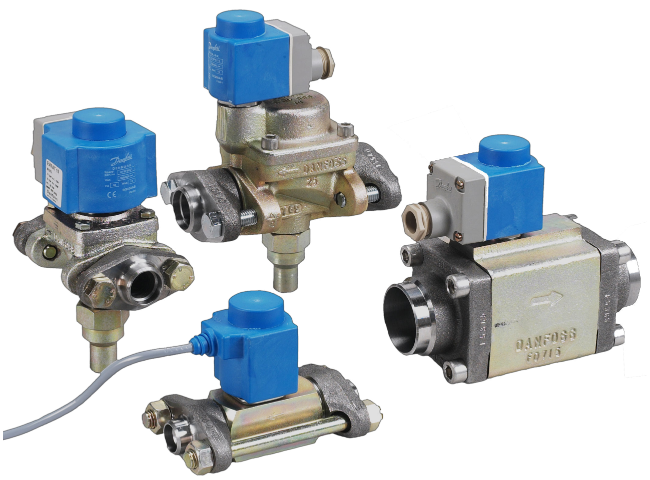
ENGINEERING TOMORROW

Data Sheet

Solenoid valve Type **EVRA** and **EVRAT**

Capable of accommodating the higher pressures of refrigerants and a broader range of applications



EVRA is a direct or servo operated solenoid valve for liquid, suction and hot gas lines with ammonia or fluorinated refrigerants.

EVRA valves are supplied complete or as separate components, i.e. valve body, coil and flanges can be ordered separately.

EVRAT is an assisted lift, servo operated solenoid valve for liquid, suction and hot gas lines with ammonia and fluorinated refrigerants.

EVRAT is specially designed to open - and stay open - at a pressure drop of 0 bar. The EVRAT solenoid valve is thus suitable for use in all plant where the required opening differential pressure is 0 bar.

EVRAT is available as components, i.e. valve body, flanges and coil must be ordered separately.

EVRAT 10, 15 and 20 all have spindle for manual operation.

Features:
- Refrigerants: Applicable to HCFC, HFC and R717 (Ammonia)
- Temperature of medium -40 °C – +105 °C and Max. 130 °C during defrosting
- Classification: DNV, CRN, BV, EAC etc. To get an updated list of certification on the products please contact your local Danfoss Sales Company

Functions

EVRA solenoid valves are designed on two different principles:

