

Catalogue

Expansion valves for Industrial Refrigeration

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Thermostatic expansion valves for ammonia

Type TEA

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Thermostatic expansion valves for ammonia

Type TEA



Thermostatic expansion valves regulate the injection of refrigerant liquid into evaporators. Injection is controlled by the refrigerant superheat.

Therefore the valves are especially suitable for liquid injection in „dry“ evaporators where the superheat at the evaporator outlet follows the evaporator load proportionally.

Features

- Large temperature range: -50 – 30 °C
Can be used in both freezing and refrigeration systems
- Interchangeable orifice assemblies
- Interchangeable thermostatic element
- Rated capacities from 3.5 – 295 kW,
1 – 85 tons (TR)
- External superheat setting
Can be matched to all evaporators to give optimum evaporator utilization
- Patented double contact bulb
Fast and easy to install. Good temperature transfer from tube to bulb
- Classification: DNV, CRN, BV, EAC etc.
To get an updated list of certification on the products please contact your local Danfoss Sales Company

Materials

Valve housing made of GGG40.3

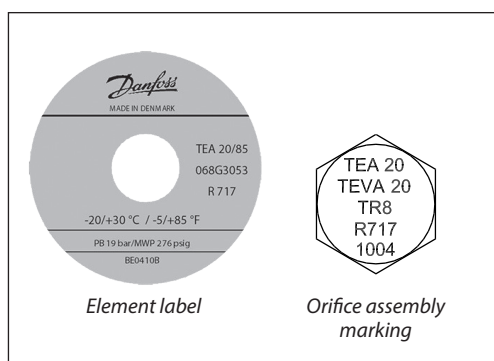
Gaskets are non asbestos

Technical data

- Refrigerant
R717 (Ammonia)
- Evaporating temperature range
D: -50 to 0 °C
P: -20 to 30 °C
- Capillary tube length
5 m
- Connection for external pressure equalization
¼ inch or Ø 6.5 / Ø 10 mm weld nipple.
An 8 mm self-cutting union can also be used
- Max. bulb temperature
100 °C
- Max. working pressure
PS / MWP = 19 bar
- Max. test pressure
28.5 bar

Thermostatic expansion valves for ammonia, type TEA

Identification

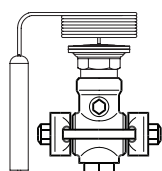


The thermostatic element has a white label attached to its top. The colour refers to the refrigerant for which the valve is designed: R 717 (Ammonia).

The orifice assembly is marked with

- valve type (TEA 20)
- rated capacity (8 TR = 28 kW)
- refrigerant R717 (NH₃)
- date stamp

Ordering



Type and rated capacity in tons	Rated capacity ¹⁾	Connection weld flanges		Code no.			
		Inlet	Outlet	Assembled valve	Separate strainer ²⁾	Separate orifice assembly	Separate thermostatic element
(TR)	[kW]	[in]	[in]				

TEA 20, range: -50 to 0 °C

TEA 20-1	3.5	½	½	068G6000	006-0042	068G2050	068G3250
TEA 20-2	7	½	½	068G6001		068G2051	
TEA 20-3	10.5	½	½	068G6002		068G2052	
TEA 20-5	17.5	½	½	068G6003		068G2053	
TEA 20-8	28	½	½	068G6004		068G2054	
TEA 20-12	42	½	½	068G6005		068G2055	
TEA 20-20	70	½	½	068G6006		068G2056	

TEA 20, range: -20 to 30 °C

TEA 20-1	3.5	½	½	068G6137	006-0042	068G2050	068G3252
TEA 20-2	7	½	½	068G6133		068G2051	
TEA 20-3	10.5	½	½	068G6134		068G2052	
TEA 20-5	17.5	½	½	068G6138		068G2053	
TEA 20-8	28	½	½	068G6139		068G2054	
TEA 20-12	42	½	½	068G6140		068G2055	
TEA 20-20	70	½	½	068G6135		068G2056	

TEA 85, range: -50 to 0 °C

TEA85-33	115	¾	¾	068G6007	006-0048	068G2057	068G3250
TEA 85-55	190	¾	¾	068G6008		068G2058	
TEA 85-85	295	¾	¾	068G6009		068G2059	

TEA 85, range: -20 to 30 °C

TEA85-33	115	¾	¾	068G6141	006-0048	068G2057	068G3252
TEA 85-55	190	¾	¾	068G6142		068G2058	
TEA 85-85	295	¾	¾	068G6143		068G2059	

¹⁾ The rated capacity is the valve capacity at -15 °C evaporating temperature and 32 °C condensing temperature. The capacities are based on approx. 4 K subcooling ahead of valve.

²⁾ The filter is supplied with gaskets, bolts and nuts.

Note:

Subcooling of the liquid in front of the valve is essential for the function of the valve. Lack of subcooling will lead to malfunction of the valve, and increased wear on the orifice.

Thermostatic expansion valves for ammonia, type TEA

Capacity in kW, range -50 – 0 °C

R 717 (NH₃)

Type and rated capacity in tons (TR)	Pressure drop across valve Δp bar								Pressure drop across valve Δp bar							
	2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature 0 °C									Evaporating temperature -10 °C							
TEA 20-1	2.1	2.9	3.3	3.7	4.1	4.3	4.5	4.8		2.7	3.0	3.3	3.6	4.0	4.2	4.4
TEA 20-2	4.1	5.6	6.5	7.4	8.1	8.6	9.0	9.3		5.2	6.0	6.8	7.5	8.0	8.3	8.7
TEA 20-3	5.9	8.3	9.9	11.2	12.1	13.0	13.5	14.0		7.8	9.1	10.1	11.2	12.0	12.6	13.0
TEA 20-5	10.5	14.1	16.7	18.6	20.2	21.5	22.4	23.3		12.9	15.1	17.1	18.7	20.0	20.8	21.5
TEA 20-8	15.7	22.1	26.2	29.7	32.0	34.3	36.1	37.2		20.9	24.4	27.9	30.2	31.7	33.1	34.3
TEA 20-12	24.4	33.1	39.5	44.5	48.3	51.8	54.7	56.4		31.4	36.6	41.9	45.0	47.7	50.0	52.3
TEA 20-20	40.7	55.0	66.3	74.4	80.9	86.1	90.2	93.7		51.8	60.5	68.6	75.1	79.1	83.3	85.6
TEA 85-33	69.3	92.8	110	122	134	145	151	157		85.6	101	113	122	134	140	145
TEA 85-55	114	151	180	204	221	238	250	256		145	169	186	204	221	233	244
TEA 85-85	180	238	285	320	343	366	384	395		221	256	291	314	337	355	372
Evaporating temperature -20 °C									Evaporating temperature -30 °C							
TEA 20-1		2.2	2.6	2.9	3.1	3.3	3.5	3.7		2.0	2.2	2.4	2.6	2.8	2.9	
TEA 20-2		4.3	4.9	5.6	6.2	6.6	6.9	7.1		4.1	4.5	4.9	5.2	5.5	5.6	
TEA 20-3		6.5	7.4	8.5	9.4	10.0	10.4	10.6		6.2	6.9	7.4	7.9	8.3	8.5	
TEA 20-5		11.0	12.9	14.4	15.6	16.5	17.2	17.7		10.1	11.3	12.3	13.1	13.7	14.3	
TEA 20-8		17.4	20.4	22.7	25.0	26.2	27.3	27.9		16.3	18.0	19.8	20.9	22.1	22.7	
TEA 20-12		25.6	30.8	34.9	37.2	39.5	41.9	43.0		25.0	27.9	30.2	31.4	32.6	33.7	
TEA 20-20		44.2	51.2	57.6	61.6	65.7	68.6	72.1		40.7	45.4	49.4	52.3	54.7	57.0	
TEA 85-33		72.1	84.9	94.9	103	109	114	116		68.6	75.0	80.9	85.6	90.2	94.2	
TEA 85-55		116	145	163	174	180	186	192		114	128	140	145	151	157	
TEA 85-85		180	221	244	267	279	291	302		174	192	209	221	233	244	
Evaporating temperature -40 °C									Evaporating temperature -50 °C							
TEA 20-1			1.3	1.7	1.9	2.0	2.2	2.3			1.2	1.3	1.4	1.5	1.6	1.7
TEA 20-2			3.1	3.5	3.8	4.0	4.2	4.4			2.4	2.7	2.8	3.0	3.1	3.3
TEA 20-3			4.8	5.2	5.7	6.0	6.4	6.6			3.7	4.1	4.3	4.5	4.8	5.0
TEA 20-5			8.0	8.7	9.4	10.1	10.6	11.0			6.0	6.6	7.1	7.6	7.9	8.3
TEA 20-8			12.8	14.0	15.1	16.3	16.9	17.4			9.3	10.5	11.0	11.6	12.2	12.8
TEA 20-12			19.2	20.9	22.7	24.4	26.2	27.3			14.5	15.7	16.9	18.0	19.2	20.4
TEA 20-20			32.0	35.5	38.4	40.7	43.0	44.8			24.4	26.2	27.9	29.7	31.4	32.6
TEA 85-33			52.3	58.2	61.6	65.1	68.6	72.1			39.5	43.6	46.5	49.4	51.8	54.1
TEA 85-55			86.8	96.5	104	110	116	122			66.3	72.1	77.8	81.9	86.1	89.6
TEA 85-85			134	151	163	174	180	186			104	113	122	128	134	140

