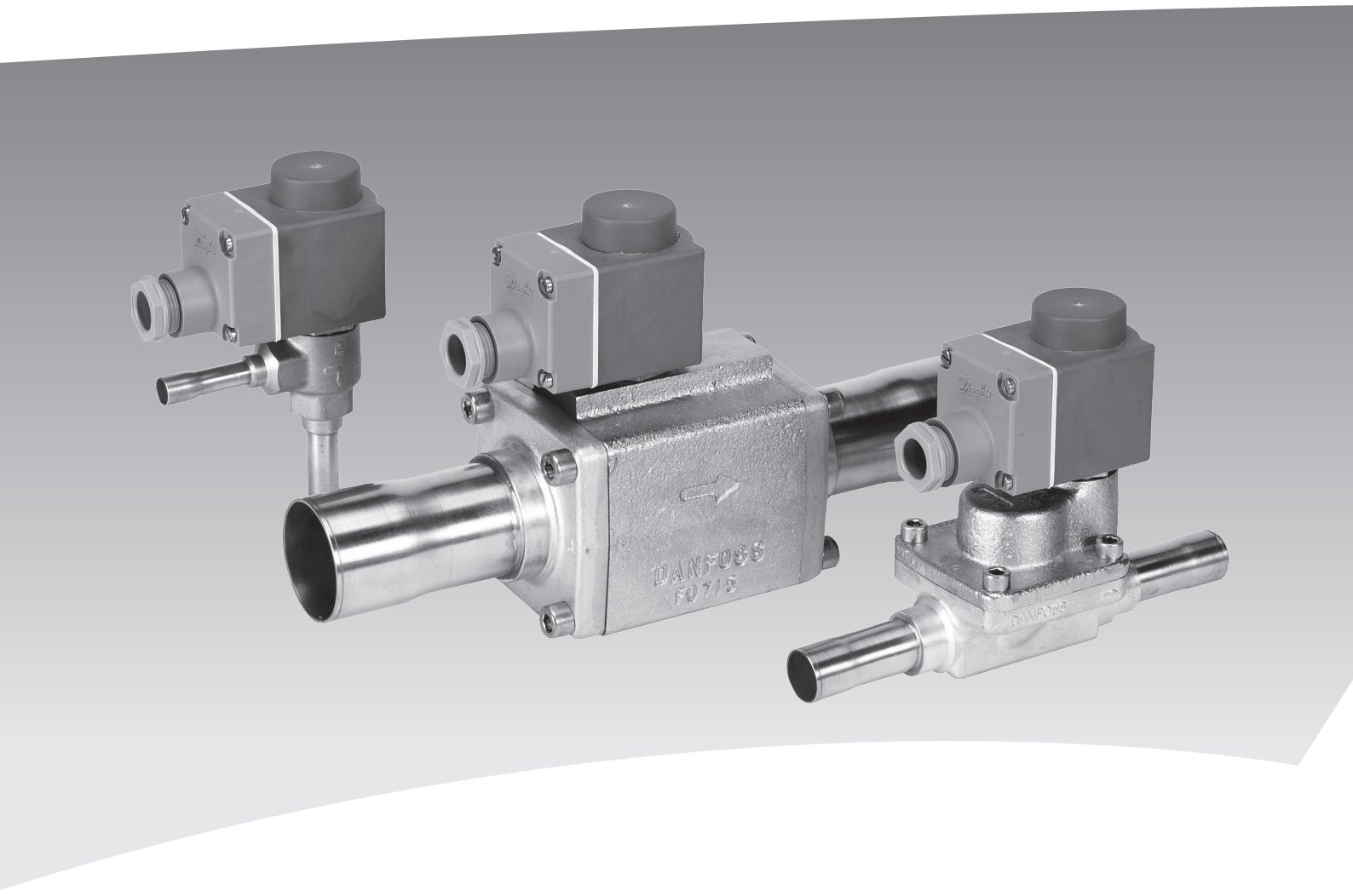


Electrically operated expansion valves,

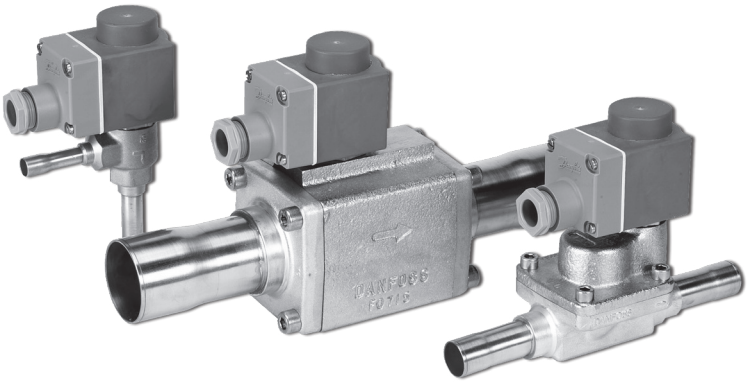
type AKV 10, AKV 15 and AKV 20

REFRIGERATION AND
AIR CONDITIONING

Technical leaflet

Contents

Introduction



AKV are electrically operated expansion valves designed for refrigerating plant.
The AKV valves can be used for HCFC and HFC, R744 refrigerants.
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

The individual capacities are 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.
The AKV 10 valves covers a capacity range from 1 kW to 16 kW (R22) and are divided up into 7 capacity ranges.

The AKV 15 valves cover a capacity range from 25 kW to 100 kW (R22) and are divided up into 4 capacity ranges.

AKV 15 valves can be used for cold rooms.

The AKV 20 valves cover a capacity range from 100 kW to 630 kW (R22) and are divided up into 5 capacity ranges.

The AKV 20 can be used for water chiller units.

Features

- For HCFC, HFC, R744 refrigerants
- The valve requires no adjustment
- Wide regulation range
- Replaceable orifice assembly
- Both expansion valve and solenoid valve.
- Wide range of coils for d.c. and a.c.

Approvals

DEMKO, Denmark

SETI, Finland

SEV, Switzerland

c UL us LISTED

UL listed (separate code. nos.)

CSA certified (separate code. nos.)

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. IP 67	Max. IP 67	Max. IP 67
Working principle (Pulse-width modulation)	PWM	PWM	PWM
Recommended period of time	6 Seconds	6 Seconds	6 Seconds
Capacity (R22)	1 to 16 kW	25 to 100 kW	100 to 630 kW