1. Direct operation
2. Servo operation

Table 1: Design Function - EVRA 3, EVRA 32 and EVRA 40

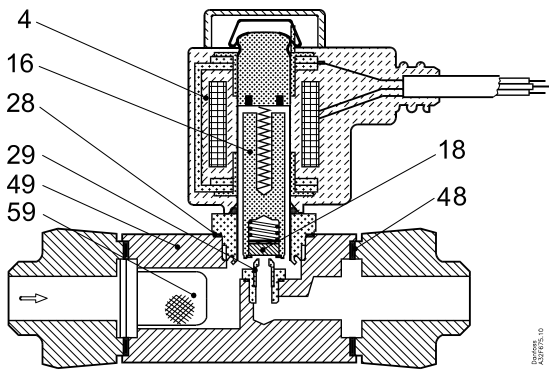
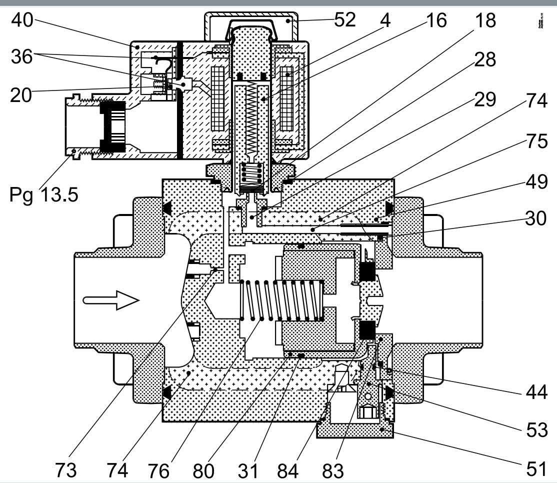
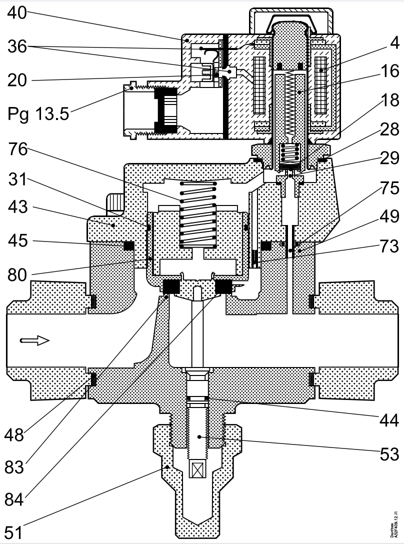
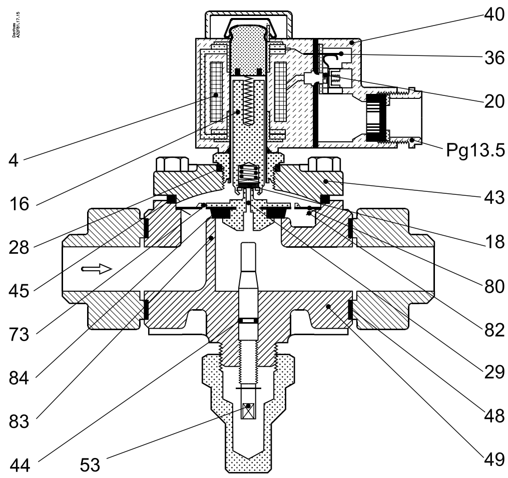
EVRA 3	EVRA 32 and EVRA 40
	

Table 2: Design Function - EVRA 25, EVRA/T 10, EVRA/T 15 and EVRA/T 20

EVRA 25	EVRA/T 10, EVRA/T 15 and EVRA/T 20
	

4	Coil	**36**	DIN plug	**59**	Strainer
16	Armature	**40**	Terminal box	**73**	Equalization hole
18	Valve plate / Pilot valve plate	**43**	Valve cover	**74**	Main channel
20	Earth terminal	**44**	O-ring	**75**	Pilot channel
24	Connection for flexible steel hose	**45**	Valve cover gasket	**76**	Compression spring
28	Gasket	**48**	Flange gasket	**80**	Diaphragm/Servo piston
29	Pilot orifice	**49**	Valve body	**82**	Support washer
30	O-ring	**51**	Cover / Threaded plug	**83**	Valve seat
31	Piston ring	**53**	Manual operation spindle	**84**	Main valve plate

Direct operation

EVRA 3 is direct operated. The valve opens direct for full flow when the armature (16) moves up into the magnetic field of the coil. This means that the valve operates with a min. differential pressure of 0 bar. The teflon valve plate (18) is fitted direct on the armature (16).

Inlet pressure acts from above on the armature and the valve plate. Thus, inlet pressure, spring force and the weight of the armature act to close the valve when the coil is currentless.

Servo operation

EVRA/T 10 → 20 are servo operated with a “floating” diaphragm (80). The pilot orifice (29) of stainless steel is placed in the centre of the diaphragm. The teflon pilot valve plate (18) is fitted direct to the armature (16).

When the coil is currentless, the main orifice and pilot orifice are closed. The pilot orifice and main orifice are held closed by the weight of the armature, the armature spring force and the differential pressure between inlet and outlet sides.

When current is applied to the coil the armature is drawn up into the magnetic field and opens the pilot orifice. This relieves the pressure above the diaphragm, i.e. the space above the diaphragm becomes connected to the outlet side of the valve. The differential pressure between inlet and outlet sides then presses the diaphragm away from the main orifice and opens it for full flow. Therefore a certain minimum differential pressure is necessary to open the EVRA valve and keep it open. For diffential pressure 0 bar use EVRAT valves. For EVRA 10 → 20 valves this differential pressure is 0.05 bar.