1) Subcooling Δt = 4K ahead of the valve.

Example

Given:
 Refrigerant = R 717 (NH₃)
 Evaporator capacity Q_e = 265 kW (75.3 TR)
 Evaporating temperature t_e = -20 °C
 (~p_e = 1.9 bar)
 Condensing temperature t_c = 32 °C
 (~p_c = 12.4 bar)
 Subcooling Δt = 4K
 If the pressure drop Δp₁ across pipelines, etc. is calculated, for example, as 0.5 bar, the effective pressure drop across the thermostatic valve becomes
 $\Delta p = p_c - p_e - p_1$
 $\Delta p = 12.4 - 1.9 - 0.5 = 10 \text{ bar.}$

Now, from the capacity table at an evaporating temperature t_e = -20 °C and Δp = 10 bar, the capacity is 267 kW.

The column on the far left of this point gives the valve designation: TEA 85-85.

The ordering table gives the code no. for TEA 85-85: 068G6009.

Generally, the maximum capacity of a valve is approx. 20% higher than the value given in the table.

If a different capacity is subsequently required, a separate orifice assembly with a suitable rated capacity can be ordered to replace the one fitted in the installed valve.

Thermostatic expansion valves for ammonia, type TEA

Capacity in kW, range -20 – 30 °C

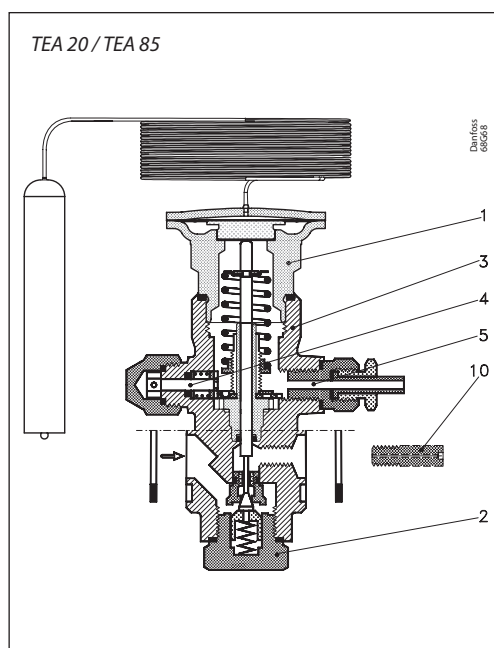
R 717 (NH₃)

Type and rated capacity in tons (TR)	Pressure drop across valve Δp bar								Pressure drop across valve Δp bar							
	2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature 30 °C									Evaporating temperature 20 °C							
TEA 20-1	2.6	3.4	3.9	4.3	4.6	4.8	5.0	5.2	2.7	3.4	3.9	4.2	4.5	4.8	4.9	5.1
TEA 20-2	4.7	6.5	7.5	8.1	8.7	9.2	9.6	9.9	4.9	6.6	7.5	8.1	8.7	9.1	9.5	9.9
TEA 20-3	5.6	7.8	9.3	10.4	11.4	12.2	12.9	13.5	5.9	8.0	9.6	10.8	11.7	12.5	13.2	13.9
TEA 20-5	11.6	16.0	19.0	20.9	22.2	23.4	24.5	25.4	12.1	16.5	19.3	20.9	22.2	23.4	24.4	25.4
TEA 20-8	19.9	27.3	31.3	34.4	36.6	38.6	40.3	41.8	20.7	28.1	31.5	34.2	36.5	38.4	40.1	41.6
TEA 20-12	29.1	39.6	45.3	49.2	52.2	55.2	57.7	59.8	30.2	40.2	45.0	48.8	52.0	54.8	57.2	59.3
TEA 20-20	42.9	66.2	74.6	81.1	86.4	90.9	94.8	98.3	50.7	65.9	73.8	80.0	85.2	89.7	93.7	97.2
TEA 85-33	83.0	106	122	133	143	150	158	164	85.0	106	120	132	141	149	156	163
TEA 85-55	134	179	205	222	236	248	259	268	137	181	202	219	233	245	256	265
TEA 85-85	196	257	297	328	353	374	392	408	200	258	296	326	351	372	390	406
Evaporating temperature 10 °C									Evaporating temperature 0 °C							
TEA 20-1	2.6	3.3	3.8	4.2	4.4	4.7	4.9	5.0	2.6	3.2	3.7	4.1	4.3	4.6	4.8	5.0
TEA 20-2	5.1	6.6	7.4	8.0	8.6	9.0	9.5	9.9	5.2	6.4	7.2	7.9	8.4	8.9	9.4	9.7
TEA 20-3	6.1	8.3	9.8	11.0	12.0	12.8	13.5	14.1	6.3	8.5	10.0	11.2	12.1	12.9	13.6	14.2
TEA 20-5	12.5	17.0	19.1	20.7	22.0	23.2	24.3	25.2	12.9	16.8	18.7	20.3	21.7	22.9	23.9	24.9
TEA 20-8	21.3	27.8	31.1	33.7	36.0	37.9	39.6	41.2	21.8	27.1	30.3	33.0	35.2	37.2	39.0	40.5
TEA 20-12	30.9	39.5	44.2	47.9	51.1	53.9	56.3	58.5	31.4	38.4	42.9	46.7	49.9	52.7	55.2	57.4
TEA 20-20	51.6	64.5	72.1	78.2	83.4	88.0	92.0	95.6	51.7	62.3	69.8	76.0	81.3	85.9	90.0	93.7
TEA 85-33	84.0	104	118	129	139	147	153	160	82.0	101	114	126	135	143	151	157
TEA 85-55	140	178	198	214	228	241	251	261	139	172	192	208	223	235	246	256
TEA 85-85	200	255	292	321	346	367	385	401	196	248	285	314	339	360	378	395
Evaporating temperature -10 °C									Evaporating temperature -20 °C							
TEA 20-1		3.1	3.6	3.9	4.2	4.4	4.6	4.8		2.9	3.2	3.5	3.8	4.0	4.2	4.4
TEA 20-2		6.1	6.9	7.5	8.1	8.6	9.0	9.4		5.4	6.2	6.8	7.3	7.8	8.2	8.6
TEA 20-3		8.5	10.0	11.2	12.1	12.9	13.5	14.1		8.4	9.9	11.0	11.9	12.5	13.0	13.4
TEA 20-5		15.6	17.5	19.1	20.4	21.6	22.7	23.6		13.6	15.4	17.0	18.3	19.4	20.4	21.3
TEA 20-8		24.7	27.8	30.4	32.6	34.6	36.3	37.8		21.0	24.0	26.5	28.6	30.4	32.0	33.4
TEA 20-12		36.9	41.5	45.3	48.6	51.5	54.0	56.3		32.2	36.7	40.4	43.5	46.3	48.7	50.9
TEA 20-20		59.7	67.3	73.6	79.0	83.7	87.9	91.7		56.9	64.6	71.0	76.6	81.4	85.6	89.5
TEA 85-33		97.0	111	122	131	140	147	154		92.0	107	118	128	136	144	150
TEA 85-55		165	185	202	216	229	241	251		158	178	196	211	224	235	245
TEA 85-85		239	276	306	331	352	371	388		230	267	297	323	345	364	381

1) Subcooling Δt = 4K ahead of the valve.

