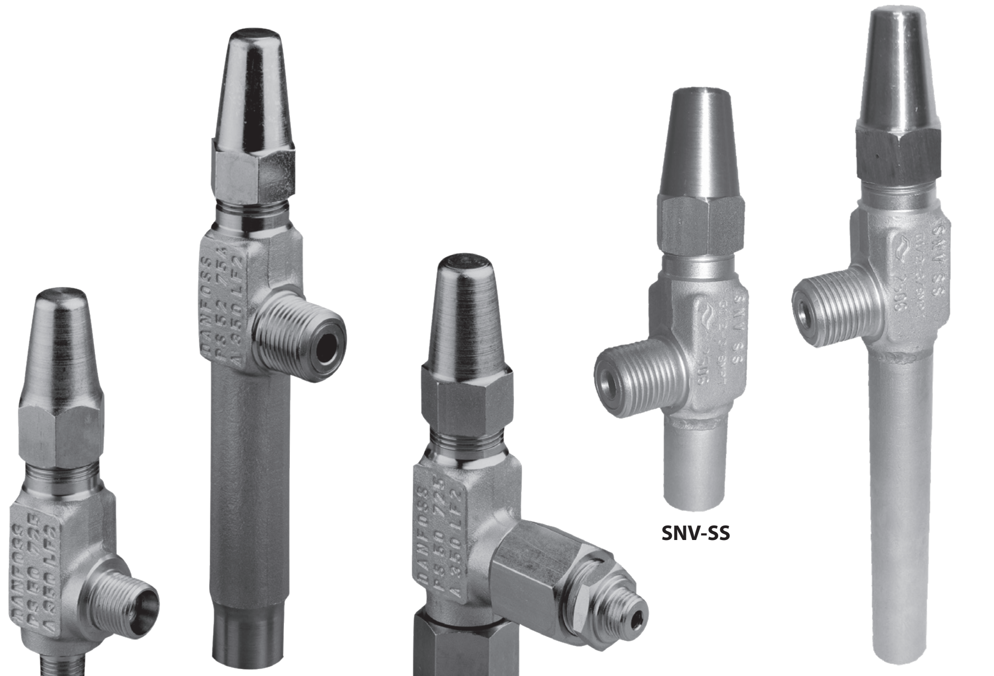
Introduction



SNV-ST and SNV-SS valves are designed to meet all industrial refrigeration application requirements. Designed as service valves they provide favourable flow characteristics.

Features

- Applicable to all common refrigerants including R717 and R744 (CO_2) and non corrosive gases/liquids.
- Suitable for "heavy duty" industrial applications having a very sturdy and safe design including high pressures and wide temperature range.
- The SNV-ST and SNV-SS valves have backseating (metal to metal).
- Compact and light valve for easy handling and installation
- No special flow direction required.
- Provide high flow characteristics.
- Each valve type is clearly marked with type and size.
- Housing and bonnet material is low temperature steel (stainless steel for SNV-SS) according to requirements of the Pressure Equipment Directive and other international classification authorities.
- Valve safety is enhanced with the spindle being secured such that it cannot be unscrewed.
- Max. operating pressure:
  52 bar g (754 psig)
  Valves for higher operating pressure available on request
- Full temperature range:
  –60/+150°C (–76/+302°F)

The complete technical leaflet (DKRCI.PD.KB0.A) can be downloaded from the Danfoss web site.

Technical data

- *Refrigerants*
  Applicable to all common refrigerants including R 717 and R744 (CO_2) and non corrosive gases/liquids. For further information please see installation instruction for SNV-ST.

  For further information please contact your local Danfoss Sales Company.

- *Temperature range*
  –60/+150°C (–76/+302°F).
- *Maximum working pressure*
  The valve is designed for: Maximum operating pressure of 52 bar g (754 psig).
  Valves for higher operating pressure available on request.

Design

Connections
Available with the following connections:

- CD Cutting ring
- MPT Male NPT ANSI
- FPT Female NPT ANSI
- G
- W Welding connection

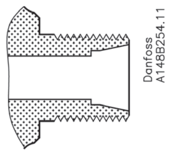
Housing
Made of special steel, approved for low temperature operations.

Spindle
Equipped with stainless steel spindle, which is ideal for O-ring sealing.

Installation
No special flow direction is required. The valve is designed to withstand high internal pressures. However, the piping system in general should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. For further information refer to installation instruction for SNV-ST and SNV-SS.

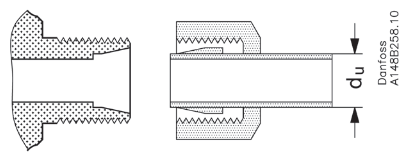
Connections

CD 6
CD10



Cutting ring, DIN 3861 & DIN 3901 class L, d_u = 6 mm

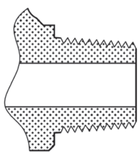
Cutiing ring, DIN 3861 & DIN 3901 class L, d_u = 10 mm



d_u is external pipe diameter

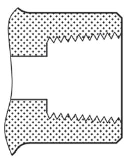
Note: Fittings not included

1/4 MPT
3/8 MPT



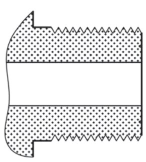
1/4" male NPT ANSI
3/8" male NPT ANSI

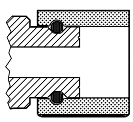
1/4 FPT
3/8 FPT



1/4" female NPT ANSI
3/8" female NPT ANSI

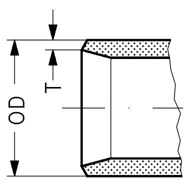
G 1/2





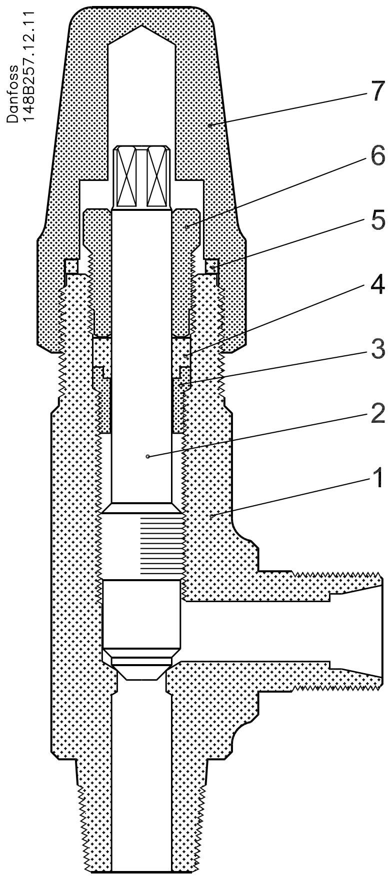
G 1/2"

W

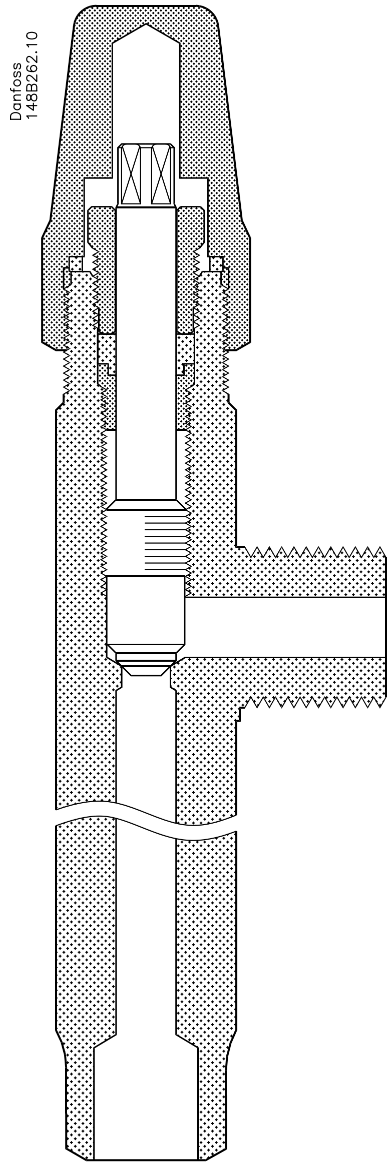


1/2" welding connection
OD = 21.3 mm (0.839 in.)
T = 2.3 mm (0.091 in.)

Material specification



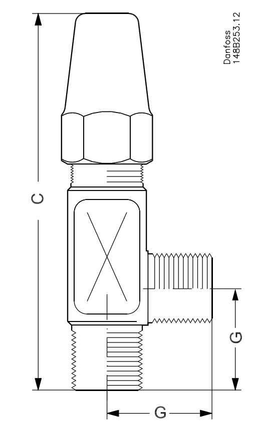
SNV-ST



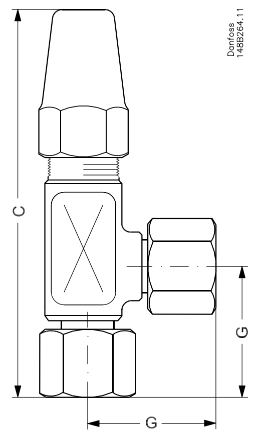
SNV-ST and SNV-SS (extended branch)

No.	Part	Material	EN	JIS	ASTM
1	Housing	Steel	P285QH EN 10222-4	SFL 2 G 3205	LF2 A350
		Stainless steel (SNV-SS)	XSCrNi18-10, 10088		AISI 304
2	Spindle	Stainless steel	X8CrNiS 18-9 EN 10088' DIN 17440 (SNV-SS only)	SUS 303	AISI 303
3	Locking ring	Steel			
4	Sealing ring	Teflon			
5	Seal cap gasket	Nylon			
6	Gland nut	Steel			
7	Seal cap	Steel			

Dimensions and weights



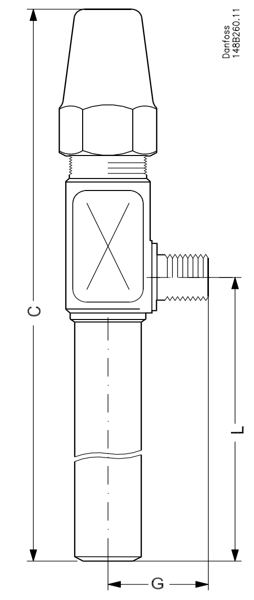
SNV-ST



SNV-ST
(manometer conn.)

Type		C	G	Weight
SNV-ST	mm	115	32	0.36 kg
	in.	4.53	1.26	0.79 lb

Type		C	G	Weight
SNV-ST (Man.)	mm	127	45	0.56 kg
	in.	5.00	1.77	1.22 lb



SNV-ST / SNV-SS
(extended branch)

Type		C	G	L	Weight
SNV-ST, SNV-SS Ext.branch	mm	131	32	50	0.60 kg
	in.	5.16	1.26	1.97	1.32 lb
SNV-ST Ext.branch	mm	181	32	100	0.60 kg
	in.	7.13	1.26	3.94	1.32 lb
SNV-ST Ext.branch	mm	206	32	125	0.60 kg
	in.	8.11	1.26	4.92	1.32 lb
SNV-SS Ext.branch	mm	231	32	150	0.60 kg
	in.	9.09	1.26	5.91	1.32 lb

Specified weights are approximate values only.

Ordering

How to order
The table below is used to identify the valve required.

Please note that the type codes only serve to identify the valves, some of which may not form part of the standard product range. For further information please contact your local Danfoss Sales Company.

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

SNV-ST

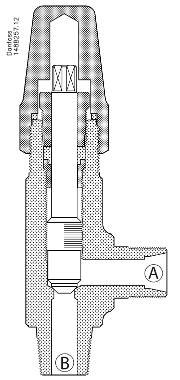


Fig. 1

SNV-ST / SNV-SS (extended branch)

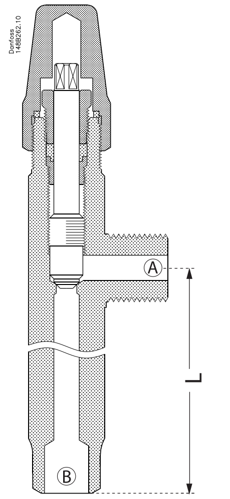


Fig. 2

SNV-ST (manometer connection)

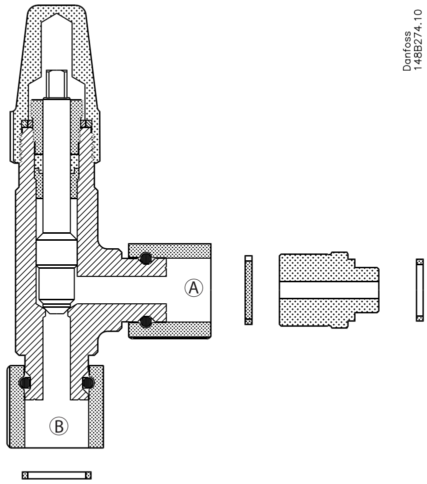


Fig. 3

See figure 1

Side branch connection Ⓐ	Bottom branch connection Ⓑ	Type	Quantity	Code No.
CD 10	CD 10	SNV-ST CD10-CD10	1 pc.	**148B3740**
CD 10	CD 10	SNV-ST CD10-CD10	30 pcs.	**148B4177**
CD 10	¼ MPT	SNV-ST CD10-1/4MPT	1 pc.	**148B3741**
CD 6	¼ MPT	SNV-ST CD6-1/4MPT	1 pc.	**148B3742**
CD 10	$^{3}/_{8}$ MPT	SNV-ST CD10-3/8MPT	1 pc.	**148B3743**
CD 6	$^{3}/_{8}$ MPT	SNV-ST CD6-3/8MPT	1 pc.	**148B3744**
G ½ (external)	G ½ (external)	SNV-ST G1/2-G1/2	1 pc.	**148B3745**
G ½ (external)	G ½ (external)	SNV-ST G1/2-G1/2	30 pcs.	**148B4179**
¼ FPT	¼ MPT	SNV-ST 1/4FPT-1/4MPT	1 pc.	**148B3746**
¼ FPT	¼ MPT	SNV-ST 1/4FPT-1/4MPT	30 pcs.	**148B4180**
$^{3}/_{8}$ FPT	$^{3}/_{8}$ MPT	SNV-ST 3/8FPT-3/8MPT	1 pc.	**148B3747**
$^{3}/_{8}$ FPT	$^{3}/_{8}$ MPT	SNV-ST 3/8FPT-3/8MPT	30 pcs.	**148B4181**
$^{3}/_{8}$ FPT	½ MPT	SNV-ST 3/8FPT-1/2MPT	30 pcs.	**148B4233**
CD ¼	¼ MPT	SNV-ST CD 1/4-1/4MPT	30 pcs.	**148B4220**
CD $^{3}/_{8}$	$^{3}/_{8}$ MPT	SNV-ST CD3/8-3/8MPT	30 pcs.	**148B4221**
CD $^{3}/_{8}$	¼ MPT	SNV-ST CD3/8-1/4MPT	30 pcs.	**148B4222**
¼ FPT	¼ FPT	SNV-ST 1/4FPT-1/4FPT	30 pcs.	**148B4223**
½ MPT	½ MPT	SNV-ST 1/2MPT-1/2MPT	30 pcs.	**148B4224**
$^{3}/_{8}$ FPT	$^{3}/_{8}$ FPT	SNV-ST 3/8FPT-3/8FPT	30 pcs.	**148B4225**
½ MPT	$^{3}/_{8}$ FPT	SNV-ST 1/2MPT-3/8FPT	30 pcs.	**148B4226**
CD 6	¼ MPT	SNV-ST CD6-1/4MPT*	30 pcs.	**148B4216**
$^{7}/_{16}$ UNF	¼ MPT	SNV-ST 7/16UNF-1/4MPT	30 pcs.	**148B4230**

* With handwheel

See figure 2
L50 = 50 mm (2 in.)
L100 = 100 mm (4 in.)
L125 = 125 mm (5 in.)
L150 = 150 mm (6 in.)

Extended Branch

Side branch connection Ⓐ	Bottom branch connection Ⓑ	Type	Quantity	Code No.
CD10	W½ L100	SNV-ST CD10-W1/2 L100	1 pc.	**148B3768**
CD10	W½ L100	SNV-ST CD10-W1/2 L100	30 pcs.	**148B4210**
G ½	W½ L100	SNV-ST G1/2-W1/2 L100	1 pc.	**148B3769**
G ½ (external)	W½ L100	SNV-ST G1/2-W1/2 L100	30 pcs.	**148B4211**
G ½ (external)	W½ L125	SNV-ST G1/2-W1/2 L125	30 pcs.	**148B4219**
G ½ (external)	W½ L50	SNV-ST G1/2-W1/2 L50	30 pcs.	**148B4218**
G ¼ (internal)	R¼ L50 (external)	SNV-ST G1/4-R1/4 L50	30 pcs.	**148B4231**
¼ FPT	¼ MPT L100	SNV-ST 1/4FPT-1/4MPT L100	30 pcs.	**148B4232**
G ½	W½L50	SNV-SS G1/2-W1/2 L50	1 pc.	**148B4265**
G ½	W½L150	SNV-SS G1/2-W1/2 L150	1 pc.	**148B4266**

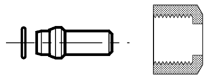
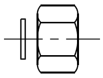
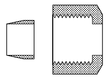
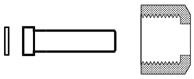
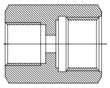
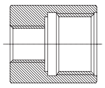
See figure 3

Manometer connection

Side branch connection	Bottom branch connection	Type	Quantity	Code No.
G ½	G ½	SNV-ST G½ Man	1 pc.	**148B3778****

** Including adaptor for connection to ICS/PM valve.

Accessories

Type		Connection type	Quantity	Code no.
	Weld nipple incl. union nut and O-ring	CD 10	1 pc.	**2469+008**
	Blind nut incl. gasket	G 1/2	1 pc.	**2469+056**
	CD 6 Cutting ring + union nut	CD 6	1 pc.	**148B4182**
	CD 10 Cutting ring + union nut	CD 10	1 pc.	**148B4183**
			60 pcs.	**148B4186**
	Welding nipple incl. aluminium gasket	G½-ND6	2 pcs.	**148B4184**
	Al gaskets included	$^{1}/_{4}$" FPT – ½" G	1 pc.	**148B3860**
	Al gaskets included	$^{3}/_{8}$" G - ½" G	1 pc.	**148B3861**

Introduction

SVA are angleway and straightway stop valves which are designed to meet all industrial refrigeration application requirements. The valves are designed to give favourable flow characteristics and are easy to dismantle and repair when necessary. The valve cone is designed to ensure perfect closing.

Features

- Applicable to all common refrigerants including R717 and non corrosive gases/ liquids dependent on sealing material compatibility
- Optional accessories:
  - Heavy duty industrial hand wheel for frequent operation
  - Cap for infrequent operation
  - Lock washers for the stop valves subjected to high vibrations/pulsations
- Available in angleway and straightway versions with standard bonnet or extended bonnet (15-100) for insulated systems
- Each valve type is clearly marked with type, size and performance range
- The valves and caps are prepared for sealing, to prevent operation by unauthorized persons, using a seal wire
- Internal metal backseating
  - DN 6 - 65 ($^1/_4$ - 2½ in.)

  Internal PTFE backseating
  - DN 80 - 200 (3 - 8 in.)
- Can accept flow in both directions
- Standard bonnet is suitable for installation in normal insulated systems
- Housing and bonnet material for SVA-ST and HS is low temperature steel according to requirements of the Pressure Equipment Directive and other international classification authorities

  SVA-SS housing material is special cold resistant stainless steel approved for low temperature operations.
- Stainless steel bolts.
- Pressure range:
  Standard version
  SVA-ST, HS: 40 bar g (580 psi g)
  SVA-SS: 52 bar g (754 psi g)
- Temperature range:
  Standard version
  SVA-ST: –50/+150°C (–58/+302°F)
  SVA-SS: –60/+150°C (–76/+302°F)
- Classification: DNV, LR, SAQ, CRN, BV etc.
  To get an updated list of certification on the products please contact your local Danfoss Sales Company

Additional features for high spec. version (SVA-HS)

- Low temperature version with extended bonnet for insulated low temperature applications.
- Can be used in chemical and petro-chemical applications.
- Stainless steel packing gland with special teflon low temperature spindle seal.
- Temperature range:
  High spec. version
  –60/+150°C (–76/+302°F)

The complete technical leaflet (DKRCI.PD.KD0.A) can be downloaded from the Danfoss web site.

Design

Connections
Available with the following connections:

- Butt-weld DIN (EN 10220)
- Butt-weld ANSI (B 36.10 Schedule 80),
  - DN 6 - 40 ($^1/_4$ - 1½ in.)
- Butt-weld ANSI (B 36.10 Schedule 40),
  - DN 50 - 200 (2 - 8 in.)
- Socket Weld (ANSI B 16.11),
  - DN 15 - DN 50 (½ - 2 in.)
- Outside pipe thread
  - G $^1/_2$ in. - G $^7/_8$ in. (ISO 228/1)
- FPT Female Pipe Thread, NPT (ANSI/ASME B 1.20.1),
  - DN 15 - 32 (½ - 1¼ in.)

Housing
Made of special, cold resistant steel (SVA-ST, HS) or stainless steel (SVA-SS) approved for low temperature operations.

Valve cone
The valve cone can be turned on the spindle, thus there will be no friction between the cone and the seat when the valve is opened and closed. A teflon tightening ring provides perfect sealing with minimum closing force.

Spindle
Made of polished stainless steel, ideal for O-ring sealing.

Packing gland
Standard version (SVA 6-10 and SVA-ST):
The standard packing gland ensures a perfect tightness in the range: –50/+150°C (–58/+302°F).
The packing glands are equipped with a scraper ring to prevent penetration of dirt and ice into the packing gland.

Stainless steel version (SVA-SS):
The stainless steel packing gland comprises a spring loaded seal packing gland which ensures a perfect tightness in the range:
-60/+150°C (-76/+302°F).
The packing glands are equipped with a scraper ring to prevent penetration of dirt and ice into the packing gland.

High spec. version (SVA-HS):
This comprises a threaded bush equipped with teflon wear rings to prevent damage of the spindle surface. In addition, a scraper ring is mounted to prevent dirt and ice to penetrate into the packing gland. The sealing consists of conical shaped teflon rings supported by metal bushings and ensures a perfect tightness in the range:
–60°C/+150°C (–76°F/+302°F).

Pressure Equipment Directive (PED)
SVA-ST and SVA-HS valves are approved according to the European standard specified in the Pressure Equipment Directive and are CE marked.

For further details / restrictions - see Installation Instruction.

Installation
It is recommended that the valves be installed in the direction of flow indicated by the arrow on the valve body. The valve can be installed in the opposite direction but this slightly reduces the k_v-value (C_v-value).

The valve is designed to withstand high internal pressure. However, the piping system in general should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion.

For further information refer to installation instructions for SVA.

Example of Marking Ring, Valve type SVA-ST

Example of marking ring, valve type SVA-HS

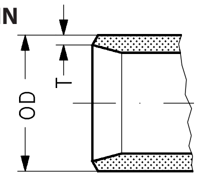
SVA			
Nominal bore	DN≤ 25 mm (1 in.)	DN32-80 mm (1¼ - 3 in.)	DN100 - 200 mm (4-8 in.)
Classified for	Fluid group I		
Category	Article 3, paragraph 3	II	III

Technical data

- Refrigerants (SVA 6-10 and SVA-ST)
  Applicable to all common non flammable refrigerants including R717 and non corrosive gases/liquids dependent on sealing material compatability. For further information please see installation instruction for SVA.
- Refrigerants (SVA-HS)
  Applicable to all common refrigerants including flammable hydrocarbons and all non-corrosive gases/liquids. For further information please see installation instruction for SVA-HS.
- Temperature range
  Standard version (ST):
  –50/+150°C (–58/+302°F).
  High spec. and stainless steel version (HS and SS):
  –60/+150°C (–76/+302°F).
- Pressure range
  The valves are designed for max. working pressure 40 bar g (580 psi g). Valves for higher working pressure are available on request.
  SVA-SS are designed for max. working pressure 52 bar (754 psi g).

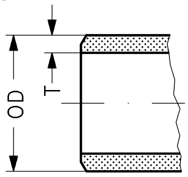
Connections SVA-ST, SS and HS

DIN



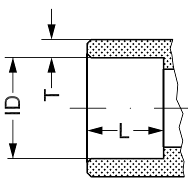
Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v-angle m^3/h	k_v-straight m^3/h	C_v-angle USgal/min	C_v-straight USgal/min
Butt-weld DIN (EN 10220)											
6	¼	13.5	2.3	0.531	0.091			2.9	2.0	3.4	2.4
10	⅜	17.2	2.3	0.677	0.091			4.5	3.2	5.2	3.6
15	½	21.3	2.3	0.839	0.091			7.0	4.9	8.1	5.7
20	¾	26.9	2.3	1.059	0.091			14.6	10.2	16.9	11.8
25	1	33.7	2.6	1.327	0.103			24.8	17.4	28.8	20.2
32	1¼	42.4	2.6	1.669	0.102			42.6	29.8	49.4	34.6
40	1½	48.3	2.6	1.902	0.103			45.2	31.6	52.4	36.7
50	2	60.3	2.9	2.37	0.11			80	65	93	76
65	2½	76.1	2.9	3	0.11			120	97	140	113
80	3	88.9	3.2	3.50	0.13			182	152	211	176
100	4	114.3	3.6	4.50	0.14			313	278	363	323
125	5	139.7	4.0	5.50	0.16			514	470	596	545
150	6	168.3	4.5	6.63	0.18			785	597	911	693
200	8	219.1	6.3	8.63	0.25			1168	1024	1355	1188

ANSI



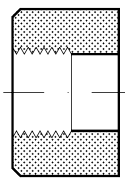
Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v-angle m^3/h	k_v-straight m^3/h	C_v-angle USgal/min	C_v-straight USgal/min
Butt-weld ANSI (B 36.10 Schedule 80)											
6	¼	13.5	3.0	0.531	0.118			2.9	2.03	3.4	2.4
10	⅜	17.2	3.2	0.677	0.126			4.5	3.15	5.2	3.6
15	½	21.3	3.7	0.839	0.146			7.0	4.9	8.1	5.7
20	¾	26.9	4.0	1.059	0.158			14.6	10.2	16.9	11.8
25	1	33.7	4.6	1.327	0.181			24.8	17.4	28.8	20.2
32	1¼	42.4	4.9	1.669	0.193			42.6	29.8	49.4	34.6
40	1½	48.3	5.1	1.902	0.201			45.2	31.6	52.4	36.7
Butt-weld ANSI (B 36.10 Schedule 40)											
50	2	60.3	3.9	2.37	0.15			80	65	93	76
65	2½	73.0	5.2	2.87	0.20			120	97	140	113
80	3	88.9	5.5	3.50	0.22			182	152	211	176
100	4	114.3	6.0	4.50	0.24			313	278	363	323
125	5	141.3	6.6	5.56	0.26			514	470	596	545
150	6	168.3	7.1	6.63	0.28			785	597	911	693
200	8	219.1	8.2	8.63	0.32			1168	1024	1355	1188

SOC



Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.	k_v-angle m^3/h	k_v-straight m^3/h	C_v-angle USgal/min	C_v-straight USgal/min
Socket welding ANSI (B 16.11)											
15	½	21.8	6.0	0.858	0.235	10	0.39	7.0	4.9	8.1	5.7
20	¾	27.2	4.6	1.071	0.181	13	0.51	10.0	7.0	11.9	8.1
25	1	33.9	7.2	1.335	0.284	13	0.51	24.8	17.4	28.8	20.2
32	1¼	42.7	6.1	1.743	0.240	13	0.51	42.6	29.8	49.4	34.6
40	1½	48.8	6.6	1.921	0.260	13	0.51	45.2	31.6	52.4	36.7
50	2	61.2	6.2	2.41	0.24	16	0.63	80	65	93	76

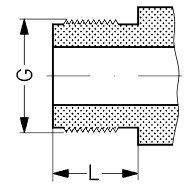
FPT



Size mm	Size in.	Inside pipe tread			k_v-angle m^3/h	k_v-straight m^3/h	C_v-angle USgal/min	C_v-straight USgal/min
FPT inside pipe thread, NPT (ANSI/ASME B 1.20.1)								
15	½	(½ × 14 NPT)			8.5	6.0	9.9	7.0
20	¾	(¾ × 14 NPT)			10	7.0	11.6	8.1
25	1	(1 × 11.5 NPT)			32	22.4	37.1	26.0
32	1¼	(1¼ × 11.5 NPT)			36	25.2	41.8	29.3

Connections - SVA 6 and SVA-ST 15

T

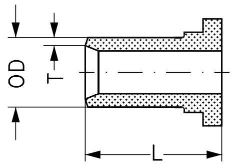


T outside pipe thread, (ISO 228/1)

Size mm	Size in.	Outside pipe thread	L mm	L in.	K_v-angle m^3/h	K_v-str. m^3/h	C_v-angle USgal/min	C_v-str USgal/min
6	$^1/_4$	G $^1/_2$	16	0.63	2.5	2.0	2.9	2.0
15	$^3/_8$ - $^1/_2$	G $^7/_8$	19	0.76	7.0	4.9	8.1	5.7

Nipples for T outside pipe thread, (ISO 228/1)

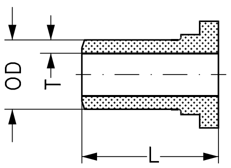
ND



ND welding nipples, (DIN 2448)

Size mm	Size in.	OD mm	T mm	OD in.	T in.	L mm	L in.	Inside pipe thread			
6	$^1/_4$	13.5	2.3	0.531	0.091	60	2.36	G$^1/_2$			
10	$^3/_8$	17.2	2.3	0.677	0.091	50	1.97	G$^7/_8$			
15	$^1/_2$	21.3	2.3	0.852	0.091	50	1.97	G$^7/_8$			

NA

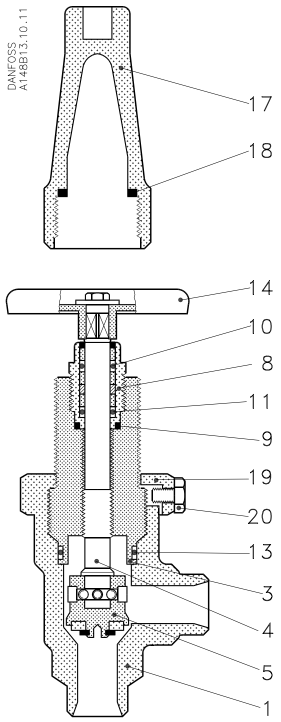


NA welding nipples, ANSI (B 36.10 Schedule 80)

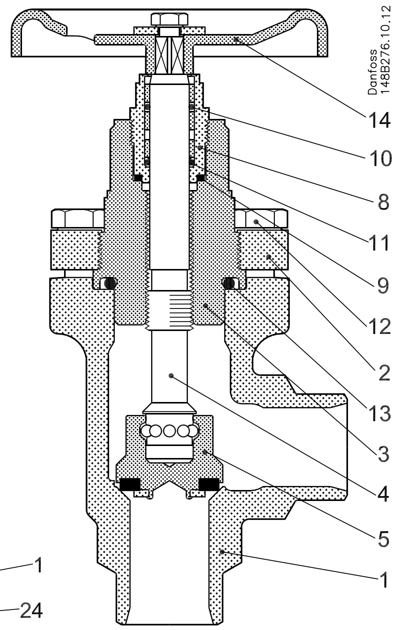
Size mm	Size in.	OD mm	T mm	OD in.	T in.	L mm	L in.	Inside pipe thread			
6	$^1/_4$	13.5	3.0	0.531	0.118	60	2.36	G$^1/_2$			
10	$^3/_8$	17.2	3.2	0.677	0.126	50	1.97	G$^7/_8$			
15	$^1/_2$	21.3	3.7	0.852	0.198	50	1.97	G$^7/_8$			

Material specification

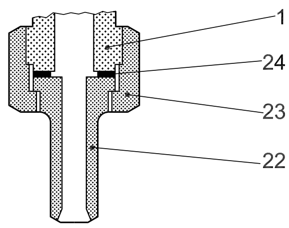
SVA-ST 6-10 ($^1/_4$ - $^3/_8$ in.)



SVA-ST and SVA-SS 15-20 ($^1/_2$ - $^3/_4$ in.)



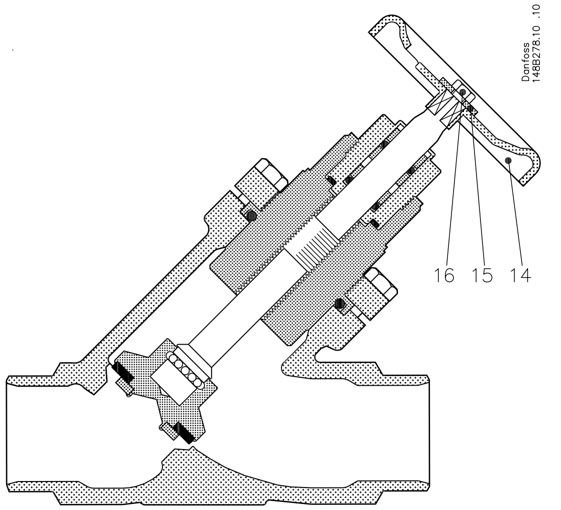
Welding nipple

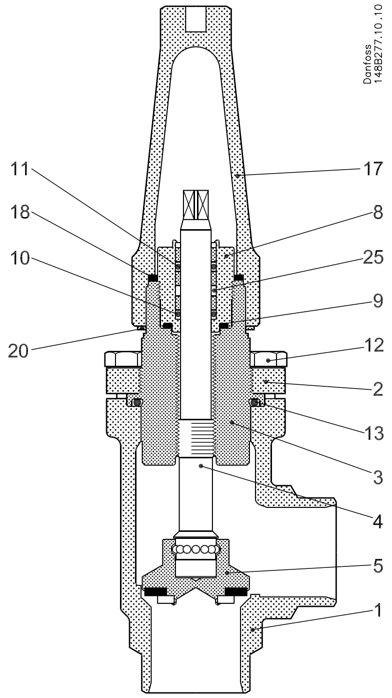


No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	G20Mn5QT, 10213-3 ----------------------------------- P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
		Stainless steel (SVA-SS)	XSCrNi18-10, 10088		AISI 304
2	Bonnet, Flange	Steel	G20Mn5QT, 10213-3 ----------------------------------- P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
		Stainless steel (SVA-SS)	XSCrNi18-10, 10088		AISI 304
3	Bonnet, Insert	Steel	11SMn30 10087	Type 2 R 683/9	AISI 1213
		Stainless steel (SVA-SS)			
4	Spindle	Stainless steel	X8CrNiS18-9 10088 DIN 17440 (SVA-SS only)	Type 17 683/13	AISI 303
5	Cone	Steel	11SMn30 10087	Type 2 R 683/9	AISI 1213
8	Packing gland	Stainless steel	X8CrNiS18-9 10088	Type 17 683/13	AISI 303
9	Packing washer	Aluminium			
10	O-ring	Cloroprene (Neoprene)			
11	O-ring	Cloroprene (Neoprene)			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
14	Handwheel	Steel			
17	Cap	Aluminium			
18	Gasket f. cap	Nylon			
19	Locking nut	Steel			
20	Screw	Steel			
22	Welding nipple	Steel	S235JRG2 10025	Fe260B, 630	Grade C, A 283
23	Nut	Steel	11SMn30 10087	Type 2 R 683/9	AISI 1213
24	Packing washer	Non-asbestos			

Material specification

SVA-ST, SS 25-40 (1 - 1½ in.)



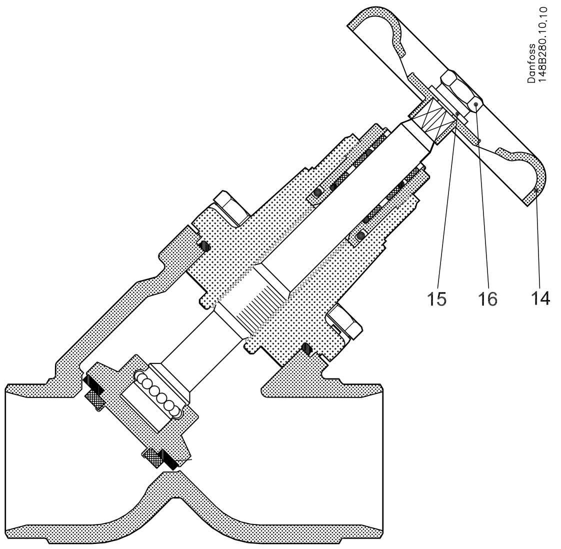


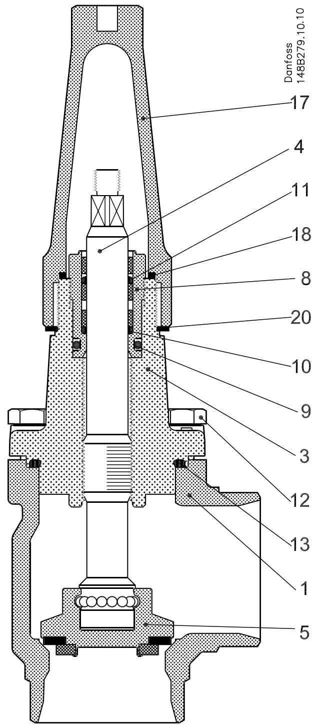
SVA-ST, SS

No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	G20Mn5QT, 10213-3 ----------------------------------- P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
		Stainless steel (SVA-SS)	XSCrNi18-10, 10088		AISI 304
2	Bonnet, flange	Steel	G20Mn5QT, 10213-3 ----------------------------------- P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
		Stainless steel (SVA-SS)	XSCrNi18-10, 10088		AISI 304
3	Bonnet, Insert	Steel	11SMn30 10087	Type 2 R 683/9	AISI 1213
		Stainless steel (SVA-SS)			
4	Spindle	Stainless steel	X8CrNiS18-9 10088 DIN 17440 (SVA-SS only)	Type 17 683/13	AISI 303
5	Cone Cone seal	Steel Teflon (PTFE)	11SMn30 10087	Type 2, R 683/9	AISI 1213
8	Packing gland	Stainless steel	X8CrNiS18-9 10088	Type 17 683/13	AISI 303
9	O-ring	Cloroprene (Neoprene)			
10-11	O-ring	Cloroprene (Neoprene)			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
14	Hand wheel	Steel			
15	Washer	Stainless steel (A2)			
16	Screw	Stainless steel (A2)			
17	Cap	Aluminium			
18	Gasket for cap	Nylon			
20	Identification ring	Stainless steel			

Material specification

SVA-ST, SS 50-65 (2 - 2½ in.)



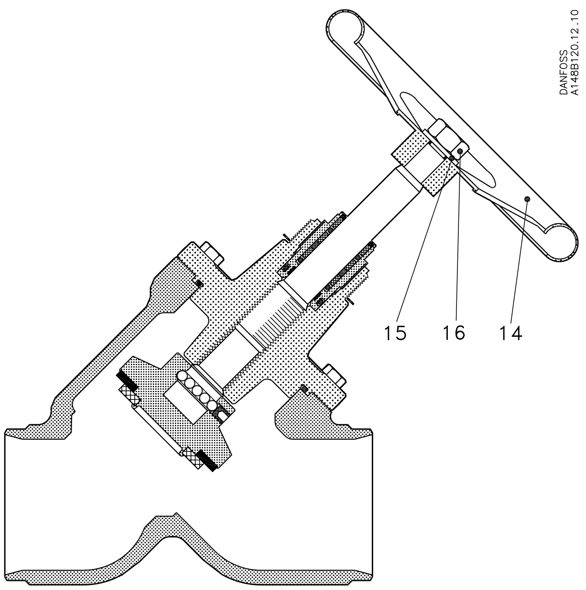


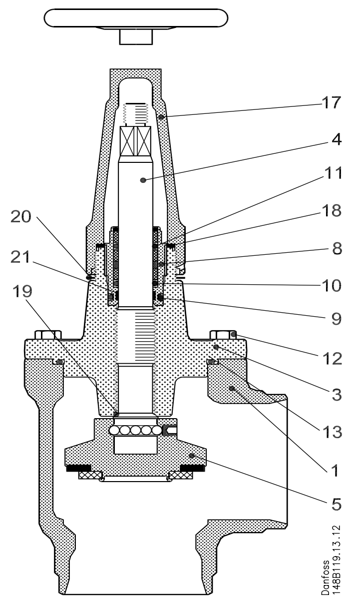
SVA-ST, SS

No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	G20Mn5QT, 10213-3 ----------------------------------- P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
		Stainless steel (SVA-SS)	XSCrNi18-10, 10088		AISI 304
3	Valve bonnet	Steel	G20Mn5QT, 10213-3 ----------------------------------- P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
		Stainless steel (SVA-SS)	XSCrNi18-10, 10088		AISI 304
4	Spindle	Stainless steel	X8CrNiS18-9 10088 DIN 17440 (SVA-SS only)	Type 17 R 683/13	AISI 303
5	Cone Cone seal	Steel Teflon (PTFE)	11SMn30 10087	Type 2, R 683/13	AISI 1213
8	Packing gland	Stainless steel	X8CrNiS18-9 10088	Type 17 R 683/13	AISI 303
9	O-ring	Cloroprene (Neoprene)			
10	O-ring	Cloroprene (Neoprene)			
11	O-ring	Cloroprene (Neoprene)			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
14	Hand wheel	Steel			
15	Washer	Stainless steel (A2)			
16	Nut	Stainless steel (A2)			
17	Cap	Aluminium			
18	Gasket for cap	Nylon (PA 6)			
20	Identification ring	Stainless steel			

Material specification

SVA-ST 80 - 200 (3 - 8 in.)



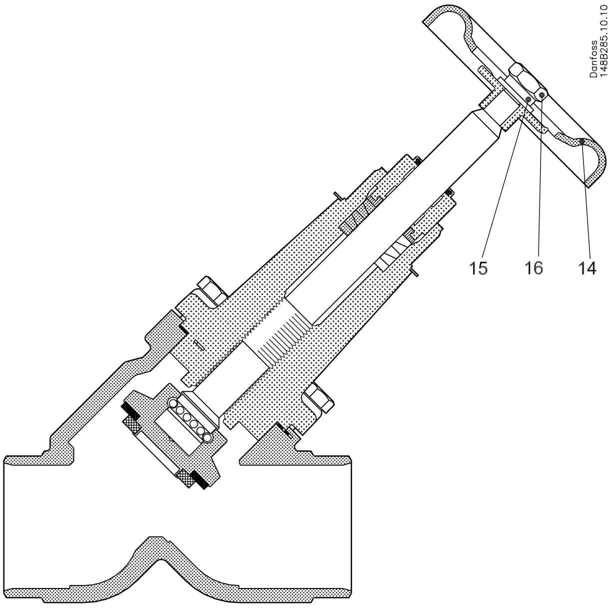


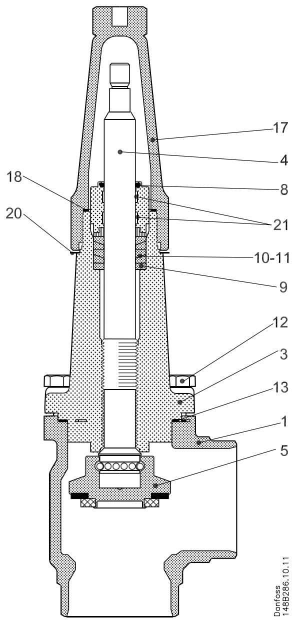
SVA-ST

No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	G20Mn5QT 10213-3		LCC A352
3	Valve bonnet	Steel	G20Mn5QT, 10213-3 ------------------------------------ P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
4	Spindle	Stainless steel	X5CrNi18-10 10088	Type 11, R 683/13	AISI 304, A276
5	Cone Cone seal	Steel Teflon (PTFE)	11SMn30 10087	Type 2, R 683/9	AISI 1213
8	Packing gland	Stainless steel	X8CrNiS18-9 10088	Type 17 R 683/13	AISI 303
9	O-ring	Cloroprene (Neoprene)			
10	O-ring	Cloroprene (Neoprene)			
11	O-ring	Cloroprene (Neoprene)			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
14	Hand wheel	Steel			
15	Washer	Stainless steel			
16	Nut	Stainless steel			
17	Cap	Aluminium			
18	Gasket for cap	Nylon (PA 6)			
19	Soft backseat	Teflon (PTFE)			
20	Identification ring	Stainless steel			
21	Wear ring	Teflon (PTFE)			

Material specification

SVA-HS 15 - 65 (½ - 2½ in.)



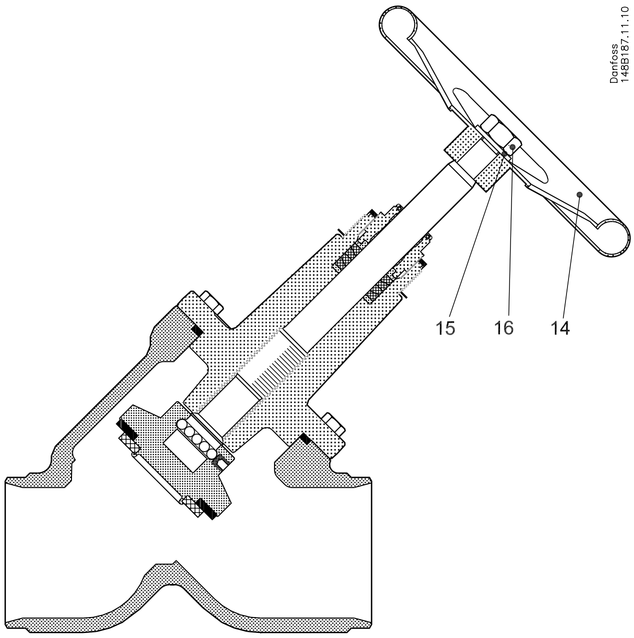


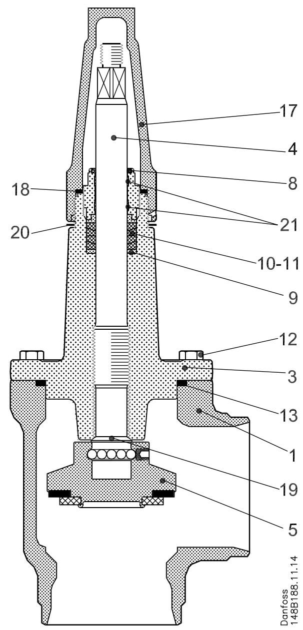
SVA-HS

No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	G20Mn5QT, 10213-3 P285QH+QT, 10222-4		LCC, A352 LF2, A350
3	Valve bonnet	Steel	G20Mn5QT, 10213-3 P285QH+QT, 10222-4		LCC, A352 LF2, A350
4	Spindle	Stainless steel	X2CrNiMo17-12-2 10088		AISI 316
5	Cone Cone seal	Steel PTFE	11SMn30 10087	Type 2, R 683/9	AISI 1213
8	Packing gland	Stainless steel	X8CrNiS18-9 10088	Type 17 R 683/13	AISI 303
9	Washer	Cast iron			
10-11	Seal ring	PTFE			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	Gasket	Fiber, Non-asbestos			
14	Hand wheel	Steel			
15	Washer	Stainless steel			
16	Screw/Nut	Stainless steel			
17	Cap	Aluminium			
18	Gasket for cap	Nylon (PA6)			
20	Identification ring	Stainless steel			
21	Wear ring	PTFE (Teflon)			

Material specification

SVA-HS 80 - 200 (3 - 8 in.)





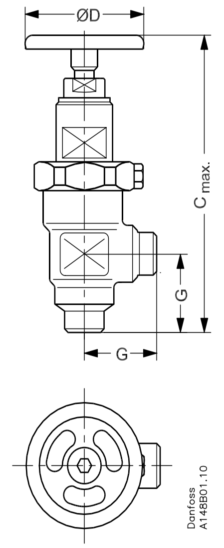
SVA-HS

No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	G20Mn5QT 10213-3		LCC A352
3	Valve bonnet	Steel	G20Mn5QT, 10213-3 ----------------------------------- P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
4	Spindle	Stainless steel	X2CrNiMo17-12-2 10088		AISI 316
5	Cone Cone seal	Steel PTFE	11SMn30 10087	Type 2, R 683/9	AISI 1213
8	Packing gland	Stainless steel	X8CrNiS18-9 10088	Type 17 R 683/13	AISI 303
9	Washer	Cast iron			
10-11	Seal ring	PTFE			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	Gasket	Fiber, Non-asbestos			
14	Hand wheel	Steel			
15	Washer	Stainless steel			
16	Screw/Nut	Stainless steel			
17	Cap	Aluminium			
18	Gasket for cap	Nylon (PA6)			
19	Internal soft backseating	PTFE			
20	Identification ring	Stainless steel			
21	Wear ring	PTFE			

Dimensions and weights

SVA 6 -10 in angle execution with handwheel (SVA 121)

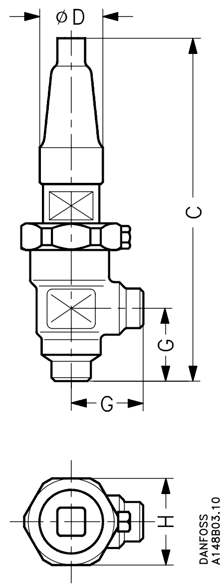
SVA 6-10



Valve size		$C_{max.}$	G	∅D	□H	Weight
SVA 6	mm in.	128 5.04	30 1.18	50 1.97		0.7 kg
SVA 10	mm in.	173 6.81	45 1.77	60 2.36	60 2.36	1.4 kg

SVA 6 - 10 in angle execution with cap (SVA 123)

SVA 6-10

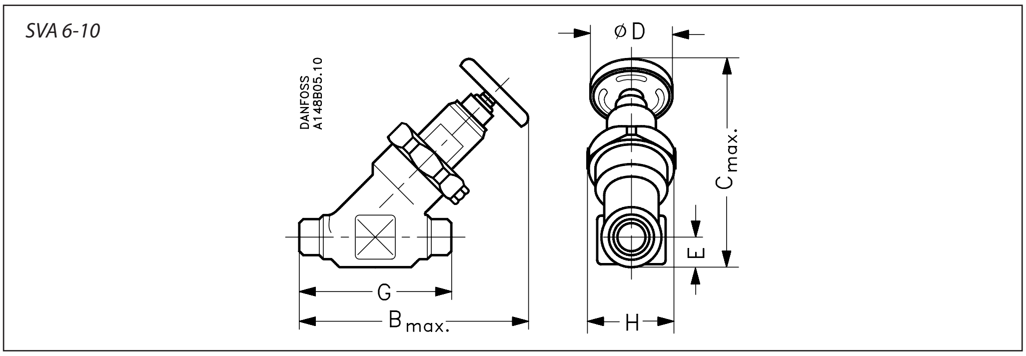


Valve size		C	G	∅D	□H	Weight
SVA 6	mm in.	139 5.47	30 1.18	30 1.18	48 1.89	0.8 kg
SVA 10	mm in.	182 7.17	45 1.77	38 1.50	60 2.36	1.4 kg

Specified weights are approximate values only.

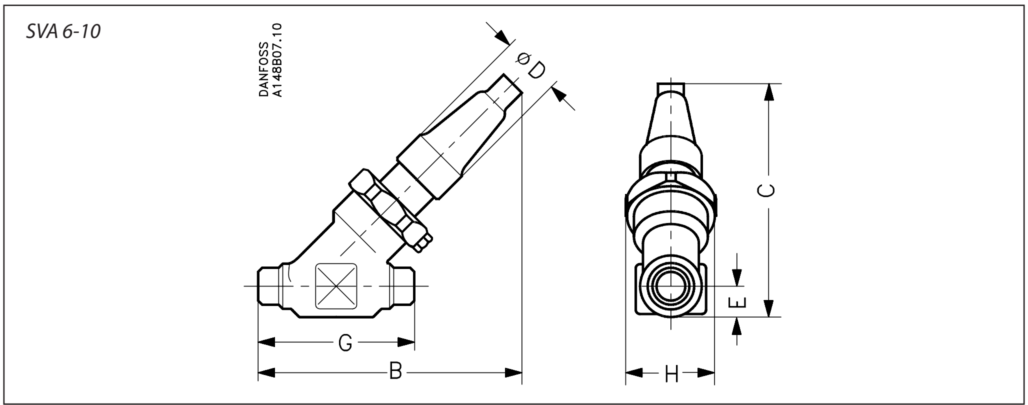
Dimensions and weights

SVA 6 - 10 in straight-way execution with handwheel (SVA 221)



Valve size			$C_{max.}$	$B_{max.}$	E	G	∅D		□H		Weight
SVA 6	mm in.		110 4.33	120 4.72	13 0.49	70 2.76	50 1.97		48 1.89		0.7 kg
SVA 10	mm in.		145 5.71	160 6.30	20 0.79	120 4.72	60 2.36		60 2.36		2.0 kg

SVA 6 - 10 in straight-way execution with cap (SVA 223)

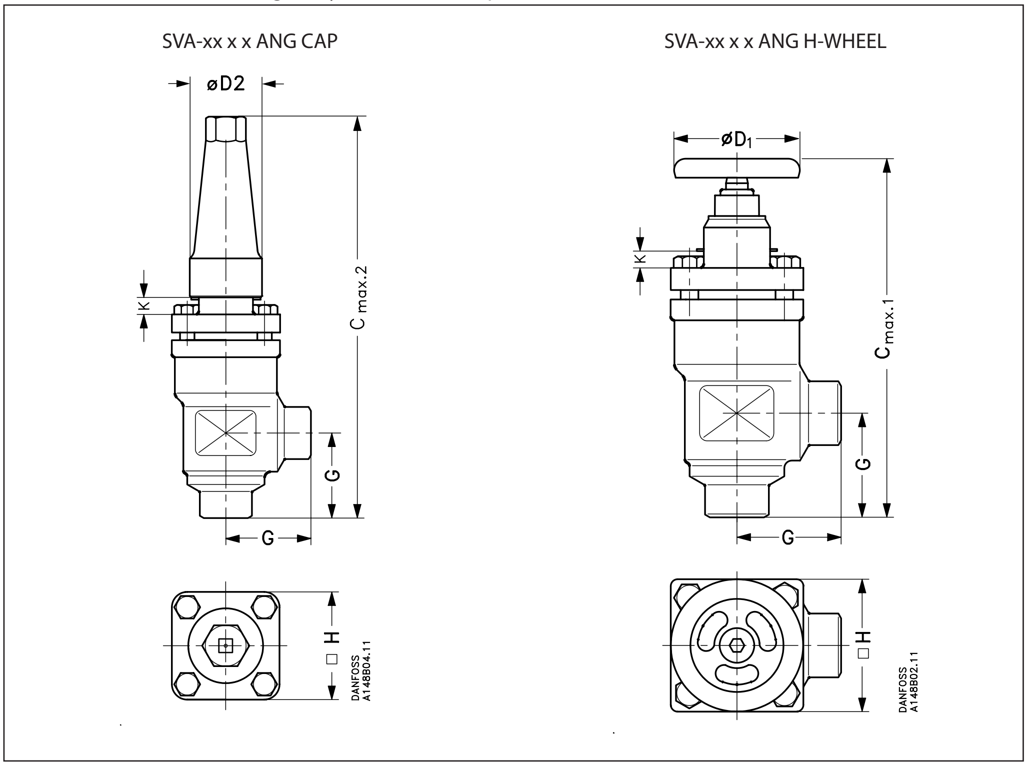


Valve size			C	B	E	G	∅D		□H		Weight
SVA 6	mm in.		110 4.33	120 4.72	13 0.49	70 2.76	30 1.16		48 1.89		0.8 kg
SVA 10	mm in.		145 5.71	155 6.10	20 0.79	120 4.72	38 1.50		60 2.36		2.0 kg

Specified weights are approximate values only.

Dimensions and weights

SVA 15 - 40 (½ - 1½ in.) in angleway version with cap / hand wheel

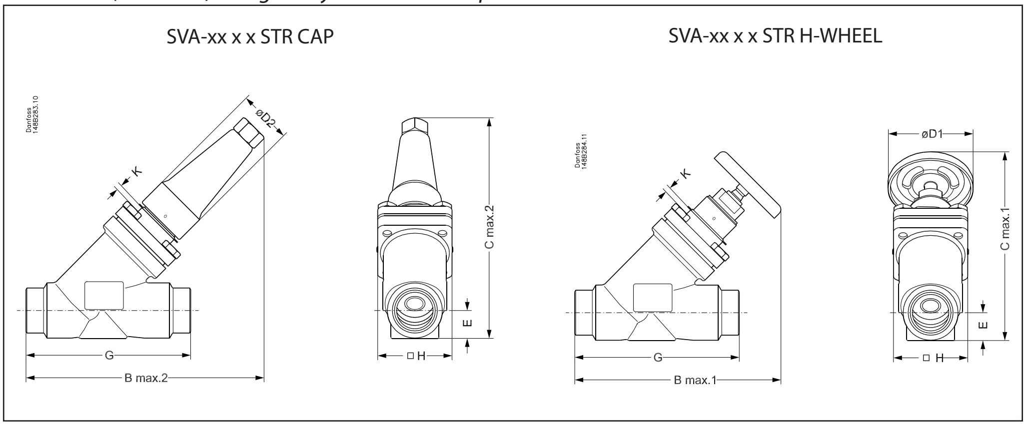


Valve size		K		$C_{max.1}$	$C_{max.2}$	G		∅D_1	∅D_2	□H		Weight
SVA-ST, SS												
SVA 15 - 20	mm	4		178	189	45		60	38	60		1.4 kg
SVA (½ - ¾)	in.	0.16		7.00	7.44	1.77		2.36	1.5	2.36		3.1 lb
SVA 25 - 40	mm	12		234	268	55		80	50	70		2.4 kg
SVA (1 - 1½)	in.	0.47		9.21	10.55	2.17		3.15	1.97	2.76		5.3 lb
SVA-ST, Socket weld												
SVA 32 - 40	mm	12		241	275	62		80	50	70		2.9 kg
SVA (1¼ - 1½)	in.	0.47		9.49	10.83	2.44		3.15	1.97	2.76		6.4 lb
SVA-HS												
SVA 15 - 20	mm	63		237	248	45		60	38	60		1.4 kg
SVA (½ - ³/₄)	in.	2.48		9.33	9.76	1.77		2.36	1.5	2.36		3.1 lb
SVA 25 - 40	mm	74		296	330	55		80	50	70		2.4 kg
SVA (1 - 1½)	in.	2.91		11.65	12.99	2.17		3.15	1.97	2.76		5.3 lb
SVA-HS, Socket weld												
SVA 32 - 40	mm	74		303	337	62		80	50	70		2.9 kg
SVA (1¼ - 1½)	in.	2.91		11.93	13.27	2.44		3.15	1.97	2.76		6.4 lb

Specified weights are approximate values only.

Dimensions and weights

SVA 15 - 40 (½ - 1½ in.) straightway version with cap / hand wheel

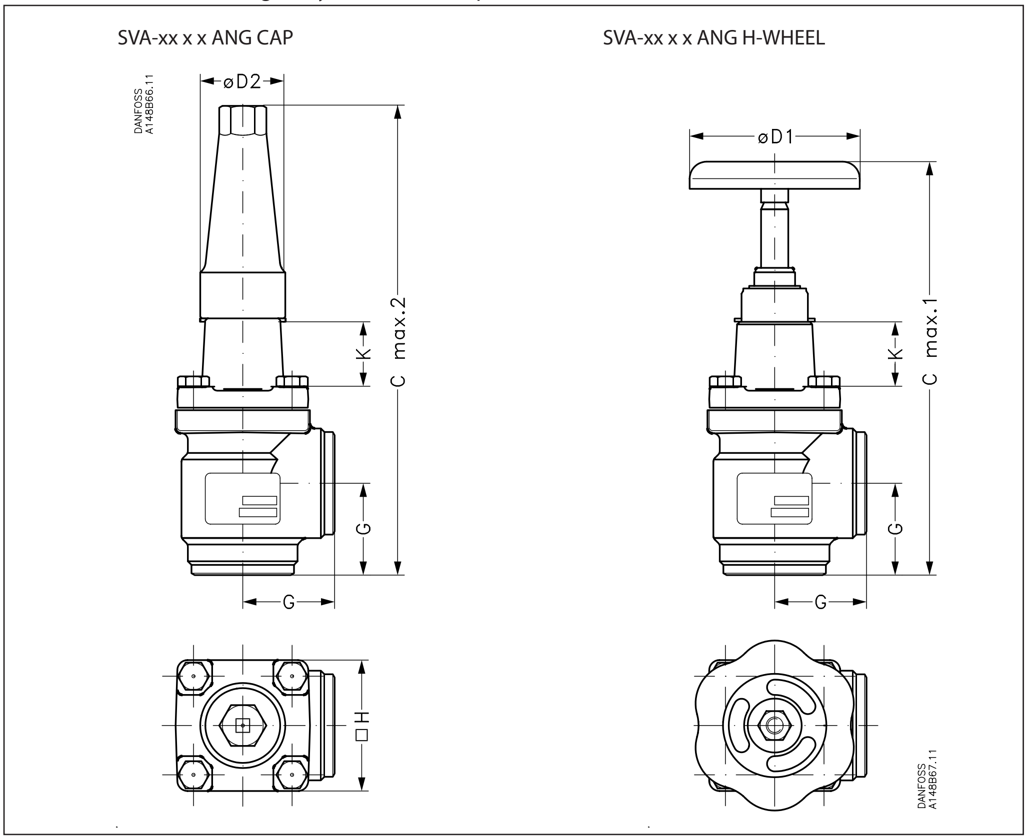


Valve size		K	$C_{max.1}$	$C_{max.2}$	$B_{max.1}$	$B_{max.2}$	E	G	∅D_1	∅D_2	□H	Weight
SVA-ST, SS												
SVA 15 - 20	mm	4	146	141	160	156	20	120	60	38	60	2.0 kg
SVA (½ - ¾)	in.	0.16	5.74	5.55	6.30	6.14	0.79	4.72	2.36	1.50	2.36	4.4 lb
SVA 25 - 40	mm	12	199	208	212	222	26	155	80	50	70	3.0 kg
SVA (1 - 1½)	in.	0.47	7.83	8.19	8.35	8.74	1.02	6.10	3.15	1.97	2.76	6.6 lb
SVA-ST, Socket weld												
SVA 32	mm	12	200	209	212	222	27.4	155	80	50	70	3.0 kg
SVA (1¼)	in.	0.47	7.87	8.23	8.35	8.74	1.08	6.10	3.15	1.97	2.76	6.6 lb
SVA 40	mm	12	204	213	212	222	31.0	155	80	50	70	3.0 kg
SVA (1½)	in.	0.47	8.03	8.39	8.35	8.74	1.22	6.10	3.15	1.97	2.76	6.6 lb
SVA-HS												
SVA 15 - 20	mm	63	188	184	202	198	20	120	60	38	60	2.0 kg
SVA (½ - ¾)	in.	2.48	7.40	7.24	7.95	7.80	0.79	4.72	2.36	1.50	2.36	4.4 lb
SVA 25 - 40	mm	74	243	252	256	265	26	155	80	50	70	3.0 kg
SVA (1 - 1½)	in.	2.91	9.57	9.92	10.08	10.43	1.02	6.10	3.15	1.97	2.76	6.6 lb
SVA-HS, Socket weld												
SVA 32	mm	74	244	253	256	265	27.4	155	80	50	70	3.0 kg
SVA (1¼)	in.	2.91	9.61	9.96	10.08	10.43	1.08	6.10	3.15	1.97	2.76	6.6 lb
SVA 40	mm	74	248	257	256	265	31.0	155	80	50	70	3.0 kg
SVA (1½)	in.	2.91	9.76	10.12	10.08	10.43	1.22	6.10	3.15	1.97	2.76	6.6 lb

Specified weights are approximate values only.

Dimensions and weights

SVA 50 - 65 (2 - 2½ in.) in angleway version with cap / hand wheel

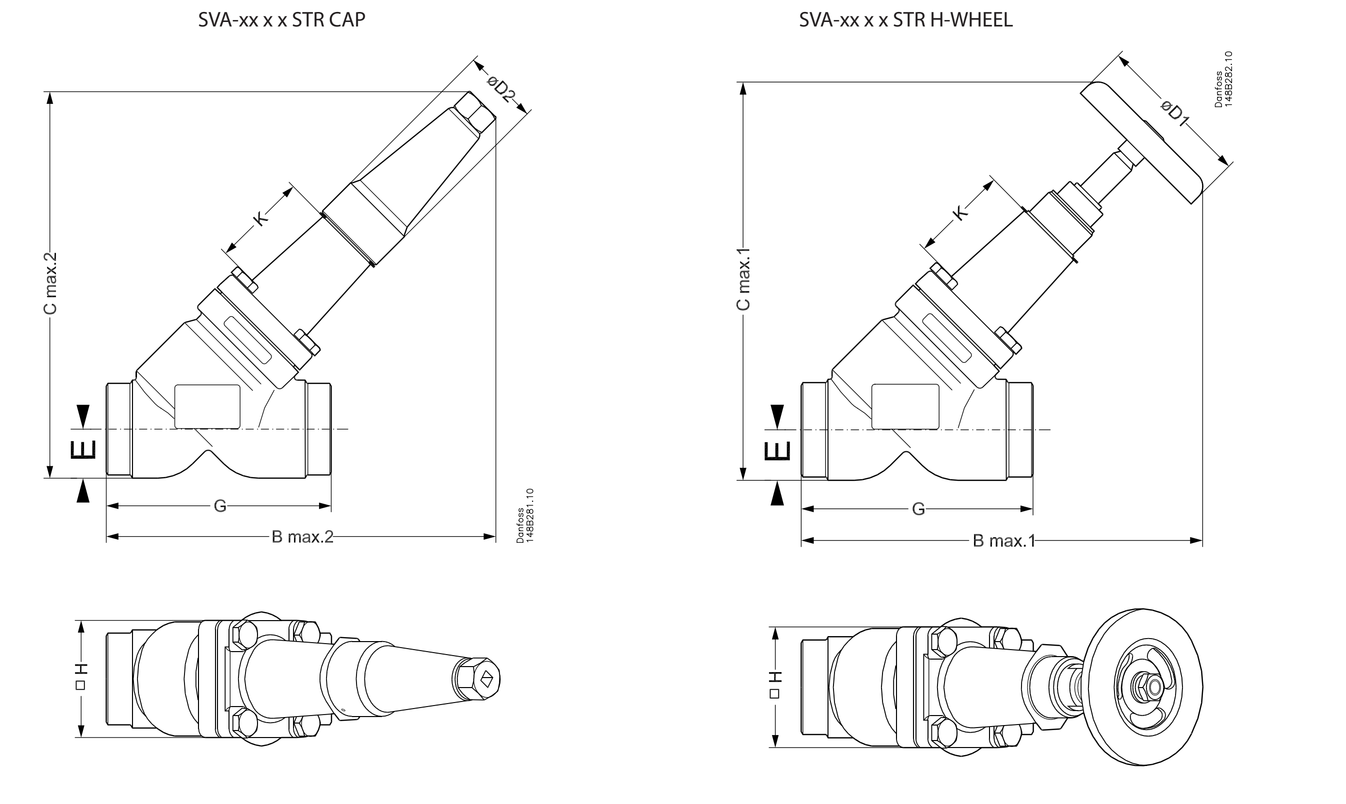


Valve size		K	$C_{max.1}$	$C_{max.2}$	G	∅D_1	∅D_2	□H	Weight
SVA-ST, SS									
SVA 50	mm	35	249	280	60	100	50	77	3.2 kg
SVA (2)	in.	1.38	9.80	11.02	2.36	3.94	1.97	3.03	7.1 lb
SVA 65	mm	40	280	305	70	100	50	90	4.8 kg
SVA (2½)	in.	1.57	11.02	12.01	2.76	3.94	1.97	3.54	10.6 lb
SVA-ST, Socket weld									
SVA 50	mm	35	254	285	65	100	50	77	4.1 kg
SVA (2)	in.	1.38	10.00	11.22	2.56	3.94	1.97	3.03	9.0 lb
SVA-HS									
SVA 50	mm	70	284	315	60	100	50	77	3.2 kg
SVA (2)	in.	2.76	11.18	12.40	2.36	3.94	1.97	3.03	7.1 lb
SVA 65	mm	70	310	335	70	100	50	90	4.8 kg
SVA (2½)	in.	2.76	12.20	13.19	2.76	3.94	1.97	3.54	10.6 lb
SVA-HS, Socket weld									
SVA 50	mm	70	289	320	65	100	50	77	4.1 kg
SVA (2)	in.	2.76	11.38	12.60	2.56	3.94	1.97	3.03	9.0 lb

Specified weights are approximate values only.

Dimensions and weights

SVA 50 - 65 (2 - 2½ in.) in straightway version with cap / hand wheel

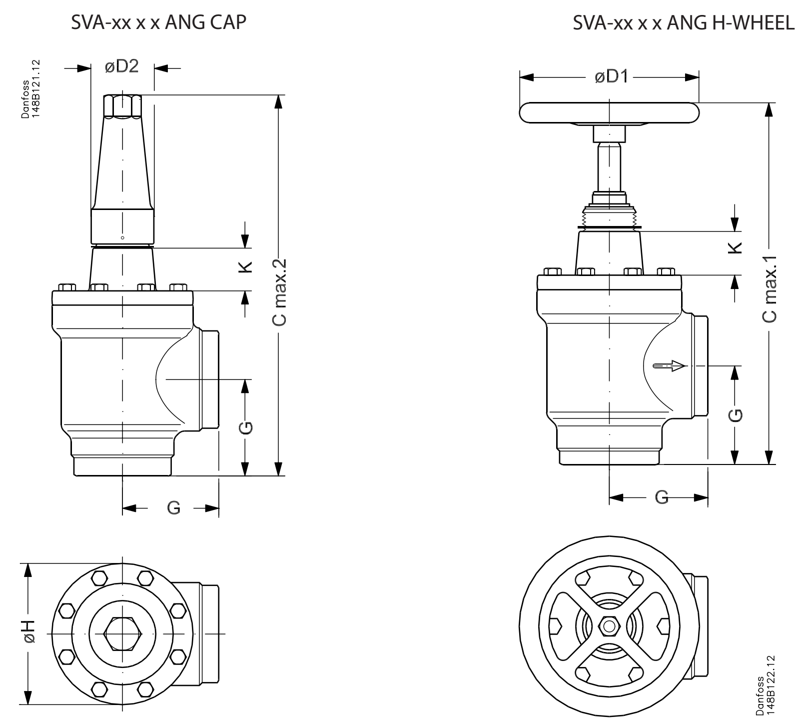


Valve size		K	$B_{max.1}$	$B_{max.2}$	$C_{max.1}$	$C_{max.2}$	E	G	∅D_1	∅D_2	□H	Weight
SVA-ST, SS												
SVA 50 SVA (2)	mm in.	35 1.38	234 9.21	234 9.21	232 9.13	232 9.13	32 1.26	148 5.83	100 3.94	50 1.97	77 3.03	4.2 kg 9.3 lb
SVA 65 SVA (2½)	mm in.	40 1.57	262 10.31	258 10.16	262 10.31	258 10.16	40 1.57	176 6.93	100 3.94	50 1.97	90 3.54	6.3 kg 13.9 lb
SVA-ST, Socket weld												
SVA 50 SVA (2)	mm in.	35 1.38	241 9.49	241 9.49	236 9.29	236 9.29	37 1.46	162 6.38	100 3.94	50 1.97	77 3.03	5.1 kg 11.2 lb
SVA-HS												
SVA 50 SVA (2)	mm in.	70 2.76	259 10.20	259 10.20	257 10.12	257 10.12	32 1.26	148 5.83	100 3.94	50 1.97	77 3.03	4.2 kg 9.3 lb
SVA 65 SVA (2½)	mm in.	70 2.76	284 11.18	280 11.02	284 11.18	280 11.02	40 1.57	176 6.93	100 3.94	50 1.97	90 3.54	6.3 kg 13.9 lb
SVA-HS, Socket weld												
SVA 50 SVA (2)	mm in.	70 2.76	266 10.47	266 10.47	261 10.28	261 10.28	37 1.26	62 6.38	100 3.94	50 1.97	77 3.03	5.1 kg 11.2 lb

Specified weights are approximate values only.

Dimensions and weights

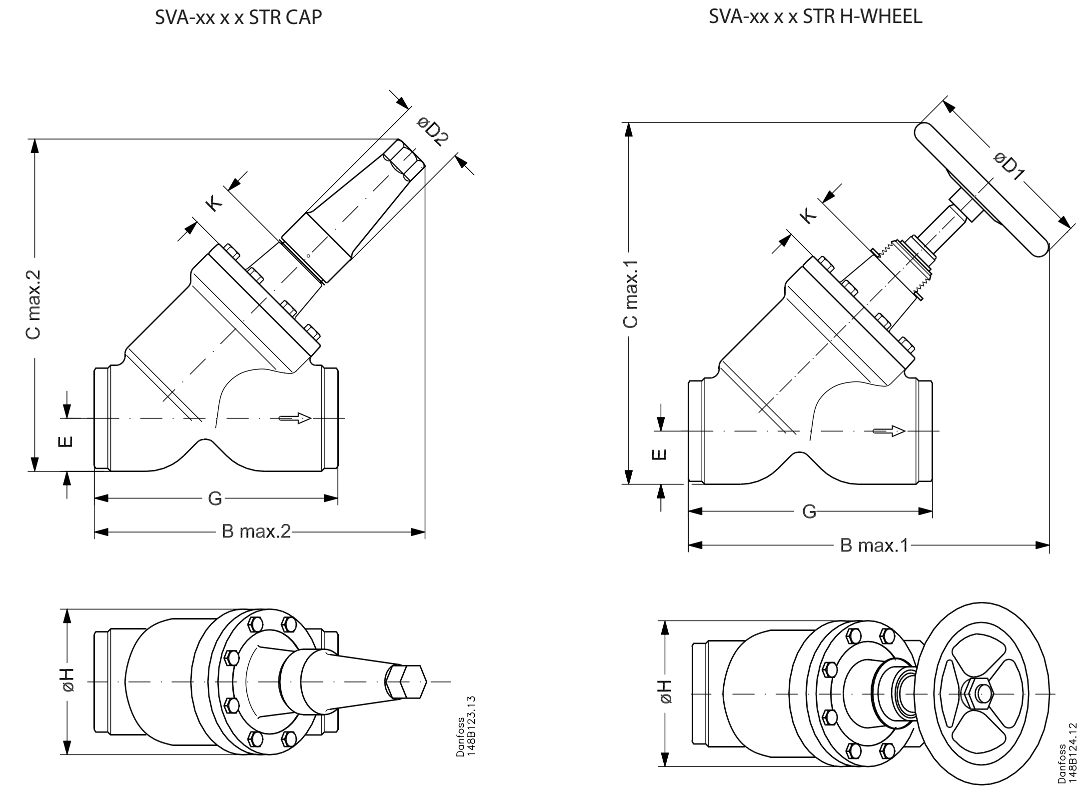
SVA 80 - 200 (3 - 8 in.) angleway version with cap / hand wheel



Valve size		K	$C_{max.1}$	$C_{max.2}$	G	$\varnothing D_1$	$\varnothing D_2$	$\varnothing H$	Weight
SVA-ST									
SVA 80	mm	41	338	353	90	200	58	129	9.2 kg
SVA (3)	in.	1.61	13.31	13.90	3.54	7.87	2.28	5.08	20.3 lb
SVA 100	mm	43	382	388	106	250	58	156	14.8 kg
SVA (4)	in.	1.69	15.04	15.28	4.17	9.84	2.28	6.14	32.6 lb
SVA 125	mm	90	517	533	128	315	74	193	28.1 kg
SVA (5)	in.	3.54	20.35	20.98	5.04	12.40	2.91	7.60	61.9 lb
SVA 150	mm	90	564	568	145	315	74	219	39.7 kg
SVA (6)	in.	3.54	22.20	22.36	5.71	12.40	2.91	8.62	87.5 lb
SVA 200	mm	90	675	678	180	400	86	276	79.5 kg
SVA (8)	in.	3.54	26.57	26.69	7.09	15.75	3.39	10.87	175.3 lb
SVA-HS									
SVA 80	mm	76	373	388	90	200	58	129	9.7 kg
SVA (3)	in.	3.00	14.69	15.28	3.54	7.87	2.28	5.08	21.4 lb
SVA 100	mm	90	432	437	106	250	58	156	15.3 kg
SVA (4)	in.	3.54	17.00	17.20	4.17	9.84	2.28	6.14	33.7 lb
SVA 125	mm	90	517	533	128	315	74	193	28.1 kg
SVA (5)	in.	3.54	20.35	20.98	5.04	12.40	2.91	7.60	61.9 lb
SVA 150	mm	90	564	568	145	315	74	219	39.7 kg
SVA (6)	in.	3.54	22.20	22.36	5.71	12.40	2.91	8.62	87.5 lb
SVA 200	mm	90	675	678	180	400	86	276	79.5 kg
SVA (8)	in.	3.54	26.57	26.69	7.09	15.75	3.39	10.87	175.3 lb

Specified weights are approximate values only.

Dimensions and weights *SVA 80 - 200 (3 - 8 in.) straightway version with cap / hand wheel*



Valve size		K	$B_{max.1}$	$B_{max.2}$	$C_{max.1}$	$C_{max.2}$	E	G	∅D_1	∅D_2	∅H	Weight
SVA-ST												
SVA 80	mm	41	340	296	342	298	48	216	200	58	129	10.4 kg
SVA (3)	in.	1.61	13.38	11.65	13.46	11.73	1.89	8.50	7.87	2.28	5.08	22.9 lb
SVA 100	mm	43	400	331	408	339	60	264	250	58	156	17.7 kg
SVA (4)	in.	1.69	15.75	13.03	16.06	13.35	2.36	10.39	9.84	2.28	6.14	39.0 lb
SVA 125	mm	90	526	444	538	456	74	322	315	74	193	32.8 kg
SVA (5)	in.	3.54	20.71	17.48	21.18	17.95	2.91	12.68	12.40	2.91	7.60	72.3 lb
SVA 150	mm	90	572	483	594	505	91	370	315	74	219	60.0 kg
SVA (6)	in.	3.54	22.52	19.02	23.39	19.88	3.58	14.57	12.40	2.91	8.62	132.3 lb
SVA 200	mm	90	692	579	726	613	117	464	400	86	276	111.5 kg
SVA (8)	in.	3.54	27.24	22.80	28.58	24.13	4.61	18.27	15.75	3.39	10.87	245.8 lb
SVA-HS												
SVA 80	mm	76	365	321	367	232	48	216	200	58	129	10.9 kg
SVA (3)	in.	3.00	14.37	12.64	14.45	12.72	1.89	8.50	7.87	2.28	5.08	24.0 lb
SVA 100	mm	90	435	367	443	375	60	264	250	58	156	18.2 kg
SVA (4)	in.	3.54	17.13	14.45	17.44	14.76	2.36	10.39	9.84	2.28	6.14	40.1 lb
SVA 125	mm	90	526	444	538	456	74	322	315	74	193	32.8 kg
SVA (5)	in.	3.54	20.71	17.48	21.18	17.95	2.91	12.68	12.40	2.91	7.60	72.3 lb
SVA 150	mm	90	572	483	594	505	91	370	315	74	219	60.0 kg
SVA (6)	in.	3.54	22.52	19.02	23.39	19.88	3.58	14.57	12.40	2.91	8.62	132.3 lb
SVA 200	mm	90	692	579	726	613	117	464	400	86	276	111.5 kg
SVA (8)	in.	3.54	27.24	22.80	28.58	24.13	4.61	18.27	15.75	3.39	10.87	245.8 lb

Specified weights are approximate values only.

