.91	2.60	3.08	3.67	3.97	10.6	14.8	20.2	23.9	28.5	30.8
	-40	1.04	1.44	1.92	2.22	2.49	2.50	8.08	11.1	14.9	17.2	19.3	19.4

Step 4

KVS 42, 1⅛ in.:

Single pack code no. 034G2850

Product details

General data

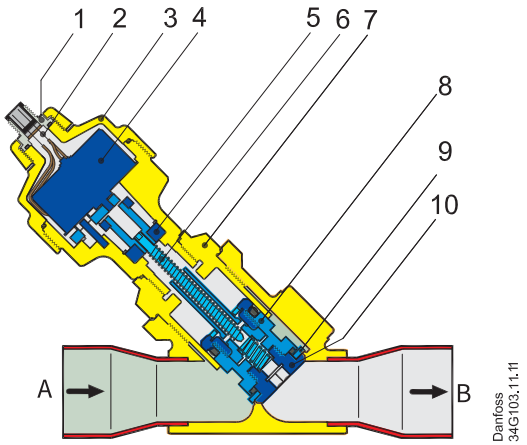
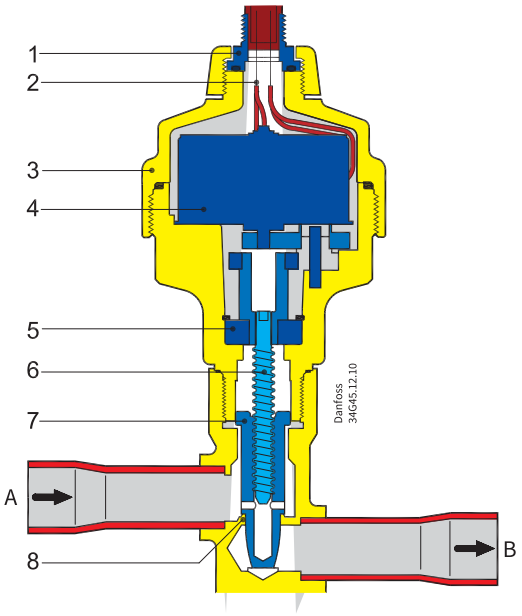
Technical Data

Parameter	KVS 15	KVS 42
Compatible refrigerants	R22, R134a, R404A, R407A, R407C, R407F, R422B, R422D, R438A, R448A, R449A, R450A, R452A, R507, R513A, R410A, R1234ze and other refrigerants	R22, R134a, R404A, R407A, R407C, R407F, R422B, R422D, R438A, R448A, R449A, R450A, R452A, R507, R513A, R410A, R1234ze and other refrigerants
Refrigerant oil	All mineral and ester oils	All mineral and ester oils
CE marking	No	Yes
MOPD	33 bar / 478.6 psig	33 bar / 478 psig
Max. working pressure	45.5 bar / 660 psig	34 bar / 493 psig
Inlet fluid temperature	-40 – 65 °C / -40 – 149 °F	-40 – 65 °C / -40 – 149 °F
Ambient temperature	-40 – 60 °C / -40 – 140 °F	-40 – 60 °C / -40 – 140 °F
Total stroke	13 mm / 0.5 inch	17.2 mm / 0.68 inch
Motor enclosure	IP 67	IP 67
Material of construction	Body and AST encloser: Brass connector: Copper	Body and AST encloser: Brass connector: Copper

Electrical Data

Parameter	KVS 15 and KVS 42
Stepper motor type	Bi-polar - permanent magnet
Step mode	2 phase full step
Phase resistance	52 Ω ±10%
Phase inductance	85 mH
Holding current	Constant voltage drive: Depends on application. Chopper drive: full current allowed (100% duty cycle)
Step angle	7.5° (motor), 0.9° (lead screw), Gearing ration 8.5:1. (38/13)2:1
Nominal voltage	Constant voltage drive: 12 V DC -4% – 15%, 150 steps/sec.
Phase current	(Using chopper drive) 100 mA RMS -4% +15%,
Max. total power	Voltage / current drive: 5.5 / 1.3 W (UL: NEC class 2)
Step rate	Constant voltage drive: 150 steps/sec. Chopper current drive: 0 – 300 steps/sec. 300 recommended
Total steps	KVS 15: 2625 [+160 / -0] steps KVS 42: 3810 [+160 / -0] steps
Full travel time	KVS 15: 17 / 8.5 sec. (voltage / current) KVS 42: 25.4 / 12.7 sec. (voltage / current)
Lifting height	KVS 15: 13 mm / 0.5 inch KVS 42: 17.2 mm / 0.68 in
Reference position	Overdriving against the full close position
Electrical connection	M12 connector
Compatible controller / driver	EKC 368 / EKD 316 or EKD 316C

