

Thermostatic Expansion Valves, type TCAE, TCBE, TCCE

Contents

	Page
Introduction.....	3
Features.....	3
Standard range:	
TCAE.....	3
TCBE.....	4
Variant range:	
TCBE/TCCE.....	4
Technical data.....	4
MOP-Valves.....	4
Identification.....	5
Ordering:	
TCAE, straightway.....	6
TCAE, orifice assembly.....	6
TCBE, straightway.....	6
Design/Function.....	7
Capacity:	
R22.....	8
R134a.....	9
R404A.....	10
R407C.....	11
R507.....	12
R410A.....	13
Dimensions and weight.....	14

Introduction

The TC thermostatic expansion valve has been developed and designed for soldering into hermetic refrigeration systems. It is manufactured in stainless steel and is therefore very suitable for installation in refrigeration systems for the food industry.

TC can be used in many different forms of refrigeration system, in particular:

- Mobile refrigeration equipment
- Air conditioning units
- Heat pump systems
- Refrigeration appliances
- Liquid coolers
- Ice cube machines
- Traditional refrigeration systems

All variants are available in both singlepacks and industrial packs as required by the customer.

TCAE with interchangeable orifice assembly and adjustable superheat.

TCBE with fixed orifice assembly and adjustable superheat.

TCCE with fixed superheat, otherwise it is identical with TCBE.

All types are straightway versions.



TCCE is manufactured to order, and consequently this technical leaflet contains no description of standard range and code numbers.

TC is also available in a range of variants that give countless valve combination possibilities. Contact Danfoss for further information.

Features

- *Bimetal connections*
 - straightforward and fast soldering (no wet cloth or cooling pliers required)
- *Refrigerants*
R22, R134a, R404A, R507, R407C, R410A and future refrigerants
- *Capacities from 17.5 to 26.5 kW (5.0 to 7.5 TR) for R22*
- *Stable regulation*
- *Biflow function (orifice 1 and 2)*
- *Compact design*
 - small dimensions and low weight
- *Stainless steel, hermetically tight solder version*
 - high connection strength
 - high corrosion resistance
 - capillary tube joints of high strength and vibration resistance.
- *Laser-welded, stainless steel thermostatic diaphragm element*
 - optimum function
 - long diaphragm life
 - high pressure resistance
- *Stainless steel double contact bulb*
 - straightforward and fast installation
 - good heat transfer from bulb to pipe
- *Adjustable superheat type (TCAE/TCBE)*
 - accurate setting
 - adjustable in operation
- *Fixed superheat type (TCCE)*
- *Filter with high dirt retention capacity*
- *Available with self-cleaning bleed*
- *Available with MOP (Max. Operating Pressure)*

Standard range, TCAE

Versions available in the standard range.

Ranges for R22, R134a, R404A, R507, R407C and R410A:

- N** -40 → +10°C without MOP
- N** -40 → +10°C MOP + 15°C
- NM** -40 → -5°C MOP + 0°C

Ranges for R404A og R507

- B** -60 → -25°C without MOP
- B** -60 → -25°C MOP -20°C

Static superheat (SS) for R22, R134a, R404A, R407C, R410A

Valves without MOP: 5 K
Valves with MOP: 4 K

Static superheat (SS) for R507

Valves without MOP: 6.4 K
Valves with MOP: 5.4 K

Capillary tube length 1.5 m

Connections:

Inlet $\frac{3}{8}$ in./10 mm
 $\frac{1}{2}$ in./12 mm
Outlet $\frac{5}{8}$ in./16 mm

Standard range, TCBE

Versions available in the standard range:
Ranges

- N** -40 → +10°C without MOP
N -40 → +10°C MOP + 15°C

Static superheat (SS) for R22, R134a, R404A, R407C, R410A
Valves without MOP: 5 K
Valves with MOP: 4 K

Static superheat (SS) for R507
Valves without MOP: 6.4 K
Valves with MOP: 5.4 K

Capillary tube length: 0.9 m

Connections:

Inlet	Orifice	1	$\frac{3}{8}$ in./10 mm
	Orifice	1-3	$\frac{1}{2}$ in./12 mm
Outlet			$\frac{5}{8}$ in./16 mm

Variant range TCBE/TCCE

In addition to the standard range, TCBE and TCCE valves are also available in these variants and variant combinations:

Ranges

- NM** -40 → -5°C MOP 0°C
B -60 → -25°C without MOP
B -60 → -25°C MOP -20°C

Valves to special temperature ranges can be supplied.

Static superheat (SS)
2K, 3K, 4K, 5K or 6K for both TCBE and TCCE.

Capillary tube length: 1.5 m

Bleed: 15%

Connections:

Inlet	Orifice	2-3	$\frac{3}{8}$ in./10 mm
Outlet	Orifice	1-3	$\frac{1}{2}$ in./12 mm

Technical data

Max. bulb temperature 100°C
Max. valve body temperature 120°C
short-lived peak 150°C

Max. working pressure (excl. R410A) PS/MWP = 34 bar
Max. working pressure, R410A PS/MWP = 42.5 bar
Max. test pressure (excl. R410A) p' = 37.5 bar
Max. test pressure, R410A p' = 47 bar

Biflow operation

With flow in the opposite direction, the rated capacity is reduced by up to 15%.
TC with orifice no. 3, cannot be used for biflow operation.