Ordering

Please note that the type codes only serve to identify the valves, some of which may not form part of the standard product range. For further information please contact your local Danfoss Sales Company.

Type codes

Valve type	**SVA**	Stop valve				
Nominal size in mm			Available connections			
			A/D	SOC	FPT	T
(valve size measured on the connection diameter)	**6**	DN 6 ($^1/_4$)	x			x
	10	DN 10 ($^3/_8$)	x			x
	15	DN 15 (½)	x	x	x	
	20	DN 20 (¾)	x	x	x	
	25	DN 25 (1)	x	x	x	
	32	DN 32 (1¼)	x	x	x	
	40	DN 40 (1½)	x	x		
	50	DN 50 (2)	x	x		
	65	DN 65 (2½)	x			
	80	DN 80 (3)	x			
	100	DN 100 (4)	x			
	125	DN 125 (5)	x			
	150	DN 150 (6)	x			
	200	DN 200 (8)	x			
Connections	**A**	Butt-weld connection: ANSI B 36.10 schedule 80, DN 15 - 40 (½ - 1½ in.) Butt-weld connection: ANSI B 36.10 schedule 40, DN 50 - 200 (2 - 8 in.)				
	D	Butt-weld connection: DIN 2448				
	SOC	Socket weld: ANSI B 16.11				
	FPT	Female Pipe Thread NPT: ANSI/ASME B 1.20.1				
	T	Outside threaded connections ISO 228/1 Pipe thread				
Valve housing	**ANG**	Angle flow				
	STR	Straight flow				
Other equipment	**H-WHEEL**	Hand wheel				
	CAP	Cap				

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

Ordering
(cont.)

Example:
SVA 6 ANSI angleway with cap = **2412+336**

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

D = Butt-weld DIN
A = Butt-weld ANSI

The table below is used to identify the valve required.

Angleway			
Size mm	Size in.	Type	**Code number**
DIN			
6	1/4	SVA 6 D ANG H-WHEEL	**2412+308**
6	1/4	SVA 6 D ANG CAP	**2412+315**
10	3/8	SVA 10 D ANG H-WHEEL	**2412+309**
10	3/8	SVA 10 D ANG CAP	**2412+316**
ANSI			
6	1/4	SVA 6 A ANG H-WHEEL	**2412+350**
6	1/4	SVA 6 A ANG CAP	**2412+357**
10	3/8	SVA 10 A ANG H-WHEEL	**2412+351**
10	3/8	SVA 10 A ANG CAP	**2412+358**

Straightway			
Size mm	Size in.	Type	**Code number**
DIN			
6	1/4	SVA 6 D STR H-WHEEL	**2412+329**
6	1/4	SVA 6 D STR CAP	**2412+336**
10	3/8	SVA 10 D STR H-WHEEL	**2412+330**
10	3/8	SVA 10 D STR CAP	**2412+337**
ANSI			
6	1/4	SVA 6 A STR H-WHEEL	**2412+371**
6	1/4	SVA 6 A STR CAP	**2412+378**
10	3/8	SVA 10 A STR H-WHEEL	**2412+372**
10	3/8	SVA 10 A STR CAP	**2412+379**

SVA 6T and SVA-ST 10-15 T

Type	**Code number**
SVA-ST 10-15 T STOPVALVE STR H-WHEEL	**148B3969**
SVA-ST 10-15 T STOPVALVE STR CAP	**148B3970**
SVA-ST 10-15 T STOPVALVE ANG H-WHEEL	**148B3818**
SVA-ST 10-15 T STOPVALVE ANG CAP	**148B3819**
SVA-ST 6 T STOPVALVE ANG H-WHEEL	**2413+123**
SVA-ST 6 T STOPVALVE ANG CAP	**2413+125**

Accessories

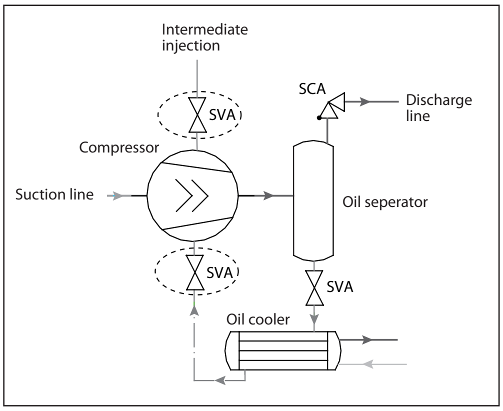
6T and 10-15T Nipple Kit solution

Code no.	
148B4244	ACCESSORY WELD.NIPPLE DN10 D + UNION NUT
148B4245	ACCESSORY WELD.NIPPLE DN6 A + UNION NUT
148B4246	ACCESSORY WELD.NIPPLE DN10 A + UNION NUT
148B4247	ACCESSORY WELD.NIPPLE DN15 A + UNION NUT
148B4184	ACCESSORY WELD.NIPPLE DN6 D + UNION NUT
148B4185	ACCESSORY WELD.NIPPLE DN15 D + UNION NUT

DN6 nipples are used with SVA 6 T.
DN10 and DN15 nipples are used with SVA-ST 10-15 T.

Lock washers for the stop valves, subjected to extreme vibrations/pulsations

Code no.	
148B4238	I-PACK(10) ACC.LOCK WASHER SVA 15-20
148B4239	I-PACK(10) ACC.LOCK WASHER SVA 25-40
148B4240	I-PACK(10) ACC.LOCK WASHER SVA 50-65
148B4241	I-PACK(10) ACC.LOCK WASHER SVA 80-100
148B4242	I-PACK(10) ACC.LOCK WASHER SVA 125-150
148B4243	I-PACK(10) ACC.LOCK WASHER SVA 200



Indication of a pipe line, where stop valves with lock washers are recommended.

Ordering - SVA-ST

Example:
SVA-ST 20 DIN angleway with hand wheel = **148B3441**

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

The table below is used to identify the valve required.

Standard version			
Angleway			
Size		Type	Code number
mm	in.		

DIN

mm	in.	Type	Code number
15	½	SVA-ST 15 D ANG H-WHEEL	**148B3361**
15	½	SVA-ST 15 D ANG CAP	**148B3362**
20	¾	SVA-ST 20 D ANG H-WHEEL	**148B3441**
20	¾	SVA-ST 20 D ANG CAP	**148B3442**
25	1	SVA-ST 25 D ANG H-WHEEL	**148B3521**
25	1	SVA-ST 25 D ANG CAP	**148B3522**
32	1¼	SVA-ST 32 D ANG H-WHEEL	**148B3601**
32	1¼	SVA-ST 32 D ANG CAP	**148B3602**
40	1½	SVA-ST 40 D ANG H-WHEEL	**148B3681**
40	1½	SVA-ST 40 D ANG CAP	**148B3682**
50	2	SVA-ST 50 D ANG H-WHEEL	**148B3032**
50	2	SVA-ST 50 D ANG CAP	**148B3033**
65	2½	SVA-ST 65 D ANG H-WHEEL	**148B3044**
65	2½	SVA-ST 65 D ANG CAP	**148B3045**
80	3	SVA-ST 80 D ANG H-WHEEL	**148B3061**
80	3	SVA-ST 80 D ANG CAP	**148B3062**
100	4	SVA-ST 100 D ANG H-WHEEL	**148B3101**
100	4	SVA-ST 100 D ANG CAP	**148B3102**
125	5	SVA-ST 125 D ANG H-WHEEL	**148B3141**
125	5	SVA-ST 125 D ANG CAP	**148B3142**
150	6	SVA-ST 150 D ANG H-WHEEL	**148B3181**
150	6	SVA-ST 150 D ANG CAP	**148B3182**
200	8	SVA-ST 200 D ANG H-WHEEL	**148B3221**
200	8	SVA-ST 200 D ANG CAP	**148B3222**

ANSI

mm	in.	Type	Code number
15	½	SVA-ST 15 A ANG H-WHEEL	**148B3371**
15	½	SVA-ST 15 A ANG CAP	**148B3372**
20	¾	SVA-ST 20 A ANG H-WHEEL	**148B3451**
20	¾	SVA-ST 20 A ANG CAP	**148B3452**
25	1	SVA-ST 25 A ANG H-WHEEL	**148B3531**
25	1	SVA-ST 25 A ANG CAP	**148B3532**
32	1¼	SVA-ST 32 A ANG H-WHEEL	**148B3611**
32	1¼	SVA-ST 32 A ANG CAP	**148B3612**
40	1½	SVA-ST 40 A ANG H-WHEEL	**148B3691**
40	1½	SVA-ST 40 A ANG CAP	**148B3692**
50	2	SVA-ST 50 A ANG H-WHEEL	**148B3034**
50	2	SVA-ST 50 A ANG CAP	**148B3035**
65	2½	SVA-ST 65 A ANG H-WHEEL	**148B3046**
65	2½	SVA-ST 65 A ANG CAP	**148B3047**
80	3	SVA-ST 80 A ANG H-WHEEL	**148B3071**
80	3	SVA-ST 80 A ANG CAP	**148B3072**
100	4	SVA-ST 100 A ANG H-WHEEL	**148B3111**
100	4	SVA-ST 100 A ANG CAP	**148B3112**
125	5	SVA-ST 125 A ANG H-WHEEL	**148B3151**
125	5	SVA-ST 125 A ANG CAP	**148B3152**
150	6	SVA-ST 150 A ANG H-WHEEL	**148B3191**
150	6	SVA-ST 150 A ANG CAP	**148B3192**
200	8	SVA-ST 200 A ANG H-WHEEL	**148B3231**
200	8	SVA-ST 200 A ANG CAP	**148B3232**

SOC

mm	in.	Type	Code number
15	½	SVA-ST 15 SOC ANG H-WHEEL	**148B3381**
15	½	SVA-ST 15 SOC ANG CAP	**148B3382**
20	¾	SVA-ST 20 SOC ANG H-WHEEL	**148B3461**
20	¾	SVA-ST 20 SOC ANG CAP	**148B3462**
25	1	SVA-ST 25 SOC ANG H-WHEEL	**148B3541**
25	1	SVA-ST 25 SOC ANG CAP	**148B3542**
32	1¼	SVA-ST 32 SOC ANG H-WHEEL	**148B3621**
32	1¼	SVA-ST 32 SOC ANG CAP	**148B3622**
40	1½	SVA-ST 40 SOC ANG H-WHEEL	**148B3701**
40	1½	SVA-ST 40 SOC ANG CAP	**148B3702**
50	2	SVA-ST 50 SOC ANG H-WHEEL	**148B3036**
50	2	SVA-ST 50 SOC ANG CAP	**148B3037**

FPT

mm	in.	Type	Code number
15	½	SVA-ST 15 FPT ANG H-WHEEL	**148B3391**
15	½	SVA-ST 15 FPT ANG CAP	**148B3392**
20	¾	SVA-ST 20 FPT ANG H-WHEEL	**148B3471**
20	¾	SVA-ST 20 FPT ANG CAP	**148B3472**
25	1	SVA-ST 25 FPT ANG H-WHEEL	**148B3551**
25	1	SVA-ST 25 FPT ANG CAP	**148B3552**
32	1¼	SVA-ST 32 FPT ANG H-WHEEL	**148B3631**
32	1¼	SVA-ST 32 FPT ANG CAP	**148B3632**

Standard version			
Straightway			
Size		Type	Code number
mm	in.		

DIN

mm	in.	Type	Code number
15	½	SVA-ST 15 D STR H-WHEEL	**148B3401**
15	½	SVA-ST 15 D STR CAP	**148B3402**
20	¾	SVA-ST 20 D STR H-WHEEL	**148B3481**
20	¾	SVA-ST 20 D STR CAP	**148B3482**
25	1	SVA-ST 25 D STR H-WHEEL	**148B3561**
25	1	SVA-ST 25 D STR CAP	**148B3562**
32	1¼	SVA-ST 32 D STR H-WHEEL	**148B3641**
32	1¼	SVA-ST 32 D STR CAP	**148B3642**
40	1½	SVA-ST 40 D STR H-WHEEL	**148B3711**
40	1½	SVA-ST 40 D STR CAP	**148B3712**
50	2	SVA-ST 50 D STR H-WHEEL	**148B3038**
50	2	SVA-ST 50 D STR CAP	**148B3039**
65	2½	SVA-ST 65 D STR H-WHEEL	**148B3050**
65	2½	SVA-ST 65 D STR CAP	**148B3051**
80	3	SVA-ST 80 D STR H-WHEEL	**148B3081**
80	3	SVA-ST 80 D STR CAP	**148B3082**
100	4	SVA-ST 100 D STR H-WHEEL	**148B3121**
100	4	SVA-ST 100 D STR CAP	**148B3122**
125	5	SVA-ST 125 D STR H-WHEEL	**148B3161**
125	5	SVA-ST 125 D STR CAP	**148B3162**
150	6	SVA-ST 150 D STR H-WHEEL	**148B3201**
150	6	SVA-ST 150 D STR CAP	**148B3202**
200	8	SVA-ST 200 D STR H-WHEEL	**148B3241**
200	8	SVA-ST 200 D STR CAP	**148B3242**

ANSI

mm	in.	Type	Code number
15	½	SVA-ST 15 A STR H-WHEEL	**148B3411**
15	½	SVA-ST 15 A STR CAP	**148B3412**
20	¾	SVA-ST 20 A STR H-WHEEL	**148B3491**
20	¾	SVA-ST 20 A STR CAP	**148B3492**
25	1	SVA-ST 25 A STR H-WHEEL	**148B3571**
25	1	SVA-ST 25 A STR CAP	**148B3572**
32	1¼	SVA-ST 32 A STR H-WHEEL	**148B3651**
32	1¼	SVA-ST 32 A STR CAP	**148B3652**
40	1½	SVA-ST 40 A STR H-WHEEL	**148B3721**
40	1½	SVA-ST 40 A STR CAP	**148B3722**
50	2	SVA-ST 50 A STR H-WHEEL	**148B3040**
50	2	SVA-ST 50 A STR CAP	**148B3041**
65	2½	SVA-ST 65 A STR H-WHEEL	**148B3052**
65	2½	SVA-ST 65 A STR CAP	**148B3053**
80	3	SVA-ST 80 A STR H-WHEEL	**148B3091**
80	3	SVA-ST 80 A STR CAP	**148B3092**
100	4	SVA-ST 100 A STR H-WHEEL	**148B3131**
100	4	SVA-ST 100 A STR CAP	**148B3132**
125	5	SVA-ST 125 A STR H-WHEEL	**148B3171**
125	5	SVA-ST 125 A STR CAP	**148B3172**
150	6	SVA-ST 150 A STR H-WHEEL	**148B3211**
150	6	SVA-ST 150 A STR CAP	**148B3212**
200	8	SVA-ST 200 A STR H-WHEEL	**148B3251**
200	8	SVA-ST 200 A STR CAP	**148B3252**

SOC

mm	in.	Type	Code number
15	½	SVA-ST 15 SOC STR H-WHEEL	**148B3421**
15	½	SVA-ST 15 SOC STR CAP	**148B3422**
20	¾	SVA-ST 20 SOC STR H-WHEEL	**148B3501**
20	¾	SVA-ST 20 SOC STR CAP	**148B3502**
25	1	SVA-ST 25 SOC STR H-WHEEL	**148B3581**
25	1	SVA-ST 25 SOC STR CAP	**148B3582**
32	1¼	SVA-ST 32 SOC STR H-WHEEL	**148B3661**
32	1¼	SVA-ST 32 SOC STR CAP	**148B3662**
40	1½	SVA-ST 40 SOC STR H-WHEEL	**148B3731**
40	1½	SVA-ST 40 SOC STR CAP	**148B3732**
50	2	SVA-ST 50 SOC STR H-WHEEL	**148B3042**
50	2	SVA-ST 50 SOC STR CAP	**148B3043**

FPT

mm	in.	Type	Code number
15	½	SVA-ST 15 FPT STR H-WHEEL	**148B3431**
15	½	SVA-ST 15 FPT STR CAP	**148B3432**
20	¾	SVA-ST 20 FPT STR H-WHEEL	**148B3511**
20	¾	SVA-ST 20 FPT STR CAP	**148B3512**
25	1	SVA-ST 25 FPT STR H-WHEEL	**148B3591**
25	1	SVA-ST 25 FPT STR CAP	**148B3592**
32	1¼	SVA-ST 32 FPT STR H-WHEEL	**148B3671**
32	1¼	SVA-ST 32 FPT STR CAP	**148B3672**

D = Butt-weld DIN
A = Butt-weld ANSI
SOC = Socket welding
FPT = Inside pipe thread

ANG = Angle-way
STR = Straight-way

CAP = Cap
H-WHEEL = Hand wheel

Ordering - SVA-SS

Example:
SVA-SS 32 DIN angleway with hand wheel = **148B3850**

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

D = Butt-weld DIN

ANG = Angle-way
STR = Straight-way

CAP = Cap
H-WHEEL = Hand wheel

The table below is used to identify the valve required.

Standard version			
Angleway			
Size mm	Size in.	Type	**Code number**
DIN			
15	½	SVA-SS 15 D ANG CAP 52BAR	**148B3843**
15	½	SVA-SS 15 D ANG H-WHEEL 52BAR	**148B3844**
20	¾	SVA-SS 20 D ANG CAP 52BAR	**148B3845**
20	¾	SVA-SS 20 D ANG H-WHEEL 52BAR	**148B3846**
25	1	SVA-SS 25 D ANG CAP 52BAR	**148B3847**
25	1	SVA-SS 25 D ANG H-WHEEL 52BAR	**148B3848**
32	1¼	SVA-SS 32 D ANG CAP 52BAR	**148B3849**
32	1¼	SVA-SS 32 D ANG H-WHEEL 52BAR	**148B3850**
40	1½	SVA-SS 40 D ANG CAP 52BAR	**148B3851**
40	1½	SVA-SS 40 D ANG H-WHEEL 52BAR	**148B3852**
50	2	SVA-SS 50 D ANG CAP 52BAR	**148B3853**
50	2	SVA-SS 50 D ANG H-WHEEL 52BAR	**148B3854**
65	2½	SVA-SS 65 D ANG CAP 52BAR	**148B3855**
65	2½	SVA-SS 65 D ANG H-WHEEL 52BAR	**148B3856**

Standard version			
Straightway			
Size mm	Size in.	Type	**Code number**
DIN			
15	½	SVA-SS 15 D STR CAP 52BAR	**148B4249**
15	½	SVA-SS 15 D STR H-WHEEL 52BAR	**148B4250**
20	¾	SVA-SS 20 D STR CAP 52BAR	**148B4251**
20	¾	SVA-SS 20 D STR H-WHEEL 52BAR	**148B4252**
25	1	SVA-SS 25 D STR CAP 52BAR	**148B4253**
25	1	SVA-SS 25 D STR H-WHEEL 52BAR	**148B4254**
32	1¼	SVA-SS 32 D STR CAP 52BAR	**148B4255**
32	1¼	SVA-SS 32 D STR H-WHEEL 52BAR	**148B4256**
40	1½	SVA-SS 40 D STR CAP 52BAR	**148B4257**
40	1½	SVA-SS 40 D STR H-WHEEL 52BAR	**148B4258**
50	2	SVA-SS 50 D STR CAP 52BAR	**148B4259**
50	2	SVA-SS 50 D STR H-WHEEL 52BAR	**148B4260**
65	2½	SVA-SS 65 D STR CAP 52BAR	**148B4261**
65	2½	SVA-SS 65 D STR H-WHEEL 52BAR	**148B4262**

Ordering - SVA-HS
(cont.)

Example:
SVA-HS 25 ANSI straightway
with cap = **148B3578**

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

D = Butt-weld DIN
A = Butt-weld ANSI
SOC = Socket welding
FPT = Inside pipe thread

ANG = Angle-way
STR = Straight-way

CAP = Cap
H-WHEEL = Hand wheel

The table below is used to identify the valve required.

Angleway			
Size		Type	**Code number**
mm	in.		
DIN			
15	½	SVA-HS 15 D ANG H-WHEEL	**148B3367**
15	½	SVA-HS 15 D ANG CAP	**148B3368**
20	¾	SVA-HS 20 D ANG H-WHEEL	**148B3447**
20	¾	SVA-HS 20 D ANG CAP	**148B3448**
25	1	SVA-HS 25 D ANG H-WHEEL	**148B3527**
25	1	SVA-HS 25 D ANG CAP	**148B3528**
32	1¼	SVA-HS 32 D ANG H-WHEEL	**148B3607**
32	1¼	SVA-HS 32 D ANG CAP	**148B3608**
40	1½	SVA-HS 40 D ANG H-WHEEL	**148B3687**
40	1½	SVA-HS 40 D ANG CAP	**148B3688**
50	2	SVA-HS 50 D ANG H-WHEEL	**148B3267**
50	2	SVA-HS 50 D ANG CAP	**148B3268**
65	2½	SVA-HS 65 D ANG H-WHEEL	**148B3327**
65	2½	SVA-HS 65 D ANG CAP	**148B3328**
80	3	SVA-HS 80 D ANG H-WHEEL	**148B3067**
80	3	SVA-HS 80 D ANG CAP	**148B3068**
100	4	SVA-HS 100 D ANG H-WHEEL	**148B3107**
100	4	SVA-HS 100 D ANG CAP	**148B3108**
125	5	SVA-HS 125 D ANG H-WHEEL	**148B3147**
125	5	SVA-HS 125 D ANG CAP	**148B3148**
150	6	SVA-HS 150 D ANG H-WHEEL	**148B3187**
150	6	SVA-HS 150 D ANG CAP	**148B3188**
200	8	SVA-HS 200 D ANG H-WHEEL	**148B3227**
200	8	SVA-HS 200 D ANG CAP	**148B3228**
ANSI			
15	½	SVA-HS 15 A ANG H-WHEEL	**148B3377**
15	½	SVA-HS 15 A ANG CAP	**148B3378**
20	¾	SVA-HS 20 A ANG H-WHEEL	**148B3457**
20	¾	SVA-HS 20 A ANG CAP	**148B3458**
25	1	SVA-HS 25 A ANG H-WHEEL	**148B3537**
25	1	SVA-HS 25 A ANG CAP	**148B3538**
32	1¼	SVA-HS 32 A ANG H-WHEEL	**148B3617**
32	1¼	SVA-HS 32 A ANG CAP	**148B3618**
40	1½	SVA-HS 40 A ANG H-WHEEL	**148B3697**
40	1½	SVA-HS 40 A ANG CAP	**148B3698**
50	2	SVA-HS 50 A ANG H-WHEEL	**148B3277**
50	2	SVA-HS 50 A ANG CAP	**148B3278**
65	2½	SVA-HS 65 A ANG H-WHEEL	**148B3337**
65	2½	SVA-HS 65 A ANG CAP	**148B3338**
80	3	SVA-HS 80 A ANG H-WHEEL	**148B3077**
80	3	SVA-HS 80 A ANG CAP	**148B3078**
100	4	SVA-HS 100 A ANG H-WHEEL	**148B3117**
100	4	SVA-HS 100 A ANG CAP	**148B3118**
125	5	SVA-HS 125 A ANG H-WHEEL	**148B3157**
125	5	SVA-HS 125 A ANG CAP	**148B3158**
150	6	SVA-HS 150 A ANG H-WHEEL	**148B3197**
150	6	SVA-HS 150 A ANG CAP	**148B3198**
200	8	SVA-HS 200 A ANG H-WHEEL	**148B3237**
200	8	SVA-HS 200 A ANG CAP	**148B3238**
SOC			
15	½	SVA-HS 15 SOC ANG H-WHEEL	**148B3387**
15	½	SVA-HS 15 SOC ANG CAP	**148B3388**
20	¾	SVA-HS 20 SOC ANG H-WHEEL	**148B3467**
20	¾	SVA-HS 20 SOC ANG CAP	**148B3468**
25	1	SVA-HS 25 SOC ANG H-WHEEL	**148B3547**
25	1	SVA-HS 25 SOC ANG CAP	**148B3548**
32	1¼	SVA-HS 32 SOC ANG H-WHEEL	**148B3627**
32	1¼	SVA-HS 32 SOC ANG CAP	**148B3628**
40	1½	SVA-HS 40 SOC ANG H-WHEEL	**148B3707**
40	1½	SVA-HS 40 SOC ANG CAP	**148B3708**
50	2	SVA-HS 50 SOC ANG H-WHEEL	**148B3287**
50	2	SVA-HS 50 SOC ANG CAP	**148B3288**
FPT			
15	½	SVA-HS 15 FPT ANG H-WHEEL	**148B3397**
15	½	SVA-HS 15 FPT ANG CAP	**148B3398**
20	¾	SVA-HS 20 FPT ANG H-WHEEL	**148B3477**
20	¾	SVA-HS 20 FPT ANG CAP	**148B3478**
25	1	SVA-HS 25 FPT ANG H-WHEEL	**148B3557**
25	1	SVA-HS 25 FPT ANG CAP	**148B3558**
32	1¼	SVA-HS 32 FPT ANG H-WHEEL	**148B3637**
32	1¼	SVA-HS 32 FPT ANG CAP	**148B3638**

Straightway			
Size		Type	**Code number**
mm	in.		
DIN			
15	½	SVA-HS 15 D STR H-WHEEL	**148B3407**
15	½	SVA-HS 15 D STR CAP	**148B3408**
20	¾	SVA-HS 20 D STR H-WHEEL	**148B3487**
20	¾	SVA-HS 20 D STR CAP	**148B3488**
25	1	SVA-HS 25 D STR H-WHEEL	**148B3567**
25	1	SVA-HS 25 D STR CAP	**148B3568**
32	1¼	SVA-HS 32 D STR H-WHEEL	**148B3647**
32	1¼	SVA-HS 32 D STR CAP	**148B3648**
40	1½	SVA-HS 40 D STR H-WHEEL	**148B3717**
40	1½	SVA-HS 40 D STR CAP	**148B3718**
50	2	SVA-HS 50 D STR H-WHEEL	**148B3297**
50	2	SVA-HS 50 D STR CAP	**148B3298**
65	2½	SVA-HS 65 D STR H-WHEEL	**148B3347**
65	2½	SVA-HS 65 D STR CAP	**148B3348**
80	3	SVA-HS 80 D STR H-WHEEL	**148B3087**
80	3	SVA-HS 80 D STR CAP	**148B3088**
100	4	SVA-HS 100 D STR H-WHEEL	**148B3127**
100	4	SVA-HS 100 D STR CAP	**148B3128**
125	5	SVA-HS 125 D STR H-WHEEL	**148B3167**
125	5	SVA-HS 125 D STR CAP	**148B3168**
150	6	SVA-HS 150 D STR H-WHEEL	**148B3207**
150	6	SVA-HS 150 D STR CAP	**148B3208**
200	8	SVA-HS 200 D STR H-WHEEL	**148B3247**
200	8	SVA-HS 200 D STR CAP	**148B3248**
ANSI			
15	½	SVA-HS 15 A STR H-WHEEL	**148B3417**
15	½	SVA-HS 15 A STR CAP	**148B3418**
20	¾	SVA-HS 20 A STR H-WHEEL	**148B3497**
20	¾	SVA-HS 20 A STR CAP	**148B3498**
25	1	SVA-HS 25 A STR H-WHEEL	**148B3577**
25	1	SVA-HS 25 A STR CAP	**148B3578**
32	1¼	SVA-HS 32 A STR H-WHEEL	**148B3657**
32	1¼	SVA-HS 32 A STR CAP	**148B3658**
40	1½	SVA-HS 40 A STR H-WHEEL	**148B3727**
40	1½	SVA-HS 40 A STR CAP	**148B3728**
50	2	SVA-HS 50 A STR H-WHEEL	**148B3307**
50	2	SVA-HS 50 A STR CAP	**148B3308**
65	2½	SVA-HS 65 A STR H-WHEEL	**148B3357**
65	2½	SVA-HS 65 A STR CAP	**148B3358**
80	3	SVA-HS 80 A STR H-WHEEL	**148B3097**
80	3	SVA-HS 80 A STR CAP	**148B3098**
100	4	SVA-HS 100 A STR H-WHEEL	**148B3137**
100	4	SVA-HS 100 A STR CAP	**148B3138**
125	5	SVA-HS 125 A STR H-WHEEL	**148B3177**
125	5	SVA-HS 125 A STR CAP	**148B3178**
150	6	SVA-HS 150 A STR H-WHEEL	**148B3217**
150	6	SVA-HS 150 A STR CAP	**148B3218**
200	8	SVA-HS 200 A STR H-WHEEL	**148B3257**
200	8	SVA-HS 200 A STR CAP	**148B3258**
SOC			
15	½	SVA-HS 15 SOC STR H-WHEEL	**148B3427**
15	½	SVA-HS 15 SOC STR CAP	**148B3428**
20	¾	SVA-HS 20 SOC STR H-WHEEL	**148B3507**
20	¾	SVA-HS 20 SOC STR CAP	**148B3508**
25	1	SVA-HS 25 SOC STR H-WHEEL	**148B3587**
25	1	SVA-HS 25 SOC STR CAP	**148B3588**
32	1¼	SVA-HS 32 SOC STR H-WHEEL	**148B3667**
32	1¼	SVA-HS 32 SOC STR CAP	**148B3668**
40	1½	SVA-HS 40 SOC STR H-WHEEL	**148B3737**
40	1½	SVA-HS 40 SOC STR CAP	**148B3738**
50	2	SVA-HS 50 SOC STR H-WHEEL	**148B3317**
50	2	SVA-HS 50 SOC STR CAP	**148B3318**
FPT			
15	½	SVA-HS 15 FPT STR H-WHEEL	**148B3437**
15	½	SVA-HS 15 FPT STR CAP	**148B3438**
20	¾	SVA-HS 20 FPT STR H-WHEEL	**148B3517**
20	¾	SVA-HS 20 FPT STR CAP	**148B3518**
25	1	SVA-HS 25 FPT STR H-WHEEL	**148B3597**
25	1	SVA-HS 25 FPT STR CAP	**148B3598**
32	1¼	SVA-HS 32 FPT STR H-WHEEL	**148B3677**
32	1¼	SVA-HS 32 FPT STR CAP	**148B3678**

Introduction

SVA-DL and SVA-DH are angleway stop valves designed to meet all industrial refrigeration application requirements.

SVA-DL (**D**elta pressure **L**ow)
is designed with a restriction in the opening function. High differential pressure can be applied from the side port and reduced pressure can be applied from bottom port. SVA-DL is a two-step valve for pressure relief.

SVA-DH (**D**elta pressure **H**igh)
is designed without restriction in the opening function. As a result of its balanced design this valve is able to open at all differential pressures with limited torque.

The angleway stop valves are carefully designed to give favourable flow conditions.
Easy to dismantle for inspection and repair.

Both SVA-DL & DH stop valves have internal backseating enabling the spindle seal to be replaced with the valve still under pressure.

The valves are designed to give favourable flow characteristics and are easy to dismantle for servicing. The valve cone is designed to ensure perfect closing.

Features

- Applicable to all common refrigerants including R 717 and non corrosive gases/ liquids dependent on sealing material compatibility
- Optional accessories:
  - Heavy duty industrial handwheel for frequent operation
  - Vented cap for infrequent operation
- Available in angleway version with extended bonnet for insulated systems
- The valve caps can be wire-sealed, to prevent operation by unauthorised persons.
- Internal PTFE backseating
- The bonnet is suitable for installation in insulated low temperature applications.
- The housing and bonnet are made from low temperature steel in accordance with the requirements of the Pressure Equipment Directive and other international classification authorities
- For an updated list of certifications on the products please contact your local Danfoss Sales Company

The complete technical leaflet (RD7AS) can be downloaded from the Danfoss web site.

Design

Connections
Available with the following connections:
Butt-weld DIN 2448
Butt-weld ANSI B 36.10
- DN250: Schedule 40
- DN300: STD

Housing and bonnet
Made from special, cold-resistant steel approved for low temperature operations.

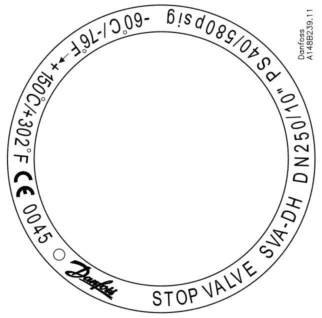
Bolts
Stainless steel, Quality A2-70

Valve cone assembly
The valve cone assembly can be turned on the spindle, thus there is no friction between cone and seat when the valve is opened and closed. A Teflon tightening ring provides perfect sealing at a minimum closing torque.

Spindle
Made of polished stainless steel, ideal for O-ring sealing.

Packing gland
The packing gland comprises a spring loaded seal packing which ensures perfect tightness in the range: –60/+150°C (–76/+302°F). Furthermore, the packing glands incorporate a scraper ring to prevent the penetration of dirt and ice.

Marking
Each valve type is clearly marked with type, size and performance range.



Example of marking ring, SVA-DH

Pressure Equipment Directive (PED)
SVA-DL and DH valves are approved and CE marked in accordance with the Pressure Equipment Directive - 97/23/EC.

For further details / restrictions - see Installation Instruction.

SVA-DL & DH valves		
Nominal bore	DN 250 mm (10 in.)	DN 300 mm (12 in.)
Classified for	Fluid group I	
Category	III	IV

Technical data

Refrigerants
Applicable to all common non-flammable refrigerants including R 717 and non- corrosive gases/liquids dependent on sealing material compatibility.
For further information please see installation instruction for SVA-DL and SVA-DH.

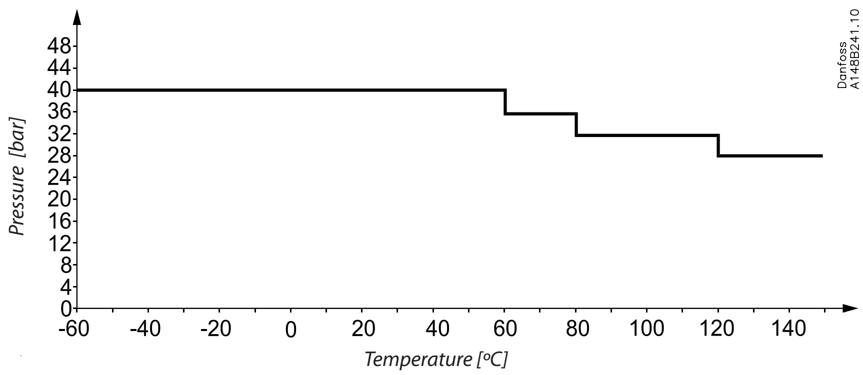
Flammable hydrocarbons are not recommended.

For further information please contact your local Danfoss Sales Company.
Temperature range

SVA-DL and SVA-DH
–60/+150°C (–76/+302°F)

Pressure range
SVA-DL and SVA-DH
40 bar g (580 psi g) at –60°C to +60°C (–76°F to +140°F)
36 bar g (522 psi g) at +60°C to +80°C (+140°F to +176°F)
32 bar g (464 psi g) at +80°C to +120°C (+176°F to +248°F)
28 bar g (406 psi g) at +120°C to +150°C (+248°F to +302°F)

Pressure/temperature range



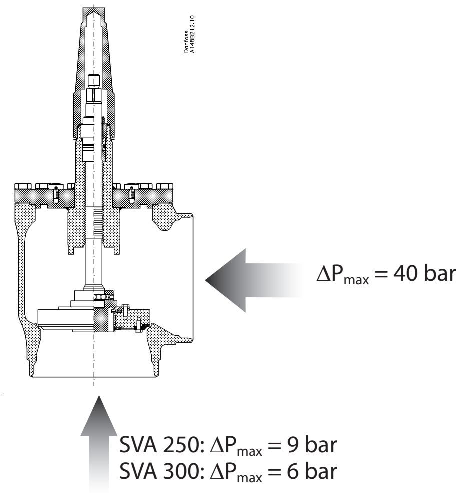
Function

SVA-DL
The SVA-DL stop valve is designed with a restriction in the flow direction (differential pressure). To ensure the most favourable valve performance the flow must be directed from the side port towards the valve cone. Operation of the valve with flow in this direction is made possible by the two-step opening valve cone as illustrated below.
The sketches below give the minimum pressures at which the the valve can be operated manually and tightness can be achieved.

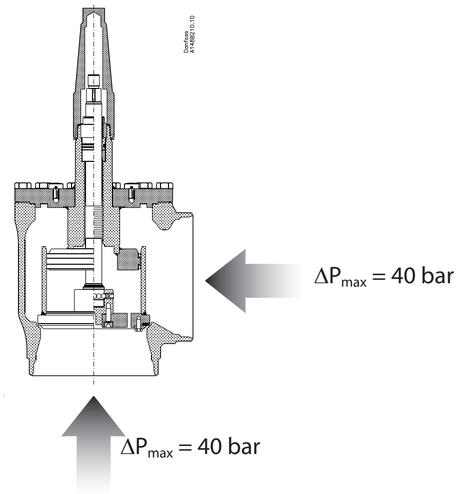
SVA-DH
The SVA-DH stop valve is designed without restrictions in either flow direction or differential pressure. Due to the balanced valve cone design the torque required to operate the valve is minimized and the valve can be opened and closed against high pressure with flow in any direction.

Pressure

SVA-DL

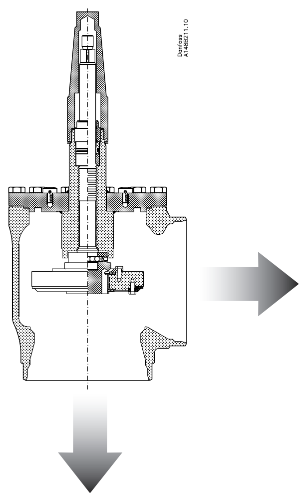


SVA-DH

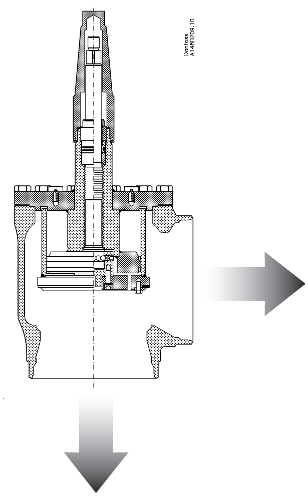


Flow

SVA-DL

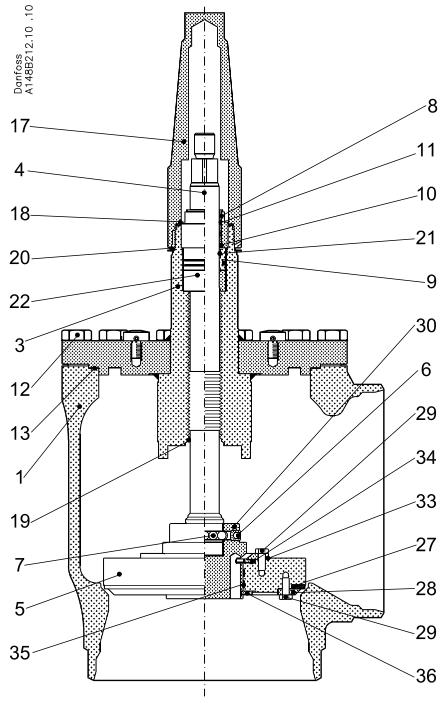


SVA-DH



Material specification

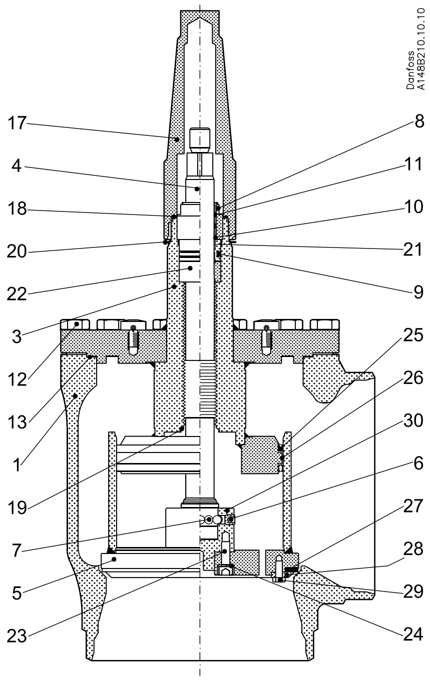
SVA-DL 250 - 300



No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	G20Mn5 QT EN 10213-3		LCC, A352
3	Bonnet (plate)	Steel	P275NL1 EN 10028-3		
4	Spindle	Steel	X5CrNi18-10 DIN 17440		
5	Cone	Steel			
6	Set screw	Steel			
7	Balls	Stainless steel			
8	Packing Gland	Steel			
9	O-ring	Cloroprene (Neoprene)			
10	U-sleeve sealing	Teflon (PTFE) + Stainless steel			
11	O-ring	Cloroprene (Neoprene)			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	Gasket	Fiber, Non-asbestos			
14	Handwheel	Steel			
15	Washer	Stainless steel			
16	Lock nut	Stainless steel+nylon			
17	Cap	Aluminium			
18	Gasket for cap	Nylon (PA 6)			
19	Soft backseat	Teflon (PTFE)			
20	Identification ring	Stainless steel			
21	Wear ring	Teflon (PTFE)			
22	Guide for spindle	Spheroidal graphite cast iron			
27	Gasket	Teflon (PTFE)			
28	Front for valve cone	Steel			
29	Bolts	Steel			
30	Insert, valve cone	Spheroidal graphite cast iron			
31	Lifting eye bolts	Steel			
33	Backing for valve cone	Steel			
34	Gasket	Teflon (PTFE)			
35	Wear ring	Teflon (PTFE)			
36	Retaining ring	Spring steel			

Material specification

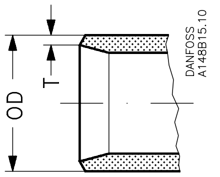
SVA-DH 250 - 300



No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	G20Mn5 QT EN 10213-3		LCC, A352
3	Bonnet (plate)	Steel	P275NL1 EN 10028-3		
4	Spindle	Steel	X5CrNi18-10 DIN 17440		
5	Valve cone Tube for valve cone	Steel Stainless steel			
6	Set screw	Steel			
7	Balls	Stainless steel			
8	Packing Gland	Steel			
9	O-ring	Cloroprene (Neoprene)			
10	U-sleeve sealing	Teflon (PTFE) + Stainless steel			
11	O-ring	Cloroprene (Neoprene)			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	Gasket	Fiber, Non-asbestos			
14	Handwheel	Steel			
15	Washer	Stainless steel			
16	Lock nut	Stainless steel+nylon			
17	Cap	Aluminium			
18	Gasket for cap	Nylon (PA 6)			
19	Soft backseat	Teflon (PTFE)			
20	Identification ring	Stainless steel			
21	Wear ring	Teflon (PTFE)			
22	Guide for spindle	Spheroidal graphite cast iron			
23	Bolts	Steel			
24	Spring washer	Steel			
25	U-sleeve sealing	Teflon (PTFE) + Stainless steel			
26	Wear ring	Teflon (PTFE)			
27	Gasket	Teflon (PTFE)			
28	Front for valve cone	Steel			
29	Bolts	Steel			
30	Insert, valve cone	Spheroidal graphite cast iron			
31	Lifting eye bolts	Steel			

Connections

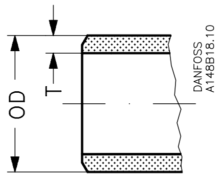
DIN



Size mm	Size in.	OD mm	T mm	OD in.	T in.
Welding DIN (2448)					
250	10	273	6.3	10.75	0.25
300	12	323.9	7.1	12.75	0.28

Type	K_v m^3/h	C_v Usgal/min
SVA-DH	1405	1630
SVA-DL	1610	1868
SVA-DH	1870	2169
SVA-DL	2082	2415

ANSI

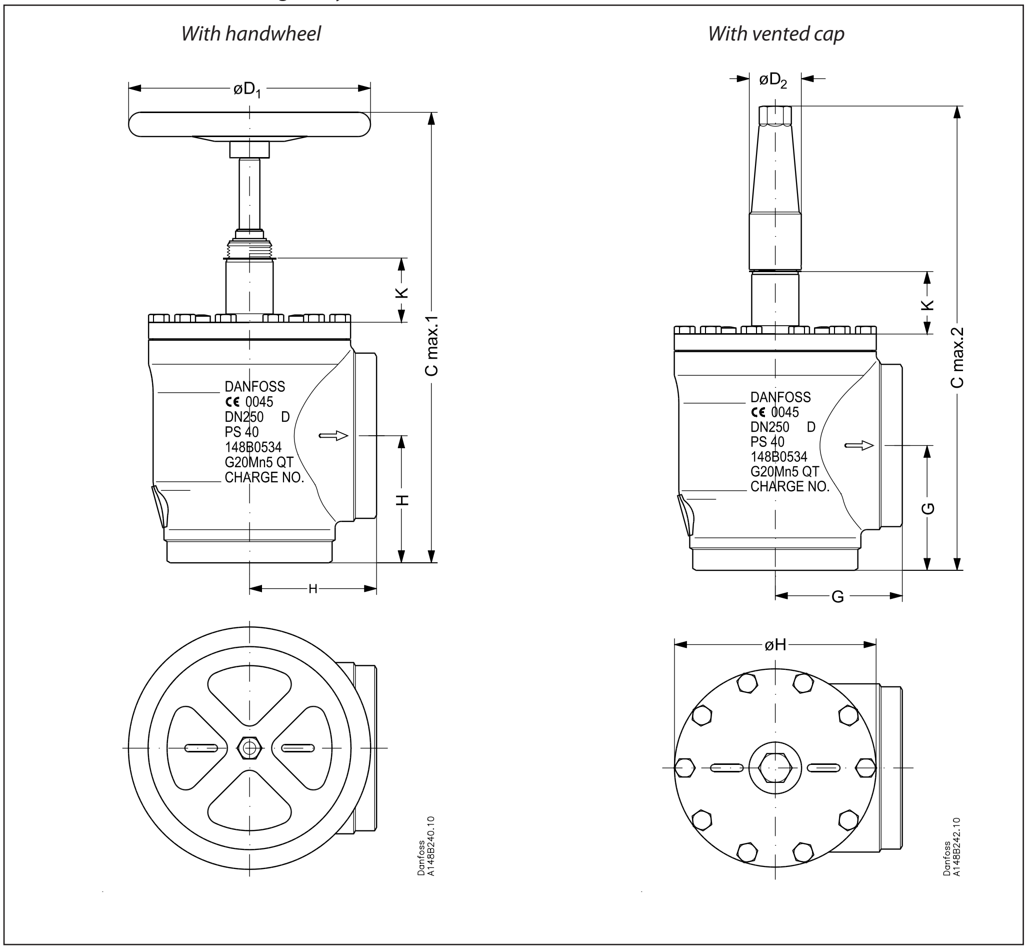


Size mm	Size in.	OD mm	T mm	OD in.	T in.
Welding ANSI (B 36.10)					
250	10	273	6.3	10.75	0.25
300	12	323.9	7.1	12.75	0.28

Type	K_v m^3/h	C_v Usgal/min
SVA-DH	1405	1630
SVA-DL	1610	1868
SVA-DH	1870	2169
SVA-DL	2082	2415

Dimensions and weights

SVA-DH, SVA-DL 250 -300, angleway version



Valve size		K	$C_{max.1}$	$C_{max.2}$	G	$øD_1$	$øD_2$	ØH	Weight
SVA-DL / SVA-DH									
SVA 250	mm	102	745	782	210	400	86	334	130 kg
SVA (10)	in.	4	29.33	30.79	8.27	15.75	3.39	13.14	287 lb
SVA 300	mm	102	852	842	240	500	86	384	190 kg
SVA (12)	in.	4	33.54	33.14	9.45	19.69	3.39	15.12	419 lb

Specified weights are approximate values only

Ordering

The table below can be used to identify the valve required.

Please note that the type codes only serve to identify the valves, some of which may not form part of the standard product range.

For further information please contact your local Danfoss Sales Company.

Type codes

Valve type Nominal size in mm	SVA-DL SVA-DH	Stop valve Stop valve	(Δp Low) (Δp High) Available connections	
			D	A
(Valve size measured on the connection diameter)	250	DN250	X	X
	300	DN300	X	X
Connections	D	Butt weld connection: DIN 2448		
	A	Butt weld connections: ANSI B 36.10 DN250: Schedule 40 DN300: STD		
Other euipment	CAP	Aluminum cap		
	H-WHEEL	Steel handweel		

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of ordering.

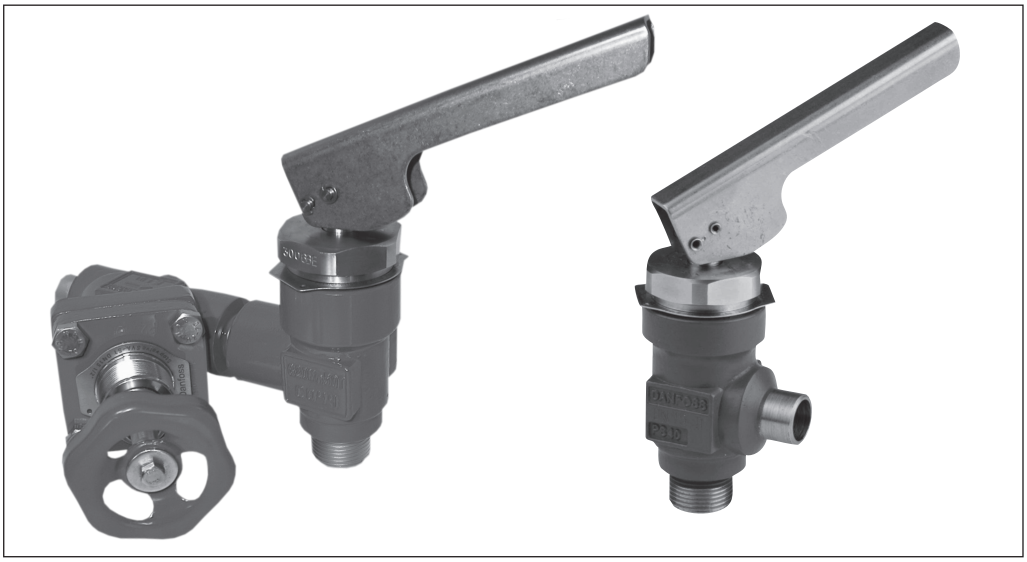
Code numbers

Size mm	Size in.	Type	**Code number**
250	10	SVA-DL 250 D CAP	**148B3760**
250	10	SVA-DL 250 D H-HEEL	**148B3761**
250	10	SVA-DL 250 A CAP	**148B3762**
250	10	SVA-DL 250 A H-WHEEL	**148B3763**
250	10	SVA-DH 250 D CAP	**148B3764**
250	10	SVA-DH 250 D H-WHEEL	**148B3765**
250	10	SVA-DH 250 A CAP	**148B3766**
250	10	SVA-DH 250 A H-WHEEL	**148B3767**
300	12	SVA-DL 300 D CAP	**148B3770**
300	12	SVA-DL 300 D H-WHEEL	**148B3771**
300	12	SVA-DL 300 A CAP	**148B3772**
300	12	SVA-DL 300 A H-WHEEL	**148B3773**
300	12	SVA-DH 300 D CAP	**148B3774**
300	12	SVA-DH 300 D H-WHEEL	**148B3775**
300	12	SVA-DH 300 A CAP	**148B3776**
300	12	SVA-DH 300 A H-WHEEL	**148B3777**

A = ANSI butt-weld
D = DIN butt-weld

H-WHEEL: Handwheel
CAP: Vented cap

Introduction



QDV is a quick closing oil drain valve, designed particularly for draining oil from systems containing refrigerant (ammonia) under pressure. The valve will close immediately on release of the handle, thus protecting user and environment against unnecessary refrigerant leaks. The valve should as a rule be installed as illustrated in fig. 1. In order to prevent hydraulic pressure building up between the stop valve and the QDV an integral relief device is included as part of the cone arrangement, which will open at approx. 25 bar g (363 psig).

QDV is designed to meet the safety demands specified by national and international authorities within industrial refrigeration.

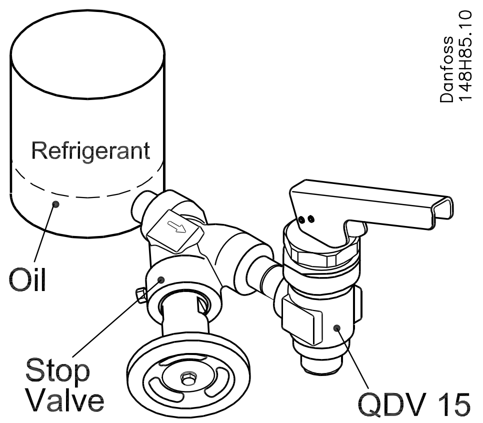


Fig. 1

Features

- QDV is generaly used with R717 (ammonia) but the valve is also applicable to all other common non flammable refrigerants and non corrosive gases/liquids dependent on sealing material compatibility
- Meets the safety demands within industrial refrigeration
- Handle can be positioned 360°
- Built-in integral relief device opening over 25 bar g (proventing hydraulic pressure building up between stop valve and QDV).
- Can be supplied together with a stop valve for quick on site mounting
- Max. operating pressure:
  40 bar g (580 psi g).
- Temperature range:
  –50/+150°C (–58/+302°F).
- Classification:
  To get an updated list of certification on the products please contact your local Danfoss Sales Company.

The complete technical leaflet (DKRCI.PD.KL0.A) can be downloaded from the Danfoss web site.

Design

Connections
Available with the following connections:

- Inlet: Welding DIN (EN 10220)
  ½ in. FPT
  ¾ in. FPT
- Outlet: G ¾ in. pipe thread (ISO 228/1)
  ½ in. FPT
  ¾ in. FPT

Optional extras for outlet:
- Welding nipple DIN (EN 10220)
- Hose connection

Other types of connection are available on request.

QDV - SVA combinations
Combinations of the QDV together with a dedicated SVA have been established for easy selection. Please study page 6 to find the code numbers for these combinations.

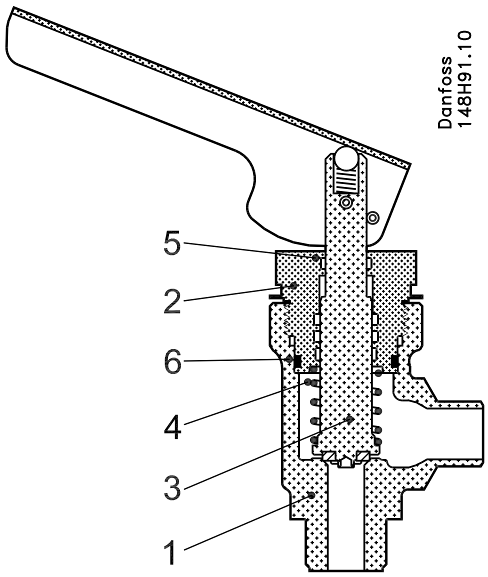
Installation
For further information refer to installation instruction for QDV.

Technical data

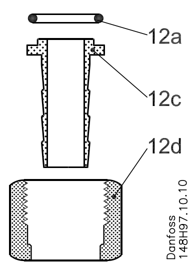
- Refrigerants
  QDV is generally used with R717 (ammonia) but the valve is also applicable to all other common non flammable refrigerants and non corrosive gases/liquids dependent on sealing material compatibility.
- QDV is a backpressure dependent valve. If any tube or hose is mounted on the outlet of the QDV it has to be calculated to prevent blackpressure building up when relieving.
- For further information please see installation instruction for QDV.
  Flammable hydrocarbons are not recommended, for further information please contact your local Danfoss Sales Company.
- Temperature range
  –50/+150°C (–58/+302°F).
- Pressure
  The valve is designed for:
  Maximum operating pressure of 40 bar g (580 psi g)

Material specification

QDV 15

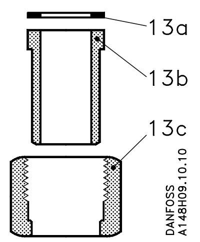


No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing	Steel	G20Mn5QT EN10213-3		LCC A352
2	Bonnet	Stainless steel X110CrNi	S189 17440	Type 17 683/13	AISI 303
3	Spindle/Cone	Stainless steel X110CrNi	S189 17440	Type 17 683/13	AISI 303
4	Spring	Steel	11SMn30	Type 2	Grade 1213
5	Wear ring		EN10087	R683/9	A29
6	O-ring	Cloroprene			



Hose connection for outlet

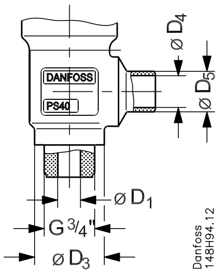
No.	Part	Material
12a	O-rings	Cloroprene (Neoprene)
12c	Stub for hose	Steel
12d	Union nut	Steel



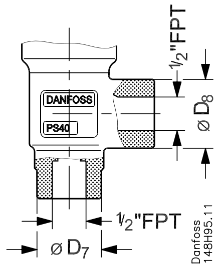
Welding nipple connection for outlet

No.	Part	Material
13a	Al-packing	Aluminium
13b	Welding nipple	Steel
13c	Union nut	Steel

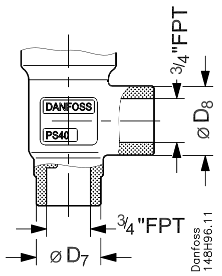
Connections



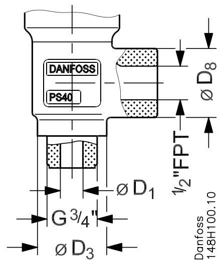
		ØD_1	ØD_3	ØD_4	ØD_5
QDV 15 DIN 15	mm	12	36.5	16.7	21.3
	in.	0.47	1.44	0.66	0.84



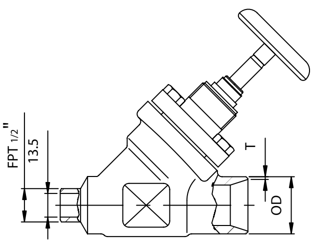
		ØD_7	ØD_8
QDV 15 ½" FPT	mm	34	36.5
	in.	1.34	1.44



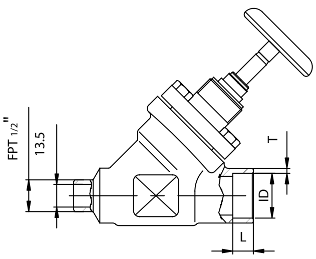
		ØD_7	ØD_8
QDV 15 ¾" FPT	mm	34	36.5
	in.	1.34	1.44



		ØD_1	ØD_3	ØD_8
QDV 15 DIN 15	mm	12	36.5	34
	in.	0.47	1.44	1.34



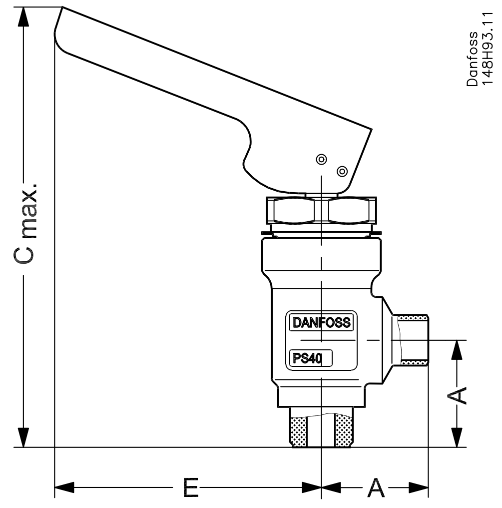
		OD	T	k_v-straight m^3/h	C_v-straight USgal/min
SVA-ST DIN 15	mm	21.3	2.3	4.9	5.7
	in.	0.839	0.091		



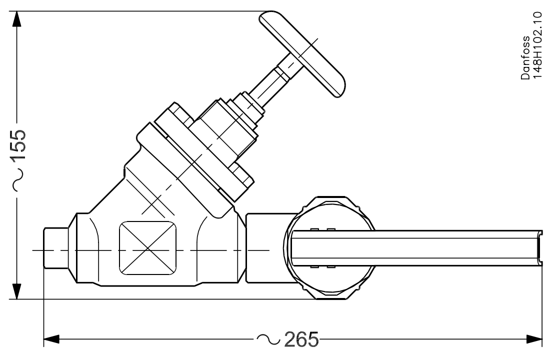
		ID	T	L	k_v-straight m^3/h	C_v-straight USgal/min
SVA-ST SOC ½ in.	mm	21.8	6.0	10	4.9	5.7
	in.	0.858	0.235	0.39		

Dimensions

QDV 15 (stand alone)



QDV 15 mounted on SVA valve



Valve size		A	C_{max}	E
QDV 15	mm	45	185	109
	in.	1.77	7.28	4.29

Ordering

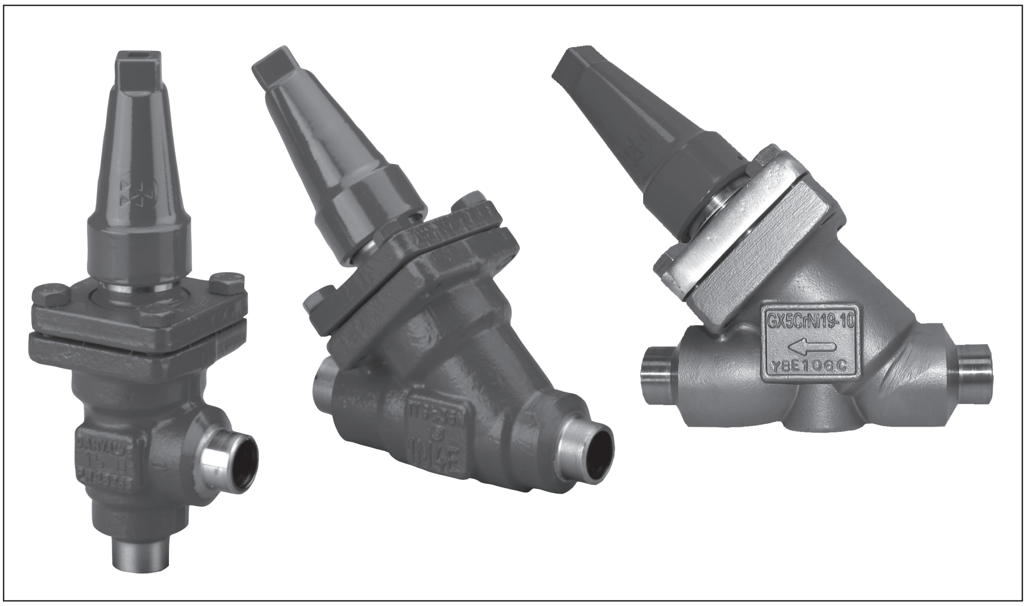
How to order
The table below is used to identify the valve required.

Type	Inlet	Outlet	**Code no.**
QDV 15 DN 15	DN 15	G ¾ in.	**148H3272**
QDV 15 ½ in. FPT	½ in. FPT	½ in. FPT	**148H3273**
QDV 15 3/4 in. FPT	¾ in. FPT	¾ in. FPT	**148H3274**
QDV 15 DN 15 + SVA-ST DN 15 H-WHEEL*	DN 15	G ¾ in.	**148H3310**
QDV 15 ½ in. FPT + SVA-ST SOC ½ in. H-WHEEL*	½ in. SOC	½ in. FPT	**148H3311**
Fittings for hose connection			**2469+065**
Fittings for welding connection			**2469+066**

* Two valves are supplied in one box and should be mounted on site.
The indicated inlet is for the stop valve - The indicated outlet is for the oil drain valve.

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

Introduction



REG are angle-way and straight-way regulating valves, which act as normal stop valves in closed position.

The valves are designed to meet the strict quality requirements on refrigerating installations specified by the international classification societies and are carefully designed to present favourable flow conditions and accurate linear characteristics.

REG are equipped with vented cap and have internal backseating enabling the spindle seal to be replaced with the valve still under pressure.

Features

- Applicable to all common non flammable refrigerants including R 717 and non corrosive gases/liquids dependent to sealing material compatibility
- Designed to ensure perfect regulation
- Internal backseating enables replacement of the spindle seal whilst the valve is active, i.e. under pressure
- Easy to disassemble for inspection and possible repair
- Max. operating pressure:
  REG: 40 bar g (580 psi g)
  REG-SS: 52 bar g (754 psi g)
  (valves for higher operating pressure available on request)
- Full temperature range packing gland
  –50/+150°C (–58/+302°F)
- Low temperature range packing gland for REG-SS
  –60/+150°C (–76/+302°F)
- Act as a normal stop valve in closed position
- Housing and bonnet material is low temperature steel (REG-SS in stainless steel) according to requirements of the Pressure Equipment Directive and other international classification authorities
- Exact capacity and setting of the valve can be calculated for all refrigerants by means of "DIRcalc™" (Danfoss Industrial Refrigeration calculation programme)
- Classification: To get an updated list of certification on the products please contact your local Danfoss Sales Company.

The complete technical leaflet (DKRCI.PD.KM0.A) can be downloaded from the Danfoss web site.

Design

Housing
Made of special, cold resistant steel (stainless steel for REG-SS) approved for low temperature operation.

Connections
Available with the following connections:

- Butt-weld DIN (EN 10220)
  – DN 6 - 65 (¼ - 2½ in.)
- Butt-weld ANSI (B 36.10 Schedule 80)
  – DN 6 - 40 (¼ - 1½ in.)
- Butt-weld ANSI (B 36.10 Schedule 40)
  – DN 50 - 65 (2 - 2½ in.)
- Socket weld (ANSI B 16.11)
  – DN 15 - 40 (½ - 1½ in.)
- Soldering connections (ANSI B 16.22)
  – DN 10 - 22 (3/8 - 7/8 in.)
- FPT inside pipe thread, NPT (ANSI/ASME B 1.20.1)
  – DN 15 - 32 (½ - 1¼ in.)

Valve cone
The valve cone is designed to ensure perfect regulation. A wide programme of valves and various precision cones provide an extensive regulating area, and irrespective of the refrigerant used, it is easy to obtain the correct capacity (see fig. 1). A cone seal ring provides perfect sealing at a minimum closing momentum.

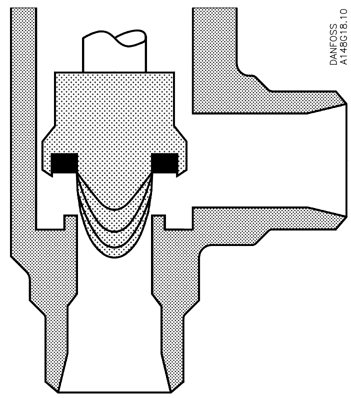


Fig. 1.

The valve cone can be turned on the spindle, thus there will be no friction between the cone and the seat when the valve is opened and closed.

Spindle
Made of polished stainless steel, which is ideal for O-ring sealing.

Packing gland - REG
The "full temperature range" packing gland ensures perfect tightness in the whole range: –50/+150°C (–58/+302°F). The packing glands are equipped with a scraper ring to prevent penetration of dirt and ice into the packing gland.

Packing gland - REG-SS (Stainless steel version):
The stainless steel packing gland comprises a spring loaded seal packing gland which ensures a perfect tightness in the range –60/+150°C (–76/+302°F). The packing glands are equipped with a scraper ring to prevent penetration of dirt and ice into the packing gland.

Installation
Install the valve with the spindle up or in horizontal position. The flow must be directed towards the cone.

The valve is designed to withstand high internal pressure. However, the piping system in general should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion.

For further information refer to installation instruction for REG.

CE

Pressure Equipment Directive (PED)
REG valves are approved according to the European standard specified in the Pressure Equipment Directive and are CE marked.

For further details / restrictions - see Installation Instruction.

REG valves	
Nominal bore	DN32 - 65 (1¼ - 2½ in.)
Classified for	Fluid group I
Category	II

Technical data

- *Refrigerants*
  Applicable to all common non flammable refrigerants including R 717 and non corrosive gases/liquids dependent on sealing material compability.

  For further information please see installation instruction for REG.

  Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.
- *Temperature range*
  REG: –50/+150°C (–58/+302°F).
  REG-SS: –60/+150°C (–76/+302°F)
- *Pressure range*
  Max. operating pressure:
  REG: 40 bar g (580 psig).
  REG-SS: 52 bar g (754 psi g)
  Valves for higher working pressure are available on request.
- *Flow coefficients*
  Flow coefficients for fully opened valves from k_v = 0.17 to 81.4 m^3/h (C_v = 0.12 to 57.3 USgal/min)

Computation and selection

Introduction
In refrigeration plants, regulating valves are primarily used in liquid lines in order to regulate the flow of refrigerant. The valves can, however, also be used as expansion valves. From a calculation point of view the two fields of application are very different.

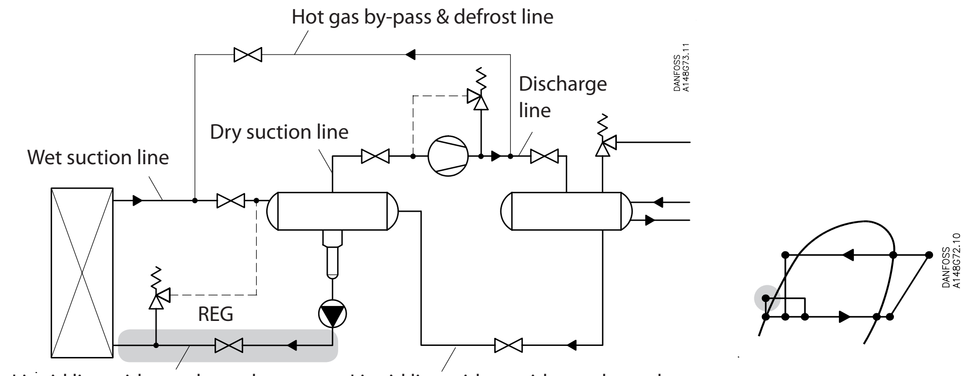
Normal flow is the term used to describe the general case where the flow through the valve is proportional to the square root of the pressure drop across it and inversely proportional to the density of the refrigerant (Bernouillis equation).

This relationship between mass flow, pressure drop and density satisfies the majority of all valve applications with refrigerants and brines.

Normal flow is characterised by turbulent flow through the valve without any phase change. The following capacity curves are based on the above mentioned assumption.

Application of the regulating valves outside the normal flow area will reduce the capacity of the valve considerably. In such cases it is recommended to use "DIRcalc™" (Danfoss Industrial Refrigeration calculation programme).

Fig. 2. Location of valve in system (marked with grey)



Sizing regulating valve for liquid flow
Liquid refrigerants: Use the liquid tables, fig. 8 - 17. For other refrigerants and brines, "Normal flow" (Turbulent flow); see below and use the flow coefficient tables (fig. 3 - 7).

SI-units

Mass flow:

$$k_v = \frac{G}{\sqrt{\rho \times 1000 \times \Delta p}} = G \times C_A \,[\mathrm{m^3/h}]$$

Volume flow:

$$k_v = \frac{\dot{V}}{\sqrt{\dfrac{1000 \times \Delta p}{\rho}}} \,[\mathrm{m^3/h}]$$

American units

Mass flow:

$$C_v = \frac{0.95 \times G}{\sqrt{\rho \times \Delta p}} = 31.6 \times G \times C_A \,[\mathrm{USgal/min.}]$$

Volume flow:

$$C_v = \frac{0.127 \times \dot{V}}{\sqrt{\dfrac{\Delta p}{\rho}}} \,[\mathrm{USgal/min.}]$$

k_v	[m³/h]	Quantity [m³/h] of water flowing through a valve at a pressure loss of 1 bar (according to VDE/VDI Norm 2173).
P_1	[bar]	Pressure before the valve (upstream).
P_2	[bar]	Pressure after the valve (downstream).
Δp	[bar]	Actual pressure loss across the valve (P_1–P_2).
G	[kg/h]	Mass flow through the valve.
$\dot{V}$	[m³/h]	Volume flow through the valve.
ρ	[kg/m³]	Density of the refrigerant before the valve.
C_A		Calculation factor (fig. 18).

C_v	[US gal/min]	Quantity [US gal/min] of water flowing through a valve at a pressure loss of 1 psi.
P_1	[psi]	Pressure before the valve (upstream).
P_2	[psi]	Pressure after the valve (downstream).
Δp	[psi]	Actual pressure loss across the valve (P_1–P_2).
G	[lb/min]	Mass flow through the valve.
$\dot{V}$	[US gal/min]	Volume flow through the valve.
ρ	[lb/ft³]	Density of the refrigerant before the valve
C_A		Calculation factor (fig. 18).

Computation and selection

Flow coefficient

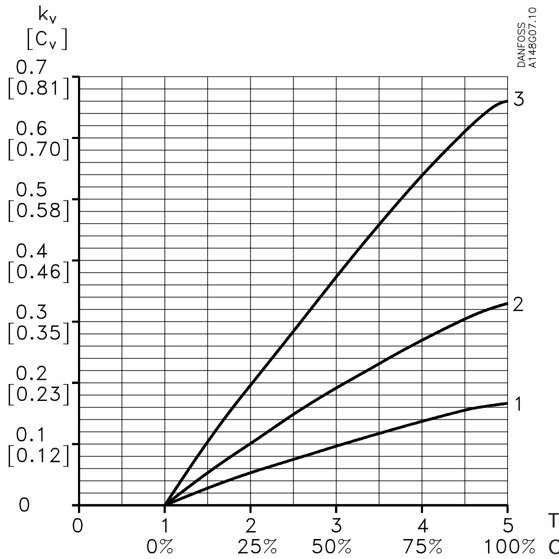


Fig. 3, cone no. ①, ②, ③

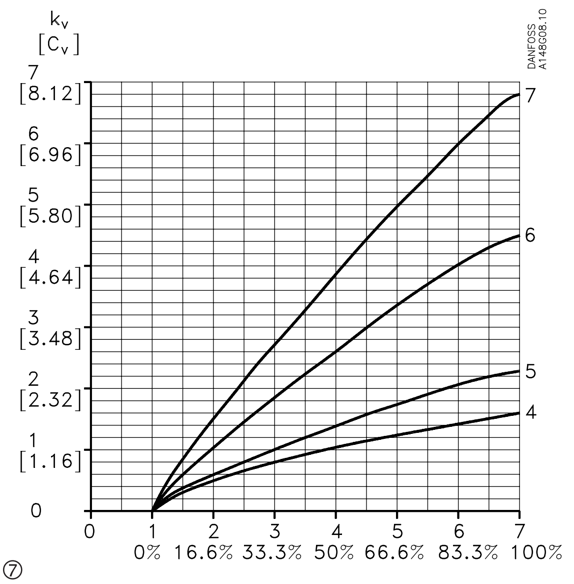


Fig. 4, cone no. ④, ⑤, ⑥, ⑦

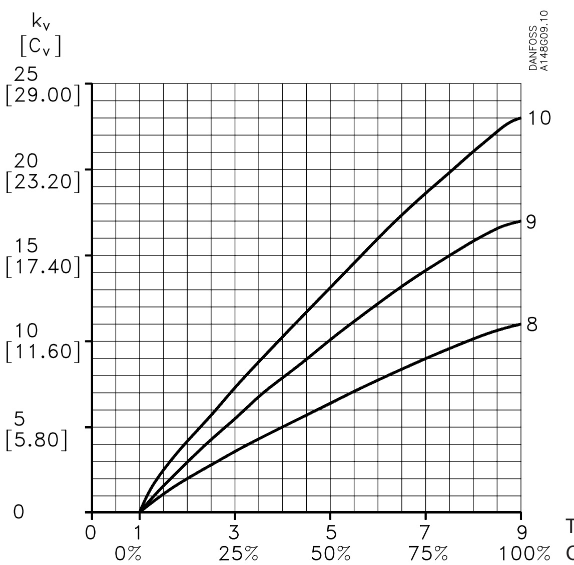


Fig. 5, cone no. ⑧, ⑨, ⑩

For choice of valve size and connection see "Connections".

Computation and selection

Flow coefficient

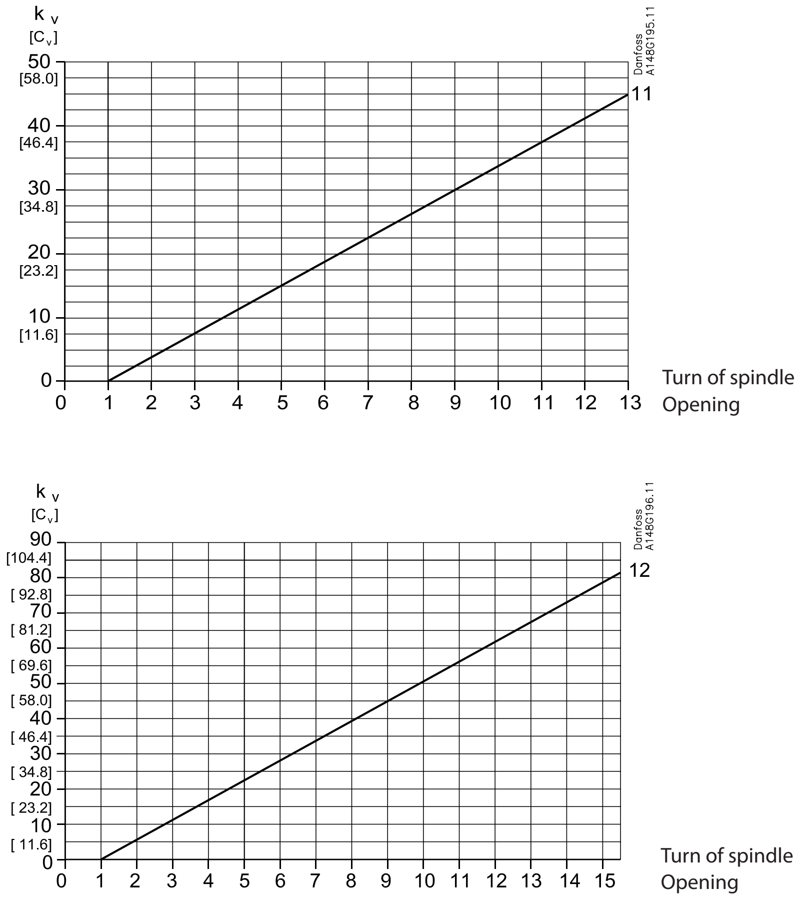


Fig. 6, cone no. 11 (REG 50)

Fig. 7, cone no. 12 (REG 65)

Liquid R 717, density: 670 kg/m³ [42 lb/ft³]

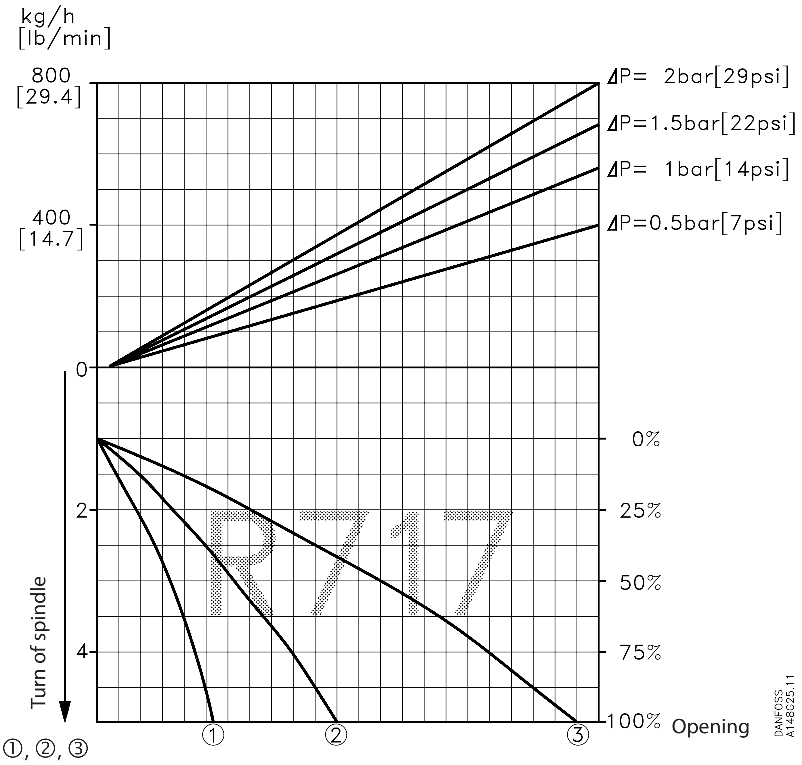


Fig. 8, cone no. 1, 2, 3

For choice of valve size and connection see "Connections".