When current is switched off, the pilot orifice closes. Via the equalization holes (73) in the diaphragm, the pressure above the diaphragm then rises to the same value as the inlet pressure and the diaphragm closes the main orifice.

EVRA 25, 32 and 40 are servo operated piston valves. The valves are closed with currentless coil. The servo piston (80) with main valve plate (84) closes against the valve seat (83) by means of the differential pressure between inlet and outlet side of the valve, the force of the compression spring (76) and possibly the piston weight.

When current to the coil is switched on, the pilot orifice (29) opens. This relieves the pressure on the piston spring side of the valve. The differential pressure will then open the valve. The minimum differential pressure needed for full opening of the valves is 0.2 bar.

NOTE:
The manual opener of EVRA/EVRAT 10, 15, 20 and 25 is intended to be activated only during initial pressure testing of the refrigeration system. After pressure testing or service-related manual forced opening of the manual opener the spindle must be turned fully back to back-seated position to avoid any packing gland leakage. Furthermore it is essential that the sealing cap is properly reinstalled. This will eliminate any risk of leakage from the manual opener.

Media

Refrigerants

Applicable to HCFC, HFC and R717 (Ammonia).

New refrigerants

Danfoss products are continually evaluated for use with new refrigerants depending on market requirements.

When a refrigerant is approved for use by Danfoss, it is added to the relevant portfolio, and the R number of the refrigerant (e.g. R513A) will be added to the technical data of the code number. Therefore, products for specific refrigerants are best checked at store.danfoss.com/en/, or by contacting your local Danfoss representative.

Product specification

Pressure and temperature data

Table 3: Pressure and temperature

Description	Values
Temperature of medium	-40 °C – +105 °C (Max. 130 °C during defrosting)

NOTE:
Ambient temperature and enclosure for coil - Refer Data sheet “Solenoid coil” (AI237186440089en-000801)

Table 4: Pressure and temperature

Type	Opening differential pressure with standard coil (Δp bar)				Temperature of medium (1) [°C]	Max. working pressure PB [bar]	k_v-value (2) [m³/h]
	Min.	Max. (= MOPD) liquid (3)					
		10 W AC	12 W AC	20 W DC			
EVRA 3	0	21	25	14	-40 – 105	42	0.23
EVRA 10	0.05	21	25	18	-40 – 105	42	1.5
EVRAT 10	0	14	21	16	-40 – 105	42	1.5
EVRA 15	0.05	21	25	18	-40 – 105	42	2.7
EVRAT 15	0	14	21	16	-40 – 105	42	2.7
EVRA 20 with AC coil	0.05	21	25	13	-40 – 105	42	4.5
EVRA 20 with DC coil	0.05	19	21	16	-40 – 105	42	4.5
EVRAT 20	0	14	21	13	-40 – 105	42	4.5
EVRA 25	0.2	21	25	14	-40 – 105	42	10
EVRA 32	0.2	21	25	14	-40 – 105	42	16
EVRA 40	0.20	21	25	14	-40 – 105	42	25

(1) Max. 130 °C during defrost
(2) The k_v value is the water flow in m³/h at a pressure drop across valve of 1 bar, ρ = 1000 kg/m³
(3) MOPD for media in gas form is approx. 1 bar greater