Regulation range (Capacity range)	10 to 100%	10 to 100%	10 to 100%
Connection	Solder	Solder	Solder or weld
Evaporating temperature	– 50 to 60°C	– 50 to 60°C	– 40 to 60°C
Ambient temperature	– 50 to 50°C	– 40 to 50°C	– 40 to 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	18 bar	22 bar	18 bar
Filter, replaceable	Internal 100 µm	External 100 µm	External 100 µm
Max. working pressure	AKV 10-1to 6 PS=52 barg AKV 10-7 PS=42 barg	AKV 15-1,2,3 PS 42 barg AKV 15-4 PS 28 barg	28 barg

Rated capacity and Ordering

AKV 10 and AKV 15

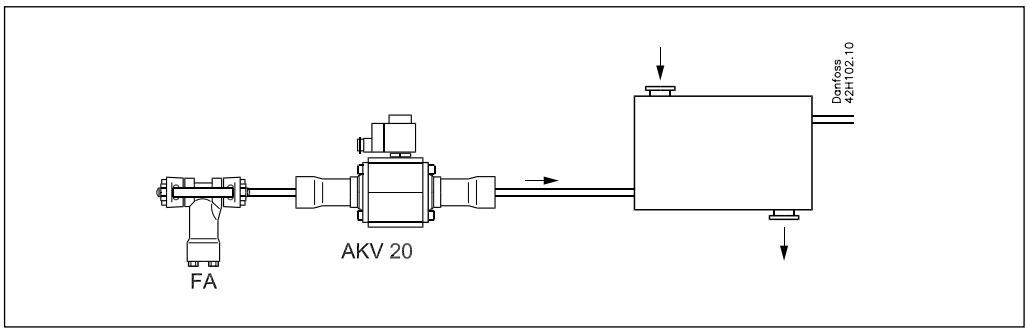
Valve type	Rated capacity kW [1]				k_v value	Connections			
						Solder ODF			
	R22	R134a	R404A/R507	R407C	m³/h	Inlet × outlet in.	**Code no.**	Inlet × outlet mm	**Code no.**
AKV 10-1	1.0	0.9	0.8	1.1	0.010	⅜ × ½	**068F1161**	10 × 12	**068F1162**
AKV 10-2	1.6	1.4	1.3	1.7	0.017	⅜ × ½	**068F1164**	10 × 12	**068F1165**
AKV 10-3	2.6	2.1	2.0	2.5	0.025	⅜ × ½	**068F1167**	10 × 12	**068F1168**
AKV 10-4	4.1	3.4	3.1	4.0	0.046	⅜ × ½	**068F1170**	10 × 12	**068F1171**
AKV 10-5	6.4	5.3	4.9	6.4	0.064	⅜ × ½	**068F1173**	10 × 12	**068F1174**
AKV 10-6	10.2	8.5	7.8	10.1	0.114	⅜ × ½	**068F1176**	10 × 12	**068F1177**
AKV 10-7	16.3	13.5	12.5	17.0	0.162	½ × ⅝	**068F1179**	12 × 16	**068F1180**
AKV 15-1	25.5	21.2	19.6	25.2	0.25	¾ × ¾	**068F5000**	18 × 18	**068F5001**
AKV 15-2	40.8	33.8	31.4	40.4	0.40	¾ × ¾	**068F5005**	18 × 18	**068F5006**
AKV 15-3	64.3	53.3	49.4	63.7	0.63	⅞ × ⅞	**068F5010**	22 × 22	**068F5010**
AKV 15-4	102	84.6	78.3	101	1.0	1⅛ × 1⅛	**068F5015**	28 × 28	**068F5016**