Computation and selection

Liquid R 717, density: 670 kg/m³ [42 lb/ft³]

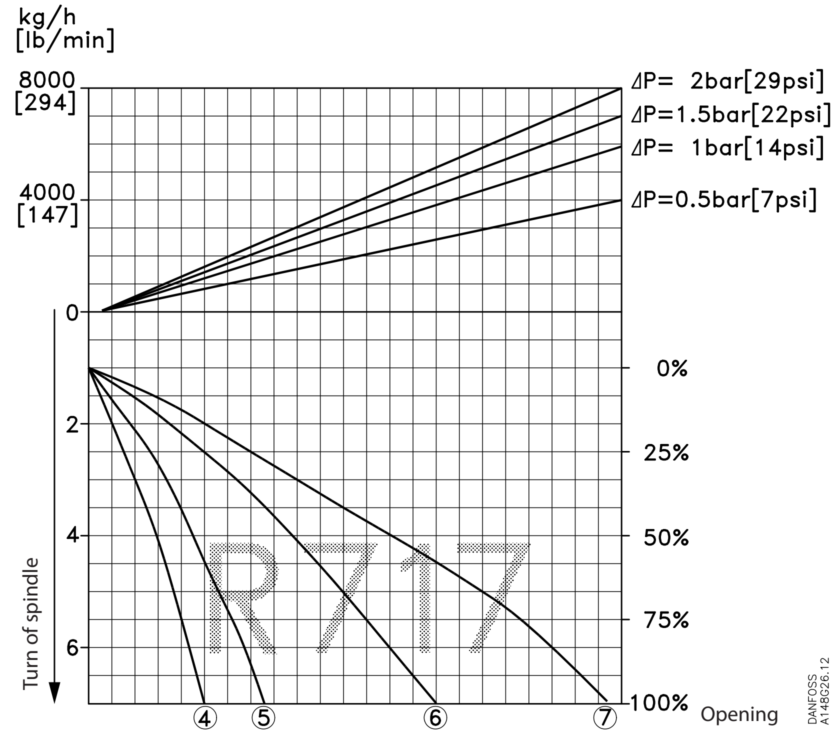


Fig. 9, cone no. ④, ⑤, ⑥, ⑦

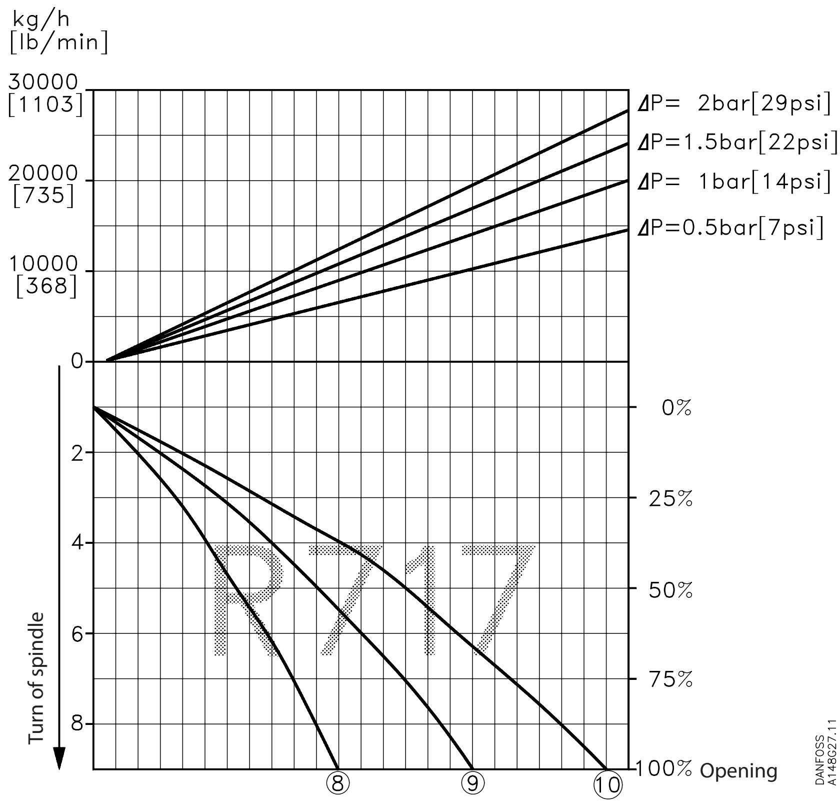


Fig. 10, cone no. ⑧, ⑨, ⑩

For choice of valve size and connection see "Connections".

Computation and selection

Liquid R 717, density: 670 kg/m³ [42 lb/ft³]

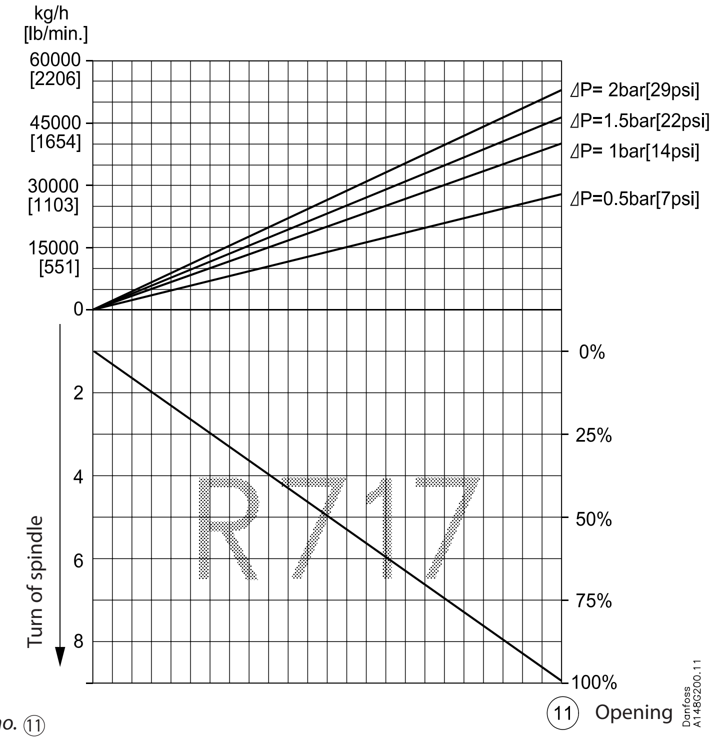


Fig. 11, cone no. 11

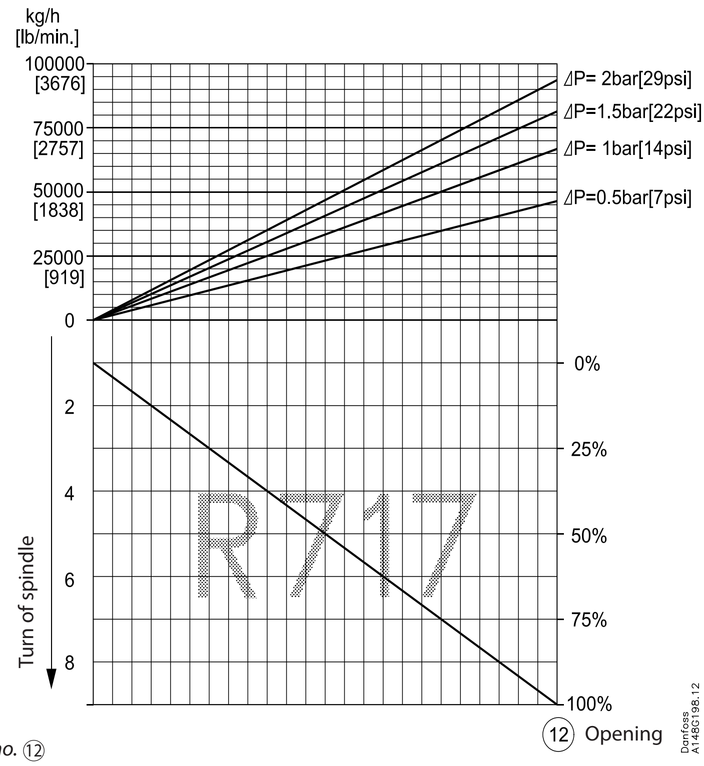


Fig. 12, cone no. 12

For choice of valve size and connection see "Connections".

Computation and selection

Liquid R 22, density: 1360 kg/m³ [85 lb/ft ³]

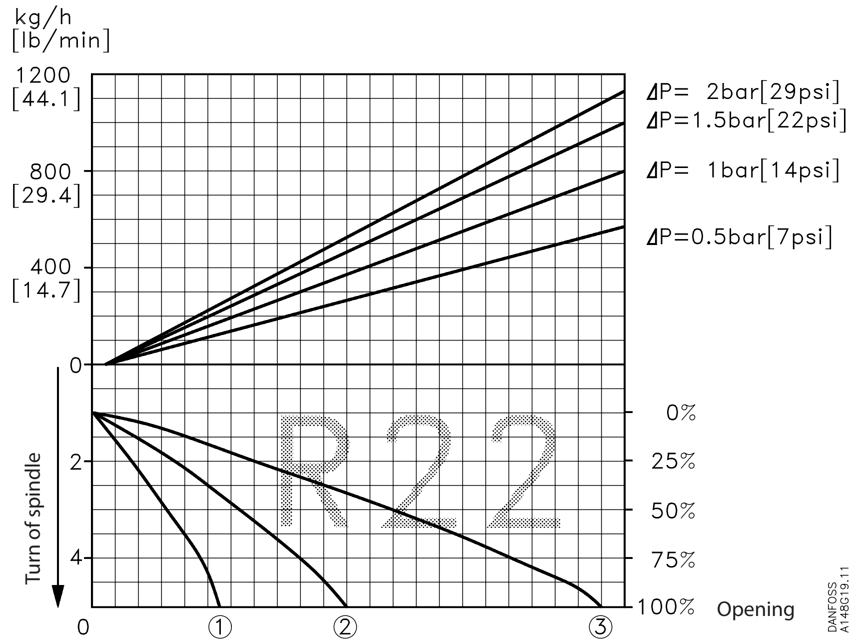


Fig. 13, cone no. ①, ②, ③

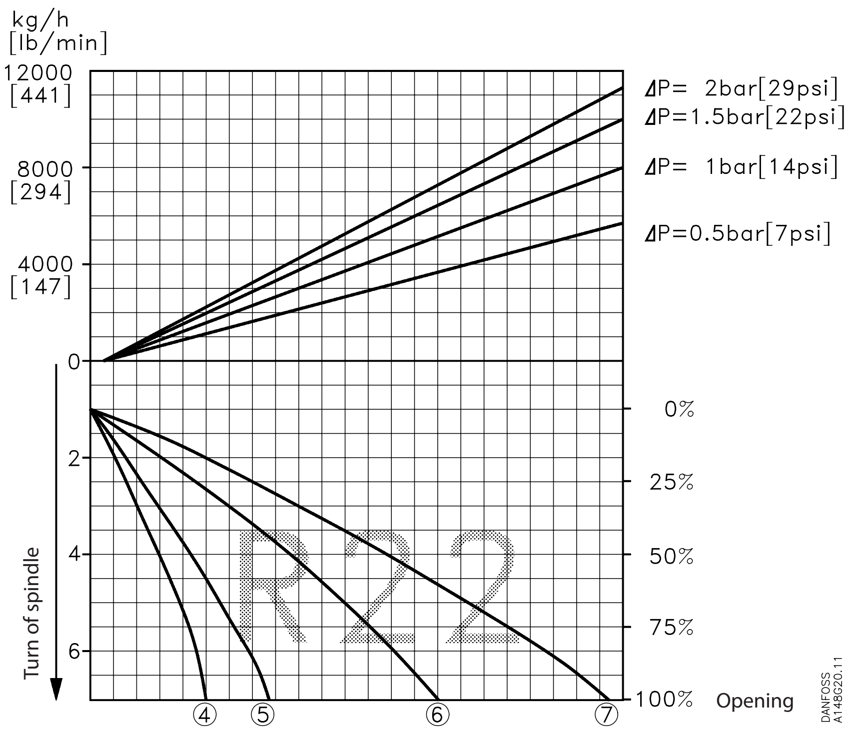


Fig. 14, cone no. ④, ⑤, ⑥, ⑦

For choice of valve size and connection see "Connections".

Computation and selection

Liquid R 22, density: 1360 kg/m³ [85 lb/ft ³]

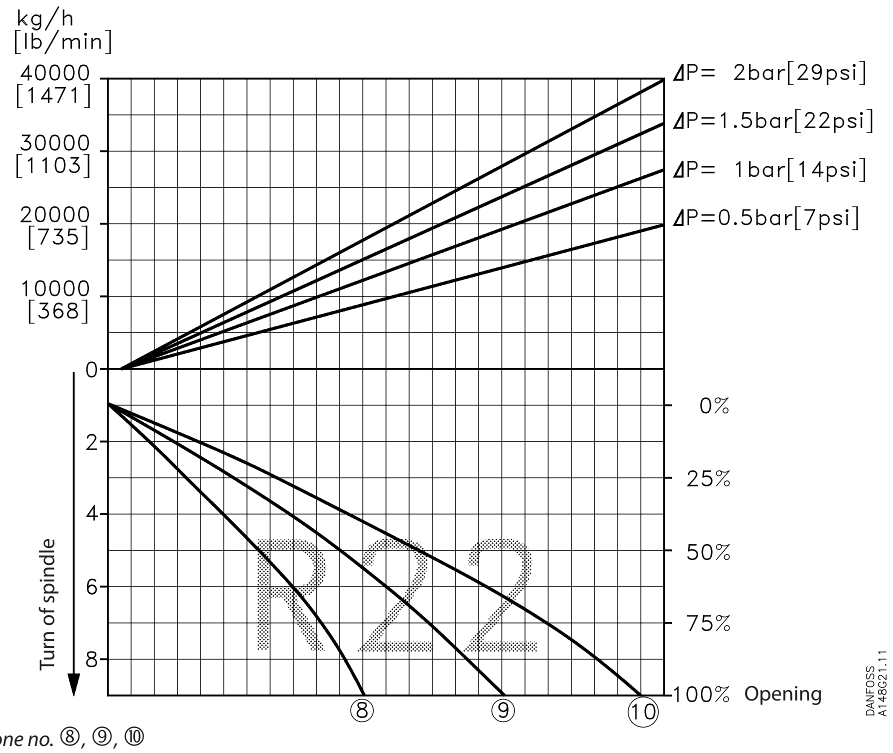


Fig. 15, cone no. ⑧, ⑨, ⑩

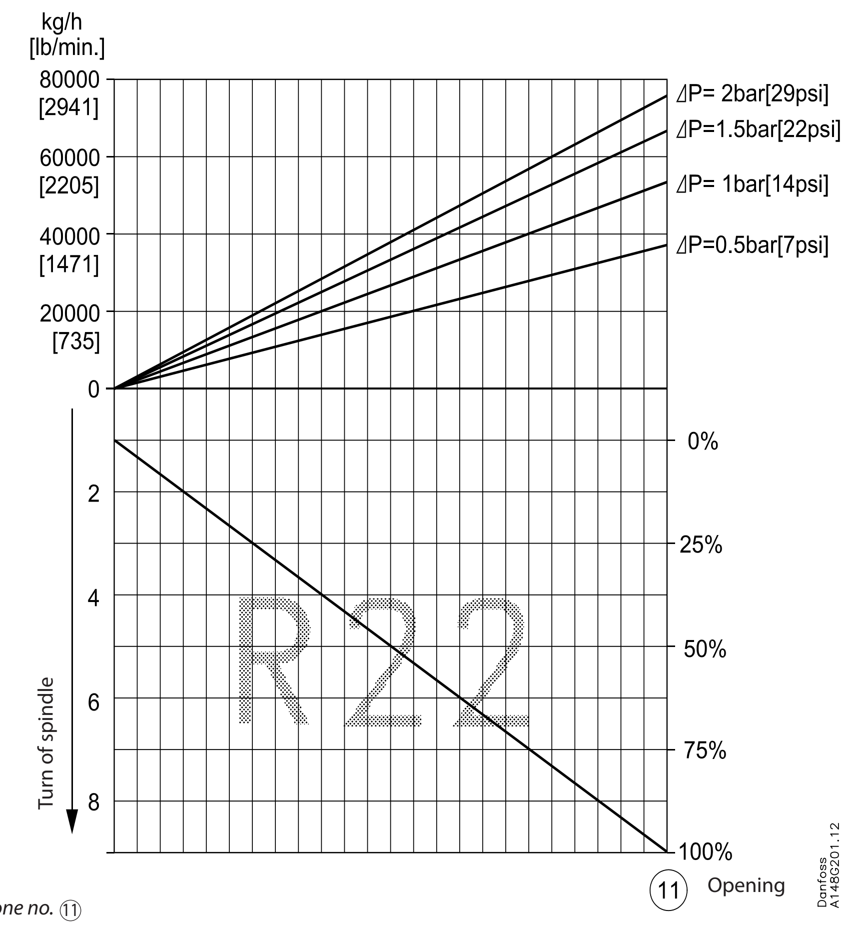


Fig. 16, cone no. ⑪

For choice of valve size and connection see "Connections".

Computation and selection

Liquid R 22, density: 1360 kg/m³ [85 lb/ft ³]

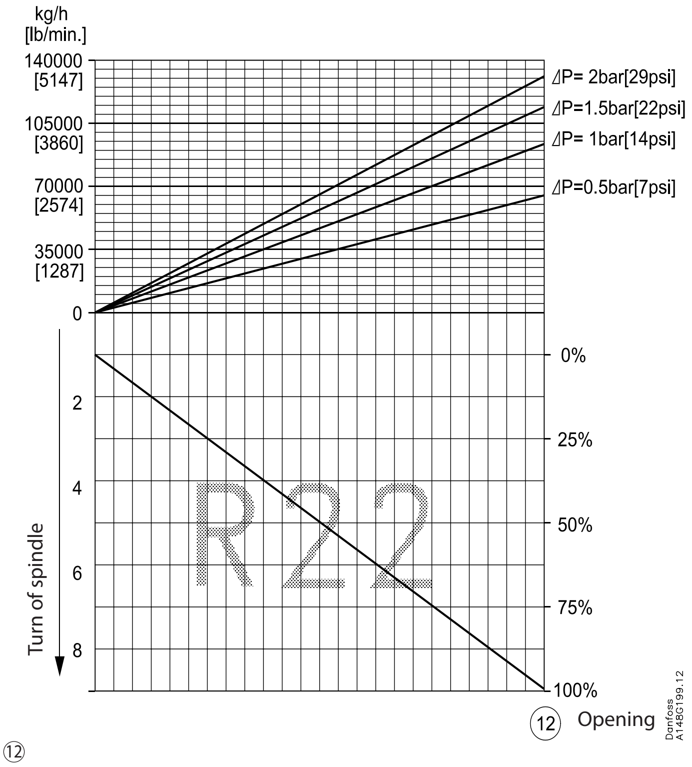


Fig. 17, cone no. ⑫

Calculation factor C_A

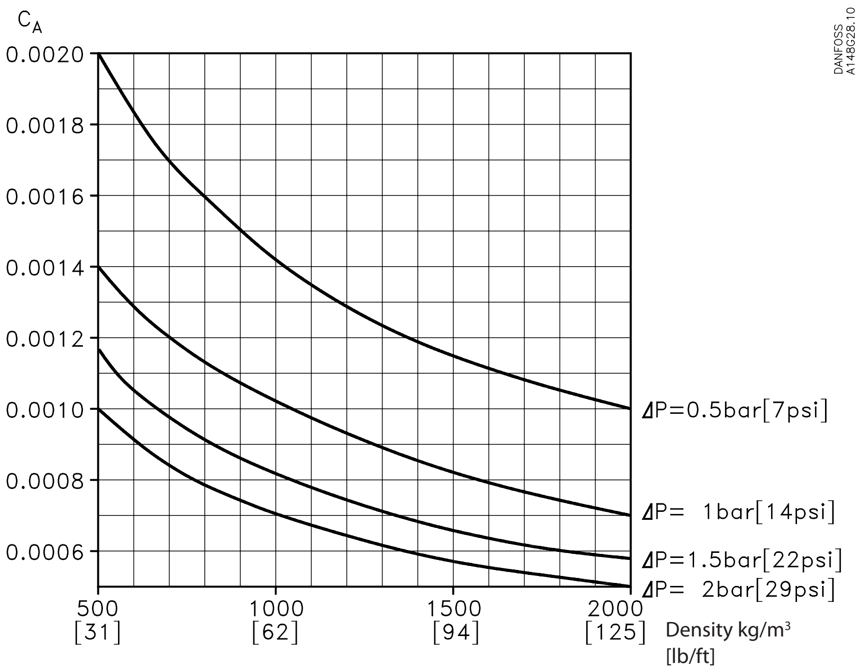


Fig. 18.

For choice of valve size and connection see "Connections".

Computation and selection
Example 1.

Refrigerant: R 717
Refrigerant flow: 2500 [kg/h]
Pressure drop: Δp = 0.5 [bar]

The above mentioned example is illustrated on the following flow rate diagram and shows that cone number 6 and 7 can be used. The main rule is that the cone with the minimum flow area gives the optimum regulation. However, owing to uncertainties cone number 6 opening degree would be > 85%. In this case cone number 7 ~ 55% is recommended.

The example is only correct if the density of the refrigerant is approx. 670 (kg/m³), and there must be no build-up of flash gas in the valve.

Flow rate diagram

Fig. 19.

For choice of valve size and connection see "Connections".

Computation and selection
Example 2.

Brine, density	ρ:	1150	[kg/m³]
Brine flow	G:	2,700	[kg/h]
Pressure drop	Δp:	0.5	[bar]

In this example it is not possible to use the selection diagrams (fig. 8 - 17) as the refrigerant in question is not included.

Either use the curves of the k_v-values instead (fig. 3 - 7) and calculate the required k_v by means of the formulas in the "Introduction" passage at the beginning of this chapter. Alternativly calculate the k_v-values by means of the calculation factor C_A (fig. 18) and the flow rate diagram (in this example: fig. 4) as per the following calculation example.

Calculation example:

Required k_v-value

C_A = 0.00132 (from fig. 18)

k_v = $C_A \times G$

k_v = 0.00132 × 2,700 [kg/h]

= 3.56 [m³/h]

Calculation factor C_A

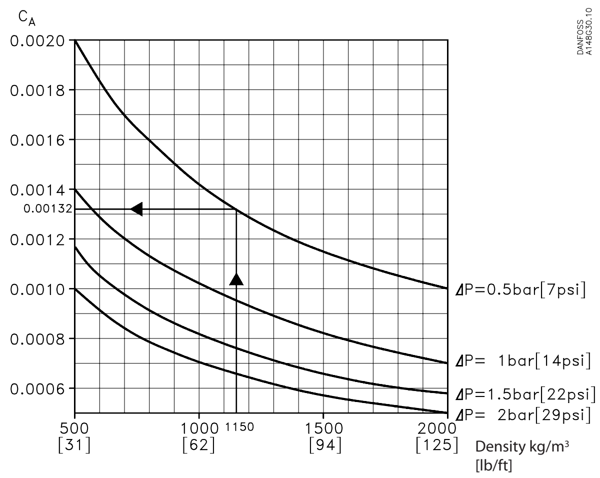


Fig. 18.

Flow rate diagram

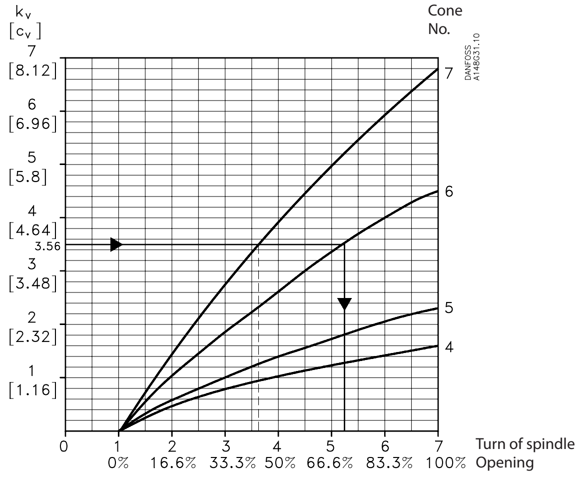
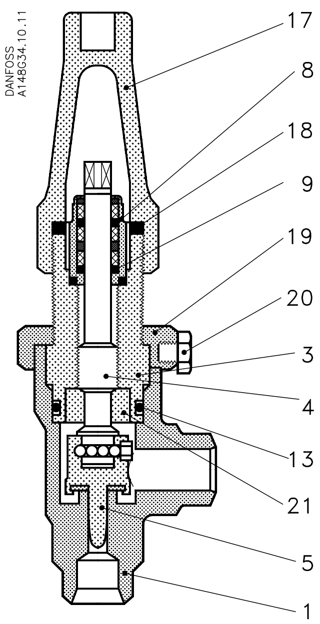


Fig. 4.

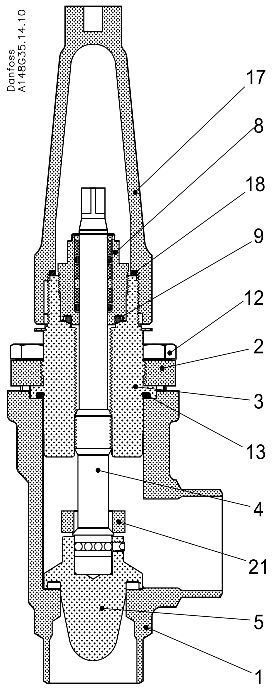
Cone no. 6 and 7 can be used. The optimum regulation is obtained if cone number 6 is used.

Material specification

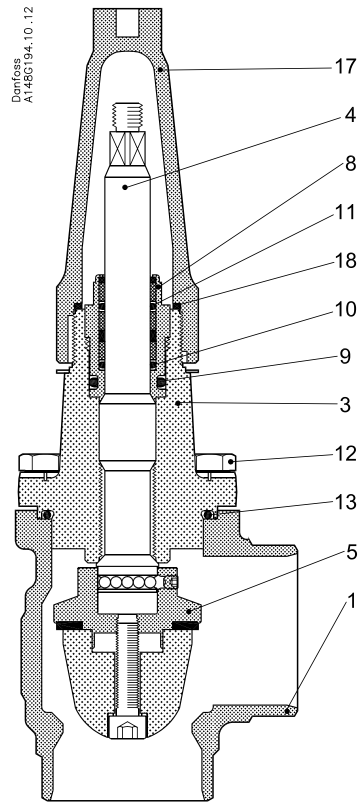
REG 6 - 15



REG 10 - 40

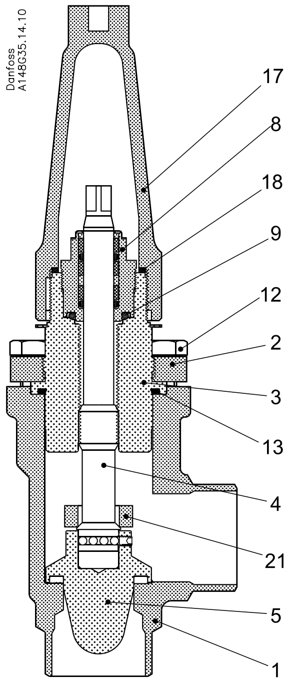


REG 50 - 65



No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	P285QH EN10222-4		LF2A350
2	DN 10 - 40 (3/8 - 1½ in.) – Bonnet, Flange	Steel	P275 NLI EN10028-3		
3	DN 6 - 40 (¼ - 1½ in.) – Bonnet, Insert DN 50 - 65 (2 - 2½ in.) – Bonnet, Flange	Steel	P285QH EN10222-4		
4	Spindle DN 6 - 40 (¼ - 1½ in.) DN 50 - 65 (2 - 2½ in.)	 Stainless steel Stainless steel	 X10CrNiS18-9, 17440 X8CrNiS18-9, 17440	 Type 17, 683/13 Type 17, 683/13	 AISI 303 AISI 303
5	Cone	Steel			
8	Packing gland	Steel			
9	DN 6 - 20 (¼ - 3/4 in.) – Packing washer DN 25 - 65 (1 - 2½ in.) – O-ring	 Non-asbestos Cloroprene (Neoprene)			
10-11	O-ring	Cloroprene (Neoprene)			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
17	Seal cap	Aluminium			
18	Gasket f. seal cap	Nylon			
19	Locking nut	Steel			
20	Screw	Steel			
21	Packing washer	PTFE (Teflon)			

Material specification

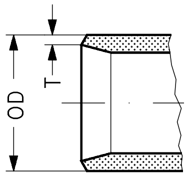


REG-SS 15 - 40 ($^1/_2$ - 1$^1/_2$")

No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing	Stainless steel	X5CrNi18-10 EN10088		AISI 304
2	Bonnet, Flange	Stainless steel	X5CrNi18-10 EN10088		AISI 304
3	Bonnet, Insert	Stainless steel			
4	Spindle	Stainless steel	X8CrNiS18-9 DIN 17440	Type 17, 683/13	AISI 303
5	Cone	Steel			
8	Packing gland	Stainless steel			
9	Packing washer	Non-asbestos			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
17	Spindle seal cap	Aluminium			
18	Seal cap gasket	Nylon			
19	Locking nut	Steel			
20	Screw	Steel			
21	Packing washer	PTFE (Teflon)			

Connections

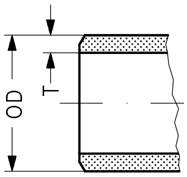
DIN



Welding DIN (EN 10220)

	Size mm	Size in.	OD mm	T mm	OD in.	T in.		Cone no.
Small	6 10	1/4 3/8	13.5 17.2	2.3 2.3	0.531 0.677	0.091 0.091		① ② ③
Medium	15 20 25	1/2 3/4 1	21.3 26.9 33.7	2.3 2.3 2.6	0.839 1.059 1.327	0.091 0.091 0.103		④ ⑤ ⑥ ⑦
Large	32 40	1 1/4 1 1/2	42.4 48.3	2.6 2.6	1.669 1.902	0.102 0.103		⑧ ⑨ ⑩
	50	2	60.3	2.9	2.37	0.11		⑪
	65	2 1/2	76.1	2.9	3	0.11		⑫

ANSI



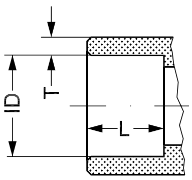
Welding ANSI (B 36.10 Schedule 80)

	Size mm	Size in.	OD mm	T mm	OD in.	T in.		Cone no.
Small	6 10	1/4 3/8	13.5 17.2	3.0 3.2	0.531 0.677	0.118 0.126		① ② ③
Medium	15 20 25	1/2 3/4 1	21.3 26.9 33.7	3.7 4.0 4.6	0.839 1.059 1.327	0.146 0.158 0.181		④ ⑤ ⑥ ⑦
Large	32 40	1 1/4 1 1/2	42.4 48.3	4.9 5.1	1.669 1.902	0.193 0.201		⑧ ⑨ ⑩

Welding ANSI (B 36.10 Schedule 40)

	Size mm	Size in.	OD mm	T mm	OD in.	T in.		Cone no.
	50	2	60.3	3.9	2.37	0.15		⑪
	65	2 1/2	73.0	5.2	2.87	0.20		⑫

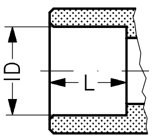
SOC



Socket welding ANSI (B 16.11)

	Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.		Cone no.
Medium	15 20	1/2 3/4	21.8 27.2	6.0 7.6	0.858 1.071	0.235 0.299	10 13	0.39 0.51		④ ⑤ ⑥ ⑦
Large	25 32 40	1 1 1/4 1 1/2	33.9 42.7 48.8	7.2 6.1 6.6	1.335 1.743 1.921	0.284 0.240 0.260	13 13 13	0.51 0.51 0.51		⑧ ⑨ ⑩

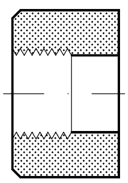
SA



Soldering (ANSI B 16.22)

	Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.		Cone no.
Small	10 15	3/8 1/2	9.60 12.75		0.378 0.502		8 10	0.31 0.39		① ② ③
Medium	22	7/8	22.30		0.878		19	0.75		④ ⑤ ⑥ ⑦

FPT

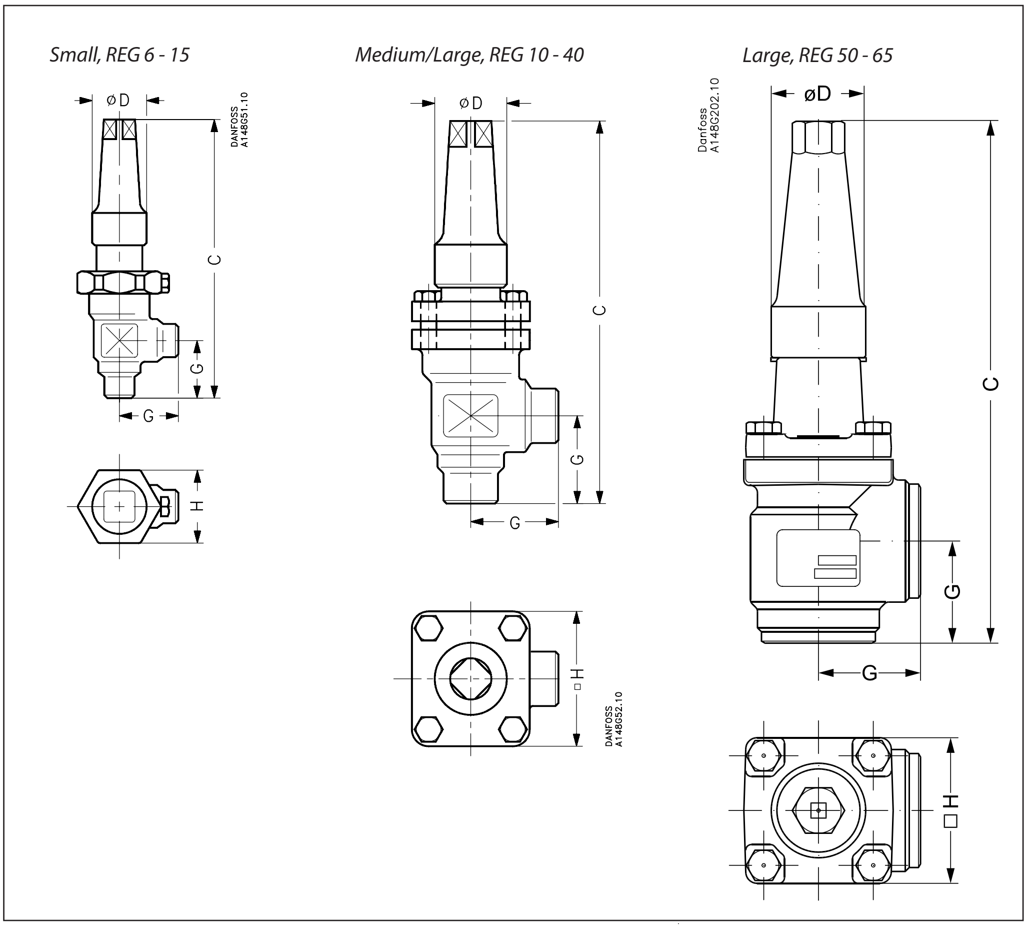


FPT inside pipe thread, NPT (ANSI/ASME B 1.20.1)

	Size mm	Size in.	Inside pipe thread		Cone no.
Mellem	15 20	1/2 3/4	(1/2 × 14 NPT) (3/4 × 14 NPT)		④ ⑤ ⑥ ⑦
Large	25 32	1 1 1/4	(1 × 11.5 NPT) (1 1/4 × 11.5 NPT)		⑧ ⑨ ⑩

Dimensions and weights

REG 6 - 40 in angleway version



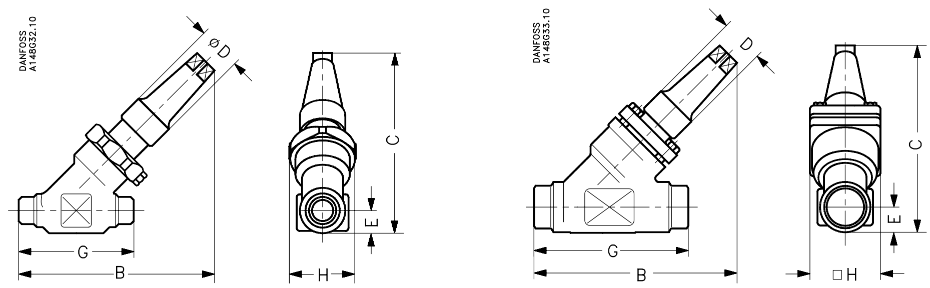
Valve size		C	G	∅D	□H	Weight
Small valve	mm	139	30	30	36	0.8 kg
housing	in.	5.47	1.18	1.18	1.42	1.8 lb
Medium valve	mm	182	45	38	60	1.4 kg
housing	in.	7.17	1.77	1.50	2.36	3.1 lb
Large valve	mm	237	55	50	70	2.4 kg
housing	in.	9.33	2.17	1.97	2.76	5.3 lb
REG 50	mm	280	60	50	77	3.2 kg
REG (2 in.)	in.	11.02	2.36	1.97	3.03	7.1 lb
REG 65	mm	305	70	50	90	4.8 kg
REG (2½ in.)	in.	12.01	2.76	1.97	3.54	10.6 lb
REG 32 SOC	mm	275	62	50	70	2.9 kg
REG (1¼ in.) SOC	in.	10.83	2.44	1.97	2.76	6.4 lb
REG 40 SOC	mm	275	62	50	70	2.9 kg
REG (1½ in.) SOC	in.	10.83	2.44	1.97	2.76	6.4 lb

Specified weights are approximate values only.

Dimensions and weights
(cont.)

REG 6 - 40 in straight way version

Small, REG 6 - 15 *Medium/Large, REG 10 - 40*



Valve size		C	B	E	G		∅D		□H		Weight
Small valve	mm	110	120	13	70		30		36		0.8 kg
housing	in.	4.33	4.72	0.51	2.76		1.18		1.42		1.8 lb
Medium valve	mm	145	155	20	120		38		60		2.0 kg
housing	in.	5.71	6.10	0.79	4.72		1.50		2.36		4.4 lb
Large valve	mm	200	215	26	155		50		70		3.0 kg
housing	in.	7.87	8.46	1.02	6.10		1.97		2.76		6.6 lb
REG 32 SOC	mm	209	222	27.4	155		50		70		3.0 kg
REG (1¼) SOC	in.	8.23	8.74	1.08	6.10		1.97		2.76		6.6 lb
REG 40 SOC	mm	213	222	31.0	155		50		70		3.0 kg
REG (1½) SOC	in.	8.39	8.74	1.22	6.10		1.97		2.76		6.6 lb

Specified weights are approximate values only.

Ordering

How to order

The table below is used to indentify the valve required.

Please note that the type codes only serve to identify the valves some of which may not form part of the standard product range. For further information please contact your local Danfoss Sales Company.

Type codes

Valve type	**REG**	Regulating Valves					
Nominal size in mm			Available connections				
			A	D	SOC	SA	FPT
(Valve size measured on the connection diameter)	**6**	DN 6	x	x			
	10	DN 10	x	x		x	
	15	DN 15	x	x	x	x	x
	20	DN 20	x	x	x		x
	22	DN 22				x	
	25	DN 25	x	x	x		x
	32	DN 32	x	x	x		x
	40	DN 40	x	x	x		
	50	DN 50	x	x			
	65	DN 65	x	x			
Connections	**A**	Welding branches: ANSI B 36.10 schedule 80, 15 - 40 (½ - 1½ in.) Welding branches: ANSI B 36.10 schedule 40, 50 - 65 (2 - 2½ in.)					
	D	Welding branches: DIN 2448					
	SOC	Socket weld: ANSI B 16.11					
	SA	Soldering branches: ANSI B 16.22					
	FPT	NPT inside pipe thread: ANSI/ASME B1.20.1					
Valve housing	**ANG**	Angle flow					
	STR	Straight flow					
Cone	Cone#	Flow area [mm^2]					
	1	3					
	2	6					
	3	12					
	4	28					
	5	44					
	6	92					
	7	152					
	8	272					
	9	432					
	10	648					
	11	822					
	12	1978					

Verification of the combination between cone no. and valve connection

Valve size	Small valve	Medium valve	Large valve	REG 50	REG 65
Cone no.	1 2 3	4 5 6 7	8 9 10	11	12

DIN	DN 6, 10, 15*	DN 15, 20, 25	DN 32, 40	DN 50	DN 65
ANSI	DN 6, 10	DN 15, 20, 25	DN 32, 40	DN 50	DN 65
SOC		DN 15, 20	DN 25, 32, 40		
SA	DN 10, 15	DN 22			
FPT		DN 15, 20	DN 25, 32		

*Small valve size 15 DIN is only available with cone number 3.

Ordering
(continued)

Example:
REG 15 DIN angleway with cone no. 7 = **148G3242**

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

D = Butt-weld DIN
A = Butt-weld ANSI
SOC = Socket weld
SA = Soldering
FPT = Inside pipe thread

ANG = Angleway
STR = Straightway

Angleway

Size		Type	**Code no.**
mm	in.		
DIN			
6	1/4	REG 6 D ANG CONE#1	**2415+426**
6	1/4	REG 6 D ANG CONE#2	**2415+427**
6	1/4	REG 6 D ANG CONE#3	**2415+428**
10	3/8	REG 10 D ANG CONE#1	**2415+432**
10	3/8	REG 10 D ANG CONE#2	**2415+433**
10	3/8	REG 10 D ANG CONE#3	**2415+434**
15	1/2	REG 15 D ANG CONE#3	**2415+883**
15	1/2	REG 15 D ANG CONE#4	**148G3239**
15	1/2	REG-SS 15 D ANG CONE#4 52BAR	**148G3542**
15	1/2	REG 15 D ANG CONE#5	**148G3240**
15	1/2	REG-SS 15 D ANG CONE#5 52BAR	**148G3543**
15	1/2	REG 15 D ANG CONE#6	**148G3241**
15	1/2	REG-SS 15 D ANG CONE#6 52BAR	**148G3544**
15	1/2	REG 15 D ANG CONE#7	**148G3242**
15	1/2	REG-SS 15 D ANG CONE#7 52BAR	**148G3545**
20	3/4	REG 20 D ANG CONE#4	**148G3247**
20	3/4	REG-SS 20 D ANG CONE#4 52BAR	**148G3546**
20	3/4	REG 20 D ANG CONE#5	**148G3248**
20	3/4	REG-SS 20 D ANG CONE#5 52BAR	**148G3547**
20	3/4	REG 20 D ANG CONE#6	**148G3249**
20	3/4	REG-SS 20 D ANG CONE#6 52BAR	**148G3548**
20	3/4	REG 20 D ANG CONE#7	**148G3250**
20	3/4	REG-SS 20 D ANG CONE#7 52BAR	**148G3549**
25	1	REG 25 D ANG CONE#4	**148G3255**
25	1	REG-SS 25 D ANG CONE#4 52BAR	**148G3550**
25	1	REG 25 D ANG CONE#5	**148G3256**
25	1	REG-SS 25 D ANG CONE#5 52BAR	**148G3551**
25	1	REG 25 D ANG CONE#6	**148G3257**
25	1	REG-SS 25 D ANG CONE#6 52BAR	**148G3552**
25	1	REG 25 D ANG CONE#7	**148G3258**
25	1	REG-SS 25 D ANG CONE#7 52BAR	**148G3553**
32	1 1/4	REG 32 D ANG CONE#8	**148G3263**
32	1 1/4	REG-SS 32 D ANG CONE#8 52BAR	**148G3555**
32	1 1/4	REG 32 D ANG CONE#9	**148G3264**
32	1 1/4	REG-SS 32 D ANG CONE#9 52BAR	**148G3556**
32	1 1/4	REG 32 D ANG CONE#10	**148G3265**
32	1 1/4	REG-SS 32 D ANG CONE#10 52BAR	**148G3554**
40	1 1/2	REG 40 D ANG CONE#8	**148G3269**
40	1 1/2	REG-SS 40 D ANG CONE#8 52BAR	**148G3558**
40	1 1/2	REG 40 D ANG CONE#9	**148G3270**
40	1 1/2	REG-SS 40 D ANG CONE#9 52BAR	**148G3559**
40	1 1/2	REG 40 D ANG CONE#10	**148G3271**
40	1 1/2	REG-SS 40 D ANG CONE#10 52BAR	**148G3557**
50	2	REG 50 D ANG CONE#11	**148G3485**
65	2 1/2	REG 65 D ANG CONE#12	**148G3486**

Ordering
(continued)

Angleway

Size		Type	Code no.
mm	in.		
ANSI			
6	1/4	REG 6 A ANG CONE#1	**2415+474**
6	1/4	REG 6 A ANG CONE#2	**2415+475**
6	1/4	REG 6 A ANG CONE#3	**2415+476**
10	3/8	REG 10 A ANG CONE#1	**2415+480**
10	3/8	REG 10 A ANG CONE#2	**2415+481**
10	3/8	REG 10 A ANG CONE#3	**2415+482**
15	1/2	REG 15 A ANG CONE#4	**148G3276**
15	1/2	REG 15 A ANG CONE#5	**148G3277**
15	1/2	REG 15 A ANG CONE#6	**148G3278**
15	1/2	REG 15 A ANG CONE#7	**148G3279**
20	3/4	REG 20 A ANG CONE#4	**148G3284**
20	3/4	REG 20 A ANG CONE#5	**148G3285**
20	3/4	REG 20 A ANG CONE#6	**148G3286**
20	3/4	REG 20 A ANG CONE#7	**148G3287**
25	1	REG 25 A ANG CONE#4	**148G3292**
25	1	REG 25 A ANG CONE#5	**148G3293**
25	1	REG 25 A ANG CONE#6	**148G3294**
25	1	REG 25 A ANG CONE#7	**148G3295**
32	1 1/4	REG 32 A ANG CONE#8	**148G3300**
32	1 1/4	REG 32 A ANG CONE#9	**148G3301**
32	1 1/4	REG 32 A ANG CONE#10	**148G3302**
40	1 1/2	REG 40 A ANG CONE#8	**148G3306**
40	1 1/2	REG 40 A ANG CONE#9	**148G3307**
40	1 1/2	REG 40 A ANG CONE#10	**148G3308**
50	2	REG 50 A ANG CONE#11	**148G3487**
65	2 1/2	REG 65 A ANG CONE#12	**148G3488**
SOC			
15	1/2	REG 15 SOC ANG CONE#4	**148G3312**
15	1/2	REG 15 SOC ANG CONE#5	**148G3313**
15	1/2	REG 15 SOC ANG CONE#6	**148G3314**
15	1/2	REG 15 SOC ANG CONE#7	**148G3315**
20	3/4	REG 20 SOC ANG CONE#4	**148G3322**
20	3/4	REG 20 SOC ANG CONE#5	**148G3323**
20	3/4	REG 20 SOC ANG CONE#6	**148G3324**
20	3/4	REG 20 SOC ANG CONE#7	**148G3325**
25	1	REG 25 SOC ANG CONE#8	**148G3330**
25	1	REG 25 SOC ANG CONE#9	**148G3331**
25	1	REG 25 SOC ANG CONE#10	**148G3332**
32	1 1/4	REG 32 SOC ANG CONE#8	**148G3336**
32	1 1/4	REG 32 SOC ANG CONE#9	**148G3337**
32	1 1/4	REG 32 SOC ANG CONE#10	**148G3338**
40	1 1/2	REG 40 SOC ANG CONE#8	**148G3342**
40	1 1/2	REG 40 SOC ANG CONE#9	**148G3343**
40	1 1/2	REG 40 SOC ANG CONE#10	**148G3417**
FPT			
15	1/2	REG 15 FPT ANG CONE#4	**148G3389**
15	1/2	REG 15 FPT ANG CONE#5	**148G3390**
15	1/2	REG 15 FPT ANG CONE#6	**148G3391**
15	1/2	REG 15 FPT ANG CONE#7	**148G3392**
20	3/4	REG 20 FPT ANG CONE#4	**148G3397**
20	3/4	REG 20 FPT ANG CONE#5	**148G3398**
20	3/4	REG 20 FPT ANG CONE#6	**148G3399**
20	3/4	REG 20 FPT ANG CONE#7	**148G3400**
25	1	REG 25 FPT ANG CONE#8	**148G3405**
25	1	REG 25 FPT ANG CONE#9	**148G3406**
25	1	REG 25 FPT ANG CONE#10	**148G3407**
32	1 1/4	REG 32 FPT ANG CONE#8	**148G3411**
32	1 1/4	REG 32 FPT ANG CONE#9	**148G3412**
32	1 1/4	REG 32 FPT ANG CONE#10	**148G3413**

D = Butt-weld DIN
A = Butt-weld ANSI
SOC = Socket weld
SA = Soldering
FPT = Inside pipe thread

ANG = Angleway
STR = Straightway

Ordering
(continued)

D = Butt-weld DIN
A = Butt-weld ANSI
SOC = Socket weld
SA = Soldering
FPT = Inside pipe thread

ANG = Angleway
STR = Straightway

Angleway

Size		Type	Code no.
mm	in.		
SA			
10	3/8	REG 10 SA ANG CONE#1 CU: 3/8"	**2415+559**
10	3/8	REG 10 SA ANG CONE#2 CU: 3/8"	**2415+560**
10	3/8	REG 10 SA ANG CONE#3 CU: 3/8"	**2415+561**
15	1/2	REG 15 SA ANG CONE#1 CU: 1/2"	**2415+565**
15	1/2	REG 15 SA ANG CONE#2 CU: 1/2"	**2415+566**
15	1/2	REG 15 SA ANG CONE#3 CU: 1/2"	**2415+567**
22	7/8	REG 22 SA ANG CONE#4 CU: 7/8"	**148G3363**
22	7/8	REG 22 SA ANG CONE#5 CU: 7/8"	**148G3364**
22	7/8	REG 22 SA ANG CONE#6 CU: 7/8"	**148G3365**
22	7/8	REG 22 SA ANG CONE#7 CU: 7/8"	**148G3366**

Ordering
(continued)

Straightway

Size mm	Size in.	Type	Code no.
DIN			
6	1/4	REG 6 D STR CONE#1	**2415+429**
6	1/4	REG 6 D STR CONE#2	**2415+430**
6	1/4	REG 6 D STR CONE#3	**2415+431**
10	3/8	REG 10 D STR CONE#1	**2415+435**
10	3/8	REG 10 D STR CONE#2	**2415+436**
10	3/8	REG 10 D STR CONE#3	**2415+437**
15	1/2	REG 15 D STR CONE#4	**148G3243**
15	1/2	REG-SS 15 D STR CONG#4 52BAR	**148G3640**
15	1/2	REG 15 D STR CONE#5	**148G3244**
15	1/2	REG-SS 15 D STR CONG#5 52BAR	**148G3641**
15	1/2	REG 15 D STR CONE#6	**148G3245**
15	1/2	REG-SS 15 D STR CONG#6 52BAR	**148G3642**
15	1/2	REG 15 D STR CONE#7	**148G3246**
15	1/2	REG-SS 15 D STR CONG#7 52BAR	**148G3643**
20	3/4	REG 20 D STR CONE#4	**148G3251**
20	3/4	REG-SS 20 D STR CONG#4 52BAR	**148G3644**
20	3/4	REG 20 D STR CONE#5	**148G3252**
20	3/4	REG-SS 20 D STR CONG#5 52BAR	**148G3645**
20	3/4	REG 20 D STR CONE#6	**148G3253**
20	3/4	REG-SS 20 D STR CONG#6 52BAR	**148G3646**
20	3/4	REG 20 D STR CONE#7	**148G3254**
20	3/4	REG-SS 20 D STR CONG#7 52BAR	**148G3647**
25	1	REG 25 D STR CONE#4	**148G3259**
25	1	REG-SS 25 D STR CONG#4 52BAR	**148G3648**
25	1	REG 25 D STR CONE#5	**148G3260**
25	1	REG-SS 25 D STR CONG#5 52BAR	**148G3649**
25	1	REG 25 D STR CONE#6	**148G3261**
25	1	REG-SS 25 D STR CONG#6 52BAR	**148G3650**
25	1	REG 25 D STR CONE#7	**148G3262**
25	1	REG-SS 25 D STR CONG#7 52BAR	**148G3651**
32	1 1/4	REG 32 D STR CONE#8	**148G3266**
32	1 1/4	REG-SS 32 D STR CONG#8 52BAR	**148G3653**
32	1 1/4	REG 32 D STR CONE#9	**148G3267**
32	1 1/4	REG-SS 32 D STR CONG#9 52BAR	**148G3654**
32	1 1/4	REG 32 D STR CONE#10	**148G3268**
32	1 1/4	REG-SS 32 D STR CONG#10 52BAR	**148G3652**
40	1 1/2	REG 40 D STR CONE#8	**148G3273**
40	1 1/2	REG-SS 40 D STR CONG#8 52BAR	**148G3656**
40	1 1/2	REG 40 D STR CONE#9	**148G3274**
40	1 1/2	REG-SS 40 D STR CONG#9 52BAR	**148G3657**
40	1 1/2	REG 40 D STR CONE#10	**148G3275**
40	1 1/2	REG-SS 40 D STR CONG#10 52BAR	**148G3655**

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STR = Straightway

Ordering
(continued)

Straightway

Size mm	Size in.	Type	Code no.
ANSI			
6	1/4	REG 6 A STR CONE#1	**2415+477**
6	1/4	REG 6 A STR CONE#2	**2415+478**
6	1/4	REG 6 A STR CONE#3	**2415+479**
10	3/8	REG 10 A STR CONE#1	**2415+483**
10	3/8	REG 10 A STR CONE#2	**2415+484**
10	3/8	REG 10 A STR CONE#3	**2415+485**
15	1/2	REG 15 A STR CONE#4	**148G3280**
15	1/2	REG 15 A STR CONE#5	**148G3281**
15	1/2	REG 15 A STR CONE#6	**148G3282**
15	1/2	REG 15 A STR CONE#7	**148G3283**
20	3/4	REG 20 A STR CONE#4	**148G3288**
20	3/4	REG 20 A STR CONE#5	**148G3289**
20	3/4	REG 20 A STR CONE#6	**148G3290**
20	3/4	REG 20 A STR CONE#7	**148G3291**
25	1	REG 25 A STR CONE#4	**148G3296**
25	1	REG 25 A STR CONE#5	**148G3297**
25	1	REG 25 A STR CONE#6	**148G3298**
25	1	REG 25 A STR CONE#7	**148G3299**
32	1 1/4	REG 32 A STR CONE#8	**148G3303**
32	1 1/4	REG 32 A STR CONE#9	**148G3304**
32	1 1/4	REG 32 A STR CONE#10	**148G3305**
40	1 1/2	REG 40 A STR CONE#8	**148G3309**
40	1 1/2	REG 40 A STR CONE#9	**148G3310**
40	1 1/2	REG 40 A STR CONE#10	**148G3311**
SOC			
15	1/2	REG 15 SOC STR CONE#4	**148G3316**
15	1/2	REG 15 SOC STR CONE#5	**148G3317**
15	1/2	REG 15 SOC STR CONE#6	**148G3318**
15	1/2	REG 15 SOC STR CONE#7	**148G3319**
20	3/4	REG 20 SOC STR CONE#4	**148G3326**
20	3/4	REG 20 SOC STR CONE#5	**148G3327**
20	3/4	REG 20 SOC STR CONE#6	**148G3328**
20	3/4	REG 20 SOC STR CONE#7	**148G3329**
25	1	REG 25 SOC STR CONE#8	**148G3333**
25	1	REG 25 SOC STR CONE#9	**148G3334**
25	1	REG 25 SOC STR CONE#10	**148G3335**
32	1 1/4	REG 32 SOC STR CONE#8	**148G3339**
32	1 1/4	REG 32 SOC STR CONE#9	**148G3340**
32	1 1/4	REG 32 SOC STR CONE#10	**148G3341**
40	1 1/2	REG 40 SOC STR CONE#8	**148G3344**
40	1 1/2	REG 40 SOC STR CONE#9	**148G3345**
40	1 1/2	REG 40 SOC STR CONE#10	**148G3346**
FPT			
15	1/2	REG 15 FPT STR CONE#4	**148G3393**
15	1/2	REG 15 FPT STR CONE#5	**148G3394**
15	1/2	REG 15 FPT STR CONE#6	**148G3395**
15	1/2	REG 15 FPT STR CONE#7	**148G3396**
20	3/4	REG 20 FPT STR CONE#4	**148G3401**
20	3/4	REG 20 FPT STR CONE#5	**148G3402**
20	3/4	REG 20 FPT STR CONE#6	**148G3403**
20	3/4	REG 20 FPT STR CONE#7	**148G3404**
25	1	REG 25 FPT STR CONE#8	**148G3408**
25	1	REG 25 FPT STR CONE#9	**148G3409**
25	1	REG 25 FPT STR CONE#10	**148G3410**
32	1 1/4	REG 32 FPT STR CONE#8	**148G3414**
32	1 1/4	REG 32 FPT STR CONE#9	**148G3415**
32	1 1/4	REG 32 FPT STR CONE#10	**148G3416**

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Ordering
(continued)

D = Butt-weld DIN
A = Butt-weld ANSI
SOC = Socket weld
SA = Soldering
FPT = Inside pipe thread

ANG = Angleway
STR = Straightway

Straightway

Size mm	Size in.	Type	Code no.
SA			
10	3/8	REG 10 SA STR CONE#1 CU: 3/8”	**2415+562**
10	3/8	REG 10 SA STR CONE#2 CU: 3/8”	**2415+563**
10	3/8	REG 10 SA STR CONE#3 CU: 3/8”	**2415+564**
15	1/2	REG 15 SA STR CONE#1 CU: 1/2”	**2415+568**
15	1/2	REG 15 SA STR CONE#2 CU: 1/2”	**2415+569**
15	1/2	REG 15 SA STR CONE#3 CU: 1/2”	**2415+570**
22	7/8	REG 22 SA STR CONE#4 CU: 7/8”	**148G3367**
22	7/8	REG 22 SA STR CONE#5 CU: 7/8”	**148G3368**
22	7/8	REG 22 SA STR CONE#6 CU: 7/8”	**148G3369**
22	7/8	REG 22 SA STR CONE#7 CU: 7/8”	**148G3370**

Introduction

SCA are check valves with a built-in stop valve function. CHV are check valves only.

The valves are designed to open at very low differential pressures, allow favourable flow conditions and are easy to disassemble for inspection and service.

SCA are equipped with vented cap and have internal backseating enabling the spindle seal to be replaced whilst the valve still under pressure.

Laser cut V-ports provide excellent opening characteristics (SCA/CHV 50-125).

The valve cone has a built-in flexibility to ensure a precise and tight closing towards the valve seat.

A well balanced dampening effect between the piston and the cylinder gives an optimal protection during low loads and against pulsations.

Features

- Applicable to all common non flammable refrigerants including R717 and non corrosive gases/liquids dependent on sealing material compatibility
- Designed to open at a very low differential pressure of 0.04 bar (0.58 psig)
- Designed with a built-in damping chamber preventing valve flutter, due to low refrigerant velocity and/or low density
- Each valve is clearly marked with type, size and performance range
- Easy to disassemble for inspection and service
- Internal backseating enables replacement of the spindle seal whilst the valve is active, i.e. under pressure
- Optimal flow characteristics ensuring quick opening to the fully open position
- Protection against pulsation by built-in damping facility
- Housing and bonnet material is low temperature steel (SCA-SS and CHV-SS are in stainless steel) according to requirements of the Pressure Equipment Directive and other international classification authorities
- Stainless steel bolts
- Pressure range
  SCA/CHV: 40 bar g (580 psig)
  SCA-SS/CHV-SS: 52 bar g (754 psi g)
- Temperature range
  –60°C/+150° (–76°F/+302°F)
- Classification: To get an updated list of certification on the products please contact your local Danfoss Sales Company.

The complete technical leaflet (DKRCI.PD.FL0.A) can be downloaded from the Danfoss web site.

Design

Connections
Available with the following connections:

- Welding DIN (EN 10220)
- Butt-weld ANSI (B 36.10 Schedule 80), - DN 15 - 40 (½ - 1½ in.)
- Butt-weld ANSI (B 36.10 Schedule 40), - DN 50 - 200 (2 - 8 in.)
- Socket-weld ANSI (B 16.11), - DN 50 (2 in.)

Housing
Made from special, cold resistant steel (SCA-SS and CHV-SS are made from stainless steel) approved for low temperature operations.

Valve Cone
Valve cone with built in metallic stop - prevents damage to teflon ring in case of overtightening.

Damping chamber
The chamber is filled with refrigerants (gas or liquid), which provides a damping effect, when the valve opens and closes.

Spindle (SCA)
Made of polished stainless steel, which is ideal for O-ring sealing.

Packing Gland (SCA)
The "full temperature range" packing gland consists of a double O-ring sealing arrangement combined with permanent lubrication from a grease reservoir. This ensures perfect tightness throughout the whole temperature range: –60/+150°C (–76/+302°F).

Pressure Equipment Directive (PED)
The SCA / CHV valves are approved and CE marked in accordance with Pressure Equipment Directive - 97/23/EC.

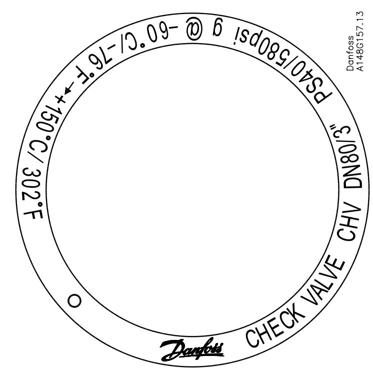
For further details / restrictions - see Installation Instruction.

Installation
The valve must be mounted vertically with the cone downwards.

The valve is designed to resist very high internal pressure. However, the piping system in general should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion.

For further information refer to installation instructions for SCA/CHV.

If cold refrigeration oil having low viscosities enters and settles in the damping chamber, problems with the check valve may arise. Consequently, it may be necessary to modify the valve for more viscous liquids by enlarging the hole to the damping chamber.



Example of marking ring, CHV

SCA / CHV valves			
Nominal bore	Standard application	DN 50-80 mm (2-3 in.)	DN 100-125 mm (4-5 in.)
	High pressure application	DN 50-65 mm (2-2½ in.)	DN 80-125 mm (3-5 in.)
Classified for		Fluid group I	
Category		II	III

Technical data

- *Refrigerants*
  Applicable to all common non flammable refrigerants including R717 and non corrosive gases/liquids dependent on sealing materials compatibility.
  For further information refer to installation instruction for SCA/CHV.
  Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales company.
- *Temperature range*
  –60/+150°C (–76/+302°F).
- *Pressure range*
  Max. working pressure:
  SCA/CHV 40 bar g (580 psig).
  SCA-SS/CHV-SS 52 bar g (754 psi g)

  Valves for higher working pressure are available on request.

Computation and selection

Introduction

When dimensioning SCA/CHV, it is important to select a valve that is best suited to all operating conditions. Therefore, it is necessary to consider both the nominal and part load working conditions.

The SCA/CHV valve can be calculated in two ways:
– Using the tables below.
– Using DIRcalc version 1.14 or higher.

Example

SI-Units

Assumed working conditions:
Maximum flow $\dot{V}$ = 1000 m^3/h
Density $\rho = 3.0\ kg/m^3$
Minimum part load = 33%

Used expressions:
Recommended velocity - C_{rec} [m/s]
Minimum recommended velocity - $C_{min,\ rec}$ [m/s]
Maximum velocity - C_{max} [m/s]
Part load velocity - C_{part} [m/s]

We know the density $\rho \approx 3.0\ kg/m^3$, consequently C_{rec} as well as $C_{min,\ rec}$ can be found in the figure (standard valve).

$C_{rec} \approx 14$ m/s
$C_{min,\ rec} \approx 3$ m/s

US-Units

Assumed working conditions:
Maximum flow $\dot{V}$ = 1160 gpm
Density $\rho = 0.187\ lb/feet^3$
Minimum part load = 33%

Used expressions:
Recommended velocity - C_{rec} [ft/min]
Minimum recommended velocity - $C_{min,\ rec}$ [ft/min]
Maximum velocity - C_{max} [ft/min]
Part load velocity - C_{part} [ft/min]

We know the density $\rho \approx 0.187\ lb/feet^3$, consequently C_{rec} as well as $C_{min,\ rec}$ can be found in the figure (standard valve).

$C_{rec} \approx 2756$ ft/min
$C_{min,\ rec} \approx 591$ ft/min

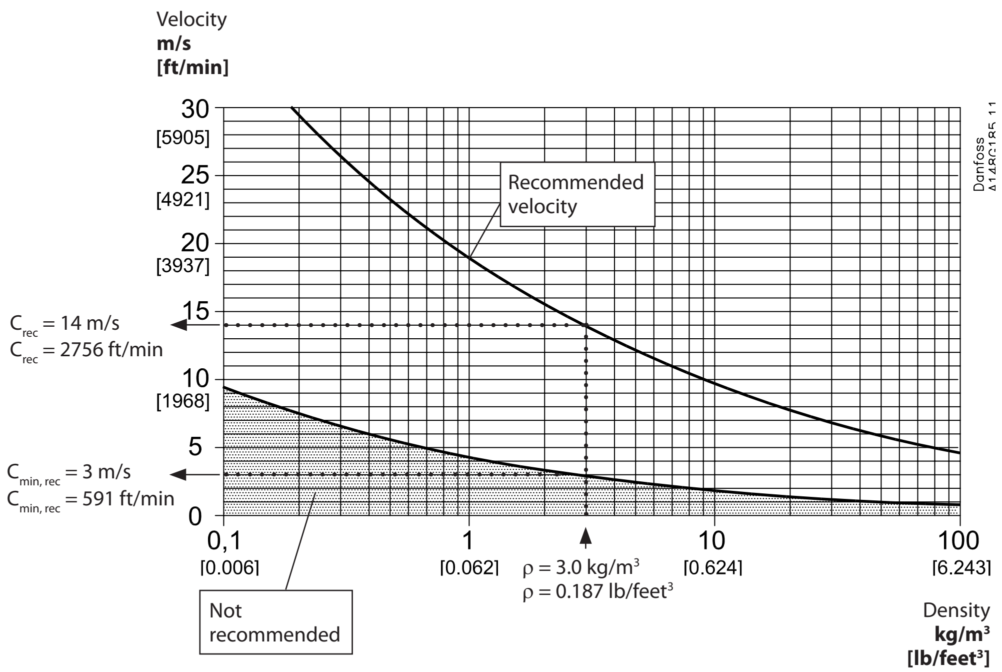


Fig. 1

Selection example continued on following page.

Computation and selection
(continued)

Knowing that $\dot{V}$ = 1000 m^3/h (1160 gpm) fig. 2 gives the following choices:

For SCA/CHV in size DN 100 the maximum velocity C_{max} ≈ 31 m/s (6100 ft/min)
For SCA/CHV in size DN 125 the maximum velocity C_{max} ≈ 20 m/s (3900 ft/min)

In conclusion SCA in size DN 125 is selected because C_{max} ≈ 20 m/s (3900 ft/min) comes nearest to the recommended velocity C_{rec} ≈ 14 m/s (2756 ft/min) and at the same time part load conditions fulfil the requirements, as described:

We know that C_{max} ≈ 20 m/s (3900 ft/min) and that minimum part load is 33%. It follows that C_{part} ≈ 6.5 m/s (1290 ft/min). Thus, C_{part} (6.5 m/s) > $C_{min, rec}$ (3.0 m/s) and the selected SCA model DN125 is the perfect choice.

If the valve in question, for instance under part load conditions provides a velocity less than $C_{min, rec}$ the valve might start hammering and become noisy. As a result the valve may wear prematurely.

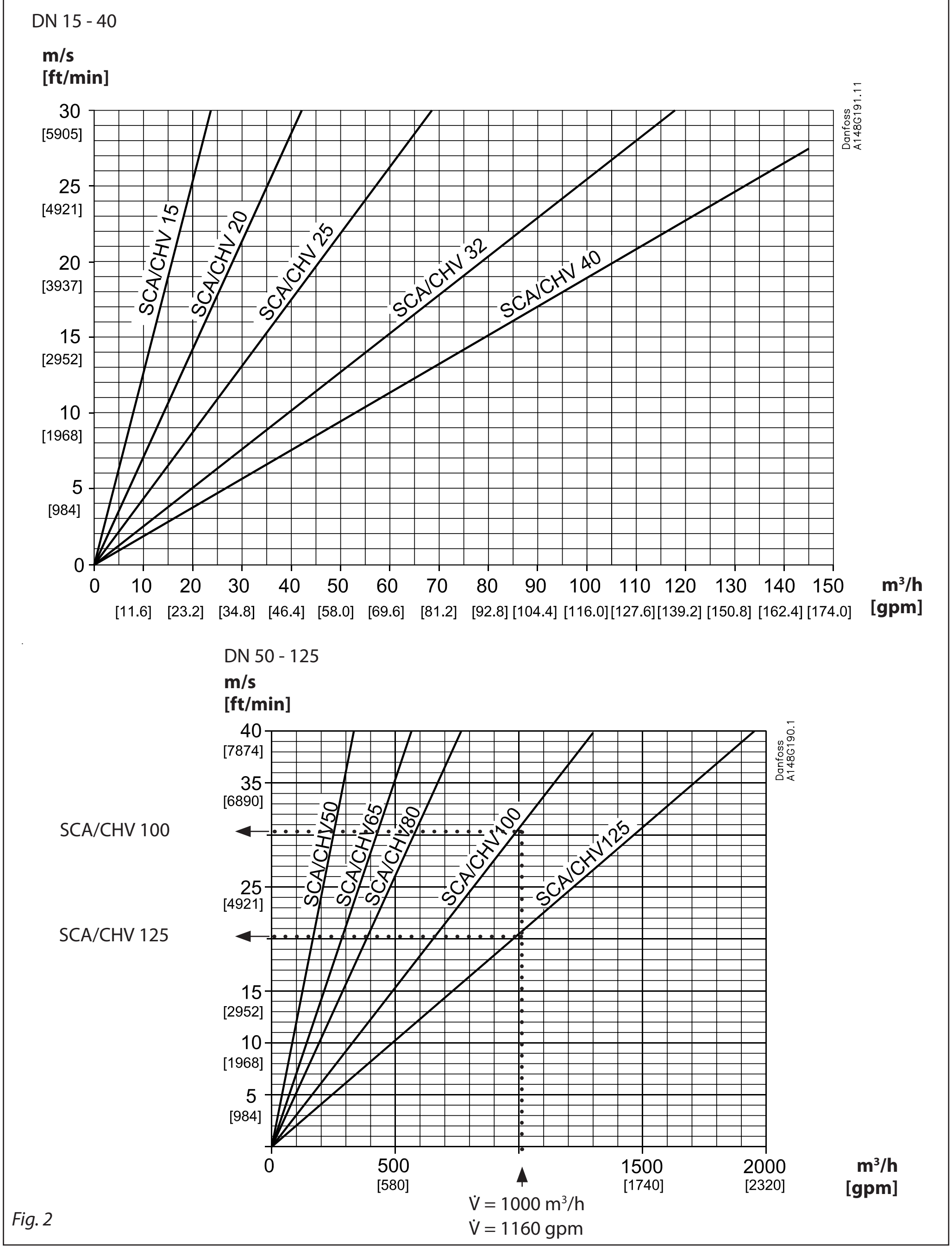


Fig. 2

Application

Figure 3 shows the stop/check valve SCA in the discharge line of a screw compressor unit.
The SCA valve in the discharge line prevents "back condensation" in the oil separator as well as pressure equalising through the compressor. Compared to an ordinary stop and check valve arrangement, the combined stop/check valve solution, as shown is easier to install and has lower flow resistance.

Installation of the SCA/CHV in the economizer line is **not** recommended.

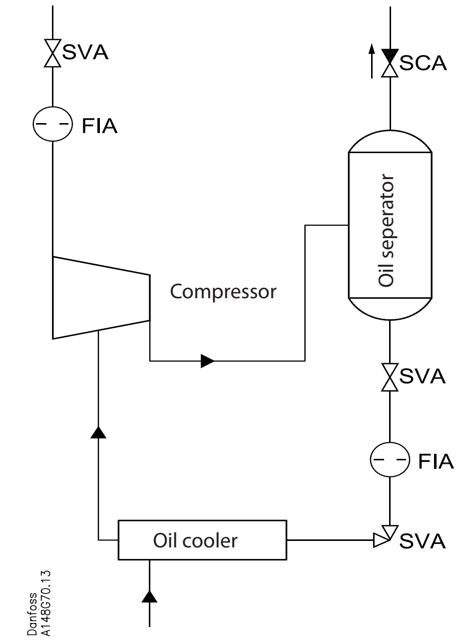
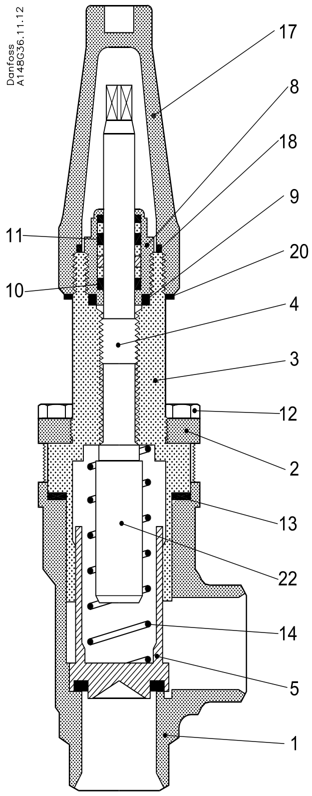
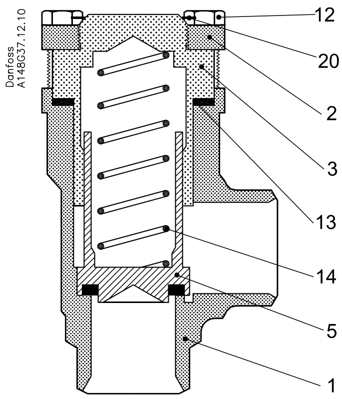


Fig. 3

Material specification



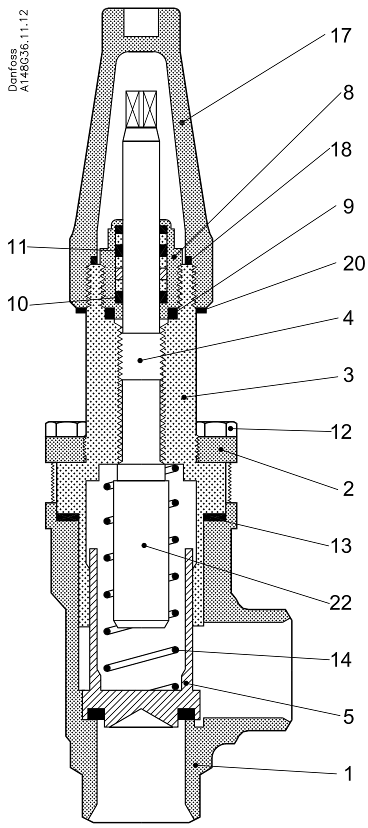
SCA 15 - 40



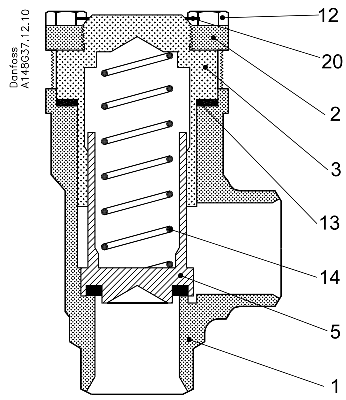
CHV 15 - 40

No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing	Steel	P285QH EN10222-4		LF2A350
2	Bonnet, Flange	Steel	P275NL1 EN10028-3		
3	Bonnet, Insert	Steel			
4	Spindle	Stainless steel	X 10CrNiS18-9	Type 17, 17440	AISI 303, 683/13
5	Cone	Steel Teflon (PTFE)			
8	Packing gland O-rings	Steel Cloroprene (Neoprene)			
9	Packing washer	Aluminium			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	Gasket	Fiber, non-asbestos			
14	Spring	Steel			
17	Spindle seal cap	Aluminium			
18	Seal cap gasket	Nylon			
20	Identification ring	Stainless steel			
22	Spindle extension	Steel			

Material specification



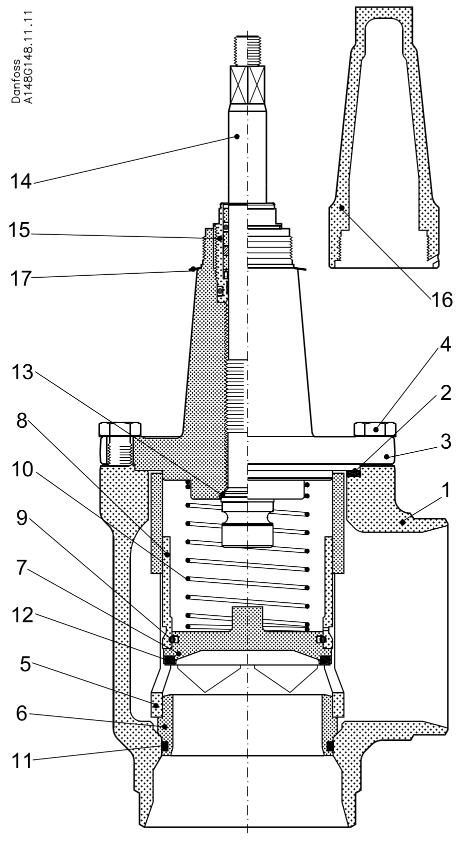
SCA-SS 15 - 40 (1/2 - 1 1/2")



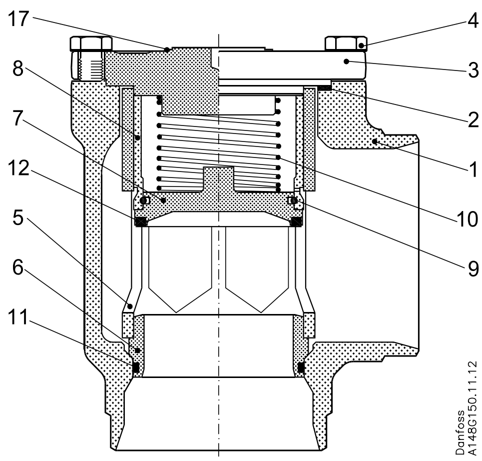
CHV-SS 15 - 40 (1/2 - 1 1/2")

No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing	Stainless steel	X5CrNi18-10 EN10088		AISI 304
2	Bonnet, Flange	Stainless steel	X5CrNi18-10 EN10088		AISI 304
3	Bonnet, Insert	Stainless steel			
4	Spindle	Stainless steel	X8CrNiS18-9	Type 17, 17440	AISI 303, 683/13
5	Cone	Steel Teflon (PTFE)			
8	Packing gland O-rings	Stainless steel Cloroprene (Neoprene)			
9	Packing washer	Aluminium			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	Gasket	Fiber, non-asbestos			
14	Spring	Steel			
17	Spindle seal cap	Aluminium			
18	Seal cap gasket	Nylon			
20	Identification ring	Stainless steel			
22	Spindle extension	Steel			

Material specification



SCA 50 - 125



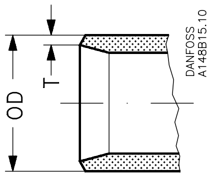
CHV 50 - 125

No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing DN 50-65	Steel	P285 QH EN 10222-4		LF2A350
	Housing DN 80-125	Steel	G20Mn5 QT SEW 685		LCC, A352
2	Gasket	Fiber, Non-asbestos			
3	SCA: Valve bonnet CHV: End cover	Steel	P285 QH EN 10222-4		LF2A350
4	Bolts	Stainless steel	A2-70	A2-70	A-276
5	Tube	Steel			
6	Seat	Steel			
7	Valve plate	Steel			
8	Guide sleeve	Steel			
9	Spring ring	Steel			
10	Spring	Steel			
11	O-ring	Cloroprene (Neoprene)			
12	Teflon ring	Teflon (PTFE)			
13	Soft back seal	Teflon (PTFE)			
14	Spindle DN 50-65	Stainless steel	X8CrNiS18-9 17440	Type 17 R 683/13	AISI 303
	Spindle DN 80-125	Stainless steel	X5CrNi1810 17440	Type 11 683/13	AISI 304 A-276
15	Packing gland	Steel	9Mn28, 1651	Type 2, R 683/9	1213, SAE J403
16	Spindle seal cap and gasket	Aluminium			
17	Marking label	Stainless steel			

Connections

Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v-angle m^3/h		C_v-angle USgal/min	

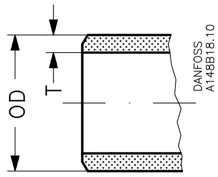
DIN



Welding DIN (EN 10220)

Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v-angle m^3/h		C_v-angle USgal/min	
15	½	21.3	2.3	0.839	0.091			8.0		9.3	
20	¾	26.9	2.3	1.059	0.091			10.0		11.6	
25	1	33.7	2.6	1.327	0.102			24.0		27.8	
32	1¼	42.4	2.6	1.669	0.102			30.0		34.8	
40	1½	48.3	2.6	1.902	0.102			30.0		34.8	
50	2	60.3	2.9	2.37	0.11			45		53	
65	2½	76.1	2.9	3.00	0.11			72		85	
80	3	88.9	3.2	3.50	0.13			103		129	
100	4	114.3	3.6	4.50	0.14			196		232	
125	5	139.7	4.0	5.50	0.16			301		356	

ANSI



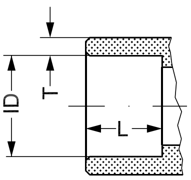
Welding ANSI (B 36.10 Schedule 80)

Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v-angle m^3/h		C_v-angle USgal/min	
15	½	21.3	3.7	0.839	0.146			8.0		9.3	
20	¾	26.9	4.0	1.059	0.158			10.0		11.6	
25	1	33.7	4.6	1.327	0.181			24.0		27.8	
32	1¼	42.4	4.9	1.669	0.193			30.0		34.8	
40	1½	48.3	5.1	1.902	0.201			30.0		34.8	

Welding ANSI (B 36.10 Schedule 40)

Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v-angle m^3/h		C_v-angle USgal/min	
50	2	60.3	3.9	2.37	0.15			45		53	
65	2½	73.0	5.2	2.87	0.20			72		85	
80	3	88.9	5.5	3.50	0.22			103		129	
100	4	114.3	6.0	4.50	0.24			196		232	
125	5	141.3	6.6	5.56	0.26			301		356	

SOC

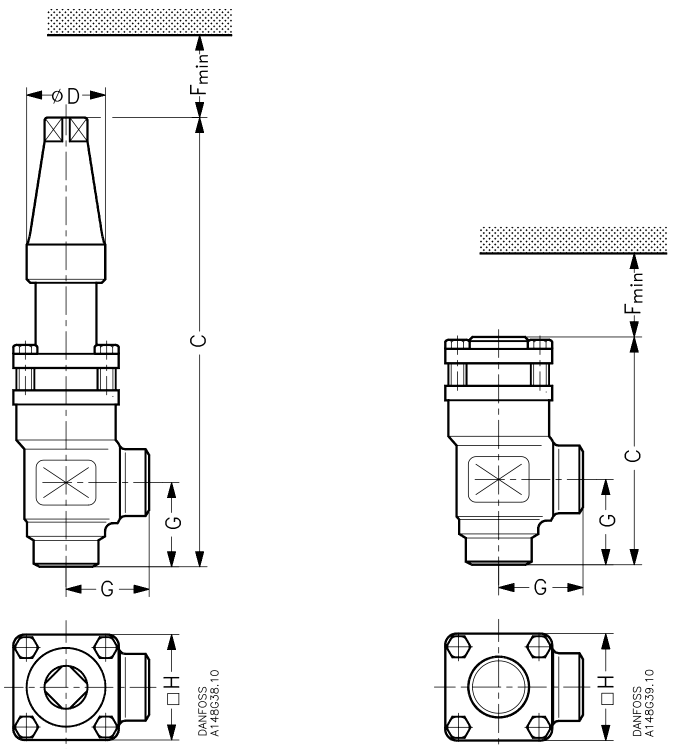


Socket welding ANSI (B 16.11)

Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.	k_v-angle m^3/h		C_v-angle USgal/min	
50	2	61.2	6.2	2.41	0.24	16	0.63	80		93	

Dimensions and weights

SCA/CHV 15 - 40 (½- 1½ in.)