Thermostatic expansion valves for ammonia, type TEA

Design / function



1. Thermostatic element (diaphragm)
2. Orifice assembly
3. Valve body
4. Superheat setting spindle (see „Instructions“)
5. Ext. pressure equalizing connection
10. Separate outlet orifice (for TEA 20-1 only)

General

TEA is equipped with interchangeable orifice assembly and thermostatic element. TEA is built up of three interchangeable main components:

- Thermostatic element (1)
- Orifice assembly (2)
- Valve body (3), with flange connections

The valve has external equalization.

A separate outlet orifice assembly (10) is for use with TEA 20-1 (3.5 kW) only.

The double contact bulb gives fast and precise reaction to temperature changes in the evaporator suction line, even with much reduced evaporator load. It also makes fitting the bulb quick and easy.

The valves are able to withstand the effects that normally occur with hot gas defrosting.

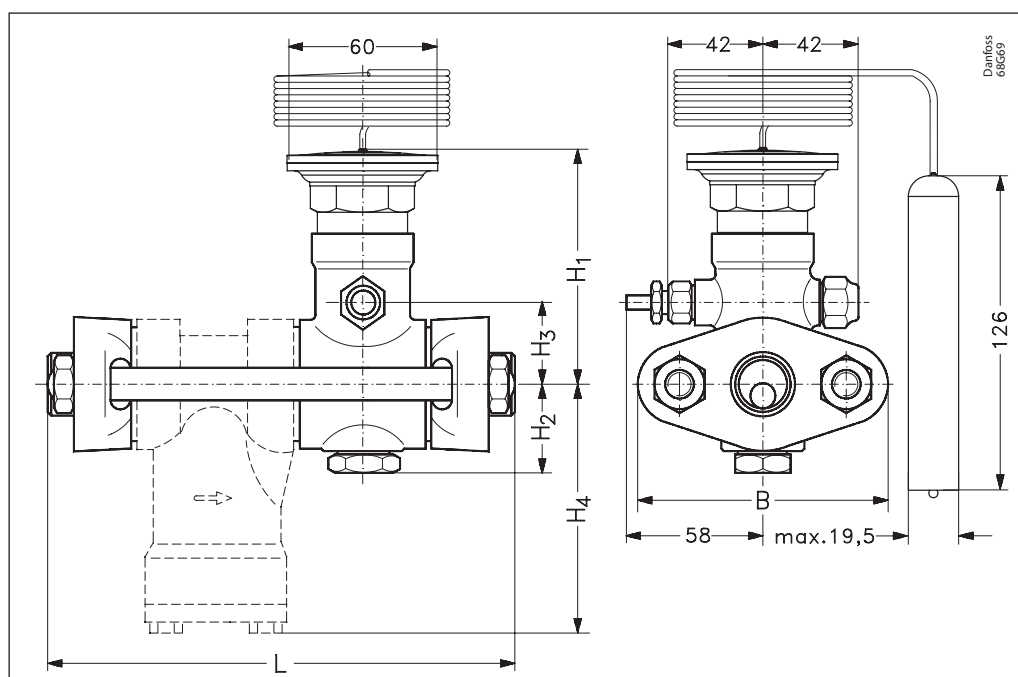
The movement of the setting spindle is transferred by a gearwheel mechanism that ensures smooth superheat setting.

The throttling section of the orifice assembly has a long operating life, the valve cone and seat being made of a special alloy steel with particularly good wear qualities.

Note:

The TEA is not able to close completely tight. Consequently a solenoid valve is needed to shut off liquid supply when systems stops.

Dimensions and weights



Type	H ₁	H ₂	H ₃	H ₄	L		B	Weight	
					Excl. strainer	Incl. strainer		Excl. strainer	Incl. strainer
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]	[kg]
TEA 20	94	38	25	96	110	164	80	2.1	3.0
TEA 85	104	37	35	106	125	199	95	3.0	4.5

Desuperheating valve

Type TEAT

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Desuperheating valve

Type TEAT



Refrigerant injection into the suction line

TEAT valves are used to inject refrigerant into the suction line of the refrigeration system to reduce the high discharge temperatures that can occur when the system operates with highly superheated suction vapour.

This applies when, for example:

- a compressor runs either with low suction pressure or with high condensing temperature
- a compressor runs with both low suction pressure and high condensing temperature. This applies especially to systems with R 22
- a compressor receives highly superheated suction vapour
- a compressor runs with capacity regulation by hot gas bypass

Two-stage refrigeration plant

TEAT valves are also used in two-stage refrigeration plant to control liquid injection into the intercooler. The bulb is installed on the discharge line from the high-pressure compressor. The theoretically obtainable discharge temperature for given operating conditions can be found in the h, log p diagram for the refrigerant concerned.

Temperature regulation of the medium

TEAT valves have a further application: the temperature regulation of the medium, e.g. the temperature of the oil in a screw compressor.

Materials

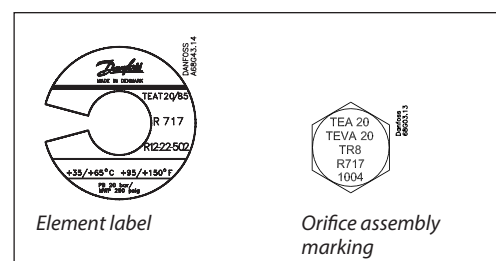
Valve housing made of GGG40.3

Gaskets are non asbestos.

Technical data

- Refrigerants
Applicable to HCFC, non flammable HFC and R717 (Ammonia)
- Regulation ranges
See ordering table
- P band
20 °C
- Capillary tube length
5 m
- Max. bulb temperature
150 °C
- Max. working pressure
PS = 20 bar
- Max. test pressure
p' = 30 bar
- Classification: DNV, CRN, BV, EAC etc.
To get an updated list of certification on the products please contact your local Danfoss Sales Company

Identification



The thermostatic element

has a label giving valve type, temperature range and max. test pressure.

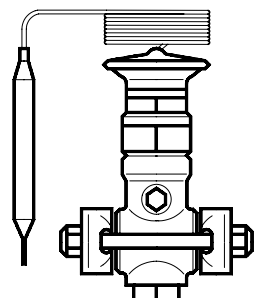
The orifice assembly

is common to TEAT, TEA and TEVA. The rated capacity, e.g. 8 TR (= 28 kW) for the refrigerant ammonia is given on the orifice assembly.

The orifice assembly can be used for both ammonia and fluorinated refrigerants.

Desuperheating valve, type TEAT

Ordering TEAT



Type and rated capacity (TR)	Regulating range [°C]	Flange connection	Code no.		
			Assembled valve	Separate orifice assembly	Separate thermostatic element
TEAT 20-1	35 – 65	½ × ½	¹⁾	068G2050	068G3262
	55 – 95	½ × ½	¹⁾	068G2050	068G3260
	90 – 130	½ × ½	¹⁾	068G2050	068G3261
TEAT 20-2	35 – 65	½ × ½	068G6125	068G2051	068G3262
	55 – 95	½ × ½	068G6062	068G2051	068G3260
	90 – 130	½ × ½	068G6065	068G2051	068G3261
TEAT 20-3	35 – 65	½ × ½	¹⁾	068G2052	068G3262
	55 – 95	½ × ½	¹⁾	068G2052	068G3260
	90 – 130	½ × ½	¹⁾	068G2052	068G3261
TEAT 20-5	35 – 65	½ × ½	068G6126	068G2053	068G3262
	55 – 95	½ × ½	068G6061	068G2053	068G3260
	90 – 130	½ × ½	068G6127	068G2053	068G3261
TEAT 20-8	35 – 65	½ × ½	068G6128	068G2054	068G3262
	55 – 95	½ × ½	068G6063	068G2054	068G3260
	90 – 130	½ × ½	068G6066	068G2054	068G3261
TEAT 20-12	35 – 65	½ × ½	¹⁾	068G2055	068G3262
	55 – 95	½ × ½	¹⁾	068G2055	068G3260
	90 – 130	½ × ½	¹⁾	068G2055	068G3261
TEAT 20-20	35 – 65	½ × ½	068G6068	068G2056	068G3262
	55 – 95	½ × ½	068G6064	068G2056	068G3260
	90 – 130	½ × ½	068G6067	068G2056	068G3261
TEAT 85-33	35 – 65	¾ × ¾	068G6129	068G2057	068G3262
	55 – 95	¾ × ¾	068G6070	068G2057	068G3260
	90 – 130	¾ × ¾	068G6072	068G2057	068G3261
TEAT 85-55	35 – 65	¾ × ¾	068G6130	068G2058	068G3262
	55 – 95	¾ × ¾	068G6073	068G2058	068G3260
	90 – 130	¾ × ¾	068G6131	068G2058	068G3261
TEAT 85-85	35 – 65	¾ × ¾	068G6069	068G2059	068G3262
	55 – 95	¾ × ¾	068G6071	068G2059	068G3260
	90 – 130	¾ × ¾	068G6132	068G2059	068G3261

¹⁾ This valve size must be ordered as a complete valve + a separate orifice assemble in the required size.