AKV 20

Valve type	Rated capacity kW [1]				k_v value	Connections					
						Solder ODF				Weld	
	R22	R134a	R404A/R507	R407C	m³/h	Inlet × outlet in.	**Code no.**	Inlet × outlet mm	**Code no.**	Inlet × outlet in.	**Code no.**
AKV 20-1	102	84.6	78.3	101	1.0	1⅜ × 1⅜	**042H2020**	35 × 35	**042H2020**	1¼ × 1¼	**042H2021**
AKV 20-2	163	135	125	170	1.6	1⅜ × 1⅜	**042H2022**	35 × 35	**042H2022**	1¼ × 1¼	**042H2023**
AKV 20-3	255	212	196	252	2.5	1⅝ × 1⅝	**042H2024**	42 × 42	**042H2025**	1¼ × 1¼	**042H2026**
AKV 20-4	408	338	314	404	4.0	2⅛ × 2⅛	**042H2027**	54 × 54	**042H2027**	1½ × 1½	**042H2028**
AKV 20-5	643	533	494	637	6.3	2⅛ × 2⅛	**042H2029**	54 × 54	**042H2029**	2 × 2	**042H2030**

[1] Rated capacities are based on:
Condensing temperature t_c = 32°C
Liquid temperature t_l = 28°C
Evaporating temperature t_e = 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	068F5283	4 pc. orifice 4 pc. gasket
1		
2		
3		
4	068F5284	3 pc. orifice 3 pc. gasket
5		
6		
7	068F5285	2 pc. orifice 2 pc. gasket
8		

Filter: **Code no. 068F0540**
Contents: 10 pcs. filters
10 pcs. Al. gaskets

Upper part: **Code no. 068F0541**
Contents: 1 pc. armature ass.
1 pc. armature tube
1 pc. Al. gasket

Gasket for upper part: **Code no. 068F0549**
Contents: 25 pcs. Cu/Tn gaskets

AKV 15

Piston

Type	Code no.	Contents
AKV 15-1	**068F5265**	1 pc. piston assembly 1 pc. gasket 1 pc. O-ring 2 pcs. labels
AKV 15-2	**068F5266**	
AKV 15-3	**068F5267**	
AKV 15-4	**068F5268**	

Gasket set: **Code no. 068F5263**
Contents: 30 pcs. O-rings
10 pcs. Cu. gasket
10 pcs. gasket

Filter: **Code no. 068F0540**
Contents: 10 pcs. filters
10 pcs. Al. gaskets

Upper part: **Code no. 068F5045**
Contents: 1 pc. armature ass.
1 pc. armature tube
1 pc. Al. gasket

Gasket for upper part: **Code no. 068F0549**
Contents: 25 pcs. Cu/Tn gaskets

AKV 20

Piston

Type	Code no.	Indhold
AKV 20-0.6	**042H2039**	1 pc. piston assembly 3 pcs. O-rings
AKV 20-1	**042H2040**	
AKV 20-2	**042H2041**	
AKV 20-3	**042H2042**	
AKV 20-4	**042H2043**	
AKV 20-5	**042H2044**	

Orifice set

Type	Code no.	Contents
AKV 20-0.6	**068F5270**	Main orifice, dia. 8 mm Pilot orifice, dia. 1.8 mm 2 pcs. Al. gaskets O-ring
AKV 20-1	**068F5270**	
AKV 20-2	**068F5270**	
AKV 20-3	**068F5270**	
AKV 20-4	**068F5271**	Main orifice, dia. 14 mm Pilot orifice, dia. 2.4 mm 2 pcs. Al. gaskets O-ring
AKV 20-5	**068F5271**	