SCA 15 - 40 *CHV 15 - 40*

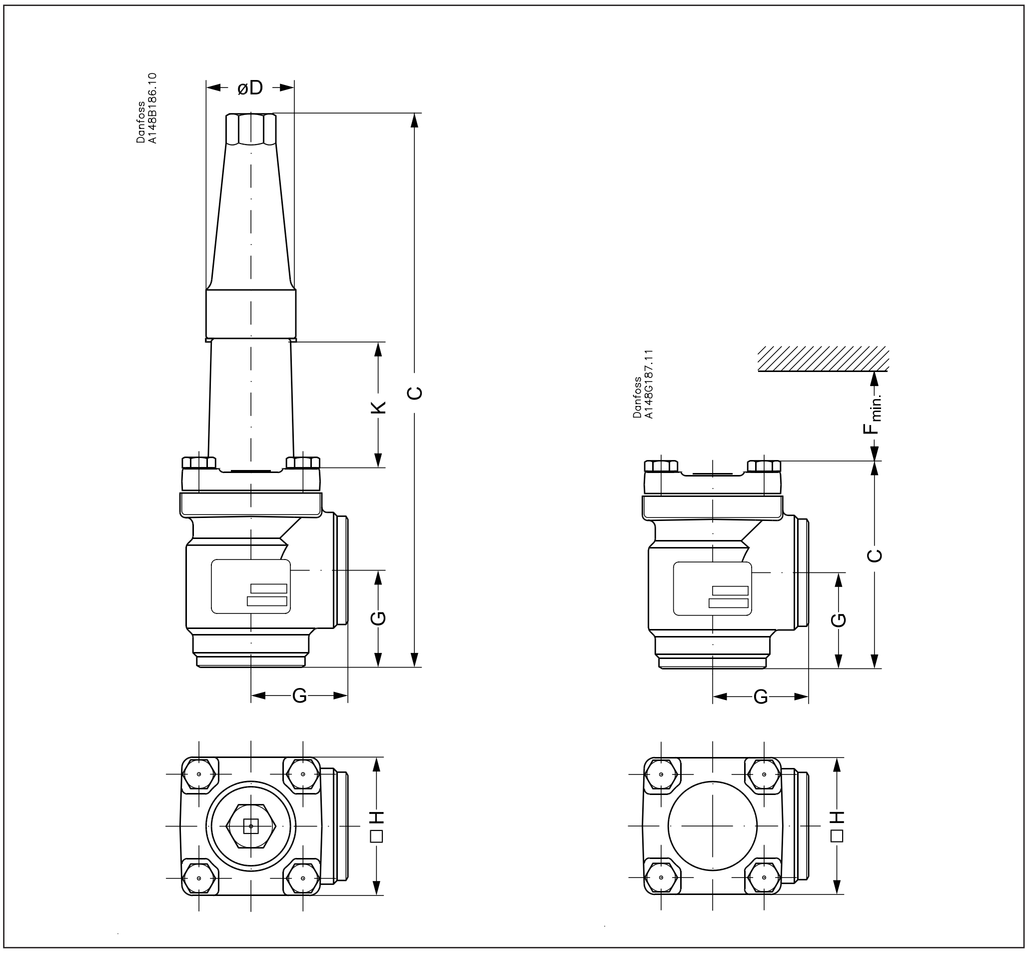
Valve size		C		G		∅D		F_{min}		□H	Weight
SCA 15 - 40											
SCA 15 (½ in.)	mm in.	212 8.35		45 1.77		38 1.50		60 2.36		60 2.36	1.6 kg
SCA 20 (¾ in.)	mm in.	212 8.35		45 1.77		38 1.50		60 2.36		60 2.36	1.6 kg
SCA 25 (1 in.)	mm in.	295 11.61		55 2.17		50 1.97		85 3.35		70 2.76	3.2 kg
SCA 32 (1¼ in.)	mm in.	295 11.61		55 2.17		50 1.97		85 3.35		70 2.76	3.2 kg
SCA 40 (1½ in.)	mm in.	295 11.61		55 2.17		50 1.97		85 3.35		70 2.76	3.2 kg

Valve size		C		G				F_{min}		□H	Weight
CHV 15 - 40											
CHV 15 (½ in.)	mm in.	103 4.06		45 1.77				60 2.36		60 2.36	1.2 kg
CHV 20 (¾ in.)	mm in.	103 4.06		45 1.77				60 2.36		60 2.36	1.2 kg
CHV 25 (1 in.)	mm in.	143 5.63		55 2.17				85 3.35		70 2.76	2.3 kg
CHV 32 (1¼ in.)	mm in.	143 5.63		55 2.17				85 3.35		70 2.76	2.3 kg
CHV 40 (1½ in.)	mm in.	143 5.63		55 2.17				85 3.35		70 2.76	2.3 kg

Specified weights are approximate values only.

Dimensions and weights

SCA/CHV 50 - 65 (2 - 2½ in.)



Valve size	K			C		G		∅D	□H		Weight

SCA

SCA 50 mm SCA (2) in.	70 2.76			315 12.40		60 2.36		50 1.97	77 3.03		3.8 kg 8.40 lb
SCA 65 mm SCA (2½) in.	70 2.76		12.20	335 13.19		70 2.76	3.94	50 1.97	90 3.54		5.5 kg 12.16 lb

Valve size				C		G		$F_{min.}$	□H		Weight

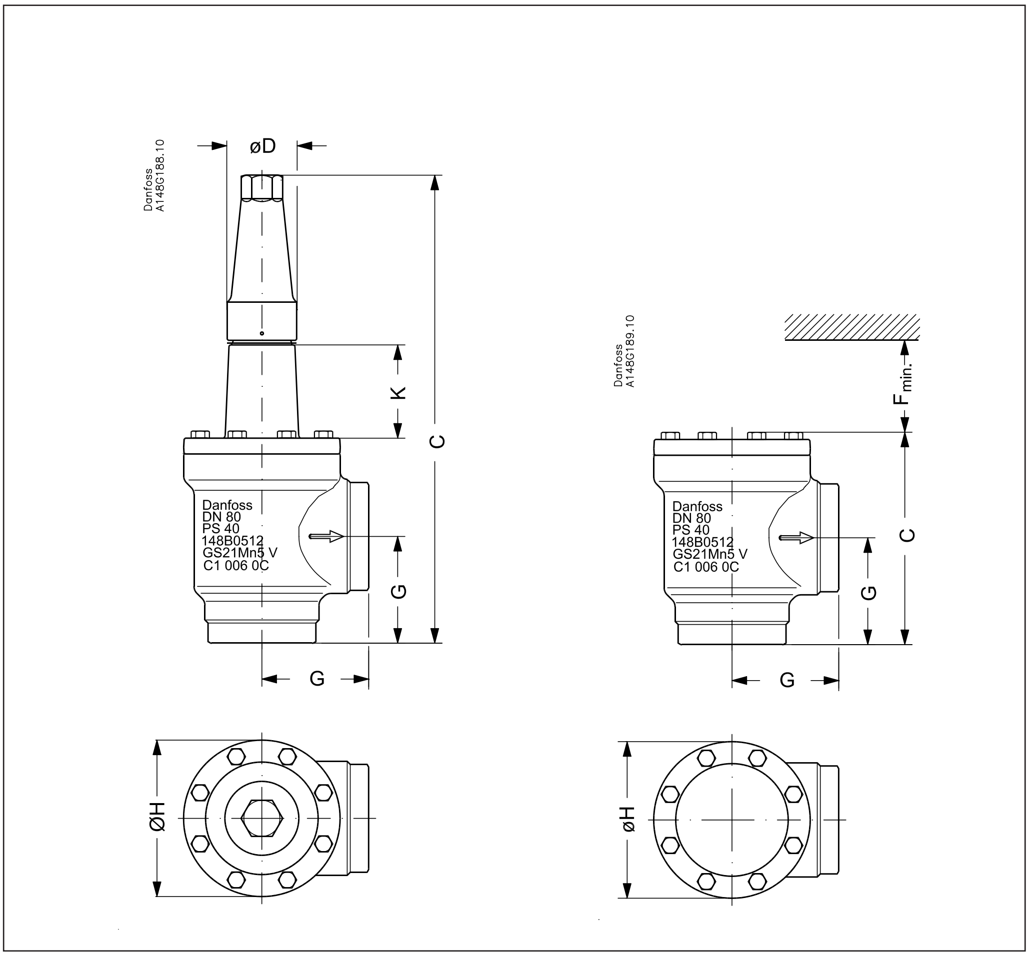
CHV

CHV 50 mm CHV (2) in.				132 5.20		60 2.36		92 3.62	77 3.03		3.2 kg 7.10 lb
CHV 65 mm CHV (2½) in.				152 5.98		70 2.76		107 4.21	90 3.54		4.5 kg 9.95 lb

Specified weights are approximate values only.

Dimensions and weights

SCA/CHV 80 - 125 (3 - 5 in.)



Valve size	K			C		G		∅D		∅H	Weight
SCA											
SCA 80 mm SCA (3) in.	76 3.00			388 15.28		90 3.54		58 2.28		129 5.08	9.7 kg 21.4 lb
SCA 100 mm SCA (4) in.	90 3.54			437 17.20		106 4.17		58 2.28		156 6.14	15.3 kg 33.7 lb
SCA125 mm SCA (5) in.	90 3.54			533 20.98		128 5.04		74 2.91		193 7.60	28.1 kg 61.9 lb

Valve size				C		G			$F_{min.}$	∅H	Weight
CHV											
CHV 80 mm CHV (3) in.				189 7.44		90 3.54			133 5.24	129 5.08	8.7 kg 19.23 lb
CHV 100 mm CHV(4) in.				223 8.78		106 4.17			163 6.43	156 6.14	14.3 kg 31.60 lb
CHV125 mm CHV(5) in.				268 10.55		128 5.04			190 7.48	193 7.60	25.6 kg 56.58 lb

Specified weights are approximate values only.

Line Components

Ordering

How to order
The table below is used to identify the valve required.

Please note that the type codes only serve to identify the valves, some of wich may not form part of the standard product range.

For further information please contact your local Danfoss Sales Company.

Valve type	**SCA** **CHV**	Stop Check Valve Check Valve			
			ANSI	**D I N**	**SOC**
(valve size measured on the connection diameter)	**15**	DN 15	x	x	
	20	DN 20	x	x	
	25	DN 25	x	x	
	32	DN 32	x	x	
	40	DN 40	x	x	
	50	DN 50	x	x	x
	65	DN 65	x	x	
	80	DN 80	x	x	
	100	DN 100	x	x	
	125	DN 125	x	x	
Connections	**A**	Welding branches: ANSI B 31.5 schedule 80 DN 15 - 40 (½ - 1½ in.) Welding branches: ANSI B 31.5 schedule 40 DN 50 - 125 (2 - 5 in.)			
	D	Welding branches: DIN 2448			
Valve housing	**ANG**	Angle flow			

Important!
Where products need to be certified according to specific certification societies, or where higher pressures are required, the relevant information should be included at the time of order.

CHV, butt-weld DIN

Size mm	Size in.	Type	**Code No.**
15	½	CHV 15 D ANG	**148G3072**
15	½	CHV-SS 15 D ANG 52BAR	**148G3537**
20	¾	CHV 20 D ANG	**148G3074**
20	¾	CHV-SS 20 D ANG 52BAR	**148G3538**
25	1	CHV 25 D ANG	**148G3080**
25	1	CHV-SS 25 D ANG 52BAR	**148G3539**
32	1¼	CHV 32 D ANG	**148G3082**
32	1¼	CHV-SS 32 D ANG 52BAR	**148G3540**
40	1½	CHV 40 D ANG	**148G3084**
40	1½	CHV-SS 40 D ANG 52BAR	**148G3541**
50	2	CHV 50 D ANG	**148G3129**
65	2½	CHV 65 D ANG	**148G3130**
80	3	CHV 80 D ANG	**148G3131**
100	4	CHV 100 D ANG	**148G3132**
125	5	CHV 125 D ANG	**148G3133**

SCA, butt-weld DIN

Size mm	Size in.	Type	**Code No.**
15	½	SCA 15 D ANG	**148G3076**
15	½	SCA-SS 15 D ANG 52BAR	**148G3532**
20	¾	SCA 20 D ANG	**148G3078**
20	¾	SCA-SS 20 D ANG 52BAR	**148G3533**
25	1	SCA 25 D ANG	**148G3086**
25	1	SCA-SS 25 D ANG 52BAR	**148G3534**
32	1¼	SCA 32 D ANG	**148G3088**
32	1¼	SCA-SS 32 D ANG 52BAR	**148G3535**
40	1½	SCA 40 D ANG	**148G3090**
40	1½	SCA-SS 40 D ANG 52BAR	**148G3536**
50	2	SCA 50 D ANG	**148G3134**
65	2½	SCA 65 D ANG	**148G3135**
80	3	SCA 80 D ANG	**148G3136**
100	4	SCA 100 D ANG	**148G3137**
125	5	SCA 125 D ANG	**148G3138**

CHV, butt-weld ANSI

Size mm	Size in.	Type	**Code No.**
15	½	CHV 15 A ANG	**148G3073**
20	¾	CHV 20 A ANG	**148G3075**
25	1	CHV 25 A ANG	**148G3081**
32	1¼	CHV 32 A ANG	**148G3083**
40	1½	CHV 40 A ANG	**148G3085**
50	2	CHV 50 A ANG	**148G3139**
65	2½	CHV 65 A ANG	**148G3140**
80	3	CHV 80 A ANG	**148G3141**
100	4	CHV 100 A ANG	**148G3142**
125	5	CHV 125 A ANG	**148G3143**

SCA, butt-weld ANSI

Size mm	Size in.	Type	**Code No.**
15	½	SCA 15 A ANG	**148G3077**
20	¾	SCA 20 A ANG	**148G3079**
25	1	SCA 25 A ANG	**148G3087**
32	1¼	SCA 32 A ANG	**148G3089**
40	1½	SCA 40 A ANG	**148G3091**
50	2	SCA 50 A ANG	**148G3144**
65	2½	SCA 65 A ANG	**148G3145**
80	3	SCA 80 A ANG	**148G3146**
100	4	SCA 100 A ANG	**148G3147**
125	5	SCA 125 A ANG	**148G3148**

CHV, socket weld SOC

Size mm	Size in.	Type	**Code No.**
50	2	CHV 50 SOC ANG	**148G3149**

SCA, socket weld SOC

Size mm	Size in.	Type	**Code No.**
50	2	SCA 50 SOC ANG	**148G3150**

Introduction

Check valve type NRVA can be used in liquid, suction and hot gas lines in refrigeration and air conditioning plant with ammonia.
NRVA can also be used in refrigerating systems with fluorinated refrigerants.

When the NRVA is used in liquid lines where cold, thick oil or impurities may be present, it is recommended that the standard spring be replaced by a special spring. See ordering table.

Features

- Ensures correct direction of flow.
- Valve housing made of steel.
- Available for 40 bar g (580 psig) working pressure.
- Large range of flanges with connection dimensions in accordance with standards: DIN, ANSI, SOC, SA and FPT.
- Fitted with damping piston that makes the valves suitable for installation in lines where pulsation can occur, e.g. in the discharge line from the compressor.

Design

Connections
There is a very wide range of connection possibilities with NRVA check valves:

- Welding, DIN (2448)
- Welding, ANSI (B 36.10)
- Welding socket, ANSI (B 16.11)
- Solder connection, DIN (2856)
- Solder connection, ANSI (B 16.22)
- FPT internal thread, NPT (ANSI/ASME B 1.20.1)

Gaskets:
Do not contain asbestos.

Valve cone:
The valve cone has a teflon tightening ring. Teflon tightening ring renders perfect sealing at a minimum closing force.

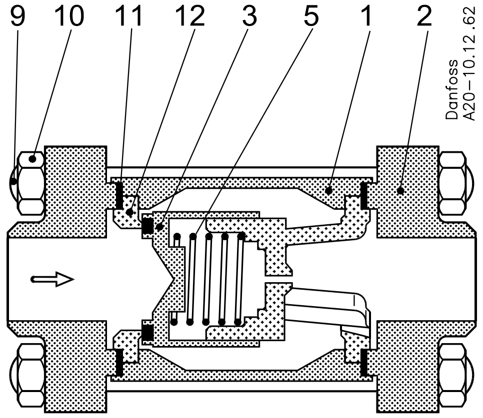
Technical data

- *Refrigerants*
  Can be used for all normal, non-flammable refrigerants, including R 717, and non-corrosive gases/liquids - assuming seals of the correct material are used.For further information please see installation instruction for NRVA.

  Use with flammable hydrocarbons cannot be recommended; please contact Danfoss.
- *Temperature range*
  –50°C / +140°C (–58°F / +284°F).
- *Pressure range*
  The valve is designed for:
  Max. working pressure: 40 bar g (580 psig).

The complete technical leaflet (RD6HA) can be downloaded from the Danfoss web site.

Material specification

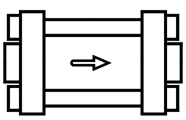


Material specification for NRVA check valves

No.	Part	Material	DIN	ISO	ASTM
1	Housing	Steel	G20Mn5QT *) EN 10213-3		LCC, A352
2	Flanges	Steel	RSt. 37-2, 10025	Fe360 B, 630	Grade C, A 283
3	Valve cone	Stainless steel Teflon			
5	Spring	Steel			
9	Bolts	Stainless steel	A2-70		
10	Nut	Stainless steel			
11	Gasket	Non asbestos			
12	Valve seat	Steel			

*) NRVA 40 / NRVA 50 housing material is TTSt 35N until January 2006

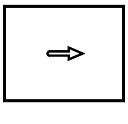
Ordering



Complete valves incl. DIN 2448 flange:

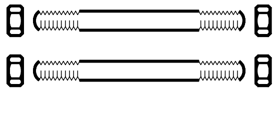
Type	Weld flange connection	Code no.		Δp [2]				k_v value [3]	C_v value [4]
		Valve	Spec. spring [1]	With standard spring		With spec. spring [1]			
	in.			bar	psig	bar	psig	m³/h	gal/min
NRVA 15	$^{1}/_{2}$	**020-2000**	**020-2307**	0.12	1.7	0.3	4.4	5	6
NRVA 20	$^{3}/_{4}$	**020-2001**	**020-2307**	0.12	1.7	0.3	4.4	6	7
NRVA 25	1	**020-2002**	**020-2317**	0.12	1.7	0.3	4.4	19	22
NRVA 32	1$^{1}/_{4}$	**020-2003**	**020-2317**	0.12	1.7	0.3	4.4	20	23
NRVA 40	1$^{1}/_{2}$	**020-2004**	**020-2327**	0.07	1.0	0.4	5.8	44	51
NRVA 50	2	**020-2005**	**020-2327**	0.07	1.0	0.4	5.8	44	51
NRVA 65	2$^{1}/_{2}$	**020-2006**	**020-2337**	0.07	1.0	0.4	5.8	75	87

[1]) A special type spring can be supplied to replace the standard valve spring.
[2]) Δp = the minimum pressure differential at which the valve is completely open.
[3]) The k_v value is the flow of water in m³/h at a pressure drop across valve of 1 bar, ρ = 1000 kg/m³.
[4]) The C_v value is the flow of water in gal/min at a pressure drop across valve of 1 psig, ρ = 10 lbs/gal.



Valve body without flanges:

Type	Code no.
NRVA 15	**020-2020**
NRVA 20	**020-2020**
NRVA 25	**020-2022**
NRVA 32	**020-2022**
NRVA 40	**020-2024**
NRVA 50	**020-2024**
NRVA 65	**020-2026**



Staybolts and gaskets

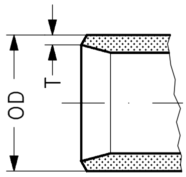
Type	Dimensions	Code no.
NRVA 15 / 20	M 12 × 115 mm	**006-1107**
NRVA 25 / 32	M 12 × 148 mm	**006-1135**
NRVA 40 / 50	M 12 × 167 mm	**006-1137**
NRVA 65	M 16 × 200 mm	**006-1138**

Flange connections

Danfoss flange sets excluding gaskets, bolts and nuts, are specially made for the Danfoss product range and must only be used for the purpose described.

Select the valve based on capacity and then select the size of flanges most suitable for the application, which can be mounted on the valve.

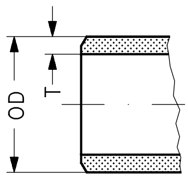
DIN



Butt welding DIN (2448)

Size mm	Size in.	OD mm	T mm	OD in.	T in.	Flange type	For use with valve housing size	Code no.
10	3/8	18	2	0.710	0.079	1.3	NRVA 15/20	**027N1112**
15	1/2	22	2.5	0.866	0.098	1.3	NRVA 15/20	**027N1115**
20	3/4	26.9	2.3	1.059	0.091	1.3	NRVA 15/20	**027N1120**
25	1	33.7	2.6	1.327	0.103	4	NRVA 25/32	**027N1026**
32	1 1/4	42.4	2.6	1.669	0.102	4	NRVA 25/32	**027N1033**
40	1 1/2	48.3	2.6	1.902	0.103	6	NRVA 40/50	**027N1042**
50	2	60.3	2.9	2.370	0.110	6	NRVA 40/50	**027N1051**
65	2 1/2	76.1	2.9	3.000	0.110	8	NRVA 65	**027N1055**

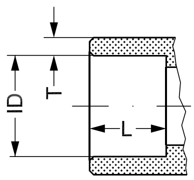
ANSI



Butt welding ANSI B 36.10

Size mm	Size in.	OD mm	T mm	OD in.	T in.	Flange type	For use with valve housing size	Code no.
10	3/8	17.2	3.2	0.677	0.126	1.3	NRVA 15/20	**027N2020**
15	1/2	21.3	3.7	0.839	0.146	1.3	NRVA 15/20	**027N2021**
20	3/4	26.9	4.0	1.059	0.158	1.3	NRVA 15/20	**027N2022**
25	1	33.7	4.6	1.327	0.181	4	NRVA 25/32	**027N2023**
32	1 1/4	42.4	4.9	1.669	0.193	4	NRVA 25/32	**027N2024**
40	1 1/2	48.3	5.1	1.902	0.201	6	NRVA 40/50	**027N2025**
50	2	60.3	3.9	2.370	0.150	6	NRVA 40/50	**027N2026**
65	2 1/2	73.0	5.2	3.000	0.200	8	NRVA 65	**027N2027**

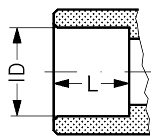
SOC



Socket welding ANSI (B 16.11)

Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.	Flange type	For use with valve housing size	Code no.
10	3/8	17.8	4.1	0.701	0.161	10	0.394	1.3	NRVA 15/20	**027N2010**
15	1/2	22	4.8	0.866	0.189	10	0.394	1.3	NRVA 15/20	**027N2011**
20	3/4	27.4	5.0	1.079	0.197	13	0.512	4	NRVA 25/32	**027N2012**
25	1	34.1	5.8	1.343	0.228	13	0.512	4	NRVA 25/32	**027N2013**
32	1 1/4	42.9	6.0	1.689	0.236	13	0.512	4	NRVA 25/32	**027N2016**
32	1 1/4	42.9	6.2	1.689	0.244	13	0.512	6	NRVA 40/50	**027N2014**
40	1 1/2	49.0	6.5	1.929	0.254	13	0.512	6	NRVA 40/50	**027N2015**

SA



Soldering DIN (2856)

Size mm	Size in.	ID mm		ID in.		L mm	L in.	Flange type	For use with valve housing size	Code no.
16		16.07				15		1.3	NRVA 15/20	**027L1116**
22		22.08				22		1.3	NRVA 15/20	**027L1122**
35		35.07				25		4	NRVA 25/32	**027L2335**
54		54.09				33		4	NRVA 40/50	**027L2554**

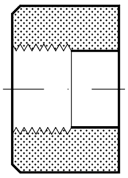
Soldering (ANSI B 16.22)

Size mm	Size in.	ID mm		ID in.		L mm	L in.	Flange type	For use with valve housing size	Code no.
	5/8			0.628			0.807	1.3	NRVA 15/20	**027L1117**
	7/8			0.878			0.866	1.3	NRVA 15/20	**027L1123**
	1 3/8			1.375			0.984	4	NRVA 25/32	**027L2335**
	2 1/8			2.125			1.300	4	NRVA 40/50	**027L2554**

To be continued next page.

Flange connections
(Continued)

FPT

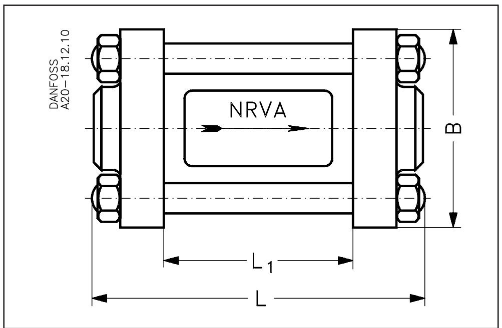


Size mm	Size in.	Inside pipe thread	Flange type	For use with valve housing size	**Code no.**
FPT inside pipe thread, NPT (ANSI/ASME B 1.20.1)					
10	$^3/_8$	($^3/_8$ × 18 NPT)	1.3	NRVA 15/20	**027G1005**
15	$^1/_2$	($^1/_2$ × 14 NPT)	1.3	NRVA 15/20	**027G1006**
20	$^3/_4$	($^3/_4$ × 14 NPT)	4	NRVA 25/32	**027G1007**
25	1	(1 × 11.5 NPT)	4	NRVA 25/32	**027G1008**

Example
NRVA 32 with 1 $^1/_4$" flanges for ANSI butt welding:
NRVA 32 + bolts + flanges (set) =
020-2022 + 006-1135 + 027N2024

NOTE:
The flanges sets are exclusive gaskets, bolts and nuts.

Dimensions and weights

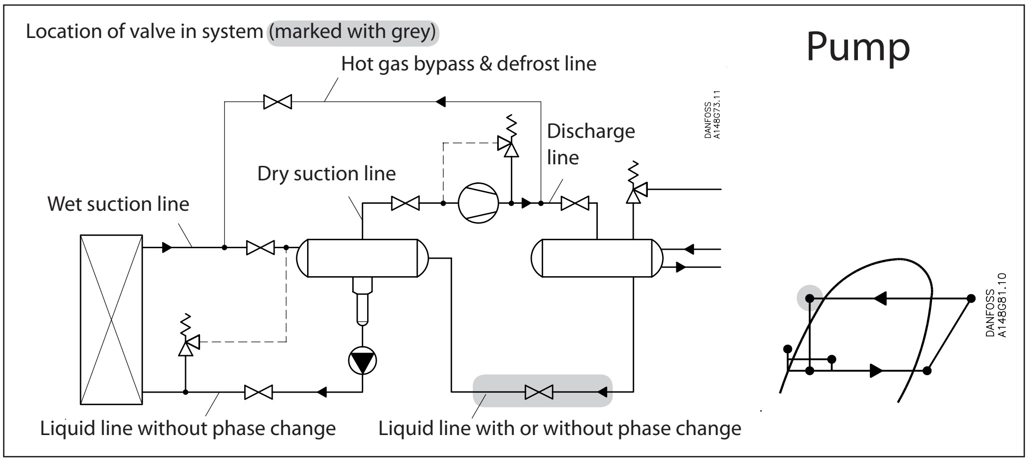


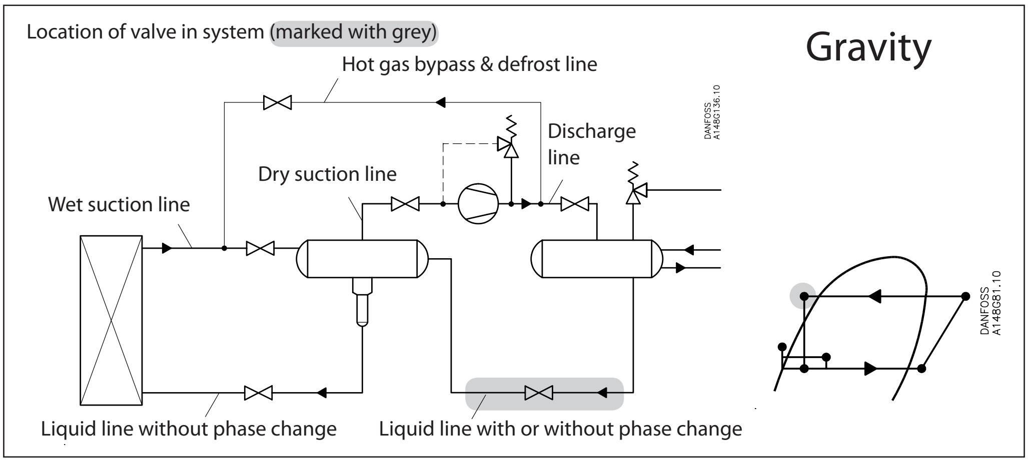
Type		L	L_1 [1]	B	Weight
NRVA 15 - 20	mm	115	50	80	1.4 kg
	in.	4.53	1.97	3.15	3.09 lb
NRVA 25 - 32	mm	138	74	∅ 83	3.0 kg
	in.	5.43	2.91	∅ 3.27	6.61 lb
NRVA 40 - 50	mm	172	94.5	∅ 103	5.0 kg
	in.	6.77	3.72	∅ 4.05	11.02 lb
NRVA 65	mm	226	124	∅ 185	13.0 kg
	in.	8.90	4.88	∅ 7.28	28.66 lb

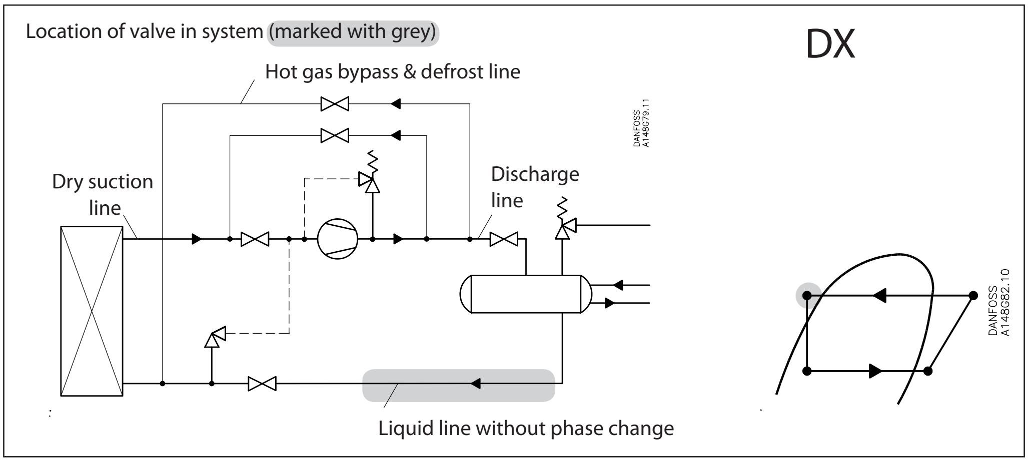
[1]) Without flanges

Nominal capacities

Liquid line with/without phase change







Nominal capacities

Liquid line with/without phase change

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 30°C,
ΔP = 0.2 bar

R 717

Type	k_v m³/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
NRVA 15	5	504	512	519	526	532	537	542	546
NRVA 20	6	605	614	623	631	638	645	651	655
NRVA 25	19	1916	1945	1973	1998	2022	2042	2060	2075
NRVA 32	20	2016	2048	2077	2104	2128	2150	2169	2185
NRVA 40	44	4436	4505	4569	4628	4682	4730	4771	4806
NRVA 50	44	4436	4505	4569	4628	4682	4730	4771	4806
NRVA 65	75	7562	7678	7787	7889	7981	8062	8133	8192

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 3 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
NRVA 15	6	143.9	145.9	147.7	149.2	150.6	151.7	152.5	153.0
NRVA 20	7	173	175	177	179	181	182	183	184
NRVA 25	22	547	554	561	567	572	576	580	581
NRVA 32	23	576	583	591	597	602	607	610	612
NRVA 40	51	1266	1284	1300	1313	1325	1335	1342	1347
NRVA 50	51	1266	1284	1300	1313	1325	1335	1342	1347
NRVA 65	87	2158	2188	2215	2239	2259	2276	2288	2295

* 2°F below min. operating temperature.

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

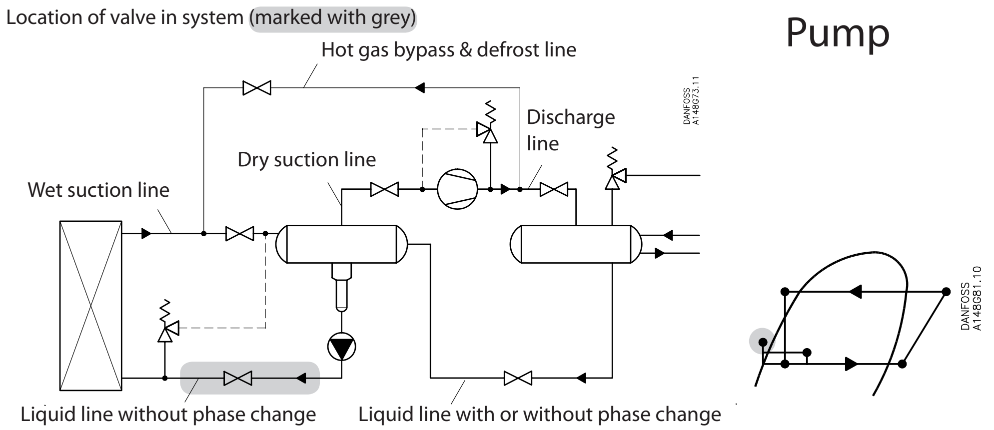
Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

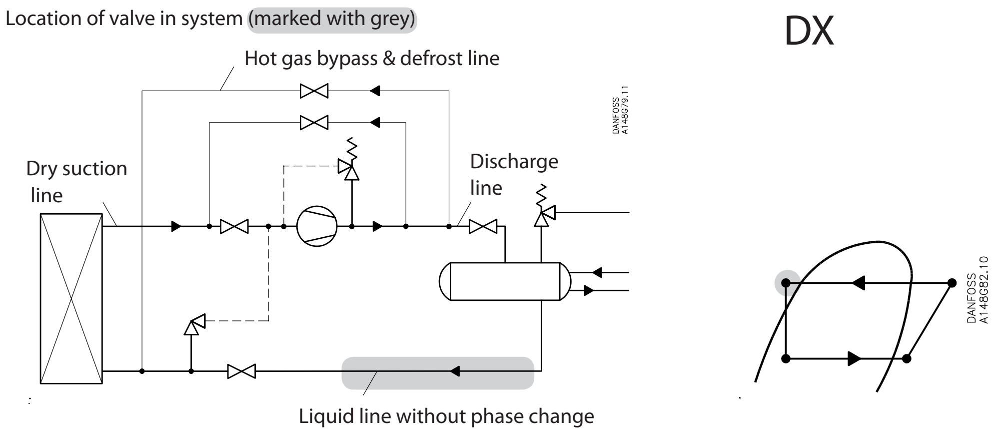
Nominal capacities

Liquid line without phase change

Location of valve in system (marked with grey)



Location of valve in system (marked with grey)



Nominal capacities

Liquid line without phase change

SI units

Capacity table for nominal conditions, Q_N [kW], circulation rate = 4, ΔP = 0.2 bar

R 717

Type	k_v m³/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
NRVA 15	5	182.5	177.1	171.9	166.4	160.7	154.9	148.8	142.5
NRVA 20	6	219	213	206	200	193	186	179	171
NRVA 25	19	693	673	653	632	611	589	566	541
NRVA 32	20	730	708	687	665	643	620	595	570
NRVA 40	44	1606	1559	1512	1464	1414	1363	1310	1254
NRVA 50	44	1606	1559	1512	1464	1414	1363	1310	1254
NRVA 65	75	2737	2657	2578	2495	2411	2324	2232	2137

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], circulation rate = 4, ΔP = 3 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
NRVA 15	6	52.8	51.1	49.5	47.8	45.9	44.0	41.9	39.8
NRVA 20	7	63.3	61.4	59.4	57.4	55.1	52.8	50.3	47.8
NRVA 25	22	200.5	194.4	188.2	181.7	174.5	167.3	159.2	151.4
NRVA 32	23	211	205	198	191	184	176	168	159
NRVA 40	51	464	450	436	421	404	387	369	351
NRVA 50	51	464	450	436	421	404	387	369	351
NRVA 65	87	792	767	743	717	689	660	628	598

* 2°F below min. operating temperature.

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for circulation rate (f_{rec})

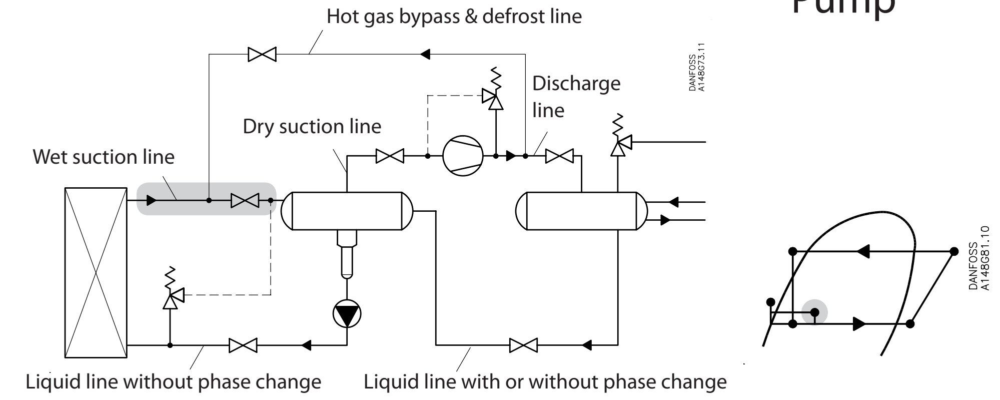
Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

Nominal capacities

Wet suction line

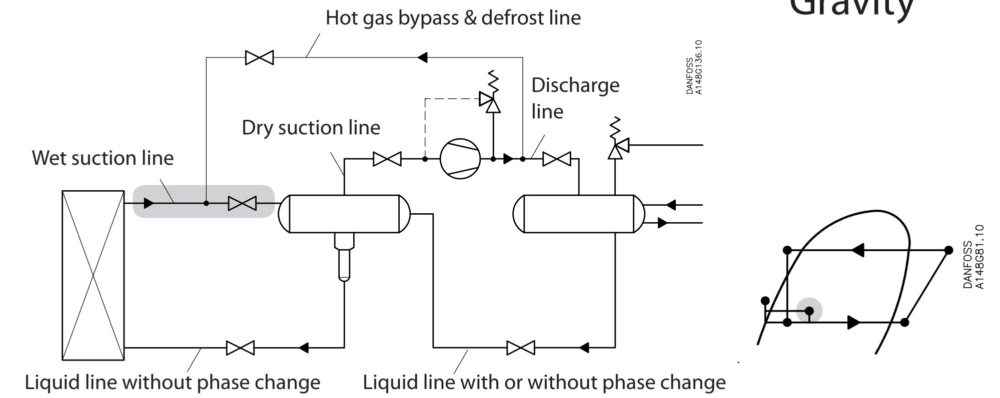
Location of valve in system (marked with grey)

Pump



Location of valve in system (marked with grey)

Gravity



Nominal capacities

Wet suction line

SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20°C$
$Q_0 = 100$ kW
Circulation rate = 3
Max. $\Delta P = 0.3$ bar

The capacity table is based on nominal conditions (pressure drop $\Delta P = 0.2$ bar, circulation rate = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 0.3 bar $f_{\Delta P} = 0.82$
Correction factor for circulation rate $f_{rec} = 0.9$.

$Q_n = Q_0 \times f_{\Delta P} \times f_{rec} = 100 \times 0.82 \times 0.9 = 73{,}8$ kW.

From the capacity table a NRVA 40 with $Q_n = 157$ kW is the correct selection for the application.

Choosing NRVA 32 would give a slightly higher pressure drop than 0.3. Accepting this requires a plant evaluation.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20°F$
$Q_0 = 10$ TR
Circulation rate = 3
Max. $\Delta P = 5$ psi

The capacity table is based on nominal conditions (pressure drop $\Delta P = 3$ psi, circulation rate = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 5 psi $f_{\Delta p} = 0.79$
Correction factor for circulation rate $f_{rec} = 0.9$.

$Q_n = Q_0 \times f_{\Delta P} \times f_{circ} = 10 \times 0.79 \times 0.9 = 7.1$ TR

From the capacity table a NRVA 25 with $Q_n = 16.5$ TR is the correct selection for the application.

Nominal capacities

Wet suction line

SI units

Capacity table for nominal conditions, Q_N [kW], circulation rate = 4, ΔP = 0.2 bar

R 717

Type	k_v m^3/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
NRVA 15	5	9.1	11.8	14.7	17.9	21.3	24.9	28.7	32.6
NRVA 20	6	11.0	14.2	17.6	21.4	25.5	29.9	34.5	39.2
NRVA 25	19	34.7	45.0	55.9	67.9	80.9	94.7	109.1	124.0
NRVA 32	20	36.6	47.3	58.8	71.5	85.1	99.7	115	131
NRVA 40	44	80.4	104.1	129.4	157	187	219	253	287
NRVA 50	44	80.4	104	129	157	187	219	253	287
NRVA 65	75	137	178	221	268	319	374	431	490

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], circulation rate = 4, ΔP = 3 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
NRVA 15	6	2.5	3.4	4.3	5.4	6.5	7.7	8.9	10.1
NRVA 20	7	3.1	4.1	5.2	6.5	7.8	9.2	10.7	12.1
NRVA 25	22	9.7	13.0	16.5	20.5	24.7	29.2	33.8	38.5
NRVA 32	23	10.2	13.7	17.3	21.6	26.0	30.8	35.5	40.5
NRVA 40	51	22.4	30.1	38.1	47.5	57.2	67.7	78.2	89.1
NRVA 50	51	22.4	30.1	38.1	47.5	57.2	67.7	78.2	89.1
NRVA 65	87	38.2	51.3	65.0	80.9	97.6	115	133	152

* 2°F below min. operating temperature.

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for circulation rate (f_{rec})

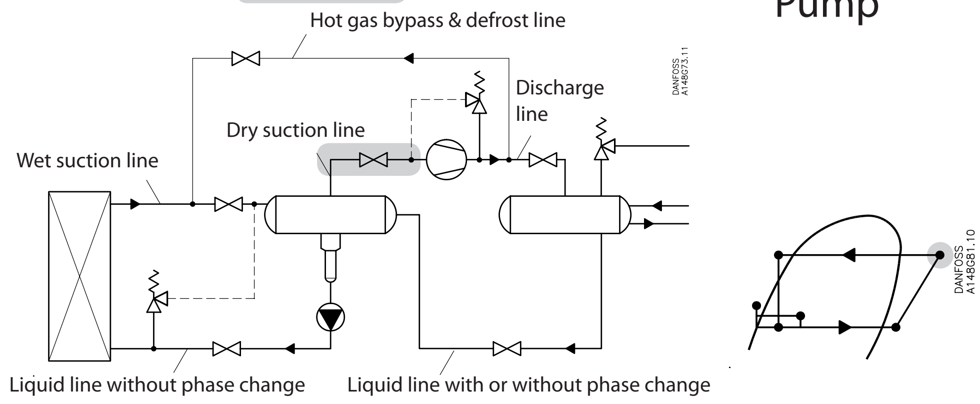
Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

Nominal capacities

Dry suction line

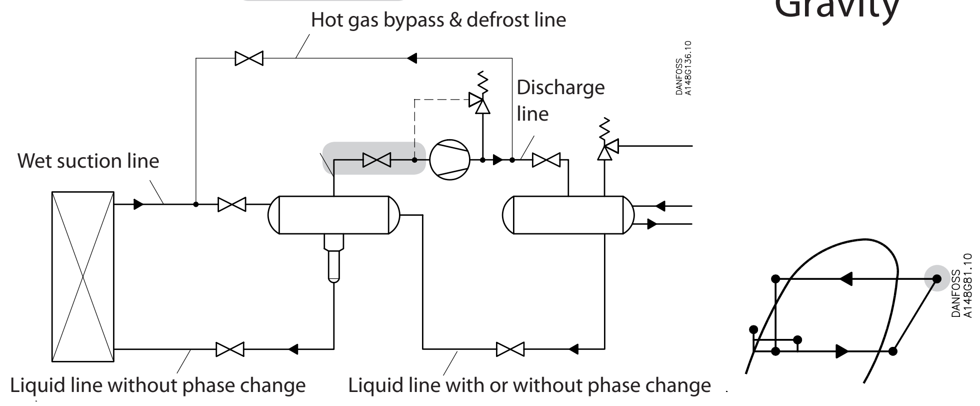
Location of valve in system (marked with grey)

Pump



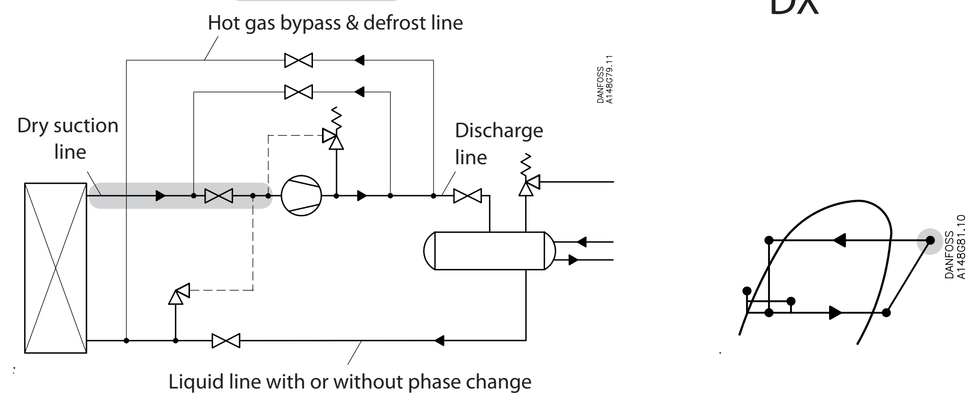
Location of valve in system (marked with grey)

Gravity



Location of valve in system (marked with grey)

DX



Nominal capacities

Dry suction line

SI units

Capacity table for nominal conditions, Q_N [kW], T_{liq} = 30°C, ΔP = 0.2 bar

R 717

Type	k_v m^3/h	Evaporating temperature T_e							
		−50°C	−40°C	−30°C	−20°C	−10°C	0°C	10°C	20°C
NRVA 15	5	12.9	17.0	21.8	27.5	33.7	41.0	49.0	57.9
NRVA 20	6	15.5	20.4	26.2	32.9	40.5	49.2	58.9	69.5
NRVA 25	19	49.0	64.7	82.8	104.3	128.2	155.7	186	220
NRVA 32	20	51.6	68.1	87.2	109.8	135	164	196	232
NRVA 40	44	113.5	149.7	192	242	297	361	432	510
NRVA 50	44	113	150	192	242	297	361	432	510
NRVA 65	75	193	255	327	412	506	615	736	869

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for superheat (T_S)

T_s	Correction factor
6°C	1.00
8°C	1.00
10°C	1.00
12°C	1.00

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
−20°C	0.82
−10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], T_{liq} = 90°F, ΔP = 3 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		−60°F*	−40°F	−20°F	0°F	20°F	40°F	60°F	80°F
NRVA 15	6	3.6	4.9	6.4	8.2	10.4	12.8	15.4	18.3
NRVA 20	7	4.3	5.9	7.7	9.8	12.4	15.4	18.5	22.0
NRVA 25	22	13.6	18.7	24.4	31.2	39.4	48.6	58.5	69.7
NRVA 32	23	14.3	19.7	25.7	32.8	41.4	51.2	61.5	73.3
NRVA 40	51	31.5	43.2	56.5	72.2	91.2	112.6	135.4	161
NRVA 50	51	31.5	43.2	56.5	72.2	91.2	113	135	161
NRVA 65	87	53.6	73.7	96.3	123	155	192	231	275

* 2°F below min. operating temperature.

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for superheat (T_S)

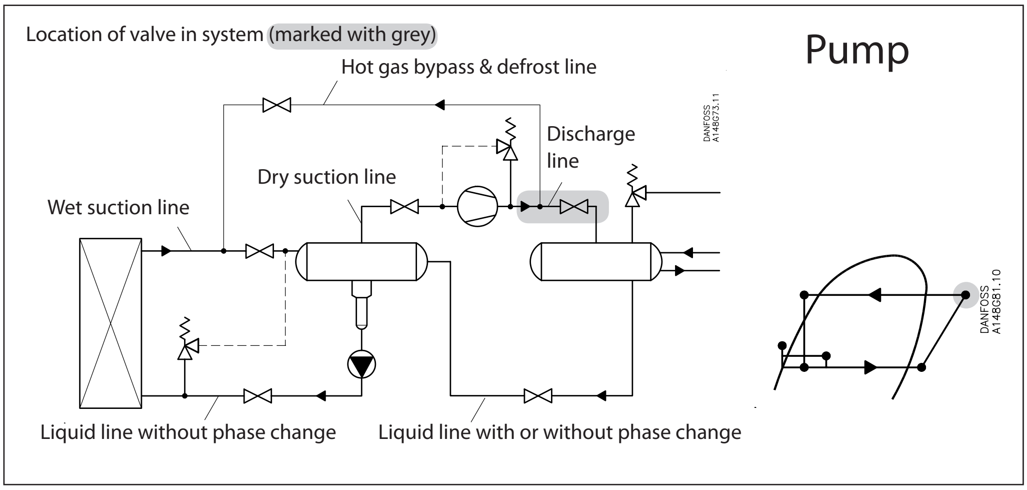
T_s	Correction factor
10°F	1.00
14°F	1.00
18°F	1.00
20°F	1.00

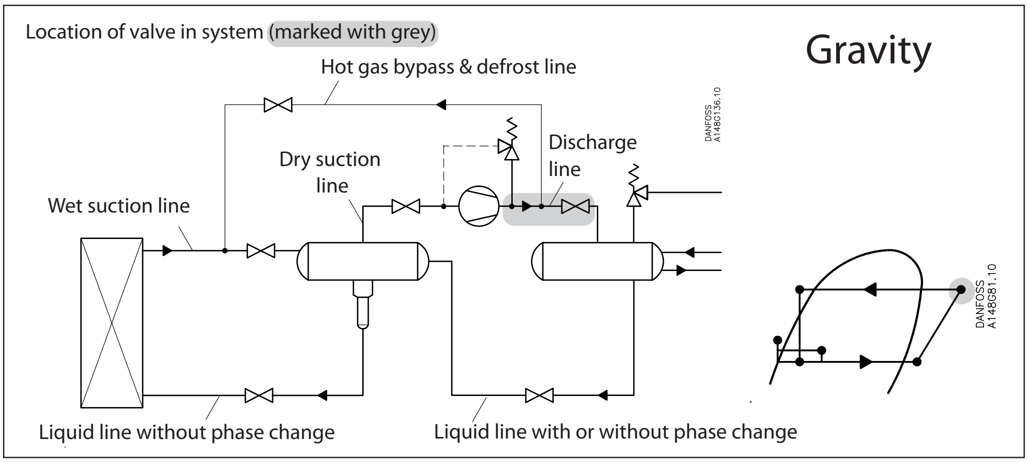
Correction factor for liquid temperature (T_{liq})

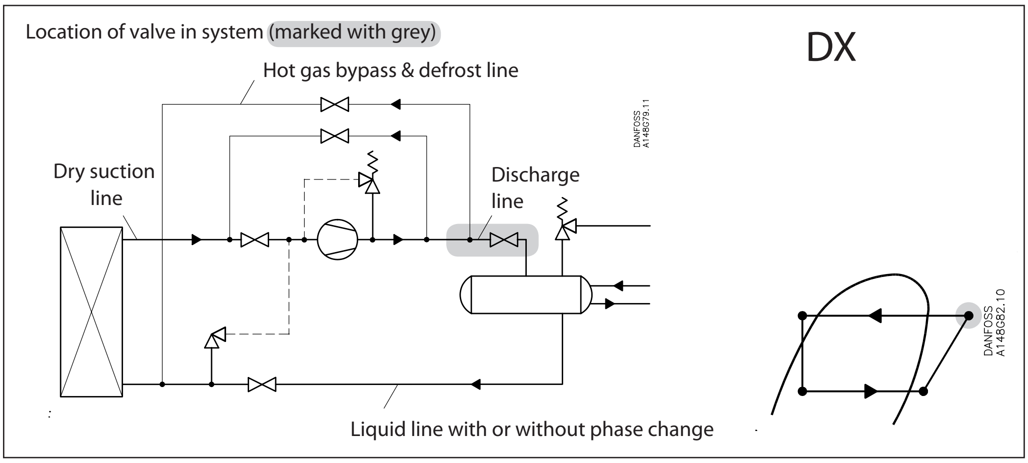
Liquid temperature	Correction factor
−10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

Nominal capacities

Discharge line







Nominal capacities

Discharge line

SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20$ °C
$Q_o = 90$ kW
$T_{liq} = 10$ °C
Max. $\Delta P = 0.4$ bar
$T_{disch} = 60$°C

The capacity table is based on nominel conditions ($\Delta P = 0.2$ bar, $T_{liq} = 30$°C, $P_{disch} = 12$ bar, $T_{disch} = 80$°C).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 0.4 bar $f_{\Delta P} = 0.72$.
Correction factor for liquid temperature $f_{Tliq} = 0.92$.
Correction factor for T_{disch} 60°C, $f_{disch} = 0.97$.
Correction factor for P_{disch} 12 bar, $f_{pdisch} = 1.0$.

$Q_n = Q_o \times f_{\Delta P} \times f_{Tliq} \times f_{Tdisch} \times f_{Pdisch}$
$= 90 \times 0.72 \times 0.92 \times 0.97 \times 1.0 = 58$ kW.

From the capacity table a NRVA 20 with $Q_n = 67.5$ kW is the correct selection for the application.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = 0$°F
$Q_o = 18$ TR
$T_{liq} = 50$ °F
Max. $\Delta P = 7$ psi
$T_{disch} = 120$°F

The capacity table is based on nominel conditions ($\Delta P = 3$ psi, $T_{liq} = 90$ °F, $P_{disch} = 185$ psi, $T_{disch} = 180$°F).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 7 psi $f_{\Delta P} = 0.67$.
Correction factor for liquid temperature $f_{Tliq} = 0.92$.
Correction factor for T_{disch} 120°F, $f_{disch} = 0.95$.
Correction factor for P_{disch} 185 psi, $f_{pdisch} = 1.0$.

$Q_n = Q_o \times f_{\Delta P} \times f_{Tliq} \times f_{circ} \times f_{Pdisch}$
$= 18 \times 0.67 \times 0.92 \times 0.95 \times 1.0 = 10.5$ TR

From the capacity table a NRVA 15 with $Q_n = 16.4$ TR is the correct selection for the application.

Nominal capacities

Discharge line

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 30°C,
$P_{disch.}$ = 12 bar,
ΔP = 0.2 bar,
$T_{disch.}$ = 80°C

R 717

Type	k_v m³/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
NRVA 15	5	53.9	54.8	55.5	56.3	56.9	57.5	58.0	58.4
NRVA 20	6	64.7	65.7	66.6	67.5	68.3	69.0	69.6	70.1
NRVA 25	19	205	208	211	214	216	218	220	222
NRVA 32	20	216	219	222	225	228	230	232	234
NRVA 40	44	475	482	489	495	501	506	510	514
NRVA 50	44	475	482	489	495	501	506	510	514
NRVA 65	75	809	821	833	844	854	862	870	876

Correction factor for discharge pressure (P_{disch})

P_{disch} (bar)	Correction factor
12	**1.00**
16	0.87
20	0.78

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.4	0.72
0.6	0.59
0.8	0.52
1	0.46
1.5	0.39
2	0.34
4	0.27

Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
50°C	0.96
60°C	0.97
80°C	**1.00**
90°C	1.01
100°C	1.03
110°C	1.04
120°C	1.06

Correction factor for liquid temperature (T_{liq}).

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 3 psi,
$P_{disch.}$ = 185 psi,
$T_{disch.}$ = 180°F

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
NRVA 15	6	15.8	16.0	16.3	16.4	16.5	16.7	16.7	16.8
NRVA 20	7	19.0	19.2	19.5	19.7	19.8	20.1	20.1	20.2
NRVA 25	22	60.1	60.9	61.8	62.3	62.8	63.5	63.6	63.9
NRVA 32	23	63	64	65	66	66	67	67	67
NRVA 40	51	139	141	143	144	145	147	147	148
NRVA 50	51	139	141	143	144	145	147	147	148
NRVA 65	87	237	241	244	246	248	251	251	252

* 2°F below min. operating temperature.

Correction factor for discharge pressure (P_{disch})

P_{disch} (psi)	Correction factor
185	**1.00**
240	0.87
300	0.78

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
5	0.79
7	0.67
10	0.56
15	0.47
20	0.41
30	0.35
60	0.28

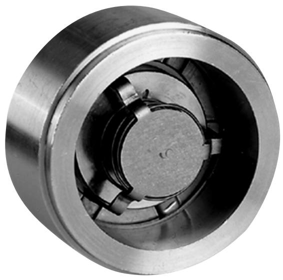
Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
120°F	0.95
140°F	0.97
180°F	**1.00**
200°F	1.02
210°F	1.02
230°F	1.04
250°F	1.06

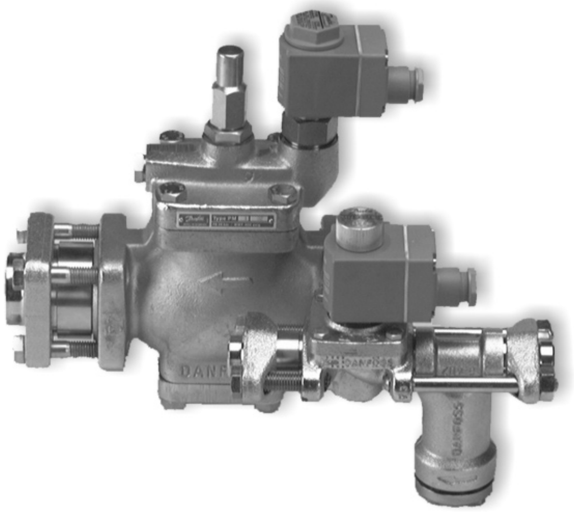
Correction factor for liquid temperature (T_{liq}).

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

Introduction



NRVS



NRVS mounted on PM and EVRA valve

Check valve type NRVS has no damping feature and therefore can only be used for liquid line applications. NRVS is designed to be mounted directly to PM or solenoid valves EVRA/EVRAT.

Features

- Ensures correct direction of flow
- Applicable to all common non flammable refrigerants including R717 and non corrosive gases/liquids dependent on sealing material compatability.

Technical data

Temperature of medium:
–50°C → +140°C

Maximum working pressure
PS = 28 bar/406 psig

Materials

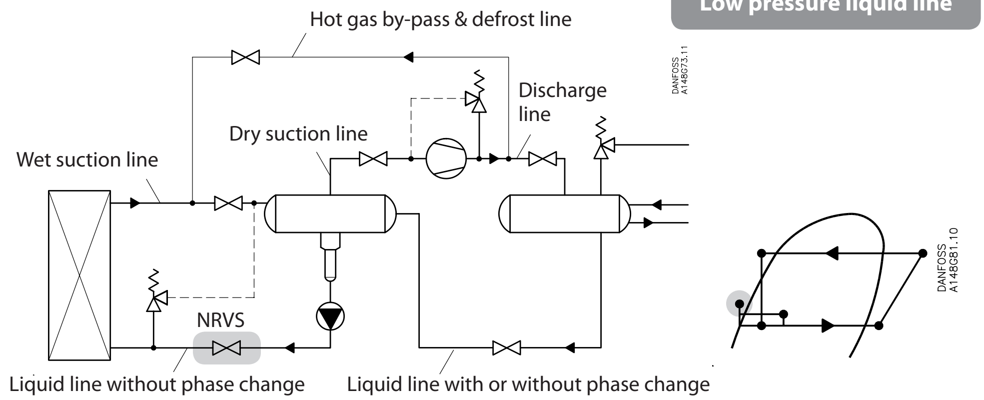
- Valve housing made of Stainless Steel
- Gaskets are non-asbestos

The complete technical leaflet (RD6NA) can be downloaded from the Danfoss web site.

Capacities

Location of valve in system (marked with grey)

Low pressure liquid line



Valve combination	EVRA/EVRAT 10 + NRVS 15	EVRA/EVRAT 15 + NRVS 15	EVRA/EVRAT 20 + NRVS 25	EVRA + NRVS 25
k_v (m^3/h)	1.4	2.2	4.1	7.0

Evaporating temperature T_e	Pressure Δp (bar)	Capacities (kW) Q_0 at circulation rate 1 R717			
–40°C	0.15	172	270	504	960
	0.25	222	349	650	1110
	0.30	243	382	713	1216
	0.40	281	441	823	1405
	0.50	314	493	920	1570
–30°C	0.15	167	262	489	835
	0.25	215	338	631	1078
	0.30	236	371	691	1180
	0.40	273	428	798	1363
	0.50	305	479	893	1524
–20°C	0.15	161	254	473	808
	0.25	208	327	610	1042
	0.30	228	359	669	1142
	0.40	264	414	772	1319
	0.50	295	463	863	1475
–10°C	0.15	156	245	456	780
	0.25	201	316	589	1005
	0.30	220	346	645	1102
	0.40	254	399	745	1271
	0.50	284	447	833	1422

Note: The capacities in the table must be divided by the actual circulation rate, or the evaporator capacities must be multiplied with the actual circulation rate.

Minimum opening differential pressure:

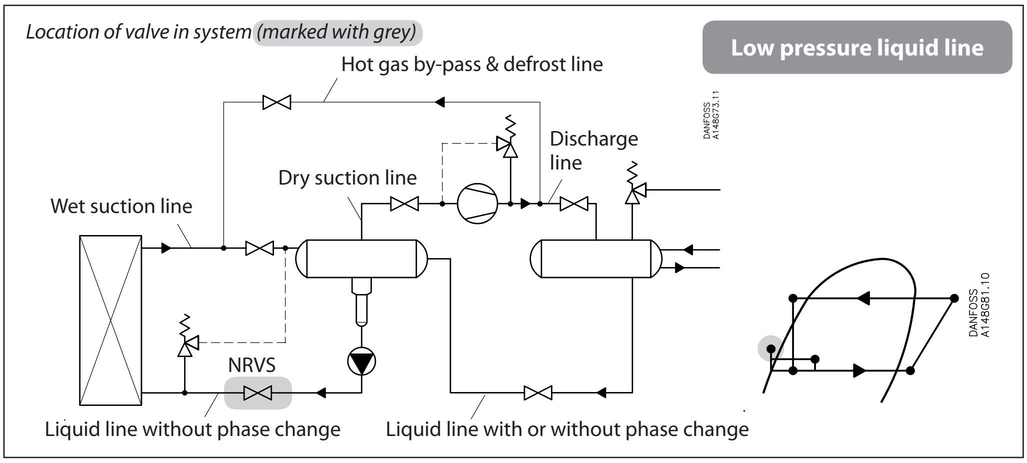
EVRA/EVRAT 10 - 20 + NRVS	0.07 bar
EVRA/EVRAT 25 + NRVS	0.11 bar

Example
An application has the following operating conditions:
Refrigerant: R717
Evaporating temperature: .... –30°C
Evaporator capacity (Q_0): .... 290 kW
Circulation rate: 4
$\Delta p \leq 0.3$ bar

Solution
$290 \times 4 = 1160$ kW
EVRAT 25 + NRVS 25: $Q_0 = 1180$ kW, at $\Delta p = 0.3$ bar is chosen.

Precise valve capacities can be calculated for various refrigerants by using the “DIRcalc™” (Danfoss Industrial Refrigeration calculation programme).

Capacities
(continued)



Valve combination	PM 15	PM 20	PM 25
	NRVS 25	NRVS 25	NRVS 25
k_v (m³/h)	4.0	6.0	7.5

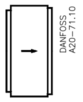
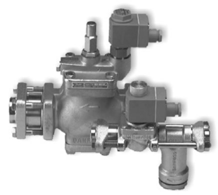
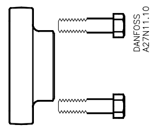
Evaporating temperature T_e	Pressure Δp (bar)	Capacities (kW) Q_0 at circulation rate 1 R717		
–50°C	0.15	-	-	-
	0.25	653	979	1224
	0.30	715	1072	1340
	0.40	825	1238	1547
	0.50	923	1384	1730
–40°C	0.15	-	-	-
	0.25	635	951	1188
	0.30	695	1043	1303
	0.40	803	1204	1506
	0.50	897	1346	1683
–30°C	0.15	-	-	-
	0.25	615	922	1152
	0.30	675	1011	1265
	0.40	779	1169	1460
	0.50	871	1306	1632
–20°C	0.15	-	-	-
	0.25	595	894	1114
	0.30	653	979	1224
	0.40	753	1130	1412
	0.50	852	1264	1580
–10°C	0.15	-	-	-
	0.25	575	862	1075
	0.30	629	944	1180
	0.40	727	1090	1362
	0.50	812	1219	1523

Note: The capacities in the table must be divided by the actual circulation rate, or the evaporator capacities must be multiplied with the actual circulation rate.

Minimum opening differential pressure:
PM + NRVS will be fully open at Δp = 0.25 bar.

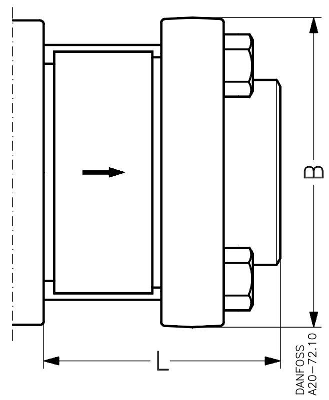
Precise valve capacities can be calculated for various refrigerants by using the “DIRcalc™” (Danfoss Industrial Refrigeration calculation programme).

Ordering

Check valve			Flanges, gaskets and bolts [1]			
						
Valve type	**Code. no.**	For valve type	**Code. no.**	Weight [2] [kg]	Flange type	Connection size
NRVS 15	**020-2032**	EVRA/T 10, EVRA/T 15	**027N1255**	0.7		$^3/_4$ in.
NRVS 25	**020-2033**	EVRA/T 20, EVRA/T 25, PM 15, PM 20, PM 25	**027N1254**	1.1		1 in.

1) Consists of one standard and one special flange, one gasket and bolts.
2) Flange and bolts only.

Dimensions and weights



Type	L mm	B mm	Weight [1] kg
NRVS 15	47.5	78.0	0.1
NRVS 25	60.5	96.0	0.25

1) NRVS without flanges and bolts

Introduction

Strainer type FA with interchangeable filter insert is used in lines carrying fluorinated refrigerants, ammonia, water, brine, oil, and gas.

Features

- *Retains contaminants,* e.g. slag, and weld beads and swarf.
- *Pressure drop insignificant*

Technical data

Temperature of media
–50 → +140°C

Max. working pressure
PS = 28 bar

Max. test pressure
p' = 42 bar

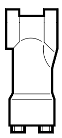
Filter insert
Stainless steel weave, mesh size 150µ (100 mesh)

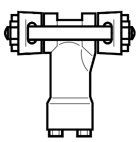
Materials

- Gaskets are non asbestos
- Valve housing made of GGG - 40.3

Ordering

Complete valves





Type	Application	Connection to valve or pipeline	Strainer area cm²	Strainer vol. cm³	k_v value [1] m³/h	Staybolts	**Code no.**
FA 15	For direct fitting on valve	6 F, TE 12, CVM	40	68	3.3	M12 × 180	**006-0040** [2]
		TEA 20, TEAT 20, TEVA 20			3.3	M12 × 170	**006-0042** [2]
		EVR 15, EVRA 3			3.3	M12 × 188	**006-0043** [2]
		EVRA/T 10-15			3.3	M12 × 107	**006-1012** [2]
FA 20		EVR 20	60	145	7.0	M12 × 240	**006-0046** [2]
		TEA 85, TEAT 85, TEVA 85			7.0	M12 × 206	**006-0048** [2]
		EVRA/T 20			7.0	M12 × 127	**006-1013** [2]
FA 15	For fitting in pipelines	$^1/_4$ in. weld flanges	40	68	1.9	M12 × 127	**006-0050** [3]
		$^3/_8$ in. weld flanges			2.6	M12 × 127	**006-0051** [3]
		$^1/_2$ in. weld flanges			3.5	M12 × 127	**006-0052** [3]
		$^3/_4$ in. weld flanges			3.5	M12 × 127	**006-0053** [3]
		$^1/_2$ in. solder flanges			2.6	M12 × 127	**006-0057** [3]
		$^5/_8$ in. solder flanges			3.4	M12 × 127	**006-0058** [3]
		$^3/_4$ in. solder flanges			3.2	M12 × 127	**006-0059** [3]
		$^7/_8$ in. solder flanges			3.5	M12 × 127	**006-0075** [3]
		1 in. solder flanges			3.5	M12 × 127	**006-0060** [3]
FA 20		$^1/_2$ in. weld flanges	60	145	5.1	M12 × 160	**006-0065** [3]
		$^3/_4$ in. weld flanges			7.4	M12 × 160	**006-0066** [3]
		1 in. weld flanges			7.4	M12 × 160	**006-0067** [3]
		$^5/_8$ in. solder flanges			5.1	M12 × 160	**006-0071** [3]
		$1^1/_8$ in. solder flanges			7.3	M12 × 160	**006-0074** [3]

1) The k_v value is the flow of water in m³/h at a pressure drop in the strainer of 1 bar, ρ =1000 kg/m³.
2) Code no. with bolts, screws and gaskets but without flanges
3) Code no. with flanges, bolts, screws and gaskets.

The complete technical leaflet (DKRCI.PD.FM0.A) can be downloaded from the Danfoss web site.

Ordering (continued)

Components / Accessories

Strainer housing without flanges

Type	Strainer area cm^2	Strainer volume cm^3	k_v value [1] m^3/h	**Code no.**
FA 15	40	68	3.3	**036-0060**
FA 20	60	145	7.0	**036-0061** [2]
FA 20	60	145	7.0	**036-0062** [3]

[1]) The k_v value is the flow of water in m^3/h at a pressure drop in the strainer of 1 bar, ρ = 1000 kg/m^3.
[2]) For direct fitting in pipeline.
[3]) For direct fitting on to valves.

Single flanges with flange gaskets for FA 15

Version	Type	**Code no.**
3/8 in. weld	T	**006-1120**
	G	**006-1121**
1/2 in. weld	T	**006-1122**
	G	**006-1123**
3/4 in. weld	T	**006-1124**
	G	**006-1125**
5/8 in. solder	T	**006-1162**
	G	**006-1163**
7/8 in. solder	T	**006-1176**
	G	**006-1177**

Staybolt set with gaskets

Version	**Code no.**
M12 × 107 mm	**006-1101**
M12 × 127 mm	**006-1108**
M12 × 160 mm	**006-1136**
M12 × 170 mm	**006-1103**
M12 × 180 mm	**006-1102**
M12 × 188 mm	**006-1104**
M12 × 206 mm	**006-1106**
M12 × 240 mm	**006-1105**

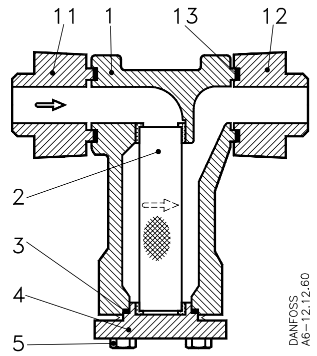
Single flanges with flange gaskets for FA 20 [1])

Version	Type	**Code no.**
3/4 in. weld	T	**006-1128**
	G	**006-1129**
1 in. weld	T	**006-1130**
	G	**006-1131**
1 1/8 in. solder	T	**006-1174**
	G	**006-1175**
22 mm solder	T	**006-1178**
	G	**006-1179**

[1]) Only for code no. **036-0061**.

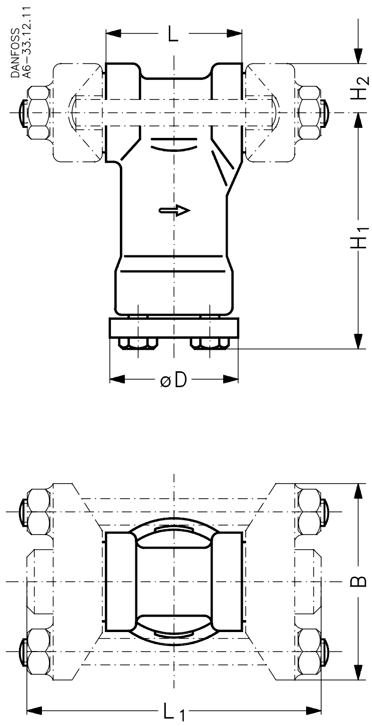
Design

1. Strainer housing
2. Strainer
3. Gasket
4. Cover
5. Screw
11. Flange (tongue)
12. Flange (groove)
13. Flange gasket
14. Flange screw



FA 15 and 20

Dimensions and weights



FA 15 and 20

Type	Code no.	H_1 mm	H_2 mm	L mm	Weld flanges L_1 mm	Solder flanges L_1 mm	B mm	∅ D mm	Weight kg
FA 15	**006-0040 → 006-0043**	95	20	54				51	1.2
FA 15	**006-0050 → 006-0058**	95	20		116	109	80	51	1.7
FA 20	**006-0046 → 006-0048**	106	26	72				60	2.2
FA 20	**006-0065 → 006-0074**	106	26		142	137	96	60	2.9

Introduction

FIA filters are a range of angle-way and straight-way filters which are carefully designed to give favourable flow conditions. The design makes the filter easy to install, and ensures quick filter inspection and cleaning.

FIA filters are used ahead of automatic controls, pumps, compressors etc. for initial plant start-up and where permanent filtration of the refrigerant is required. The filter reduces the risk of undesirable system breakdowns and reduces wear and tear on plant components.

FIA filters are equipped with a screen mesh of stainless steel, available in sizes 100, 150, 250 and 500μ (microns*), (US 150, 100, 72, 38 mesh*).