MOP-Valves

To avoid charge migration when MOP valves are used, the bulb temperature must be lower than the thermostatic element temperature.

MOP points

Refrigerant	Range N -40 → +10°C	Range NM -40 → -5°C	Range B -60 → -25°C
	MOP point for evaporating temperature t_e and evaporating pressure p_e ¹⁾		
	$t_e = +15°C/+60°F$	$t_e = 0°C/+32°F$	$t_e = -20°C/-4°F$
R22	$p_e = 100 \text{ psig}/6.9 \text{ bar}$	$p_e = 60 \text{ psig}/4.0 \text{ bar}$	$p_e = 20 \text{ psig}/1.5 \text{ bar}$
R134a	$p_e = 55 \text{ psig}/3.9 \text{ bar}$	$p_e = 30 \text{ psig}/1.9 \text{ bar}$	
R404A / R507	$p_e = 120 \text{ psig}/8.4 \text{ bar}$	$p_e = 75 \text{ psig}/5.0 \text{ bar}$	$p_e = 30 \text{ psig}/2.0 \text{ bar}$
R407C	$p_e = 95 \text{ psig}/6.6 \text{ bar}$	$p_e = 50 \text{ psig}/3.6 \text{ bar}$	$p_e = 15 \text{ psig}/1.1 \text{ bar}$
R410A	$p_e = 165 \text{ psig}/11.5 \text{ bar}$	$p_e = 100 \text{ psig}/7.0 \text{ bar}$	$p_e = 45 \text{ psig}/3.0 \text{ bar}$

¹⁾ p_e in bar gauge

Identification

Main valve data is given on the element (fig. 1) on the valve body (fig. 2), or on the orifice assembly (fig. 3)

Valves with bleed are marked on the element or orifice assembly: BP 15 (=15% bleed of nominal capacity).

For valves with fixed superheat setting (type TCCE) the superheat is printed on the element (e.g. SS 5°C / 9°F).

Main valve data example, fig. 1

TCBE	=	Type (E = external pressure equalisation)
68U4204	=	Code numbers
R22	=	Refrigerant
MOP 100 / +15°C	=	MOP-point in psig and in °C
-40 / +10°C	=	Evaporating temperature range in °C
-40 / +50°F	=	Evaporating temperature range in °F
PB 34 bar / MWP 500 psig	=	Max. working pressure in bar and psig
182B	=	Date marking (week 18 , year 2002, weekday B = Tuesday)

Main valve data example, fig. 2

⇒	=	Normal flow direction
IN	=	Connection in inches (MM = millimetres)
ORIF1	=	Orifice number 1
5.0 TR	=	Rated capacity $Q_{nom.}$ in Tons of Refrigeration
17.5 kW	=	Rated capacity $Q_{nom.}$ in kW

Example orifice assembly

TC	=	Valve type
1	=	Orifice number
68U4100	=	Code no., orifice with filter and gasket
327	=	Date marking (week 32 , year 1997)

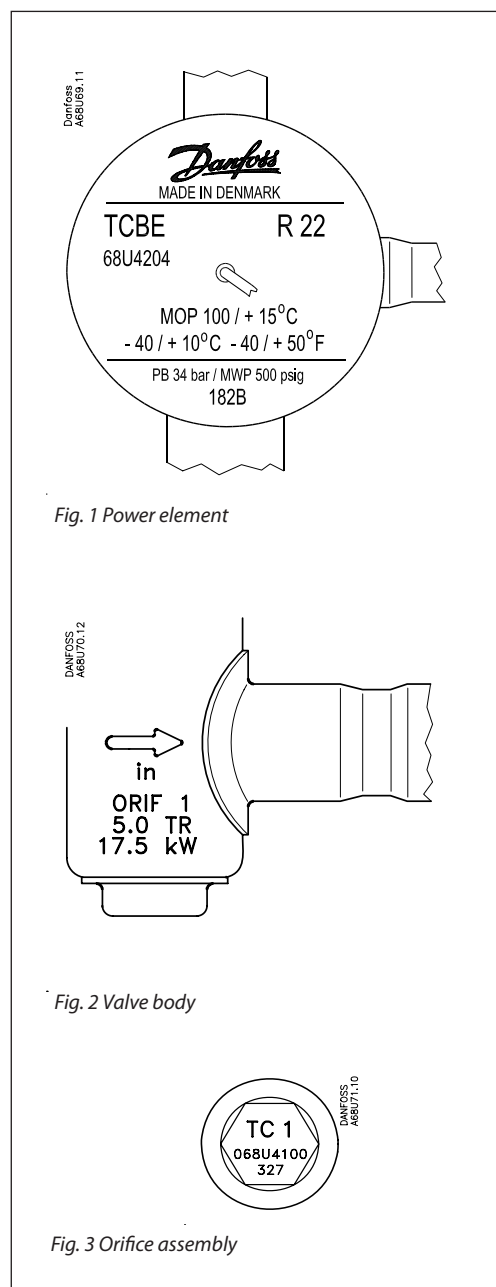
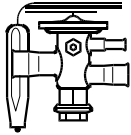