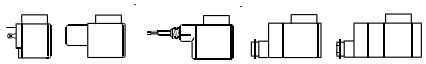
Gasket set: **Code no. 042H0160**
Contents: Complete gasket set for new and old valves

Upper part: **Code no. 068F5045**
Contents: 1 pc. armature ass.
1 pc. armature tube
1 pc. Al. gasket

Gasket for upper part: **Code no. 068F0549**
Contents: 25 pcs. Cu/Tn gaskets

Ordering

Coils for AKV valves



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

D.C. coils	Code no.						
220 V d.c. 20 W, standard with terminal box	**018F6851**	+	+	+	+	+	+
100 V d.c. 18 W, special with terminal box with DIN plugs	**018F6780**	+	+	+	+	+	+
230 V d.c. 18 W, special with terminal box with DIN plugs	**018F6781**[1)] **018F6991**[1)]	+	+	+	+	+	+
230 V d.c. 18 W, special with 2.5 m cable with 4.0 m cable with 8.0 m cable	**018F6288**[1)] **018F6278**[1)] **018F6279**[1)]	+	+	+	+	+	+

[1)] Recommended for commercial refrigeration plant

A.C. coils	Code no.						
240 V a.c. 10 W, 50 Hz with terminal box with DIN plugs	**018F6702** **018F6177**	+	+	–	+	–	–
240 V a.c. 10 W, 60 Hz with terminal box with DIN plugs	**018F6713** **018F6188**	+	+	–	+	–	–
240 V a.c. 12 W, 50 Hz with terminal box	**018F6802**	+	+	+	+	+	–
230 V a.c. 10 W, 50 Hz with terminal box with DIN-plugs	**018F6701** **018F6176**	+	+	–	+	–	–
230 V a.c. 10 W, 60 Hz with terminal box with DIN-plugs	**018F6714** **018F6189**	+	+	–	+	–	–
230 V a.c. 10 W, 50/60 Hz with terminal box with DIN-plugs	**018F6732** **018F6193**	+	+	–	+	–	–
230 V a.c. 12 W, 50 Hz with terminal box	**018F6801**	+	+	–	+	+	–
230 V a.c. 12 W, 60 Hz with terminal box	**018F6814**	+	+	–	+	+	–
115 V a.c. 10 W, 50 Hz with terminal box with DIN-plugs	**018F6711** **018F6186**	+	+	–	+	–	–
115 V a.c. 10 W, 60 Hz with terminal box with DIN-plugs	**018F6710** **018F6185**	+	+	–	+	–	–
110 V a.c. 12 W, 50 Hz with terminal box	**018F6811**	+	+	–	+	+	–
110 V a.c. 12 W, 60 Hz with terminal box	**018F6813**	+	+	–	+	+	–
110 V a.c. 20 W, 50 Hz with terminal box	**018Z6904**	+	+	+	+	+	+
24 V a.c. 10 W, 50 Hz with terminal box with DIN-plugs	**018F6707** **018F6182**	+	–	–	+	–	–
24 V a.c. 10 W, 60 Hz with terminal box with DIN-plugs	**018F6715** **018F6190**	–	–	–	+	–	–
24 V a.c. 12 W, 50 Hz with terminal box	**018F6807**	+	–	–	+	+	+
24 V a.c. 12 W, 60 Hz with terminal box	**018F6815**	+	–	–	+	+	+
24 V a.c. 20 W, 50 Hz with terminal box	**018F6901**[2)]	+	+	+	+	+	+
24 V a.c. 20 W, 60 Hz with terminal box	**018F6902**[2)]	+	+	+	+	+	+

[2)] 20 W coils can not be connected to AKC 24P2 and AKC 24W2

Capacity

R22

Valve type	Capacity in kW at pressure drop across valve Δp bar								
	2	4	6	8	10	12	14	16	18
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	110	115	118	121	122	123
AKV 20 - 1	69.9	89.9	102	110	115	118	121	122	123
AKV 20 - 2	112	144	163	176	184	189	193	195	193
AKV 20 - 3	175	225	255	275	287	296	301	304	306
AKV 20 - 4	280	360	408	440	459	474	482	487	490
AKV 20 - 5	440	566	643	692	723	746	759	767	772

R134a

Valve type	Capacity in kW at pressure drop across valve Δp bar								
	2	4	6	8	10	12	14	16	18
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	135	144	149	150	150	149	144
AKV 20 - 3	148	189	212	225	232	235	235	232	225
AKV 20 - 4	236	303	338	360	371	376	376	371	360
AKV 20 - 5	372	477	533	566	585	592	592	585	566