Example: TEAT 20-3 must be ordered as **068G6125 + 068G2052**.

The orifice in the complete TEAT 20-2 valve must then be changed with the separate orifice assemble.

Separate filter with gaskets, staybolts and nuts
for TEAT 20, code no. **006-0042**
for TEAT 85, code no. **006-0048**.

Stainless steel bulb pocket, gasket, and union nut,
code no. **993N3615**, for screwing into G ½ socket
welded to tube or tank.

Rated capacity in kW

Type and rated capacity (TR)	Rated capacity in kW ¹⁾ at Δp = 8 bar					
	R717 (NH ₃)	R22	R134a	R404A	R12	R502
TEAT 20-1	3.3	0.8	0.7	0.6	0.5	0.6
TEAT 20-2	6.4	1.5	1.2	1.1	0.9	1.1
TEAT 20-3	9.7	2.3	1.7	1.6	1.3	1.6
TEAT 20-5	16.0	3.6	3.0	2.9	2.3	2.7
TEAT 20-8	25.6	6.2	4.6	4.4	3.5	4.4
TEAT 20-12	38.4	9.2	6.9	6.7	5.3	6.5
TEAT 20-20	64.0	15.4	13.1	12.6	10.0	10.8
TEAT 85-33	106	26	19.5	18.8	14.9	18.0
TEAT 85-55	173	42.4	31.8	30.6	24.3	27.4
TEAT 85-85	274	66.3	50.3	48.4	38.4	46.5

¹⁾ Rated capacity is valve capacity at 5 °C evaporating temperature, and 4K subcooling of the liquid in front of the valve.

²⁾ Note: Subcooling of the liquid in front of the valve is essential for the function of the valve. Lack of subcooling will lead to malfunction of the valve and increased wear on orifice.

Desuperheating valve, type TEAT

Extended capacities in kW

R717 ¹⁾

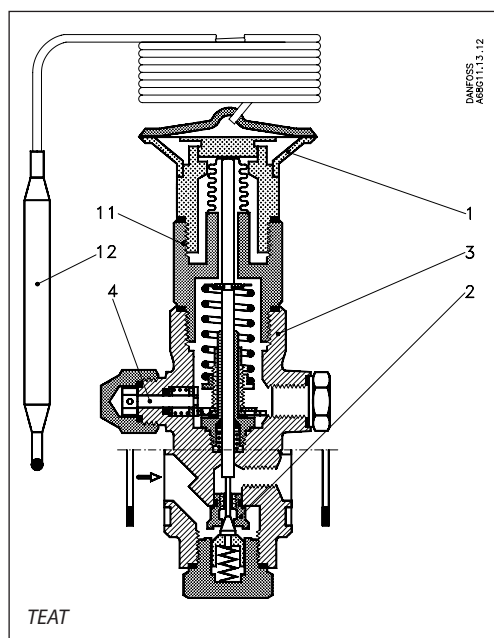
Valve size	Pressure drop across valve Δp bar				
	4	6	8	11	15
20 - 1	2.3	2.8	3.3	3.6	4.7
20 - 2	4.8	5.7	6.4	7.2	7.9
20 - 3	7.2	8.5	9.7	10.8	11.7
20 - 5	12.1	14.2	16.0	18.0	19.8
20 - 8	18.6	22.1	25.6	28.5	31.4
20 - 12	29.1	33.7	38.4	43.0	47.1
20 - 20	47.7	57.0	64.0	72.1	79.1
85 - 33	80.2	94.2	106.4	118.6	130.3
85 - 55	136.1	157.0	176.8	197.7	215.2
85 - 85	203.5	239.6	274.5	302.4	334.9

R22 ¹⁾

Valve size	Pressure drop across valve Δp bar				
	4	6	8	11	15
20 - 1	0.6	0.7	0.8	0.9	1.0
20 - 2	1.2	1.4	1.5	1.7	1.9
20 - 3	1.7	2.0	2.3	2.6	2.9
20 - 5	2.7	3.1	3.6	4.0	4.8
70 - 8	4.4	5.2	6.2	6.9	7.6
20 - 12	7.0	8.1	9.2	10.4	11.3
20 - 20	11.5	13.7	15.4	17.2	18.8
85 - 33	19.3	22.4	25.6	28.5	31.4
85 - 55	32.6	37.8	42.4	47.7	52.3
85 - 85	48.8	58.2	66.3	72.1	81.4

¹⁾ The rated capacity is valve capacity at 5 °C evaporating temperature, 32 °C condensing temperature and 4K subcooling of the liquid in front of the valve.

Design / function



- 1. Thermostatic element (diaphragm)
- 2. Orifice assembly
- 3. Valve body
- 4. Setting spindle
- 11. Intermediate section
- 12. Bulb

Temperature variations in the discharge pipe where the bulb is placed act on the thermal charge in the bulb (12). This changes the pressure in the thermostatic element (1) and thus gives modulating liquid injection.

If leakage in the thermostatic element does occur, it will not result in refrigerant loss.

The thermostatic element is screwed to the intermediate section (11) of the valve. A bellow on the intermediate section means that the suction pressure cannot influence the valve setting.

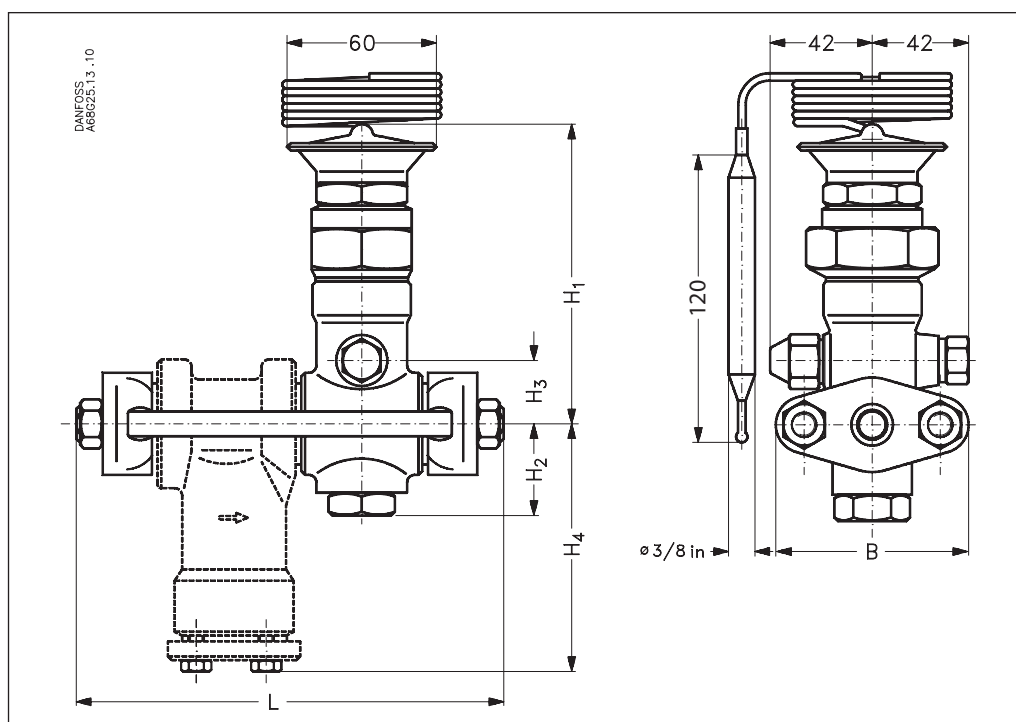
The movement of the setting spindle (4) is transferred through a gearwheel mechanism.