Material specification

Figure 1: EVRA 3 and EVRA/T 10/15/20

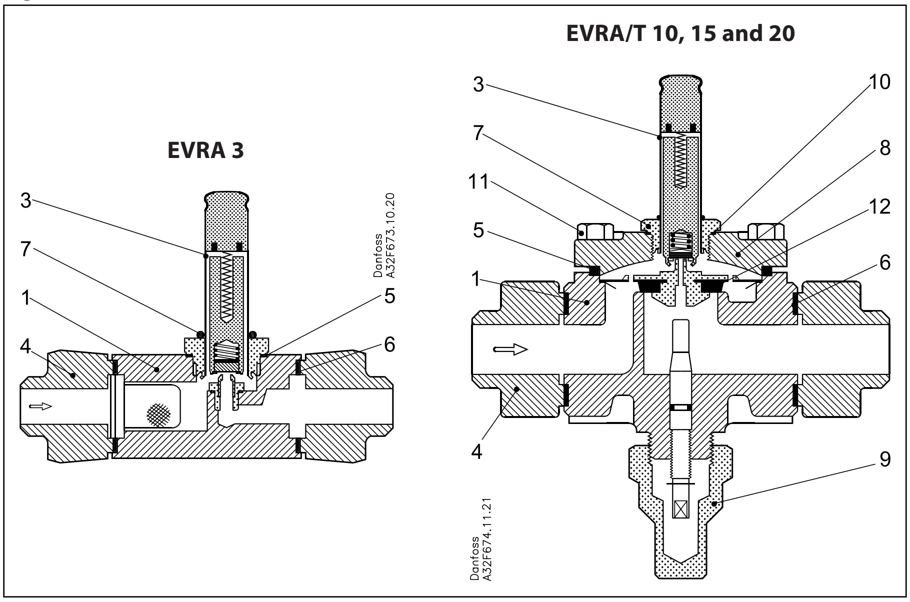


Table 5: EVRA 3 and EVRA/T 10/15/20

No.	Description	Solenoid valves	Material	Analysis	Mat.	W.nc	ISO	EN
1	Valve body	EVRA 3	Free-cutting steel	11MnPb30				10277-3
	Valve body	EVRA/T 10/15/20	Cast-iron	GJS-400-18-LT				1563
3	Armature tube	EVRA 3/10/15/20	Stainless steel	X2CrNi19-11				10088
4	Flange	EVRA/T 3/10/15/20	Steel	S235JRG2				10025

No.	Description	Solenoid valves	Material	Analysis	Mat.	W.nc	ISO	EN
5	Gasket	EVRA 3	Aluminium	Al 99.5				10210
	Gasket	EVRA/T 10/15/20	Rubber	Cr				
6	Gasket	EVRA/T 3/10/15/20	asbestos-free					
7	Armature tube nut	EVRA/T 3/10/15/20	Stainless steel	X8CrNiS18-9				10088
8	Cover	EVRA/T 10/15/20	Cast-iron	GJS-400-18-LT				1563
9	Cover/ thread plug	EVRA/T 10/15/20	Free-cutting steel	11SMnPb30				10277-3
10	Gasket	EVRA/T 10/15/20	Aluminium	Al 99.5				10210
11	Bolts	EVRA/T 10/15/20	Stainless steel	A2-70			3506	
12	Valve seat	EVRA/T 10/15/20	Teflon (PTFE)					