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 Δt_{sub}

Correction factor	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R22	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 *(con tinued)*

R404A/R507

Valve type	Capacity in kW at pressure drop across valve Δp bar								
	2	4	6	8	10	12	14	16	18
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

R407C

Valve type	Capacity in kW at pressure drop across valve Δp bar								
	2	4	6	8	10	12	14	16	18
AKV 10 - 1	0.7	1.0	1.1	1.1	1.2	1.2	1.2	1.2	1.2
AKV 10 - 2	1.2	1.5	1.7	1.7	1.9	1.9	2.0	2.0	1.9
AKV 10 - 3	1.8	2.4	2.5	2.8	2.9	3.0	3.0	3.0	3.0
AKV 10 - 4	3.0	3.8	4.0	4.5	4.7	4.8	4.9	4.9	4.9
AKV 10 - 5	4.7	5.9	6.4	7.1	7.4	7.5	7.7	7.7	7.6
AKV 10 - 6	7.4	9.4	10.1	11.3	11.7	12.0	12.2	12.2	12.1
AKV 10 - 7	11.9	15.1	17.0	17.4	18.8	19.1	19.5	19.5	19.1
AKV 15 - 1	18.1	23.6	25.2	28.3	29.3	29.9	30.4	30.4	30.3
AKV 15 - 2	29.7	37.8	40.4	45.3	46.8	47.9	48.7	48.7	48.5
AKV 15 - 3	46.6	59.4	63.7	71.3	73.7	75.3	76.7	76.7	76.4
AKV 15 - 4	74.1	94.4	101	113	117	120	122	122	121
AKV 20 - 1	74.1	94.4	101	113	117	120	122	122	121
AKV 20 - 2	119	151	170	174	188	191	195	195	191
AKV 20 - 3	181	236	252	283	293	299	304	304	303
AKV 20 - 4	297	378	404	453	468	479	487	487	485
AKV 20 - 5	466	594	637	713	737	753	767	767	764

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 Δt_{sub}

Correction factor	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R404A / R507	1.00	0.91	0.83	0.78	0.73	0.68	0.65	0.61	0.59	0.56
R407C	1.00	0.93	0.88	0.83	0.79	0.75	0.72	0.69	0.66	0.64

Corrected capacity = evaporator capacity x correction factor.

Capacity *(continued)*

R410A

Valve type	Capacity in kW at pressure drop across valve Δp bar								
	2	4	6	8	10	12	14	16	18
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

R744

Valve type	Capacity in kW at pressure drop across valve Δp bar								
	2	4	6	8	10	12	14	16	18
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 Δt_{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.

Dimensioning

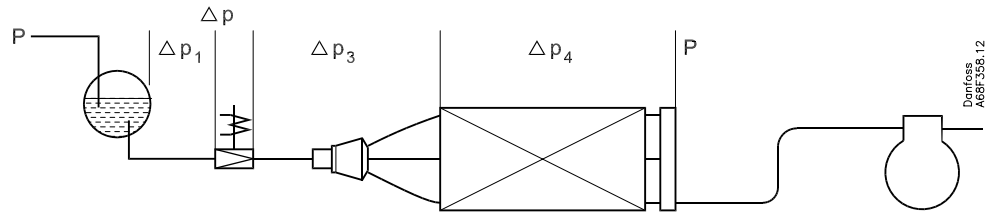
To obtain an expansion valve that will function correctly under different load conditions it is necessary to consider the following points when the valve has to be dimensioned:
These points must be dealt with in the following sequence:

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 sundry other pressure drops in the liquid line, distributor, evaporator, etc. It is indicated in the following formula:
$\Delta p_{valve} = p_c - (p_e + \Delta p_1 + \Delta p_3 + \Delta p_4)$



Δp_{valve}	pressure drop across the valve
p_c	condensing pressure
p_e	evaporating pressure
Δp_1	pressure drop across the liquid line
Δp_3	pressure drop across the distributor system
Δp_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 valve's max. capacity, as the valve operates with pulse-width modulation.