The orifice assembly (2) is identical to that of TEA thermostatic expansion valves.

Note: The TEAT is not able to close completely tight, so a solenoid valve is needed to shut off liquid supply, when the system stops.

Desuperheating valve, type TEAT

Dimensions and weights



Type	H ₁ [mm]	H ₂ [mm]	H ₃ [mm]	H ₄ [mm]	L		B [mm]	Weight	
					Excl. strainer [mm]	Incl. strainer [mm]		Excl. strainer [kg]	Incl. strainer [kg]
TEAT 20	121.5	37	25	96	110	164	80	2.1	3.0
TEAT 85	131.5	37	35	106	125	199	95	3.0	4.5

Electric expansion valves

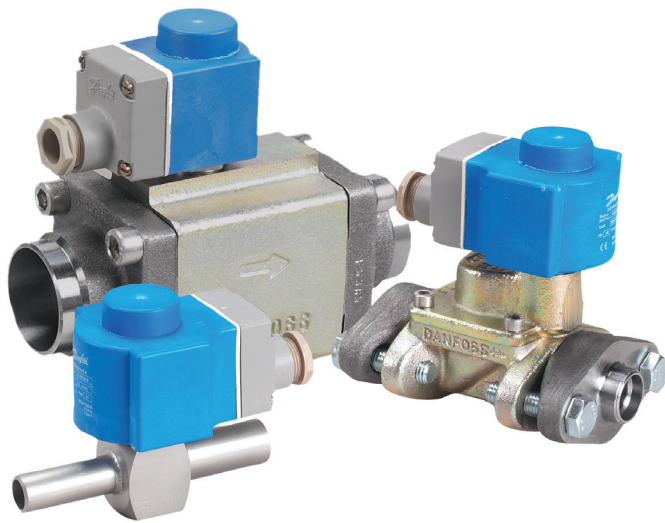
Types AKVA 10, 15 & 20

Contents

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Electric expansion valves

Types AKVA 10, 15 & 20



AKVA are electric expansion valves designed for ammonia refrigerating plant.

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

The AKVA 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 AKVA 10-3.

The orifice assembly is replaceable.

Features

- For R717 (Ammonia) and R744 (CO₂)
- The valve requires no adjustment
- Wide regulation range
- Replaceable orifice assembly
- Wide range of coils for DC and AC
- Quick reaction in whole range of stated capacity
- In some applications AKVA can be used both as expansion valve and solenoid valve.
- Classification: DNV, CRN, BV, EAC etc.
To get an updated list of certification on the products please contact your local Danfoss Sales Company.

Approvals

DEMKO, Denmark
SETI, Finland
SEV, Switzerland

AKVA 20 are CE marked according to Pressure Equipment Directive 97/23



UL listed to U.S. and Canadian standards
(separate code nos.)

Electric expansion valves, types AKVA 10, 15 & 20

Technical data

The AKVA 10 valves covers a capacity range from 4 kW to 100 kW (R 717) and are divided up into 8 capacity ranges.

The AKVA 10 valve bodies are made in stainless steel and have weld connections.

The AKVA 15 valves have flange connections. The valve covers a capacity range from 125 kW to 500 kW (R 717) and are divided up into 4 capacity ranges.

The AKVA 20 valves cover a capacity range from 500 kW to 3150 kW (R 717) and are divided up into 5 capacity ranges.

The AKVA 20 valve has weld connections.

The AKVA valves can be used for:

- Flooded evaporation (high / low pressure)
- Pump separators
- Direct expansion. See appendix

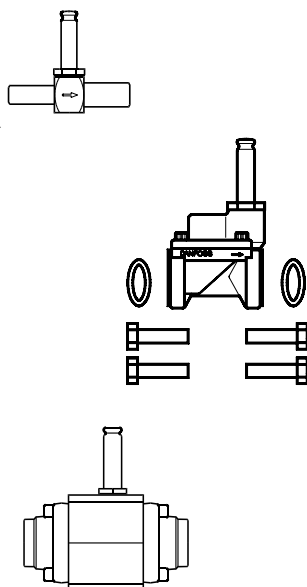
If AKVA has to be used in chillers please contact Danfoss.

The AKVA can be used for R717 (Ammonia) and R744 (CO₂).

Valve type	AKVA 10	AKVA 15	AKVA 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
Recommend period of time	6 seconds	6 seconds	6 seconds
Capacity (R717)	4 to 100 kW	125 to 500 kW	500 to 3150 kW
Regulation range	10 – 100%	10 – 100%	10 – 100%
Connection	Weld	Weld	Weld
Media temperature	-50 – 60 °C	-40 – 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	18 bar	22 bar	18 bar
Filter	Internal 100 µm replaceable	external 100 µm	external 100 µm
Max. working pressure	PS = 42 bar g	PS = 42 bar g	PS = 42 bar g

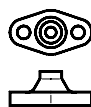
Electric expansion valves, types AKVA 10, 15 & 20

Rated capacity and ordering



Valve type	Rated capacity ¹⁾		k _v -value [m ³ /h]	Connections Inlet x outlet [in]	Code no.	Connections Inlet x outlet [in]	Code no.
	[kW]	[tons]					
AKVA 10-1	4	1.1	0.010	3/8 x 1/2	068F3261	1/2 x 3/4	068F3281
AKVA 10-2	6.3	1.8	0.015	3/8 x 1/2	068F3262	1/2 x 3/4	068F3282
AKVA 10-3	10	2.8	0.022	3/8 x 1/2	068F3263	1/2 x 3/4	068F3283
AKVA 10-4	16	4.5	0.038	3/8 x 1/2	068F3264	1/2 x 3/4	068F3284
AKVA 10-5	25	7.1	0.055	3/8 x 1/2	068F3265	1/2 x 3/4	068F3285
AKVA 10-6	40	11.4	0.103	3/8 x 1/2	068F3266	1/2 x 3/4	068F3286
AKVA 10-7	63	17.9	0.162			1/2 x 3/4	068F3267
AKVA 10-8	100	28.4	0.251			1/2 x 3/4	068F3268
AKVA 15-1	125	35	0.25	Flange	068F5020²⁾		
AKVA 15-2	200	60	0.40	Flange	068F5023²⁾		
AKVA 15-3	300	90	0.63	Flange	068F5026²⁾		
AKVA 15-4	500	140	1.0	Flange	068F5029²⁾		
AKVA 20-1	500	140	1.0	1 1/4 x 1 1/4	042H2101		
AKVA 20-2	800	240	1.6	1 1/4 x 1 1/4	042H2102		
AKVA 20-3	1250	350	2.5	1 1/4 x 1 1/4	042H2103		
AKVA 20-4	2000	600	4.0	1 1/2 x 1 1/2	042H2104		
AKVA 20-5	3150	900	6.3	2 x 2	042H2105		

- ¹⁾ Rated capacities are based on
 Condensing temperature t_c = 32 °C
 Liquid temperature t_l = 28 °C
 Evaporating temperature t_e = 5 °C
²⁾ Incl. bolts and gaskets but without flanges



Flange set for AKVA 15

Valve type	Connection (in.)	Code no.
AKVA 15-1 to 4	3/4	027N1220
	1	027N1225

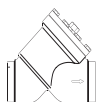
Electric expansion valves, types AKVA 10, 15 & 20

Ordering (continued) Accessories

Strainer

On plants with ammonia and similar industrial plant a strainer must be mounted in front of AKVA 15 and AKVA 20.

AKVA 10 has built-in strainer and external strainer is not necessary.