Fig. 1 Power element

Fig. 2 Valve body

Fig. 3 Orifice assembly

Ordering
TCAE, straightway
Thermostatic element without orifice and with bulb strap



R22, R134a, R404A, R507, R407C, R410A

Refrigerant	Type	Pressure equalisation	Connection Inlet x outlet		Code no.				
					Range N -40/+10°C		Range NM -40/-5°C	Range B -60/-25°C	
					without MOP	with MOP	MOP 0°C	without MOP	with MOP
R22	TCAE	ext.	$\frac{3}{8} \times \frac{5}{8}$		068U4280	068U4282	068U4288		
	TCAE	$\frac{1}{4}$ in.	$\frac{1}{2} \times \frac{5}{8}$		068U4281	068U4283	068U4289		
	TCAE	ext.		10 x 16	068U4284	068U4286	068U4290		
	TCAE	6 mm		12 x 16	068U4285	068U4287	068U4291		
R134a	TCAE	ext.	$\frac{3}{8} \times \frac{5}{8}$		068U4292	068U4294	068U4300		
	TCAE	$\frac{1}{4}$ in.	$\frac{1}{2} \times \frac{5}{8}$		068U4293	068U4295	068U4301		
	TCAE	ext.		10 x 16	068U4296	068U4298	068U4302		
	TCAE	6 mm		12 x 16	068U4297	068U4299	068U4303		
R404A R507	TCAE	ext.	$\frac{3}{8} \times \frac{5}{8}$		068U4304	068U4306	068U4312	068U4316	068U4318
	TCAE	$\frac{1}{4}$ in.	$\frac{1}{2} \times \frac{5}{8}$		068U4305	068U4307	068U4313	068U4317	068U4319
	TCAE	ext.		10 x 16	068U4308	068U4310	068U4314	068U4320	068U4322
	TCAE	6 mm		12 x 16	068U4309	068U4311	068U4315	068U4321	068U4323
R407C	TCAE	ext.	$\frac{3}{8} \times \frac{5}{8}$		068U4324	068U4326	068U4332		
	TCAE	$\frac{1}{4}$ in.	$\frac{1}{2} \times \frac{5}{8}$		068U4325	068U4327	068U4333		
	TCAE	ext.		10 x 16	068U4328	068U4330	068U4334		
	TCAE	$\frac{1}{4}$ in.		12 x 16	068U4329	068U4331	068U4335		
R410A	TCAE	ext.	$\frac{3}{8} \times \frac{5}{8}$		068U4336	068U4338	068U4344		
	TCAE	$\frac{1}{4}$ in.	$\frac{1}{2} \times \frac{5}{8}$		068U4337	068U4339	068U4345		
	TCAE	ext.		10 x 16	068U4340	068U4342	068U4346		
	TCAE	6 mm		12 x 16	068U4341	068U4343	068U4347		

Capillary tube length 1.5 m

Ordering
TCAE, orifice assembly
with filter and gasket

¹⁾ TC with orifice no. 3, cannot be used for biflow operation.

Orifice ¹⁾	Bleed%	Code no.
1	0	068U4100
1	15	068U4097
2	0	068U4101
2	15	068U4098
3	0	068U4102
3	15	068U4099

Spare parts

TCAE gaskets*) (24-off)

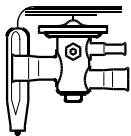
code no. 068U0015

TCAE filter (24-off)

code no. 068U0016

*) To secure tightness the orifice gasket must be exchanged each time the orifice assembly is unscrewed.