Features

- Applicable to all common refrigerants and all non-corrosive gases/liquids.
- Filter net of stainless steel mounted direct without extra gaskets means easy servicing.
- FIA filter housing compatible with housings belonging to other Danfoss products. A compatibility overview can be obtained from local Danfoss Sales Company
- Two types of filter inserts are available:
  - A plain insert of stainless steel
  - A pleated insert (DN 15-200) with extra large surface, which ensures long intervals between cleaning and low pressure drop.
- FIA 15-40 (½ – 1 ½ in.):
  A special insert (50μ) can be used in combination with a standard version when cleaning a plant during commissioning.
- FIA 50-300 (2 - 12 in.):
  A large capacity filter bag (50μ) can be inserted for cleaning plant during commissioning
- FIA 50-300 (2 - 12 in.) can be equipped with a magnetic insert for detension of iron particles and other magnetic particles.
- Each filter clearly marked with type, size and performance range
- Housing and bonnet of low temperature steel (FIA) or stainless steel (FIA-SS) in accordance with the requirements of the Pressure Equipment Directive and those of other international classification authorities
- Temperature range
  –60/+150°C (–76/+302°F)
- Pressure range:
  FIA: 40 bar g (580 psi g)
  FIA-SS: 52 bar g (754 psi g)
- Classification: DNV, LR, SAQ, CRN, BV etc.
  To obtain an updated product certification list please contact your local Danfoss Sales Company

* Mesh is the number of threads per inch.
μ (microns) is the distance between two threads
(1μ = 1 /1000 mm).

The complete technical leaflet (DKRCI.PD.FN0.A) can be downloaded from the Danfoss web site.

Design

Connections
Available with the following connections:

- Butt-weld DIN (EN 10220)
- Butt-weld ANSI (B 36.10 Schedule 80), DN 15 - 40 ($^{1}/_{2}$ - 1$^{1}/_{2}$ in.)
- Butt-weld ANSI (B 36.10 Schedule 40), DN 50 - 300 (2 - 12 in.)
- Socket Weld (ANSI B 16.11), DN 15 - DN 50 ($^{1}/_{2}$ - 2 in.)
- FPT Female Pipe Thread, NPT (ANSI/ASME B 1.20.1) , DN 15 - 32 ($^{1}/_{2}$ - 1$^{1}/_{4}$ in.)

Filter Insert
A filter grid and filter net of stainless steel ensure long element life. The filter net offers a very high degree of cleanability.

Housing
The filter housing is made of special, cold resistant steel (FIA) or stainless steel (FIA-SS) approved for low temperature application.

Pressure Equipment Directive (PED)
FIA filters are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction

Nominal bore	DN ≤ 25 (1 in.)	DN 32-80 mm (1$^{1}/_{4}$ - 3 in.)	DN 100-250 mm (4-10 in.)	DN 300 (12 in.)
Classified for	Fluid group I			
Category	Article 3, paragraph 3	II	III	IV

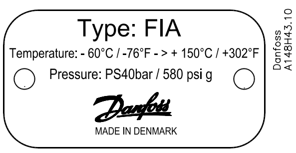
Installation/Maintenance
The filter is designed to resist high internal pressures. However, the piping system in general should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion.

Install the filter with the cover downwards. Danfoss recommends to replacement/cleaning of the filter when the differential pressure loss >0.5 bar (7.3 psi) in the liquid line and >0.05 bar (0.7 psi) in the suction line. The max. permissible differential pressure is 1 bar (15 psi).

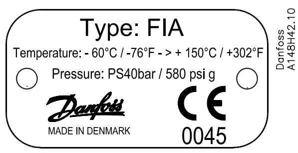
For further information refer to installation instruction for FIA.

Identification:

DN 15 - 25
($^{1}/_{2}$ - 1 in.)



DN 32 - 300
(1$^{1}/_{4}$ - 12 in.)



Technical data

- *Refrigerants*
  Applicable to all common refrigerants including flammable refrigerants and all non-corrosive gases/liquids. For further information please see installation instruction for FIA.
- *Temperature range*
  –60°C/+150°C (–76°F/+302°F).
- *Pressure range*
  Max. working pressure:
  FIA: 40 bar g (580 psi g).
  FIA-SS: 52 bar g (754 psi g).

Selection of filter size

The nesh aperture size of the filter must satisfy the requirements stated by the suppliers of the equipment to be protected.

The following recommendations of aperture size apply in general to refrigeration installations:

All lines
First start up:.......... **50μ**
(Use filter element with removable insert for FIA DN15-40 or separate filter bag for FIA DN 50-200. 50μ insert should normally be removed after the first 24 hours of operation)

Liquid Lines
Ahead of pumps:.......... **500μ** [38 mesh]
After pumps:.......... **150μ** [100 mesh] / 250μ [72 mesh]
In front of AKVA valves.......... **100μ** [150 mesh]

Protection of automatic regulation equipment
Generally.......... **150μ** [100 mesh] / 250μ [72 mesh]
Sensitive equipment, e.g.
suction regulators with low temperature.......... **250μ** [72 mesh]

Definition
Mesh is the number of threads per inch. μ (microns) is the distance between two threads (1μ = 1 /1000 mm).

Suction Lines
Ahead of screw compressor.......... **250μ** [72 mesh]
Ahead of piston compressor.......... **150μ** [100 mesh]

Flow coefficient (DIN/ANSI)

Size FIA	μ	**mesh**	**wire** mm	**wire** in.	**free space** %	**screen area** Plain elements cm²	Plain elements in²	Pleated elements cm²	Pleated elements in²
15 - 20 (1/2" - 3/4")	100		0.068	0.003	35	25	3.9	45	7.0
	150	100	0.10	0.004	36	25	3.9	45	7.0
	250	72	0.10	0.004	51	25	3.9	45	7.0
	500	38	0.16	0.006	57.6	25	3.9	45	7.0
25 - 40 (1" - 1 1/2")	100		0.068	0.003	35	71	11	160	25.0
	150	100	0.10	0.004	36	71	11	160	25.0
	250	72	0.10	0.004	51	71	11	160	25.0
	500	38	0.16	0.006	57.6	71	11	160	25.0
50 (2")	100		0.068	0.003	35	71	11	200	31.2
	150	100	0.10	0.004	36	87	13.5	200	31.2
	250	72	0.10	0.004	51	87	13.5	200	31.2
	500	38	0.16	0.006	57.6	87	13.5	200	31.2
65 (2 1/2")	150	100	0.10	0.004	36	127	19.7	305	47.6
	250	72	0.10	0.004	51	127	19.7	305	47.6
	500	38	0.16	0.006	57.6	127	19.7	305	47.6
80 (3")	150	100	0.10	0.004	36	205	31.8	450	70.2
	250	72	0.10	0.004	51	205	31.8	450	70.2
	500	38	0.16	0.006	57.6	205	31.8	450	70.2
100 (4")	150	100	0.10	0.004	36	370	57.4	790	123.2
	250	72	0.10	0.004	51	370	57.4	790	123.2
	500	38	0.16	0.006	57.6	370	57.4	790	123.2
125 (5")	150	100	0.10	0.004	36	510	79.1	1105	172.4
	250	72	0.10	0.004	51	510	79.1	1105	172.4
	500	38	0.16	0.006	57.6	510	79.1	1105	172.4
150 (6")	150	100	0.10	0.004	36	726	112.5	1600	249.6
	250	72	0.10	0.004	51	726	112.5	1600	249.6
	500	38	0.16	0.006	57.6	726	112.5	1600	249.6
200 (8")	150	100	0.10	0.004	36	1315	203.8		
	250	72	0.10	0.004	51	1315	203.8		
	500	38	0.16	0.006	57.6	1315	203.8		
250 (10")	150	100	0.10	0.004	36	1800	70.9		
	250	72	0.10	0.004	51	1800	70.9		
	500	38	0.16	0.006	57.6	1800	70.9		
300 (12")	150	100	0.10	0.004	36	2590	102.0		
	250	72	0.10	0.004	51	2590	102.0		
	500	38	0.16	0.006	57.6	2590	102.0		

Selection of filter size
(Continued)

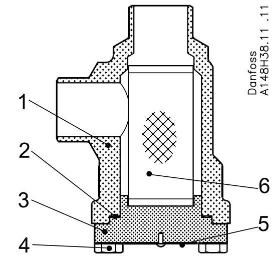
K_v values

DN	FIA angle - plain filter net				FIA angle - pleated filter net		
	µ100	µ150	µ250	µ500	µ150	µ250	µ500
15	3.3	3.4	3.5	3.7	4.2		
20	6.9	7.1	7.3	7.7	8.8		
25	13.8	14.0	14.5	15.2	17.2	17.9	
32	23.0	23.8	24.7	25.5	29.2	30.5	
40	25.1	25.5	26.4	28.1	31.4	32.6	
50	45.1	45.9	47.6	50.2	56.7	58.8	62.0
65		56.1	57.8	60.4	69.3	71.4	74.6
80		104.6	108.0	113.1	129.2	133.4	139.7
100		162.4	167.5	176.0	200.6	206.9	217.4
125		275.4	283.9	298.4	340.2	350.7	368.6
150		362.1	373.2	391.9	447.3		
200		572.9	590.8	620.5			
250		784.5	808.9	849.7			
300		1062.3	1095.4	1150.8			

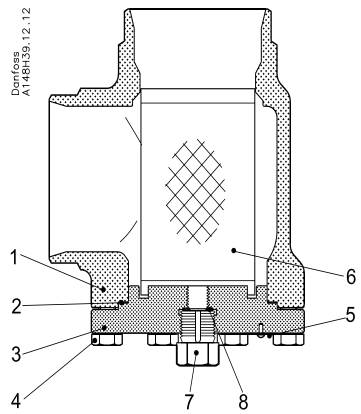
DN	**FIA straight - plain filter net**				**FIA straight- pleated filter net**		
	µ100	µ150	µ250	µ500	µ150	µ250	µ500
15	2.5	2.6	2.7	2.8	3.3		
20	5.3	5.4	5.6	5.9	6.9		
25	10.5	10.7	11.1	11.6	13.8	14.5	
32	17.6	18.2	18.9	19.5	23.9	24.7	
40	19.2	19.5	20.2	21.5	25.5	26.4	
50	34.5	35.1	36.4	38.4	45.9	47.6	50.2
65		42.9	44.2	46.2	56.1	57.8	60.4
80		80.0	82.6	86.5	104.6	108.0	113.1
100		124.2	128.1	134.6	162.4	167.5	176.0
125		210.6	217.1	228.2	275.4	283.9	298.4
150		276.9	285.4	299.7	362.1		
200		438.1	451.8	474.5			

Material specification

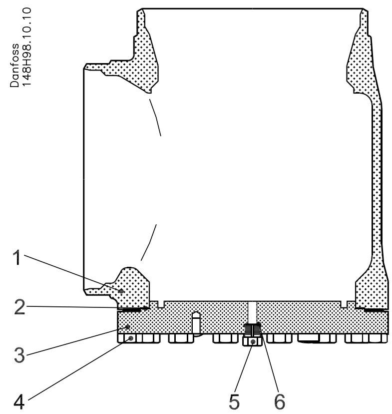
FIA, FIA-SS 15 - 65 ($^1/_2$" - 2 $^1/_2$")

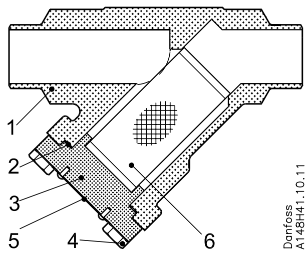


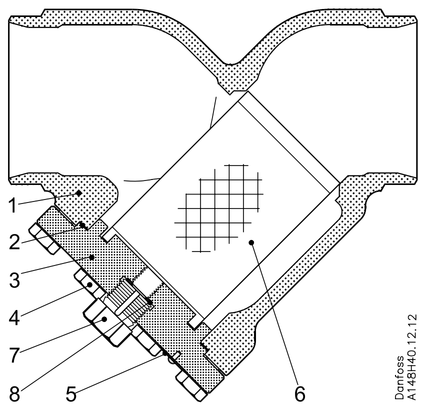
FIA 80 - 200 (3" - 8")



FIA 250 - 300 (10" - 12")







FIA, FIA-SS 15-65 ($^1/_2$" - 2$^1/_2$")

No.	Part	Material	DIN	ISO	ASTM
1	Housing	Steel	G20Mn5QT, 10213-3 ------------------------------------ P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
		Stainless steel (FIA-SS only)	X5CrNi18-10 EN 10088		AISI 304
2	Gasket	Fibre, Non-asbestos			
3	Cover	Steel	P275NL1 EN 10028-3		
		Stainless steel (FIA-SS only)	X5CrNi18-10 EN 10088		AISI 304
4	Bolts	Stainless steel	A2-70	A2-70	Type 308
5	Marking label	Aluminium			
6	Filter element	Stainless steel			

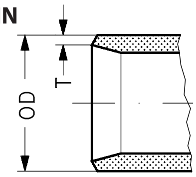
FIA 80-300 (3" - 12")

No.	Part	Material	DIN	ISO	ASTM
1	Housing	Steel	G20Mn5QT, 10213-3 ------------------------------------ P285QH+QT, 10222-4		LCC, A352 -------------------------------- LF2, A350
2	Gasket	Fibre, Non-asbestos			
3	Cover	Steel	P275NL1 EN 10028-3		
4	Bolts	Stainless steel	A2-70	A2-70	Type 308
5	Marking label	Aluminium			
6	Filter element	Stainless steel			
7*	Pressure relief (screw)	Stainless steel			
8*	Packing washer	Aluminium			

* pos 7 and 8 used in FIA 50-200

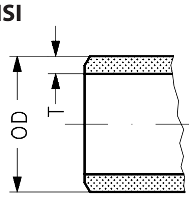
Connections

DIN



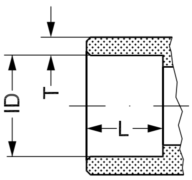
Size mm	Size in.	OD mm	T mm	OD in.	T in.
Butt-weld DIN (EN 10220)					
15	$^1/_2$	21.3	2.3	0.839	0.091
20	$^3/_4$	26.9	2.3	1.059	0.091
25	1	33.7	2.6	1.327	0.103
32	$1^1/_4$	42.4	2.6	1.669	0.102
40	$1^1/_2$	48.3	2.6	1.902	0.103
50	2	60.3	2.9	2.37	0.11
65	$2^1/_2$	76.1	2.9	3	0.11
80	3	88.9	3.2	3.50	0.13
100	4	114.3	3.6	4.50	0.14
125	5	139.7	4.0	5.50	0.16
150	6	168.3	4.5	6.63	0.18
200	8	219.1	6.3	8.63	0.25
250	10	273	6.3	10.75	0.25
300	12	323.9	7.1	12.75	0.28

ANSI



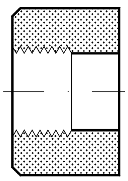
Size mm	Size in.	OD mm	T mm	OD in.	T in.
Butt-weld ANSI (B 36.10 Schedule 80)					
15	$^1/_2$	21.3	3.7	0.839	0.146
20	$^3/_4$	26.9	4.0	1.059	0.158
25	1	33.7	4.6	1.327	0.181
32	$1^1/_4$	42.4	4.9	1.669	0.193
40	$1^1/_2$	48.3	5.1	1.902	0.201
Butt-weld ANSI (B 36.10 Schedule 40)					
50	2	60.3	3.9	2.37	0.15
65	$2^1/_2$	73.0	5.2	2.87	0.20
80	3	88.9	5.5	3.50	0.22
100	4	114.3	6.0	4.50	0.24
125	5	141.3	6.6	5.56	0.26
150	6	168.3	7.1	6.63	0.28
200	8	219.1	8.2	8.63	0.32
250	10	273	6.3	10.75	0.25
300	12	323.9	7.1	12.75	0.28

SOC



Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.
Socket welding ANSI (B 16.11)							
15	$^1/_2$	21.8	6.0	0.858	0.235	10	0.39
20	$^3/_4$	27.2	4.6	1.071	0.181	13	0.51
25	1	33.9	7.2	1.335	0.284	13	0.51
32	$1^1/_4$	42.7	6.1	1.743	0.240	13	0.51
40	$1^1/_2$	48.8	6.6	1.921	0.260	13	0.51
50	2	61.2	6.2	2.41	0.24	16	0.63

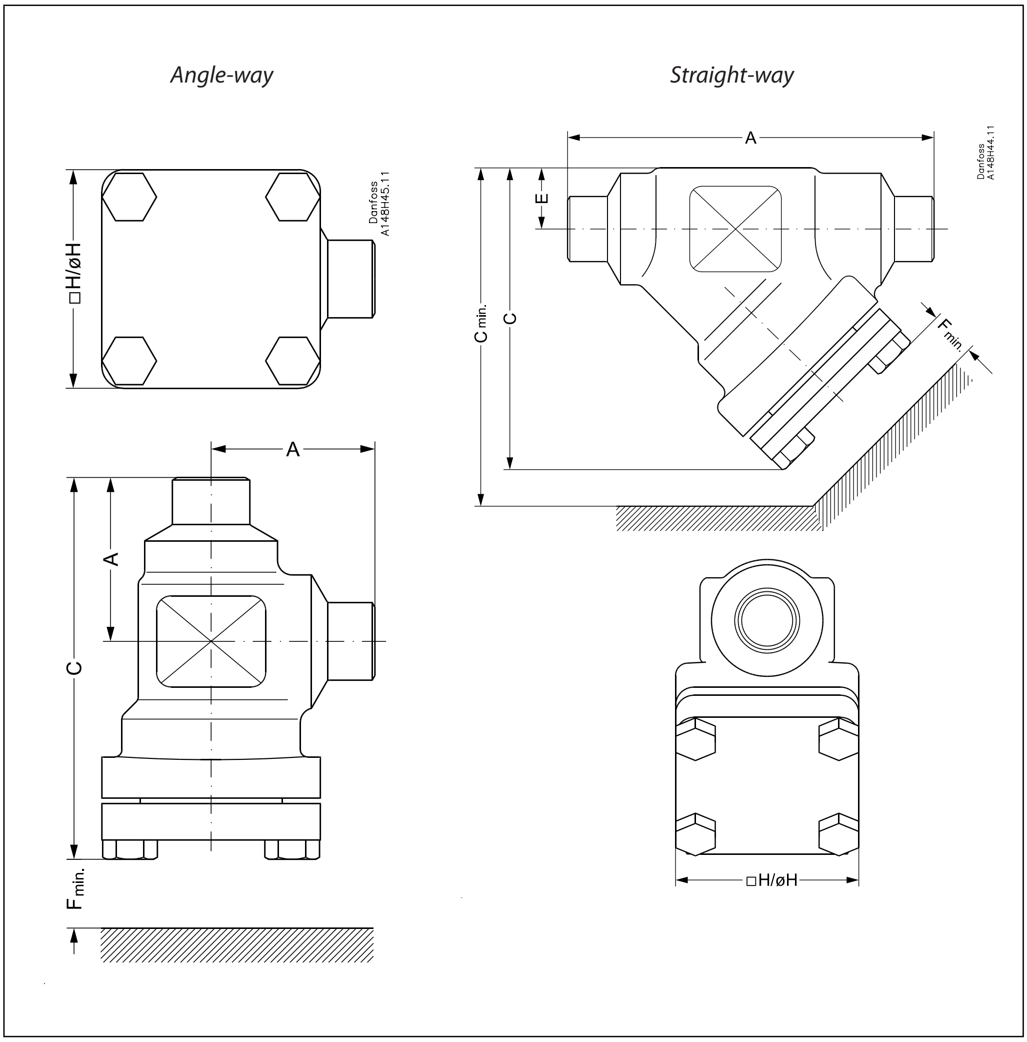
FPT



Size mm	Size in.	Inside pipe thread
FPT inside pipe thread, NPT (ANSI/ASME B 1.20.1)		
15	$^1/_2$	($^1/_2$ × 14 NPT)
20	$^3/_4$	($^3/_4$ × 14 NPT)
25	1	(1 × 11.5 NPT)
32	$1^1/_4$	($1^1/_4$ × 11.5 NPT)

Dimensions and weights

FIA 15 - 65



Angle-way

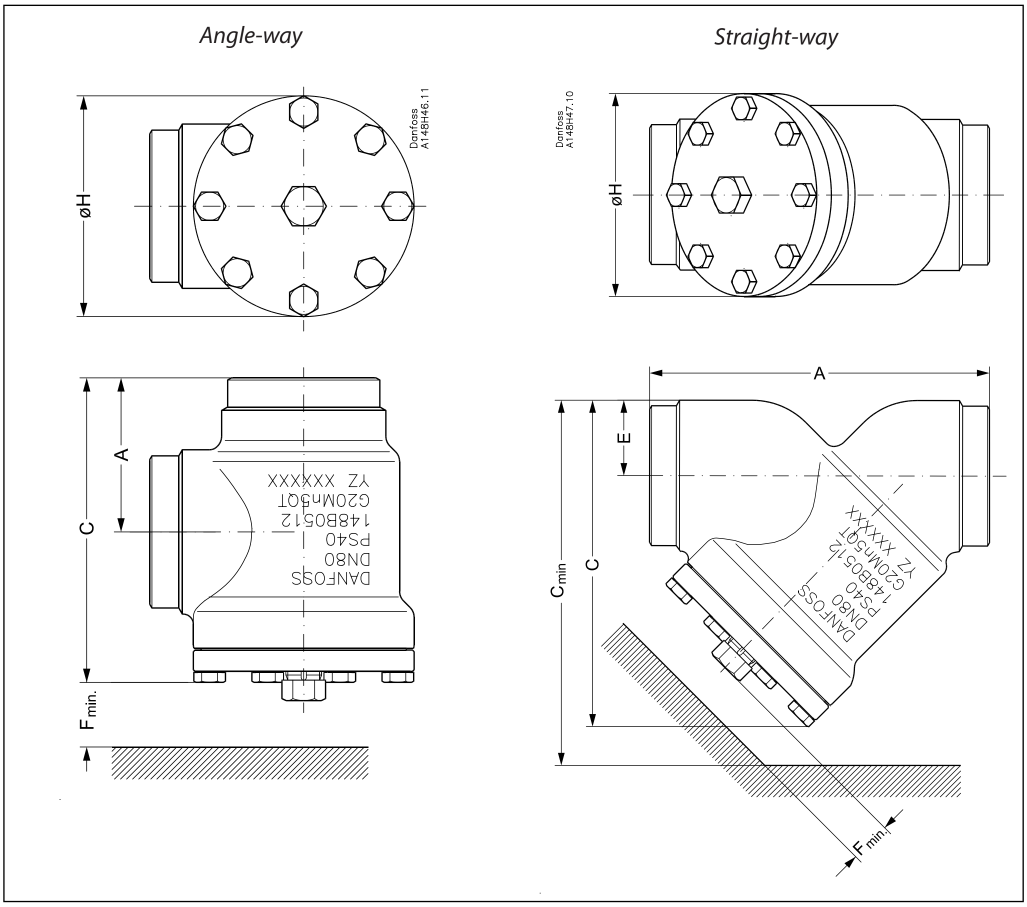
Filter size		A	C	H	$F_{min.}$	Weight
FIA 15-20	mm	45	105	60	68	1.1 kg
($^1/_2$" - $^3/_4$")	in.	1.77	4.13	2.36	2.68	2.4 lbs
FIA 25-40	mm	55	132	70	95	1.7 kg
(1" - 1$^1/_2$")	in.	2.17	5.20	2.76	3.74	3.7 lbs
FIA 50	mm	60	132	77	92	2.8 kg
(2")	in.	2.36	5.20	3.03	3.62	6.2 lbs
FIA 65	mm	70	152	90	107	3.8 kg
(2$^1/_2$")	in.	2.76	5.98	3.54	4.21	8.4 lbs

Straight-way

Valve size		A	C	$C_{min.}$	H	E	$F_{min.}$	Weight
FIA 15-20	mm	120	99	133	60	20	68	1.4 kg
($^1/_2$" - $^3/_4$")	in.	4.72	3.90	5.24	2.36	0.79	2.68	3.1 lbs
FIA 25-40	mm	155	129	177	70	26	95	2.4 kg
(1" - 1$^1/_2$")	in.	6.10	5.08	6.97	2.76	1.02	3.74	5.3 lbs
FIA 50	mm	148	138	184	77	32	92	3.5 kg
(2")	in.	5.83	5.43	7.24	3.03	1.26	3.62	7.7 lbs
FIA 65	mm	176	165	219	90	40	107	5.3 kg
(2$^1/_2$")	in.	6.93	6.50	8.62	3.54	1.57	4.21	11.7 lbs

Dimensions and weights

FIA 80 - 300



Angle-way

Filter size		A	C	H	$F_{min.}$	Weight
FIA 80	mm	90	189	129	133	7.3 kg
(3”)	in.	3.54	7.44	5.08	5.24	16.1 lbs
FIA 100	mm	106	223	156	163	11.9 kg
(4”)	in.	4.17	8.78	6.14	6.42	26.2 lbs
FIA 125	mm	128	268	192	190	21.2 kg
(5”)	in.	5.04	10.6	7.56	7.48	46.7 lbs
FIA 150	mm	145	303	219	223	30.5 kg
(6”)	in.	5.71	11.93	8.62	8.78	67.2 lbs
FIA 200	mm	180	372	276	280	68 kg
(8”)	in.	7.09	14.65	10.87	11.02	150 lbs
FIA 250	mm	210	397	334	285	89 kg
(10”)	in.	8.27	15.63	13.14	11.22	196.3 lbs
FIA 300	mm	240	458	384	340	125 kg
(12”)	in.	9.45	18.03	15.12	13.39	275.5 lbs

Straight-way

Filter size		A	C	$C_{min.}$	H	E	$F_{min.}$	Weight
FIA 80	mm	216	204	271	129	48	133	8.6 kg
(3”)	in.	8.50	8.03	10.67	5.08	1.89	5.24	19 lbs
FIA 100	mm	264	256	337	156	60	163	14.9 kg
(4”)	in.	10.39	10.08	13.27	6.14	2.36	6.42	32.8 lbs
FIA 125	mm	322	313	408	192	74	190	26.9 kg
(5”)	in.	12.68	12.32	16.06	7.56	2.91	7.48	59.3 lbs
FIA 150	mm	370	370	482	219	91	223	51 kg
(6”)	in.	14.57	14.57	18.98	8.62	3.58	8.78	112 lbs
FIA 200	mm	464	465	605	276	117	280	95 kg
(8”)	in.	18.27	18.31	23.82	10.87	4.61	11.02	209 lbs

Ordering

The table below is used to identify the filter required.
Please note that you have to order **FIA filter housing, a filter element** and **accessories.**

Example:
FIA 50 D ANG + FIA-X 50 150µ Filter Element + Filter Bag = **148H3056** + **148H3130** + **148H3150**

Size mm	Size in.	Type	Code number: Without Filter Element	Filter Element 100µ 150 mesh	Filter Element 150µ 100 mesh	Filter Element 250µ 72 mesh	Filter Element 500µ 38 mesh	Pleated filter element 150µ 100 mesh	Pleated filter element 250µ 72 mesh	Pleated filter element 500µ 38 mesh
15	½	FIA 15 D ANG	**148H3051**	**148H3122**	**148H3124**	**148H3126**	**148H3128**	**148H3303**	-	-
15	½	FIA-SS 15 D ANG 52BAR	**148H3221**							
15	½	FIA 15 A ANG	**148H3063**							
15	½	FIA 15 SOC ANG	**148H3075**							
15	½	FIA 15 FPT ANG	**148H3081**							
15	½	FIA 15 D STR	**148H3085**							
15	½	FIA-SS 15 D STR 52BAR	**148H3285**							
15	½	FIA 15 A STR	**148H3097**							
15	½	FIA 15 SOC STR	**148H3109**							
15	½	FIA 15 FPT STR	**148H3115**							
20	¾	FIA 20 D ANG	**148H3052**	**148H3122**	**148H3124**	**148H3126**	**148H3128**	**148H3303**	-	-
20	¾	FIA-SS 20 D ANG 52BAR	**148H3222**							
20	¾	FIA 20 A ANG	**148H3064**							
20	¾	FIA 20 FPT ANG	**148H3082**							
20	¾	FIA 20 SOC ANG	**148H3076**							
20	¾	FIA 20 D STR	**148H3086**							
20	¾	FIA-SS 20 D STR 52BAR	**148H3286**							
20	¾	FIA 20 A STR	**148H3098**							
20	¾	FIA 20 FPT STR	**148H3116**							
20	¾	FIA 20 SOC STR	**148H3110**							
25	1	FIA 25 D ANG	**148H3053**	**148H3123**	**148H3125**	**148H3127**	**148H3129**	**148H3304**	**148H3269**	-
25	1	FIA-SS 25 D ANG 52BAR	**148H3223**							
25	1	FIA 25 A ANG	**148H3065**							
25	1	FIA 25 FPT ANG	**148H3083**							
25	1	FIA 25 SOC ANG	**148H3077**							
25	1	FIA 25 D STR	**148H3087**							
25	1	FIA-SS 25 D STR 52BAR	**148H3287**							
25	1	FIA 25 A STR	**148H3099**							
25	1	FIA 25 FPT STR	**148H3117**							
25	1	FIA 25 SOC STR	**148H3111**							
32	1¼	FIA 32 D ANG	**148H3054**	**148H3123**	**148H3125**	**148H3127**	**148H3129**	**148H3304**	**148H3269**	-
32	1¼	FIA-SS 32 D ANG 52BAR	**148H3224**							
32	1¼	FIA 32 A ANG	**148H3066**							
32	1¼	FIA 32 FPT ANG	**148H3084**							
32	1¼	FIA 32 SOC ANG	**148H3078**							
32	1¼	FIA 32 D STR	**148H3088**							
32	1¼	FIA-SS 32 D STR 52BAR	**148H3288**							
32	1¼	FIA 32 A STR	**148H3100**							
32	1¼	FIA 32 FPT STR	**148H3118**							
32	1¼	FIA 32 SOC STR	**148H3112**							
40	1½	FIA 40 D ANG	**148H3055**	**148H3123**	**148H3125**	**148H3127**	**148H3129**	**148H3304**	**148H3269**	-
40	1½	FIA-SS 40 D ANG 52BAR	**148H3225**							
40	1½	FIA 40 A ANG	**148H3067**							
40	1½	FIA 40 SOC ANG	**148H3079**							
40	1½	FIA 40 D STR	**148H3089**							
40	1½	FIA-SS 40 D STR 52BAR	**148H3289**							
40	1½	FIA 40 A STR	**148H3101**							
40	1½	FIA 40 SOC STR	**148H3113**							
50	2	FIA 50 D ANG	**148H3056**	**148H3157**	**148H3130**	**148H3138**	**148H3144**	**148H3179**	**148H3184**	**148H3189**
50	2	FIA-SS 50 D ANG 52BAR	**148H3283**							
50	2	FIA 50 A ANG	**148H3068**							
50	2	FIA 50 SOC ANG	**148H3080**							
50	2	FIA 50 D STR	**148H3090**							
50	2	FIA-SS 50 D STR 52BAR	**148H3290**							
50	2	FIA 50 A STR	**148H3102**							
50	2	FIA 50 SOC STR	**148H3114**							

D = Butt-weld DIN
A = Butt-weld ANSI
SOC = Socket welding
FPT = Inside pipe thread

ANG = Angle-way
STR = Straight-way

Ordering

Size mm	Size in.	Type	Code number: Without Filter Element	Filter Element 150μ 100 mesh	Filter Element 250μ 72 mesh	Filter Element 500μ 38 mesh	Pleated filter element 150μ 100 mesh	Pleated filter element 250μ 72 mesh	Pleated filter element 500μ 38 mesh
65	2½	FIA 65 D ANG	**148H3057**	**148H3131**	**148H3139**	**148H3145**	**148H3180**	**148H3185**	**148H3190**
65	2½	FIA-SS 65 D ANG 52BAR	**148H3284**						
65	2½	FIA 65 A ANG	**148H3069**						
65	2½	FIA 65 D STR	**148H3091**						
65	2½	FIA-SS 65 D STR 52BAR	**148H3291**						
65	2½	FIA 65 A STR	**148H3103**						
80	3	FIA 80 D ANG	**148H3058**	**148H3119**	**148H3120**	**148H3121**	**148H3181**	**148H3186**	**148H3191**
80	3	FIA 80 A ANG	**148H3070**						
80	3	FIA 80 D STR	**148H3092**						
80	3	FIA 80 A STR	**148H3104**						
100	4	FIA 100 D ANG	**148H3059**	**148H3132**	**148H3140**	**148H3146**	**148H3182**	**148H3187**	**148H3192**
100	4	FIA 100 A ANG	**148H3071**						
100	4	FIA 100 D STR	**148H3093**						
100	4	FIA 100 A STR	**148H3105**						
125	5	FIA 125 D ANG	**148H3060**	**148H3133**	**148H3141**	**148H3147**	**148H3183**	**148H3188**	**148H3193**
125	5	FIA 125 A ANG	**148H3072**						
125	5	FIA 125 D STR	**148H3094**						
125	5	FIA 125 A STR	**148H3106**						
150	6	FIA 150 D ANG	**148H3061**	**148H3134**	**148H3142**	**148H3148**	**148H3226**	-	-
150	6	FIA 150 A ANG	**148H3073**						
150	6	FIA 150 D STR	**148H3095**						
150	6	FIA 150 A STR	**148H3107**						
200	8	FIA 200 D ANG	**148H3062**	**148H3135**	**148H3143**	**148H3149**	-	-	-
200	8	FIA 200 A ANG	**148H3074**						
200	8	FIA 200 D STR	**148H3096**						
200	8	FIA 200 A STR	**148H3108**						
250	10	FIA 250 D ANG	**148H3171**	**148H3136**	**148H3175**	**148H3177**	-	-	-
250	10	FIA 250 A ANG	**148H3173**						
300	12	FIA 300 D ANG	**148H3172**	**148H3137**	**148H3176**	**148H3178**	-	-	-
300	12	FIA 300 A ANG	**148H3174**						

D = Butt-weld DIN
A = Butt-weld ANSI
ANG = Angle-way
STR = Straight-way

Accessories

Part	Accessory for	**Code number**
Magnet insert	FIA 65-100	**2464+596**
	FIA 125-200	**2464+597**

Part	Accessory for	**Code number**
Filter element μ150 with removable element μ50 for the first start up	FIA 15-20	**148H3301**
	FIA 25-40	**148H3302**

Part	Accessory for	**Code number**
Filter bag	FIA 50	**148H3150**
	FIA 65	**148H3151**
	FIA 80	**148H3152**
	FIA 100	**148H3153**
	FIA 125	**148H3154**
	FIA 150	**148H3155**
	FIA 200	**148H3156**

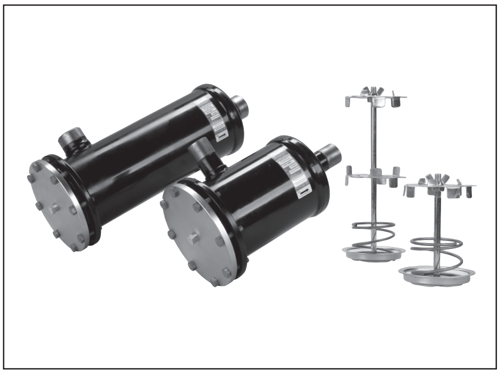
Part	Accessory for	**Code number**
Purge valve complete, blind nut and gasket	FIA 50 - 200	**2412+634**

Introduction

Danfoss ***Eliminator*** filter driers with replaceable solid core, type DCR, are for use in liquid and/or suction lines in refrigeration, freezing and air-conditioning systems.

Besides being able to meet the demanding requirements of high working pressure levels when operating with R410A and CO_2, the new DCR programme offers flexibility with respect to different pressure versions.

The customers can thus choose between two versions, a normal pressure version and a high pressure version.



Features

DCR housings:

- DCR housings (incl.core holder) are made entirely of steel and are thus compatible with all refrigerants.
- DCR housings have undergone zinc-phosphate pre-treatment and have a corrosion-resistant powder-paint finish.
- DCR housings are helium leak tested.

Top covers for DCR housings:

- Zinc-chromated steel top covers with or without external access connection.

Inserts for DCR housings - solid cores

48 - DM *- 100% molecular sieve solid core suitable for HFC refrigerants:*

- Provides high moisture adsorption at low and high condensing temperatures.
- Effective protection against impurities.

48 - DC *- 80% molecular sieve and 20% activated alumina solid core suitable for CFC & HCFC refrigerants and compatible with HFC refrigerants:*

- Adsorbs moisture and acid in the system throughout the entire temperature range.

48 - DA *- 30% molecular sieve and 70% activated alumina solid core suitable after compressor burn-out and compatible with CFC / HCFC / HFC refrigerants:*

- High acid adsorption and standard water adsorption.

All solid cores have an optimised uniform grain size ensuring effective dirt removal and low pressure drop. The robust solid cores withstand pressure surge and vibration.

Inserts for DCR housings - strainer

48 - F *strainer - compatible with all refrigerants:*

- Retains dirt particles larger than 15 µm.
- For use direct in DCR housings.
- Utilised in the suction or liquid line.

Approvals

CE marked in accordance with the European Pressure Equipment Directive - 97/23/EC

C(UL)US listed 207 and C22.2 no. 140.3

EN 12284

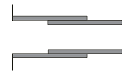
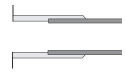
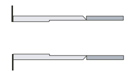
The complete technical leaflet (DKRCC.PD.EJ0.A) can be downloaded from the Danfoss web site.

Technical data

Type	PS / MWP	Refrigerant	Temperature range
DCR 048	35 bar / 500 psig	CFC / HCFC / HFC	–40 → +70°C / –40 → +160°F
DCR 096			
DCR 144			
DCR 192	28 bar / 400 psig		

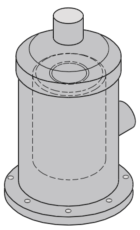
DCR 048 HP	46 bar / 667 psig	CFC / HCFC / HFC	–40 → +70°C / –40 → +160°F
DCR 096 HP			

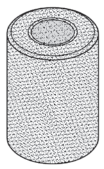
Type of connector and recommended soldering material

	Copper ODF solder connector Copper pipe
	Steel ODF solder connector Copper pipe
	Steel butt weld connector Steel pipe

Solder connector	Recommended soldering material
Copper	Sil-fos 15
Steel	Silver-flo 55 + Easy-flow flux

Capacity





48-DM

Type	Number of cores	Drying capacity [kg refrigerant] [1]						Liquid capacity [kW] [2]		
		R134a		R404A / R507		R407C / R410A		R134a	R404A / R507	R407C / R410A
		24°C	52°C	24°C	52°C	24°C	52°C			
DCR 0485 DCR 0487 DCR 0489 DCR 04811 DCR 04813 DCR 04817 DCR 04821	1	82.5	78.5	135.0	74.0	83.0	71.0	79 139 186 227 227 227 227	57 99 133 162 162 162 162	88 153 206 259 259 259 259
DCR 0967 DCR 0969 DCR 09611 DCR 09613 DCR 09617	2	165.0	157.0	270.0	148.0	166.0	142.0	140 217 295 358 358	100 155 211 256 256	155 240 326 396 396
DCR 1449 DCR 14411 DCR 14413 DCR 14417	3	247.5	235.5	405.0	222.0	249.0	213.0	226 356 356 356	162 255 255 255	250 394 394 394
DCR 19211 DCR 19213 DCR 19217	4	330.0	314.0	540.0	296.0	332.0	284.0	372 460 460	266 329 329	411 509 509

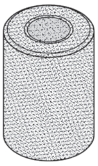
48-DC

Type	Number of cores	Drying capacity [kg refrigerant] [1]								Liquid capacity [kW] [2]			
		R22		R134a		R404A / R507		R407C / R410A		R22	R134a	R404A / R507	R407C / R410A
		24°C	52°C	24°C	52°C	24°C	52°C	24°C	52°C				
DCR 0485 DCR 0487 DCR 0489 DCR 04811 DCR 04813 DCR 04817 DCR 04821	1	67.0	62.0	71.0	67.5	115.0	62.0	70.5	60.0	88 153 206 259 259 259 259	79 139 186 227 227 227 227	57 99 133 162 162 162 162	88 153 206 259 259 259 259
DCR 0967 DCR 0969 DCR 09611 DCR 09613 DCR 09617	2	134.0	124.0	142.0	135.0	230.0	124.0	141.0	120.0	155 240 326 396 396	140 217 295 358 358	100 155 211 256 256	155 240 326 396 396
DCR 1449 DCR 14411 DCR 14413 DCR 14417	3	201.0	186.0	213.0	202.5	345.0	186.0	211.5	180.0	250 394 394 394	226 356 356 356	162 255 255 255	250 394 394 394
DCR 19211 DCR 19213 DCR 19217 DCR 19221	4	268.0	248.0	284.0	270.0	460.0	248.0	282.0	240.0	411 509 509 509	372 460 460 460	266 329 329 329	411 509 509 509

[1]) Drying capacity is based on the following moisture contents before and after drying:
R22: From 1050 ppm W to 60 ppm W in accordance with ARI 710-86.
R134a: From 1050 ppm W to 75 ppm W. If refrigerant is to be dried to 50 ppm W, reduce the stated capacities by 15%.
R404A, R407C & R507: From 1020 ppm W to 30 ppm W.
R410A: From 1050 ppm W to 60 ppm W.

[2]) Liquid capacity given in accordance with ARI 710-2002 evaporating temperature $t_e = -15°C$, condensing temperature $t_c = +30°C$ and pressure drop across filter drier $\Delta p = 0.07$ bar.

Capacity *(cont.)*



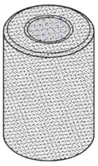
48-DA

Type	Number of cores	Drying capacity [g of water] [3] Evaporating temperature t_e [°C]												Acid capacity [4] [g]
		R22			R134a			R404A / R507			R407C / R410A			
		–40	–20	4.4	–30	–20	4.4	–40	–20	4.4	–40	–20	4.4	
DCR 048	1	28	19	12	45	38	27	47	30	19	42	35	25	26.6
DCR 096	2	56	37	24	90	77	54	94	60	37	84	70	50	53.3
DCR 144	3	84	56	36	135	115	81	142	90	56	126	105	75	79.9
DCR 192	4	112	74	48	180	153	108	189	120	75	168	140	100	106.5

[3]) Drying capacity is expressed during drying in:
R22: EPD = 10 ppm W, corresponding to a dew point temperature = –50°C
R134a: EPD = 50 ppm W, corresponding to a dew point temperature = –37°C
R404A: EPD = 10 ppm W, corresponding to a dew point temperature = –40°C
R407C: EPD = 10 ppm W, corresponding to a dew point temperature = –40°C

[4]) Adsorption capacity of oleic acid at 0.05 TAN (Total Acid Number)

Recommended plant capacity in suction line - burn-out

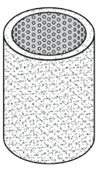


48-DA

Type	Recommended plant capacity [kW] Evaporating temperature t_e [°C] / Pressure drop [Δp bar]											
	R22			R134a			R404A/ R507			R407C / R410A		
	–40	–20	4.4	–30	–20	4.4	–40	–20	4.4	–40	–20	4.4
	0.04	0.10	0.21	0.04	0.07	0.14	0.04	0.10	0.21	0.04	0.10	0.21
DCR 0485	3.1	8.9	21.0	3.0	5.4	13.0	2.4	7.1	17.5	3.1	8.9	21.0
DCR 0487	5.8	16.1	37.8	5.6	9.9	23.4	4.5	12.9	31.2	5.8	16.1	37.8
DCR 0489	7.8	21.6	50.7	7.5	13.3	31.5	6.0	17.2	41.8	7.8	21.6	50.7
DCR 04811	10.0	27.3	63.3	9.6	16.8	39.5	7.7	21.8	51.9	10.0	27.3	63.3
DCR 04813	10.0	27.3	63.3	9.6	16.8	39.5	7.7	21.8	51.9	10.0	27.3	63.3
DCR 04817	10.0	27.3	63.3	9.6	16.8	39.5	7.7	21.8	51.9	10.0	27.3	63.3
DCR 04821	10.0	27.3	63.3	9.6	16.8	39.5	7.7	21.8	51.9	10.0	27.3	63.3
DCR 0965	3.3	9.1	21.4	3.2	5.7	13.4	2.5	7.4	18.0	3.3	9.2	21.6
DCR 0967	5.8	16.2	38.1	5.6	9.9	23.6	4.5	12.9	31.4	5.8	16.2	38.1
DCR 0969	8.7	24.6	58.3	8.4	15.0	35.9	6.8	19.7	48.1	8.7	24.6	58.3
DCR 09611	11.9	33.4	79.3	11.4	20.4	48.9	9.3	26.8	65.4	11.9	33.4	79.3
DCR 09613	14.1	39.9	95.2	13.6	24.3	58.5	11.0	32.0	78.7	14.1	39.9	95.2
DCR 09617	14.1	39.9	95.2	13.6	24.3	58.5	11.0	32.0	78.7	14.1	39.9	95.2
DCR 09621	14.1	39.9	95.2	13.6	24.3	58.5	11.0	32.0	78.7	14.1	39.9	95.2
DCR 1445	3.5	10.0	22.8	3.4	6.0	14.0	2.7	7.7	18.9	3.5	10.0	22.8
DCR 1447	6.6	18.9	42.9	6.3	11.2	26.4	5.1	14.5	35.6	6.6	18.9	42.9
DCR 1449	8.8	25.1	57.2	8.4	15.0	35.2	6.8	19.4	47.5	8.8	25.1	57.2
DCR 14411	13.2	38.1	92.2	12.7	23.0	56.2	10.3	30.7	76.6	13.2	38.1	92.2
DCR 14413	13.2	38.1	92.2	12.7	23.0	56.2	10.3	30.7	76.6	13.2	38.1	92.2
DCR 14417	13.2	38.1	92.2	12.7	23.0	56.2	10.3	30.7	76.6	13.2	38.1	92.2
DCR 14421	13.2	38.1	92.2	12.7	23.0	56.2	10.3	30.7	76.6	13.2	38.1	92.2
DCR 1925	4.2	11.5	27.3	4.0	7.1	16.8	3.2	9.2	22.7	4.2	11.5	27.3
DCR 1927	7.9	21.6	51.4	7.6	13.4	31.6	6.1	17.4	42.7	7.9	21.6	51.4
DCR 1929	10.6	28.9	68.9	10.2	18.0	42.1	8.2	23.3	57.2	10.6	28.9	68.9
DCR 19211	14.8	41.8	99.4	14.3	25.5	61.2	11.6	33.6	82.2	14.8	41.8	99.4
DCR 19213	18.0	51.1	122.1	17.4	31.1	75.0	14.1	41.1	101.0	18.0	51.1	122.1
DCR 19217	18.0	51.1	122.1	17.4	31.1	75.0	14.1	41.1	101.0	18.0	51.1	122.1
DCR 19221	18.0	51.1	122.1	17.4	31.1	75.0	14.1	41.1	101.0	18.0	51.1	122.1

Data given in accordance with ARI-Standard 710-2002 for t_e = 4.4°C and t_c = 32.2°C.

Strainer mounted in suction line



48-F

Refrigerant	R22			R134a			R404A / R507			R407C / R410A		
Evaporating temperature [°C]	–40	–20	4.4	–30	–20	4.4	–40	–20	4.4	–40	–20	4.4
Pressure drop [Δp bar]	0.04	0.10	0.21	0.04	0.07	0.14	0.04	0.10	0.21	0.04	0.10	0.21
Recommended system capacity [kW]	15	47	113	15	28	69	12	38	93	15	47	113

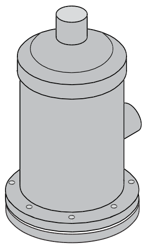
Strainer mounted in liquid line

Refrigerant	R22	R134a	R404A / R507	R407C / R410A
Recommended system capacity [kW]	390	350	260	390

Liquid capacity is given in accordance with ARI 710-2002 at:
Evaporating temperature t_e = –15°C
Condensing temperature t_c = +30°C
Pressure drop across filter drier Δp = 0.07 bar

The data given apply to DCR 04811 with 48-F core.

Ordering



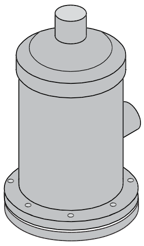
Normal pressure versions

DCR housings + top cover

Type	Number of cores	Steel connectors			Code number	Max. working pressure (PS/MWP)
		Solder		Butt weld		
		ODF in.	ODF mm	in.		
DCR 0485	1	5/8	16	1/2	**023U7050**	35 bar
DCR 0487		7/8	22	3/4	**023U7051**	
DCR 0489			28	1	**023U7052**	
DCR 0489		1 1/8		1	**023U7053**	
DCR 04811		1 3/8	35	1 1/4	**023U7054**	
DCR 04813		1 5/8		1 1/2	**023U7055**	
DCR 04813			42	1 1/2	**023U7056**	
DCR 04817		2 1/8	54	2	**023U7057**	
DCR 04821		2 5/8		2 1/2	**023U7076**	
DCR 0967	2	7/8	22	3/4	**023U7058**	35 bar
DCR 0969			28	1	**023U7059**	
DCR 0969		1 1/8		1	**023U7060**	
DCR 09611		1 3/8	35	1 1/4	**023U7061**	
DCR 09613		1 5/8		1 1/2	**023U7062**	
DCR 09613			42	1 1/2	**023U7063**	
DCR 09617		2 1/8	54	2	**023U7064**	
DCR 1449	3		28	1	**023U7065**	35 bar
DCR 1449		1 1/8		1	**023U7066**	
DCR 14411		1 3/8	35	1 1/4	**023U7067**	
DCR 14413		1 5/8		1 1/2	**023U7068**	
DCR 14413			42	1 1/2	**023U7069**	
DCR 14417		2 1/8	54	2	**023U7070**	
DCR 19211	4	1 3/8	35	1 1/4	**023U7071**	28 bar
DCR 19213		1 5/8		1 1/2	**023U7072**	
DCR 19213			42	1 1/2	**023U7073**	
DCR 19217		2 1/8	54	2	**023U7074**	

Type	Number of cores	Copper connectors		Code number	Max. working pressure (PS/MWP)
		Solder			
		ODF in.	ODF mm		
DCR 0485s	1	5/8	16	**023U7250**	35 bar
DCR 0487s		7/8	22	**023U7251**	
DCR 0489s			28	**023U7252**	
DCR 0489s		1 1/8		**023U7253**	
DCR 04811s		1 3/8	35	**023U7254**	
DCR 04813s		1 5/8		**023U7255**	
DCR 04813s			42	**023U7256**	
DCR 04817s		2 1/8	54	**023U7257**	
DCR 04821s		2 5/8		**023U7276**	
DCR 0967s	2	7/8	22	**023U7258**	35 bar
DCR 0969s			28	**023U7259**	
DCR 0969s		1 1/8		**023U7260**	
DCR 09611s		1 3/8	35	**023U7261**	
DCR 09613s		1 5/8		**023U7262**	
DCR 09613s			42	**023U7263**	
DCR 09617s		2 1/8	54	**023U7264**	
DCR 09621s		2 5/8		**023U7281**	
DCR 1449s	3		28	**023U7265**	35 bar
DCR 14411s		1 3/8	35	**023U7267**	
DCR 14413s		1 5/8		**023U7282**	
DCR 14413s			42	**023U7269**	
DCR 14417s		2 1/8	54	**023U7270**	
DCR 19213s	4	1 5/8		**023U7272**	28 bar
DCR 19213s			42	**023U7273**	
DCR 19217s		2 1/8	54	**023U7274**	

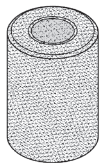
Ordering *(cont.)*

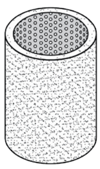


High pressure versions

DCR housings + top cover

Type	Number of cores	High-pressure steel connectors			Code no.	Max. working pressure (PS/MWP)
		Solder		Butt weld		
		ODF in.	ODF mm	in.		
DCR 0487	1	7/8	22	3/4	**023U7451**	46 bar
DCR 0489			28	1	**023U7452**	
DCR0489		1 1/8		1	**023U7453**	
DCR 04811		1 3/8	35	1 1/4	**023U7454**	
DCR 04813		1 5/8		1 1/2	**023U7455**	
DCR 04817		2 1/8	54	2	**023U7457**	
DCR 0967	2	7/8	22	3/4	**023U7458**	46 bar
DCR 0969			28	1	**023U7459**	
DCR 09611		1 3/8	35	1 1/4	**023U7461**	
DCR 09613		1 5/8		1 1/2	**023U7462**	
DCR 09617		2 1/8	54	2	**023U7464**	





DCR inserts

Type	**Material**	**Code no.**		
		8 pcs.		1 piece with gasket
		with gasket	without gasket	
48-DM solid core	100% molecular sieve	**023U1392**	**023U1393**	**023U1391**
48-DC solid core	80% molecular sieve & 20% Al_3O_2	**023U4381**	**023U4382**	**023U4380**
48-DA solid core	30% molecular sieve & 70% Al_3O_2	**023U5381**	**023U5382**	**023U5380**
48-F strainer		**023U1921**		

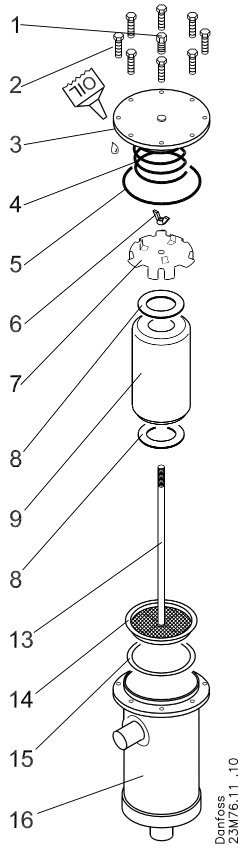
Core surface
DM 048, DC 048 and DA 048 = 435 cm^2
DM 096, DC 096 and DA 096 = 870 cm^2
DM 144, DC 144 and DA 144 = 1305 cm^2
DM 192, DC 192 and DA 192 = 1740 cm^2
48-F = 405 cm^2

Core volume
DM 048, DC 048 and DA 048 = 760 cm^3
DM 096, DC 096 and DA 096 = 1520 cm^3
DM 144, DC 144 and DA 144 = 2280 cm^3
DM 192, DC 192 and DA 192 = 3040 cm^3

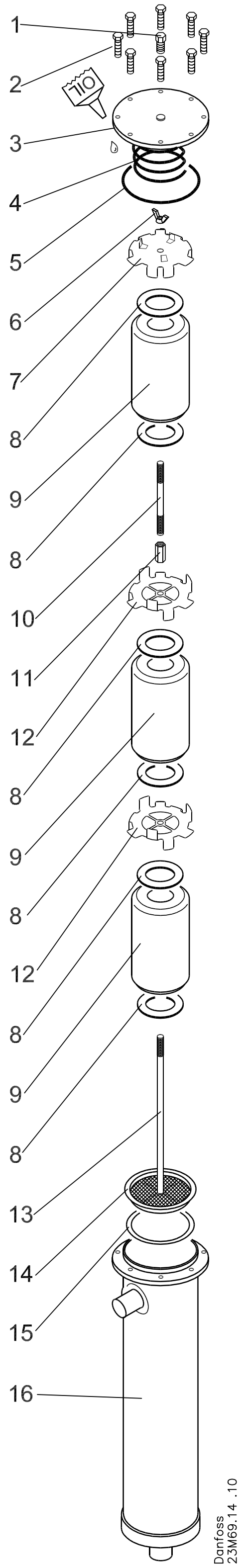
Design

1. Plug $^1/_4$ in. NPT
2. Top cover bolts
   M8 × 35, class 10.9
3. Top cover
4. Spring
5. Top cover gasket
   Ø121.8 × Ø113.6 × 0.8 mm
6. Wing nut
   M10 (torque max. 3 Nm)
7. Top plate
8. Felt gasket
   Ø95.5 × Ø45.5 × 2 mm
9. Solid core
10. Extension rod
11. Extension nut
12. Intermediate plate
13. Distance rod
14. Bottom plate / strainer
15. Felt gasket
   Ø95.5 × Ø78 × 2 mm
16. Filter drier shell

Example:

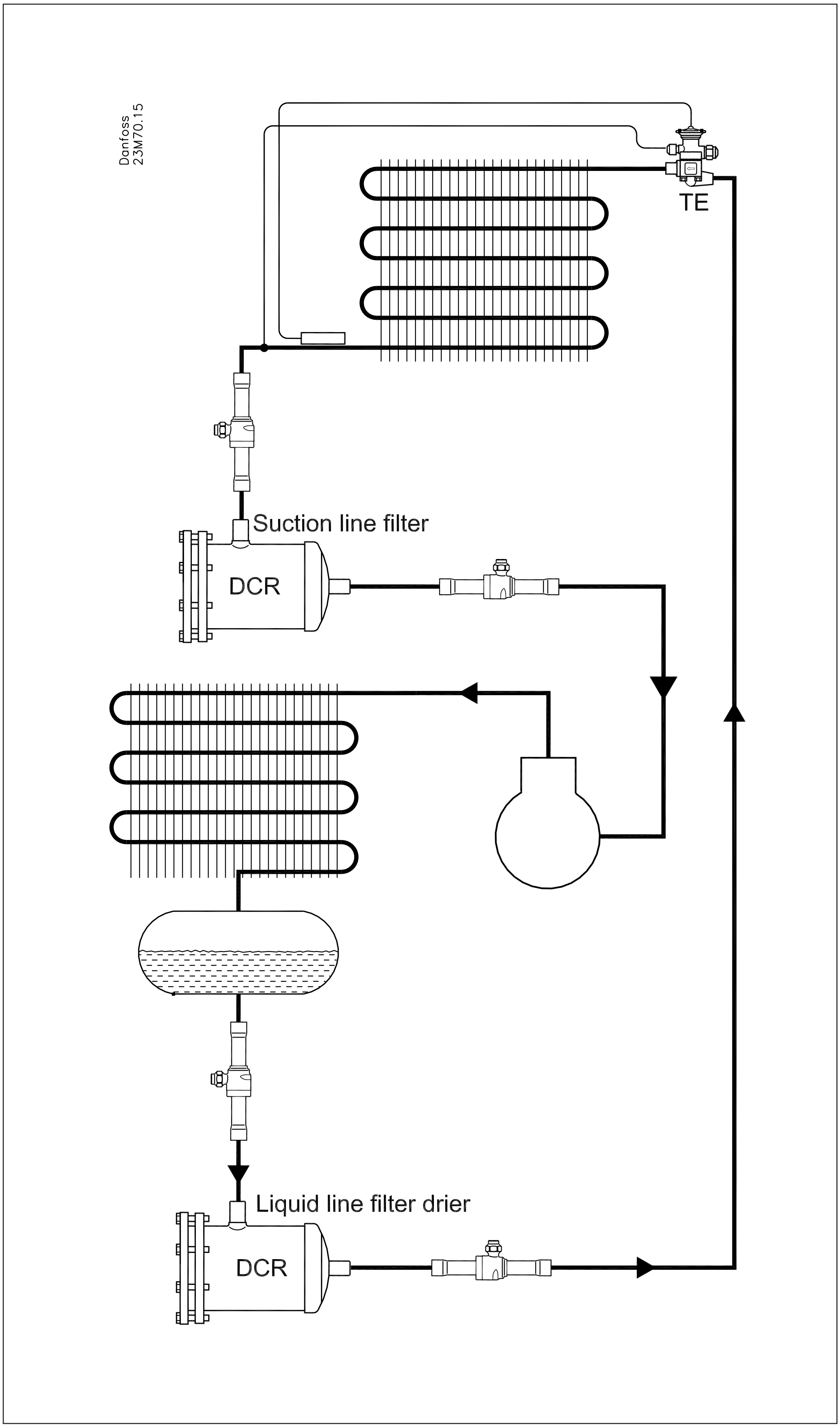


DCR with core holder, one core



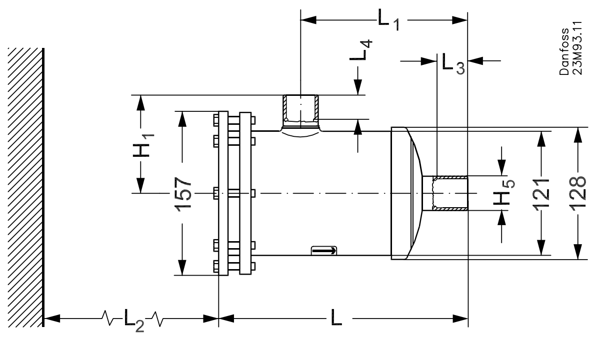
DCR with core holder, three cores

Application

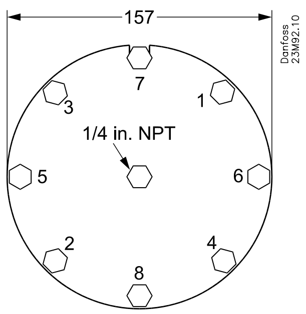


Dimensions and weights for normal-pressure version

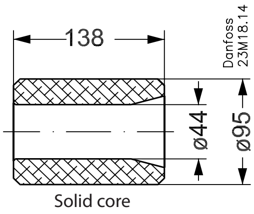
DCR housing



DCR top cover



DCR solid core



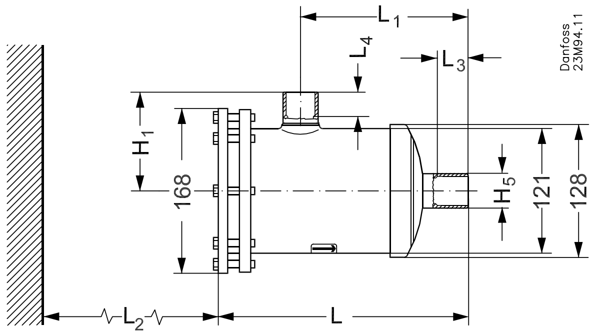
Weight
Tin containing solid core 0.8 kg

Type	Number of cores	DCR with steel connectors							DCR with copper connectors							Weight*
		L mm	L_1 mm	L_2 mm	L_3 mm	L_4 mm	H_1 mm	H_5 mm	L mm	L_1 mm	L_2 mm	L_3 mm	L_4 mm	H_1 mm	H_5 mm	kg
DCR 0485(s)		245.5	165		12	12	96	21	262.5	182		12	12	113	19	
DCR 0487(s)		239.5	159		17	17	90	27	262.5	181		17	17	113	25	
DCR 0489(s)		243.5	162		22	22	94	34	264.5	184		20	20	116	32	
DCR 0489(s)		243.5	162		22	22	94	34	264.5	184		20	20	116	32	
DCR 04811(s)	1	245.5	165	170	25	25	97	42	267.5	186	170	25	25	119	39	5.2
DCR 04813(s)		250.5	170		29	29	103	48	268.5	188		29	29	121	46	
DCR 04813(s)		250.5	170		29	29	103	48	268.5	188		29	29	121	46	
DCR 04817(s)		256.5	176		33	33	111	60	270.5	190		34	34	125	58	
DCR 04821(s)		254.5	174		38	38	116	73	267.5	187		34	34	129	71	
DCR 0965(s)		384.5	304		12	12	96	21	401.5	321		12	12	113	19	
DCR 0967(s)		378.5	298		17	17	90	27	401.5	320		17	17	113	25	
DCR 0969(s)		382.5	301		22	22	94	34	403.5	323		20	20	116	32	
DCR 0969(s)		382.5	301		22	22	94	34	403.5	323		20	20	116	32	
DCR 09611(s)	2	384.5	304	310	25	25	97	42	406.5	325	310	25	25	119	39	6.6
DCR 09613(s)		389.5	309		29	29	103	48	407.5	327		29	29	121	46	
DCR 09613(s)		389.5	309		29	29	103	48	407.5	327		29	29	121	46	
DCR 09617(s)		395.5	315		33	33	111	60	409.5	329		34	34	125	58	
DCR 09621(s)		393.5	313		38	38	116	73	406.5	326		34	34	129	71	
DCR 1445(s)		526.5	446		12	12	96	21	543.5	463		12	12	113	19	
DCR 1447(s)		520.5	440		17	17	90	27	543.5	462		17	17	113	25	
DCR 1449(s)		524.5	443		22	22	94	34	545.5	465		20	20	116	32	
DCR 1449(s)		524.5	443		22	22	94	34	545.5	465		20	20	116	32	
DCR 14411(s)	3	526.5	446	310	25	25	97	42	548.5	467	310	25	25	119	39	7.8
DCR 14413(s)		531.5	451		29	29	103	48	549.5	469		29	29	121	46	
DCR 14413(s)		531.5	451		29	29	103	48	549.5	469		29	29	121	46	
DCR 14417(s)		537.5	457		33	33	111	60	551.5	471		34	34	125	58	
DCR 14421(s)		535.5	455		38	38	116	73	548.5	468		34	34	129	71	
DCR 1925(s)		666.5	586		12	12	96	21	683.5	603		12	12	113	19	
DCR 1927(s)		660.5	580		17	17	90	27	683.5	602		17	17	113	25	
DCR 1929(s)		664.5	583		22	22	94	34	685.5	605		20	20	116	32	
DCR 1929(s)		664.5	583		22	22	94	34	685.5	605		20	20	116	32	
DCR 19211(s)	4	666.5	586	310	25	25	97	42	688.5	607	310	25	25	119	39	9.1
DCR 19213(s)		671.5	591		29	29	103	48	689.5	609		29	29	121	46	
DCR 19213(s)		671.5	591		29	29	103	48	689.5	609		29	29	121	46	
DCR 19217(s)		677.5	597		33	33	111	60	691.5	611		34	34	125	58	
DCR 19221(s)		675.5	595		38	38	116	73	688.5	608		34	34	129	71	

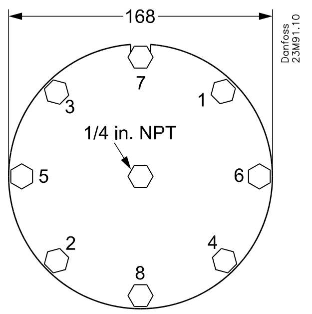
* Weights stated without core. All values approximate.

Dimensions and weights for high-pressure version

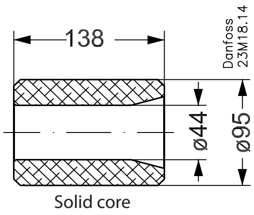
DCR housing



DCR top cover



DCR solid core



Weight
Tin containing solid core 0.8 kg

Type	Number of cores	High-pressure DCR with steel connectors							
		L mm	L_1 mm	L_2 mm	L_3 mm	L_4 mm	H_1 mm	H_5 mm	Weight* kg
DCR 0487(s)	1	245.5	159	170	17	17	90	25	6.8
DCR 0489(s)		248.5	162		22	22	94	32	
DCR 04811		251.5	165		25	25	97	39	
DCR 04813		256.5	170		29	29	103	46	
DCR 04817		262.5	176		33	33	111	58	
DCR 0967	2	384.5	298	310	17	17	90	25	8.2
DCR 0969		387.5	301		22	22	94	32	
DCR 09611		390.5	304		25	25	97	39	
DCR 09613		395.5	309		29	29	103	46	
DCR 09617		401.5	315		33	33	111	58	

* Weights stated without core. All values approximate.

Introduction

The MLI sight glass is mainly used to indicate the condition of the refrigerant as well as the liquid level in the receiver or the oil level in the compressor.

The MLI is equipped with a sensitive indicator that reflects a colour, depending on the moisture content in the refrigerant.

Features

- MLI are moisture indicators suitable for use with liquid halocarbon refrigerants e.g. R404a, R134a or R22.
- MLI can be used for refrigerants within the temperature range +80/–40°C (+176/–40°F) to maximum operating pressure of 25 bar.
- MLI are available with weld or solder connections.
- MLI 100 can, when the indicator element has been removed, alternatively be used as a normal sight glass for all refrigerants inclusive R717 (ammonia).

  Note: MLI Sight glasses sizes 32 and 40 are not PED approved and cannot be used in PED areas.

Design

Housing
The MLI housing is made of special, cold resistant steel approved for low temperature applications.

Connections
- Welding DIN (2448), DN 20 to 40
- Welding ANSI (B 36.10 Schedule 80), DN 20 to 40
- Soldering ANSI (B 16.22)

Installation
For further information refer to installation instruction for MLI

Technical data

- Max. operating pressure is 25 bar.
- The MLI 20-40 are designed for:
  Strength test: 50 bar g (725 psig).
  Leakage test: 25 bar g (362 psig).

The moisture liquid indicators are designed as sight glasses with an integral moisture indicator element.

The indicator element is a filter paper impregnated with a chemical salt, which is sensitive to moisture. The indicator element will change color upon detection of moisture within the system. The color change is reversible.

New systems or systems where the drier has been replaced may cause the element to change color almost immediately. However, it is recommended that the plant is allowed to operate for at least 12 hours to allow the system to reach equilibrium before deciding if the drier should be changed.

The drying of the system should be continued until the indicator element stays dark green.

Moisture content

MLI for CFC and HCFC refrigerants

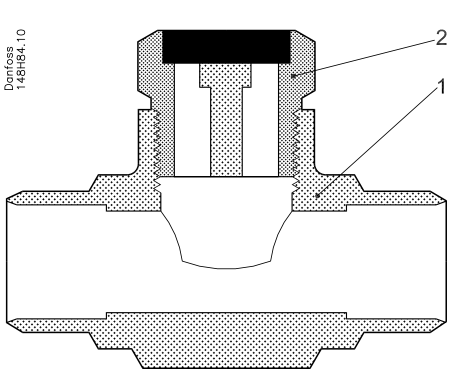
	Moisture content ppm = parts per million					
	MLI 100					
	25°C			43°C		
	Green/dry	Intermediate color	Yellow/wet	Green/dry	Intermediate color	Yellow/wet
R22	< 30	30 - 90	> 90	< 45	45 - 130	> 130

MLI for HFC and HCFC refrigerants

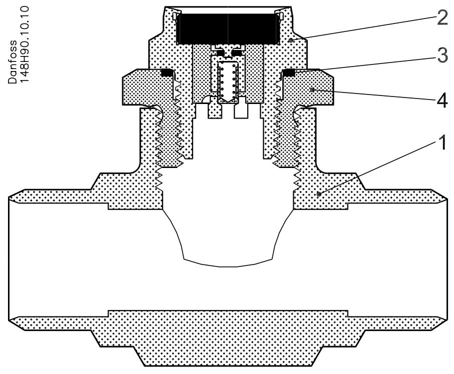
	Moisture content ppm = parts per million					
	MLI 200					
	25°C			43°C		
	Green/dry	Intermediate color	Yellow/wet	Green/dry	Intermediate color	Yellow/wet
R134a	< 30	30 - 100	> 100	< 45	45 - 170	> 170
R404A	< 20	20 - 70	> 70	< 25	25 - 100	> 100
R407C	< 30	30 – 140	> 140	< 60	60 – 225	> 225
R507	< 15	15 - 60	> 60	< 30	30 - 110	> 110

The complete technical leaflet (DKRCI.PD.GH0.A) can be downloaded from the Danfoss web site.

Material specification



MLI 100



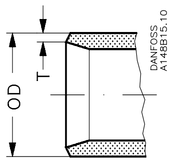
MLI 200

No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing	Steel	TTSt 35N 17173	TW6 2604/3	Grade 1 A 333, A 334 A350 LF2*
2	Indicator MLI 100 Indicator MLI 200	steel/glass brass/glass			
3	O-ring	Rubber			
4	Adapter	Steel			

* - alternative material

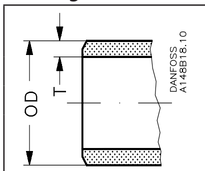
Connections

Welding DIN (2448)



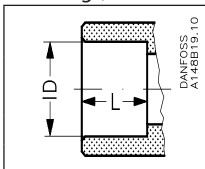
mm	inch	**OD / ID** Ø mm	**OD / ID** Ø inch
20	¾″	26.9 / 22.3	1.059 / 0.878
25	1″	33.7 / 28.5	1.327 / 1.122
32	1 ¼″	42.4 / 37.2	1.669 / 1.465
40	1 ½″	48.3 / 43.1	1.902 / 1.697

Welding ANSI (B 36.10 Schedule 80)



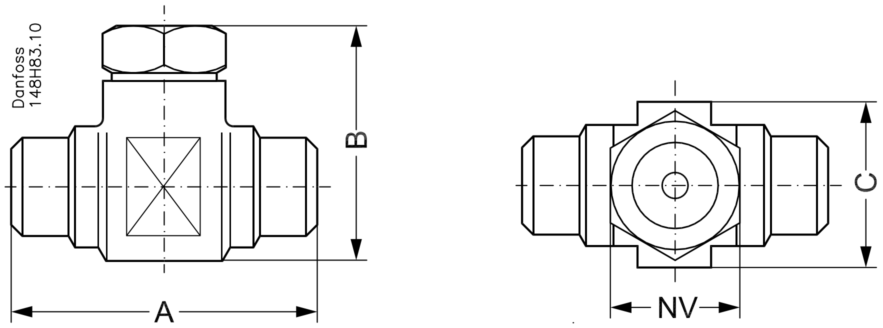
mm	inch	**OD / ID** Ø mm	**OD / ID** Ø inch
20	¾″	26.9 / 18.9	1.059 / 0.744
25	1″	33.7 / 24.5	1.327 / 0.965
32	1 ¼″	42.4 / 32.6	1.669 / 1.283
40	1 ½″	48.3 / 38.1	1.902 / 1.500

Soldering (ANSI B 16.22)



mm	inch	**ID** Ø mm	**L** mm	**ID** Ø inch	**L** inch
22	$^{7}/_{8}$″	22.30	19	0.878	0.75
27	$1^{1}/_{8}$″	28.65	23	1.128	0.91
32	$1^{3}/_{8}$″	35.00	25	1.378	0.98
40	$1^{5}/_{8}$″	41.35	28	1.628	1.10

Dimensions



Size	Connection	A mm	A in.	B mm	B in.	C mm	C in.	NV mm	NV in.	Weight kg	Weight lb
DN 20	D / A	85	3.35	45	1.77	46	1.81	35	1.38	0.6	1.32
DN 25	D / A										
DN 22	SA										
DN 27	SA										
DN 32	D / A / SA	110	4.33	50	1.97	60	2.36	35	1.38	1.0	2.20
DN 40	D / A / SA										

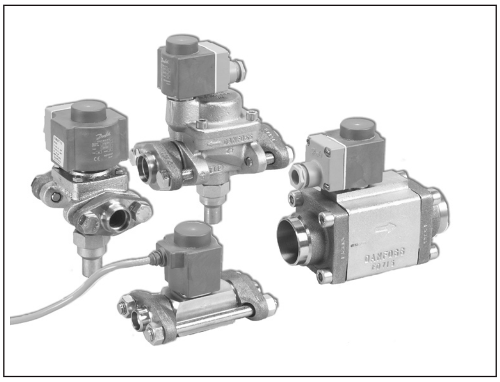
D = Welding DIN (2448)
A = Welding ANSI (B 36.10 Schedule 80)
SA = Soldering (ANSI B 16.22)

Ordering

DIN weld connection/ANSI solder connection						ANSI connection			
Size welding mm	Size welding inch	Size solder mm	Size solder inch	Type	**Code no.**	mm	inch	Type	**Code no.**
20	¾″	22	7/8″	MLI 20 D 100	**2511+019**	20	¾″	MLI 20 A 100	**2511+088**
25	1″	27	1 1/8″	MLI 25 D 100	**2511+020**	25	1″	MLI 25 A 100	**2511+089**
32	1 ¼″	32	1 3/8″	MLI 32 D 100	**2511+021**	32	1 ¼″	MLI 32 A 100	**2511+090**
40	1 ½″	40	1 5/8″	MLI 40 D 100	**2511+022**	40	1 ½″	MLI 40 A 100	**2511+091**
20	¾″	22	7/8″	MLI 20 D 200	**2511+093**	20	¾″	MLI 20 A 200	**2511+097**
25	1″	27	1 1/8″	MLI 25 D 200	**2511+094**	25	1″	MLI 25 A 200	**2511+098**
32	1 ¼″	32	1 3/8″	MLI 32 D 200	**2511+095**	32	1 ¼″	MLI 32 A 200	**2511+099**
40	1 ½″	40	1 5/8″	MLI 40 D 200	**2511+096**	40	1 ½″	MLI 40 A 200	**2511+100**

Introduction

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.



Approval

DNV, Det Norske Veritas, Norway
Π Polski Rejestr Statków, Poland
MRS, Maritime Register of Shipping, Russia
Pressure Equipment Directive (PED) (97/23/EC)(EVRA 32 and 40 CE marked according to PED)
UL listed with GP coils

Technical data

Refrigerants
R 717 (NH_3), R 22, R 134a, R 404A, 410 A, R 744 (CO_2), R 502 etc.

Ambient temperature and enclosure for coil
See “Coils for solenoid valves”, RD.3J.E2.02.

Temperature of medium
–40 → +105°C.
Max. 130°C during defrosting.

Type	Opening differential pressure with standard coil (Δp bar)				Temperature of medium	Max. working pressure PB	k_V-value 1)
		Max. (= MOPD) liquid 2)					
	Min.	10 W a.c.	12 W a.c.	20 W d.c.	°C	bar	m³/h
EVRA 3	0.00	21	25	14	–40 → 105	42	0.23
EVRA 10	0.05	21	25	18	–40 → 105	42	1.5
EVRAT 10	0.00	14	21	16	–40 → 105	42	1.5
EVRA 15	0.05	21	25	18	–40 → 105	42	2.7
EVRAT 15	0.00	14	21	16	–40 → 105	42	2.7
EVRA 20	0.05	21	25	13	–40 → 105	42	4.5
EVRAT 20	0.00	14	21	13	–40 → 105	42	4.5
EVRA 25	0.20	21	25	14	–40 → 105	42	10.0
EVRA 32	0.20	21	25	14	–40 → 105	42	16.0
EVRA 40	0.20	21	25	14	–40 → 105	42	25.0

1) The k_v value is the water flow in m^3/h at a pressure drop across valve of 1 bar, ρ = 1000 kg/m^3.
2) MOPD for media in gas form is approx. 1 bar greater.

Type	Rated capacity 1) [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	142.0	30.2	27.8	21.1	9.0	3.4	2.5	3.1	42.6	13.9	11.0	11.3
EVRA/T 15	256.0	54.4	50.1	38.0	16.1	6.2	4.4	5.5	76.7	24.9	19.8	20.3
EVRA/T 20	426.0	90.6	83.5	63.3	26.9	10.3	7.3	9.2	128.0	41.5	32.9	33.9
EVRA 25	947.0	201.0	186.0	141.0	59.7	22.8	16.3	20.4	284.0	92.3	73.2	75.3
EVRA 32	1515.0	322.0	297.0	225.0	95.5	36.5	26.1	32.6	454.0	148.0	117.0	120.0
EVRA 40	2368.0	503.0	464.0	351.0	149.0	57.0	40.8	51.0	710.0	231.0	183.0	188.0

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.

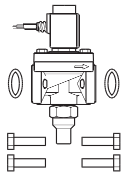
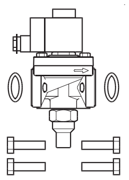
Rated hot gas capacity is based on condensing temperature t_c = +40°C, pressure drop across valve Δp = 0.8 bar, hot gas temperature t_h = +65°C, and subcooling of refrigerant Δt_{sub} = 4 K.

The complete technical leaflet (RD3CB) can be downloaded from the Danfoss web site.

Ordering

Complete valves without flanges

Type	Connection	Code no. [1]	
		10 W coil with 1 m cable	10 W coil with terminal box

Valves without manual operation

EVRA 3	See table *"Flange set"*	**032F3102**	**032F3103**
EVRA 10		**032F6207**	**032F6208**

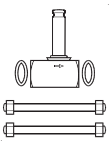
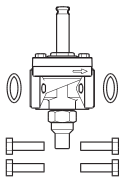
Valves with manual operation

EVRA 10	See table *"Flange set"*	**032F6212**	**032F6213**
EVRA 15		**032F6217**	**032F6218**
EVRA 20		**032F6222**	**032F6223**

[1]) Valve body with gaskets, bolts and 10 W a.c. coil. Please specify code no., voltage and frequency. Voltage and frequency can also be given in the form of an appendix number, see table "Appendix numbers", under EVR.

