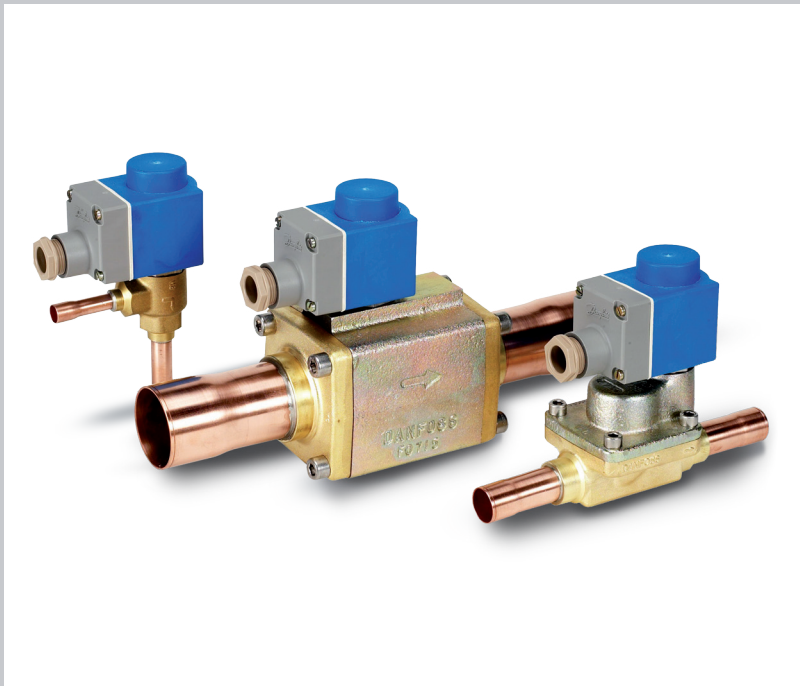


Data sheet

# Electrically Operated Expansion Valve

## Types AKV 10, AKV 15 and AKV 20



AKV are electrically operated expansion valves designed for refrigerating plants.

The AKV valves are normally controlled by a controller from Danfoss' range of ADAP- KOOL® controllers.

The AKV valves are supplied as a component programme, as follows:

- Separate valve
- Separate coil with terminal box or cable
- Spare parts in the form upper part, orifice and filter

Valve capacity is indicated with a number forming part of the type designation. The number represents the size of the orifice of the valve in question. A valve with orifice 3 will for example be designated AKV 10-3. The orifice assembly is replaceable.

**Features**

- Refrigerants: R744, R22/R407C, R404A/R507, R410A, R134a, R407A, R23. For other refrigerants, please contact Danfoss
- The valve requires no adjustment
- Wide regulation range
- Replaceable orifice assembly
- Both expansion valve and solenoid valve
- Wide range of a.c. and d.c. coils

**Approvals**

DEMKO, Denmark  
SETI, Finland  
SEV, Switzerland

UL listed (separate code nos)  
CSA certified (separate code nos)  
Low Voltage Directive (LVD) 2006/95/EC

Technical data

Valve type	AKV 10	AKV 15	AKV 20
Tolerance of coil voltage	10 / - 15%	10 / - 15%	10 / - 15%
Enclosure to IEC 529	Max. IP67	Max. IP67	Max. IP67
Working principle	Pulse Width Modulation (PWM)		
Recommended period of time	6 s.	6 s.	6 s.
Capacity (R404A/R507)	0.6 – 14 kW	14 – 85 kW	56 – 530 kW
Regulation range (Capacity range)	10 – 100%	10 – 100%	10 – 100%
Connection	Solder	Solder	Solder or weld
Evaporating temperature	-50 – 60 °C	-50 – 60 °C	-40 – 60 °C
Ambient temperature	-50 – 50 °C	-40 – 50 °C	-40 – 50 °C
Leak of valve seat	< 0.02% of $k_v$ -value	< 0.02% of $k_v$ -value	< 0.02% of $k_v$ -value
MOPD (Max. Opening Pressure Differential)	18 bar	22 bar	18 bar
Filter, replaceable	Internal 100 µm	External 100 µm	External 100 µm
Max. working pressure	AKV 10-1 – 10-6, PS=52 barg	AKV 15-1 – 15-3, PS 42 barg	MWP 28 barg
	AKV 10-7, PS=42 barg	AKV 15-4, PS 28 barg	

Rated capacity and ordering

Valve type	Rated capacity [kW] <sup>1)</sup>			$k_v$ value [m <sup>3</sup> /h]	Connections Solder ODF			
	R22/R407C	R134a	R404A/R507		Inlet × outlet [in.]	Code no.	Inlet × outlet [mm]	Code no.
<b>AKV 10</b>								
AKV 10-1	1.0	0.9	0.8	0.010	$\frac{3}{8} \times \frac{1}{2}$	068F1161	10 × 12	068F1162
AKV 10-2	1.6	1.4	1.3	0.017	$\frac{3}{8} \times \frac{1}{2}$	068F1164	10 × 12	068F1165
AKV 10-3	2.6	2.1	2.0	0.025	$\frac{3}{8} \times \frac{1}{2}$	068F1167	10 × 12	068F1168
AKV 10-4	4.1	3.4	3.1	0.046	$\frac{3}{8} \times \frac{1}{2}$	068F1170	10 × 12	068F1171
AKV 10-5	6.4	5.3	4.9	0.064	$\frac{3}{8} \times \frac{1}{2}$	068F1173	10 × 12	068F1174
AKV 10-6	10.2	8.5	7.8	0.114	$\frac{3}{8} \times \frac{1}{2}$	068F1176	10 × 12	068F1177
AKV 10-7	16.3	13.5	12.5	0.162	$\frac{1}{2} \times \frac{5}{8}$	068F1179	12 × 16	068F1180
<b>AKV 15</b>								
AKV 15-1	25.5	21.2	19.6	0.250	$\frac{3}{4} \times \frac{3}{4}$	068F5000	18 × 18	068F5001
AKV 15-2	40.8	33.8	31.4	0.400	$\frac{3}{4} \times \frac{3}{4}$	068F5005	18 × 18	068F5006
AKV 15-3	64.3	53.3	49.4	0.630	$\frac{7}{8} \times \frac{7}{8}$	068F5010	22 × 22	068F5010
AKV 15-4	102.0	84.6	78.3	1.000	$1 \frac{1}{8} \times 1 \frac{1}{8}$	068F5015	28 × 28	068F5016