Example of calculation of pressure drop across a valve:
Refrigerant: R22
Condensing temperature: 35°C (p_c = 13.5 bar)
Evaporating temperature: 0 - 6°C (p_e = 4.1 bar)
Δp_1 = 0.2 bar
Δp_3 = 0.8 bar
Δp_4 = 0.1 bar

This will give you the following equation:
$\Delta p_{valve} = p_c - (p_e + \Delta p_1 + \Delta p_3 + \Delta p_4)$
$= 13.5 - (4.1 + 0.2 + 0.8 + 0.1)$
$= 8.3$ bar

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

Dimensioning *(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 Δt_{sub}

Correction factor	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R22	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
R404A / R507	1.00	0.91	0.83	0.78	0.73	0.68	0.65	0.61	0.59	0.56
R407C	1.00	0.93	0.88	0.83	0.79	0.75	0.72	0.69	0.66	0.64
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.

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

Example of corection:
Refrigerant: R22
Evaporator capacity Q_e: 5 kW
Subcooling: 10 K

Correction factor according to the table = 0.94
Corrected capacity = 5 × 0.94 = 4.7 kW.

Note: Too little subcooling may cause flash gas.

---

4) Correction for evaporating temperature (t_e)
To obtain a correctly dimensioned valve it is important that the application is considered. 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.

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:

Correction factors for evaporating temperature (t_e)

Evaporating temperature t_e°C	5	0	– 10	–15	– 20	– 30	– 40
AKV 10	1.25	1.25	1.25	1.25	1.6	1.6	1.6
AKV 15	1.0	1.0	1.0	1.0	1.2	1.3	1.4
AKV 20	1.0	1.0	1.0	1.0	1.2	1.3	1.4

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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 you 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:
Δp_{valve} = 8.3 bar
$Q_{e\ corrected}$ = 4.7 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 Δp_{valve} = 8.3 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.

Dimensioning *(continued)*

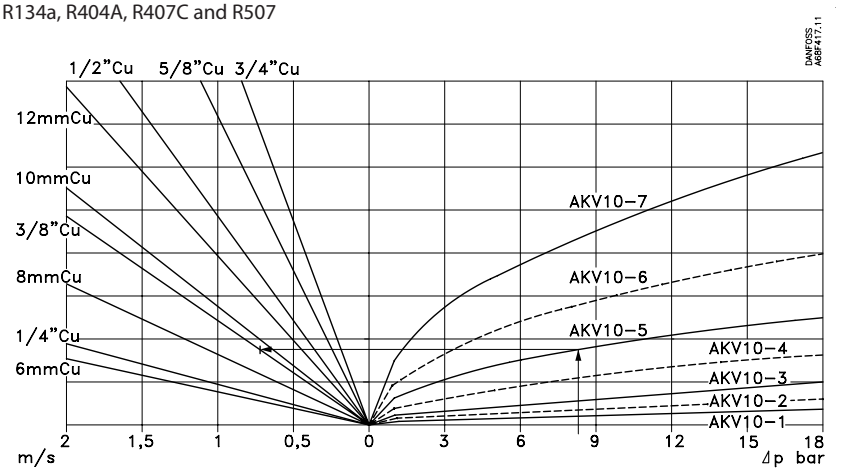
6) Correctly dimensioned liquid line
To obtain a correct supply of liquid to the AKV valve, the liquid line to the individual AKV valve must be correctly dimensioned.

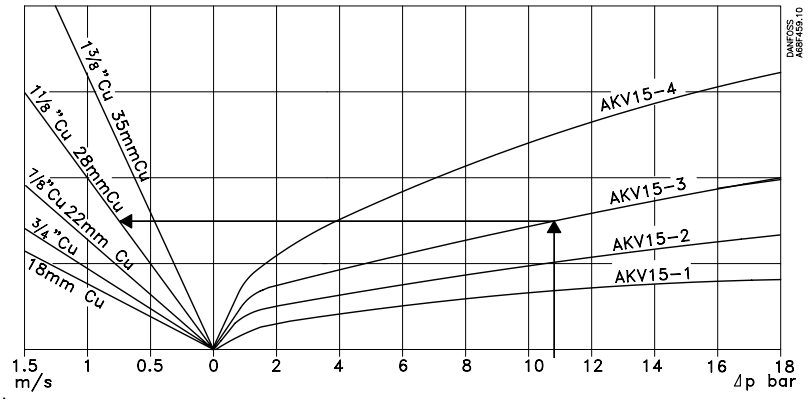
The liquid flow rate should not exceed 1 m/sec.