Ordering
TCBE, straightway
Thermostatic expansion valve with bulb strap



R22, R134a, R404A, R507, R407C, R410A

Refrigerant	Type	Rated capacity ²⁾		Orifice no.	Pressure equalisation	Code no.					
		kW	TR			Connection inlet x outlet in. x in.	Range N -40/+10°C		Connection inlet x outlet mm x mm	Range N -40/+10°C	
							without MOP	with MOP		without MOP	with MOP
R22	TCBE	17.5	5	1	ext.	$\frac{3}{8} \times \frac{5}{8}$	068U4200	068U4204	10 x 16	068U4208	068U4212
	TCBE	17.5	5	1	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4201	068U4205	12 x 16	068U4209	068U4213
	TCBE	21.0	6	2	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4202	068U4206	12 x 16	068U4210	068U4214
	TCBE	26.5	7.5	3 ¹⁾	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4203	068U4207	12 x 16	068U4211	068U4215
R134a	TCBE	12.0	3.5	1	ext.	$\frac{3}{8} \times \frac{5}{8}$	068U4216	068U4220	10 x 16	068U4224	068U4228
	TCBE	12.0	3.5	1	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4217	068U4221	12 x 16	068U4225	068U4229
	TCBE	14.5	4.1	2	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4218	068U4222	12 x 16	068U4226	068U4230
	TCBE	18.0	5.2	3 ¹⁾	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4219	068U4223	12 x 16	068U4227	068U4231
R404A R507	TCBE	13.5	3.8	1	ext.	$\frac{3}{8} \times \frac{5}{8}$	068U4232	068U4236	10 x 16	068U4240	068U4244
	TCBE	13.5	3.8	1	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4233	068U4237	12 x 16	068U4241	068U4245
	TCBE	16.0	4.5	2	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4234	068U4238	12 x 16	068U4242	068U4246
R407C	TCBE	20.0	5.7	3 ¹⁾	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4235	068U4239	12 x 16	068U4243	068U4247
	TCBE	19.0	5.4	1	ext.	$\frac{3}{8} \times \frac{5}{8}$	068U4248	068U4252	10 x 16	068U4256	068U4260
	TCBE	19.0	5.4	1	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4249	068U4253	12 x 16	068U4257	068U4261
	TCBE	23.0	6.5	2	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4250	068U4254	12 x 16	068U4258	068U4262
R410A	TCBE	28.5	8.1	3 ¹⁾	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4251	068U4255	12 x 16	068U4259	068U4263
	TCBE	23.0	6.5	1	ext.	$\frac{3}{8} \times \frac{5}{8}$	068U4264	068U4268	10 x 16	068U4272	068U4276
	TCBE	23.0	6.5	1	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4265	068U4269	12 x 16	068U4273	068U4277
	TCBE	27.5	7.8	2	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4266	068U4270	12 x 16	068U4274	068U4278
TCBE	34.0	9.8	3 ¹⁾	ext.	$\frac{1}{2} \times \frac{5}{8}$	068U4267	068U4271	12 x 16	068U4275	068U4279	

Valves with inch connections have $\frac{1}{4}$ in. pressure equalisation.
 Valves with mm connections have 6 mm pressure equalisation.

**Design/
Function**

1. Bulb with capillary tube
2. Thermostatic element with diaphragm
3. Setting spindle for adjustment of static superheat SS
4. Orifice assembly
5. Filter

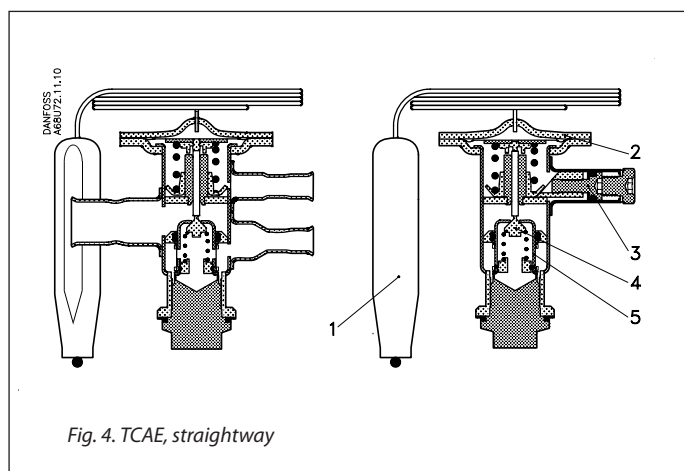


Fig. 4. TCAE, straightway

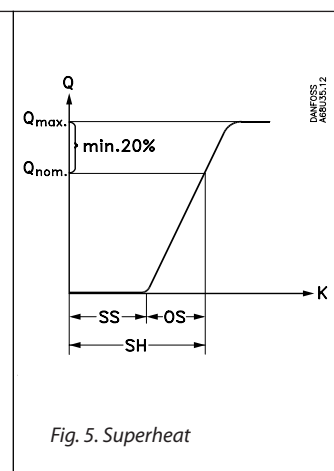


Fig. 5. Superheat

Superheat, TC

See fig. 5.

- SS = static superheat
- OS = opening superheat
- SH = SS + OS = total superheat
- $Q_{nom.}$ = rated capacity of the valve
- $Q_{max.}$ = maximum capacity of the valve

Static superheat SS can be adjusted with setting spindle 3, see fig. 4 (TCAE/TCBE). Static superheat cannot be adjusted on TCCE.

The standard superheat setting SS is 5 K for valves without MOP and 4 K for valve with MOP. The opening superheat OS is 4 K from when opening begins to where the valve gives its rated capacity $Q_{nom.}$.

Example

- Static superheat SS = 5 K
- Opening superheat OS = 4 K
- Total superheat SH = 5 + 4 = 9 K

Capacity

Correction for subcooling Δt_{sub}

The evaporator capacity used must be corrected if subcooling deviates from 4 K. The corrected capacity can be obtained by dividing the evaporator capacity by the correction factor given below.

Note:

Insufficient subcooling can produce flash gas.