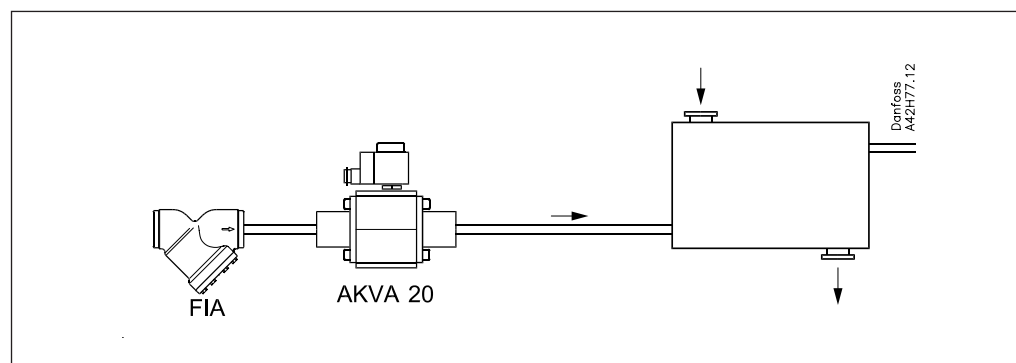


Recommended strainer for AKVA 15 / 20

Strainer type	Code no.	
	House	Strainer insert 100 µm
FIA 20 D STR	148B5343	148H3122
FIA 25 D STR	148B5443	148H3123
FIA 32 D STR	148B5544	
FIA 40 D STR	148B5625	
FIA 50 D STR	148B5713	148H3157

For further information: see Danfoss catalogue AI22586432958

Examples of combinations



Electric expansion valves, types AKVA 10, 15 & 20

Ordering (continued) Spare parts

AKVA 10



Orifice

Type	Code no.	Contents
AKVA 10-1	068F0526	1 pcs. orifice 1 pcs. Al. gasket 1 pcs. cap for coil
AKVA 10-2	068F0527	
AKVA 10-3	068F0528	
AKVA 10-4	068F0529	
AKVA 10-5	068F0530	
AKVA 10-6	068F0531	
AKVA 10-7	068F0532	
AKVA 10-8	068F0533	

Filter

	Code no.	Contents
	068F0540	10 pcs. filters 10 pcs. Al. gaskets

Upper part

	Code no.	Contents
	068F5045	1 pcs. armature 1 pcs. armature tube 1 pcs. Al. gasket

AKVA 15



Piston

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

Gasket set	068F5264	Complete gasket set
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Orifice set

	Code no.	Contents
	068F5261	Main orifice Pilot orifice Al gaskets O-rings Gasket

Upper part

	Code no.	Contents
	068F5045	1 pcs. armature 1 pcs. armature tube 1 pcs. Al. gasket

Filter

	Code no.	Contents
	068F0540	10 pcs. filters 10 pcs. Al. gaskets

AKVA 20



Piston

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

Orifice set

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

Gasket set	042H0160	Complete gasket set for new and old valves
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Upper part

	Code no.	Contents
	068F5045	1 pcs. armature 1 pcs. armature tube 1 pcs. Al. gasket

Electric expansion valves, types AKVA 10, 15 & 20

Ordering (continued) Coils for AKVA valves

AKVA 10-1 10-2 10-3 10-4 10-5	AKVA 10-6	AKVA 10-7 10-8	AKVA 15-1 15-2 15-3 15-4	AKVA 20-1 20-2 20-3	AKVA 20-4 20-5
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DC coils	Code no.						
220 V DC 20 W, standard with terminal box	018F6851	+	+	+	+	+	+
100 V DC 18 W, special with terminal box with DIN plugs	018F6780	+	+	+	+	+	+
230 V DC 18 W, special with terminal box with DIN plugs	018F6781¹⁾ 018F6991¹⁾	+	+	+	+	+	+
230 V DC 18 W, special with 2.5 m cable with 4.0 m cable with 8.0 m cable	018F6288¹⁾ 018F6278¹⁾ 018F6279¹⁾	+	+	+	+	+	+

¹⁾ Recommended for commercial refrigeration plant

AC coils	Code no.						
240 V AC 10 W, 50 Hz with terminal box with DIN plugs	018F6702 018F6177	+	+	—	+	—	—
240 V AC 10 W, 60 Hz with terminal box with DIN plugs	018F6713	+	+	—	+	—	—
240 V AC 12 W, 50 Hz with terminal box	018F6802	+	+	+	+	+	—
220 V AC 10 W, 50 Hz with terminal box with DIN plugs	018F6701 018F6176	+	+	—	+	—	—
220 V AC 10 W, 60 Hz with terminal box with DIN plugs	018F6714 018F6189	+	+	—	+	—	—
220 V AC 12 W, 50 Hz with terminal box	018F6801	+	+	—	+	+	—
220 V AC 12 W, 60 Hz with terminal box	018F6814	+	+	—	+	+	—
115 V AC 10 W, 50 Hz with terminal box with DIN plugs	018F6711	+	+	—	+	—	—
115 V AC 10 W, 60 Hz with terminal box with DIN plugs	018F6710 018F6185	+	+	—	+	—	—
110 V AC 12 W, 50 Hz with terminal box	018F6811	+	+	—	+	+	—
110 V AC 12 W, 60 Hz with terminal box	018F6813	+	+	—	+	+	—
24 V AC 10 W, 50 Hz with terminal box with DIN plugs	018F6707 018F6182	+	—	—	+	—	—
24 V AC 10 W, 60 Hz with terminal box with DIN plugs	018F6715	+	—	—	+	—	—
24 V AC 12 W, 50 Hz with terminal box	018F6807	+	—	—	+	+	+
24 V AC 12 W, 60 Hz with terminal box	018F6815	+	—	—	+	+	+
24 V AC 20 W, 50 Hz with terminal box	018F6901	+	+	+	+	+	+
24 V AC 20 W, 60 Hz with terminal box	018F6902	+	+	+	+	+	+

Electric expansion valves, types AKVA 10, 15 & 20

Capacity

Range: – 40 to 10°C

R 717

Valve type	Capacity in [kW] at pressure drop across valve Δp bar							
	2	4	6	8	10	12	14	16
AKVA 10 - 1	2.2	3.1	3.7	4.1	4.4	4.7	5.0	5.2
AKVA 10 - 2	3.5	4.9	5.8	6.5	7.0	7.5	7.9	8.3
AKVA 10 - 3	5.6	7.7	9.1	10.2	11.1	11.9	12.5	13.1
AKVA 10 - 4	9.1	12.4	14.7	16.5	17.9	19.2	20.2	21.1
AKVA 10 - 5	14.2	19.4	22.9	25.7	28.0	29.9	31.6	33.0
AKVA 10 - 6	23.0	31.2	36.4	41.4	45.0	48.1	50.7	53.1
AKVA 10 - 7	36.6	49.3	58.1	65.0	70.6	75.3	79.4	83.0
AKVA 10 - 8	59.1	78.9	93.5	104	112	120	126	131
AKVA 15 - 1		95.7	113	127	138	148	156	163
AKVA 15 - 2		153	181	203	221	236	250	261
AKVA 15 - 3		231	274	308	335	358	377	395
AKVA 15 - 4		383	455	510	555	593	625	655
AKVA 20 - 1		383	455	510	555	593	625	655
AKVA 20 - 2		612	726	814	886	947	999	1045
AKVA 20 - 3		959	1137	1275	1388	1482	1564	1635
AKVA 20 - 4		1552	1836	2057	2239	2391	2523	2639
AKVA 20 - 5		2479	2921	3267	3550	3789	3994	4174

Correction for subcooling

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

Multiply the liquid injected capacity by the correction factor to obtain the corrected capacity.

Correction factors for subcooling Δt_{sub}

Correction factor	2K	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R 717	1.01	1.00	0.98	0.96	0.94	0.92	0.91	0.89	0.87	0.86	0.85

Corrected capacity = liquid injected 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

Dimensioning
(continued)

Example for a direct expansion system

1. Evaporator capacity

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

2. Pressure drop across the valve

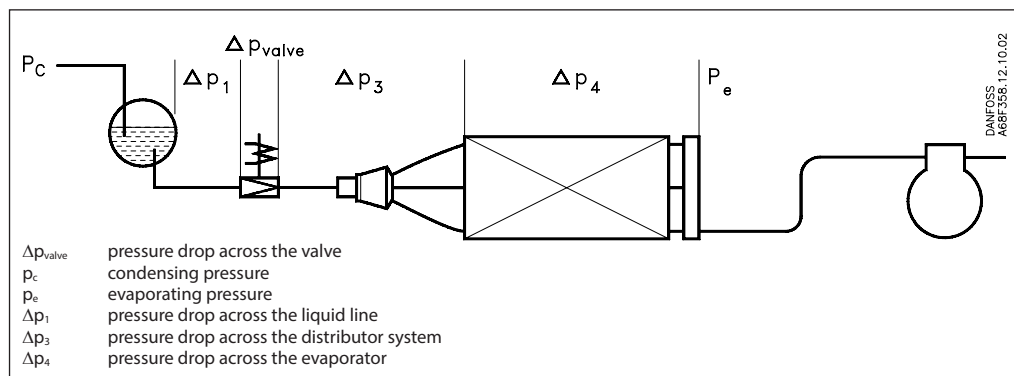
The pressure drop across the valve directly determines the capacity and must therefore be considered.