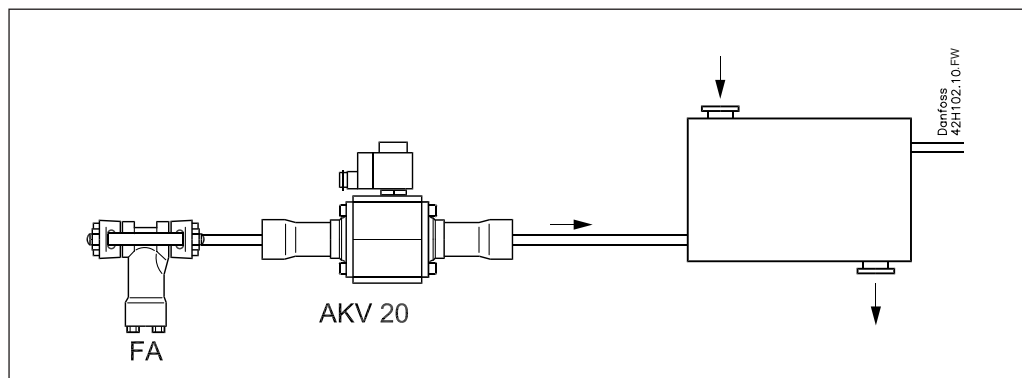
<sup>1)</sup> Rated capacities are based on:  
 Condensing temperature  $t_c = 32\text{ °C}$   
 Liquid temperature  $t_l = 28\text{ °C}$   
 Evaporating temperature  $t_e = 5\text{ °C}$

**Rated capacity and ordering**  
(continued)

Valve type	Rated capacity [kW] <sup>1)</sup>			k <sub>v</sub> value [m <sup>3</sup> /h]	Connections					
	R22/ R407C	R134a	R404A/ R507		Solder ODF			Weld		
					Inlet × outlet [in.]	Code no.	Inlet × outlet [mm]	Code no.	Inlet × outlet [in.]	Code no.
<b>AKV 20</b>										
AKV 20-1	102	84.6	78.3	1.0	1 3/8 × 1 3/8	042H2020	35 × 35	042H2020	1 1/4 × 1 1/4	042H2021
AKV 20-2	163	135	125	1.6	1 3/8 × 1 3/8	042H2022	35 × 35	042H2022	1 1/4 × 1 1/4	042H2023
AKV 20-3	255	212	196	2.5	1 5/8 × 1 5/8	042H2024	42 × 42	042H2025	1 1/4 × 1 1/4	042H2026
AKV 20-4	408	338	314	4.0	2 1/8 × 2 1/8	042H2027	54 × 54	042H2027	1 1/2 × 1 1/2	042H2028
AKV 20-5	643	533	494	6.3	2 1/8 × 2 1/8	042H2029	54 × 54	042H2029	2 × 2	042H2030

<sup>1)</sup> Rated capacities are based on:  
 Condensing temperature t<sub>c</sub> = 32 °C  
 Liquid temperature t<sub>l</sub> = 28 °C  
 Evaporating temperature t<sub>e</sub> = 5 °C

**Filter**



On plants using AKV 15 or AKV 20 a filter must be mounted in front of AKV 15 and AKV 20.

AKV 10 has built-in filter and external filter is not necessary.

Spare parts

AKV 10		
Orifice		
Orifice no.	Code no.	Contents
0	<b>068F5283</b>	4 pcs. orifices 4 pcs. gaskets
1		
2		
3		
4	<b>068F5284</b>	3 pcs. orifices 3 pcs. gaskets
5		
6		
7	<b>068F5285</b>	2 pcs. orifices 2 pcs. gaskets
8		
	Filter:	<b>Code no. 068F0540</b>
	Contents:	10 pcs. filters 10 pcs. Al gaskets
	Upper part:	<b>Code no. 068F0541</b>
	Contents:	1 pcs. armature ass. 1 pcs. armature tube 1 pcs. Al gasket

AKV 15		
Piston		
Type	Code no.	Contents
AKV 15-1	<b>068F5265</b>	1 pcs. piston assembly 1 pcs. gasket 1 pcs. o-ring 2 pcs. labels
AKV 15-2	<b>068F5266</b>	
AKV 15-3	<b>068F5267</b>	
AKV 15-4	<b>068F5268</b>	
	Filter:	<b>Code no. 068F0540</b>
	Contents:	10 pcs. filters 10 pcs. Al gaskets
	Upper part:	<b>Code no. 068F5045</b>
	Contents:	1 pcs. armature ass. 1 pcs. armature tube 1 pcs. Al gasket
	Gasket set:	<b>Code no. 068F5264</b>
	Contents:	30 pcs. o-rings 10 pcs. Cu. gaskets 10 pcs. gaskets

AKV 20		
Piston		
Type	Code no.	Contents
AKV20-0.6	<b>042H2039</b>	1 pcs. piston assembly 3 pcs. o-rings
AKV 20-1	<b>042H2040</b>	
AKV 20-2	<b>042H2041</b>	
AKV 20-3	<b>042H2042</b>	
AKV 20-4	<b>042H2043</b>	
AKV 20-5	<b>042H2044</b>	
Orifice set		
Type	Code no.	Contents
AKV20-0.6	<b>068F5270</b>	1 pcs. main orifice, dia. 8 mm 1 pcs. pilot orifice, dia. 1.8 mm 2 pcs. Al gaskets 1 pcs. o-ring
AKV 20-1	<b>068F5270</b>	
AKV 20-2	<b>068F5270</b>	
AKV 20-3	<b>068F5270</b>	
AKV 20-4	<b>068F5271</b>	
AKV 20-5	<b>068F5271</b>	1 pcs. main orifice, dia. 14 mm 1 pcs. pilot orifice, dia. 24 mm 2 pcs. Al gaskets 1 pcs. o-ring
	Gasket set:	<b>Code no. 042H0160</b>
	Contents:	Complete gasket set for new and old valves
	Upper part:	<b>Code no. 068F5045</b>
	Contents:	1 pcs. armature ass. 1 pcs. armature tube 1 pcs. Al gasket