Design

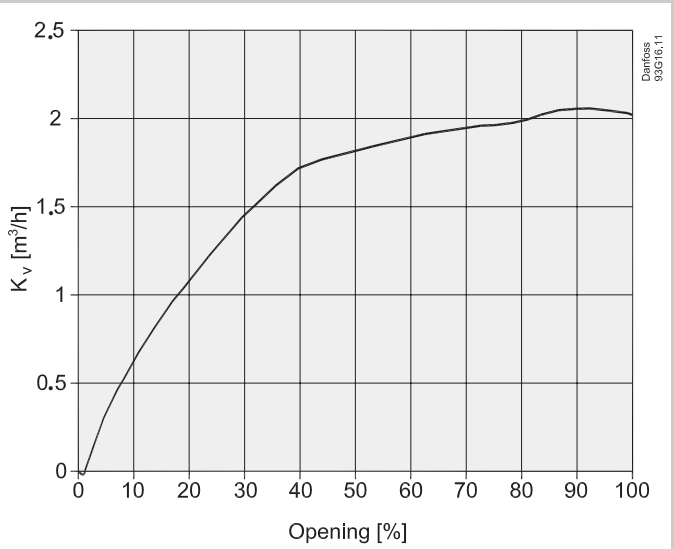
Product Type	Image	Legends
KVS 42		1. M12 Connector 2. Glass seal 3. AST motor housing 4. Stepper motor 5. Bearing 6. Spindle 7. Top nut 8. Valve piston 9. Valve seat 10. Valve cone
KVS 15		1. M12 connection 2. Glass seal 3. AST motor housing 4. Stepper motor 5. Bearing 6. Spindle 7. Cone and lead nut 8. Valve seat

Note:
Flow direction from A to B refers the normal flow.

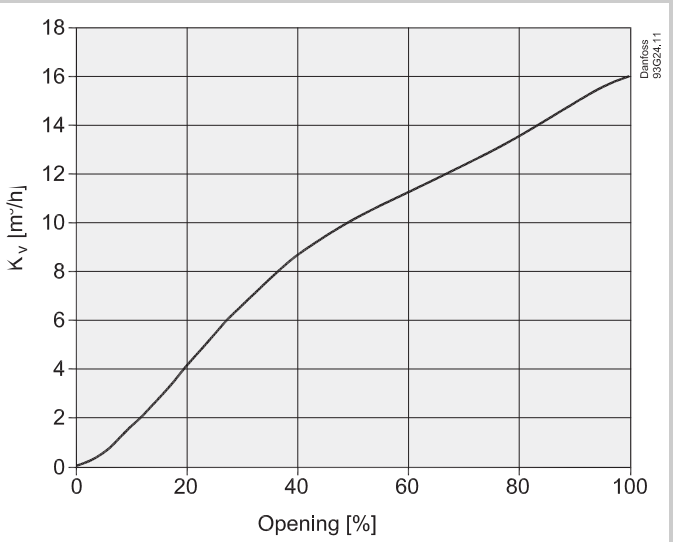
Capacity

Flow curves

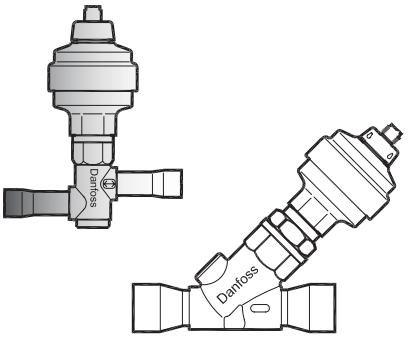
KVS 15 Capacity Curve



KVS 42 Capacity Curve



Rated Capacity (kW) SI Units:



	t_e [°C]	KVS15						KVS 42					
		Pressure drop Δp [bar]						Pressure drop Δp [bar]					
		0.05	0.1	0.2	0.3	0.5	0.7	0.05	0.1	0.2	0.3	0.5	0.7
R134a	10	2.94	4.12	5.73	6.91	8.62	9.84	22.75	31.92	44.43	53.54	66.82	76.28
	0	2.38	3.33	4.60	5.50	6.75	7.56	18.46	25.81	35.67	42.65	52.32	58.56
	-10	1.90	2.64	3.61	4.26	5.07	5.46	14.72	20.47	27.96	33.00	39.27	42.29
	-20	1.48	2.05	2.74	3.15	3.52	**3.55**[1])	11.50	15.85	21.20	24.42	27.30	**27.47**[1])
R404A	10	3.30	4.65	6.52	7.93	10.08	11.74	25.54	35.99	50.53	61.43	78.11	91.00
	0	2.71	3.81	5.34	6.47	8.18	9.46	21.01	29.56	41.37	50.14	63.35	73.30
	-10	2.20	3.09	4.30	5.19	6.49	7.43	17.03	23.91	33.32	40.20	50.28	57.54
	-20	1.75	2.45	3.39	4.06	5.00	5.61	13.58	19.00	26.29	31.47	38.72	43.47
	-30	1.37	1.91	2.60	3.08	3.67	3.97	10.61	14.76	20.18	23.85	28.47	30.78
	-40	1.04	1.44	1.92	2.22	2.49	**2.50**[1])	8.08	11.14	14.91	17.20	19.26	**19.39**[1])
R407C	10	3.58	5.04	7.06	8.56	10.84	12.57	27.73	39.04	54.69	66.34	83.98	97.37
	0	2.94	4.14	5.77	6.97	8.74	10.03	22.81	32.05	44.71	54.01	67.74	77.75
	-10	2.39	3.34	4.63	5.55	6.86	7.74	18.48	25.88	35.87	43.03	53.14	59.94
	-20	1.90	2.64	3.62	4.29	5.16	5.62	14.70	20.48	28.07	33.26	39.96	43.56
R22	10	3.74	5.26	7.38	8.96	11.36	13.19	28.95	40.76	57.16	69.40	88.01	102.22
	0	3.14	4.41	6.16	7.45	9.38	10.80	24.30	34.16	47.73	57.74	72.66	83.70
	-10	2.60	3.64	5.06	6.09	7.57	8.60	20.12	28.21	39.21	47.17	58.63	66.60
	-20	2.12	2.96	4.07	4.85	5.90	6.54	16.40	22.90	31.55	37.59	45.75	50.67
	-30	1.69	2.35	3.18	3.73	4.36	4.57	13.10	18.18	24.68	28.92	33.79	35.44
	-40	1.32	1.81	2.39	2.71	**2.89**[1])	**x**[1])	10.23	14.02	18.52	20.99	**22.37**[1])	**x**[1])

* The valves in the capacity table refer to the evaporator capacity and based on liquid temperature t_l = 30 °C, superheat= sub cooling = 0 K.

* The conditions printed are the most common for the different refrigerants.

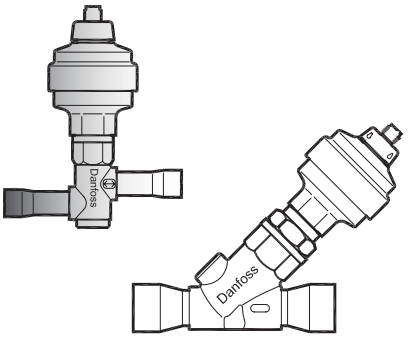
Other conditions can be calculated with Danfoss calculation software CoolSelector®

* The pressure drop across the valve is assumed to be the difference between evaporation pressure and suction pressure.

[1]) The capacity of vapor flow will not increase for pressure drops above the critical pressure drop.

Rated Capacity (TR) US Units:

(TR) = ton of refrigerants



	t_e [°F]	KVS15						KVS 42					
		Pressure drop Δp [psi]						Pressure drop Δp [psi]					
		0.7	1.5	3	5	7	10	0.7	1.5	3	5	7	10
R134a	50	0.86	1.25	1.73	2.19	2.53	2.91	6.65	9.66	13.44	16.96	19.60	22.58
	30	0.68	0.98	1.36	1.69	1.93	2.17	5.28	7.63	10.53	13.12	14.96	16.83
	10	0.53	0.76	1.03	1.26	1.40	1.49	4.10	5.88	7.99	9.74	10.82	11.58
	-5	0.43	0.61	0.82	0.96	1.03	**1.03**[1])	3.34	4.74	6.32	7.46	7.95	**8.01**[1])
R404A	50	0.98	1.43	2.00	2.56	3.00	3.53	7.59	11.06	15.53	19.84	23.23	27.33
	30	0.79	1.15	1.61	2.04	2.38	2.78	6.12	8.90	12.45	15.83	18.45	21.52
	10	0.63	0.91	1.26	1.59	1.84	2.12	4.85	7.03	9.78	12.34	14.26	16.41
	-5	0.52	0.75	1.04	1.29	1.48	1.67	4.01	5.81	8.02	10.03	11.47	12.97
	-20	0.42	0.61	0.83	1.03	1.15	1.26	3.28	4.72	6.46	7.95	8.94	9.80
	-40	0.32	0.45	0.60	0.71	0.76	**0.77**[1])	2.44	3.47	4.64	5.50	5.89	**5.95**[1])
R407C	50	1.05	1.53	2.14	2.72	3.18	3.72	8.12	11.82	16.55	21.09	24.62	28.81
	30	0.84	1.23	1.71	2.16	2.50	2.90	6.54	9.50	13.24	16.75	19.40	22.44
	10	0.67	0.96	1.33	1.67	1.91	2.16	5.17	7.47	10.33	12.91	14.77	16.71
	-5	0.55	0.79	1.08	1.33	1.50	1.64	4.26	6.14	8.40	10.34	11.62	12.73
R22	50	1.08	1.58	2.21	2.82	3.30	3.87	8.40	12.24	17.16	21.88	25.58	29.99
	30	0.89	1.30	1.81	2.30	2.67	3.10	6.92	10.06	14.04	17.80	20.68	24.01
	10	0.72	1.05	1.45	1.82	2.10	2.39	5.60	8.11	11.25	14.13	16.24	18.54
	-5	0.61	0.88	1.21	1.50	1.70	1.90	4.72	6.81	9.36	11.62	13.18	14.69
	-20	0.51	0.73	0.99	1.20	1.33	1.42	3.92	5.62	7.64	9.30	10.31	10.99
	-40	0.39	0.54	0.72	0.83	**0.86**[1])	**x**[1])	2.98	4.22	5.56	6.43	**6.64**[1])	**x**[1])

* The valves in the capacity table refer to the evaporator capacity and based on liquid temperature t_l = 86 °F, superheat= sub cooling = 0 K.

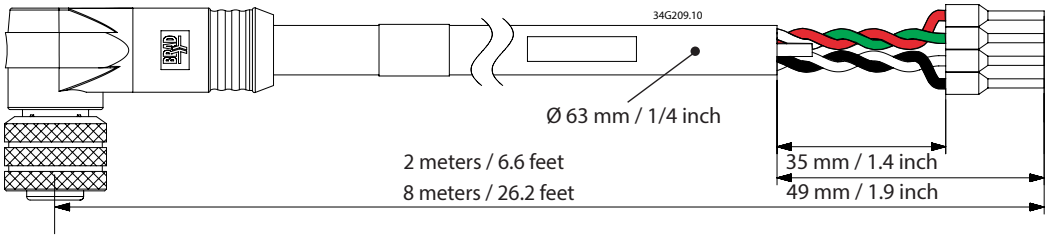
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Other conditions can be calculated with Danfoss calculation software CoolSelector®

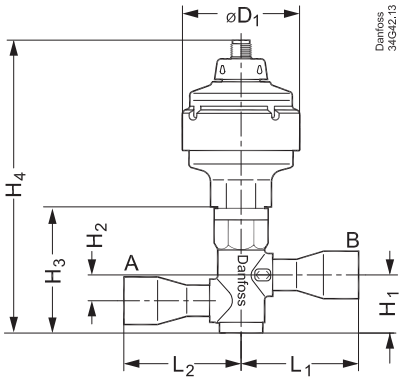
* The pressure drop across the valve is assumed to be the difference between evaporation pressure and suction pressure.

[1]) The capacity of vapor flow will not increase for pressure drops above the critical pressure drop.