Correction factor	Δt_{sub}									
	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R22	1.00	1.06	1.11	1.15	1.2	1.25	1.3	1.35	1.39	1.44
R134a	1.00	1.08	1.13	1.19	1.25	1.31	1.37	1.42	1.48	1.54
R404A / R507	1.00	1.1	1.2	1.29	1.37	1.46	1.54	1.63	1.7	1.78
R407C	1.00	1.08	1.14	1.21	1.27	1.33	1.39	1.45	1.51	1.57
R410A	1.00	1.08	1.15	1.21	1.27	1.33	1.39	1.45	1.50	1.56

Example

Refrigerant = R22
 Evaporating temperature $t_e = -10\text{ }^\circ\text{C}$
 Pressure drop in valve $\Delta p = 10\text{ bar}$
 Subcooling $\Delta t_{sub} = 15\text{ K}$
 Evaporator capacity = 18 kW
 Correction factor (table) = 1.11
 The corrected evaporator capacity thus becomes 18 divided by 1.11 = 16.2 kW

Since the expansion valve capacity must be equal to or lightly more than the corrected evaporator capacity of 16.2 kW, a TC with orifice 1 and a table capacity of 16.3 would be a suitable choice.

Capacity
R22
Capacity in kW for range N: -40°C to +10°C and opening superheat OS = 4 K

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature +10°C										Evaporating temperature 0°C							
TC	1	11.6	15.4	17.7	19.3	20.5	21.3	21.8	22.2	10.8	14.1	16.2	17.6	18.6	19.2	19.7	20.1
	2	14.0	18.7	21.3	23.3	24.8	25.7	26.5	27.0	12.9	16.9	19.4	21.1	22.3	23.2	23.9	24.3
	3	17.4	23.0	26.5	28.9	30.7	31.9	32.8	33.4	16.2	21.2	24.4	26.4	27.8	29.1	30.0	30.6
Evaporating temperature -10°C										Evaporating temperature -20°C							
TC	1	9.6	12.5	14.2	15.4	16.3	16.9	17.3	17.5		10.7	21.1	13.1	13.8	14.2	14.5	14.8
	2	11.4	14.9	17.3	18.5	19.5	20.2	20.8	21.2		12.6	14.3	15.5	16.3	17.0	17.4	17.7
	3	14.4	18.8	21.4	23.3	24.7	25.7	26.5	27.1		16.0	18.2	19.8	21.2	21.8	22.5	23.0
Evaporating temperature -30°C										Evaporating temperature -40°C							
TC	1		8.7	9.9	10.6	11.1	11.5	11.8	11.9			7.7	8.3	8.7	8.9	9.1	9.3
	2		10.2	11.6	12.5	13.2	13.7	14.0	14.3			9.0	9.7	10.2	10.6	10.8	11.0
	3		13.1	14.9	16.1	17.1	17.8	18.3	18.7			11.6	12.6	13.3	13.9	14.3	14.6

Capacity in kW for range B: -60°C to -25°C and opening superheat OS = 4 K

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature -25°C										Evaporating temperature -30°C							
TC	1	8.1	10.5	11.9	12.9	13.6	14.2	14.6	14.8	7.4	9.5	10.8	11.7	12.3	12.8	13.1	13.4
	2	10.4	13.4	15.3	16.7	17.8	18.6	19.3	19.9	9.4	12.1	13.9	15.1	16.1	16.8	17.4	17.9
	3	13.6	17.3	19.8	21.7	23.1	24.3	25.3	26.1	12.2	15.7	18.0	19.7	21.0	22.1	23.0	23.8
Evaporating temperature -40°C										Evaporating temperature -50°C							
TC	1	5.9	7.5	8.5	9.2	9.7	10.1	10.3	10.5	4.5	5.7	6.4	6.9	7.3	7.6	7.8	7.9
	2	7.4	9.5	10.9	11.9	12.6	13.2	13.7	14.1	5.6	7.2	8.2	8.9	9.5	9.9	10.3	10.6
	3	9.7	12.5	14.3	15.7	16.8	17.7	18.4	19.1	7.4	9.5	10.8	11.9	12.7	13.4	14.0	14.5
Evaporating temperature -60°C																	
TC	1	3.2	4.1	4.6	5.0	5.2	5.4	5.6	5.6								
	2	4.0	5.1	5.9	6.4	6.8	7.1	7.4	7.6								
	3	5.3	6.8	7.8	8.6	9.2	9.7	10.1	10.5								

Correction factors for subcooling Δt_{sub}

Δt_{sub}	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R22	1.00	1.06	1.11	1.15	1.20	1.25	1.30	1.35	1.39	1.44

Capacity
R134a

 Capacity in kW for range N: -40°C to $+10^{\circ}\text{C}$ and opening superheat $OS = 4\text{ K}$