Ordering

Coils for AKV valves

d.c. coils		Code no.	AKV	AKV	AKV	AKV	AKV	AKV
			10-1 10-2 10-3 10-4 10-5	10-6	10-7	15-1 15-2 15-3 15-4	20-1 20-2 20-3	20-4 20-5
220 V d.c. 20 W standard	with terminal box	<b>018F6851</b>	+	+	+	+	+	+
100 V d.c. 18 W, special	with terminal box	<b>018F6780</b>	+	+	+	+	+	+
	with DIN plugs	—						
230 V d.c. 18 W, special	with terminal box	<b>018F6781</b> <sup>1)</sup>	+	+	+	+	+	+
	with DIN plugs	<b>018F6991</b> <sup>1)</sup>						
230 V d.c. 18 W, special	with 2.5 m cable	<b>018F6288</b> <sup>1)</sup>						
	with 4.0 m cable	<b>018F6278</b> <sup>1)</sup>	+	+	+	+	+	+
	with 8.0 m cable	<b>018F6279</b> <sup>1)</sup>						

<sup>1)</sup> Recommended for commercial refrigeration plant.

a.c. coils		Code no.	AKV	AKV	AKV	AKV	AKV	AKV
240 V a.c. 10 W, 50 Hz	with terminal box	<b>018F6702</b>	+	+	-	+	-	-
	with DIN plugs	<b>018F6177</b>						
240 V a.c. 10 W, 60 Hz	with terminal box	<b>018F6713</b>	+	+	-	+	-	-
	with DIN plugs	—						
240 V a.c. 12 W, 50 Hz	with terminal box	<b>018F6802</b>	+	+	+	+	+	-
230 V a.c. 10 W, 50 Hz	with terminal box	<b>018F6701</b>	+	+	-	+	-	-
	with DIN-plugs	<b>018F6176</b>						
230 V a.c. 10 W, 60 Hz	with terminal box	<b>018F6714</b>	+	+	-	+	-	-
	with DIN-plugs	<b>018F6189</b>						
230 V a.c. 10 W, 50/60 Hz	with terminal box	<b>018F6732</b>	+	+	-	+	-	-
	with DIN-plugs	<b>018F6193</b>						
230 V a.c. 12 W, 50 Hz	with terminal box	<b>018F6801</b>	+	+	-	+	+	-
230 V a.c. 12 W, 60 Hz	with terminal box	<b>018F6814</b>	+	+	-	+	+	-
230 V a.c. 20 W, 50 Hz	with terminal box	<b>018F6905</b> <sup>2)</sup>	+	+	+	+	+	+
115 V a.c. 10 W, 50 Hz	with terminal box	<b>018F6711</b>	+	+	-	+	-	-
	with DIN-plugs	—						
115 V a.c. 10 W, 60 Hz	with terminal box	<b>018F6710</b>	+	+	-	+	-	-
	with DIN-plugs	<b>018F6185</b>						
110 V a.c. 12 W, 50 Hz	with terminal box	<b>018F6811</b>	+	+	-	+	+	-
110 V a.c. 12 W, 60 Hz	with terminal box	<b>018F6813</b>	+	+	-	+	+	-
110 V a.c. 20 W, 50 Hz	with terminal box	<b>018Z6904</b>	+	+	+	+	+	+
24 V a.c. 10 W, 50 Hz	with terminal box	<b>018F6707</b>	+	-	-	+	-	-
	with DIN-plugs	<b>018F6182</b>						
24 V a.c. 10 W, 60 Hz	with terminal box	<b>018F6715</b>	-	-	-	+	-	-
	with DIN-plugs	—						
24 V a.c. 12 W, 50 Hz	with terminal box	<b>018F6807</b>	+	-	-	+	+	+
24 V a.c. 12 W, 60 Hz	with terminal box	<b>018F6815</b>	+	-	-	+	+	+
24 V a.c. 20 W, 50 Hz	with terminal box	<b>018F6901</b> <sup>2)</sup>	+	+	+	+	+	+
24 V a.c. 20 W, 60 Hz	with terminal box	<b>018F6902</b> <sup>2)</sup>	+	+	+	+	+	+

<sup>2)</sup> 20 W coils can not be connected to AKC 24P2 and AKC 24W2

Capacity

Valve type	Capacity in [kW] at pressure drop across valve $\Delta p$ [bar]								
	2	4	6	8	10	12	14	16	18
<b>R22/R407C</b>									
AKV 10-1	0.7	0.9	1.0	1.1	1.2	1.2	1.2	1.2	1.2
AKV 10-2	1.1	1.4	1.6	1.8	1.8	1.9	1.9	2.0	1.9
AKV 10-3	1.8	2.3	2.6	2.8	2.9	3.0	3.0	3.0	3.1
AKV 10-4	2.8	3.6	4.1	4.4	4.6	4.7	4.8	4.9	4.9
AKV 10-5	4.4	5.7	6.4	6.9	7.2	7.5	7.6	7.7	7.7
AKV 10-6	7.0	9.0	10.2	11.0	11.5	11.8	12.1	12.2	12.3
AKV 10-7	11.2	14.4	16.3	17.6	18.4	18.9	19.3	19.5	19.3
AKV 15-1	17.5	22.5	25.5	27.5	28.7	29.6	30.1	30.4	30.6
AKV 15-2	28.0	36.0	40.8	44.0	45.9	47.4	48.2	48.7	49.0
AKV 15-3	44.0	56.6	64.3	69.2	72.3	74.6	75.9	76.7	77.2
AKV 15-4	69.9	89.9	102.0	110.0	115.0	118.0	121.0	122.0	123.0
AKV 20-1	69.9	89.9	102.0	110.0	115.0	118.0	121.0	122.0	123.0
AKV 20-2	112.0	144.0	163.0	176.0	184.0	189.0	193.0	195.0	193.0
AKV 20-3	175.0	225.0	255.0	275.0	287.0	296.0	301.0	304.0	306.0
AKV 20-4	280.0	360.0	408.0	440.0	459.0	474.0	482.0	487.0	490.0
AKV 20-5	440.0	566.0	643.0	692.0	723.0	746.0	759.0	767.0	772.0
<b>R134a</b>									
AKV 10-1	0.6	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
AKV 10-2	0.9	1.2	1.4	1.4	1.5	1.5	1.5	1.5	1.4
AKV 10-3	1.5	1.9	2.1	2.3	2.3	2.4	2.4	2.3	2.3
AKV 10-4	2.4	3.0	3.4	3.6	3.7	3.8	3.8	3.7	3.6
AKV 10-5	3.7	4.8	5.3	5.7	5.9	5.9	5.9	5.9	5.7
AKV 10-6	5.9	7.6	8.5	9.0	9.3	9.4	9.4	9.3	9.0
AKV 10-7	9.4	12.1	13.5	14.4	14.8	15.0	15.0	14.8	14.4
AKV 15-1	14.8	18.9	21.2	22.5	23.2	23.5	23.5	23.2	23.5
AKV 15-2	23.6	30.3	33.8	36.0	37.1	37.6	37.6	37.1	36.0
AKV 15-3	37.2	47.7	53.3	56.6	58.5	59.2	59.2	58.5	56.6
AKV 15-4	59.0	75.7	84.6	89.9	92.8	94.0	94.0	92.8	89.9
AKV 20-1	59.0	75.7	84.6	89.9	92.8	94.0	94.0	92.8	89.9
AKV 20-2	94.9	121.0	135.0	144.0	149.0	150.0	150.0	149.0	144.0
AKV 20-3	148.0	189.0	212.0	225.0	232.0	235.0	235.0	232.0	225.0
AKV 20-4	236.0	303.0	338.0	360.0	371.0	376.0	376.0	371.0	360.0
AKV 20-5	372.0	477.0	533.0	566.0	585.0	592.0	592.0	585.0	566.0