Figure 2: EVRA 25 and EVRA 32/40

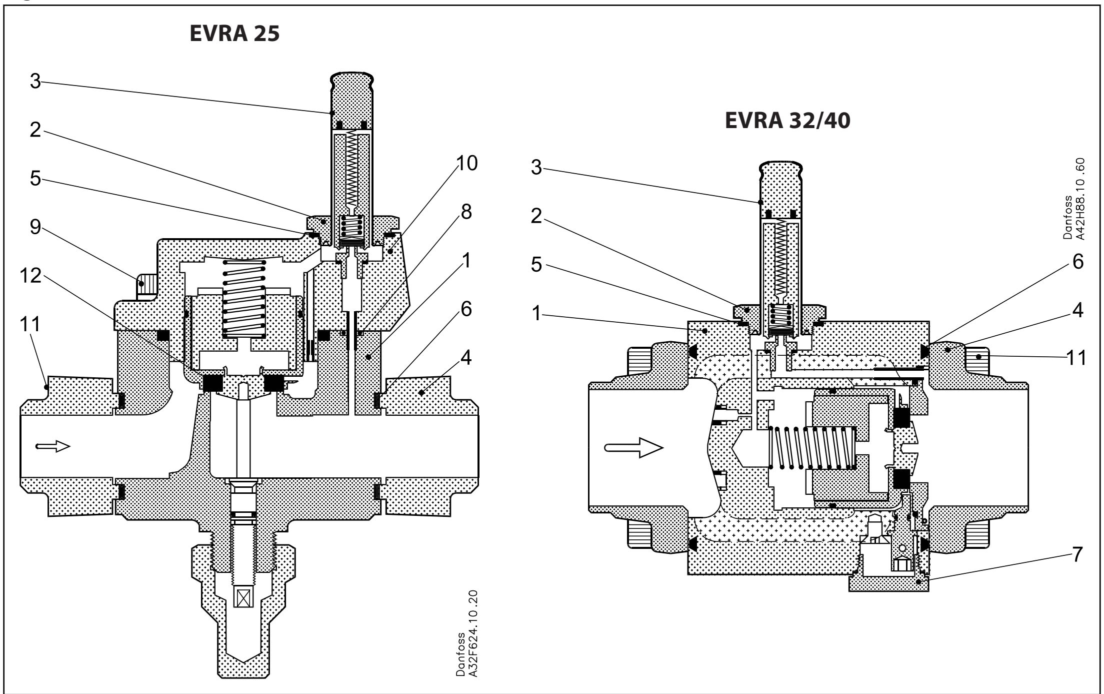


Table 6: EVRA 25 and EVRA 32/40

No.	Description	Solenoid valves	Material	Analysis	Mat.	W.nc	ISO	EN
1	Valve body	EVRA 25/32/40	Cast-iron	GJS-400-18-LT				1563
2	Armature tube nut	EVRA 25/32/40	Stainless steel	X8CrNiS 18-9				10088
3	Armature tube	EVRA 25/32/40	Stainless steel	X2CrNi19-11				10088
4	Flange	EVRA 25	Steel	S235JRG2				10025
	Flange	EVRA 32/40	Steel	P285QH				10222-4
5	Gasket	EVRA 25/32/40	Stainless steel/NBR	X10CrNi18-8				1.431
6	Gasket	EVRA 25	asbestos-free					
	Gasket	EVRA 32/40	Rubber	Cr				
7	Cover/thread plug	EVRA 25	Free-cutting steel	11SMnPb30				10277-3
	Cover/thread plug	EVRA 32/40	Stainless steel	X5CrNi17-10				10088
8	Gasket	EVRA 25	Rubber	CR				
9	Bolts	EVRA 25	Stainless steel	A2-70			3506	
10	Cover	EVRA 25	Cast-iron	GJS-400-18-LT				1563
11	Bolts	EVRA 25/32/40	Stainless steel	A2-70			3506	
12	Valve seat	EVRA 25	Teflon (PTFE)					

Rated capacity

Table 7: Rated capacity

Type	Rated capacity (1) [kW]								Rated capacity (2) [kW]			
	Liquid				Suction vapour				Hot gas			
	R717	R22	R134a	R404A	R717	R22	R134a	R404A	R717	R22	R134a	R404A
EVRA 3	21.8	4.6	4.3	3.2				6.5	2.1	1.7	1.7	
EVRA/T 10	142	30.2	27.8	21.1	9	3.4	2.5	3.1	42.6	13.9	11	11.3
EVRA/T 15	256	54.4	50.1	38	16.1	6.2	4.4	5.5	76.7	24.9	19.8	20.3
EVRA/T 20	426	90.6	83.5	63.3	26.9	10.3	7.3	9.2	128	41.5	32.9	33.9
EVRA 25	947	201	186	141	59.7	22.8	16.3	20.4	284	92.3	73.2	75.3
EVRA 32	1515	322	297	225	95.5	36.5	26.1	32.6	454	148	117	120
EVRA 40	2368	503	464	351	149	57	40.8	51	710	231	183	188

(1) Rated liquid and suction vapour capacity is based on evaporating temperature t_e = -10 °C, liquid temperature ahead of valve t_l = +25 °C, and pressure drop across valve Δp = 0.15 bar.
(2) Rated hot gas capacity is based on condensing temperature t_c = +40 °C, pressure drop across valve Δp = 0.8 bar, hot gas temperature t_h = +65 °C, and subcooling of refrigerant Δtsub = 4 K.