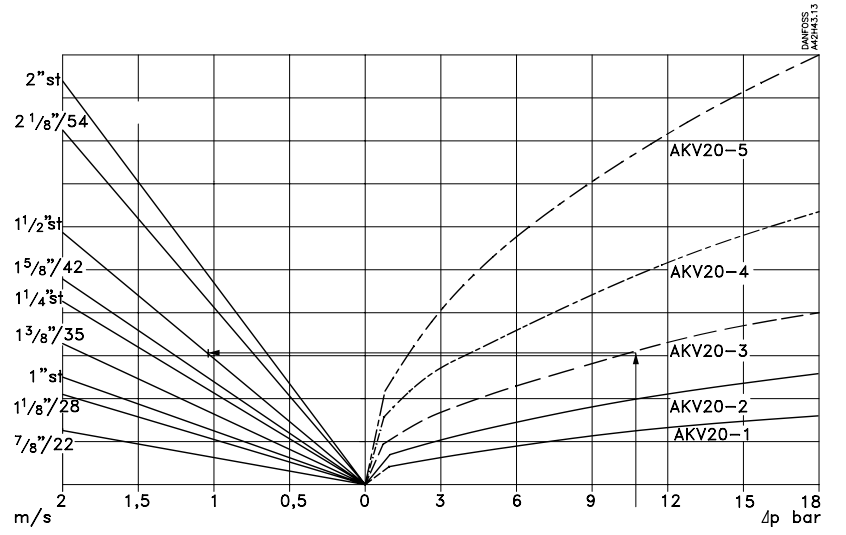
This must be observed on account of the pressure drop in the liquid line (lack of subcooling) and pulsations in the liquid line.

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.

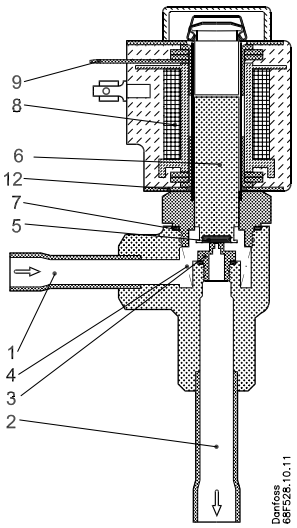
R22, R134a, R404A, R407C and R507





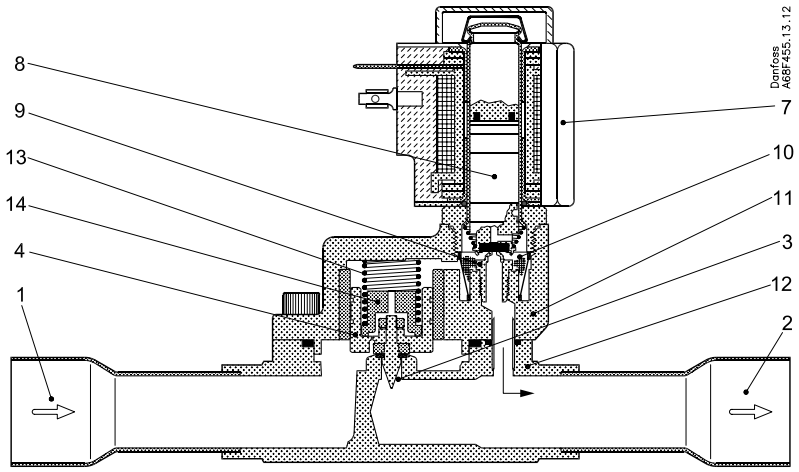


Design



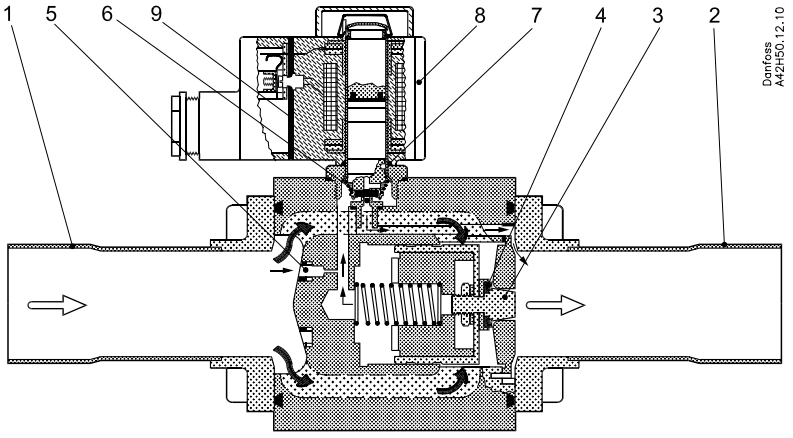
1. Inlet
2. Outlet
3. Orifice
4. Filter
5. Valve seat
6. Armature
7. Copper gasket
8. Coil
9. DIN plug
12. O-ring