*Correction for subcooling*

The evaporator capacity used must be corrected, if the subcooling deviates from 4 K. Use the actual correction factor indicated in the table.

Multiply the evaporator capacity by the correction factor to obtain the corrected capacity.

*Correction factors for subcooling  $\Delta t_{sub}$*

Correction factor	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R22/R407C	1.00	0.94	0.90	0.87	0.83	0.80	0.77	0.74	0.72	0.69
R134a	1.00	0.93	0.88	0.84	0.80	0.76	0.73	0.70	0.68	0.65

Corrected capacity = evaporator capacity x correction factor.

**Capacity**  
(continued)

Valve type	Capacity in [kW] at pressure drop across valve $\Delta p$ [bar]								
	2	4	6	8	10	12	14	16	18
<b>R404A/R507</b>									
AKV 10-1	0.6	0.7	0.8	0.8	0.9	0.8	0.8	0.8	0.8
AKV 10-2	0.9	1.1	1.3	1.3	1.4	1.4	1.3	1.3	1.2
AKV 10-3	1.4	1.8	2.0	2.1	2.1	2.1	2.1	2.0	1.9
AKV 10-4	2.3	2.9	3.1	3.3	3.4	3.4	3.3	3.3	3.1
AKV 10-5	3.6	4.5	4.9	5.2	5.3	5.3	5.3	5.1	4.9
AKV 10-6	5.6	7.1	7.8	8.2	8.4	8.5	8.4	8.2	7.7
AKV 10-7	9.0	11.4	12.5	13.2	13.5	13.5	13.4	13.1	12.4
AKV 15-1	14.1	17.8	19.6	20.6	21.0	21.1	20.9	20.4	19.4
AKV 15-2	22.6	28.5	31.4	33.0	33.7	33.9	33.4	32.6	30.8
AKV 15-3	35.5	44.9	49.4	51.9	53.0	53.2	52.7	51.4	48.7
AKV 15-4	56.4	71.2	78.3	82.4	84.2	84.6	83.7	81.5	77.3
AKV 20-1	56.4	71.2	78.3	82.4	84.2	84.6	83.7	81.5	77.3
AKV 20-2	90.3	114	125	132	135	135	134	131	124
AKV 20-3	141	178	196	206	210	211	209	204	194
AKV 20-4	226	285	314	330	337	339	334	326	308
AKV 20-5	355	449	494	519	530	532	527	514	487

*Correction for subcooling*

The evaporator capacity used must be corrected, if the subcooling deviates from 4 K. Use the actual correction factor indicated in the table.

Multiply the evaporator capacity by the correction factor to obtain the corrected capacity.

*Correction factors for subcooling  $\Delta t_{sub}$*

Correction factor	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
<b>R404A/R507</b>	1.00	0.91	0.83	0.78	0.73	0.68	0.65	0.61	0.59	0.56

Corrected capacity = evaporator capacity x correction factor.

**Capacity**  
(continued)

Valve type	Capacity in [kW] at pressure drop across valve $\Delta p$ [bar]								
	2	4	6	8	10	12	14	16	18
<b>R410A</b>									
AKV 10-1	0.9	1.1	1.3	1.4	1.5	1.5	1.6	1.6	1.6
AKV 10-2	1.4	1.8	2.0	2.2	2.3	2.4	2.5	2.5	2.5
AKV 10-3	2.1	2.8	3.2	3.4	3.6	3.8	3.9	3.9	4.0
AKV 10-4	3.4	4.4	5.1	5.5	5.8	6.0	6.2	6.3	6.4
AKV 10-5	5.3	7.0	8.0	8.7	9.1	9.5	9.7	9.9	10.4
AKV 10-6	8.5	11.1	12.7	13.7	14.5	15.0	15.4	15.7	15.9
AKV 10-7	13.6	17.7	20.2	22.0	23.2	24.0	24.7	25.2	25.4
AKV 15-1	21.2	27.7	31.6	34.4	36.2	37.6	38.5	39.2	39.8
AKV 15-2	33.9	44.3	50.6	55.0	57.8	60.2	61.7	62.8	63.7
AKV 15-3	53.2	69.6	79.7	86.5	91.1	94.7	97.2	98.9	100
AKV 15-4	84.6	111	127	137	145	150	154	157	159
AKV 20-1	84.6	111	127	137	145	150	154	157	159
AKV 20-2	136	177	202	220	232	240	247	252	254
AKV 20-3	212	277	316	344	362	376	385	392	398
AKV 20-4	339	443	506	550	578	602	617	628	637
AKV 20-5	532	696	797	865	911	947	972	989	1000
<b>R744</b>									
AKV 10-1	0.8	1.1	1.3	1.5	1.7	1.8	2.0	2.1	2.2
AKV 10-2	1.2	1.7	2.1	2.4	2.7	2.9	3.2	3.4	3.6
AKV 10-3	2.0	2.8	3.4	3.9	4.3	4.8	5.1	5.5	5.8
AKV 10-4	3.1	4.3	5.3	6.2	6.8	7.5	8.1	8.7	9.1
AKV 10-5	4.8	6.8	8.3	9.6	10.7	11.7	12.7	13.5	14.3
AKV 10-6	7.7	10.8	13.2	15.3	17.0	18.7	20.2	21.5	22.7
AKV 10-7	12.2	17.3	21.0	24.5	27.2	29.8	32.3	34.4	36.3
AKV 15-1	19.1	27.0	32.9	38.3	42.6	46.7	50.5	53.8	56.9
AKV 15-2	30.6	43.2	52.6	61.2	68.1	74.7	80.8	86.1	91.0
AKV 15-3	48.2	68.2	82.9	96.5	107	118	127	136	143
AKV 15-4	76.5	108	132	153	170	187	202	215	227
AKV 20-1	76.5	108	132	153	170	187	202	215	227
AKV 20-2	122	173	210	245	272	298	323	344	363
AKV 20-3	191	270	329	383	426	467	505	538	569
AKV 20-4	306	432	526	612	681	747	808	861	910
AKV 20-5	482	682	829	965	1074	1177	1273	1357	1434