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature $+10^{\circ}\text{C}$										Evaporating temperature 0°C							
TC	1	9.0	11.4	12.8	13.6	13.9	14.1			8.0	10.1	11.2	11.6	12.1	12.3		
	2	11.3	14.5	16.2	17.2	17.8	18.0			10.1	12.7	14.1	14.9	15.4	15.6		
	3	14.5	18.5	20.6	21.9	22.7	23.1			13.0	16.5	18.2	19.3	19.9	20.3		
Evaporating temperature -10°C										Evaporating temperature -20°C							
TC	1	6.8	8.5	9.4	9.9	10.2	10.2				6.9	7.6	8.0	8.1	8.2		
	2	8.6	10.7	11.8	12.5	12.8	13.0				8.6	9.5	10.0	10.3	10.4		
	3	11.2	13.9	15.4	16.3	16.8	17.1				11.3	12.5	13.2	13.6	13.8		
Evaporating temperature -30°C										Evaporating temperature -40°C							
TC	1		5.4	5.9	6.1	6.2	6.2				4.0	4.3	4.5	4.6	4.5		
	2		6.5	7.3	7.6	7.8	7.9				4.9	5.3	5.6	5.7	5.7		
	3		8.8	9.7	10.2	10.5	10.7				6.5	7.2	7.5	7.7	7.8		

Correction factors for subcooling Δt_{sub}

Δt_{sub}	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R134a	1.00	1.08	1.13	1.19	1.25	1.31	1.37	1.42	1.48	1.54

Capacity
R404A
Capacity in kW for range N: -40°C to +10°C and opening superheat OS = 4 K

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature +10°C										Evaporating temperature 0°C							
TC	1	8.2	10.6	11.9	12.6	12.9	13.0	12.8	12.5	7.7	9.9	11.1	11.7	12.0	12.0	11.9	11.6
	2	10.4	13.5	15.1	16.1	16.4	16.5	16.3	15.9	9.8	12.6	14.0	14.8	15.2	15.2	15.1	14.7
	3	13.2	17.0	19.0	20.2	20.7	20.8	20.6	20.1	12.6	16.0	17.8	18.9	19.3	19.4	19.2	18.8
Evaporating temperature -10°C										Evaporating temperature -20°C							
TC	1	7.0	8.9	9.9	10.4	10.6	10.7	10.3	10.2		7.7	8.5	8.9	9.1	9.1	8.9	8.7
	2	8.9	11.3	12.7	13.1	13.4	13.5	13.3	13.0		9.6	10.7	11.2	11.4	11.4	11.3	11.0
	3	11.4	14.5	16.1	16.9	17.3	17.4	17.2	16.8		12.6	13.8	14.5	14.8	14.9	14.7	14.5
Evaporating temperature -30°C										Evaporating temperature -40°C							
TC	1			7.0	7.3	7.4	7.4	7.2	7.0			5.5	5.7	5.8	5.7	5.6	5.4
	2			8.7	9.1	9.2	9.2	9.1	8.9			6.8	7.1	7.2	7.2	7.0	6.8
	3			11.4	11.9	12.2	12.2	12.0	11.8			9.1	9.5	9.6	9.6	9.5	9.3

Capacity in kW for range B: -60°C to -25°C and opening superheat OS = 4 K

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature -25°C										Evaporating temperature -30°C							
TC	1	7.2	9.1	10.0	10.4	10.6	10.6	10.4	10.1	6.7	8.3	9.1	9.5	9.6	9.6	9.4	9.2
	2	9.1	11.4	12.6	13.3	13.6	13.6	13.5	13.2	8.4	10.4	11.5	12.0	12.3	12.3	12.2	12.0
	3	11.9	14.8	16.4	17.2	17.7	17.9	17.8	17.6	10.3	13.6	15.0	15.8	16.2	16.4	16.3	16.1
Evaporating temperature -40°C										Evaporating temperature -50°C							
TC	1	5.4	6.6	7.2	7.5	7.6	7.6	7.4	7.2		5.1	5.5	5.7	5.7	5.7	5.6	5.4
	2	6.8	8.5	9.1	9.6	9.7	9.8	9.6	9.4		6.3	6.9	7.2	7.3	7.3	7.2	7.0
	3	8.9	11.0	12.1	12.7	13.1	13.2	13.1	12.9		8.4	9.2	9.7	10.0	10.0	10.0	9.8
Evaporating temperature -60°C																	
TC	1			3.9	4.1	4.1	4.0	3.9	3.8								
	2			4.9	5.1	5.2	5.2	5.1	4.9								
	3			6.7	7.0	7.2	7.3	7.2	7.0								

Correction factors for subcooling Δt_{sub}

Δt_{sub}	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R404A	1.00	1.10	1.20	1.29	1.37	1.46	1.54	1.63	1.70	1.78