Dimensions

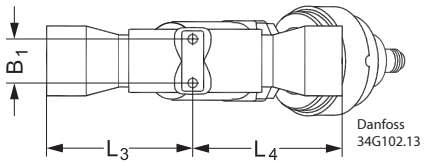


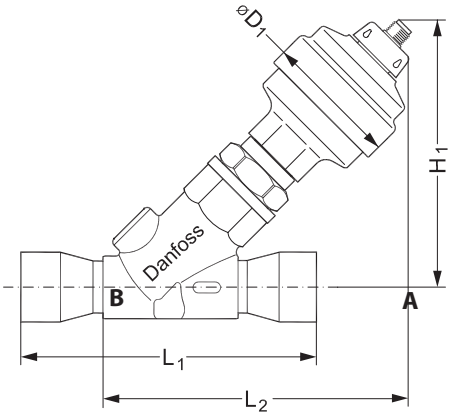
KVS 15



Type	Connections		H1		H2		H3		H4		L1		L2		øD1		Weight	
	ODF x ODF (A x B)		[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[kg]	[lb.]
	[in]	[mm]																
KVS 15	⅝ × ⅝	16 × 16	1.2	30	0.5	13	2.5	64	5.9	159	2.4	60	2.4	60	2.4	60	0.7	1.5
	⅞ × ⅞	22 × 22																

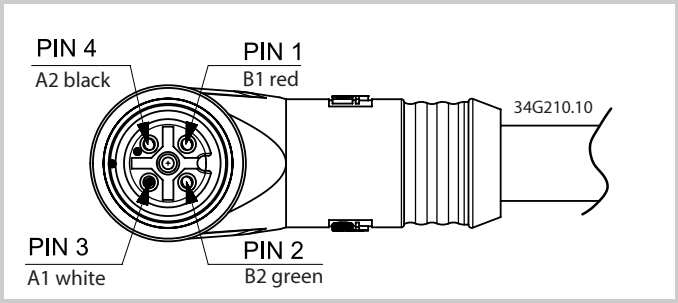
KVS 42

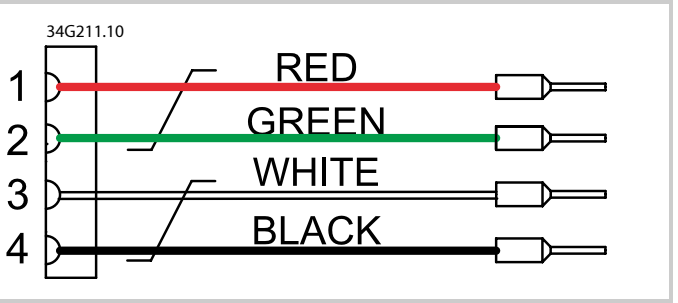




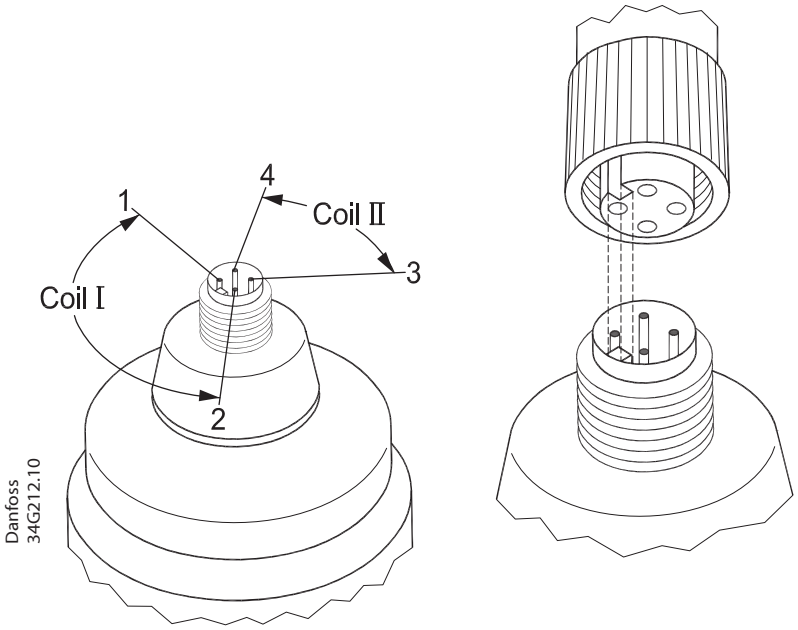
Type	Connections		H1		L1		L2		L3		L4		øD1		B1		Weight	
	ODF x ODF (A x B)		[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[kg]	[lb.]
	[in]	[mm]																
KVS 42	⅞ × ⅞	22 × 22	4.8	120	7.4	188.5	5.6	143	3.7	93	3.8	95.5	2.4	60	0.95	24	1.9	4.2
	1 ⅛ × 1 ⅛	28 × 28	4.8	120	6.7	168.5	5.6	143.0	3.3	83.0	3.4	85.5	2.4	60	0.95	24	1.9	4.2
	1 ⅜ × 1 ⅜	35 × 35	4.8	120	7.0	178.5	5.6	143.0	3.5	88.0	3.6	90.5	2.4	60	0.95	24	1.9	4.2
	1 ⅝ × 1 ⅝	–	4.8	120	7.4	188.5	5.6	143.0	3.7	93.0	3.8	95.5	2.4	60	0.95	24	1.9	4.2