*Correction for subcooling*

The evaporator capacity used must be corrected, if the subcooling deviates from 4 K. Use the actual correction factor indicated in the table.

Multiply the evaporator capacity by the correction factor to obtain the corrected capacity.

*Correction factors for subcooling  $\Delta t_{sub}$*

Correction factor	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R410A	1.00	0.95	0.90	0.85	0.81	0.77	0.73	0.70	0.67	0.64
R744	1.00	0.91	0.86	0.81	0.77	0.73	0.69	0.66	0.63	0.60

Corrected capacity = evaporator capacity x correction factor.



**Valve sizing**

To obtain an expansion valve that will function correctly under different load conditions it is necessary to consider the following points in below sequence when sizing the valve:

- 1) Evaporator capacity
- 2) Pressure drop across the valve
- 3) Correction for subcooling
- 4) Correction for evaporating temperature
- 5) Determination of valve size
- 6) Correctly dimensioned liquid line

**1) Evaporator capacity**

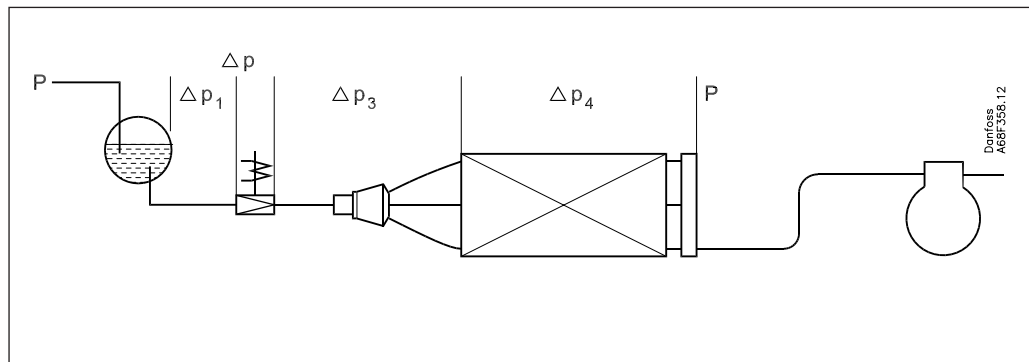
The evaporator capacity is found in the specifications from the evaporator supplier.

**2) Pressure drop across the valve**

The pressure drop across the valve directly determines the capacity and must therefore be considered.

The pressure drop across the valve is normally calculated as the condensing pressure less the evaporating pressure and other sundry pressure drops in the liquid line, distributor, evaporator, etc. It is indicated in the following formula:

$$\Delta p_{\text{valve}} = p_c - (p_e + \Delta p_1 + \Delta p_3 + \Delta p_4)$$



- $\Delta p_{\text{valve}}$  pressure drop across the valve
- $p_c$  condensing pressure
- $p_e$  evaporating pressure
- $\Delta p_1$  pressure drop across the liquid line
- $\Delta p_3$  pressure drop across the distributor system
- $\Delta p_4$  pressure drop across the evaporator

**⚠ Note:**

The pressure drop across the liquid line and the distributor system must be calculated on the basis of the max. capacity of the valve, as the valve operates with pulse-width modulation.

*Example of calculation of pressure drop across a valve:*

Refrigerant: R22/R407C  
 Condensing temperature: 35 °C ( $p_c = 13.5$  bar)  
 Evaporating temperature: 0 – 6 °C ( $p_e = 4.1$  bar)  
 $\Delta p_1 = 0.2$  bar  
 $\Delta p_3 = 0.8$  bar  
 $\Delta p_4 = 0.1$  bar

This will give the following equation:

$$\begin{aligned} \Delta p_{\text{valve}} &= p_c - (p_e + \Delta p_1 + \Delta p_3 + \Delta p_4) \\ &= 13.5 - (4.1 + 0.2 + 0.8 + 0.1) \\ &= 8.3 \text{ bar} \end{aligned}$$

The found value for “pressure drop across the valve” is used later in the section “Determination of valve size”.

**Valve sizing**  
(continued)

**3) Correction for subcooling**

The evaporator capacity used must be corrected, if the subcooling deviates from 4 K. Use the actual correction factor indicated in the table.

Multiply the evaporator capacity by the correction factor to obtain the corrected capacity.

Correction factors for subcooling  $\Delta t_{sub}$

Correction factor	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
<b>R22/R407C</b>	1.00	0.94	0.90	0.87	0.83	0.80	0.77	0.74	0.72	0.69
<b>R134a</b>	1.00	0.93	0.88	0.84	0.80	0.76	0.73	0.70	0.68	0.65
<b>R404A/R507</b>	1.00	0.91	0.83	0.78	0.73	0.68	0.65	0.61	0.59	0.56
<b>R410A</b>	1.00	0.95	0.90	0.85	0.81	0.77	0.73	0.70	0.67	0.64
<b>R744</b>	1.00	0.91	0.86	0.81	0.77	0.73	0.69	0.66	0.63	0.60

Corrected capacity = evaporator capacity x correction factor.