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:

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



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.

This will give you the following equation:

$$\begin{aligned} \Delta p_{\text{valve}} &= p_c - (p_e + \Delta p_1 + \Delta p_3 + \Delta p_4) \\ &= 13.5 - (1.9 + 0.2 + 0.8 + 0.1) \\ &= 10.5 \text{ bar} \end{aligned}$$

Example of calculation

of pressure drop across a valve:

Refrigerant: R 717

Condensing temperature: 35°C ($p_c = 13.5$ bar)

Evaporating temperature: -20°C ($p_e = 1.9$ bar)

$\Delta p_1 = 0.2$ bar

$\Delta p_3 = 0.8$ bar

$\Delta p_4 = 0.1$ bar

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

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	2 K	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R 717	1.01	1.00	0.98	0.96	0.94	0.92	0.91	0.89	0.87	0.86	0.85

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: R 717

Evaporator capacity Q_e : 300 kW

Subcooling: 10 K

Correction factor according to the table = 0.98

Corrected evaporator capacity = 300 x 0.98 = 294 kW.

Electric expansion valves, types AKVA 10, 15 & 20

Dimensioning (continued)

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
AKVA 10, AKVA 15, AKVA 20	1.0	1.0	1.0	1.0	1.2	1.3	1.4

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:

$$\Delta p_{\text{valve}} = 10.5 \text{ bar}$$

$$Q_{e \text{ corrected}} = 294 \text{ kW}$$

From tabel "Correction factors for evaporating temperature", factor 1.2 is given for the evaporating temperature -20°C.

The dimensioned capacity will then be:

$$1.2 \times 294 \text{ kW} = 353 \text{ kW.}$$

Now select a valve size from tabel "Capacity".

With the given values $\Delta p_{\text{valve}} = 10.5 \text{ bar}$ and a capacity of 353 kW, AKVA 15 - 4 is selected.

This valve will have a capacity of approx. 555 kW.

6. Correctly dimensioned liquid line

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

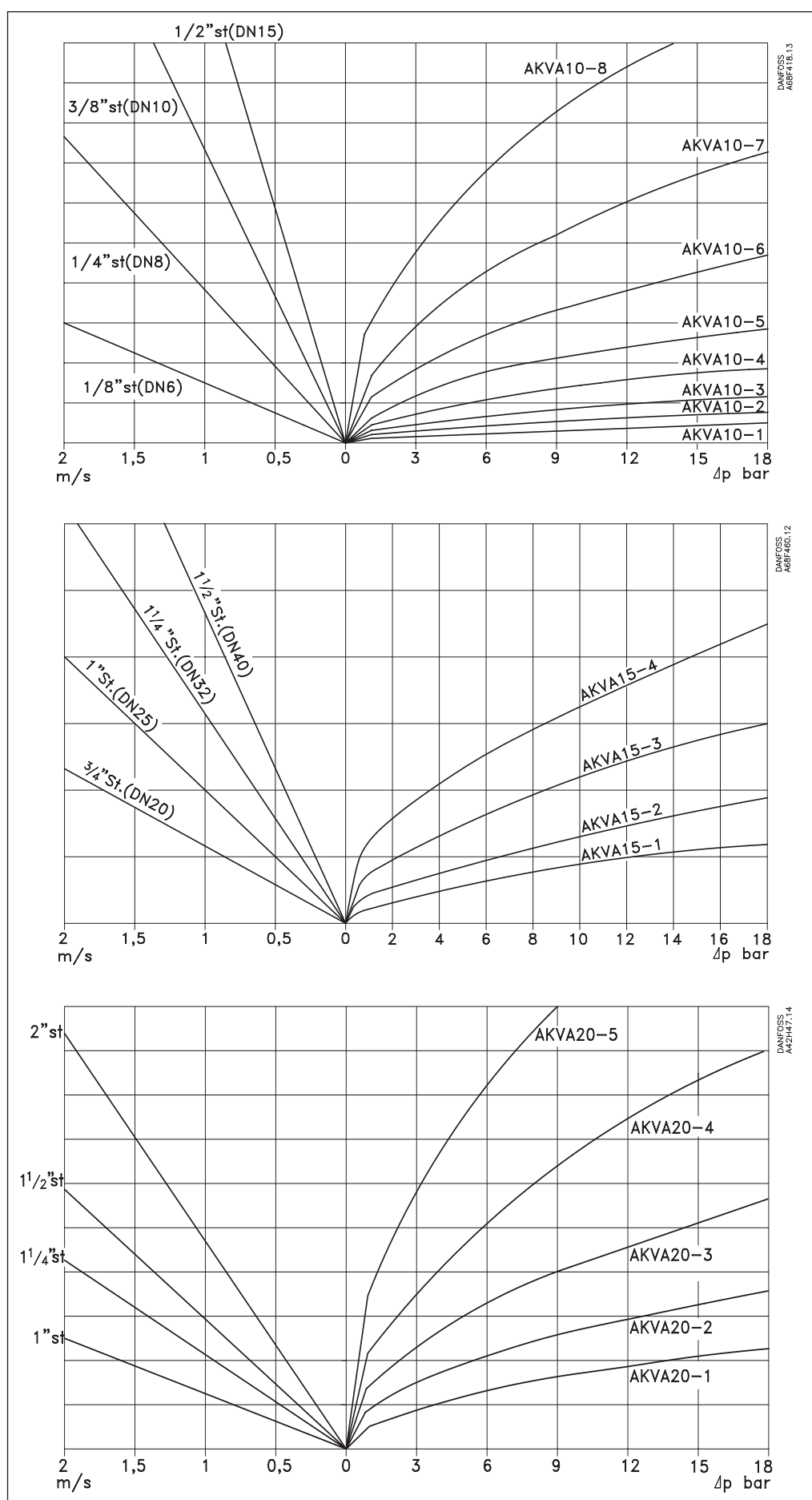
The liquid flow rate must not exceed 1 m/sec at a fully open valve.

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, see next page

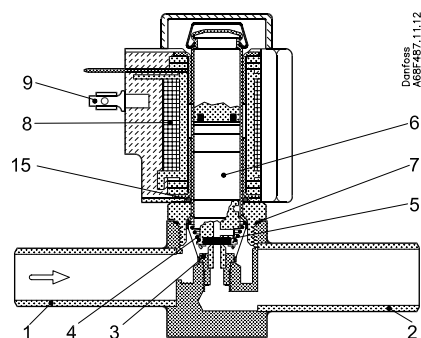
Electric expansion valves, types AKVA 10, 15 & 20

Dimensioning (continued)