Separate valve bodies

Type	Connection	Required coil type	**Code no.**

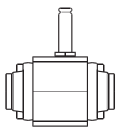
Valves with manual operation

EVRA 10	See table *"Flange set"*	a.c./d.c.	**032F6210**
EVRAT 10		a.c./d.c.	**032F6214**
EVRA 15		a.c./d.c.	**032F6215**
EVRAT 15		a.c./d.d.	**032F6216**
EVRA 20		a.c.	**032F6220**
EVRA 20		a.c./d.c.	**032F6221**
EVRAT 20		a.c./d.c.	**032F6219**
EVRA 25		a.c./d.c.	**032F6225**

Valves without manual operation

EVRA 3	See table *"Flange set"*	a.c./d.c.	**032F3050**
EVRA 10		a.c./d.c.	**032F6211**
EVRA 25		a.c./d.c.	**032F6226**

Separate valve bodies with butt weld connections



Type	Butt weld connection		**Code no.**
	DIN	ANSI	
Valves with manual operation			
EVRA 32	1 1/4 in.		**042H1126**
EVRA 32	1 ½ in.		**042H1131**
EVRA 32		1 1/4 in.	**042H1140**
EVRA 32		1 ½ in.	**042H1141**
EVRA 40	1 ½ in.		**042H1128**
EVRA 40	2 in.		**042H1132**
EVRA 40		1 ½ in.	**042H1142**
EVRA 40		2 in.	**042H1143**

Coils
See "Coils for solenoid valves", RD.3J.E3.02.

Accessories
Strainer FA for direct mounting, see "FA", RD.6C.
A3.02

Flanges,
see the following pages.

Example
EVRA 15 complete valve with terminal box,
220 V, 50 Hz, code no. **032F6218**
+ 3/4 in. weld flange set, code no. **027N1120**.

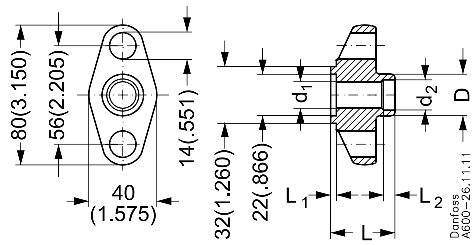
Example
EVRA 15 valve body with manual operation,
code no. **032F6215**
+ 3/4 in. weld flange set, code no. **027N1120**
+ coil with terminal box, 220 V, 50 Hz,
code no. **018F6701**

Ordering *(continued)*

Tongue/ tongue flange sets version 1.3

Used for:
EVRA 3, EVRA/T 10, EVRA/T 15
Each code no. includes two flanges

Separate flange gaskets,
ID 22 x OD 32 x 1.0 mm
(ID 0.866 x OD 1.260 x 0.039 in.):
Code no. 020-2133 (40 stk.). must be ordered separately



Butt welding DIN (2448)
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
10	3/8	18	0.709	10	0.394	14	0.551	32.5	1.280	3	0.118	6	0.236	**027N1112**
15	1/2	22	0.866	14	0.551	17	0.669	32.5	1.280	3	0.118	6	0.236	**027N1115**
20	3/4	27	1.063	19	0.748	22	0.866	32.5	1.280	3	0.118	6	0.236	**027N1120**

Butt welding ANSI B 36.10
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
10	3/8	17.1	0.673	10.7	0.421	10.7	0.421	32.5	1.280	3	0.118	6	0.236	**027N2020**
15	1/2	21.3	0.839	13.9	0.547	13.9	0.547	32.5	1.280	3	0.118	6	0.236	**027N2021**
20	3/4	26.9	1.059	18.9	0.744	18.9	0.744	32.5	1.280	3	0.118	6	0.236	**027N2022**

Socket welding ANSI (B 16.11)
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
10	3/8	26	1.024	12.5	0.492	17.8	0.701	32.5	1.280	3	0.118	10	0.394	**027N2010**
15	1/2	31.6	1.244	15.8	0.622	22	0.866	32.5	1.280	3	0.118	10	0.394	**027N2011**

FPT internal thread, NPT (ANSI / ASME B 1.20.1)
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	Code no.
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
10	3/8	26	1.024	14.3	0.563	3/8″-18 NPT	3/8″-18 NPT	32.5	1.477	3	0.118	**027G1005**
15	1/2	31.6	1.244	17.8	0.701	1/2″-14 NPT	1/2″-14 NPT	32.5	1.280	3	0.118	**027G1006**

Solder DIN (2856)
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
mm		mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
16		21	0.827	13	0.512	16	0.630	29.5	2.122	3	0.118	15	0.591	**027L1116**
22		27	1.063	19	0.748	22.1	0.869	29.5	1.161	3	0.118	22	0.866	**027L1122**

Solder ANSI B 16.22
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
	5/8	21	0.827	13	0.512	15.9	0.626	29.5	1.161	3	0.118	20.5	0.807	**027L1117**
	7/8	27	1.063	19	0.748	22.2	0.874	29.5	1.161	3	0.118	22	0.866	**027L1123**

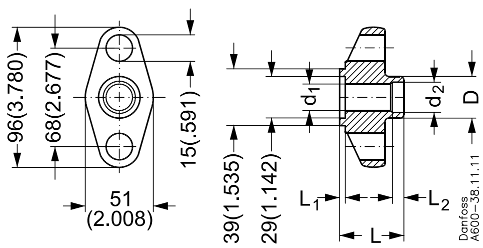
Solenoid valves

Ordering (continued)

Tongue/ tongue flange sets version 3

Used for
EVRA/T 20, EVRA 25
Each code no. includes two flanges.

Separate flange gaskets,
ID 29 x OD 39 x 1.5 mm
(ID 1.142 x OD 1.535 x 0.059 in.)



Butt welding DIN (2448)
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
20	$^3/_4$	27	1.063	19	0.748	22	0.866	35	1.378	3	0.118	6	0.236	**027N1220**
25	1	34	1.339	26	1.024	28	1.102	37.5	1.476	3	0.118	6	0.236	**027N1225**
32	$1^1/_4$	43	1.693	26	1.024	37	1.457	37.5	1.476	3	0.118	6	0.236	**027N1230**

Butt welding ANSI B 36.10
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
20	$^3/_4$	26.9	1.059	18.9	0.744	18.9	0.744	33	1.299	3	0.118	6	0.236	**027N3031**
25	1	33.7	1.327	24.5	0.965	24.5	0.965	37.5	1.476	3	0.118	6	0.236	**027N3032**
32	$1^1/_4$	42.4	1.669	26	1.024	32.6	1.283	37.5	1.476	3	0.118	6	0.236	**027N3033**

Socket welding ANSI (B 16.11)
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
20	$^3/_4$	37.4	1.472	21	0.827	27.4	1.079	33	1.299	3	0.118	13	0.512	**027N2001**
25	1	45.6	1.795	26.6	1.047	34.1	1.343	33	1.299	3	0.118	13	0.512	**027N2002**

FPT internal thread, NPT (ANSI / ASME B 1.20.1)
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	Code no.
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
20	$^3/_4$	37.4	1.472	23	0.906	$^3/_4$"-14 NPT	$^3/_4$"-14 NPT	33	1.299	3	0.118	**027G1001**
25	1	45.6	1.795	29	1.142	1"-11.5 NPT	1"-11.5 NPT	33	1.299	3	0.118	**027G1002**

Soldering DIN (2856)
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
mm		mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
22		34	1.338	19	0.748	22	0.866	32	1.260	4	0.157	16.5	0.650	**027L1222**
28		34	1.338	26	1.024	28	1.102	34	1.338	4	0.157	26	1.024	**027L1228**

Soldering ANSI B 16.22
Tongue flange sets

Connection		D	D	d_1	d_1	d_2	d_2	L	L	L_1	L_1	L_2	L_2	Code no.
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	
	$^7/_8$	34	1.338	19	0.748	22.2	0.874	32	1.260	4	0.157	16.5	0.650	**027L1223**
	$1^1/_8$	34	1.338	26	1.024	28.6	1.126	34	1.338	4	0.157	26	1.024	**027L1229**

Capacity

Liquid capacity Q_l kW

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

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	1093.0	1340.0	1547.0	1729.0
EVRA 32	1237.0	1749.0	2144.0	2475.0	2766.0
EVRA 40	1933.0	2734.0	3349.0	3867.0	4322.0

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

t_v°C	−10	0	+10	+20	+25	+30	+40	+50
R 717 (NH_3)	0.84	0.88	0.92	0.97	1.0	1.03	1.09	1.16

Suction vapour capacity Q_e kW

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 t_e 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.

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	100.0
EVRA 32	0.1	36.2	47.8	63.2	77.9	94.7	113.0
	0.15	42.7	57.4	74.1	95.5	116.0	139.0
	0.2	47.7	64.8	84.3	106.0	134.0	160.0
EVRA 40	0.1	56.5	74.8	98.8	122.0	148.0	177.0
	0.15	66.8	89.8	116.0	149.0	181.0	217.0
	0.2	74.5	101.0	132.0	166.0	209.0	251.0

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

t_v°C	−10	0	+10	+20	+25	+30	+40	+50
R 717 (NH_3)	0.84	0.88	0.92	0.97	1.0	1.03	1.09	1.16

Capacity
(continued)

R 717 (NH_3)

Hot gas capacity Q_h kW

Type	Pressure drop across valve	Hot gas capacity Q_e kW				
		Evaporating temp. t_e = –10°C. Hot gas temp. $t_h = t_c + 25$°C. Subcooling Δt_{sub}=4K				
		Condensing temperature t_c °C				
	Δp bar	+20	+30	+40	+50	+60
EVRA 3	0.1	1.8	2.1	2.3	2.5	2.6
	0.2	2.6	2.9	3.2	3.5	3.7
	0.4	3.8	4.2	4.6	4.9	5.3
	0.8	5.1	6.0	6.5	7.1	7.6
	1.6	7.4	8.3	9.1	9.9	10.9
EVRA/T 10	0.1	12.0	13.4	14.7	16.0	17.2
	0.2	17.1	19.0	20.9	22.7	24.4
	0.4	24.5	27.1	29.7	32.2	34.7
	0.8	34.0	39.0	42.6	46.1	49.5
	1.6	48.5	53.8	59.1	64.3	71.3
EVRA/T 15	0.1	21.7	24.1	26.4	28.8	31.0
	0.2	30.8	34.2	37.5	40.8	44.0
	0.4	44.1	48.8	53.5	58.0	62.4
	0.8	61.2	70.3	76.7	83.0	89.1
	1.6	87.4	96.9	106.0	116.0	128.0
EVRA/T 20	0.1	36.1	40.1	44.0	48.0	51.7
	0.2	51.4	57.0	62.6	68.0	73.2
	0.4	73.5	81.3	89.1	96.7	104.0
	0.8	102.0	117.0	128.0	138.0	148.0
	1.6	146.0	161.0	177.0	193.0	214.0
EVRA 25	0.1	80.2	89.1	98.0	107.0	115.0
	0.2	114.0	127.0	139.0	151.0	163.0
	0.4	163.0	181.0	198.0	215.0	231.0
	0.8	227.0	260.0	284.0	307.0	330.0
	1.6	324.0	358.0	394.0	429.0	475.0
EVRA 32	0.1	128.0	143.0	157.0	171.0	184.0
	0.2	183.0	203.0	223.0	242.0	260.0
	0.4	261.0	289.0	317.0	344.0	370.0
	0.8	362.0	416.0	455.0	492.0	528.0
	1.6	518.0	574.0	631.0	688.0	761.0
EVRA 40	0.1	201.0	223.0	244.0	267.0	287.0
	0.2	286.0	317.0	348.0	378.0	407.0
	0.4	408.0	452.0	495.0	537.0	578.0
	0.8	566.0	650.0	710.0	769.0	825.0
	1.6	809.0	897.0	986.0	1074.0	1188.0

An increase in hot gas temperature t_h of 10 K, based on $t_h = t_c$ +25°C, reduces valve capacity approx. 2% and vice versa.

A change in evaporating temperature t_e changes valve capacity; see correction factor table below.

Correction factor
When sizing valves, the table value must be multiplied by a correction factor depending on evaporating temperature t_e.

t_o °C	–40	–30	–20	–10	0	+10
R 717 (NH_3)	0.89	0.91	0.96	1.0	1.06	1.10

Capacity
(continued)

Hot gas capacity G_h kg/s

Type	Hot gas temperature t_h °C	Condensing temperature t_k °C	Hot gas capacity G_h kg/s at pressure drop across valve Δp bar								
			0.5	1	2	3	4	5	6	7	8

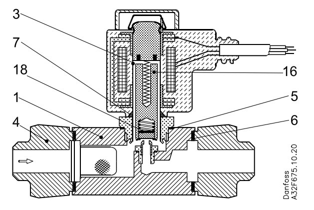
R 717 (NH_3)

Type	t_h °C	t_k °C	0.5	1	2	3	4	5	6	7	8
EVRA 3	+90	+25	0.003	0.005	0.006	0.007	0.007	0.007	0.007	0.007	0.007
		+35	0.004	0.005	0.007	0.009	0.009	0.01	0.01	0.01	0.01
		+45	0.005	0.006	0.009	0.01	0.011	0.012	0.013	0.013	0.013
EVRA/T 10		+25	0.022	0.03	0.04	0.045	0.048	0.048	0.048	0.048	0.048
		+35	0.026	0.036	0.048	0.056	0.061	0.064	0.065	0.065	0.065
		+45	0.030	0.041	0.056	0.066	0.074	0.079	0.083	0.085	0.086
EVRA/T 15		+25	0.040	0.054	0.072	0.081	0.086	0.087	0.087	0.087	0.087
		+35	0.046	0.064	0.086	0.1	0.109	0.115	0.117	0.117	0.117
		+45	0.053	0.074	0.101	0.12	0.133	0.142	0.149	0.153	0.155
EVRA/T 20		+25	0.066	0.09	0.12	0.12	0.144	0.145	0.145	0.145	0.145
		+35	0.077	0.107	0.144	0.167	0.182	0.191	0.195	0.195	0.195
		+45	0.089	0.124	0.169	0.199	0.211	0.237	0.248	0.255	0.258
EVRA 25		+25	0.143	0.197	0.26	0.296	0.313	0.316	0.316	0.316	0.316
		+35	0.168	0.232	0.313	0.364	0.397	0.417	0.425	0.425	0.425
		+45	0.194	0.269	0.368	0.434	0.482	0.516	1.54	0.555	0.561
EVRA 32		+25	0.233	0.322	0.424	0.483	0.511	0.516			
		+35	0.274	0.379	0.511	0.594	0.648	0.681	0.694		
		+45	0.316	0.439	0.601	0.709	0.787	0.842	0.882	0.906	0.916
EVRA 40		+25	0.362	0.503	0.663	0.755	0.798	0.806			
		+35	0.429	0.592	0.798	0.929	1.013	1.064	1.084		
		+45	0.495	0.686	0.939	1.107	1.23	1.316	1.378	1.416	1.431

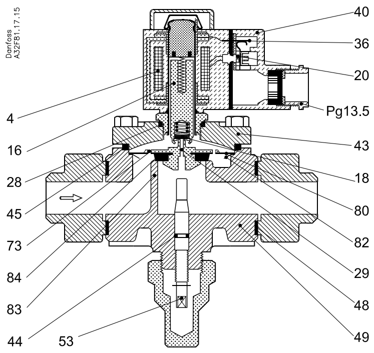
An increase in hot gas temperature t_h of 10 K reduces valve capacity approx. 2% and vice versa.

Design
Function

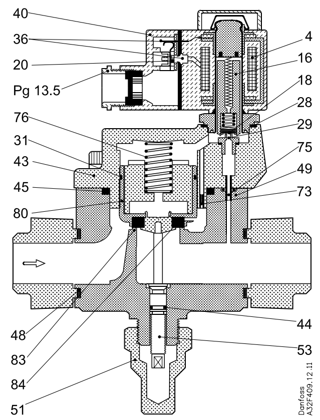
4. Coil
16. Armature
18. Valve plate / Pilot valve plate
20. Earth terminal
24. Connection for flexible steel hose
28. Gasket
29. Pilot orifice
30. O-ring
31. Piston ring
36. DIN plug
40. Terminal box
43. Valve cover
44. O-ring
45. Valve cover gasket
48. Flange gasket
49. Valve body
51. Cover / Threaded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



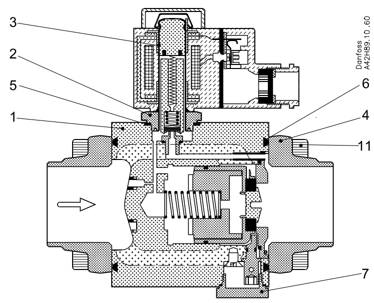
EVRA 3



EVRA/T 10, 15 and 20



EVRA 25



EVRA 32 and 40

EVRA solenoid valves are designed on two different principles:
1. Direct operation
2. Servo operation

1. 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.

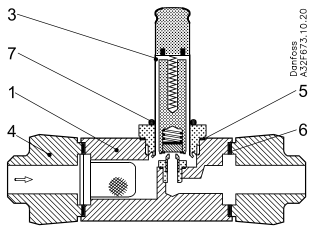
2. Servo operation
EVRA/T 10 → 20 are servo operated with a "floating" diaphragm (80). The pilot orifice (29) of stainless steel is placed in the centre of the diaphragm. The teflon pilot valve plate (18) is fitted direct to the armature (16).
When the coil is currentless, the main orifice and pilot 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 valve and keep it open.
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.

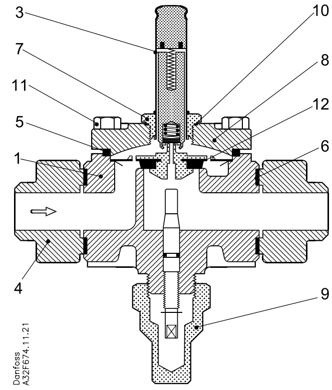
EVRA 25, 32 and 40 are servo operated piston valves. The valves are closed with currentless coil.
The servo piston (80) with main valve plate (84) closes against the valve seat (83) by means of the differential pressure between inlet and outlet side of the valve, the force of the compression spring (76) 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 0.07 bar.

Material specification

EVRA 3

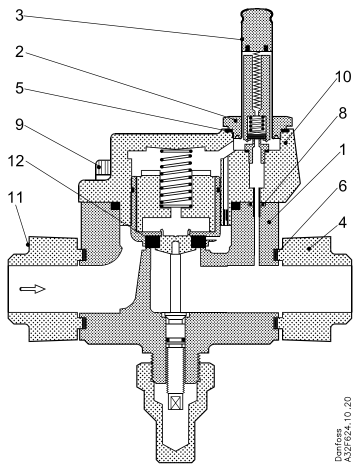


EVRA/T 10/15/20

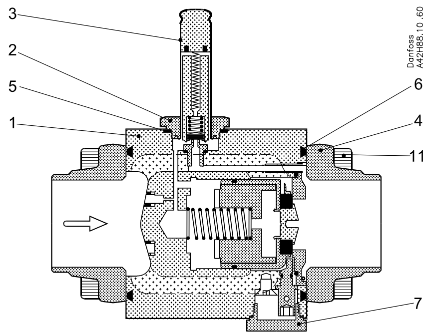


No.	Description	Solenoid valves	Material	Analysis	Mat.no.	W.no.	ISO	EN
1	Valve body	EVRA 3	Free-cutting steel	11MnPb30				10277-3
		EVRA/T 10/15/20	Cast-iron	GJS-400-18-LT				1563
3	Armature tube	EVRA 3/10/15/20	Stainless steel	X2CrNi19-11				10088
4	Flange	EVRA/T 3/10/15/20	Steel	S235JRG2				10025
5	Gasket	EVRA 3	Aluminium	Al 99.5				10210
		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)					

EVRA 25

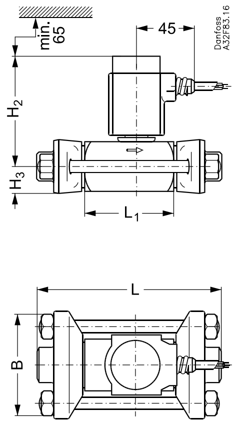


EVRA 32/40

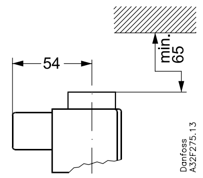


No.	Description	Solenoid valves	Material	Analysis	Mat.no.	W.no.	ISO	EN
1	Valve body	EVRA 25/32/40	Cast-iron	GJS-400-18-LT				1563
2	Armature tube nut	EVRA 25/32/40	Stainless steel	X8CrNiS 18-9				10088
3	Armature tube	EVRA 25/32/40	Stainless steel	X2CrNi19-11				10088
4	Flange	EVRA 25	Steel	S235JRG2				10025
		EVRA 32/40	Steel	P285QH				10222-4
5	Gasket	EVRA 25/32/40	Aluminium	Al 99.5				10210
6	Gasket	EVRA 25	asbestos-free					
		EVRA 32/40	Rubber	Cr				
7	Cover/thread plug	EVRA 25	Free-cutting steel	11SMnPb30				10277-3
		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)					

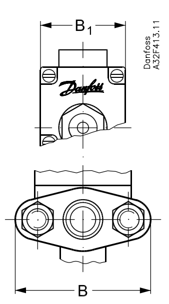
Dimensions and weight



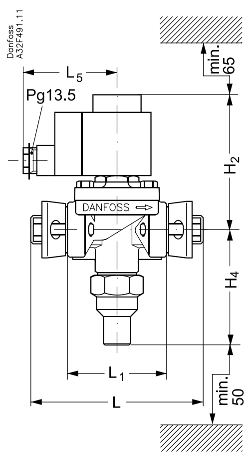
EVRA 3
Coil with cable



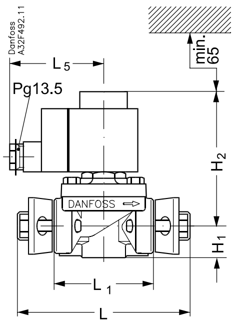
EVRA 3 → 20
Coil with DIN plugs



EVRA 3 → 20
Coil with terminal box



EVRA/T 10 → 20
Coil with terminal box



EVRA 10
Coil with terminal box

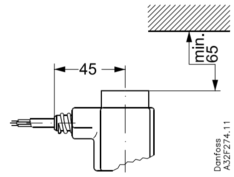
Weight of coil
10 W: approx. 0.3 kg
12 and 20 W: approx. 0.5 kg

Weight of flange set
For EVRA 3, 10 and 15: 0.6 kg
For EVRA 20: 0.9 kg

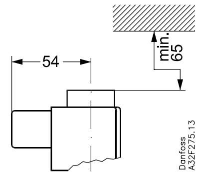
Type	H_1	H_2	H_3	H_4	L	L_1	L_5 max. 10 W	L_5 max. 12 W 20 W	B	B_1 max.	Weight [1]
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg
EVRA 3		84	19		124	65	75	85	80	68	1.2
EVRA/T 10	22	100		81	130	68			80	68	1.7
EVRA/T 15		100		81	130	68			80	68	1.8
EVRA/T 20		110		77	155	85			96	68	2.7

[1]) With coil, without flanges

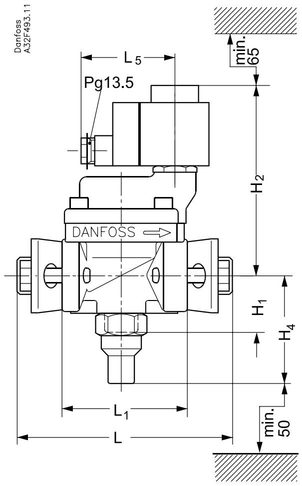
Dimensions and weight
(continued)



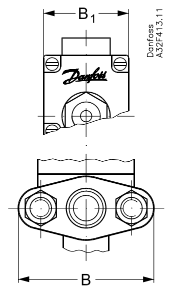
EVRA 25, 32 and 40
Coil with cable



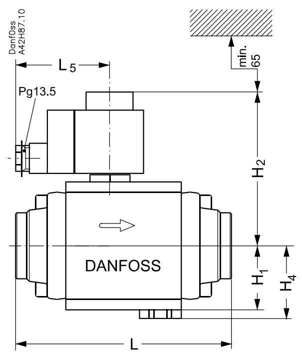
EVRA 25, 32 and 40
Coil with DIN plugs



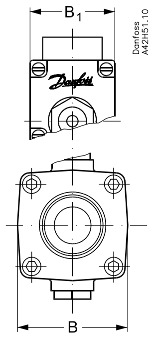
EVRA 25
Coil with terminal box



EVRA 25
Coil with terminal box



EVRA 32 and 40
Coil with terminal box



EVRA 32 and 40
Coil with terminal box

Weigh of coil
10 W: approx. 0.3 kg
12 and 20 W: approx. 0.5 kg

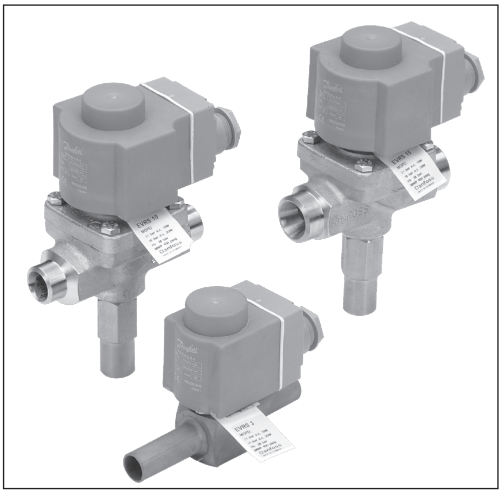
Weight of flange set
For EVRA 25: 0.9 kg

Type	H_1	H_2	H_3	H_4	L	L_1	L_5 max.		B	B_1 max.	Weight [1])
							10 W	12 W 20 W			
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg
EVRA 25	46	141		78	162	92			95	68	3.0
EVRA 32	47	115		53	175		75	85	80	68	4.0
EVRA 40	47	115		53	175				80	68	4.0

[1]) With coil, without flanges

Introduction

EVRS and EVRST are valves made of stainless steel.
EVRS 3 is direct operated.
EVRS 10, 15 and 20 are servo operated.
EVRST 10,15 and 20 are forced servo operated valves used in liquid, suction, hot gas and oil return lines with ammonia or fluorinated refrigerants.
EVRS 3 and EVRST are designed for keeping open at a pressure drop of 0 bar.
EVRS/EVRST 10, 15 and 20 are equipped with spindel for manual opening.
EVRS and EVRST are supplied as components, i.e. valve body and coil must be separately ordered.



Features

- Stainless steel valve body and connections
- Max. working pressure 50 barg
- Used for ammonia and all fluorinated refrigerants
- MOPD up to 38 bar with 20 watt a.c. coil
- Wide choice of a.c. and d.c. coils
- Designed for temperatures of media up to 105°C
- Manual stem on EVRS and EVRST 10, EVRST 15 and EVRST 20

Approvals

The Low Voltage Directive (LVD) 73/23/EC with ammendments EN 60730-2-8

Technical data

Refrigerants
R717 (NH_3), R22, R134a, R404A; R744; R410A etc.

Temperature of medium
–40 → +105°C for 10 or 12 watt coil. Max. 130°C during defrosting.
–40 → +80°C for 20 watt coil.

Ambient temperature and enclosure for coil: See "Coils for solenoid valves", lit.no. RD.3J.E2.02

Type	Opening differential pressure Δp bar					k_v value 2) m³/h	Max. working pressure Ps
	Min.	Max. (MOPD) liquid 1)					
		10 W a.c.	12 W a.c.	20 W a.c.	20 W d.c.		
EVRS 3	0.0	21	25	38	14	0.23	50 barg
EVRS 10	0.05	21	25	38	18	1.5	
EVRST 10	0.0	14	21	38	16	1.5	
EVRS 15	0.05	21	25	38	18	2.7	
EVRST 15	0.0	14	21	38	18	2.7	
EVRS 20	0.05	21	25	38	13	4.5	28 barg for R717, HCFC, HFC, R744 3) 50 barg only for R744, R410 4)
EVRST 20	0.0	14	21	38	13	4.5	

1) MOPD for media in gas form is approx. 1 bar greater.
2) The k_v value is the water flow in m³/h at a pressure drop in the valve of 1 bar, ρ = 1000 kg/m³.
3) All refrigerants in group I according to Pressure Equipment Directive PED 97/23/CE article 9 section 2.1
Group I comprises fluids defined as:
- explosive
- extremely flammable
- highly flammable
- flammable (where the maximum allowable temperature is above flashpoint)
- very toxic
- toxic
- oxidizing

4) Only for refrigerants in group 2 according to Pressure Equipment Directive PED 97/23/CE article 9 section 2.2
Group 2 comprises all other fluids not referred to in 2.1

The complete technical leaflet (DKRCC.PD.B00.A) can be downloaded from the Danfoss web site.

Technical data *(continued)*

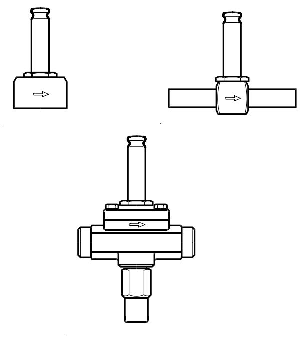
Type	Rated capacity[1]) kW														
	Liquid					Suction vapour					Hot gas				
	R717	R22	R134a	R404A	R410A	R717	R22	R134a	R404A	R410A	R717	R22	R134a	R404A	R410A
EVRS 3	21.8	4.6	4.3	3.2	4.5						6.5	2.1	1.7	1.7	2.3
EVRS/EVRST 10	142.0	30.2	27.8	21.1	29.7	9.0	3.4	2.5	3.1	4.3	42.6	13.9	11.0	11.3	14.9
EVRS/EVRST 15	256.0	54.4	50.1	38.0	53.5	16.1	6.2	4.4	5.5	7.7	76.7	24.9	19.8	20.3	26.7
EVRS/EVRST 20	426.0	90.6	83.5	63.3	89.1	26.9	10.3	7.3	9.2	12.0	128.0	41.5	32.9	33.9	44.5

[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.
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 = +60°C, and subcooling of refrigerant Δt_{sub} = 4 K.

Type	R 744 Rated capacity kW [2])	
	Liquid	Suction
EVRS 3	6.65	-
EVRS/ EVRST 10	43.3	6.9
EVRS/ EVRST 15	78.0	12.4
EVRS/ EVRST 20	130.0	20.7

[2]) Rated liquid and suction vapour capacity is based on evaporating temperature t_e = −40ºC, liquid temperature ahead of the vale t_l = – 8ºC and pressure drop across the valve Δp = 0.15 bar
For other condition please refer to DIR-Calc or contact your local Danfoss office.

Ordering



Separate valve bodies

Type	Max. working pressure Ps barg	Connection		**Code no.**	
		Weld in.	Pipe thread ISO 228/1	With manual stem	Without manual stem
EVRS 3	50	3/8			**032F3080**
EVRS 3	50		G 1/4		**032F3081**
EVRS 10	50	1/2		**032F3082**	
EVRST 10	50	1/2		**032F3083**	
EVRS 15	50	3/4		**032F3084**	
EVRST 15	50	3/4		**032F3085**	
EVRS 20	28	1		**032F3086**	
EVRST 20	28	1		**032F2237**	
EVRS 20	50	1		**032F5437**	
EVRST 20	50	1		**032F5438**	

Coils See "Coils for solenoid valves", lit.no. RD.3J.E3.02.

Capacity

Liquid capacity Q_l kW

Type	Liquid capacity Q_e kW at pressure drop across valve Δp bar				
	0.1	0.2	0.3	0.4	0.5
R717 (NH_3)					
EVRS 3	17.8	25.1	30.8	35.6	39.8
EVRS/EVRST 10	116.0	164.0	201.0	232.0	259.0
EVRS/EVRST 15	209.0	295.0	362.0	418.0	467.0
EVRS/EVRST 20	348.0	492.0	603.0	696.0	778.0

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 t_l ahead of valve/evaporator.
When the corrected capacity is known, the selection can be made from the table.

t_v °C	–10	0	+10	+20	+25	+30	+40	+50
R717 (NH_3)	0.84	0.88	0.92	0.97	1.0	1.03	1.09	1.16

Suction vapour capacity Q_e kW

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
R717 (NH_3)							
EVRS/EVRST 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
EVRS/EVRST 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
EVRS/EVRST 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

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 t_e and pressure drop Δp in 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 t_l ahead of expansion valve. When the corrected capacity is known, the selection can be made from the table.

t_v °C	–10	0	+10	+20	+25	+30	+40	+50
R717 (NH_3)	0.84	0.88	0.92	0.97	1.0	1.03	1.09	1.16
R22, R134a	0.76	0.81	0.88	0.96	1.0	1.05	1.16	1.31
R404A	0.70	0.76	0.84	0.94	1.0	1.07	1.24	1.47
R410A	0.76	0.80	0.89	0.96	1.0	1.05	1.18	1.37

Capacity
(continued)

Hot gas capacity Q_e kW

R717 (NH_3)

Type	Pressure drop across valve Δp bar	Hot gas capacity Q_h kW Evaporating temp. $t_e = -10$°C. Hot gas temp. $t_h = t_c + 25$°C. Subcooling $\Delta t_{sub} = 4$ K Condensing temperature t_c °C: +20	+30	+40	+50	+60
EVRS 3	0.1	1.8	2.1	2.3	2.5	2.6
	0.2	2.6	2.9	3.2	3.5	3.7
	0.4	3.8	4.2	4.6	4.9	5.3
	0.8	5.1	6.0	6.5	7.1	7.6
	1.6	7.4	8.3	9.1	9.9	10.9
EVRS/EVRST 10	0.1	12.0	3.4	14.7	16.0	17.2
	0.2	17.1	19.0	20.9	22.7	24.4
	0.4	24.5	27.1	29.7	32.2	34.7
	0.8	34.0	39.0	42.6	46.1	49.5
	1.6	48.5	53.8	59.1	64.3	1.3
EVRS/EVRST 15	0.1	21.7	24.1	26.4	28.8	31.0
	0.2	30.8	34.2	37.5	40.8	44.0
	0.4	44.1	48.8	53.5	58.0	62.4
	0.8	61.2	70.3	76.7	83.0	89.1
	1.6	87.4	96.9	106.0	116.0	128.0
EVRS/EVRST 20	0.1	36.1	40.1	44.0	48.0	51.7
	0.2	51.4	57.0	62.6	68.0	73.2
	0.4	73.5	81.3	89.1	96.7	104.0
	0.8	102.0	117.0	128.0	138.0	148.0
	1.6	146.0	161.0	177.0	193.0	214.0

Correction factors
When sizing valves, the table value must be multiplied by a correction factor depending on evaporating temperature t_e.

t_o°C	–40	–30	–20	–10	0	+10
R717 (NH_3)	0.89	0.91	0.96	1.0	1.06	1.10
R22	0.90	0.94	0.97	1.0	1.03	1.05

Hot gas capacity G_h kg/s

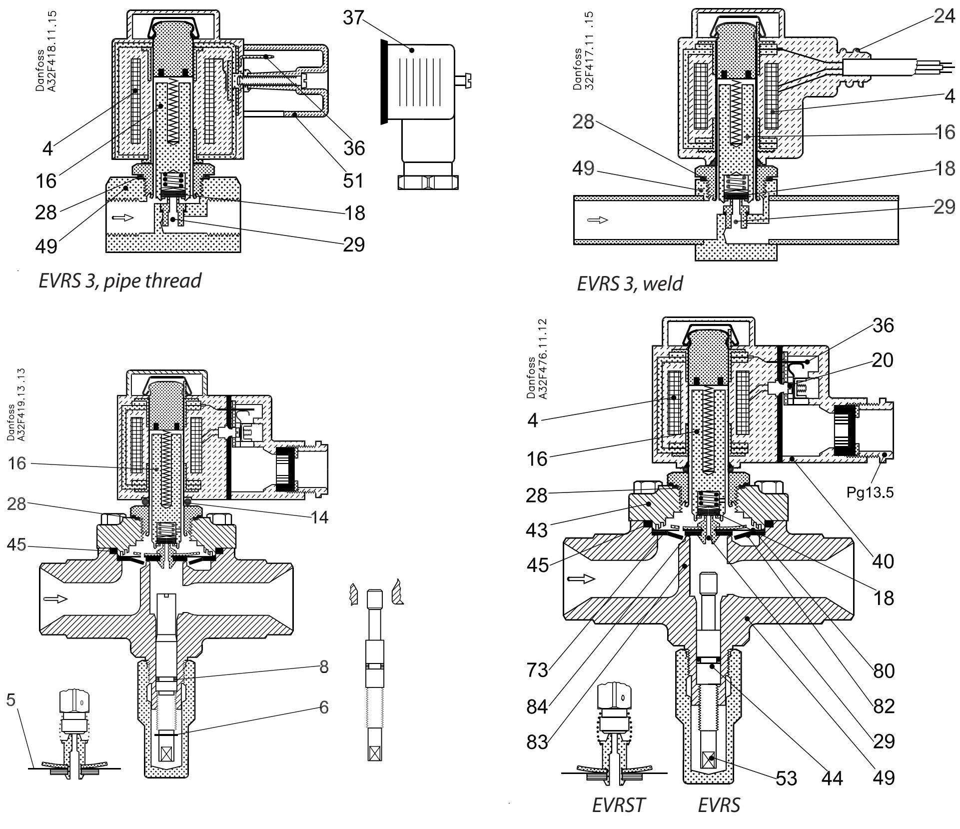
R717 (NH_3)

Type	Hot gas temperature t_h °C	Condensing temperature t_c °C	Hot gas capacity G_h kg/s at pressure drop across valve Δp bar: 0.5	1	2	3	4	5	6	7	8
EVRS 3	90	25	0.003	0.005	0.006	0.007	0.007	0.007	0.007	0.007	0.007
		35	0.004	0.005	0.007	0.009	0.009	0.01	0.01	0.01	0.01
		45	0.005	0.006	0.009	0.01	0.011	0.012	0.013	0.013	0.013
EVRS/ EVRST 10		25	0.022	0.03	0.04	0.045	0.048	0.048	0.048	0.048	0.048
		35	0.026	0.036	0.048	0.056	0.061	0.064	0.065	0.065	0.065
		45	0.030	0.041	0.056	0.066	0.074	0.079	0.083	0.085	0.086
EVRS/ EVRST 15		25	0.040	0.054	0.072	0.081	0.086	0.087	0.087	0.087	0.087
		35	0.046	0.064	0.086	0.100	0.109	0.115	0.117	0.117	0.117
		45	0.053	0.074	0.101	0.120	0.133	0.142	0.149	0.153	0.155
EVRS/ EVRST 20		25	0.066	0.090	0.120	0.120	0.144	0.145	0.145	0.145	0.145
		35	0.077	0.107	0.144	0.167	0.182	0.191	0.195	0.195	0.195
		45	0.089	0.124	0.169	0.199	0.211	0.237	0.248	0.255	0.258

An increase in hot gas temperature t_h of 10 K reduces valve capacity approx. 2% and vice versa.

A change in evaporating temperature t_e changes valve capacity; see correction factor table below.

Design
Function



EVRS 3, pipe thread

EVRS 3, weld

EVRS / EVRST 10 and 15

EVRS / EVRST 20

4. Coil
16. Armature
18. Pilot valve plate
20. Earth terminal
24. Connection for flexible steel hose
28. Gasket
29. Pilot orifice
36. DIN plug
40. Terminal box
43. Valve cover
44. O-ring
45. Valve cover gasket
49. Valve body
51. Cover
53. Manual operating spindle
73. Equalization hole
80. Diaphragm
82. Support washer
83. Valve seat
84. Main valve plate

The solenoid valve design is based on three different principles:
1. Direct operation
2. Servo operation
3. Forced servo operation

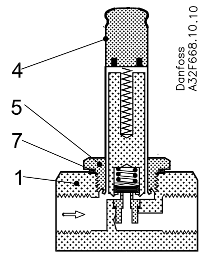
1. Direct operation
EVRS 3 is directly operated. The valve opens direct for full flow when the armature (16) moves up into the magnetic field of the coil. This means that the valve operates with a min. differential pressure of 0 bar.
The valve plate (18) made of teflon and is fitted direct to the armature (16).
Inlet pressure acts from above on the armature and with it the valve plate. Thus, inlet pressure, spring force and the weight of the armature act to close the valve when the coil is currentless.

2. Servo operation
EVRS 10, 15 and 20 are servo operated with a "floating" diaphragm (80). The pilot orifice (29), which is of stainless steel, is placed in the centre of the diaphragm.
The teflon pilot valve plate (18) is fitted direct to the armature (16).
With the coil 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.

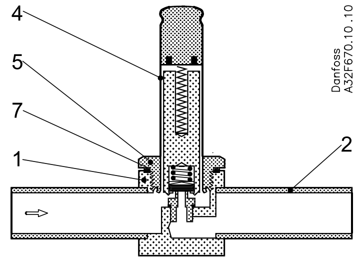
When current is applied to the coil the armature is drawn up into the magnetic field and opens the pilot orifice. This relieves the pressure above the diaphragm because the space above the diaphragm becomes connected to the outlet side of the valve.
The differential pressure between inlet and outlet sides then presses the diaphragm away from the main orifice which opens to full flow.
Thus a certain minimum differential pressure is necessary to open the valve and keep it open. For EVRS 10, 15 and 20 valves this differential pressure is 0.05 bar.
When current is switched off, the pilot orifice closes. Then the pressure above the diaphragm rises, via the equalization holes (73) in the diaphragm, to the inlet pressure and causes the diaphragm to close the main orifice.

3. Forced servo operation
EVRST 10, 15 and 20 are forced servo operated solenoid valves.
Forced servo operation differs from servo operation in that in a forced servo operated valve the armature and the diaphragm are connected by a spring. Thus the armature helps to lift the diaphragm (80) and keep it lifted so that the pressure drop in the open valve is the least possible. These types of valves therefore require no differential pressure to keep them open.

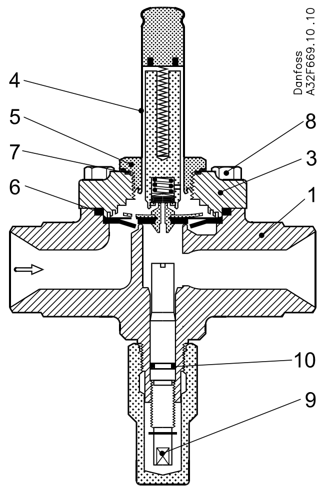
Material specification



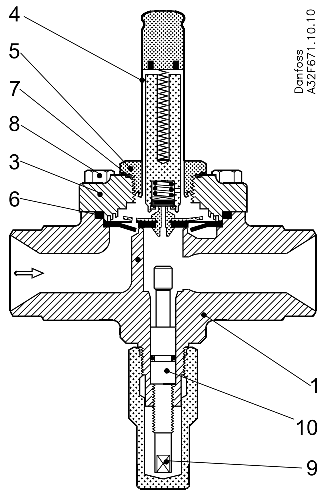
EVRS 3, Pipe thread



EVRS 3, welded



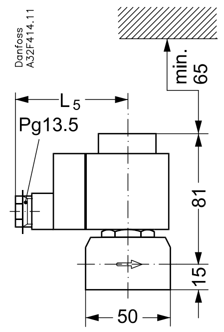
EVRS/ EVRST 10 and 15



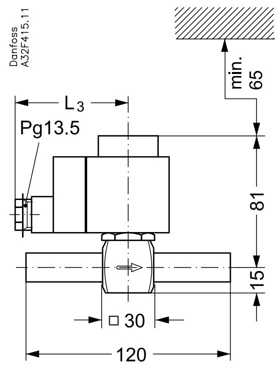
EVRS/ EVRST 20

		Solenoid valves					Standard	
No.	Description	Type	Material	Analysis	Mat.no.	W.no.	DIN	EN
1	Valve housing	EVRS 3	Stainless steel	X8 CrNiS 18-9		1.4305		10088
		EVRS (T) 10/15/20	Stainless steel	X6 CrNi 18-9		1.4308	17455	
2	Welding tube	EVRS 3	Stainless steel	X2 CrNiMo 17-12-2		1.4404	17455	
3	Cover	EVRS (T) 10(15/20	Stainless steel	X6 CrNi 18-9		1.4308	17455	
4	Armature tube	EVRS(T) 3/10/15/20	Stainless steel	X2 CrNi 19-11		1.4306		10088
5	Armature tube nut	EVRS(T) 3/10/15/20	Stainless steel	X8 CrNi 19-11		1.4305		10088
6	Gasket	EVRS(T) 3/10/15/20	Rubber	Cr				
7	Gasket armature tube	EVRS(T) 10/15/20	Al gasket	Al 99.5		3.0255		10210
8	Screws	EVRS(T) 10/15/20	Stainless steel	A2-70			3506	
9	Spindle for man. oper.	EVRS(T) 10/15/20	Stainless steel	X8 CrNiS 18-9		1.4305		10088
10	Gasket	EVRS(T) 10/15/20	Rubber	Cr				

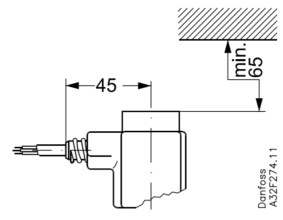
Dimensions and weights



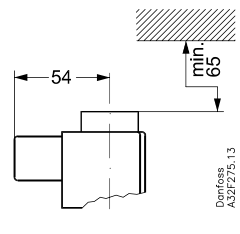
EVRS 3, pipe thread



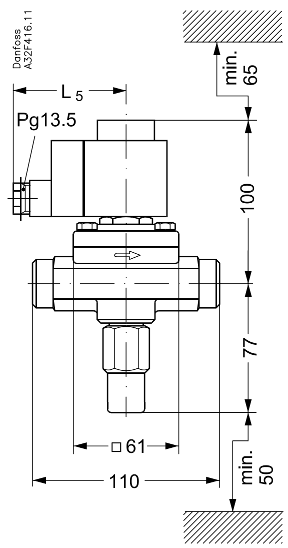
EVRS 3, weld



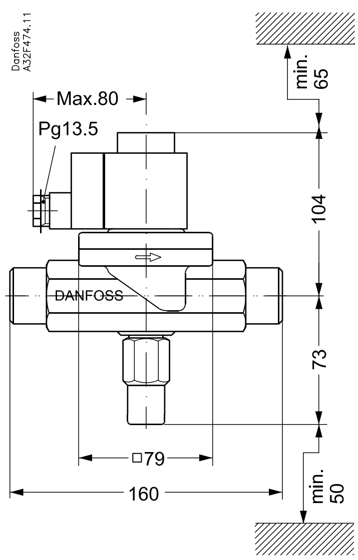
Coil with cable



Coil with DIN plugs



EVRS / EVRST 10 and 15
Coil with terminal box

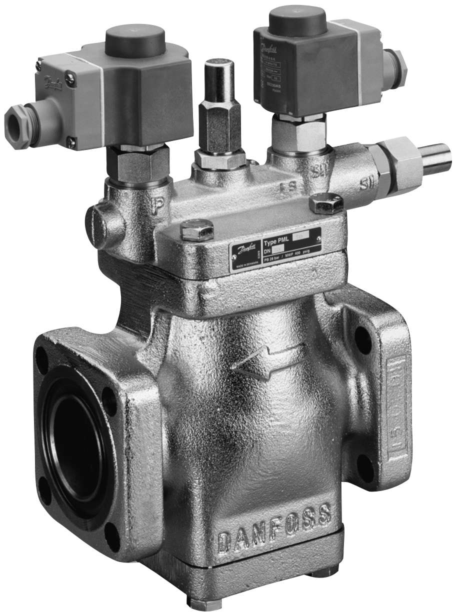


EVRS / EVRST 20
Coil with terminal box

Weight of coil
10 W: approx. 0.3 kg
12 and 20 W: approx. 0.5 kg

Type	L_5 max.		Weight with coil
	10 W	12 W 20 W	
	mm	mm	kg
EVRS 3, pipe thread	75	85	0.7
EVRS 3, weld	75	85	0.6
EVRS/EVRST 10	75	85	1.2
EVRS/EVRST 15	75	85	1.3
EVRS/EVRST 20	75	85	2.0

Introduction



PML valves are servo-operated main valves with screwed-on pilot solenoid valves. PML valves use an external pressure source for opening (which means that no differential pressure across the PML valve is required in order to maintain open state). This makes the valve especially suitable for low-pressure suction lines).

The PML valves can be used in all types of refrigeration systems:

- Direct expansion
- Pump recirculation
- Natural circulation

Within their specified pressure and temperature ranges PML valves can be used for fluorinated refrigerants (R 22, R 134a, R 404A, R 12, R 502, etc.) or ammonia (R 717).

PML pilot-operated solenoid valves can be installed in:

- Suction lines
- Return lines (liquid/vapour)
- Pressure-equalising lines
- Bypass lines

Features

- The PML valves can be used for all normal, non-flammable refrigerants, including
- R 717, and non-corrosive gases/liquids - assuming seals of the correct material are used.
- Large range of flanges with connection dimensions in accordance with standards: DIN, ANSI, SOC and SA.
- Inexpensive and simple installation.
- Pilot valves screwed directly into the valve cover.
- Only one signal required for both pilot solenoid valves.
- The PML main valve top cover can be oriented in any direction without the function of pilot valves being affected.
- Especially suitable for systems where low pressure drop is required.
- PML remains open even though the pressure drop across the valve is 0 bar.

The complete technical leaflet (DKRCI.PD.BQ0.A) can be downloaded from the Danfoss web site.

Design

Connections
There is a very wide range of connection possibilities with PML main valves:

- Welding, DIN (2448)
- Welding, ANSI (B 36.10)
- Welding socket, ANSI (B 16.11)
- Solder connection, DIN (2856)
- Solder connection, ANSI (B 16.22)

The PML main valve top cover can be oriented in any direction without the function of pilot valves being affected.

Valve body
EN-GJS-400-18-LT

Seals
Do not contain asbestos.

Pressure Equipment Directive (PED)
The PML-valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction

PML valves			
Nominal bore	DN≤ 25 (1 in.)	DN32-125 mm (1 $^1/_4$ - 5 in.)	DN 150 mm (6 in.)
Classified for	Fluid group I		
Category	Article 3, paragraph 3	II	III

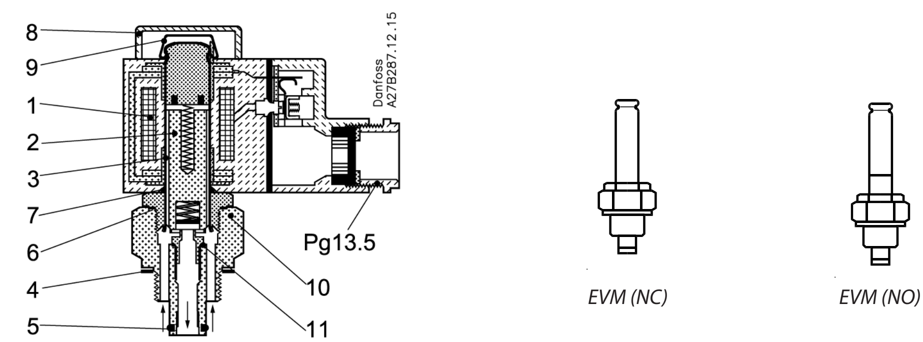
Technical data

- *Refrigerants*
  Can be used for all normal, non-flammable refrigerants, including R 717, and non-corrosive gases/liquids - assuming seals of the correct material are used.
  Use with flammable hydrocarbons are not recommended; please contact Danfoss.
- *Temperature range*
  –60/+120°C (–76/+248°F).
- *Surface*
  PML 32 - 65:
  The external surface is zinc-chromated to give good protection against corrosion.
  PML 80 - 125:
  The surface of the PML 80 - 125 is treated with a multi-layer painting.
- *Pressure range*
  The valve is designed for:
  Max. working pressure: 28 bar g (406 psig)
  Test pressure: 42 bar g (609 psig)

  Opening differential pressure:
  0 bar g (0 psi g) as valve is kept open by external pilot pressure.
  Max. (MOPD), solenoid valves only
  (10 W a.c. [NC] /12 W a.c. [NO] or
  20 W d.c.): 21 bar g (305 psig).

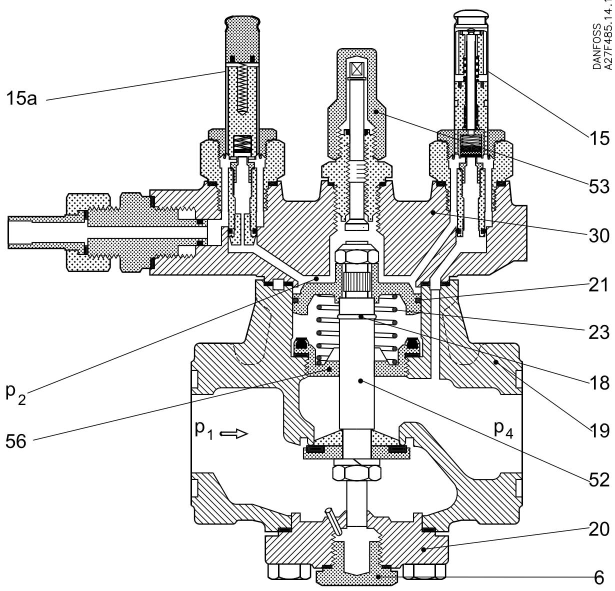
Design
Function

1 Coil
2 Armature
3 Armature tube
4 Gasket
5 O-ring
6 Seal ring
7 O-ring
8 Fixed cap
9 Clip
10 Union nut
11 Valve seat



EVM

6 Drain plug
15 + 15a Pilot valve
18 Locking ring
19 Valve body
20 Bottom cover
21 Piston
23 Compression spring
30 Cover
52 Valve spindle
53 Manual operation
56 Insert bush



PML

Solenoid valves PML are pilot-operated valves in which the external pilot pressure will open the valve without a differential pressure across the valve. The differential pressure across the valve is coming from the refrigerant flow through the valve and is giving in the capacity tables.

The main valve is provided with two pilot solenoid valves, as well as a nipple for connection to external pilot pressure.

The external pilot pressure line must be connected to a system pressure (p_2) which is at least 1 bar (14.7 psig) higher than the inlet pressure (p_1) of the valve.

The PML is kept open when voltage is applied to the EVM pilot solenoid valves (pos. 15 and 15a).

The PML is kept closed when the EVM pilot solenoid valves (pos. 15 and 15a) are de-energised.

EVM, (pos. 15), relieves the pilot pressure across the servo piston to the discharge side of the valve.

EVM, (pos. 15a), allows pilot pressure into the valve and onto the piston.

Function
(continued)

Since the PML uses external pilot pressure, the valve will open even if the pressure drop across the valve is 0. This valve type is therefore very suitable for suction and return lines, especially at low evaporating pressures.

When the valve is open, the servo piston forms a seal against the built-in teflon ring, i.e. no refrigerant is able to flow from the pilot pressure side to the system side.

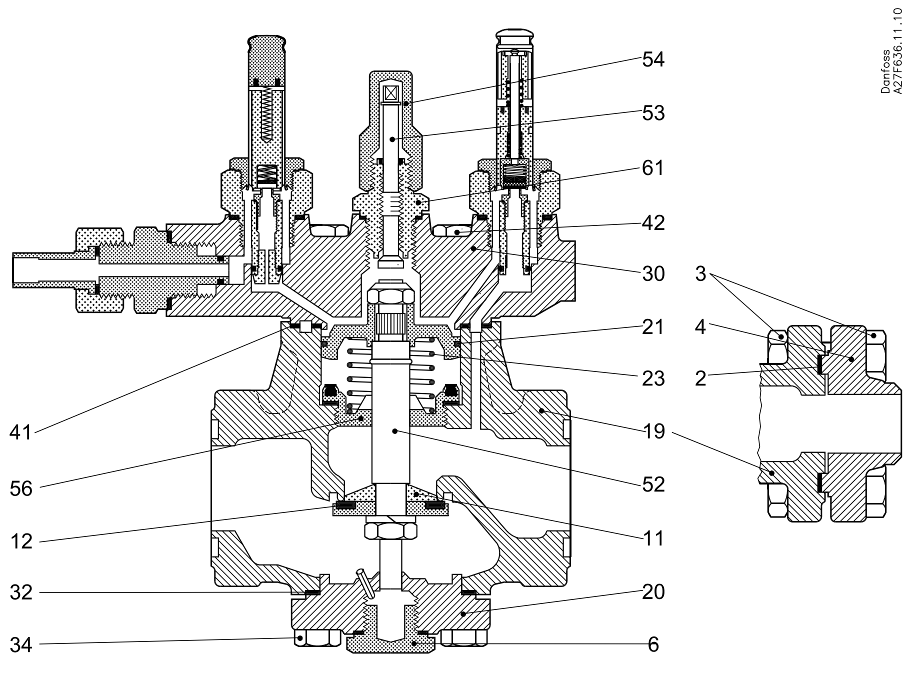
When, for example, the condensing pressure is used as pilot pressure, the system side will not be loaded with undesired hot gas injection.

PML function cannot be obtained by a PM 3 regulator fitted with two EVM solenoid valves and an external pilot connection, one of the reasons being that there are significant differences in the design of the two main valves PML and PM 3.

Important note for PML valves:
The PML valve is kept in its open position by means of hot gas. The hot gas therefore condenses in the cold valve and creates liquid on top of the servo piston. When the pilot valves change status to close the PML, the pressure on the servo piston equalises with the suction pressure (p_4) through the pilot valve (pos. 15). This equalisation takes time because condensed liquid is present in the valve. The exact time taken from when the pilot valves change position to complete closing of the PML will depend on temperature, pressure, refrigerant and size of the valve. Thus an exact closing time for the valves cannot be given but, in general, lower temperatures give longer closing times.

It is very important to take the closing times into consideration when hot gas defrost is performed on evaporators. Steps must be taken to ensure that the hot gas supply valve is <u>not</u> opened before the PML in the suction line is completely closed. If the hot gas supply valve is opened before the PML in the suction line is closed, considerable energy will be lost and potentially dangerous situations might arise because of “liquid hammer”.

Material specification



Material specification for PML valves

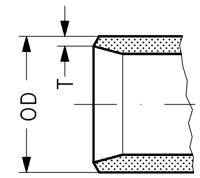
No.	Part	Material	DIN / EN	ISO	ASTM
2	Gasket between body and bottom cover	Non-metal Non-asbestos			
3	Bolts for flange (to be ordered separately)	Stainless steel	A2 / A4-70	A2 / A4-70	
4	Flange PML 32 - 65	Steel	RSt. 37-2, 10025	Fe360 B, 630	Grade C, A 283
4	Flange PML 80 - 125	Steel	TSTE 355, 2635 / 3159		
6	Plug	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
11	Trottle cone	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
12	Valve seat	Teflon [PTFE]			
19	Valve body	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563		
20	Bottom cover	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563		
21	Servo piston	Cast iron	GG-25	Grade 250	Class 40B
23	Spring	Steel			
30	Cover	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563		
32	Gasket between body and bottom cover	Non-metal Non-asbestos			
34	Bolts for bottom cover (to be ordered separately)	Stainless steel	A2 / A4-70	A2 / A4-70	
41	Gasket	Non-metal Non-asbestos			
42	Bolts for top cover (to be ordered separately)	Stainless steel	A2 / A4-70	A2 / A4-70	
52	Valve spindle	Stainless steel	A2-70	A2-70	Type 308
53	Manual operating spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
54	Cap for manual operating spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
56	Servo piston	Cast iron	GG-25	Grade 250	Class 40B
61	Spindle seal	Steel 1651	9SMn28 R683/9	Type 2 SAE J 403	1213

Flange connections

Danfoss flange sets inclusive of gaskets, bolts and nuts, are specially made for the Danfoss product range and must only be used for the purpose described.
When ordering PML valves, select the flanges from the list of standard flanges below. (The code numbers are for one set of two flanges).
The required PML valves can then be selected with or without pilot valves.

PML 80 to PML 125 can also be ordered complete with DIN weld flanges by a separate code number.

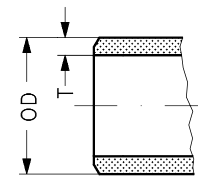
DIN



Butt welding DIN (2448)

For use with valve type	Size DN	Size in.	OD mm	T mm	OD in.	T in.	Flange type	Code no.
PML 32	32 40	1 1/4 1 1/2	42.4 48.3	2.6 2.6	1.669 1.902	0.102 0.103	10	**027N2332** **027N2340**
PML 40	40 50	1 1/2 2	48.3 60.3	2.6 2.9	1.902 2.370	0.103 0.110	11	**027N2440** **027N2450**
PML 50	50 65	2 2 1/2	60.3 76.1	2.9 2.9	2.370 3.000	0.110 0.110	12	**027N2550** **027N2565**
PML 65	65 80	2 1/2 3	76.1 88.9	2.9 3.2	3.000 3.500	0.110 0.130	13	**027N2665** **027N2680**
PML 80	100	4	114.3	3.6	4.500	0.140	14A	**027F2123**
PML 100	125	5	139.7	4.0	5.500	0.160	14B	**027F2124**
PML 125	150	6	168.3	4.5	6.630	0.180	14C	**027F2125**

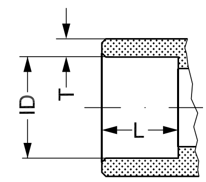
ANSI



Butt welding ANSI B 36.10

For use with valve type	Size DN	Size in.	OD mm	T mm	OD in.	T in.	Flange type	Schedule	Code no.
PML 32	32 40	1 1/4 1 1/2	42.4 48.3	4.9 5.1	1.669 1.902	0.193 0.201	10	80 80	**027N3034** **027N3035**
PML 40	40 50	1 1/2 2	48.3 60.3	5.1 3.9	1.902 2.370	0.201 0.150	11	80 40	**027N3036** **027N3037**
PML 50	50 65	2 2 1/2	60.3 73.0	3.9 5.2	2.370 2.870	0.150 0.200	12	40 40	**027N3038** **027N3039**
PML 65	65 80	2 1/2 3	73.0 88.9	5.2 5.5	2.870 3.500	0.200 0.220	13	40 40	**027N3040** **027N3041**
PML 80	100	4	114.3	6.0	4.500	0.240	14A	40	**027N3042**
PML 100	125	5	141.3	6.6	5.560	0.260	14B	40	**027N3043**
PML 125	150	6	168.3	7.1	6.630	0.280	14C	40	**027N3044**

SOC



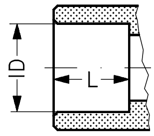
Socket welding ANSI (B 16.11)

For use with valve type	Size DN	Size in	ID mm	T mm	ID in.	T in.	L mm	L in.	Flange type	Code no.
PML 32	32	1 1/4	42.7	6.05	1.681	0.238	13	0.512	10	**027N2003**
PML 40	40	1 1/2	48.8	6.35	1.921	0.250	13	0.512	11	**027N2004**
PML 50	50	2	61.2	6.95	2.409	0.274	16	0.630	12	**027N2005**
PML 65	65	2 1/2	74.0	8.75	2.913	0.344	16	0.630	13	**027N2006**

NOTE:
The flanges sets are exclusive gaskets, bolts and nuts.

Flange connections

SA



For use with valve type	Size DN	Size in.	ID mm		ID in.		L mm	L in.	Flange type	Code no.
Soldering DIN (2856)										
PML 32	35		35.07				25		10	**027L2335**
PML 40	42		42.09				28		11	**027L2442**
PML 50	54		54.09				33		12	**027L2554**
PML 65	76		76.1				33		13	**027L2676**
Soldering (ANSI B 16.22)										
PML 32		$1^{3}/_{8}$			1.375			0.984	10	**027L2335**
PML 40		$1^{5}/_{8}$			1.625			1.102	11	**027L2441**
PML 50		$2^{1}/_{8}$			2.125			1.300	12	**027L2554**
PML 65		$2^{5}/_{8}$			2.625			1.300	13	**027L2666**

Ordering of PML valves

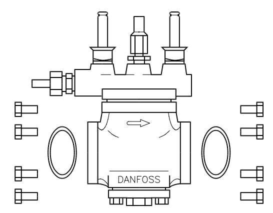
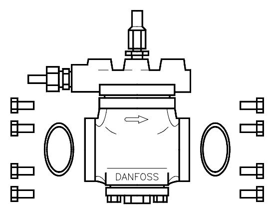
Complete valves

The code nos. for PML 32 - 125 include:
- Main valve
- External pilot connection
- Flange gaskets
- Flange bolts
- PML 32-125 can be orderec with or without NC/NO pilot valves.

Flanges must always be ordered separately. Code nos. for PML 80, 100 and 125 are also available including DIN weld flanges.

If PML valves with other combinations of pilot valves are required (e.g. NC/NC or NO/NO) please order the main valve (PML without pilot valves) and the pilot valves separately.

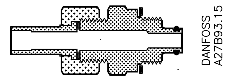
Coils are ordered separately according to coil voltage and frequency.
For EVM (NC), code no. **027B1120**, 10 / 12 watt a.c. coils or 20 watt d.c. coils are used.
For EVM (NO), code no. **027B1130**, 12 watt a.c. coils or 20 watt d.c. coils, type I, are used.

	PML with NC / NO pilot valves	PML without pilot valves with external pilot connection and damping orifice
		
Valve size	EN-GJS-400-18-LT*	EN-GJS-400-18-LT*
PML 32	**027F3020**	**027F3028**
PML 40	**027F3021**	**027F3029**
PML 50	**027F3022**	**027F3030**
PML 65	**027F3023**	**027F3031**
PML 80	**027F1288**	**027F1287**
PML 100	**027F1293**	**027F1292**
PML 125	**027F1298**	**027F1297**

* CE marked

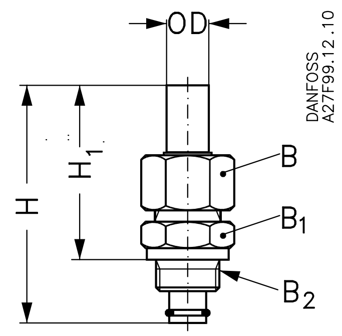
Accessories

External pilot connection



PML	Description	Code no.
32 - 65	External pilot connection (incl. damping orifice, D: 1.0 mm)	**027F1048**
32 - 65	External pilot connection ($^1/_4$" FPT) (incl. damping orifice, D: 1.0 mm)	**027B2065**
80 - 125	External polot connection (incl. damping orifice, D: 1.8 mm)	**027F1049**
80 - 125	External pilot connection ($^1/_4$" FPT) (incl. damping orifice, D: 1.8 mm)	**027B2066**
32 - 125	Accessory bag with seal and O-ring for pilot valve	**027F0666**

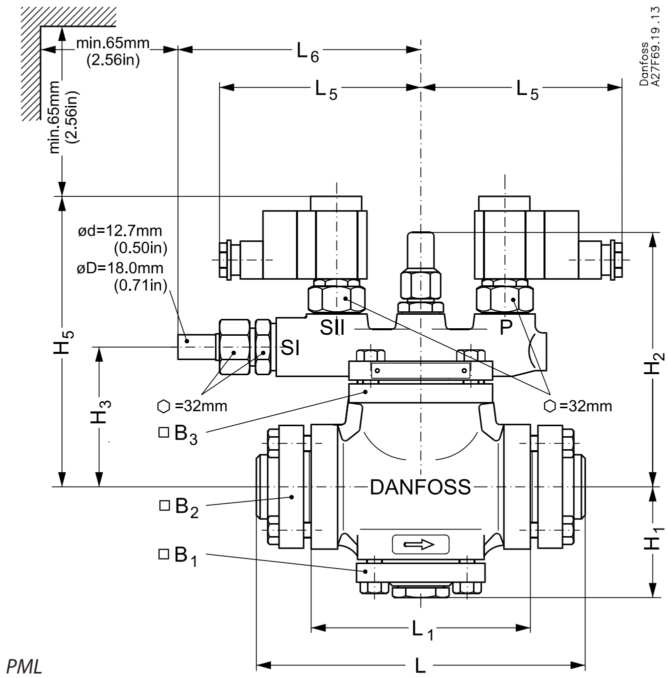
PML	Description	Code no.
32 - 65	Damping orifice for EVM. 10 off, (D: 1.0 mm)	**027F0664**
80 - 125	Damping orifice for EVM. 10 off, (D: 1.8 mm)	**027F0176**



A damping orifice should be installed if the pressure difference between the low and the high pressure side is more than 6 bar.

Accessories			H	H_1	OD	B	B_1	B_2
External pilot connection								
	mm in.		90 3.54	66 2.60	18 0.71	NV 32	NV 32	M 24 × 1.5

Dimensions and weights



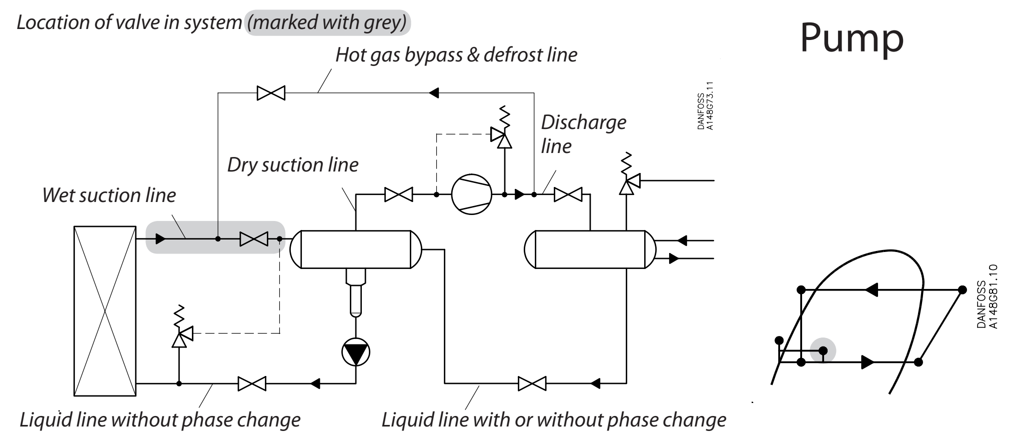
Flange set for valve type	Weight kg. / lb
PML 32	1.5 kg.
(DN 20 - 32)	3.3 lb
PML 40	1.9 kg.
(DN 40 - 50)	4.2 lb
PML 50	2.8 kg.
(DN 50 - 65)	6.2 lb
PML 65	3.0 kg.
(DN 65 - 80)	6.6 lb

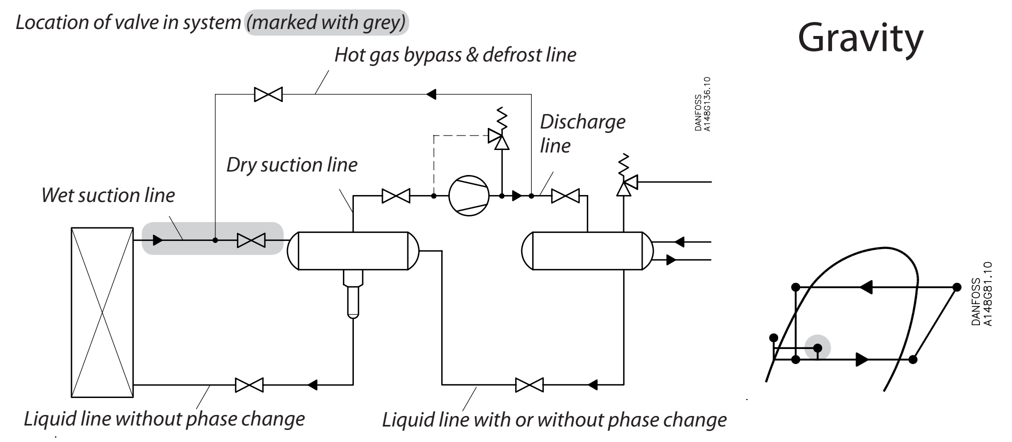
Type		H_1	H_2	H_3	H_5	L	L_1	L_5 max.		L_6	B_1	B_2	B_3	Weight
								10 W	20 W					
PML 32	mm	72	178	96	208	240	170	122	132	160	84	82	94	12.6 kg.
(DN 20 - 32)	in.	2.8	7	3.8	8.2	9.4	6.7	4.8	5.2	6.3	3.3	3.2	3.7	27.8 lb
PML 40	mm	79	187	105	215	254	170	125	135	163	94	89	102	15.3 kg.
(DN 40 - 50)	in.	3.1	7.4	4.2	8.5	10	6.7	4.9	5.3	6.4	3.7	3.5	4.2	33.7 lb
PML 50	mm	95	205	123	234	288	200	125	135	163	104	106	113	21.1 kg.
(DN 50 - 65)	in.	3.7	8.1	4.8	9.2	11.3	7.9	4.9	5.3	6.4	4.1	4.2	4.4	46.5 lb
PML 65	mm	109	227	146	257	342	250	130	140	168	127	113	135	29.6 kg.
(DN 65 - 80)	in.	4.3	8.9	5.7	10.1	13.5	9.8	5.1	5.5	6.6	5.0	4.4	5.3	65.2 lb
PML 80	mm	152	365	214	325	437	310	141	151	182	190	235	210	80 kg. [1])
(DN 100)	in.	6.0	14.4	8.4	12.8	17.2	12.2	5.5	5.9	7.2	7.5	9.2	8.3	176.4 lb [1])
PML 100	mm	173	396	246	356	489	350	155	165	192	226	270	243	120 kg. [1])
(DN 125)	in.	6.8	15.6	9.7	14	19.3	13.8	6.1	6.5	7.5	8.9	10.6	9.6	264.5 lb [1])
PML 125	mm	208	453	301	412	602	455	171	181	218	261	300	286	170 kg.[1])
(DN 150)	in.	8.2	17.8	11.8	16.2	23.7	17.9	6.7	7.1	8.6	10.3	11.8	11.3	374.8 lb [1])

[1]) Weight with flanges and pilot valves.

Nominal capacities

Wet suction line





Nominal capacities

Wet suction line

SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

T_e = –20°C
Q_0 = 100 kW
Circulation ratio = 3
Max. ΔP = 0.1 bar

The capacity table is based on nominal conditions (pressure drop ΔP = 0.05 bar, circulation ratio = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP = 0.1 bar, $f_{\Delta P}$ = 0.71
Correction factor for circulation ratio, f_{circ} = 0.9

$Q_n = Q_0 \times f_{\Delta P} \times f_{circ}$ = 100 x 0.71 x 0.9 = 63.9 kW.

From the capacity table a PML 50 with Q_n = 89 kW is the correct selection for the application.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

T_e = – 20°F
Q_0 = 10 TR
Circulation ratio = 3
Max. ΔP = 1.25 psi

The capacity table is based on nominal conditions (pressure drop ΔP = 0.75 psi, circulation ratio = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP = 1.25 psi, $f_{\Delta p}$ = 0.77
Correction factor for circulation ratio, f_{circ} = 0.9

$Q_n = Q_0 \times f_{\Delta P} \times f_{circ} = 10 \times 0.77 \times 0.9 = 6.9$ TR

From the capacity table a PML 32 with Q_n = 11.1 TR is the correct selection for the application.

Solenoid valves

Nominal capacities

Wet suction line

SI units

Capacity table for nominal conditions, Q_N [kW],
circulation ratio = 4,
ΔP = 0.05 bar

R 717

Type	k_v m³/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
PML 32	25.5	23.3	30	38	46	54	64	73	83
PML 40	34	31	40	49	60	71	83	96	109
PML 50	50	46	59	74	89	106	125	144	163
PML 65	81	74	96	119	145	172	202	233	264
PML 80	188	172	222	276	336	400	468	540	614
PML 100	269	246	318	396	481	573	670	772	878
PML 125	427	390	505	628	763	909	1064	1226	1394

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.01	2.24
0.03	1.29
0.05	**1**
0.08	0.79
0.10	0.71
0.14	0.60

Correction factor for circulation ratio (f_{circ})

Circulation ratio	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
circulation ratio = 4,
ΔP = 0.75 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
PML 32	29.6	6.5	8.7	11.1	13.8	16.6	19.6	23	26
PML 40	39	8.5	11.4	14.5	18.1	22	26	30	34
PML 50	58	12.7	17.1	22	27	33	38	44	51
PML 65	94	21	28	35	44	53	62	72	82
PML 80	218	48	64	81	101	122	145	167	190
PML 100	312	68	92	117	145	175	207	239	272
PML 125	495	109	146	185	230	278	328	379	432

* 2°F below min. operating temperature.

Correction factor for ΔP ($f_{\Delta P}$)

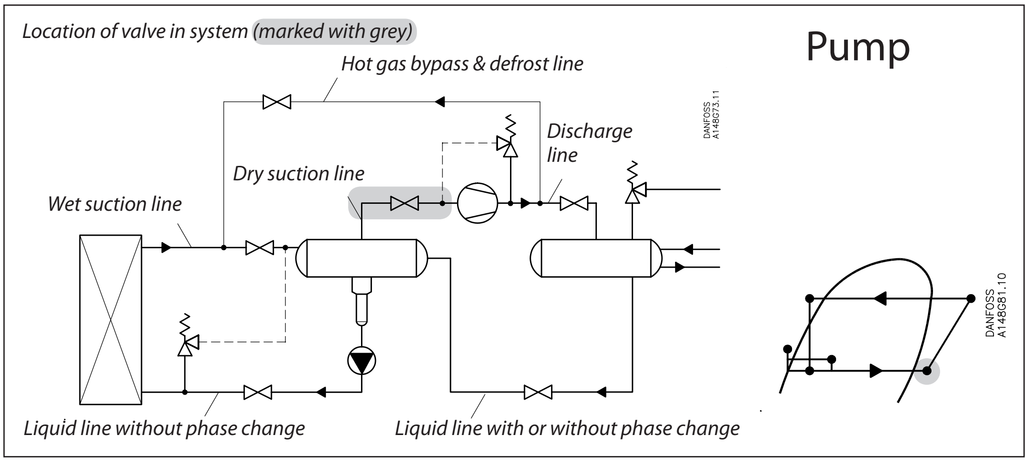
ΔP (psi)	Correction factor
0.15	2.24
0.45	1.29
0.75	**1**
1.25	0.77
1.75	0.65
2.25	0.58

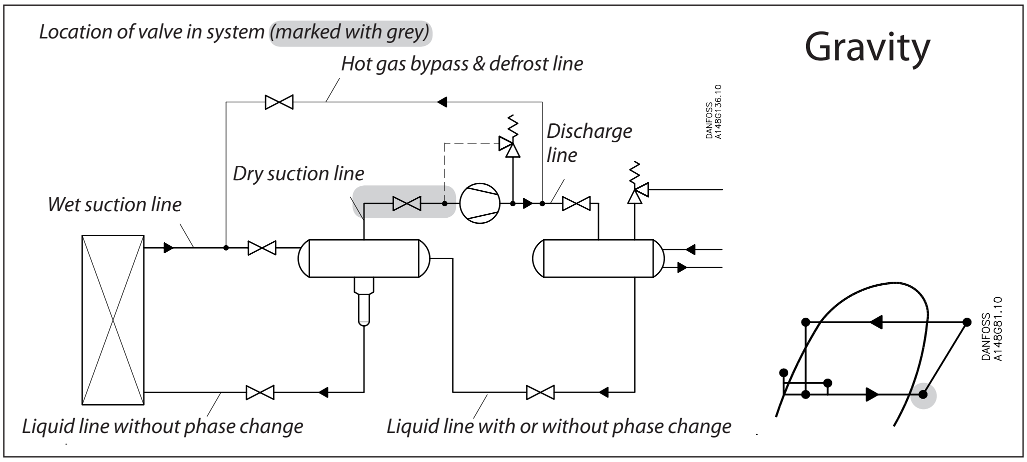
Correction factor for circulation ratio (f_{circ})

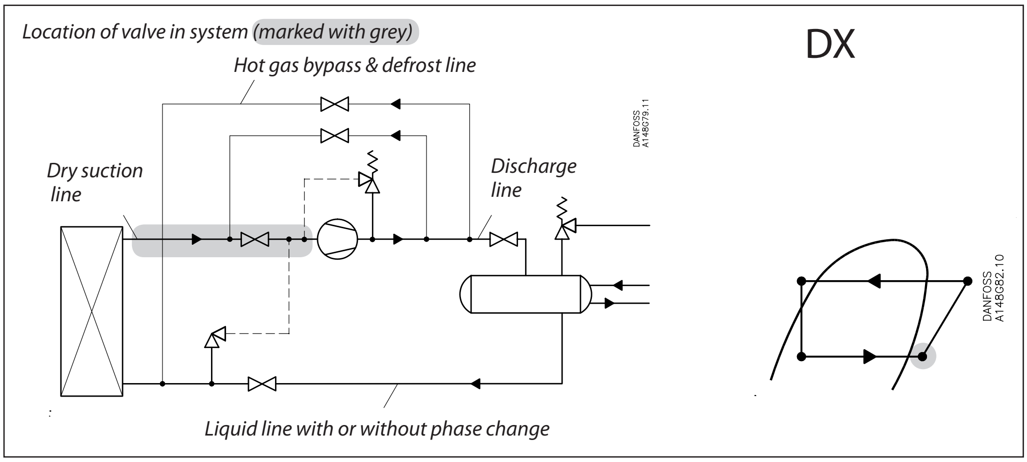
Circulation ratio	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

Nominal capacities

Dry suction line







Nominal capacities

Dry suction line

SI units

Calculation example (R 134a capacities):

Running conditions in a plant are as follows:

$T_e = -20°C$
$Q_0 = 90$ kW
$T_{liq} = 10°C$
$T_s = 6°C$
Max. $\Delta P = 0.1$ bar

The capacity table is based on nominal conditions (pressure drop $\Delta P = 0.05$ bar, $T_{liq} = 30°C$).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for $\Delta P = 0.05$ bar, $f_{\Delta P} = 0.71$
Correction factor for liquid temperature, $f_{Tliq} = 0.82$
Correction factor for superheat (T_S) = 1.0

$Q_n = Q_0 \times f_{\Delta P} \times f_{Tliq} \times f_{Ts}$
$= 90 \times 0.71 \times 0.82 \times 1.0 = 52.4$ kW

From the capacity table a PML 65 with $Q_n = 60$ kW is the correct selection for the application.