The corrected capacity is used in the section "Determination of valve size".

**⚠ Note:**  
Too little subcooling may cause flash gas.

*Example of correction:*  
Refrigerant: R22/R407C  
Evaporator capacity  $Q_e$ : 5 kW  
Subcooling: 10 K  
Correction factor according to the table = 0.94  
Corrected capacity =  $5 \times 0.94 = 4.7$  kW.

**4) Correction for evaporating temperature ( $t_e$ )**

To obtain a correctly dimensioned valve it is important that the application is considered.

The valve's opening degree should therefore be between 50 and 75% when regulating. In this way it is ensured that the valve has a sufficiently wide regulation range, so that it can manage changed loads at or near the normal working point. Correction factors based on the evaporating temperature are indicated below:

Depending on the application, the valve should have an overcapacity enabling it to cope with the extra amount of refrigeration needed during certain periods, e.g. during the defrost recovery process.

Correction factors for evaporating temperature ( $t_e$ )

Evaporating temperature $t_e$ [°C]	5	0	-10	-15	-20	-30	-40
<b>AKV 10</b>	1.25	1.25	1.25	1.25	1.6	1.6	1.6
<b>AKV 15</b>	1.0	1.0	1.0	1.0	1.2	1.3	1.4
<b>AKV 20</b>	1.0	1.0	1.0	1.0	1.2	1.3	1.4

**Valve sizing**  
(continued)

**5) Determination of valve size**

When the valve size meeting the required capacity is selected it is important to note that the capacity indications are the valve's rated capacity, i.e. when the valve is 100% open.

In this section we tell you how the valve's size is determined.

*There are three factors that have an influence on the choice of the valve:*

- The pressure drop across the valve
- The corrected capacity (correction for subcooling)
- The corrected capacity for evaporating temperature

The three factors have been described earlier in this section on dimensioning.

*When these three factors have been established, the selection of the valve can be made:*

- First multiply the "corrected capacity" by a value stated in the table.
- Use the new value in the capacity table in combination with the pressure drop value.
- Now select the valve size.

*Example of selection of valve*

Use as starting point the two earlier mentioned examples, where the following two values have been obtained:

$$\Delta p_{\text{valve}} = 8.3 \text{ bar}$$

$$Q_e \text{ corrected} = 4.7 \text{ kW}$$

The valve should be used in a coldroom. Consequently, 1.25 should be selected as "correction factor for the evaporating temperature".

The dimensioned capacity will then be:  
1.25 x 4.7 kW = 5.88 kW.

Now select a valve size from one of the capacity tables.

With the given values  $\Delta p_{\text{valve}} = 8.3 \text{ bar}$  and a capacity of 5.88 kW, select the valve size for AKV 10-5. This valve will have a capacity of approx. 7 kW.

**6) Correctly dimensioned liquid line**

To obtain a correct supply of liquid to the AKV valve, the liquid line to the individual AKV valve must be correctly dimensioned.

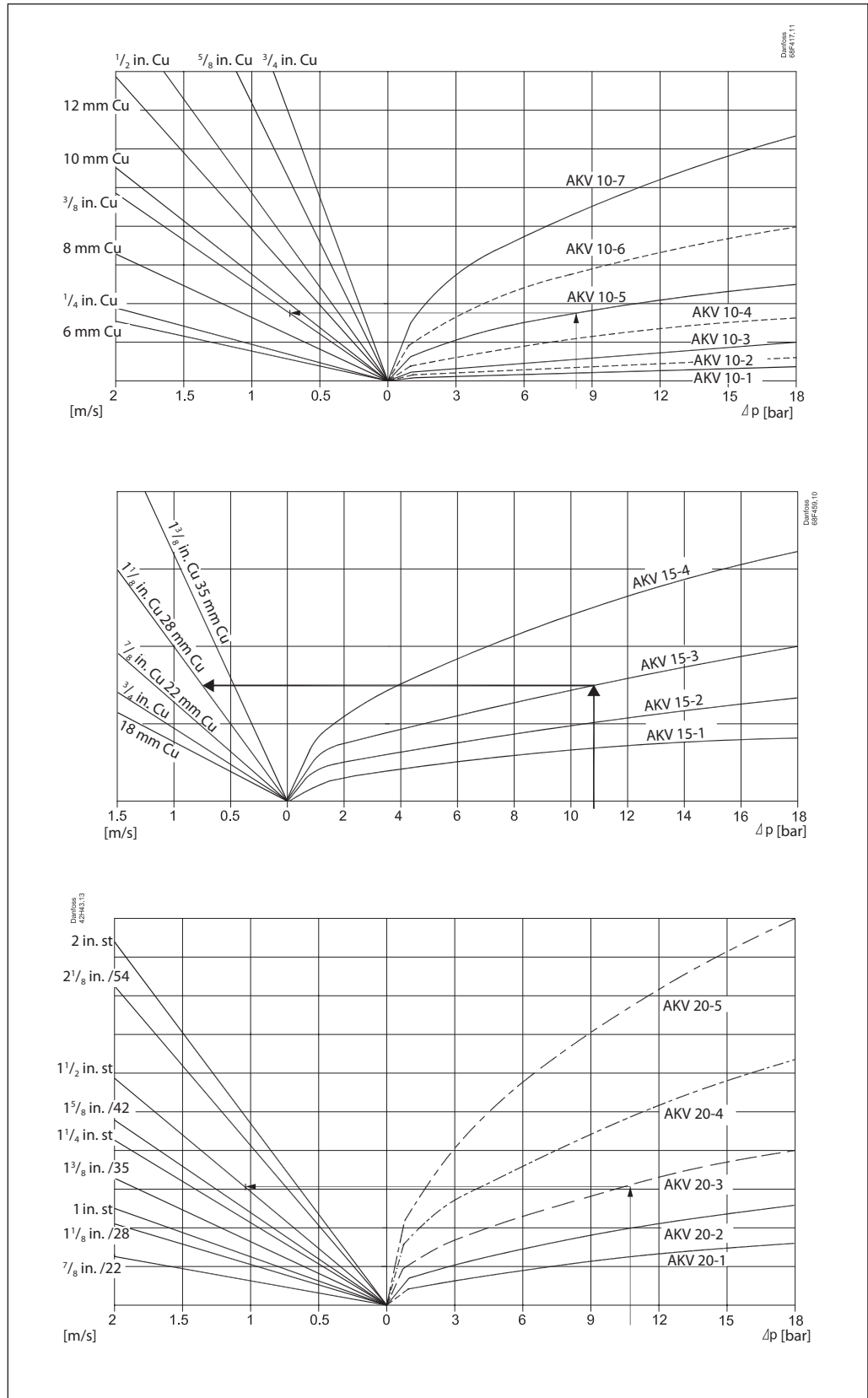
The liquid flow rate should not exceed 1 m/sec.