Capacity

Table 8: Liquid capacity Ql kW

R 717 (NH_3)

Type	Liquid capacity Q_e kW at pressure drop across valve Δp bar				
	0.1	0.2	0.3	0.4	0.5
EVRA 3	17.8	25.1	30.8	35.6	39.8
EVRA/T 10	116.0	164.0	201.0	232.0	259.0
EVRA/T 15	209.0	295.0	362.0	418.0	467.0
EVRA/T 20	348.0	492.0	603.0	696.0	778.0
EVRA 25	773.0	1093	1340	1547	1729
EVRA 32	1237	1749	2144	2475	2766
EVRA 40	1933	2734	3349	3867	4322

Table 9: Liquid capacity Ql kW

R 22

Type	Liquid capacity Q_e kW at pressure drop across valve Δp bar				
	0.1	0.2	0.3	0.4	0.5
EVRA 3	3.8	5.3	6.6	7.6	8.5
EVRA/T 10	24.7	34.9	42.7	49.3	55.1
EVRA/T 15	44.4	62.8	76.9	88.8	99.2
EVRA/T 20	73.9	105	128	148	165
EVRA 25	165	232	285	329	368
EVRA 32	263	372	455	526	588
EVRA 40	411	581	712	822	919

Table 10: Liquid capacity Ql kW

R 134a

Type	Liquid capacity Q_e kW at pressure drop across valve Δp bar				
	0.1	0.2	0.3	0.4	0.5
EVRA 3	3.5	4.9	6.0	7.0	7.8
EVRA/T 10	22.7	32.2	39.4	45.5	50.8
EVRA/T 15	40.9	57.9	70.9	81.8	91.5
EVRA/T 20	68.2	96.5	118	136	153
EVRA 25	152	214	263	303	339
EVRA 32	243	343	420	485	542
EVRA 40	379	536	656	758	847

Table 11: Liquid capacity Ql kW

R 404A					
Type	Liquid capacity Q_e kW at pressure drop across valve Δp bar				
	0.1	0.2	0.3	0.4	0.5
EVRA 3	2.6	3.7	4.6	5.3	5.9
EVRA/T 10	17.2	24.3	29.8	34.4	38.5
EVRA/T 15	31.0	43.8	53.7	62.0	69.3
EVRA/T 20	51.7	73.0	89.5	103	116
EVRA 25	115	162	199	230	257
EVRA 32	184	260	318	367	411
EVRA 40	287	406	497	574	642

NOTE:
Capacities are based on liquid temperature t_l = +25 °C ahead of valve, evaporating temperature t_e = -10 °C, and superheat 0 K.

Correction factors
When sizing valves, the plant capacity must be multiplied by a correction factor depending on liquid temperature tl ahead of valve/evaporator. When the corrected capacity is known, the selection can be made from the table.

Table 12: Correction factors

t_v °C	-10	0	10	20	25	30	40	50
R 717 (NH_3)	0.84	0.88	0.92	0.97	1	1.03	1.09	1.16
R 22, R 134a	0.76	0.81	0.88	0.96	1	1.05	1.16	1.31
R 404A	0.7	0.76	0.84	0.94	1	1.07	1.24	1.47