US units

Calculation example (R 134a capacities):

Running conditions in a plant are as follows:

$T_e = 0°F$
$Q_0 = 15$ TR
$T_{liq} = 50°F$
$T_s = 10°F$
Max. $\Delta P = 1.25$ psi

The capacity table is based on nominal conditions (pressure drop $\Delta P = 0.75$ psi, $T_{liq} = 90°F$)

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for $\Delta P = 1.25$ psi, $f_{\Delta p} = 0.77$
Correction factor for liquid temperature, $f_{Tliq} = 0.81$
Correction factor for superheat (T_S) = 1.0

$Q_n = Q_0 \times f_{\Delta P} \times f_{Tliq} \times f_{Ts}$
$= 20 \text{ x } 0.77 \text{ x } 0.81 \text{ x } 1.0 = 9.4$ TR

From the capacity table a PML 50 with $Q_n = 11$ TR is the correct selection for the application.

Nominal capacities

Dry suction line

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 30°C,
ΔP = 0.05 bar

R 717

Type	k_v m³/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
PML 32	25.5	33	43	56	70	86	104	125	148
PML 40	34	43	57	73	92	113	137	164	194
PML 50	50	64	85	109	137	169	205	245	290
PML 65	81	104	138	177	222	273	332	397	469
PML 80	188	242	320	410	516	634	770	922	1089
PML 100	269	347	458	586	739	908	1102	1319	1559
PML 125	427	551	727	931	1172	1441	1750	2094	2474

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.01	2.24
0.03	1.29
0.05	**1**
0.08	0.79
0.10	0.71
0.14	0.60

Correction factor for superheat (T_S)

T_s	Correction factor
6°C	1
8°C	1
10°C	1
12°C	1

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1**
40°C	1.04
50°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 0.75 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
PML 32	29.6	9.1	12.5	16.4	20.9	26	33	39	47
PML 40	39	12.0	16.5	22	27	35	43	52	61
PML 50	58	17.9	25	32	41	52	64	77	92
PML 65	94	29	40	52	66	84	104	125	148
PML 80	218	67.2	92	121	154	195	241	289	345
PML 100	312	96.2	132	173	221	279	344	414	493
PML 125	495	153	210	274	350	442	547	657	783

* 2°F below min. operating temperature.

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
0.15	2.24
0.45	1.29
0.75	**1**
1.25	0.77
1.75	0.65
2.25	0.58

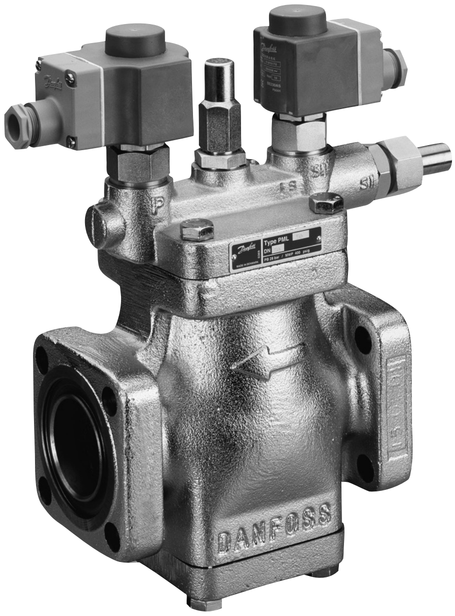
Correction factor for superheat (T_S)

T_s	Correction factor
10°F	1
14°F	1
18°F	1
20°F	1

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1**
110°F	1.04
130°F	1.09

Introduction



PMLX are 2-step servo-operated main valves with screwed-on pilot solenoid valves. PMLX valves use an external pressure source for opening (which means that no differential pressure across the PMLX valve is required).
PMLX are used in suction lines for the opening against high differential pressure, e.g. after hot gas defrost in large industrial refrigeration systems with ammonia or fluorinated refrigerants.

PMLX opens in two steps:

- Step one opens to approx. 10% of the capacity, when the pilot solenoid valves are activated.
- Step two opens automatically after the pressure differential across the valve reaches approximately 1.5 bar.

Features

- Can be used for all normal, non-flammable refrigerants, including R 717, and non-corrosive gases/liquids - assuming seals of the correct material are used.
- Large range of flanges with connection dimensions in accordance with standards: DIN, ANSI, SOC and SA.
- Inexpensive and simple installation.
- Screw thread pilot valve fitting.
- Only one signal required for both pilot solenoid valves.
- The PMLX main valve top cover can be oriented in any direction without the function of pilot valves being affected.
- Especially suitable for systems where low pressure drop is required.
- Stabilizes working conditions and eliminates pressure pulsations during opening after defrosting.
- Provides safety against pressure "shocks" as the valve can only open fully when $\Delta p < 1.5$ bar (22 psig).

The complete technical leaflet (DKRCI.PD.BR0.A) can be downloaded from the Danfoss web site.

Design

Connections
There is a very wide range of connection possibilities with PMLX main valves:

- Welding, DIN (2448)
- Welding, ANSI (B 36.10)
- Welding socket, ANSI (B 16.11)
- Solder connection, DIN (2856)
- Solder connection, ANSI (B 16.22)

The PMLX main valve top cover can be oriented in any direction without the function of pilot valves being affected.

Valve body
EN-GJS-400-18-LT

Seals
Do not contain asbestos.

Pressure Equipment Directive (PED)
The PMLX-valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.

For further details / restrictions - see Installation Instruction

PMLX valves			
Nominal bore	DN≤ 25 (1 in.)	DN 32-125 mm ($1^{1}/_{4}$ - 5 in.)	DN 150 mm (6 in.)
Classified for	Fluid group I		
Category	Article 3, paragraph 3	II	III

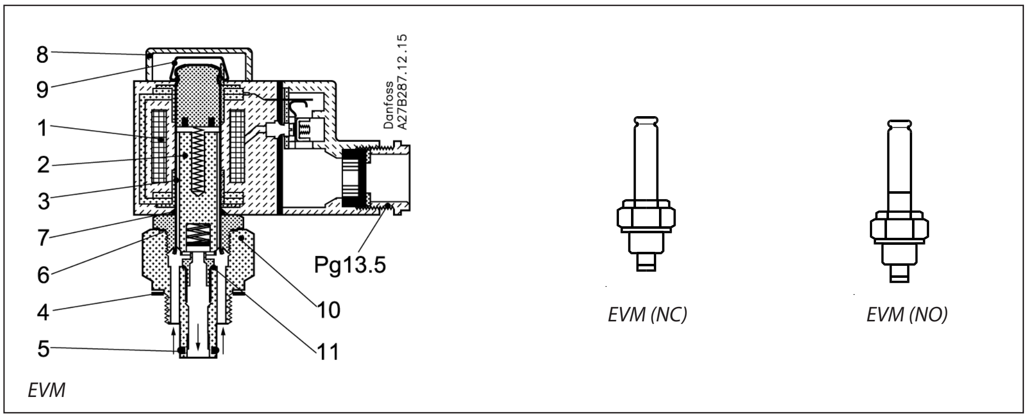
Technical data

- *Refrigerants*
  Can be used for all normal, non-flammable refrigerants, including R 717, and non-corrosive gases/liquids - assuming seals of the correct material are used.
  Use with flammable hydrocarbons cannot be recommended; please contact Danfoss.
- *Temperature range*
  –60/+120°C (–76/+248°F).
- *Surface*
  PMLX 32 - 65:
  The external surface is zinc-chromated to give good protection against corrosion.
  PMLX 80 - 125:
  The surface of the PMLX 80 - 125 is treated with a multi-layer painting.
- *Pressure range*
  The valve is designed for:
  Max. working pressure: 28 bar g (406 psig)
  Test pressure: 42 bar g (609 psig)

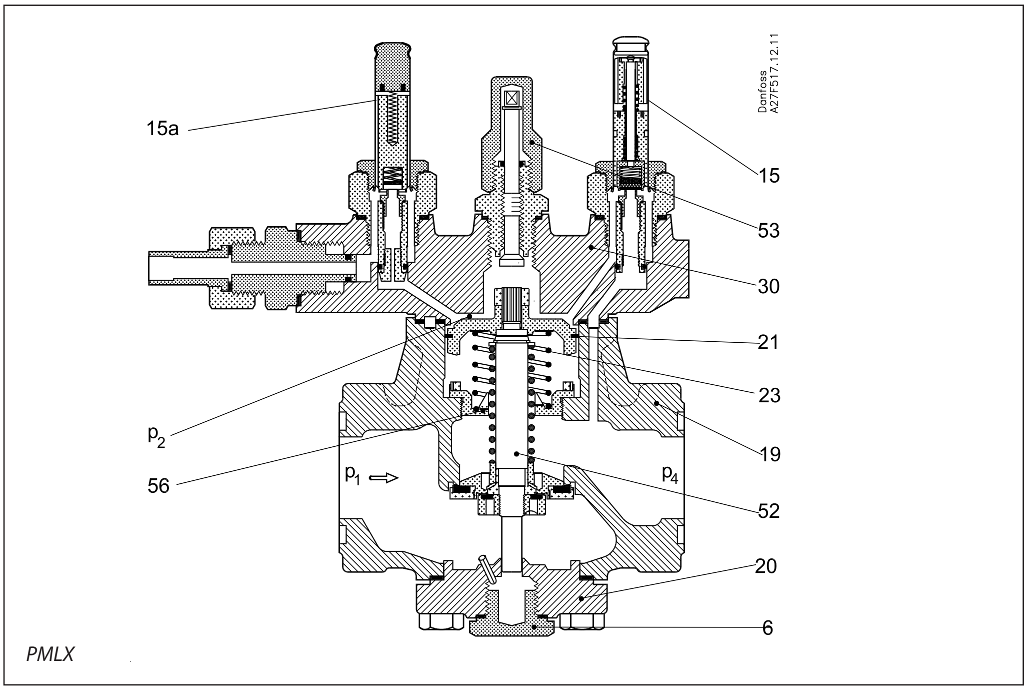
  Opening differential pressure:
  0 bar g (0 psig) as valve is kept open by external pilot pressure.
  Max. (MOPD), solenoid valves only (10 W a.c. [NC] /12 W a.c. [NO] or 20 W d.c.): 21 bar g (305 psig).

Design
Function

1	Coil
2	Armature
3	Armature tube
4	Gasket
5	O-ring
6	Seal ring
7	O-ring
8	Fixed cap
9	Clip
10	Union nut
11	Valve seat



6	Drain plug
15 + 15a	Pilot valve
19	Valve body
20	Bottom Cover
21	Piston
23	Compression spring
30	Cover
52	Valve spindle
53	Manual operation
56	Insert bush



Solenoid valves PMLX are pilot-operated valves in which the external pilot pressure will open the valve without a differential pressure across the valve. The differential pressure across the valve comes from the refrigerant flow through the valve and is given in the capacity tables.

The main valve is provided with two pilot solenoid valves, as well as a nipple for connection to external pilot pressure.

The external pilot pressure line must be connected to a system pressure (p_2) which is at least 1 bar (14.7 psig) higher than the inlet pressure (p_1) of the valve.

The PMLX is kept open when voltage is applied to the EVM pilot solenoid valves pos. 15 and pos. 15a.

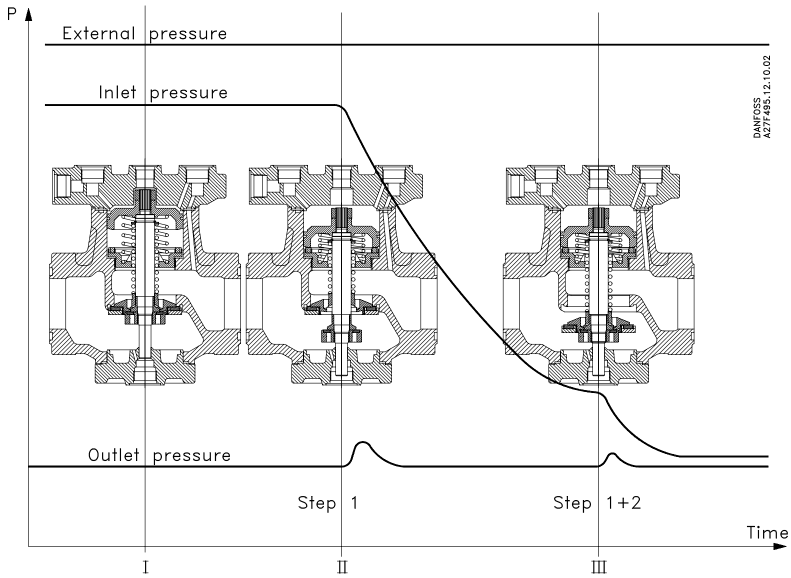
The PMLX is kept closed when the EVM pilot solenoid valves pos. 15 and pos. 15a are de-energised.

EVM, pos. 15, relieves the pilot pressure across the servo piston to the discharge side of the valve.

EVM, pos. 15a, allows pilot pressure into the valve and onto the piston.

Function
(continued)

Two step opening principle



The valve is used as a shut-off valve in suction lines to open after hot gas defrost.

Since PMLX uses external pilot pressure, the valve will be open even if the differential pressure is 0.

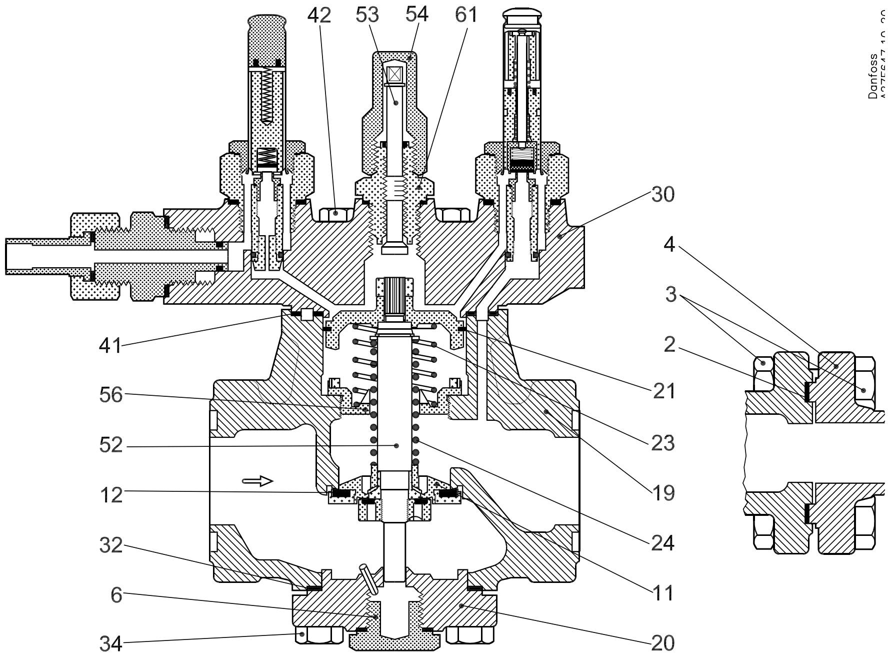
PMLX must not be used in pipe systems where the differential pressure across the main valve in open position can exceed 1 bar (15 psig), otherwise the step two on the valve will close.

The pilot solenoid valve (pos.15a) allows external pilot pressure (p_2) to the top of the servo piston and thus opens the first step corresponding to approx. 10% of the valve capacity. At the same time the spring, (pos. 23), will be compressed. This will start a pressure equalization of the inlet pressure (p_1) to the outlet pressure (p_4). When the differential pressure across the valve has fallen to approx. 1.5 bar (22 psig) the spring will be strong enough to open the second step and open the valve for full capacity.
This way high-pressure pulsations, which would occur when opening for full capacity in one step, can be avoided.

Important note for PMLX valves:
The PMLX valve is kept in its open position by hot gas. The hot gas condenses in the cold valve and creates liquid on top of the servo piston. When the pilot valves change status to close the PMLX, the pressure on the servo piston equalises with the suction pressure (p4) through the pilot valve (pos. 15). This equalisation takes time because condensed liquid is present in the valve.

The exact time taken from when the pilot valves change position to complete closing of the PMLX will depend on temperature, pressure, refrigerant and size of valve. Thus an exact closing time for the valves cannot be given but, in general, lower temperatures give longer closing times.
It is very important to take the closing times into consideration when hot gas defrost is performed on evaporators. Steps must be taken to ensure that the hot gas supply valve is not opened before the PMLX in the suction line is completely closed. If the hot gas supply valve is opened before the PMLX in the suction line is closed, considerable energy will be lost and potentially dangerous situations might arise because of "liquid hammer". In PMLX valves, the spring-loaded second stage might be induced to hammer by gas and liquid being forced through the valve at $\Delta p > 1.5$ bar across the PMLX. The final result could be severe damage to the valve.

Material specification



Material specification for PMLX valves

No.	Part	Material	DIN / EN	ISO	ASTM
2	Gasket between body and bottom cover	Non-metal Non-asbestos			
3	Bolts for flange (to be ordered separately)	Stainless steel	A2 / A4-70	A2 / A4-70	
4	Flange PMLX 32 - 65	Steel	RSt. 37-2, 10025	Fe360 B, 630	Grade C, A 283
4	Flange PMLX 80 - 125	Steel	TSTE 355, 2635 / 3159		
6	Plug	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
11	Trottle cone	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
12	Valve seat	Teflon [PTFE]			
19	Valve body	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563		
20	Bottom cover	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563		
21	Servo piston	Cast iron	GG-25	Grade 250	Class 40B
23	Spring	Steel			
30	Cover	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563		
32	Gasket between body and bottom cover	Non-metal Non-asbestos			
34	Bolts for bottom cover (to be ordered separately)	Stainless steel	A2 / A4-70	A2 / A4-70	
41	Gasket	Non-metal Non-asbestos			
42	Bolts for top cover (to be ordered separately)	Stainless steel	A2 / A4-70	A2 / A4-70	
52	Valve spindle	Stainless steel	A2-70	A2-70	Type 308
53	Manual operating spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
54	Cap for manual operating spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
56	Servo piston	Cast iron	GG-25	Grade 250	Class 40B
61	Spindle seal	Steel 1651	9SMn28 R683/9	Type 2 SAE J 403	1213

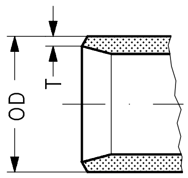
Flange connections

Danfoss flange sets inclusive of gaskets, bolts and nuts, are specially made for the Danfoss product range and must only be used for the purpose described.
When ordering PMLX valves, select the connection flanges from the list of standard flanges below. (The code numbers are for one set of two flanges).

The required PMLX valves can then be selected with or without pilot valves.

PMLX 80 to PMLX 125 can also be ordered complete with DIN weld flanges by separate code number.

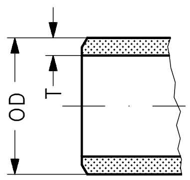
DIN



Butt welding DIN (2448)

For use with valve type	Size mm	Size in.	OD mm	T mm	OD in.	T in.	Flange type	**Code no.**
PMLX 32	32 40	1 1/4 1 1/2	42.4 48.3	2.6 2.6	1.669 1.902	0.102 0.103	10	**027N2332** **027N2340**
PMLX 40	40 50	1 1/2 2	48.3 60.3	2.6 2.9	1902 2.370	0.103 0.110	11	**027N2440** **027N2450**
PMLX 50	50 65	2 2 1/2	60.3 76.1	2.9 2.9	2.370 3.000	0.110 0.110	12	**027N2550** **027N2565**
PMLX 65	65 80	2 1/2 3	76.1 88.9	2.9 3.2	3.000 3.500	0.110 0.130	13	**027N2665** **027N2680**
PMLX 80	100	4	114.3	3.6	4.500	0.140	14A	**027F2123**
PMLX 100	125	5	139.7	4.0	5.500	0.160	14B	**027F2124**
PMLX 125	150	6	168.3	4.5	6.630	0.180	14C	**027F2125**

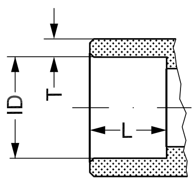
ANSI



Butt welding ANSI B 36.10

For use with valve type	Size mm	Size in.	OD mm	T mm	OD in.	T in.	Flange type	Schedule	**Code no.**
PMLX 32	32 40	1 1/4 1 1/2	42.4 48.3	4.9 5.1	1.669 1.902	0.193 0.201	10	80 80	**027N3034** **027N3035**
PMLX 40	40 50	1 1/2 2	48.3 60.3	5.1 3.9	1.902 2.370	0.201 0.150	11	80 40	**027N3036** **027N3037**
PMLX 50	50 65	2 2 1/2	60.3 73.0	3.9 5.2	2.370 2.870	0.150 0.200	12	40 40	**027N3038** **027N3039**
PMLX 65	65 80	2 1/2 3	73.0 88.9	5.2 5.5	2.870 3.500	0.200 0.220	13	40 40	**027N3040** **027N3041**
PMLX 80	100	4	114.3	6.0	4.500	0.240	14A	40	**027N3042**
PMLX 100	125	5	141.3	6.6	5.560	0.260	14B	40	**027N3043**
PMLX 125	150	6	168.3	7.1	6.630	0.280	14C	40	**027N3044**

SOC



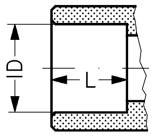
Socket welding ANSI (B 16.11)

For use with valve type	Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.	Flange type	**Code no.**
PMLX 32	32	1 1/4	42.7	6.05	1.681	0.238	13	0.512	10	**027N2003**
PMLX 40	40	1 1/2	48.8	6.35	1.921	0.250	13	0.512	11	**027N2004**
PMLX 50	50	2	61.2	6.95	2.409	0.274	16	0.630	12	**027N2005**
PMLX 65	65	2 1/2	74.0	8.75	2.913	0.344	16	0.630	13	**027N2006**

NOTE:
The flanges sets are exclusive gaskets, bolts and nuts.

Flange connections

SA



For use with valve type	Size mm	Size in.	ID mm		ID in.		L mm	L in.	Flange type	Code no.
Soldering DIN (2856)										
PMLX 32	35		35.07				25		10	**027L2335**
PMLX 40	42		42.09				28		11	**027L2442**
PMLX 50	54		54.09				33		12	**027L2554**
PMLX 65	76		76.1				33		13	**027L2676**
Soldering (ANSI B 16.22)										
PMLX 32		$1^3/_8$			1.375			0.984	10	**027L2335**
PMLX 40		$1^5/_8$			1.625			1.102	11	**027L2441**
PMLX 50		$2^1/_8$			2.125			1.300	12	**027L2554**
PMLX 65		$2^5/_8$			2.625			1.300	13	**027L2666**

Ordering of PMLX valves

Complete valves

The code nos. for PMLX 32 - 65 include:
- Main valve
- External pilot connection
- Flange gaskets
- Flange bolts
- NC/NO pilot valves.

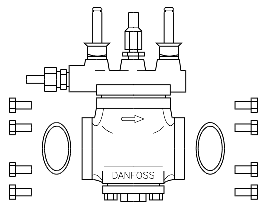
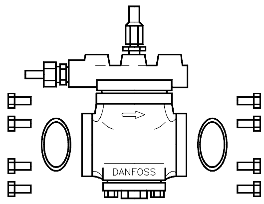
The code nos. for PMLX 80-125 include:
- Main valve
- External pilot connection
- Flange gaskets
- Flange bolts

Flanges must always be ordered separately.

Code nos. for PMLX 80, 100 and 125 are also available including DIN weld flanges.

If PMLX valves with other combinations of pilot valves are required (e.g. NC/NC or NO/NO) please order the main valve (PMLX without valves) and the pilot valves separately.

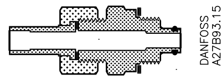
Coils are ordered separately according to coil voltage and frequency (see RD3JE).
For EVM (NC), code no. **027B1120**,
10 / 12 watt a.c. coils or 20 watt d.c. coils are used.
For EVM (NO), code no. **027B1130**, 12 watt d.c. coils or 20 watt d.c. coils, type I, are used.

	PMLX with NC / NO pilot valves	PMLX without pilot valves with external pilot connection and damping orifice
		
Valve size	EN-GJS-400-18-LT*	EN-GJS-400-18-LT*
PMLX 32	**027F3032**	**027F3040**
PMLX 40	**027F3033**	**027F3041**
PMLX 50	**027F3034**	**027F3042**
PMLX 65	**027F3035**	**027F3043**
PMLX 80	-	**027F2254**
PMLX 100	-	**027F2255**
PMLX 125	-	**027F2256**

* CE marked

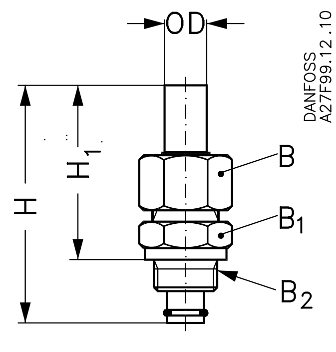
Accessories

External pilot connection



PMLX	Description	Code no.
32 - 65	External pilot connection (incl. damping orifice, D: 1.0 mm)	**027F1048**
32 - 65	External pilot connection (1/4" FPT) (incl. damping orifice, D: 1.0 mm)	**027B2065**
80 - 125	External polot connection (incl. damping orifice, D: 1.8 mm)	**027F1049**
80 - 125	External pilot connection (1/4" FPT) (incl. damping orifice, D: 1.8 mm)	**027B2066**
32 - 125	Accessory bag with seal and O-ring for pilot valve	**027F0666**

PMLX	Description	Code no.
32 - 65	Damping orifice for EVM. 10 off, (D: 1.0 mm)	**027F0664**
80 - 125	Damping orifice for EVM. 10 off, (D: 1.8 mm)	**027F0176**

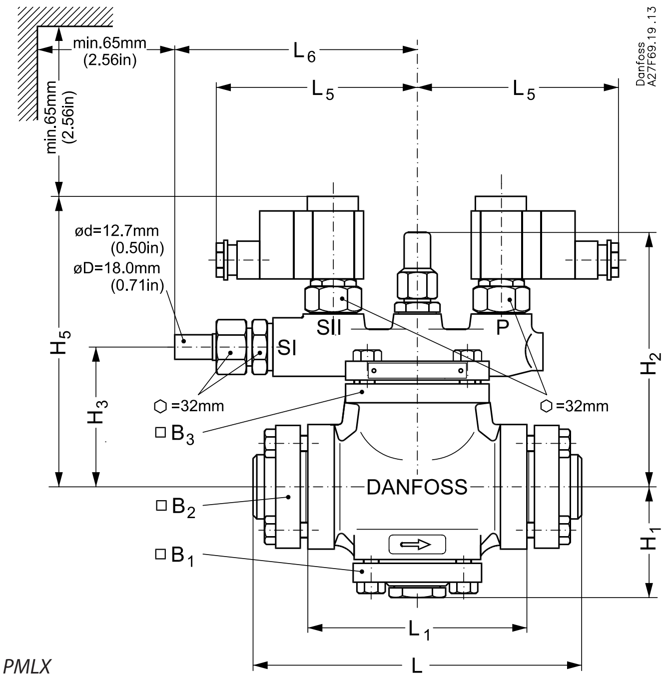


A damping orifice should be installed if the pressure difference between the low and the high pressure side is more than 6 bar.

Accessories			H	H_1	OD	B	B_1	B_2
External pilot connection								
	mm in.		90 3.54	66 2.60	18 0.71	NV 32	NV 32	M 24 × 1.5

Dimensions and weights

Flange set for valve type	Weight kg. / lb
PMLX 32	1.5 kg.
(DN 20 - 32)	3.3 lb
PMLX 40	1.9 kg.
(DN 40 - 50)	4.2 lb
PMLX 50	2.8 kg.
(DN 50 - 65)	6.2 lb
PMLX 65	3.0 kg.
(DN 65 - 80)	6.6 lb



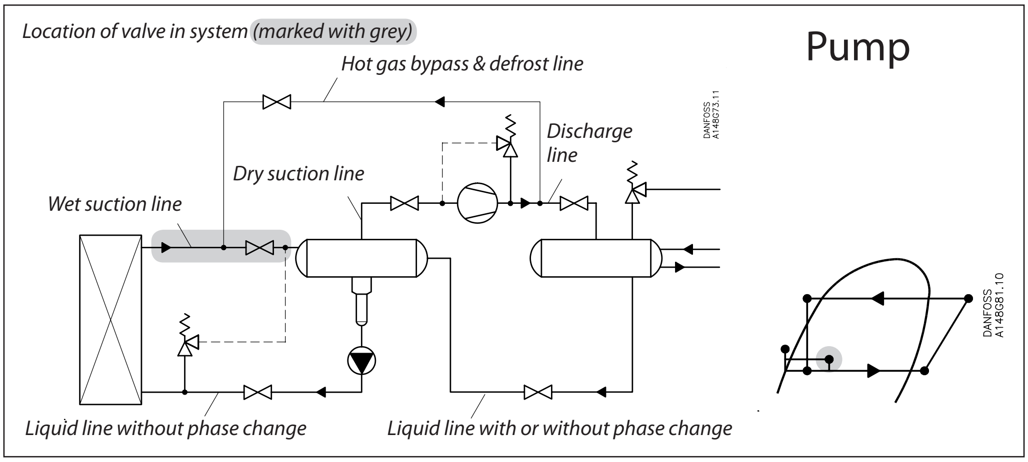
PMLX

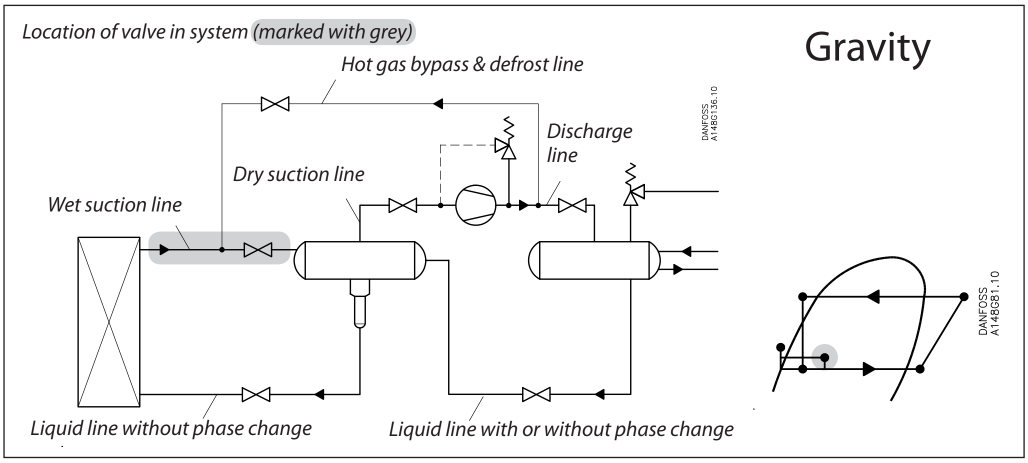
Type		H_1	H_2	H_3	H_5	L	L_1	L_5 max. 10 W	L_5 max. 20 W	L_6	B_1	B_2	B_3	Weight
PMLX 32	mm	72	178	96	208	240	170	122	132	160	84	82	94	12.6 kg.
(DN 20 - 32)	in.	2.8	7	3.8	8.2	9.4	6.7	4.8	5.2	6.3	3.3	3.2	3.7	27.8 lb
PMLX 40	mm	79	187	105	215	254	170	125	135	163	94	89	102	15.3 kg.
(DN 40 - 50)	in.	3.1	7.4	4.2	8.5	10	6.7	4.9	5.3	6.4	3.7	3.5	4.2	33.7 lb
PMLX 50	mm	95	205	123	234	288	200	125	135	163	104	106	113	21.1 kg.
(DN 50 - 65)	in.	3.7	8.1	4.8	9.2	11.3	7.9	4.9	5.3	6.4	4.1	4.2	4.4	46.5 lb
PMLX 65	mm	109	227	146	257	342	250	130	140	168	127	113	135	29.6 kg.
(DN 65 - 80)	in.	4.3	8.9	5.7	10.1	13.5	9.8	5.1	5.5	6.6	5.0	4.4	5.3	65.2 lb
PMLX 80	mm	152	365	214	325	437	310	141	151	182	190	235	210	80 kg. [1])
(DN 100)	in.	6.0	14.4	8.4	12.8	17.2	12.2	5.5	5.9	7.2	7.5	9.2	8.3	176.4 lb [1])
PMLX 100	mm	173	396	246	356	489	350	155	165	192	226	270	243	120 kg. [1])
(DN 125)	in.	6.8	15.6	9.7	14	19.3	13.8	6.1	6.5	7.5	8.9	10.6	9.6	264.5 lb [1])
PMLX 125	mm	208	453	301	412	602	455	171	181	218	261	300	286	170 kg.[1])
(DN 150)	in.	8.2	17.8	11.8	16.2	23.7	17.9	6.7	7.1	8.6	10.3	11.8	11.3	374.8 lb [1])

[1]) Weight with flanges and pilot valves.

Nominal capacities

Wet suction line





Nominal capacities

Wet suction line

SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

T_e = –20°C
Q_0 = 100 kW
Circulation ratio = 3
Max. ΔP = 0.1 bar

The capacity table is based on nominal conditions (pressure drop ΔP = 0.05 bar, circulation ratio = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP = 0.1 bar, $f_{\Delta P}$ = 0.71
Correction factor for circulation ratio, f_{circ} = 0.9

$Q_n = Q_0 \times f_{\Delta P} \times f_{circ}$ = 100 x 0.71 x 0.9 = 63.9 kW.

From the capacity table a PMLX 50 with Q_n = 85 kW is the correct selection for the application.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

T_e = – 20°F
Q_0 = 10 TR
Circulation ratio = 3
Max. ΔP = 1.25 psi

The capacity table is based on nominal conditions (pressure drop ΔP = 0.75 psi, circulation ratio = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP = 1.25 psi, $f_{\Delta p}$ = 0.77
Correction factor for circulation ratio, f_{circ} = 0.9

$Q_n = Q_0 \times f_{\Delta P} \times f_{circ} = 10 \times 0.77 \times 0.9 = 6.9$ TR

From the capacity table a PMLX 32 with Q_n = 9.7 TR is the correct selection for the application.

Nominal capacities

Wet suction line

SI units

Capacity table for nominal conditions, Q_N [kW],
circulation ratio = 4,
ΔP = 0.05 bar

R 717

Type	k_v m^3/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
PMLX 32	22.4	20.5	27	33	40	48	56	64	73
PMLX 40	29.4	27	35	43	53	63	73	84	96
PMLX 50	47.8	44	57	70	85	102	119	137	156
PMLX 65	80.3	73	95	118	143	171	200	231	262
PMLX 80	170	155	201	250	304	362	424	488	555
PMLX 100	242	221	286	356	432	515	603	695	790
PMLX 125	385	352	456	566	688	820	959	1106	1256

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.01	2.24
0.03	1.29
0.05	1
0.08	0.79
0.10	0.71
0.14	0.60

Correction factor for circulation ratio (f_{circ})

Circulation ratio	Correction factor
2	0.77
3	0.90
4	1
6	1.13
8	1.20
10	1.25

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
circulation ratio = 4,
ΔP = 0.75 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
PMLX 32	26.0	5.7	7.7	9.7	12.1	14.6	17.2	20	23
PMLX 40	34.1	7.5	10.0	12.7	15.9	19	23	26	30
PMLX 50	55.4	12.2	16.3	21	26	31	37	42	48
PMLX 65	93	20	27	35	43	52	62	71	81
PMLX 80	197	43	58	74	92	111	131	151	172
PMLX 100	281	62	83	105	131	157	186	215	245
PMLX 125	447	98	132	167	208	250	296	342	390

* 2°F below min. operating temperature.

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
0.15	2.24
0.45	1.29
0.75	**1**
1.25	0.77
1.75	0.65
2.25	0.58

Correction factor for circulation ratio (f_{circ})

Circulation ratio	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

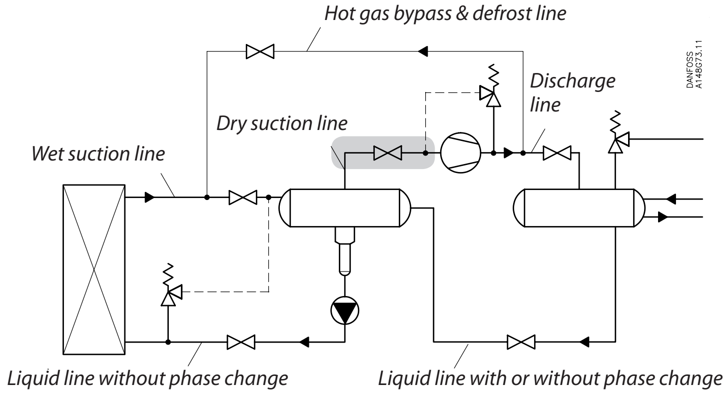
Solenoid valves

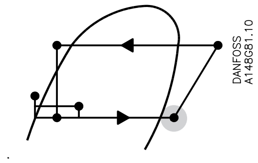
Nominal capacities

Dry suction line

Location of valve in system (marked with grey)

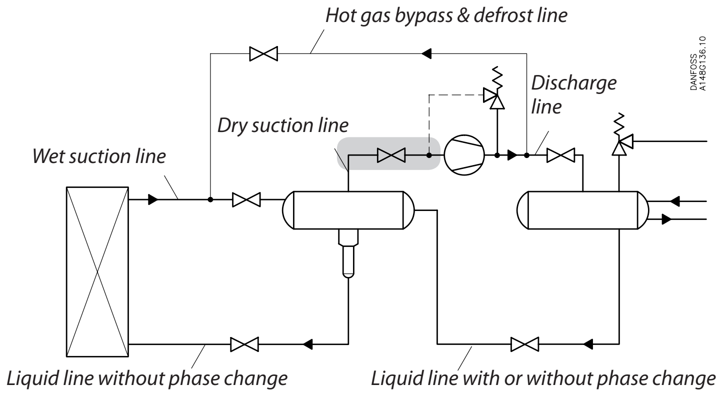
Pump

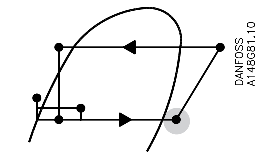




Location of valve in system (marked with grey)

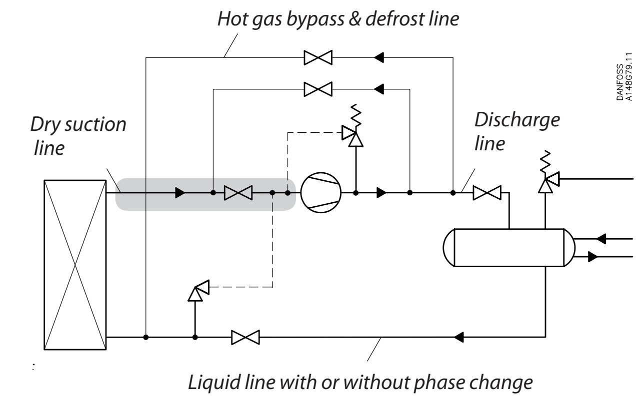
Gravity

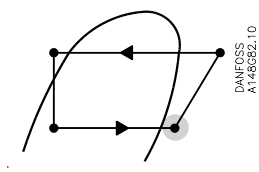




Location of valve in system (marked with grey)

DX





Nominal capacities

Dry suction line

SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20°C$
$Q_0 = 100$ kW
$T_{liq} = 10°C$
Max. $\Delta P = 0.1$ bar

The capacity table is based on nominal conditions (pressure drop $\Delta P = 0.05$ bar, $T_{liq} = 30°C$).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for $\Delta P = 0.1$ bar, $f_{\Delta P} = 0.71$
Correction factor for liquid temperature, $f_{Tliq} = 0.92$

Correction factor for superheat (T_s) = 1.0
$Q_n = Q_0 \times f_{\Delta P} \times f_{Tliq} \times f_{Ts}$
$= 100 \times 0.71 \times 0.92 \times 1.0 = 65.3$ kW

From the capacity table a PMLX 40 with $Q_n = 81$ kW is the correct selection for the application.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = 0°F$
$Q_0 = 30$ TR
$T_{liq} = 50°F$
Max. $\Delta P = 1.25$ psi

The capacity table is based on nominal conditions (pressure drop $\Delta P = 0.75$ psi, $T_{liq} = 90°F$)

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for $\Delta P = 1.25$ psi, $f_{\Delta p} = 0.77$
Correction factor for liquid temperature, $f_{Tliq} = 0.92$

Correction factor for superheat (T_s) = 1.0
$Q_n = Q_0 \times f_{\Delta P} \times f_{Tliq} \times f_{Ts}$
$= 30 \times 0.77 \times 0.92 \times 1.0 = 21.25$ TR

From the capacity table a PMLX 40 with $Q_n = 24$ TR is the correct selection for the application.

Nominal capacities

Dry suction line

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 30°C,
ΔP = 0.05 bar

R 717

Type	k_v m³/h	Evaporating temperature T_e							
		−50°C	−40°C	−30°C	−20°C	−10°C	0°C	10°C	20°C
PMLX 32	22.4	28.9	38.1	49	61	76	92	110	130
PMLX 40	29.4	38	50	64	81	99	120	144	170
PMLX 50	47.8	62	81	104	131	161	196	234	277
PMLX 65	80.3	103.5	137	175	220	271	329	394	465
PMLX 80	170	219	289	371	467	574	697	834	985
PMLX 100	242	312	412	528	664	817	992	1187	1402
PMLX 125	385	496	655	839	1057	1299	1578	1888	2231

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
−20°C	0.82
−10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1**
40°C	1.04
50°C	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.01	2.24
0.03	1.29
0.05	**1**
0.08	0.79
0.10	0.71
0.14	0.60

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 0.75 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		−60°F*	−40°F	−20°F	0°F	20°F	40°F	60°F	80°F
PMLX 32	26.0	8.0	11.0	14.4	18.4	23.2	28.7	34.5	41
PMLX 40	34.1	10.5	14.4	18.9	24.1	30.5	37.6	45	54
PMLX 50	55.4	17.1	23.5	30.7	39	50	61.2	74	88
PMLX 65	93	28.7	39	52	66	83	103	124	147
PMLX 80	197	60.8	84	109	139	176	218	262	312
PMLX 100	281	86.5	119	155	198	251	310	372	444
PMLX 125	447	138	189	247	316	399	493	592	706

* 2°F below min. operating temperature.

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
−10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1**
110°F	1.04
130°F	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
0.15	2.24
0.45	1.29
0.75	**1**
1.25	0.77
1.75	0.65
2.25	0.58

Introduction

GPLX are automatic two step on/off normally closed (NC) valves. They are designed for hot gas defrosting, suction lines and other applications.

The valves have a built-in pressure equalising system preventing pressure shock and therefore eliminating the need for external bypass with resultant cost savings. GPLX are angle valves with weld connections.

Features

- Applicable to all common non flammable refrigerants including R 717 and non corrosive gases/liquids dependent on sealing material compatibility.
- Built-in pressure equalising system for prevention of pressure shock - no external bypass required.
- Angle valves with weld connections.
- –60°/+150°C (–76°/+302°F).
- Housing and bonnet made from low temperature steel according to requirements of the Pressure Equipment Directive and other international classification authorities.
- Each valve is clearly marked with type, size and performance range.
- Stainless steel bolts.
- Max. operating pressure 40 bar g (580 psi g). Valves for higher operating pressure available on request.
- The valve cone has two teflon tightening rings with built-in metallic stops to prevent damage to the teflon rings in case of extreme pressure difference.
- Classification: To receive an updated list of certification on the products please contact your local Danfoss Sales Company.

Pressure Equipment Directive (PED)
The GPLX valves are approved and CE-marked in accordance with the Pressure Equipment Directive - 97/23/CE.

For further details / restrictions - see Installation Instruction.

GPLX valves		
Nominal bore	DN 80 mm (3 in.)	DN 100 - 150 mm (4-6 in.)
Classified for	Fluid group I	
Category	II	III

Technical data

The complete technical leaflet (DKRCI.PD.BO0.A) can be downloaded from the Danfoss web site.

Refrigerants
Applicable to all common non flammable refrigerants including R 717 and non corrosive gases/liquids dependent on sealing material compatability.
For further information please see installation instruction for GPLX.
Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.

Temperature Range
–60°/+150°C (–76°/+302°F).

Pressure
The valves are designed for:
Max. working pressure: 40 bar g (580 psi g).
Valves for higher working pressure are available on request.

Design
(See figure 1)

Standard sizes DN 80 - 150 (3 in. - 6 in.)
GPLX are equipped with an extension on the top of the actuator (1) for manual opening of the valve.

Connections
Available with the following connections:
Butt weld DIN (2448)
Butt weld ANSI (B 36.10, schedule 40).

Housing and bonnet
Made of special cold resistant steel approved for low temperature operation.

Cone (10)
The valve cone has two teflon tightening rings (2 & 3), both with built-in metallic stops to prevent damage to the teflon rings in case of an extreme pressure difference.

Spindle (1)
Made of gas-tempered steel; consequently the valve spindle has an extremely hard and smooth surface.

Packing Glands
GPLX has no external packing glands. Internally, the valve is equipped with three packing glands of the O-ring type: One between the valve housing and the lower actuator chamber (4) and two between the lower and upper actuator chamber (5 & 6).

Actuator
The GPLX actuator has two chambers (A & B) separated by a piston (7).
The upper compartment has two springs.
The inner spring (8) provides the second stage opening.
The function of the outer spring (9) is to close the inner teflon ring (3) of the valve cone. The outer spring also serves to force any possible condensate out of the lower actuator chamber, through the pilot valve assembly into the upper actuator chamber and from there into the suction side of the system.
The lower chamber (B) of the actuator is connected to the hot gas supply (P_2), which must be activated during the period when the main valve is open.

Installation
The actuator has one threaded (G $^1/_4$ in.) connection for mounting of the pilot valve.
Fittings for connection of steel pipe DN 8 (d_o/d_i = $^{10}/_8$ mm) by means of cutting rings or welding nipples are supplied.
The installation of a FIL 6 filter accessory in the pilot line is recommended.
The valve is designed to resist very high internal pressure, but as to the pipe system in general, hydraulic pressure caused by thermal expansions in entrapped refrigerants should be avoided.

For further information please refer to GPLX installation instruction.

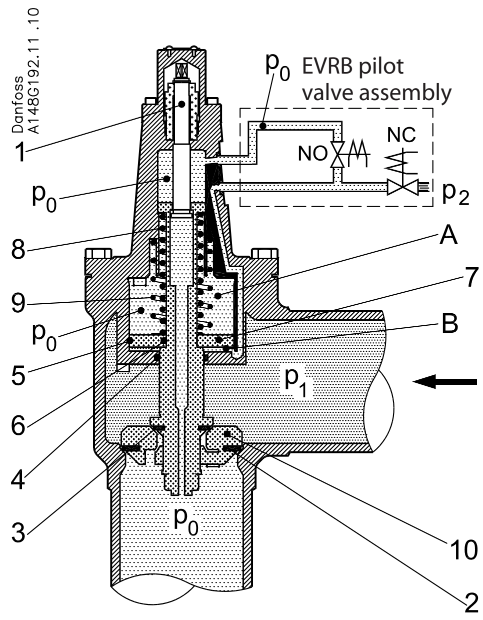


Figure 1

Function

(See figure 1 and 2)

The GPLX valve is of the Normally Closed-type (NC), i.e. in an unloaded condition the valve will always be closed. When the valve is closed, the channel through the spindle (1) is open so that the low pressure (P_0) will travel up through the channel to the top of the piston (7). The valve remains closed due to the force of the outer spring (9).

Furthermore, the pressure difference across the valve cone (10) ($P_1 > P_0$) will increase the closing force of the valve.

The valve is opened by allowing hot gas (P_2) into the chamber below the piston (7) by the EVRB pilot valve assembly, NC.

When the hot gas pressure (P_2) below the piston (7) has reached a level where it is able to overcome both the outer spring and the pressure difference across the valve cone (10) (P_1 - P_0), the spindle (1) will begin to move upwards against the spring force on the top of the piston (7), and the inner pilot seat (3) will open (**stage 1**).

If the hot gas pressure P_2 increases, it has no influence on **stage 2** pressure difference, because this pressure will only force the piston to move upwards and thereby compress both the outer and inner springs (8 & 9) and not allow **stage 2** opening before the pressure difference P_1-P_0 is 1.5 bar. The reason for this is that the force for opening stage 2 comes from the compressed inner spring (9) and not P_2.

When the inner pilot seat (3) is opened, the main valve pressure will begin to equalise (P_1 will be equalised to P_0), and furthermore, the channel through the spindle will feed the pressure P_1 to the top of the piston.

When the pressure equalisation across the valve seat is sufficient, the inner spring will be able to fully open the valve (**stage 2**).

The valve is closed by releasing the hot gas pressure from the chamber below the piston (7) and at the same time connecting it with the suction side P_0. Then the force from the outer spring will close the valve.

To ensure smooth operation of the GPLX valve the following rules must be adhered to:
$P_2 \geq P_0$ + 3 bar g (43.5 p sig) and
$P_2 \geq P_1$ and
$P_1 \leq$ 25 bar g (363 p sig)
$P_1 - P_0 \leq$ 20 bar g (290.1 psi g)

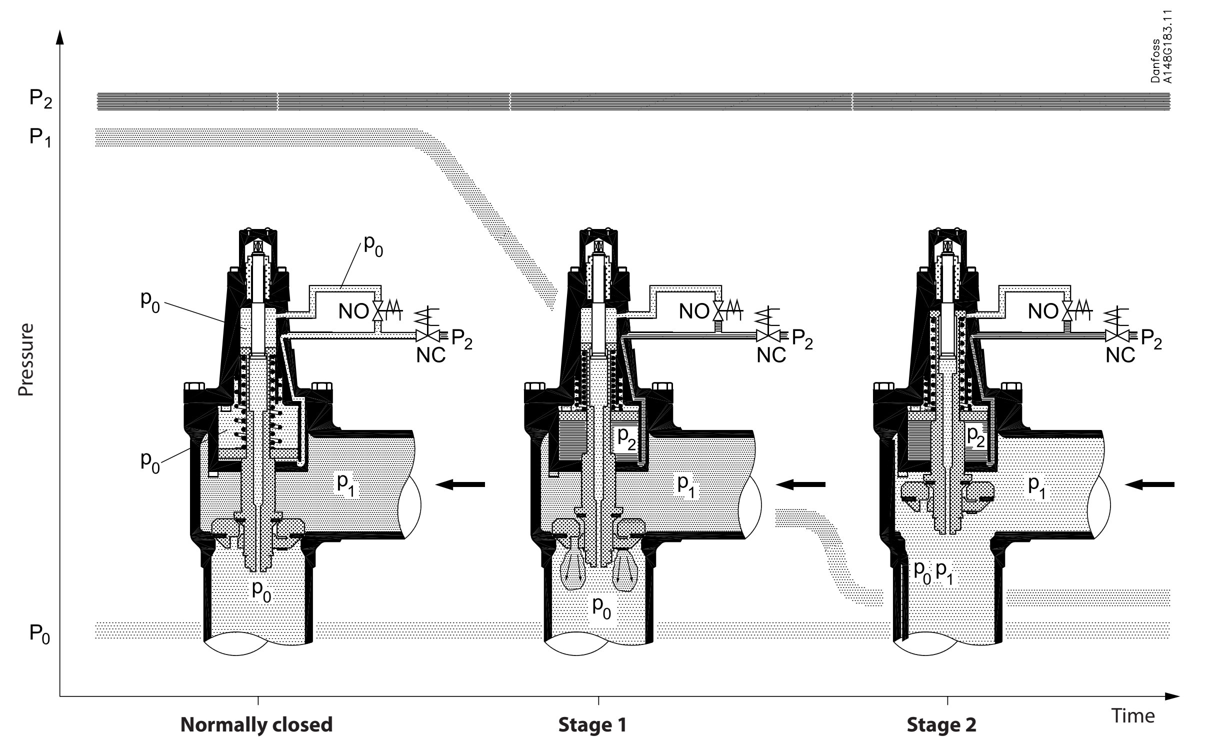
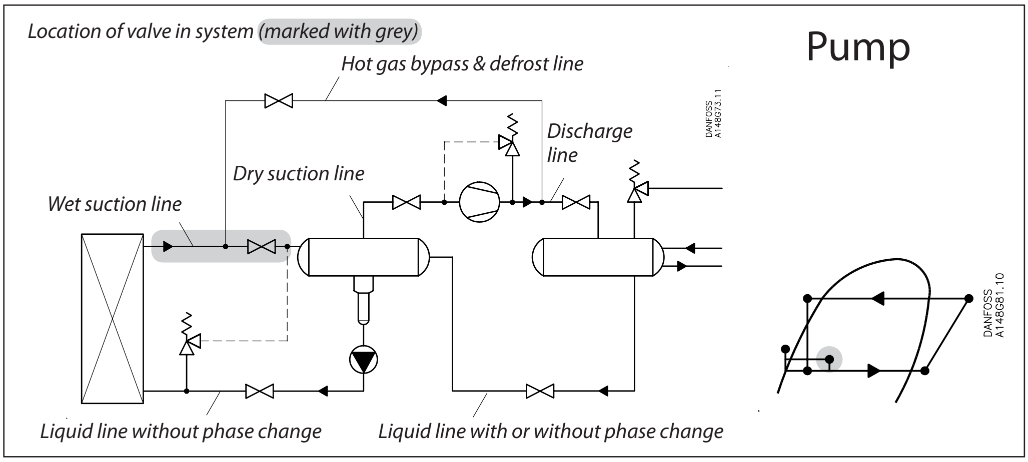
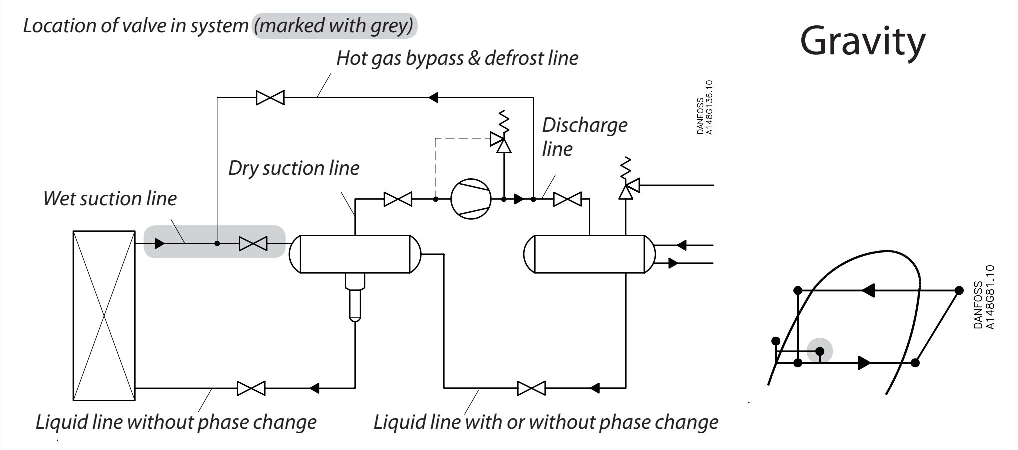


Figure 2

Nominal capacities

Wet suction line





Nominal capacities

Wet suction line

SI units

Calculation example (R 717 capacities):

An application has the following running conditions:
T_e = –35°C
Q_0 = 250 kW
Recirculating rate = 3
Max. Δp = 0.03 bar

The capacity table is based on nominal conditions (recirculation rate = 4, pressure drop Δp = 0.05 bar). Therefore the actual capacity must be corrected to the nominal condition by means of correction factors.

Correction factor for:
Recirculation rate 3 ($f_{rec.}$) = 0.90
Δp 0.03 bar ($f_{\Delta p}$) = 1.29

Nominal capacity, Q_N [kW]:
$Q_N = Q_0 \times f_{rec.} \times f_{\Delta p}$
$= 250 \times 0.90 \times 1.29 = 290$ kW

From the capacity table a GPLX 100 with Q_N capacity (264 + 328) ÷ 2 = **296** kW is selected.

US units

Calculation example (R 22 capacities):

An application has the following running conditions:
T_e = –20°F
Q_0 = 50 TR
Recurculating rate = 3
Max. Δp = 0.45 psi.

The capacity table is based on nominal conditions (recirculation rate = 4, pressure drop Δp = 0.75 psi). Therefore the actual capacity must be corrected to the nominal condition by means of correction factors.

Correction factor for:
Recirculation rate 3 ($f_{rec.}$) = 0.90
Δp 0.45 psi ($f_{\Delta p}$) = 1.29

Nominal capacity, Q_N [TR]:
$Q_N = Q_0 \times f_{rec} \times f_{\Delta p}$
$= 50 \times 0.90 \times 1.29 = 58$ TR

From the capacity table a GPLX 125 with Q_N capacity (58.3 + 71.1) ÷ 2 = **64.7** TR is selected.

Solenoid valves

Nominal capacities

Wet suction line

SI units

Capacity table at nominal conditions,
Q_N [kW],
Recirculation rate = 4
Δp = 0.05 bar

R 717

Type	k_v m^3/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
GPLX 80	131	120	155	193	234	279	326	376	428
GPLX 100	223	204	264	328	398	475	556	640	728
GPLX 125	370	338	438	544	661	788	922	1063	1208
GPLX 150	566	517	670	832	1011	1205	1410	1625	1847

Correction factor for Δp ($f_{\Delta p}$)

Δp (bar)	Correction factor
0.01	2.24
0.03	1.29
0.05	**1.00**
0.08	0.79
0.10	0.71
0.14	0.60

Correction factor for recirculating rate ($f_{rec.}$)

Recirculating rate	Correction factor
2.0	0.77
3.0	0.90
4.0	**1.00**
6.0	1.13
8.0	1.20
10.0	1.25

US units

Capacity table at nominal conditions,
Q_N [Tons of Refrigeration],
Recirculating rate = 4.0
Δp = 0.75 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F *)	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
GPLX 80	152	33.4	44.8	56.8	70.7	85.2	100.7	116	133
GPLX 100	259	56.8	76.3	96.8	120.4	145	172	198	226
GPLX 125	429	94.1	126.4	160	199	241	284	329	374
GPLX 150	657	144	194	246	305	368	435	503	573

*) 2°F below min. operating temperature.

Correction factor for Δp ($f_{\Delta p}$)

Δp (psi)	Correction factor
0.15	2.24
0.45	1.29
0.75	**1.00**
1.25	0.77
1.75	0.65
2.25	0.58

Correction factor for recirculating rate ($f_{rec.}$)

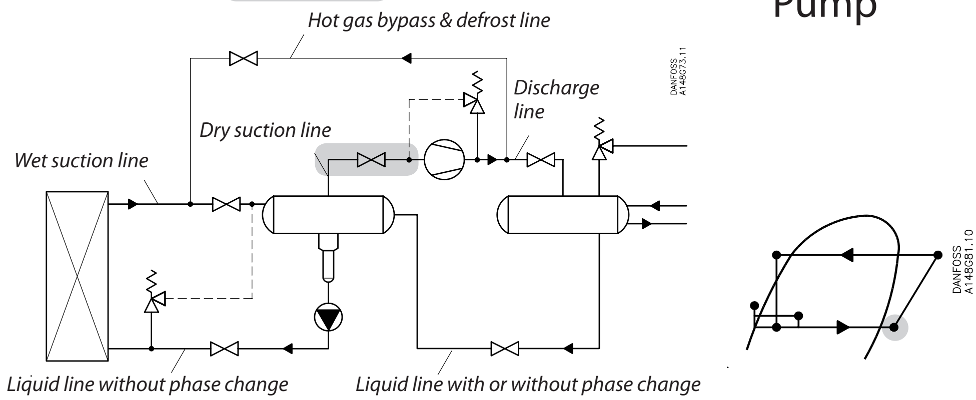
Recirculating rate	Correction factor
2.0	0.77
3.0	0.90
4.0	**1.00**
6.0	1.13
8.0	1.20
10.0	1.25

Nominal capacities

Dry suction line

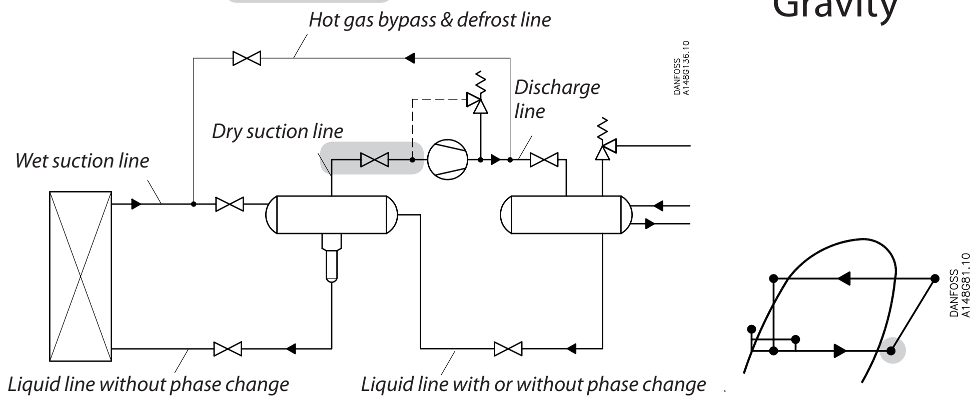
Location of valve in system (marked with grey)

Pump



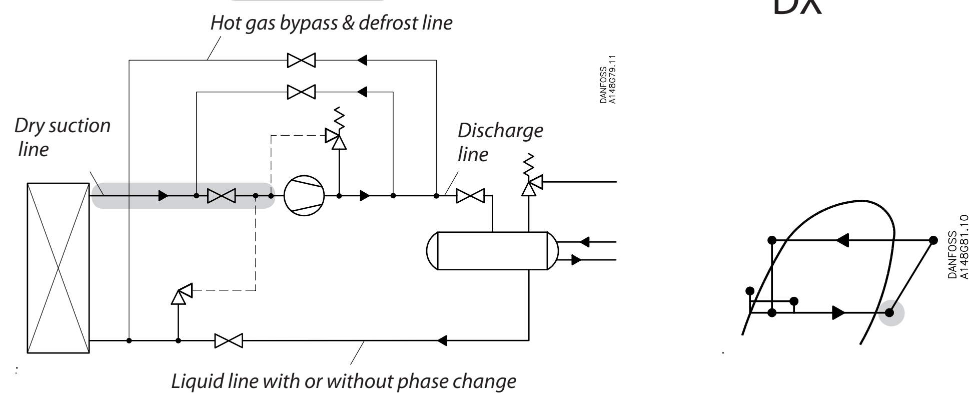
Location of valve in system (marked with grey)

Gravity



Location of valve in system (marked with grey)

DX



Solenoid valves

Nominal capacities

Dry suction line

SI units

Calculation example (R 717 capacities):

An application has the following running conditions:
$T_e = -20°C$
$Q_0 = 650$ kW
Max. $\Delta p = 0.08$ bar
$T_{liq.} = 40°C$
$T_s = 12$ K

The capacity table is based on nominal conditions ($T_{liq.} = 30°C$, pressure drop $\Delta p = 0.05$ bar, superheat $T_s = 8$ K). Therefore the actual capacity must be corrected to the nominal condition by means of correction factors.

Correction factor for:
Δp 0.08 bar $f_{\Delta p} = 0.79$
$T_{liq.}$ 40°C $f_{Tliq.} = 1.09$
T_s 12 K $f_{Ts} = 1.00$

Nominal capacity, Q_N [kW]:

$$Q_N = Q_0 \times f_{\Delta p} \times f_{Tliq.} \times f_{Ts}$$
$$= 650 \times 0.79 \times 1.09 \times 1.00 = 560 \text{ kW}$$

From the capacity table a GPLX 100 with Q_N capacity **630** kW is selected.

US units

Calculation example (R 22 capacities):

An application has the following running conditions:
$T_e = -20°F$
$Q_0 = 105$ TR
Max. $\Delta p = 0.45$ psi
$T_{liq.} = 50°F$
$T_s = 20°F$

The capacity table is based on nominal conditions ($T_{liq.} = 90°F$, pressure drop $\Delta p = 0.75$ psi, superheat $T_s = 20°F$). Therefore the actual capacity must be corrected to the nominal condition by means of correction factors.

Correction factor for:
Δp 0.45 psi ($f_{\Delta p}$) = 1.29
$T_{liq.}$ 50°F (f_{Tliq}.) = 0.92
T_s 20°F (f_{Ts}) = 1.00

$$Q_N = Q_0 \times f_{\Delta p} \times f_{Tliq.} \times f_{T\,s}$$
$$= 105 \times 1.29 \times 0.87 \times 1.00 = 118 \text{ TR}$$

From the capacity table a GPLX 150 (6 in.) with Q_N capacity **137** TR is selected.

Nominal capacities

Dry suction line

SI units

Capacity table at nominal conditions,
Q_N [kW],
T_{liq} = 30°C,
Δp = 0.05 bar

R 717

Type	k_v m³/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
GPLX 80	131	168.9	222.9	286	360	442	537	642	759
GPLX 100	223	288	379	486	612	753	914	1094	1292
GPLX 125	370	477	630	807	1016	1249	1516	1815	2144
GPLX 150	566	729.8	963	1234	1554	1910	2319	2776	3279

Correction factor for Δp ($f_{\Delta p}$)

Δp (bar)	Correction factor
0.01	2.24
0.03	1.29
0.05	**1.00**
0.08	0.79
0.10	0.71
0.14	0.60

Correction factor for superheat (T_S)

T_s	Correction factor
6 K	1.00
8 K	1.00
10 K	1.00
12 K	1.00

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

US units

Capacity table at nominal conditions,
Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
Δp = 0.75 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F *)	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
GPLX 80	152	46.8	64.4	84.1	107.4	135.8	167.7	201.6	240
GPLX 100	259	79.8	109.7	143.3	183.1	231.3	285.8	344	409
GPLX 125	429	132.2	181.7	237.4	303	383	473.4	569	678
GPLX 150	657	202.5	278	364	464	587	725	871	1038

* 2°F below min. operating temperature.

Correction factor for Δp ($f_{\Delta p}$)

Δp (psi)	Correction factor
0.15	2.24
0.45	1.29
0.75	**1.00**
1.25	0.77
1.75	0.65
2.25	0.58

Correction factor for superheat (T_S)

T_s	Correction factor
10°F	1.00
14°F	**1.00**
18°F	1.00
20°F	1.00

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

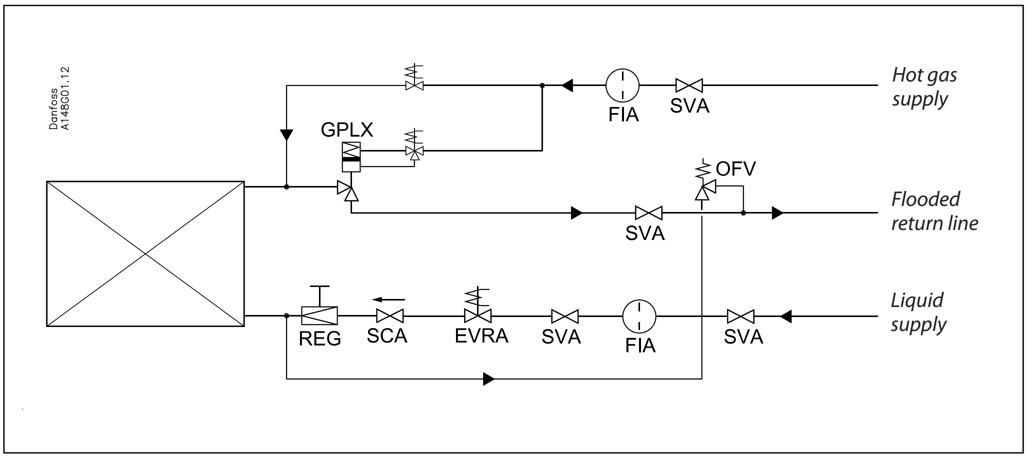
Hot Gas Defrosting
Pump circulation systems
(flooded evaporators)

It is recommended to start the defrosting cycle by closing the EVRA valve in the liquid supply line and allowing some of the cold liquid contained in the evaporator to return to the liquid separator.

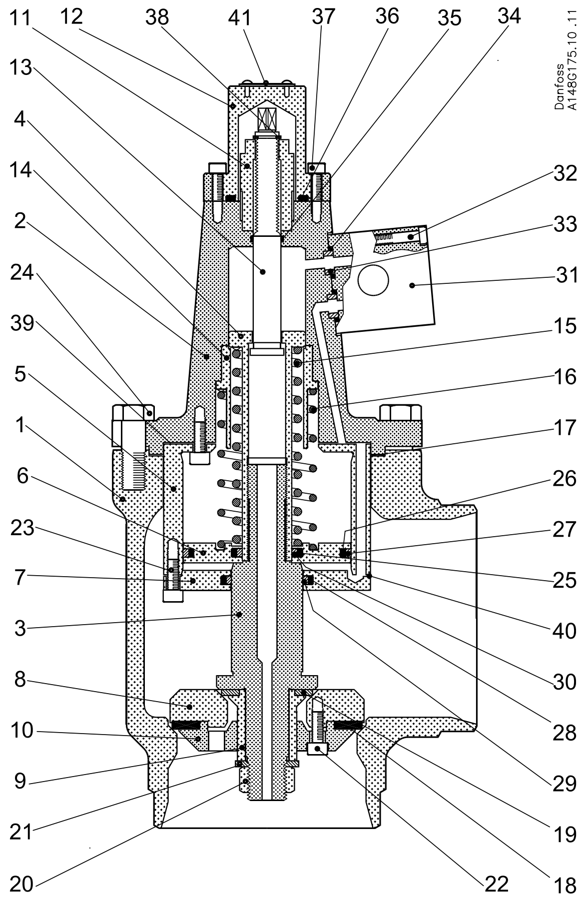
Close the GPLX valve in the wet suction line (flooded return line) and after a delay open the solenoid valve in the hot gas supply in order to build up the defrosting pressure in the evaporator.
Whenever a GPLX is installed in a liquid line, build-up of hydraulic pressure must be avoided.

After defrosting, the GPLX should be opened to allow the evaporator pressure to equalise with the suction side before opening the EVRA in the liquid supply line.

GPLX valves are designed to allow the equalisation of pressures between evaporator pressure and system suction pressure, which eliminates the need to install an external by-pass around the GPLX valve.

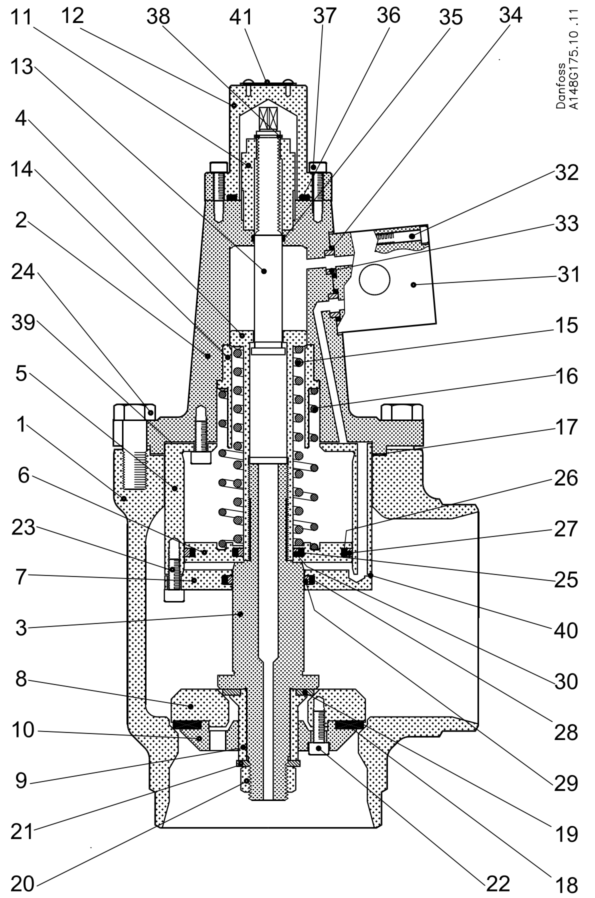


Material specification



No.	Part	Material	EN	ASTM	JIS
1	Valve Housing	Steel	G20Mn5 QT EN 10213-3	LCC A 352	SCPL1 G 5152
2	Bonnet	Steel	P285QH EN 10222-4	LF2 A350	SFL 2 G 3205
3	Valve spindle	Steel			
4	Piston rod	Steel			
5	Cylinder	Steel			
6	Piston	Steel			
7	Spindle guide	Steel			
8	Valve cone back	Steel			
9	Valve cone bush	Steel			
10	Valve front cone	Steel			
11	Spindle top thread bush	Steel			
12	Valve top cap	Steel			
13	Manual opening spindle	Steel			
14	Bushing for spring	Steel			
15	Inner spring for opening	Steel			
16	Outer spring for closing	Steel			

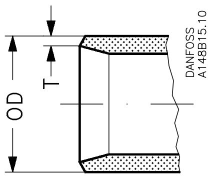
Material specification
(cont.)



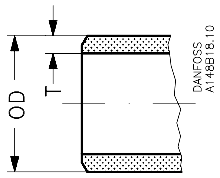
No.	Part	Material	EN	ASTM	JIS
17	Top gasket	Fiber, Non-asbestos			
18	Teflon ring step 2	PTFE			
19	Teflon ring step 1	PTFE			
20	Cone nut	Steel			
21	Cone nut disc	Steel			
22	Cone assembly screw	Steel			
23	Cylinder screw	Steel			
24	Hexagon set screw	Stainless steel	A2-70 EN 1515-1	Type 308 A276	A2-70 B 1054
25	O-ring	Cloroprene (Neoprene)			
26	O-ring	Cloroprene (Neoprene)			
27	Piston sealing ring	PTFE			
28	O-ring	Cloroprene (Neoprene)			
29	Spindle sealing ring	PTFE			
30	Sealing ring	PTFE			
31	Solenoid valve, EVRB				
32	Solenoid fixing screw	Steel			
33	Bushing	Steel			
34	O-ring	Cloroprene (Neoprene)			
35	O-ring	Cloroprene (Neoprene)			
36	O-ring	Cloroprene (Neoprene)			
37	Top cap fixing screw	Steel			
38	Spring ring	Steel			
39	Gasket for cylinder top	Fiber, Non-asbestos			
40	O-ring	Cloroprene (Neoprene)			
41	Marking plate	Steel			

Connections

DIN



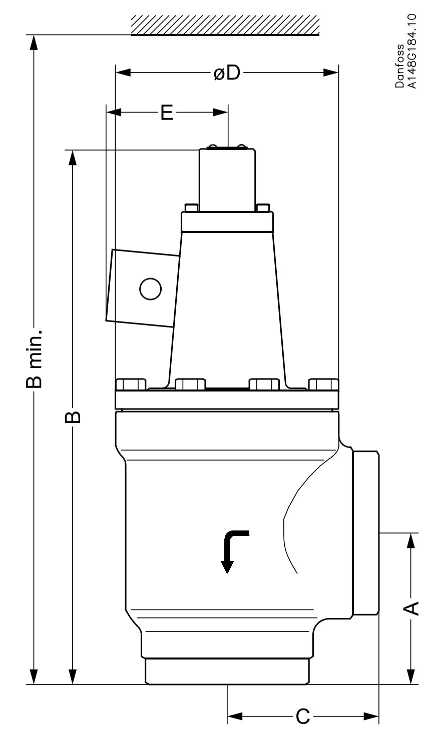
ANSI



Size		OD	T	OD	T			K_v-angle	C_v-angle	K_v-angle	C_v-angle
mm	in.	mm	mm	in.	in.			m³/h	USgal/min	m³/h	USgal/min
Welding DIN (2448)								First opening step		Fully open	
80	3	88.9	3.2	3.50	0.13			7.7	9	131	152
100	4	114.3	3.6	4.50	0.14			12.0	14	223	259
125	5	139.7	4.0	5.50	0.16			24.0	28	370	429
150	6	168.3	4.5	6.63	0.18			36.0	42	566	657
Welding ANSI (B 36.10)								First opening step		Fully open	
80	3	88.9	5.5	3.50	0.22			7.7	9	131	152
100	4	114.3	6.0	4.50	0.24			12.0	14	223	259
125	5	139.7	6.6	5.50	0.26			24.0	28	370	429
150	6	168.3	7.1	6.63	0.28			36.0	42	566	657

Solenoid valves

Dimensions and weights



Valve size		A	B	B_{min}	C		ØD		E	Weight
GPLX 80-150										
GPLX 80 (3 in.)	mm in.	100 3.9	390 15.4	570 22.4	100 3.9		155 6.1		135 5.3	20.0 kg
GPLX 100 (4 in.)	mm in.	125 4.9	500 19.7	725 28.5	125 4.9		190 7.5		150 5.9	33.0 kg
GPLX 125 (5 in.)	mm in	150 5.9	565 22.2	790 31.1	150 5.9		190 7.5		150 5.9	45.0 kg
GPLX 150 (6 in.)	mm in.	180 7.1	620 24.4	845 33.3	180 7.1		190 7.5		150 5.9	65.0 kg

Specified weights are approximate values only.