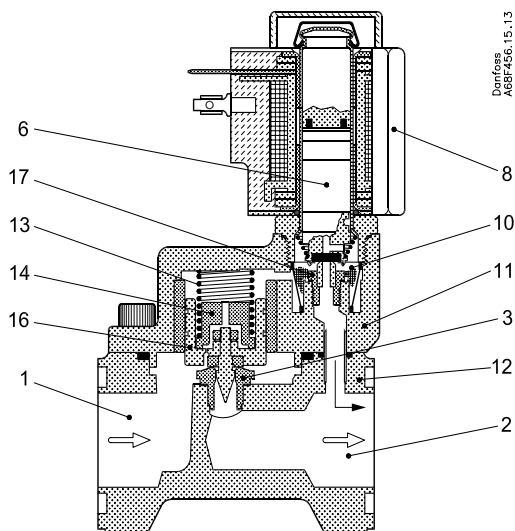


Electric expansion valves, types AKVA 10, 15 & 20

Design

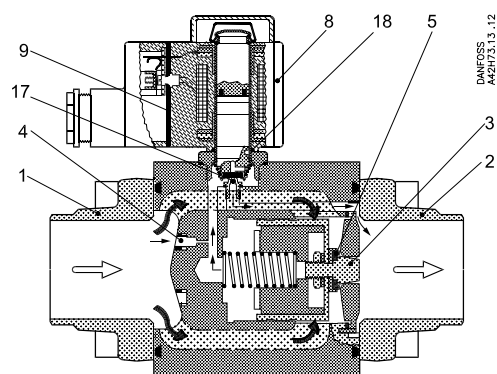


AKVA 10



AKVA 15

1. Inlet
2. Outlet
3. Orifice
4. Filter
5. Valve seat
6. Armature
7. Aluminium gasket
8. Coil
9. DIN plug
10. Filter
11. Cover
12. Valve body
13. Spring
14. Orifice assembly
15. O-ring
16. Piston assembly
17. Pilot orifice
18. Pilot valve

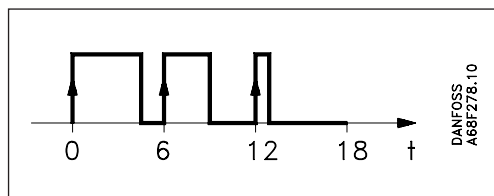


AKVA 20

Electric expansion valves, types AKVA 10, 15 & 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.

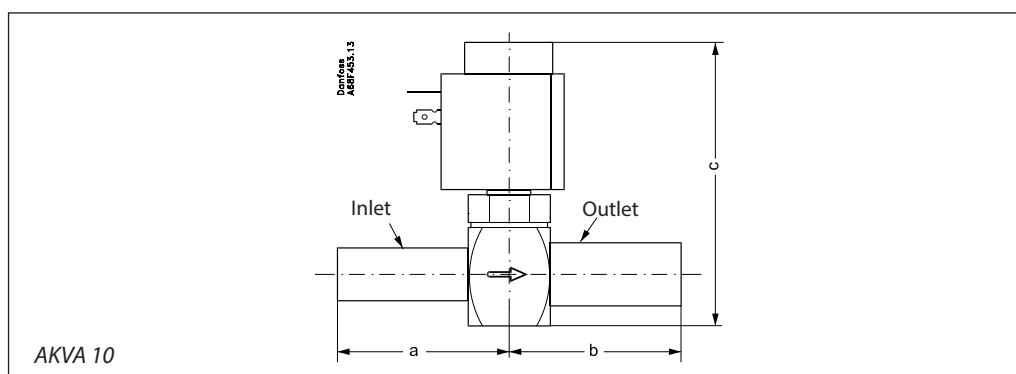


The relation between this opening and closing time indicates the actual capacity. If there is an intense need for refrigeration, the valve will remain open for almost all six seconds of the period. If the required amount of refrigeration is modest, the valve will only stay open during a fraction of the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

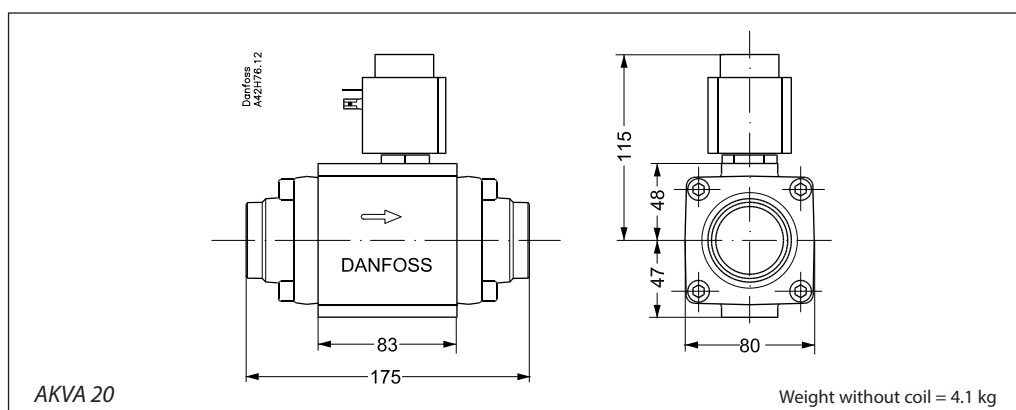
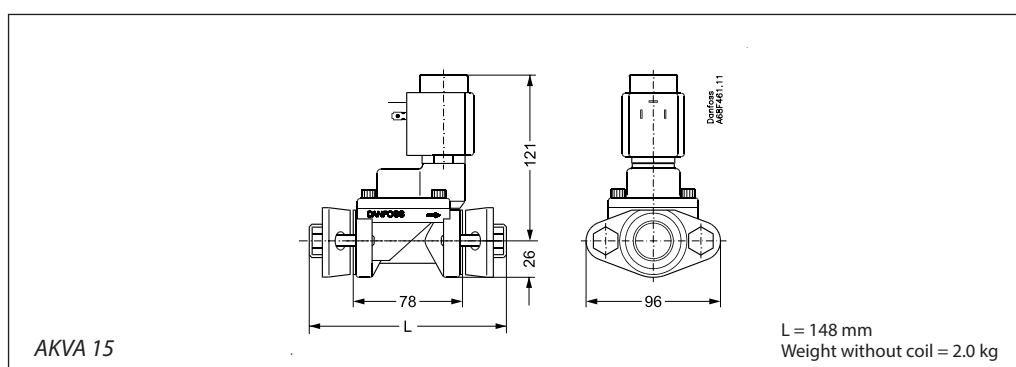
When no refrigeration is required, the valve will remain closed.

In some applications, AKVA can advantageously be used both as expansion valve and solenoid valve. See appendix.

Dimension and weight



Valve type		A	B	C	Connection		Weight without coil [kg]
		[mm]	[mm]	[mm]	Inlet [in]	Outlet [in]	
AKVA 10	1 → 6	60	60	113	3/8	1/2	0.35
AKVA 10	7 → 8	60	60	113	1/2	3/4	0.35



Appendix

Recommendations

It is important to realize when AKVA is operating, that the valve always is fully open or fully closed.

That means that this way of operation should always be considered during the refrigeration design. (Piping, liquid velocity, sub cooling etc.)

Danfoss have the following recommendations/guidelines to be taken into considerations.

- In 1:1 applications (1 evaporator, 1 condenser and 1 compressor) chillers with a small amount of refrigerant or installed in front of a Plate Heat Exchangers, it must be observed that every time the AKVA is fully open or closed it will have a significant impact on the whole system. (e.g. pressure variations on suction side).

Please observe that the performance of such a system is not only related to one component. (e.g. AKVA) Other factors which is very important to include in the overall refrigeration system design:

- Liquid distribution at and design of evaporator
- total evaporator coil is of adequate length thus superheat can be controlled within the entered period time (normal 6 sec. or 3 sec.)
- mounting principle of temperature sensor, to ensure a steady and fast signal can be detected by the electronic system.

- If pressure dependent valves like, PM with pilots like CVP e.t.c., is installed between evaporator and compressor, it can effect the lifetime of PM, because the piston of the PM will operate together with operation of AKVA. Type of refrigerant and evaporator has a big influence of the size of pulsations after the evaporator and in front of the PM.
- AKVA is a direct pressure independent valve unlike TQ, PHTQ and TEAQ, which all are pressure dependent. That means that if non-Danfoss electronic controllers is used, intelligent and fast optimal control is needed, because the quick pressure changes only can be detected and compensated via the electronic control system.
- Liquid lines must be designed according to AKVA capacity and not evaporator capacity.
- To avoid flash-gas ensure sufficient sub-cooling or design liquid lines thus to big pressure drop is avoided, when AKVA is open. If not sufficient subcooling is not obtained (normally 4K) it will have an impact on the lifetime of the valve).
- Where the demand for safety level is extremely high, (e.g. Liquid Level Control in a pump separator) an extra valve can be installed in front of AKVA to avoid leakage. This valve must be Danfoss type EVRAT.
- Always install a 100 µm filter in front of AKVA 15 and AKVA 20 valves.
- If AKVA has to be used in chillers. Please contact Danfoss.

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