Capacity

R407C

Capacity in kW for range N: -40°C to +10°C and opening superheat OS = 4 K

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature +10°C										Evaporating temperature 0°C							
TC	1	11.5	15.0	17.0	18.4	19.2	19.7	19.9	19.9	10.6	13.7	15.5	16.6	17.0	17.7	17.9	17.9
	2	14.5	18.8	21.6	23.2	24.3	25.0	25.3	25.4	13.3	17.2	19.5	21.0	21.9	22.4	22.7	22.8
	3	18.3	23.9	27.1	29.2	30.5	31.4	31.9	31.9	16.8	21.9	24.7	26.6	27.8	28.6	29.9	29.2
Evaporating temperature -10°C										Evaporating temperature -20°C							
TC	1	9.3	12.0	13.5	14.5	15.1	15.4	15.5	15.5	7.9	10.1	11.3	12.1	12.5	12.8	12.9	12.9
	2	11.7	15.1	17.0	18.2	18.9	19.4	19.7	19.7	9.9	12.6	14.2	15.1	15.7	16.1	16.3	16.3
	3	15.3	19.3	21.8	23.3	24.3	25.0	25.4	25.6	12.9	16.3	18.3	19.6	20.5	21.0	21.4	21.5
Evaporating temperature -30°C										Evaporating temperature -40°C							
TC	1		8.2	9.1	9.7	10.0	10.2	10.3	10.3			7.0	7.4	7.7	7.8	7.8	7.8
	2		10.1	11.3	12.0	12.5	12.8	12.9	13.0			8.6	9.2	9.5	9.7	9.8	9.8
	3		13.2	14.8	15.8	16.5	16.9	17.2	17.3			11.4	12.2	12.7	13.0	13.2	13.3

Capacity in kW for range B: -60°C to -25°C and opening superheat OS = 4 K

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature -25°C										Evaporating temperature -30°C							
TC	1	7.5	9.5	10.6	11.5	11.8	12.1	12.2	12.3	6.7	8.5	9.5	10.2	10.6	10.8	10.9	10.9
	2	9.4	12.0	13.5	14.5	15.2	15.7	16.0	16.1	8.5	10.8	12.1	13.0	13.6	14.0	14.2	14.4
	3	12.5	15.9	18.0	19.4	20.5	21.2	21.8	22.2	11.2	14.3	16.1	17.4	18.4	19.1	19.6	20.0
Evaporating temperature -40°C										Evaporating temperature -50°C							
TC	1	5.3	6.6	7.4	7.8	8.2	8.3	8.4	8.4	3.9	4.9	5.5	5.8	6.0	6.1	6.2	6.2
	2	6.6	8.3	9.3	10.0	10.5	10.8	11.0	11.1	4.9	6.1	6.9	7.4	7.7	7.9	8.1	8.1
	3	8.8	11.1	12.6	13.6	14.4	14.9	15.4	15.7	6.6	8.3	9.4	10.1	10.7	11.1	11.4	11.7
Evaporating temperature -60°C																	
TC	1	2.8	3.5	3.9	4.1	4.2	4.3	4.3	4.3								
	2	3.5	4.3	4.9	5.2	5.4	5.6	5.6	5.7								
	3	4.7	5.9	6.7	7.2	7.6	7.9	8.1	8.3								

Correction factors for subcooling Δt_{sub}

Δt _{sub}	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R407C	1.00	1.08	1.14	1.21	1.27	1.33	1.39	1.45	1.51	1.57

Capacity
R507
Capacity in kW for range N: -40°C to +10°C and opening superheat OS = 4 K

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature +10°C										Evaporating temperature 0°C							
TC	1	8.1	10.6	12.1	13.0	13.4	13.7	13.8	13.6	7.6	9.9	11.2	11.9	12.4	12.6	12.6	12.5
	2	10.3	13.5	15.3	16.5	17.1	17.4	17.6	17.4	9.7	12.5	13.9	15.1	15.8	16.0	16.1	16.0
	3	13.0	17.1	19.2	20.8	21.6	22.1	22.1	22.0	12.4	15.9	18.0	19.3	20.0	20.4	20.5	20.4
Evaporating temperature -10°C										Evaporating temperature -20°C							
TC	1	7.0	8.9	10.0	10.6	11.0	11.1	11.2	11.1		7.7	8.6	9.1	9.4	9.5	9.5	9.4
	2	8.7	11.2	12.6	13.4	13.9	14.1	14.2	14.1		9.7	10.8	11.4	11.8	12.0	12.0	11.9
	3	11.3	14.4	16.2	17.3	17.9	18.2	18.3	18.2		12.6	14.0	14.8	15.3	15.6	15.7	15.6
Evaporating temperature -30°C										Evaporating temperature -40°C							
TC	1			7.1	7.5	7.7	7.7	7.7	7.6			5.6	5.9	6.0	6.0	6.0	5.9
	2			8.8	9.3	9.6	9.7	9.7	9.6			7.0	7.3	7.5	7.6	7.5	7.5
	3			11.5	12.2	12.6	12.8	12.9	12.8			9.2	9.7	10.0	10.1	10.1	10.0