Capacity

Table 13: Suction vapour capacity Qe kW

R 717 (NH_3)							
Type	Pressure drop across valve Δp bar	Suction vapour capacity Q_e kW at evaporating temperature t_e °C					
		-40	-30	-20	-10	0	10
EVRA/T 10	0.1	3.4	4.5	5.9	7.3	8.9	10.6
	0.15	4.0	5.4	7.0	9.0	10.9	13.0
	0.2	4.5	6.1	7.9	10.0	12.6	15.0
EVRA/T 15	0.1	6.1	8.1	10.7	13.2	16.0	19.1
	0.15	7.2	9.7	12.5	16.1	19.6	23.4
	0.2	8.0	11.0	14.2	18.0	22.6	27.0
EVRA/T 20	0.1	10.2	13.5	17.8	21.9	26.6	31.9
	0.15	12.1	16.1	20.9	26.9	32.6	39.0
	0.2	13.4	18.3	23.7	29.9	37.7	45.1
EVRA 25	0.1	22.6	30.0	39.5	48.7	59.2	70.8
	0.15	26.7	35.9	46.3	59.7	72.5	86.7
	0.2	29.8	40.5	52.7	66.4	83.7	100
EVRA 32	0.1	36.2	47.8	63.2	77.9	94.7	113
	0.15	42.7	57.4	74.1	95.5	116	139
	0.2	47.7	64.8	84.3	106	134	160
EVRA 40	0.1	56.5	74.8	98.8	122	148	177
	0.15	66.8	89.8	116	149	181	217
	0.2	74.5	101.0	132	166	209	251

Table 14: Suction vapour capacity Qe kW

R 22							
Type	Pressure drop across valve Δp bar	Suction vapour capacity Q_e kW at evaporating temperature t_e °C					
		-40	-30	-20	-10	0	10
EVRA/T 10	0.1	1.4	1.8	2.3	2.8	3.4	4.0
	0.15	1.6	2.1	2.7	3.4	4.1	4.9
	0.2	1.8	2.4	3.1	3.8	4.8	5.6

R 22							
Type	Pressure drop across valve Δp bar	Suction vapour capacity Q_e kW at evaporating temperature t_e °C					
		-40	-30	-20	-10	0	10
EVRA/T 15	0.1	2.5	3.2	4.1	5.0	6.1	7.2
	0.15	2.9	3.8	4.8	6.2	7.4	8.8
	0.2	3.3	4.3	5.5	6.8	8.6	10.2
EVRA/T 20	0.1	4.1	5.3	6.8	8.4	10.1	12
	0.15	4.9	6.4	8.1	10.3	12.3	14.7
	0.2	5.5	7.2	9.2	11.4	14.3	16.9
EVRA 25	0.1	9.1	11.8	15.2	18.6	22.4	26.6
	0.15	10.9	14.2	17.9	22.8	27.4	32.6
	0.2	12.2	16.1	20.4	25.3	31.7	37.6
EVRA 32	0.1	14.6	18.9	24.3	29.8	35.8	42.6
	0.15	17.4	22.7	28.8	36.5	43.8	52.2
	0.2	19.6	25.7	32.6	40.5	50.7	60.2
EVRA 40	0.1	22.8	29.5	38.1	46.5	56	66.5
	0.15	27.2	35.4	45	57	68.6	81.5
	0.2	30.5	40.2	51	63.3	79.2	94

NOTE:
Capacities are based on liquid temperature t_l = +25 °C ahead of evaporator. The table values refer to the evaporator capacity and are given as a function of evaporating temperature te and pressure drop Δp across valve. Capacities are based on dry, saturated vapour ahead of valve. During operation with superheated vapour ahead of valve, the capacities are reduced by 4% for each 10 K superheat.

Correction factors

When sizing valves, the evaporator capacity must be multiplied by a correction factor depending on liquid temperature tl ahead of expansion valve. When the corrected capacity is known, the selection can be made from the table.