This must be observed on account of the pressure drop in the liquid line (lack of subcooling) and pulsations in the liquid line.

Dimensioning of the liquid line **must be based on the capacity of the valve at the pressure drop** with which it is operating (cf. capacity table), and not on the evaporator's capacity.

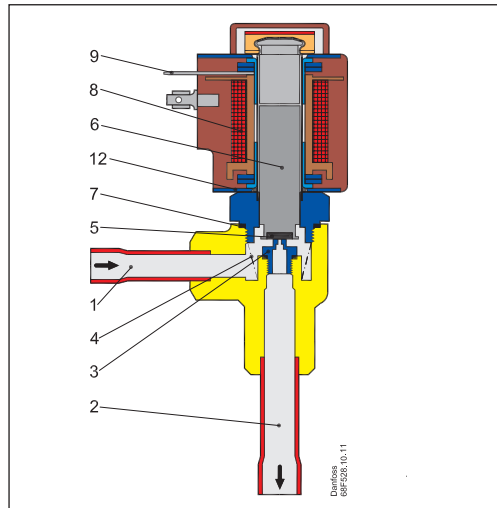
Valve sizing  
(continued)

R22/R407C, R134a, R404A, R507



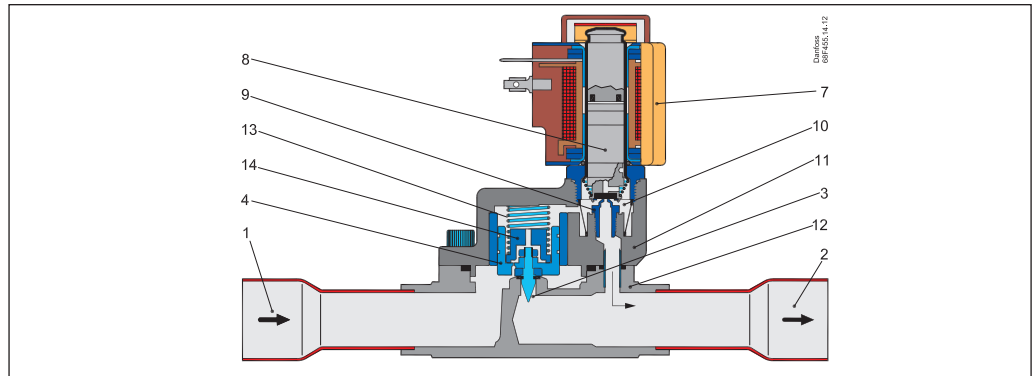
Design

AKV 10



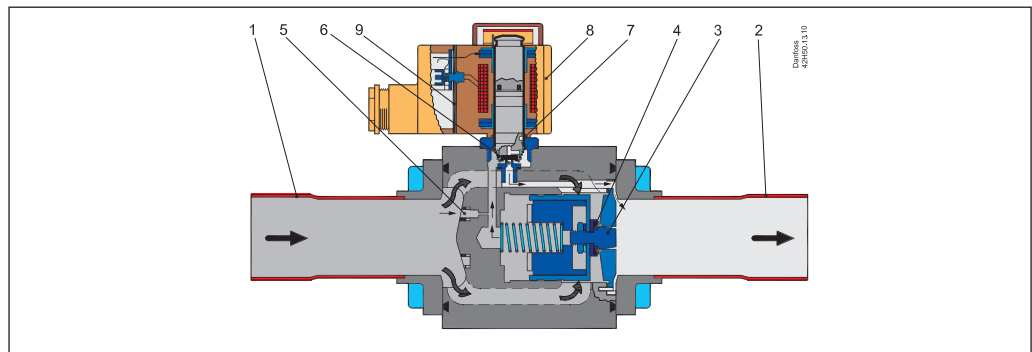
1. Inlet
2. Outlet
3. Orifice
4. Filter
5. Valve seat
6. Armature
7. Copper gasket
8. Coil
9. DIN plug
12. O-ring

AKV 15



1. Inlet
2. Outlet
3. Orifice
4. Piston assembly
7. Coil
8. Armature
9. Pilot orifice
10. Filter
11. Cover
12. Valve body
13. Spring
14. Orifice assembly

AKV 15



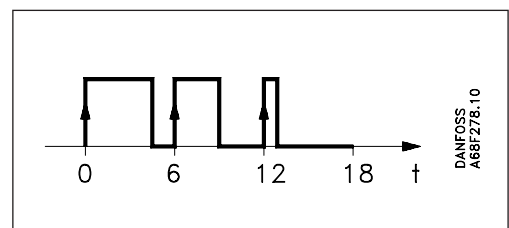
1. Inlet
2. Outlet
3. Orifice
4. Valve seat
5. Filter
6. Pilot orifice
7. O-ring
8. Coil
9. Terminal box

Function

The valve capacity is regulated by means of pulse-width modulation. Within a period of six seconds a voltage signal from the controller will be transmitted to and removed from the valve coil. This makes the valve open and close for the flow of refrigerant.

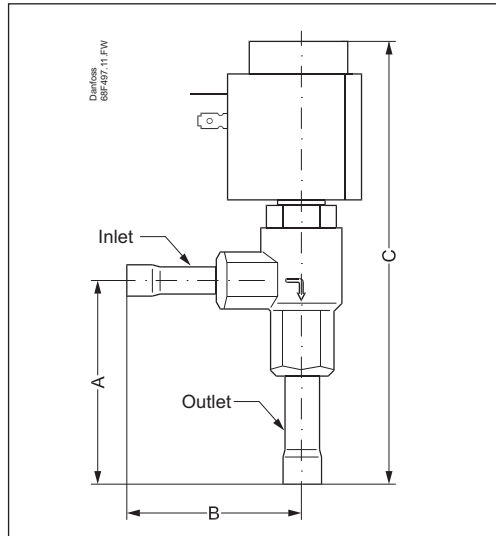
The amount of refrigeration needed is determined by the controller. When no refrigeration is required, the valve will remain closed and thus function as a solenoid valve.