Capacity in kW for range B: -60°C to -25°C and opening superheat OS = 4 K

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		2	4	6	8	10	12	14	16	2	4	6	8	10	12	14	16
Evaporating temperature -25°C										Evaporating temperature -30°C							
TC	1	7.4	9.3	10.3	10.8	11.2	11.3	11.3	11.2	6.8	8.5	9.4	9.9	10.2	10.3	10.3	10.2
	2	9.2	11.9	13.2	14.0	14.5	14.8	14.9	14.8	8.7	10.9	12.0	12.8	13.2	13.4	13.5	13.5
	3	12.3	15.4	17.1	18.3	19.0	19.4	19.7	19.7	11.4	14.2	15.7	16.8	17.4	17.8	18.1	18.1
Evaporating temperature -40°C										Evaporating temperature -50°C							
TC	1	5.6	6.9	7.5	7.9	8.1	8.2	8.2	8.1		5.3	5.8	6.0	6.1	6.2	6.1	6.0
	2	7.1	8.8	9.6	10.2	10.5	10.7	10.7	10.7		6.7	7.3	7.7	7.9	8.1	8.1	8.0
	3	9.4	11.5	12.8	13.6	14.1	14.5	14.6	14.7		8.9	9.8	10.4	10.8	11.1	11.2	11.3
Evaporating temperature -60°C																	
TC	1			4.2	4.3	4.4	4.4	4.4	4.3								
	2			5.3	5.5	5.7	5.8	5.7	5.7								
	3			7.2	7.6	7.9	8.1	8.1	8.1								

Correction factors for subcooling Δt_{sub}

Δt_{sub}	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R507	1.00	1.10	1.20	1.29	1.37	1.46	1.54	1.63	1.70	1.78

Capacity
R410A

 Capacity in kW for range N: -40°C to $+10^{\circ}\text{C}$ and opening superheat $OS = 4\text{ K}$

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		3	6	9	12	15	18	21	24	3	6	9	12	15	18	21	24
Evaporating temperature $+10^{\circ}\text{C}$										Evaporating temperature 0°C							
TC	1	13.9	18.2	20.6	22.2	23.0	23.4	23.3	22.9	12.7	16.6	18.9	20.2	21.0	21.4	21.4	21.2
	2	17.6	23.1	26.3	28.2	29.3	29.8	29.8	29.4	16.1	21.1	23.9	25.7	26.7	27.2	27.3	27.0
	3	22.2	29.2	33.2	35.6	37.0	37.7	37.6	36.9	20.8	26.9	30.6	32.8	34.2	34.9	35.0	34.7
Evaporating temperature -10°C										Evaporating temperature -20°C							
TC	1	11.3	14.6	16.6	17.7	18.4	18.7	18.8	18.6		12.4	13.8	14.9	15.5	15.7	15.8	15.6
	2	14.1	18.4	20.9	22.4	23.3	23.8	23.9	23.7		15.5	17.5	18.8	19.5	19.9	20.0	19.9
	3	18.4	23.8	27.0	29.0	30.2	30.8	31.1	30.9		20.3	22.9	24.5	25.6	26.1	26.3	26.3
Evaporating temperature -30°C										Evaporating temperature -40°C							
TC	1		10.1	11.3	12.0	12.5	12.7	12.7	12.6			8.8	9.3	9.7	9.8	9.8	9.7
	2		12.4	14.0	15.1	15.6	16.0	16.0	15.9			10.9	11.6	12.1	12.3	12.3	12.3
	3		16.5	18.6	19.9	20.7	21.2	21.4	21.3			14.5	15.5	16.1	16.5	16.6	16.6

 Capacity in kW for range B: -60°C to -25°C and opening superheat $OS = 4\text{ K}$

Type	Orifice no.	Pressure drop across the valve Δp bar								Pressure drop across the valve Δp bar							
		3	6	9	12	15	18	21	24	3	6	9	12	15	18	21	24
Evaporating temperature -25°C										Evaporating temperature -30°C							
TC	1	12.7	16.4	18.5	19.8	20.5	20.9	21.0	20.9	11.8	15.1	17.0	18.2	18.9	19.3	19.4	19.3
	2	16.3	21.0	23.8	25.6	26.7	27.4	27.7	27.7	15.1	19.3	21.8	23.5	24.6	25.2	25.6	25.6
	3	21.2	27.2	30.9	33.3	34.9	35.9	36.6	36.6	19.7	25.3	28.6	30.9	32.4	33.5	34.1	34.3
Evaporating temperature -40°C										Evaporating temperature -50°C							
TC	1	9.8	12.4	13.9	14.9	15.5	15.8	15.9	15.8	7.7	9.7	10.9	11.6	12.0	12.3	12.3	12.3
	2	12.4	15.8	17.8	19.2	20.1	20.7	21.0	21.0	9.6	12.2	13.8	14.9	15.6	16.1	16.3	16.4
	3	16.3	20.9	23.7	25.6	27.0	28.0	28.6	28.9	12.9	16.4	18.7	20.2	21.4	22.2	22.7	23.0
Evaporating temperature -60°C																	
TC	1		7.2	8.0	8.5	8.9	9.0	9.1	9.0								
	2		9.0	10.2	11.0	11.5	11.8	12.0	12.1								
	3		12.2	13.9	15.1	16.0	16.6	17.0	17.3								

Correction factors for subcooling Δt_{sub}

Δt_{sub}	4 K	10 K	15 K	20 K	25 K	30 K	35 K	40 K	45 K	50 K
R410A	1.00	1.08	1.15	1.21	1.27	1.33	1.39	1.45	1.50	1.56

Dimensions and weight