Connections





Electrical wiring



Note:
Electrical check of stepper motor and wiring: coil I = 52 ohm & coil II = 52 ohm

Stepper motor switch sequence

If the controller driving the KVS valve is from another manufacturer than Danfoss or a custom design, the following points must be considered in order to overcome potential step loss.

a. To ensure total closing of the valve, the con- troller should have a function to overdrive the valve in the closing direction. It is recommended to overdrive ten percent of the full step range at appropriate intervals.

b. The amount of lost steps may increase as a function of the amount of changes of the opening degree. Such designed controller should be able to compensate the lost steps after a defined number of changes in opening degree.

Warning:
At power failure the KVS valve will remain in the opening position it has at the moment of power failure, unless a safety device in the form of a battery backup is installed.

	STEP	Coil I		Coil II		
		Red	Green	White	Black	
CLOSING	1	+	-	+	-	OPENING
	2	+	-	-	+	
	3	-	+	-	+	
	4	-	+	+	-	
	1	+	-	+	-	

Accessories

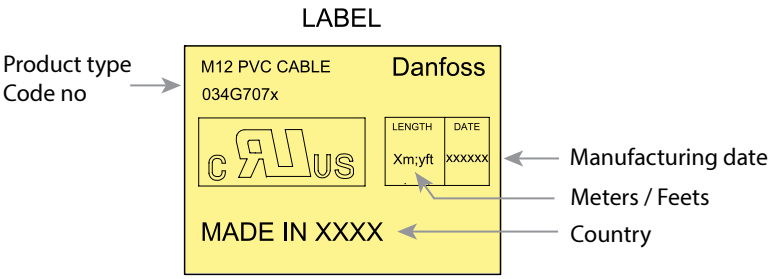
M12 angle cable

M12 angle female connector is intended for use with a standard M12 male connector, available on stepper motor valves.
This cable is designed to offer high flexibility and small outer diameters with tensile strength.
The angle way M12 cable consist of paired, twisted wires, which decreases mutual influence between signals transmitted along the cable and reduces influence of external sources of interference. The cables thus provide a higher degree of protection against lost steps compared to other cables.

Table: Specification

Jacket	PVC – black
Cable outer sheath	Oil – resistant
Waterproof rating	IP 67
Operating temperature ran	-40 – 80 °C
Wire type	Twisted pair, cross section 20 AWG / 0.5 mm2
Cable outer diameter	7.0 mm
Minimum bending radius	10 x cable diameter
Cable combustibility / test	Flame retardant / VW–1 / CSA FT – 1
M12 standard	EN 61076–2–101
Reference standard	UL style 2464 and DIN VDE 0812
LVD directive	73/23/EEC and 93/68/EEC

Identification



Certificates, declarations and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

When you click on the link you will be directed to the latest version of the 'Declaration of Conformity'. Products developed and sold before this date of issue conform to the directives/standards in force at the time of their sale.

Approval type	Title	Certification body	Approval topic
Export Control Declaration	Pressure and Temperature regulating valves	Danfoss	
UA Declaration	Danfoss UA 8481	Danfoss	UA RoHS
Pressure Safety Certificate	LLC CDC EURO-TYSK UA.TR.089.1015.02-22	LLC CDC EURO TYSK - Ukraine	PED, Pressure
UA Declaration	Danfoss UA 2023-01-10 Valves PL01 PL40	Danfoss	PED, Pressure
Manufacturer's Declaration	Danfoss MD-UK 034R9822.05	Danfoss	PED, Pressure, EU RoHS
EU-UK Declaration	Danfoss EU-UK 034R9821.05	Danfoss	EMC, PED, Pressure

Contact details

Online support

Danfoss offers a wide range of support along with our products, including digital information, software, mobile apps and expert guidance. See the possibilities below.

The Danfoss Design center

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