The relation between this opening and closing time indicates the actual capacity. If there is an intense need for refrigeration, the valve will remain open for almost all six seconds of the period. If the required amount of refrigeration is modest, the valve will only stay open during a fraction of the period.



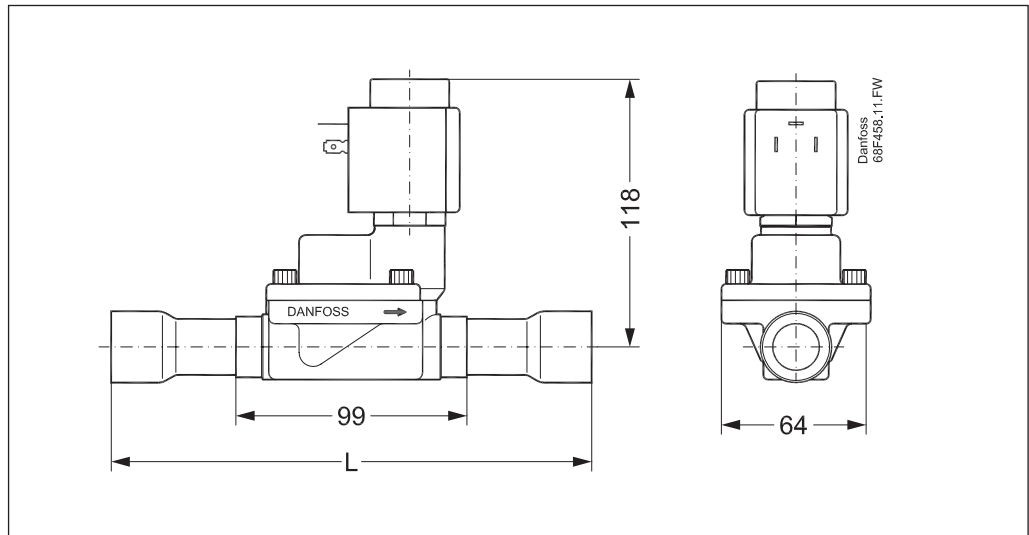
Dimensions and weights

AKV 10 solder



Valve type	Connection type	n	A [mm]	B [mm]	C [mm]	Inlet [in.]	Outlet [in.]	Inlet [mm]	Outlet [mm]	Net weight without coil [kg]
AKV 10-n	Solder	1, 2, 3, 4, 5, 6	75	67	154	3/8	1/2	10	12	0.38
AKV 10-n	Solder	7	73	75	152	1/2	5/8	12	16	0.38

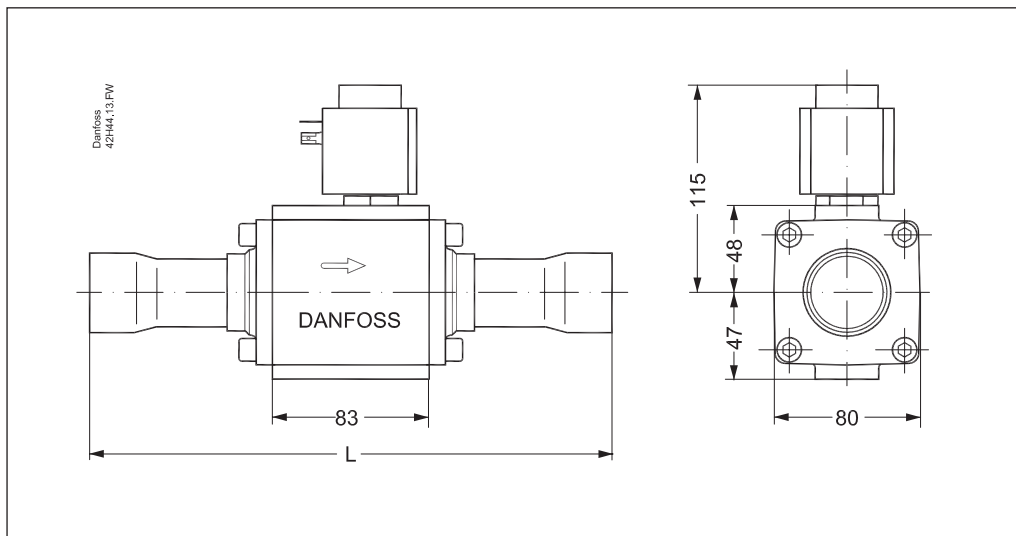
AKV 15



Valve type	Inlet [in.]	Outlet [in.]	Inlet [mm]	Outlet [mm]	L [mm]	Net weight without coil [kg]
AKV 15-1	3/4	3/4	18	18	190	1.5
AKV 15-2	3/4	3/4	18	18	190	1.5
AKV 15-3	7/8	7/8	22	22	190	1.5
AKV 15-4	1 1/8	1 1/8	28	28	216	1.5

Dimensions and weights  
(continued)

AKV 20



Valve type	Solder connections						Weld connections			
	Inlet	Outlet	Inlet	Outlet	L	Net weight without coil	Inlet	Outlet	L	Net weight without coil
	[in.]	[in.]	[mm]	[mm]	[mm]	[kg]	[in.]	[in.]	[mm]	[kg]
AKV 20-1	1 3/8	1 3/8	35	35	281	4.3	1 1/4	1 1/4	176	4.1
AKV 20-2	1 3/8	1 3/8	35	35	281	4.3	1 1/4	1 1/4	176	4.1
AKV 20-3	1 5/8	1 5/8	42	42	281	4.3	1 1/4	1 1/4	176	4.1
AKV 20-4	2 1/8	2 1/8	54	54	281	4.3	1 1/2	1 1/2	176	4.1
AKV 20-5	2 1/8	2 1/8	54	54	281	4.3	2	2	176	4.1

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.