AKV 10



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

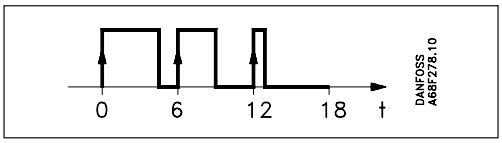


1. Inlet
2. Outlet
3. Orifice
4. Valve seat
5. Filter
6. Pilot orifice
7. O-ring
8. Coil
9. Terminal box

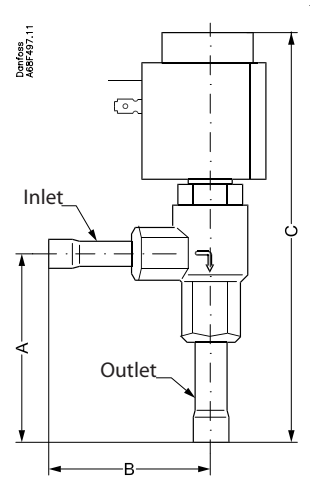
AKV 20

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 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. 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.

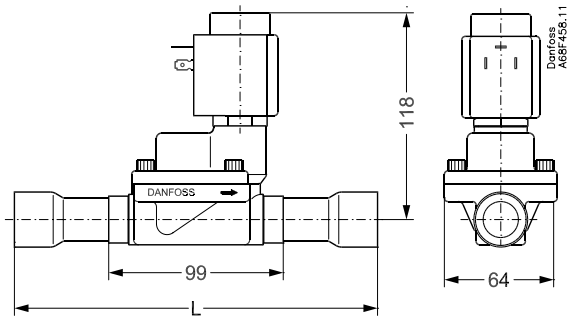


Dimensions and weights



AKV 10 solder

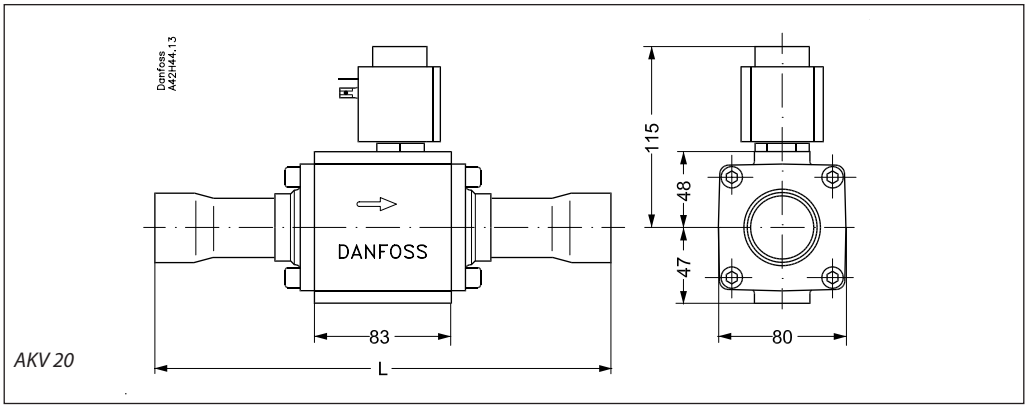
Valve type	Connection type	n	A mm	B mm	C mm	Inlet in.	Outlet in.	Inlet mm	Outlet mm	Weight without coil kg
AKV 10-n	Solder	1, 2, 3, 4, 5, 6	75	67	154	⅜	½	10	12	0.38
		7	73	75	152	½	⅝	12	16	0.38



AKV 15

Valve type	Inlet in.	Outlet in.	Inlet mm	Outlet mm	L mm	Weight without coil kg
AKV 15 -1	¾	¾	18	18	190	1.5
AKV 15 - 2	¾	¾	18	18	190	1.5
AKV 15 - 3	⅞	⅞	22	22	190	1.5
AKV 15 - 4	1 ⅛	1 ⅛	28	28	216	1.5

Dimensions and weights
(continued)



AKV 20

Valve type	Solder connections						Weld connections			
	Inlet	Outlet	Inlet	Outlet	L	Weight without coil	Inlet	Outlet	L	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	180	4.1
AKV 20 - 2	1 3/8	1 3/8	35	35	281	4.3	1 1/4	1 1/4	200	4.1
AKV 20 - 3	1 5/8	1 5/8	42	42	281	4.3	1 1/4	1 1/4	230	4.1
AKV 20 - 4	2 1/8	2 1/8	54	54	281	4.3	1 1/2	1 1/2	230	4.1
AKV 20 - 5	2 1/8	2 1/8	54	54	281	4.3	2	2	230	4.1