Table 15: Correction factors

t_v °C	-10	0	10	20	25	30	40	50
R 717 (NH_3)	0.84	0.88	0.92	0.97	1	1.03	1.09	1.16
R 22	0.76	0.81	0.88	0.96	1	1.05	1.16	1.31

Capacity

Table 16: Suction vapour capacity Qe kW

R 134a							
Type	Pressure drop across valve Δp bar	Suction vapour capacity Q_e kW at evaporating temperature t_e °C					
		-40	-30	-20	-10	0	10
EVRA/T 10	0.1	0.87	1.2	1.6	2.1	2.6	3.2
	0.15	0.99	1.4	1.9	2.4	3.2	3.9
	0.2	1.1	1.6	2.1	2.8	3.5	4.5
EVRA/T 15	0.1	1.6	2.1	2.8	3.8	4.7	5.7
	0.15	1.8	2.5	3.4	4.4	5.7	7.0
	0.2	2.0	2.8	3.8	5.0	6.3	8.1
EVRA/T 20	0.1	2.6	3.6	4.7	6.3	7.8	9.5
	0.15	3.0	4.2	5.6	7.3	9.5	11.7
	0.2	3.3	4.7	6.4	8.3	10.5	13.5
EVRA 25	0.1	5.8	7.9	10.5	13.9	17.2	21.1
	0.15	6.6	9.3	12.5	16.3	21.1	25.9
	0.2	7.3	10.4	14.1	18.5	23.4	29.9
EVRA 32	0.1	9.3	12.6	16.8	22.2	27.7	33.8
	0.15	10.6	14.9	20.0	26.1	33.8	41.4
	0.2	11.7	16.6	22.6	29.6	37.4	47.8

R 134a							
Type	Pressure drop across valve Δp bar	Suction vapour capacity Q_e kW at evaporating temperature t_e °C					
		-40	-30	-20	-10	0	10
EVRA 40	0.1	14.5	19.8	26.3	34.8	43.3	52.8
	0.15	16.5	23.3	31.3	40.8	52.8	64.8
	0.2	18.3	26.0	35.3	46.3	58.5	74.8

Table 17: Suction vapour capacity Qe kW

R 404A							
Type	Pressure drop across valve Δp bar	Suction vapour capacity Q_e kW at evaporating temperature t_e °C					
		-40	-30	-20	-10	0	10
EVRA/T 10	0.1	1.2	1.5	2.0	2.5	3.1	3.7
	0.15	1.4	1.8	2.4	3.1	3.8	4.6
	0.2	1.6	2.1	2.7	3.4	4.3	5.3
EVRA/T 15	0.1	2.1	2.7	3.6	4.5	5.5	6.6
	0.15	2.5	3.3	4.3	5.5	6.8	8.2
	0.2	2.8	3.7	4.9	6.1	7.8	9.5
EVRA/T 20	0.1	3.5	4.6	6.0	7.5	9.2	11.1
	0.15	4.1	5.5	7.1	9.2	11.3	13.6
	0.2	4.6	6.2	8.1	10.2	13	15.8
EVRA 25	0.1	7.7	10.1	13.3	16.6	20.4	24.6
	0.15	9.1	12.1	15.8	20.4	25	30.3
	0.2	10.3	13.8	18.0	22.7	28.8	35
EVRA 32	0.1	12.3	16.2	21.3	26.6	32.6	39.4
	0.15	14.6	19.4	25.3	32.6	40	48.5
	0.2	16.5	22.0	28.8	36.3	46.1	56
EVRA 40	0.1	19.3	25.3	33.3	41.5	51	61.5
	0.15	22.9	30.3	39.5	51	62.5	75.6
	0.2	25.8	34.5	45.0	56.8	72.1	87.5

NOTE:
Capacities are based on liquid temperature t_l = +25 °C ahead of evaporator. The table values refer to the evaporator capacity and are given as a function of evaporating temperature te and pressure drop Δp across valve. Capacities are based on dry, saturated vapour ahead of valve. During operation with superheated vapour ahead of valve, the capacities are reduced by 4% for each 10 K superheat.

Correction factors

When sizing valves, the evaporator capacity must be multiplied by a correction factor depending on liquid temperature tl ahead of expansion valve. When the corrected capacity is known, the selection can be made from the table.

Table 18: Correction factors

t_v °C	-10	0	10	20	25	30	40	50
R 134a	0.76	0.81	0.88	0.96	1	1.05	1.16	1.31
R 404A	0.7	0.76	0.84	0.94	1	1.07	1.24	1.47