Ordering

GPLX valves are supplied complete with EVRB pilot valve less solenoid coils.
Please select required coils from the table below. The coils will be supplied loose for site assembly.

DIN butt-weld:

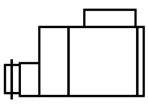
Size		Type	**Code number**
mm	in.		
80	3	GPLX 80 D	**148G3151**
100	4	GPLX 100 D	**148G3152**
125	5	GPLX 125 D	**148G3153**
150	6	GPLX 150 D	**148G3154**

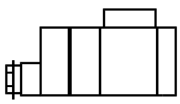
ANSI butt-weld:

Size		Type	**Code number**
mm	in.		
80	3	GPLX 80 A	**148G3155**
100	4	GPLX 100 A	**148G3156**
125	5	GPLX 125 A	**148G3157**
150	6	GPLX 150 A	**148G3158**

D = DIN butt-weld
A = ANSI butt-weld

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.



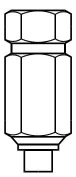


Please select a set of coils (two pieces) from the list below:

Sets of coils	**Code number**
24V 50Hz 10W 24V 50Hz 12W	**018F6707** **018F6807**
110V 50/60Hz 10W 110V 60Hz 12W	**018F6730** **018F6813**
220/230V 50Hz 10W 220/230V 50Hz 12W	**018F6701** **018F6801**
220V 60Hz 10W 220V 60Hz 12W	**018F6714** **018F6814**
24V d.c. - 20W	**018F6857**
110V d.c. - 20W	**018F6860**
220V d.c. - 20W	**018F6851**

Note:
Always use coils with the same voltage as the rated power supply.

For further information please contact your local Danfoss Sales Company.



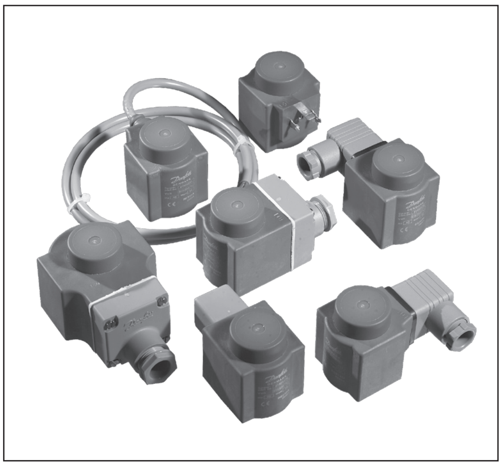
Optional:
Filter for pilot connection with threaded connection - $^{1}/_{4}$" BSP male:

Type	**Code number**
FIL 6 R $^{1}/_{4}$"	**2464+608**

Coils for solenoid valves

Introduction

The coils are specially designed to operate in the aggressive environment of high humidity and temperature fluctuations that you find in most refrigeration systems.
The new Clip-on fastening system ensures a faultless installation and makes the coils easy to mount and dismount. A Danfoss Clip-on coil can be mounted without any tools at all, and it is simple to dismount the coil by means of a screwdriver.
The Clip-on coils are available for the entire range of Danfoss solenoid valves for refrigeration, freezing and air conditioning purposes.



Features

- Encapsulated coils with long operating life, even under extreme conditions
- Standard coils for a.c. or d.c.
- Standard coils available with 3-core cable,
- terminal box or DIN plugs
- Standard coils from 12 V to 420 V, 50, 60 or 50/60 Hz
- Standard coils dimensioned for max. opening differential pressure (MOPD) of up to 21 bar
- Coils can be fitted without the use of tools

Technical data

Ambient temperature
10 or 12 W a.c. coil for NC (normally closed) valve:
–40 → +80°C
10 W a.c. coil
for NO (normally open) valve:
–40 → +55°C
20 W d.c. coil for NC and NO valve:
–40 → +50°C

Permissible voltage variation
10 and 12 W a.c. coils: +10 → –15% and as double frequency coils: ±10%
a.c. coils for 220-230 / 380-400 V: +6 → –15% and as double frequency coils: +6 → –10%
20 W d.c. coils: ±10%.

Enclosure
IP 67 with cable or terminal box
IP 20 with DIN plugs and protective cap
IP 65 with DIN socket
IP 00 with DIN plugs.

Approvals
See under the required solenoid valve.

Connection

3-core cable
The external thread in the screwed cable entry suits flexible steel hose or corresponding cable protection.

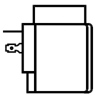
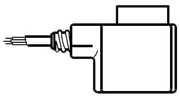
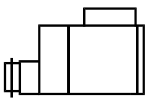
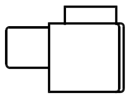
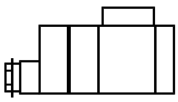
Terminal box
Leads are connected to terminal screws in the terminal box. The box is fitted with a Pg 13.5 screwed entry for 6 → 14 mm cable.
Max. lead cross section: 2.5 mm^2.

DIN plugs
The three pins on the coil can be fitted with spade tabs, 6.3 mm wide (to DIN 46247).
The two current carrying pins can also be fitted with spade tabs, 4.8 mm wide.
Max. lead cross section: 1.5 mm^2.
Use of the protective cap supplied will prevent inadvertent contact with live parts.

DIN socket
(to DIN 43650)
Leads are connected in the socket. The socket is fitted with a Pg 11 screwed entry for 6 → 12 mm.

The complete technical leaflet (DKRCC.PD.BS0.A) can be downloaded from the Danfoss web site.

Ordering
Clip-on coils

Valve type	Voltage V	Frequency Hz	Code no. With 1 m 3-core cable IP 67	With terminal box IP 67	With DIN plugs and protect. cap IP 20	With DIN plugs**)	Appen-dix no.*)	Power con-sumption

Alternating current a.c.

Valve type	Voltage V	Frequency Hz	With 1 m 3-core cable IP 67	With terminal box IP 67	With DIN plugs and protect. cap IP 20	With DIN plugs**)	Appendix no.*)	Power consumption
EVR 2 → 40 (NC) EVR 6 → 22 (NO) EVRH 4 → 40 EVRC EVRA EVRAT EVRS / EVRST PKVD EVM (NC)	12	50	**018F6256**	**018F6706**	**018F6181**		15	Holding: 10 W 21 VA Inrush: 44 VA
	24	50	**018F6257**	**018F6707**	**018F6182**	**018F7358**	16	
	42	50	**018F6258**	**018F6708**	**018F6183**		17	
	48	50	**018F6259**	**018F6709**	**018F6184**		18	
	115	50	**018F6261**	**018F6711**	**018F6186**	**018F7361**	22	
	220-230	50	**018F6251**	**018F6701**	**018F6176**	**018F7351**	31	
	240	50	**018F6252**	**018F6702**	**018F6177**	**018F7352**	33	
	380-400	50	**018F6253**	**018F6703**	**018F6178**		37	
	420	50	**018F6254**	**018F6704**	**018F6179**		38	
	24	60	**018F6265**	**018F6715**	**018F6190**		14	
	115	60	**018F6260**	**018F6710**	**018F6185**		20	
	220	60	**018F6264**	**018F6714**	**018F6189**		29	
	240	60	**018F6263**	**018F6713**	**018F6188**		30	
	110	50/60	**018F6280**	**018F6730**	**018F6192**	**018F7360**	21	
	220-230	50/60	**018F6282**	**018F6732**	**018F6193**	**018F7363**	32	

Direct current d.c. Coil type I

Valve type	Voltage V	Frequency Hz	With 1 m 3-core cable IP 67	With terminal box IP 67	With DIN plugs and protect. cap IP 20	With DIN plugs**)	Appendix no.*)	Power consumption
EVR 2 → 15 (NC) EVR 25 → 40 (NC/NO) EVR 6 → 15 (NO) EVRC 10 → 15 EVRA 3 → 15 (NC) EVRA 25 → 40 (NC) EVRAT 10 → 15 (NC) EVRS / EVRST 3 → 15 PKVD EVM (NC/NO)	12			**018F6856**			01	20 W
	24			**018F6857**			02	
	48			**018F6859**			04	
	110			**018F6860**			06	
	115			**018F6861**			07	
	220			**018F6851**			09	

Direct current d.c. Coil type II

Valve type	Voltage V	Frequency Hz	With 1 m 3-core cable IP 67	With terminal box IP 67	With DIN plugs and protect. cap IP 20	With DIN plugs**)	Appendix no.*)	Power consumption
EVR 20 → 22 (NC/NO) EVRC 20 EVRA 20 EVRAT 20 EVRST 20	12			**018F6886**			01	20 W
	24			**018F6887**			02	
	48			**018F6889**			04	
	110			**018F6890**			06	
	220			**018F6881**			09	

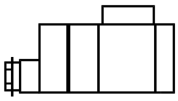
See "Opening differential pressure" under "Technical data" for the valve concerned.

*) Indicates voltage and frequency
**) Can only be used with DIN socket
***) When replacing a coil with terminal box, it is sufficient to change the coil unit itself. Therefore, order coil with DIN plugs and protective cap.

Ordering *(Continued)*

Special coils

Valve type	Voltage V	Frequency Hz	**Code no.** With terminal box IP 67	Appendix no. Indicates voltage and frequency	Power consumption



Alternating current a.c.

EVR 3 → 40 EVRC EVRA EVRAT EVRS / EVRST PKVD EVM (NC / NO)	24	50	**018F6807**	16	Holding: 12 W 26 VA Inrush: 55 VA
	42	50	**018F6808**	17	
	48	50	**018F6809**	18	
	110	50	**018F6811**	22	
	220-230	50	**018F6801**	31	
	240	50	**018F6802**	33	
	380-400	50	**018F6803**	37	
	24	60	**018F6815**	14	
	110	60	**018F6813**	20	
	220	60	**018F6814**	29	

Alternating current a.c.

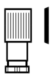
EVR 2 → 40 (NC) EVR 6 → 22 (NO) EVRH 4 → 40 (NO) EVRC EVRA/EVRAT EVR/EVRST PKVD EVM (NC)	24	50	**018F6901**		Holding: 20 W 45VA Inrush: 65VA
	24	60	**018F6902**		
	230	50	**018F6905**		

Recommended use for EVRH with high MOPD (38 bar)

See "Opening differential pressure" under "Technical data" for the valve concerned.

When replacing a coil with terminal box, it is sufficent to change the coil unit itself. Therefore, order coil with DIN plugs and protective cap.

Accessories

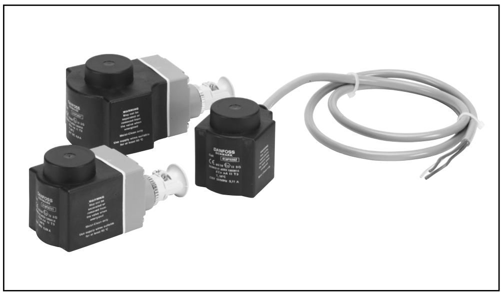


Description	**Code no.**
DIN socket	**042N0156**
Terminal box with build-in light emmiting indicator diode for solenoid valves	**018Z0089**

Dimensions and weights
See under the required solenoid valve.

Introduction

Danfoss has developed a series of ATEX approved coils for use in EX zone 2. The coils are equipped with clip-on fastening system for easy and faultless installation. Thus the coil can be installed without use of tools and easily dismounted by means of a screwdriver.



Features

- ATEX approved for use in EX zone 2
- Embedded coils with long lifetime - even under extreme conditons
- Available with 1 m 3-core cable or terminal
- Quick and safe mounting with "clip-on"coil
- Mounting on valve without use of tools
- Standard coils for a.c. and d.c.
- Standard coils from 24 to 240 V
- Standard coils dimensioned to max. opening differential pressure (MOPD) up to 21 bar

Approval

EExnAIIT3 DEMKO 01 ATEX 130591X

Technical data

Ambient temperature

- 11 or 14 W, 50 Hz a.c. coil –20 → +80°C
- 13 W, 50/60 Hz a.c. coil –20 → +50°C
- 20 W d.c. coil –20 → +50°C

Temperature of medium
max. 105°C

Enclosure for coil

- IP 67

Permissible voltage variation

- 11 and 14 W a.c. coils: +10 → –15% and as double frequency coils: ±10%
- 20 W d.c. coils: ±10%

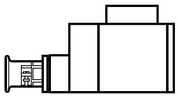
Connections

3-core cable
The external thread of the cable entry is suitable for flexible steel hose or similar cable protection

Terminal box
The cables are connected with the terminal screws in the terminal box which is equipped with a Pg 13.5 cable gland for 6 → 14 mm cable.
Max. cable diam.: 2.5 mm^2

Note:
Always install a fuse ahead of the coil.
It should not exceed 2 A for coils rated less than 50 V and it should not exceed 1 A for coils rated 50 V or more.

Ordering
Coils



Type	Voltage V	Frequency Hz	Code no. With 1 m 3-core cable IP 67	Code no. With terminal box IP 67	Power consumption

Alternating current a.c.

EVR 2 → 40 (NC) EVR 6 → 22 (NO) EVRC EVRA/ EVRAT EVRS / EVRST PKVD EVM (NC / NO)	24	50		**018F5707**	Holding: 11 W 21 VA Inrush: 44 VA
	230	50		**018F5701**	
	240	50		**018F5702**	
	230	50/60		**018F5732**	Holding: 13 W 25 VA Inrush: 48 VA
	224	50/60		**018F5727**	

Alternating current a.c.

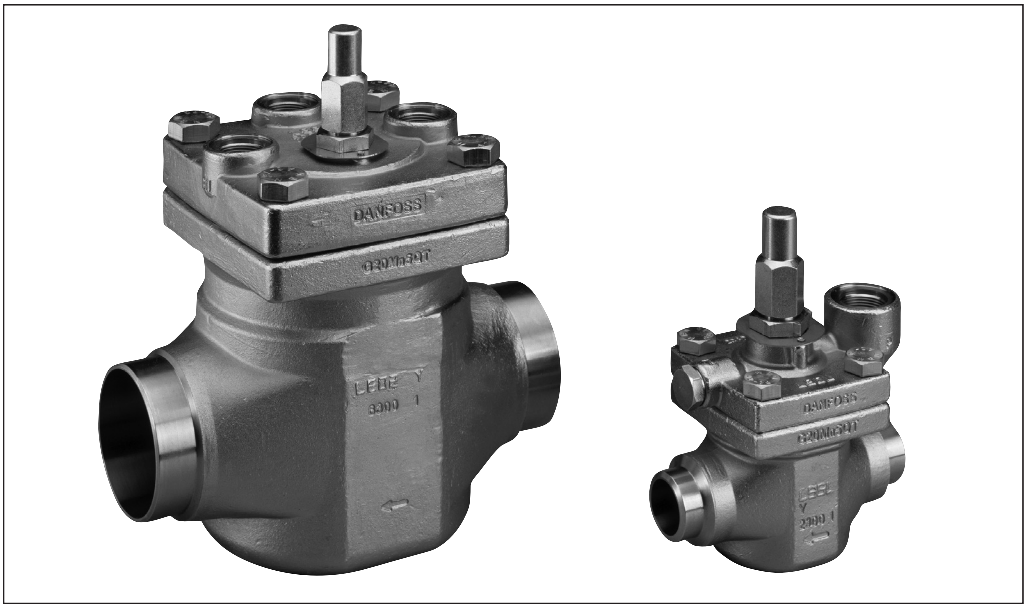
EVR 2 → 40 (NC) EVR 6 → 22 (NO) EVRC EVRA/ EVRAT EVRS / EVRST PKVD EVM (NC)	24	50		**018F5807**	Holding: 14 W 26 VA Inrush: 55 VA
	110	50		**018F5811**	
	230	50		**018F5801**	

Direct current d.c.

EVR 2 →15 (NC) EVR 25 → 40 (NC/ NO) EVR 6 →15 (NO) EVRC 10 → 15 EVRA 3 → 15 (NC) EVRA 25 → 40 (NC) EVRAT 10 → 15 (NC) EVRS/ EVRST 3 → 15 PKVD EVR (NC/NO)	24			**018F5857**	20 W

Must always be installed with fuse ahead of coil

Introduction



ICS servo valves belong to the ICV (Industrial Control Valve) family and are one of two product groups.

ICV types
– ICS - Industrial Control Servo
– ICM - Industrial Control Motor

The valve comprises three main components: valve body, function module and top cover.

ICS servo valves are pilot operated valves for regulating pressure, temperature and ON/OFF function in refrigeration systems. ICS valves are designed for low and high-pressure refrigerants.

ICS valves can be used on the high and low-pressure sides, in wet and dry suction lines and in liquid lines without phase change (i.e. where no expansion takes place in the valve).

The function of ICS valves is dependent on the pilot pressure applied from either a pilot valve or external pilot pressure source.

ICS 1 pilot has one pilot pressure connection and ICS 3 pilot has three pilot pressure connections.

The associated Danfoss pilot valves can be either screwed directly into the ICS valve or connected via an external pilot line. Several pilot valves can be used on one ICS valve to provide numerous variations in control functions.

The ICS valve top cover includes a pressure gauge connection port which can be used to monitor the valve inlet pressure when setting and adjusting the pilot valves.

The spindle in the top cover can be used for manually opening the ICS valve.

Features

- Designed for industrial refrigeration applications for a maximum working pressure of 52 bar/754 psig.
- Applicable to all common refrigerants including R717 and R744 (CO_2) and non corrosive gases/liquids.
- Direct coupled connections
- Connection types include butt weld, socket weld, solder and threaded connections.
- Low temperature steel body
- Low weight and compact design.
- V-port regulating cone ensures optimum regulating accuracy particularly at part load.
- Function module has a PTFE piston ring ensuring precise control accuracy.
- Modular Concept
  - Each valve body is available with several different connection types and sizes
  - Valve overhaul is performed by replacing the function module
  - Possible to convert ICS servo to ICM motor valve
- Manual opening.
- The ICS valve is a multifunction valve where several pilot valves can be mounted into the pilot ports.
- The standard range of pilot valves can be used on all sizes of ICS valves. Pilot valves can be either screwed directly into the ICS valve, thus eliminating the need for solder/weld connections or external pilot lines.
- Pressure gauge connection port to measure valve inlet pressure.
- The top cover can be rotated into any one of four positions without affecting the operation of the valve.

The complete technical leaflet (DKRCI.PD.HS0.A) can be downloaded from the Danfoss web site.

Design

ICS valves are designed as pilot operated valves requiring minimal pressure differential to open. If the pressure difference is 0 bar/0 psi, the ICS valve will be closed. If the pressure difference is 0.2 bar/3 psi or more, the ICS valve will be fully open. At pressure differences between 0.07 bar/1 psi and 0.2 bar /3 psi, the opening degree will be correspondingly proportional.

The ICS is available for use with either one or three pilot valves.

Two of the three pilot pressure connections (S1 and S2) are connected in series whilst the third (P) is connected in parallel to S1 and S2. This allows different combinations of pilot valves to be used, thus providing numerous variations in control functions.

Connections
There is a very wide range of connection types available with ICS valves:

- D: Butt weld, DIN (2448)
- A: Butt weld, ANSI (B 36.10)
- J: Butt weld, JIS (B S 602)
- SOC: Socket weld, ANSI (B 16.11)
- SD: Solder connection, DIN (2856)
- SA: Solder connection, ANSI (B 16.22)
- FPT: Female pipe thread (ANSI/ASME B 1.20.1)

Approvals
The ICV valve concept is designed to fulfil global refrigeration requirements.
For specific approval information, please contact Danfoss.

The ICS valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction

Valve body and top cover material
Low temperature steel

ICS valves		
Nominal bore	DN≤ 25 (1 in.)	DN 32-65 mm ($1^1/_4$ - $2^1/_2$ in.)
Classified for	Fluid group I	
Category	Article 3, paragraph 3	II

Technical data

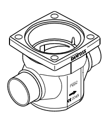
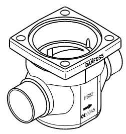
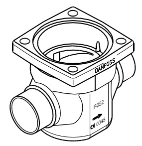
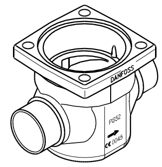
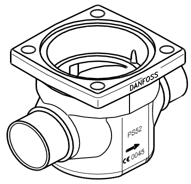
- *Refrigerants*
  Applicable to all common refrigerants including R717 and R744 (CO_2) and non-corrosive gases/liquids.
  Use with flammable hydrocarbons cannot be recommended; please contact Danfoss.
- *Temperature range*
  –60/+120°C (–76/+248°F).
- *Surface protection*
  ICS 25 - 65:
  The external surface is zinc-chromated to provide good corrosion protection.
- *Pressure range*
  The valve is designed for:
  Max. working pressure: 52 bar g (754 psig)

  Opening differential pressure:
  Fully open: Min. 0.2 bar g (min. 3 psig)
  Max. Opening Pressure Differential (MOPD), solenoid valves only - at nominal conditions.
  – 10 W a.c. up to 21 bar (305 psi)
  – 20 W a.c. up to 40 bar (580 psi)
  – "Power electronic" up to 50 bar (725 psi)

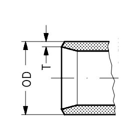
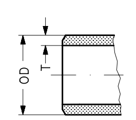
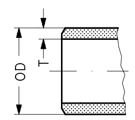
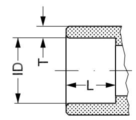
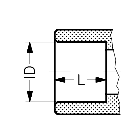
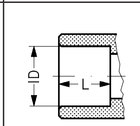
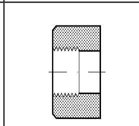
The ICS Concept

The ICS concept is developed around a modular principle. This gives the possibility of combining function modules and top covers with special valve body size that is available in a variety of connection possibilities.

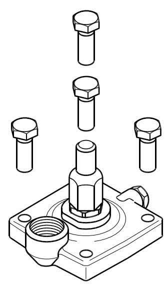
- There are five valve bodies available.

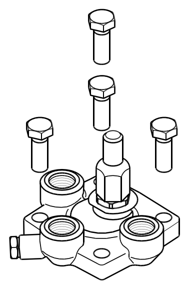
				
ICV 25	ICV 32	ICV 40	ICV 50	ICV 65

- Each valve body is available with a range of undersized through oversized connection sizes and types.

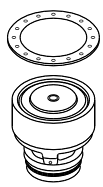
D	A	J	SOC	SD	SA	FPT
						
Butt-weld DIN	Butt-weld ANSI	Butt-weld JIS	Socket weld ANSI	Solder DIN	Solder ANSI	Female Pipe Thread

- Each valve body may be fitted with a 1 pilot or 3 pilot top cover.





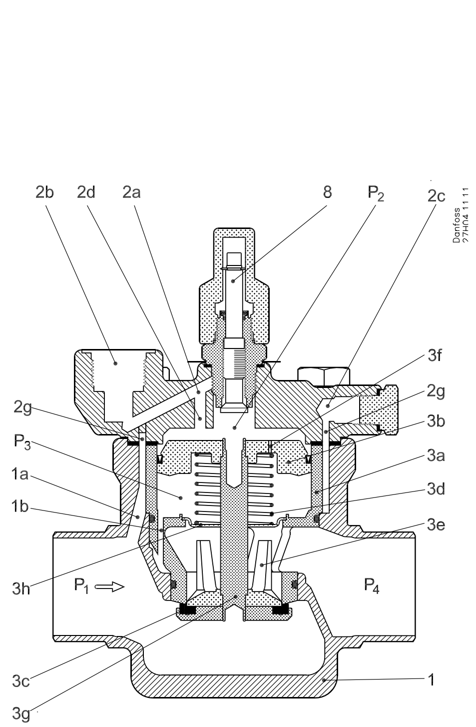
In ICS, multiple inserts (function modules) are available to give different capacities.



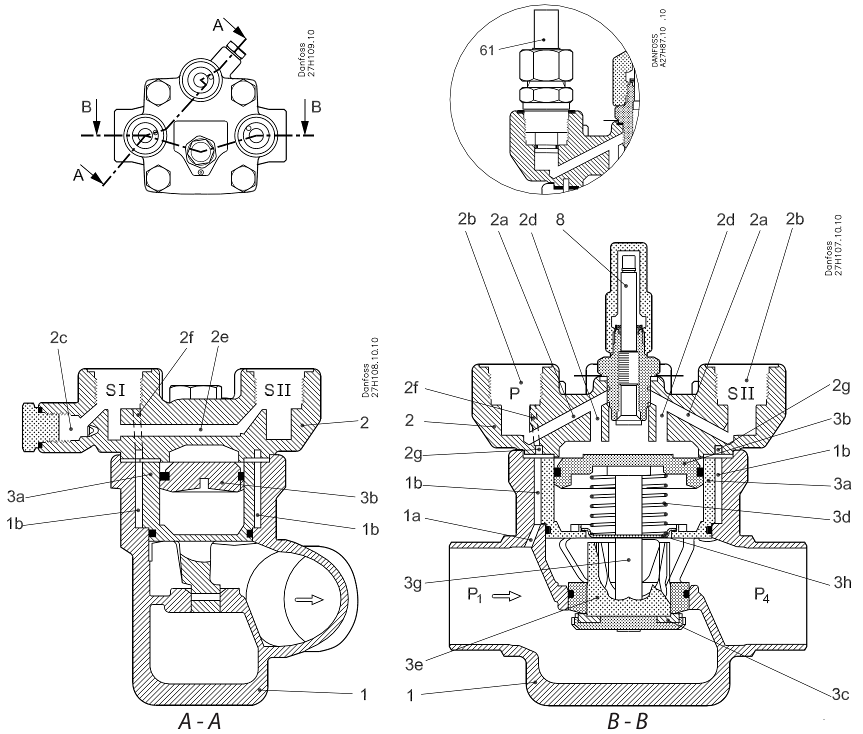
Type	Valve body size	K_v (m³/h)	C_v (USgal/min)
ICS25-5	25	1.7	2.0
ICS25-10		3.5	4.1
ICS25-15		6.0	7.0
ICS25-20		8	9.3
ICS25-25		11.5	13.3
ICS32	32	17	20
ICS40	40	27	31
ICS50	50	44	51
ICS65	65	70	81

Pressure and temp. rregulators

Function



ICS 1 Pilot Fig. 1



ICS 3 Pilots Fig. 2

ICS 1 Pilot and ICS 3 Pilot

1.	Body
1a	Pilot channel to inlet side
1b	Circular gap between house and module
2.	Top cover
2a	Pilot channels in top cover
2b	Pilot insertion hole
2c	Pressure gauge connection
2d	Piston top inlet channel
2e	Cross channel SI to SII
2f	SI inlet channel
2g	Circular groove
3	Function module
3a	Cylinder
3b	Piston
3c	Valve plate
3d	Spring
3e	Cone
3f	Equalisation orifice
3g	Spindle
3h	Spring support plate
p_1	Inlet pressure
p_2	Pressure on piston
p_3	Pressure underneath piston
p_4	Outlet pressure
8	Manual operating spindle

The ICS main valve is a pilot operated valve. The types of pilot valves used determine the function. The ICS main valve with pilot valve(s) controls refrigerant flow by modulation or on/off in accordance with the pilot valve and main valve status. The manual spindle can be used to open the valve plate.

The degree of opening of the main valve is determined by the pressure difference (differential pressure) between pressure p_2, which acts on top of the servo piston (3b), and pressure p_3, which acts on the underside of the servo piston.

If this pressure difference is 0, the main valve will be fully closed.
If the pressure difference is 0.2 bar (3 psi) or greater, the main valve will be fully open.
At pressure differences (p_2 - p_3) between 0.07 bar (1 psi) and 0.2 bar (3 psi), the degree of opening will be correspondingly proportional.

The port of the throttle cone (3e) is V-shaped, which provide good regulation characteristic to pilot operated main valves even at low loads.
P_3 pressure is equal to the valve outlet pressure (P_4), due to a clearance between the spindle (3g) and the spring support plate (3h) in the function module. The opening degree of the ICS valve is therefore controlled by the application of P_2 pressure acting on top of the servo piston, which is equal to or greater than valve outlet pressure (P_4).

$p_2 = p_4$ ~ closed
$p_2 = p_4 + 0.2$ bar (3 psi)~ fully open
$p_4 \leq p_2 \leq p_4 + 0.2$ bar (3 psi) ~ proportional degree of opening.

The maximum pressure (p_2) can act on the top of the servo piston (3b). p_2 normally corresponds to the pressure, p_1 - ICS main valve inlet pressure. Inlet pressure p_1 is led, via the drilled channels (1a, 1b, 2f, 2b (pilot), 2a, 2d) in the valve body (1) and cover (2) through the individual pilot valves and onto the top of the servo piston (3b).

The degree of opening of the individual pilot valves determines the magnitude of pressure p_2 and thus the degree of opening of the main valve. The equalisation hole (3f) in the servo piston (3b) ensures that pressure p_2 is balanced in accordance with the degree of opening of the pilot valve.

Note:
When ICS valves with 3 pilot ports are used with external pressure connector (fig. 2, pos. 61), the valve port inlet pressure will be isolated.

The ICS can be fitted with just a single screwed-in pilot valve or external pilot connection. The degree of opening of the main valve will be in accordance with the control status of the pilot valve or external pilot flow control.
ICS main valve with one pilot connection is fully closed when the pilot valve is fully closed and fully open when the pilot valve is fully open. Otherwise the degree of opening of the main valve is proportional to the degree of opening of the pilot valve.

The ICS 3 pilot version can be fitted with one, two, or three pilot valves so that up to three regulating functions are possible. If the external pilot connection is used, more functions can be added.

Function *(continued)*

In the ICS three pilot version, the pilot ports are related as follows:

- The pilot valves fitted in ports SI and SII are connected in series.
  The ICS 3 pilot operated main valve will be fully closed if just one of the series-connected pilot valves is closed. The main valve can only open if both pilot valves are open at the same time.
- The pilot valve fitted in port P is connected in parallel to the pilot valves in ports SI and SII.

The ICS valve will be fully open if the pilot valve in P is fully open, irrespective of the degree of opening of pilot valves SI and SII.
The ICS valve will be fully closed if the pilot valve in P is fully closed and at least one of the valves in SI or SII is fully closed at the same time. The relation between the pilot valves in ports SI, SII and P is shown in the table on the next page.

If the ICS is not fitted with three pilot valves, the unused port(s) must be sealed with a blanking plug. If the blanking plug is fitted as an assembled unit, A + B, the channels from the specific port will be closed. (See illustration below)

If only the top part, A, of the plug is fitted, the channels from the ports in question will be open. If the degree of opening of the ICS main valve is not to be a function of the main valve inlet pressure, or if more than three regulating functions are required, ports SI, SII or P can be fitted with a nipple for the connection of external pilot pressure. This applies to all ICS versions.

The pressure to which the external pilot line is connected will then determine pressure p_2 on top of the servo piston. The pilot valves fitted in that external pilot line will determine the main valve function. Pilot valves installed in external lines must be mounted in a type CVH housing.

Depending on the function of the pilot valves, the ICS regulating characteristic becomes:

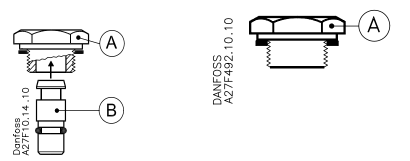
- on/off
- proportional
- integral or
- cascade.

ICS main valves are therefore especially suitable for all forms of temperature and pressure regulating systems.

An overview of the types of pilot valves available can be found in the literature “Pilot valves for operated main valves” (RD4XC).

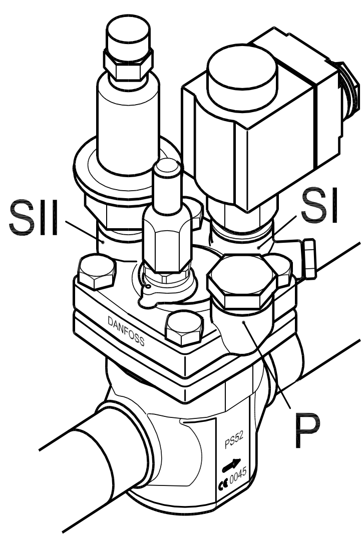
On the following pages, a number of configuration examples can be found. These are only for explanatory purpose. However, by using the literature regarding pilot valves these examples are easier to comprehend.

Pilot valve port			ICS valve
SI	SII	P	
Open	Open	Closed	Open
Open	Open	Open	Open
Open	Closed	Closed	Closed
Open	Closed	Open	Open
Closed	Open	Closed	Closed
Closed	Open	Open	Open
Closed	Closed	Closed	Closed
Closed	Closed	Open	Open

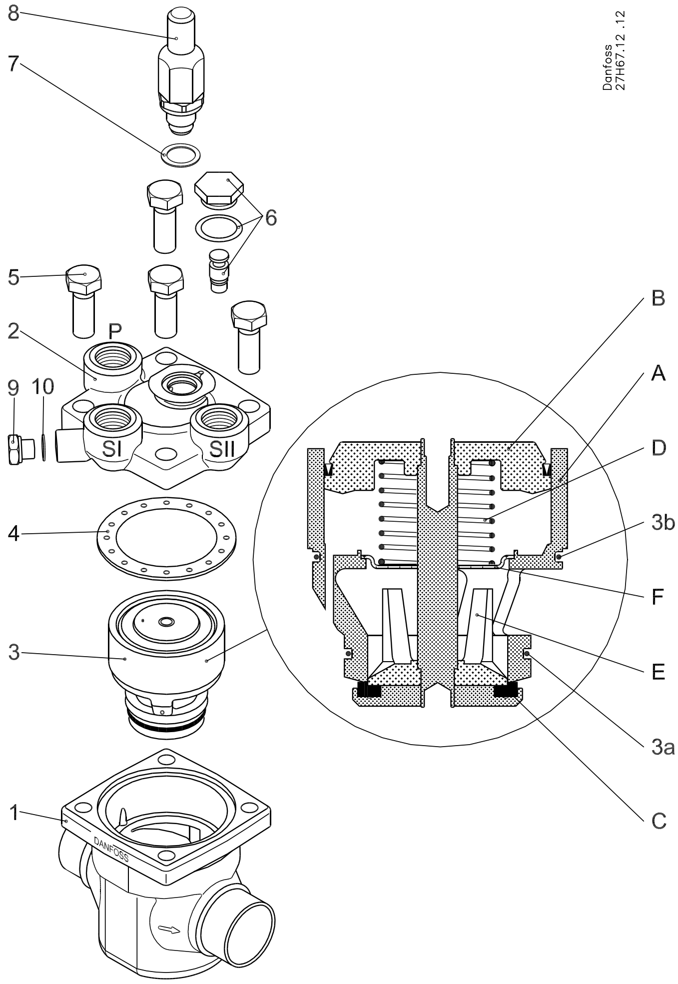


Blanking plug A + B *Blanking plug A*

Example (ICS with 3 pilot valves)



Material specification

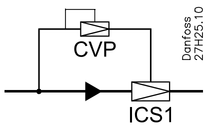
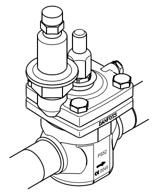


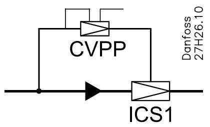
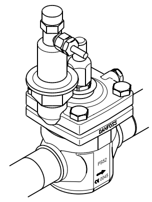
Bolt sizes (pos. 5)

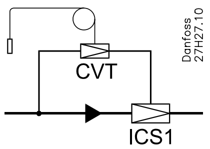
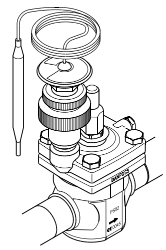
Type	Screw
ICS 25	M12 × 30 A2-70 DIN 933
ICS 32	M14 × 35 A2-70 DIN 933
ICS 40	M14 × 40 A2-70 DIN 933
ICS 50	M16 × 40 A2-70 DIN 933
ICS 65	M16 × 50 A2-70 DIN 933

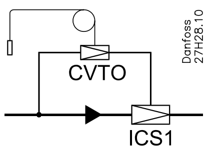
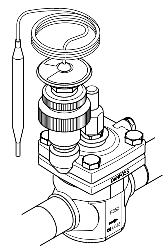
No.	Part	Material	EN	ASTM	JIS
1	Body	Low temperature steel	G20Mn5QT, EN 10213-3	LCC A352	SCPL1 G5151
2	Top cover	Low temperature steel	G20Mn5QT, EN 10213-3	LCC A352	SCPL1 G5151
3	Function module (assembled)				
3a	o-ring	Cloroprene (Neoprene)			
3b	o-ring	Cloroprene (Neoprene)			
A	Cylinder	Steel			
B	Piston	Steel			
C	Valve plate	PTFE			
D	Spring	Steel			
E	Cone	Steel			
F	Intermediate plate	Steel			
4	Gasket	Fiber, non-asbestos			
5	Bolts	Stainless steel	A2-70, EN 1515-1	Grade B8 A320	A2-70, B 1054
6	Plug	Steel			
7	Gasket	Aluminium			
8	Manual operating spindle	Steel			
9	Plug	Steel			
10	Gasket	Aluminium			

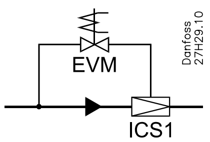
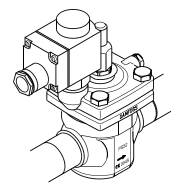
Configuration examples

Example no. 1-1		*Products*	
Constant pressure regulation. –0.66 to 7 bar g (19.5 in. Hg to 102 psig).		1 × ICS 1 Pilot 1 × CVP (LP)	

Example no. 1-2		*Products*	
Differential pressure regulation. 0 to 7 bar g (0 to 102 psig).		1 × ICS 1 Pilot 1 × CVPP (LP)	

Example no. 1-3		*Products*	
Temperature regulation. –40 to 60°C (–40 to 140°F). Opening at rising temperature. Pressure independent.		1 × ICS 1 Pilot 1 × CVT	

Example no. 1-4		*Products*	
Temperature regulation. –40 to 60°C (–40 to 140°F). Closing at rising temperature. Pressure independent.		1 × ICS 1 Pilot 1 × CVTO	

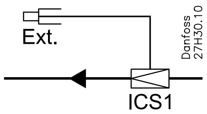
Example no. 1-5		*Products*	
On/off regulation (solenoid valve).		1 × ICS 1 Pilot 1 × EVM 1 × coil	

These examples are also relevant for PM main valve.

Configuration examples *(continued)*

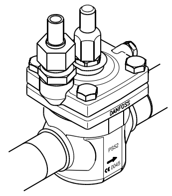
Example no. 1-6

Regulation with external control pressure.



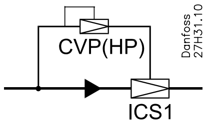
Products

1 × ICS 1 Pilot
1 × nipple for external control pressure



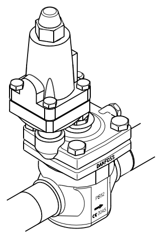
Example no. 1-7

Constant pressure regulation.
–0.66 to 28 bar g
(19.5 in. Hg to 406 psig).



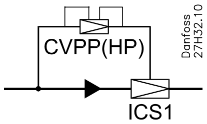
Products

1 × ICS 1 Pilot
1 × CVP (HP)



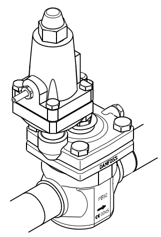
Example no. 1-8

Differential pressure regulation.
0 to 22 bar g (0 to 319 psig).



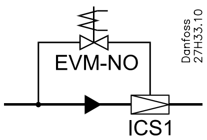
Products

1 × ICS 1 Pilot
1 × CVPP (HP)



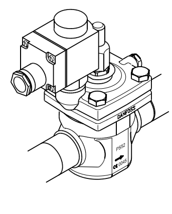
Example no. 1-9

On/off regulation (solenoid valve).



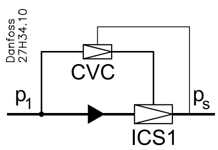
Products

1 × ICS 1 Pilot
1 × EVM-NO (12 W coil)



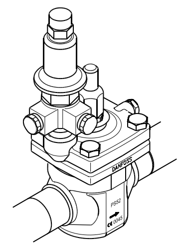
Example no. 1-10

Crankcase pressure regulation.
(Max. suction pressure regulation)
–0.45 to 7 bar g
(13.3 in. Hg to 102 psig).



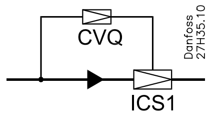
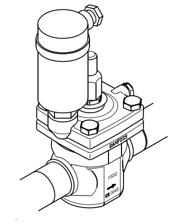
Products

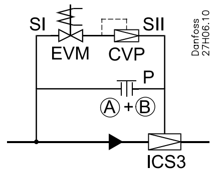
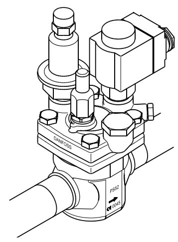
1 × ICS 1 Pilot
1 × CVC

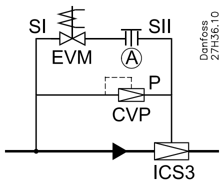
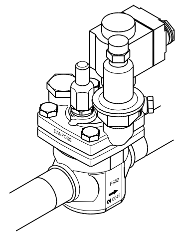


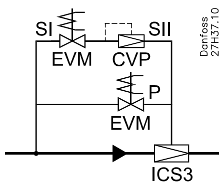
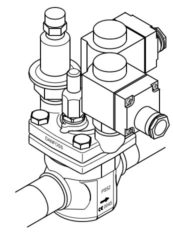
For further information please see the PMC and CVC technical leaflet (RD4ED).

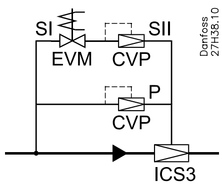
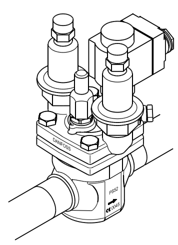
Configuration examples *(continued)*

Example no. 1-11		*Products*	
Electronically controlled media temperature regulation. –1 to 8 bar g (0 in. Hg to 116 psig).		1 × ICS 1 Pilot 1 × CVQ	

Example no. 3-1		*Products*	
Constant pressure regulation combined with electrical shut off. –0.66 to 7 bar g (19.5 in. Hg to 102 psig).		1 × ICS 3 Pilots 1 × blanking plug 1 × CVP (LP) 1 × EVM 1 × coil	

Example no. 3-2		*Products*	
Constant pressure regulation combined with electrical wide open. –0.66 to 7 bar g (19.5 in. Hg to 102 psig).		1 × ICS 3 Pilots 1 × blanking plug 1 × CVP (LP) 1 × EVM	

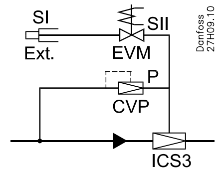
Example no. 3-3		*Products*	
Constant pressure regulation combined with electrical shut off and wide open. –0.66 to 7 bar g (19.5 in. Hg to 102 psig).		1 × ICS 3 Pilots 1 × CVP (LP) 2 × EVM 2 × coils	

Example no. 3-4		*Products*	
Constant pressure regulation with change-over between two preset evaporating pressures. –0.66 to 7 bar g (19.5 in. Hg to 102 psig).		1 × ICS 3 Pilots 2 × CVP (LP) 1 × EVM 1 × coil	

Configuration examples *(continued)*

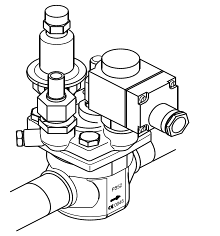
Example no. 3-5

External control pressure with electrical shut off combined with constant pressure regulation.
–0.66 to 7 bar g
(19.5 in. Hg to 102 psig).



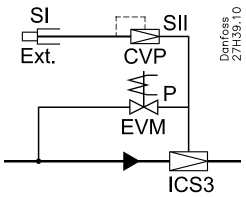
Products

1 × ICS 3 Pilots
1 × nipple for external control pressure
1 × CVP (LP)
1 × EVM
1 × coil



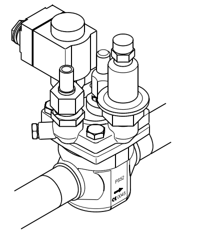
Example no. 3-6

Constant pressure regulation with external control pressure combined with electrical wide open.
–0.66 to 7 bar g
(19.5 in. Hg to 102 psig).



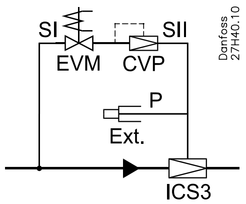
Products

1 × ICS 3 Pilots
1 × nipple for external control pressure
1 × CVP (LP)
1 × EVM
1 × coil



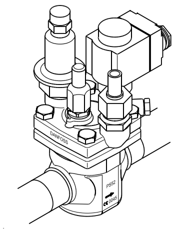
Example no. 3-7

Constant pressure regulation with electrical shut off combined with external control pressure.
–0.66 to 7 bar g
(19.5 in. Hg to 102 psig).



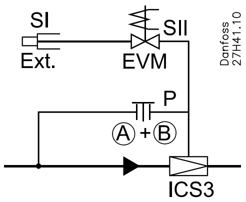
Products

1 × ICS 3 Pilots
1 × nipple for external control pressure
1 × CVP (LP)
1 × EVM
1 × coil



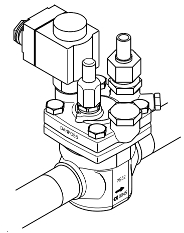
Example no. 3-8

Solenoid valve with external control pressure for small pressure drops.



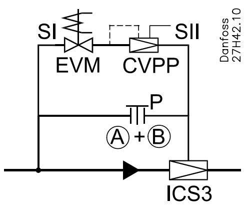
Products

1 × ICS 3
1 × blanking plug
1 × nipple for external control pressure
1 × EVM
1 × coil



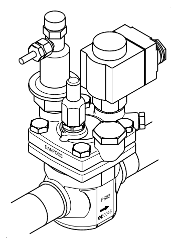
Example no. 3-9

Differential pressure regulation combined with electrical shut off.
0 to 7 bar g
(0 to 102 psig).

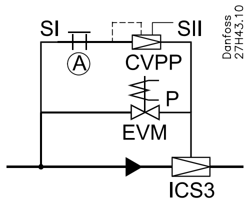
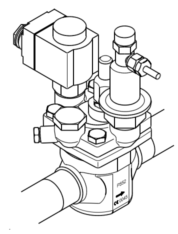


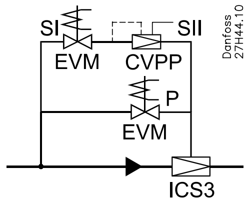
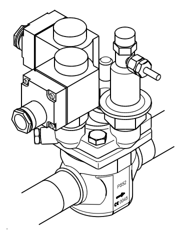
Products

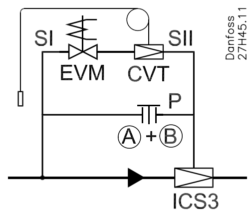
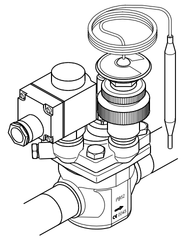
1 × ICS 3
1 × blanking plug
1 × CVPP (LP)
1 × EVM
1 × coil

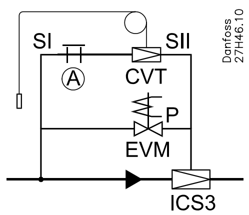
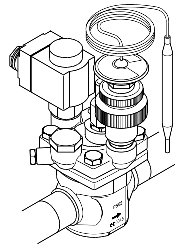


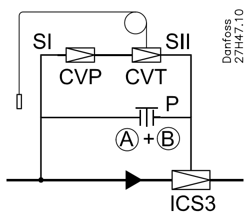
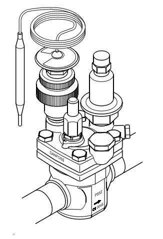
Configuration examples *(continued)*

Example no. 3-10		*Products*	
Differential pressure regulation combined with electrical wide open. 0 to 7 bar g (0 to 102 psig).		1 × ICS 3 Pilots 1 × blanking plug 1 × CVPP (LP) 1 × EVM 1 × coil	

Example no. 3-11		*Products*	
Differential pressure regulation combined with electrical wide open and shut off. 0 to 7 bar g (0 to 102 psig).		1 × ICS 3 Pilots 1 × CVPP (LP) 2 × EVM 2 × coils	

Example no. 3-12		*Products*	
Thermostatic regulation combined with electrical shut off. Pressure independent. –40 to 60°C (–40 to 140°F).		1 × ICS 3 Pilots 1 × blanking plug 1 × CVT 1 × EVM 1 × coil	

Example no. 3-13		*Products*	
Thermostatic regulation combined with electrical wide open. Pressure independent. –40 to 60°C (–40 to 140°F).		1 × ICS 3 Pilots 1 × blanking plug 1 × CVT 1 × EVM 1 × coil	

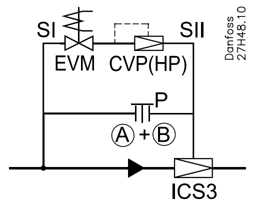
Example no. 3-14		*Products*	
Thermostatic regulation with protection against too low evaporating pressure. –40 to 60°C (–40 to 140°F). –0.66 to 7 bar g (19.5 in. Hg to 102 psig).		1 × ICS 3 Pilots 1 × blanking plug 1 × CVT 1 × CVP	

Pressure and temp. rregulators

Configuration examples *(continued)*

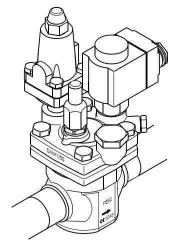
Example no. 3-15

Constant pressure regulation combined with electrical shut off.
–0.66 to 28 bar g
(19.5 in. Hg to 406 psig).



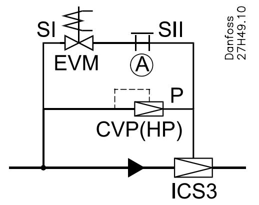
Products

1 × ICS 3 Pilots
1 × blanking plug
1 × CVP (HP)
1 × EVM
1 × coil



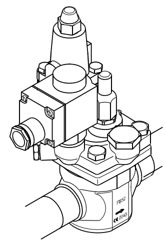
Example no. 3-16

Constant pressure regulation combined with electrical wide open.
–0.66 to 28 bar g
(19.5 in. Hg to 406 psig).



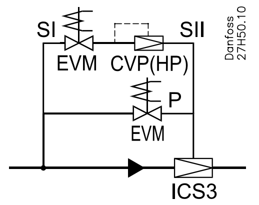
Products

1 × ICS 3 Pilots
1 × blanking plug
1 × CVP (HP)
1 × EVM
1 × coil



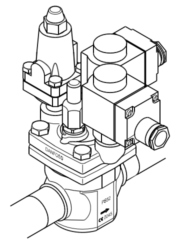
Example no. 3-17

Constant pressure regulation combined with electrical shut off and wide open.
–0.66 to 28 bar g
(19.5 in. Hg to 406 psig).



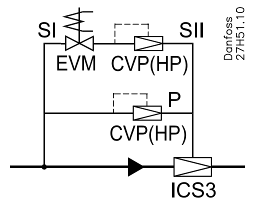
Products

1 × ICS 3 Pilots
1 × CVP (HP)
2 × EVM
2 × coils



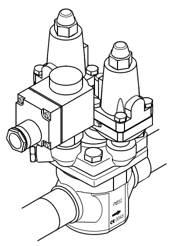
Example no. 3-18

Constant pressure regulation with change-over between two preset evaporating pressures.
–0.66 to 28 bar g
(19.5 in. Hg to 406 psig).



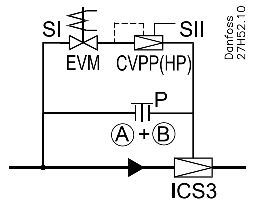
Products

1 × ICS 3 Pilots
2 × CVP (HP)
1 × EVM
1 × coil



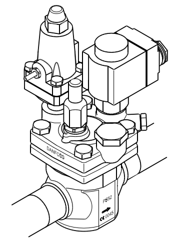
Example no. 3-19

Differential pressure regulation combined with electrical shut off.
0 to 22 bar g
(0 to 319 psig).



Products

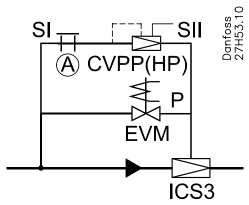
1 × ICS 3 Pilots
1 × blanking plug
1 × CVPP (HP)
1 × EVM
1 × coil



Configuration examples *(continued)*

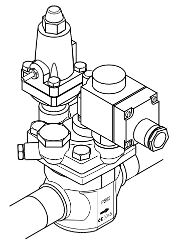
Example no. 3-20

Differential pressure regulation combined with electrical wide open.
0 to 22 bar g
(0 to 319 psig).



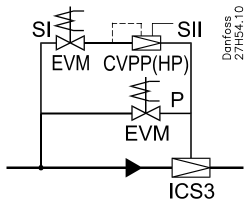
Products

1 × ICS 3 Pilots
1 × blanking plug
1 × CVPP (HP)
1 × EVM
1 × coil



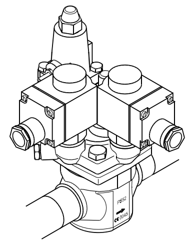
Example no. 3-21

Differential pressure regulation combined with electrical wide open and shut off.
0 to 22 bar g
(0 to 319 psig).



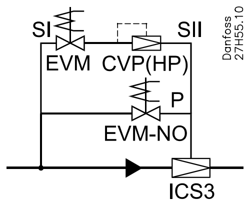
Products

1 × ICS 3 Pilots
1 × CVPP (HP)
2 × EVM
2 × coils



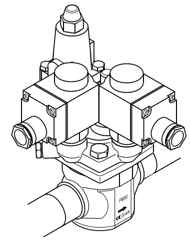
Example no. 3-22

Constant pressure regulation combined with electrical wide open and shut off.
–0.66 to 28 bar g
(19.5 in. Hg to 406 psig).



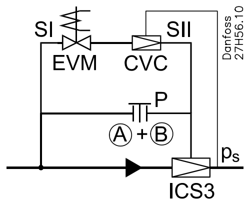
Products

1 × ICS 3 Pilots
1 × CVP (HP)
1 × EVM
1 × EVM-NO (12 W coil)
2 × coils



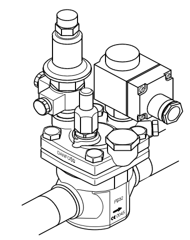
Example no. 3-23

Crankcase pressure regulation (max. suction pressure regulation) combined with shut off.
–0.45 to 7 bar g
(13.3 in. Hg to 102 psig).



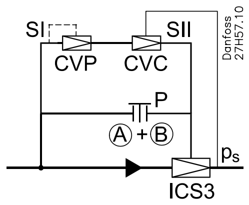
Products

1 × ICS 3 Pilots
1 × blanking plug
1 × CVC
1 × EVM
1 × coil



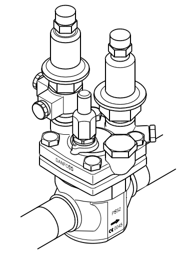
Example no. 3-24

Crankcase pressure regulation (max. suction pressure regulation) combined with evaporating pressure regulation.
–0.66 to 28 bar g
(19.5 in. Hg to 406 psig).



Products

1 × ICS 3 Pilots
1 × blanking plug
1 × CVC
1 × CVP(LP)

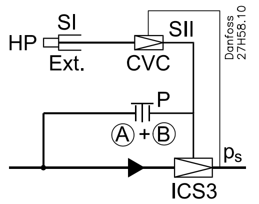


Pressure and temp. rregulators

Configuration examples *(continued)*

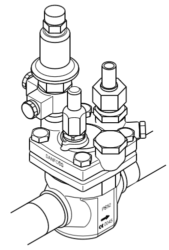
Example no. 3-25

Crankcase pressure regulation (max. suction pressure regulation) at low pressure drops across the valve.
–0.45 to 7 bar g
(13.3 in. Hg to 102 psig).



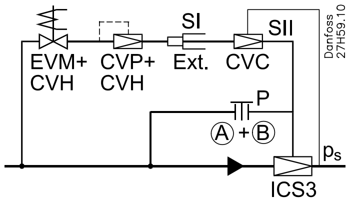
Products

1 × ICS 3 Pilots
1 × blanking plug
1 × nipple for external control pressure
1 × CVC



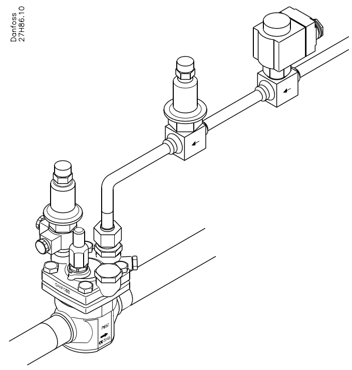
Example no. 3-26

Crankcase pressure regulation (max. suction pressure regulation) combined with constant pressure regulation and electrical shut off.
–0.66 to 7 bar g
(19.5 in. Hg to 102 psig).



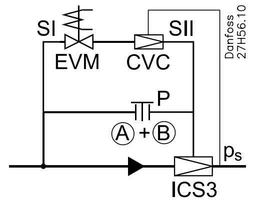
Products

1 × ICS 3 Pilots
1 × blanking plug
1 × nipple for external control pressure
1 × CVP (LP)
1 × EVM
1 × coil
2 × CVH
1 × CVC



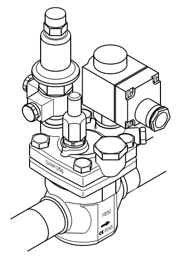
Example no. 3-27

Hot gas bypass regulation combined with electrical shut off.
–0.45 to 7 bar g
(13.3 in. Hg to 102 psig).



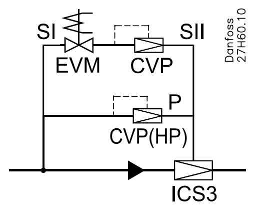
Products

1 × ICS 3 Pilots
1 × blanking plug
1 × CVC
1 × EVM
1 × coil



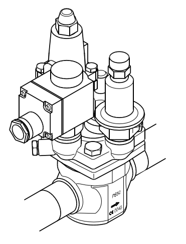
Example no. 3-28

Constant pressure regulation with electrical shut off and protection against high pressure when suction line is closed.
–0.66 to 28 bar g
(19.5 in. Hg to 406 psig).



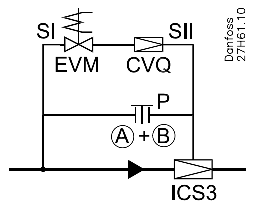
Products

1 × ICS 3 Pilots
1 × CVP (LP)
1 × EVM
1 × coil
1 × CVP (HP)



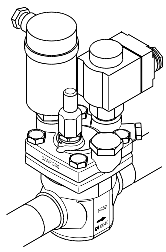
Example no. 3-29

Electronically controlled media temperature regulation combined with electrical shut off.
–1 to 8 bar g
(0 in. Hg to 116 psig).



Products

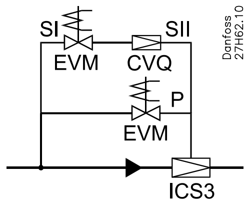
1 × ICS 3 Pilots
1 × blanking plug
1 × CVQ
1 × EVM
1 × coil



Configuration examples *(continued)*

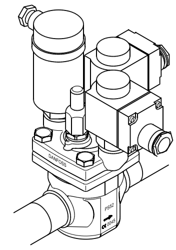
Example no. 3-30

Electronically controlled media temperature regulation combined with electrical shut off and wide open.
–1 to 8 bar g
(0 in. Hg to 116 psig).



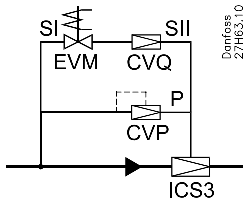
Products

1 × ICS 3 Pilots
1 × CVQ
2 × EVM
2 × coils



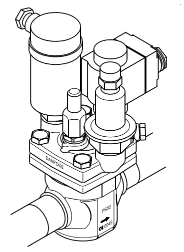
Example no. 3-31

Electronically controlled media temperature regulation combined with electrical shut off and changeover to constant pressure regulation.
–1 to 8 bar g
(0 in. Hg to 116 psig).



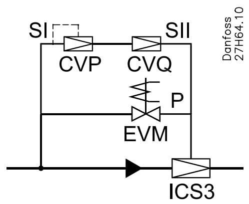
Products

1 × ICS 3 Pilots
1 × CVQ
1 × CVP (LP)
1 × EVM
1 × coil



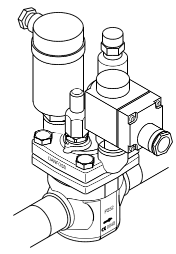
Example no. 3-32

Electronically controlled media temperature regulation with low evaporating pressure protection combined with wide open.
–1 to 8 bar g
(0 in. Hg to 116 psig).



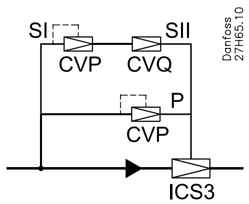
Products

1 × ICS 3 Pilots
1 × CVQ
1 × CVP (LP)
1 × EVM
1 × coil



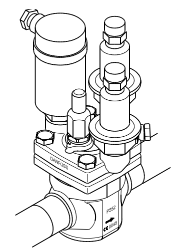
Example no. 3-33

Electronically controlled media temperature regulation with low evaporating pressure protection combined with changeover to constant pressure regulation.
–1 to 8 bar g
(0 in. Hg to 116 psig).



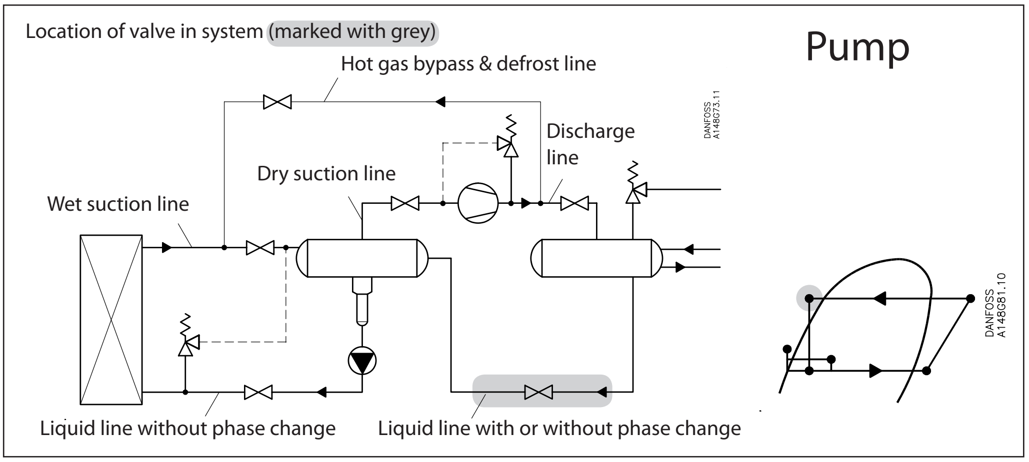
Products

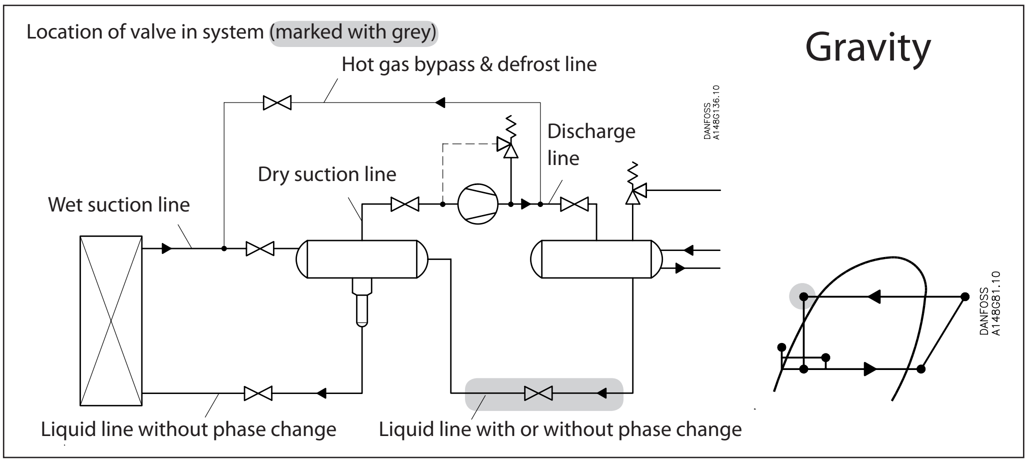
1 × ICS 3 Pilots
1 × CVQ
2 × CVP (LP)

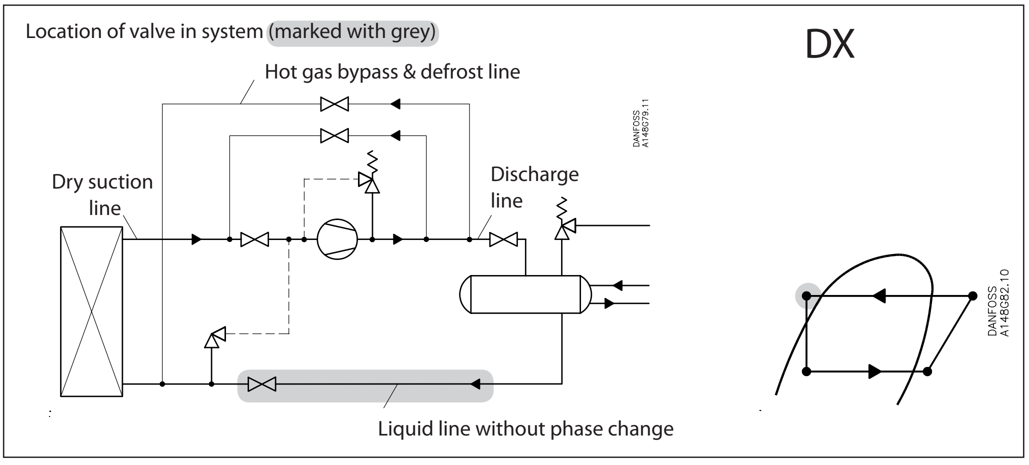


Nominal capacities

Liquid line with/without phase change







Nominal capacities

Liquid line with/without phase change

SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20$ C
$Q_o = 250$ kW
$T_{liq} = 10$ °C
Max. $\Delta p = 0.3$ bar

The capacity table is based on nominal condition (pressure drop $\Delta p = 0.2$ bar, $T_{liq} = 30$°C)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 0.3 bar $f_{\Delta p} = 0.82$
Correction factor for liquid temperature $f_{Tliq} = 0.92$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} = 250 \times 0.82 \times 0.92 = 189$ kW

From the capacity table a ICS 25-10 with Q_n capacity 366 kW is selected.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20$°F
$Q_o = 130$ TR
Liquid temperature = 50°F
Max. $\Delta p = 4$ psi

The capacity table is based on nominal condition (pressure drop $\Delta p = 3$ psi, $T_{liq} = 90$°F)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 4 psi, $f_{\Delta p} = 0.87$
Correction factor for liquid temperature $f_{Tliq} = 0.92$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} = 130 \times 0.87 \times 0.92 = 104$ TR

From the capacity table a ICS25-15 with Q_n capacity 175 TR is selected.

Nominal capacities

Liquid line with/without phase change

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 30°C,
ΔP = 0.2 bar

R 717

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICS25-5	25	1.7	169	171	174	176	178	180	181	182
ICS25-10		3.5	347	353	358	362	366	370	372	374
ICS25-15		6	595	604	613	621	628	633	638	642
ICS25-20		8	794	806	818	828	838	845	852	856
ICS25-25		11.5	1140	1158	1175	1190	1203	1216	1223	1231
ICS32	32	17	1687	1710	1738	1760	1777	1795	1810	1820
ICS40	40	27	2675	2720	2760	2795	2825	2850	2875	2890
ICS50	50	44	4365	4430	4500	4550	4600	4650	4685	4700
ICS65	65	70	6940	7050	7150	7250	7325	7400	7450	7495

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	1.00
40°C	1.04
50°C	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	1.00
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 3 psi

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	48.0	48.8	49.6	50.6	51.0	51.4	52.0	52.0
ICS25-10		4.1	99.0	100	102	104	105	106	107	107
ICS25-15		7	169	172	175	178	180	181	183	184
ICS25-20		9.3	226	230	233	237	240	242	244	245
ICS25-25		13.3	324	330	335	341	345	348	351	352
ICS32	32	20	480	488	496	503	509	514	518	520
ICS40	40	31	762	775	788	799	808	816	822	826
ICS50	50	51	1242	1262	1285	1302	1317	1330	1340	1345
ICS65	65	81	1975	2010	2043	2070	2095	2115	2130	2140

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	1.00
110°F	1.04
130°F	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	1.00
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Nominal capacities

Liquid line with/without phase change

SI units

Capacity table for nominal conditions, Q_N [kW], T_{liq} = 10°C, ΔP = 0.2 bar

R 744

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]						
			–40	–30	–20	–10	0		10
ICS25-5	25	1.7	41.0	41.0	41.0	41.0	41.0	40.0	39.0
ICS25-10		3.5	84.0	85.0	85.0	85.0	85.0	83.0	80.0
ICS25-15		6	144	145	146	146	145	142	137
ICS25-20		8	193	194	195	195	194	190	183
ICS25-25		11.5	277	278	280	281	278	273	263
ICS32	32	17	409	412	415	415	411	403	388
ICS40	40	27	650	654	658	659	654	641	617
ICS50	50	44	1058	1065	1073	1073	1065	1044	1005
ICS65	65	70	1685	1695	1707	1708	1694	1661	1598

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.52
–10°C	0.67
0°C	0.91
10°C	**1.00**
15°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], T_{liq} = 50°F, ΔP = 3 psi

R 744

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	11.7	11.9	12.0	12.0	11.9	11.6	10.9	9.3
ICS25-10		4.1	24.2	24.6	24.8	24.8	24.5	23.8	22.4	19.0
ICS25-15		7	41.5	42.1	42.5	42.5	42.0	40.8	38.4	32.7
ICS25-20		9.3	55.3	56.2	56.7	56.7	56.0	54.4	51.0	43.6
ICS25-25		13.3	79.5	81.8	81.5	81.5	80.5	78.0	73.5	63.0
ICS32	32	20	118	119	120	120	119	115	109	93
ICS40	40	31	187	190	191	191	189	184	173	147
ICS50	50	51	304	309	312	312	308	299	281	240
ICS65	65	81	484	492	496	496	490	476	448	382

Correction factor for ΔP ($f_{\Delta P}$)

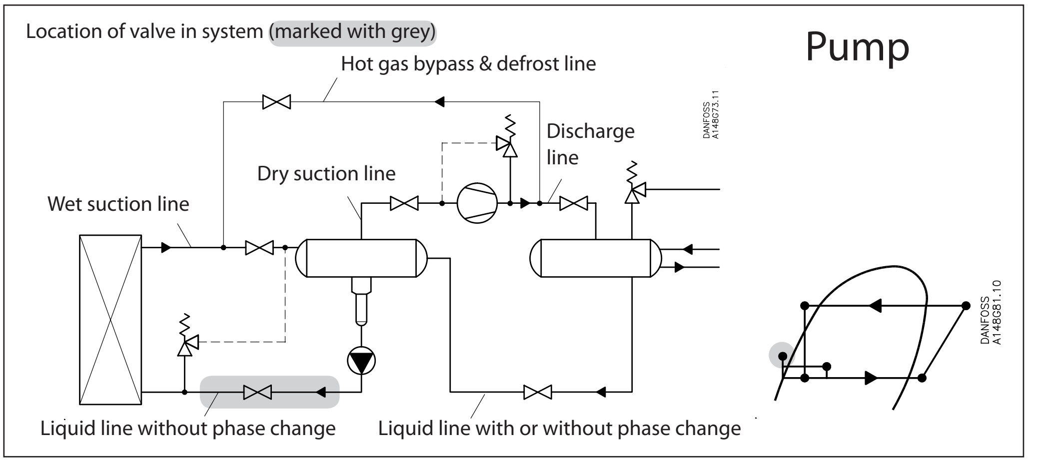
ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.48
10°F	0.64
30°F	0.88
50°F	**1.00**

Nominal capacities

Liquid line without phase change



SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20$ C
$Q_o = 180$ kW
Circulation rate = 3
Max. $\Delta p = 0.3$ bar

The capacity table is based on nominal condition (pressure drop $\Delta p = 0.2$ bar, circulation rate = 4)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 0.3 bar $f_{\Delta p} = 0.82$
Correction factor for circulation rate $f_{rec} = 0.75$

$Q_n = Q_o \times f_{\Delta p} \times f_{rec} = 180 \times 0.82 \times 0.75 = 111$ kW

From the capacity table a ICS 25-10 with Q_n capacity 117 kW is selected.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20$ F
$Q_o = 130$ TR
Circulation rate = 3
Max. $\Delta p = 4$ psi

The capacity table is based on nominal condition (pressure drop $\Delta p = 3$ psi, circulation rate = 4)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 4 psi, $f_{\Delta p} = 0.87$
Correction factor for circulation rate $f_{rec} = 0.75$

$Q_n = Q_o \times f_{\Delta p} \times f_{rec} = 130 \times 0.87 \times 0.75 = 85$ TR

From the capacity table a ICS 25 with Q_n capacity 114 TR is selected.

Nominal capacities

Liquid line without phase change

SI units

Capacity table for nominal conditions, Q_N [kW], circulation rate = 4, ΔP = 0.2 bar

R 717

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICS25-5	25	1.7	63.0	61.0	59.0	56.6	55.0	52.5	50.3	48.0
ICS25-10		3.5	128	124	121	117	112	108	104	99.0
ICS25-15		6	219	213	207	200	193	185	178	169
ICS25-20		8	292	284	276	266	257	247	237	226
ICS25-25		11.5	419	408	396	383	369	355	340	325
ICS32	32	17	620	603	585	566	546	525	503	480
ICS40	40	27	985	959	930	900	868	833	798	761
ICS50	50	44	1605	1560	1515	1465	1413	1360	1300	1242
ICS65	65	70	2550	2485	2410	2330	2248	2160	2070	1976

Pressure and temp. rregulators

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], circulation rate = 4, ΔP = 3 psi

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	18.0	17.4	16.9	16.2	15.6	14.9	14.2	13.4
ICS25-10		4.1	37.0	35.9	34.7	33.4	32.0	30.6	29.6	27.6
ICS25-15		7	63.4	61.5	59.4	57.3	55.0	52.5	50.0	47.3
ICS25-20		9.3	84.5	82.0	79.3	76.3	73.3	70.0	66.6	63.0
ICS25-25		13.3	122	118	114	110	105	102	95.7	91.0
ICS32	32	20	180	174	169	162	156	149	142	134
ICS40	40	31	285	276	267	258	247	236	225	213
ICS50	50	51	465	451	436	420	403	385	366	347
ICS65	65	81	740	717	694	668	641	613	583	552

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

Nominal capacities

Liquid line without phase change

SI units

Capacity table for nominal conditions, Q_N [kW], circulation rate = 4, ΔP = 0.2 bar

R 744

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICS25-5	25	1.7	19.0	18.0	16.6	15.2	13.6	12.0	9.8	7.1
ICS25-10		3.5	39.3	37.0	34.2	31.3	28.0	24.4	20.0	14.7
ICS25-15		6	68.0	63.0	59.0	54.0	48.0	42.0	36.0	25.0
ICS25-20		8	90.0	85.0	78.0	72.0	64.0	56.0	46.0	34.0
ICS25-25		11.5	129	121	112	103	92.0	80.0	66.0	48.0
ICS32	32	17	191	179	166	152	136	118	98	72
ICS40	40	27	303	285	264	241	216	188	155	113
ICS50	50	44	494	464	430	393	352	306	252	185
ICS65	65	70	787	738	685	626	560	487	401	294

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], circulation rate = 4, ΔP = 3 psi

R 744

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	5.6	5.8	4.8	4.3	3.8	3.2	2.4	1.4
ICS25-10		4.1	11.4	10.7	9.8	8.8	7.8	6.5	5.0	2.8
ICS25-15		7	19.6	18.3	16.8	15.2	13.3	11.2	8.6	4.8
ICS25-20		9.3	26.1	24.4	22.4	20.2	17.7	14.9	11.4	6.3
ICS25-25		13.3	37.6	35.0	32.2	29.0	25.5	21.4	16.4	9.1
ICS32	32	20	55.5	51.8	47.6	43.0	37.7	31.6	24.2	13.5
ICS40	40	31	88.0	82.0	75.5	68.0	60.0	50.2	38.5	21.4
ICS50	50	51	144	134	123	111	98.0	82.0	62.7	35.0
ICS65	65	81	229	213	196	177	155	130	100	55.4

Correction factor for ΔP ($f_{\Delta P}$)

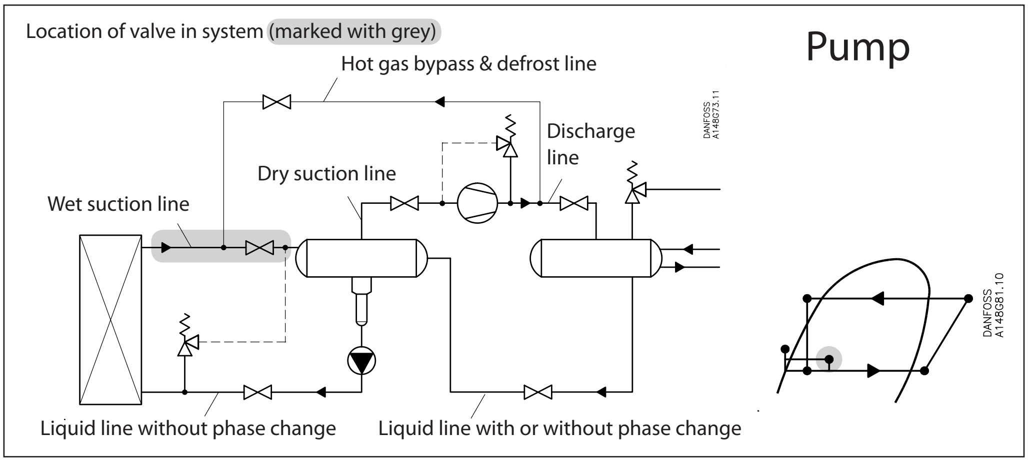
ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

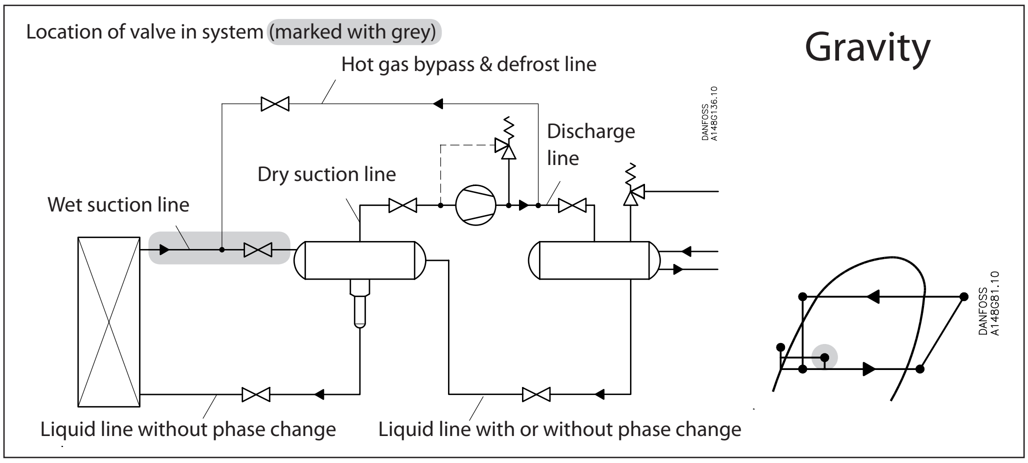
Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

Nominal capacities

Wet suction line





Nominal capacities

Wet suction line

SI units

Calculation example (R 717 capacities):

An application has following running conditions:

$T_e = -20$ C
$Q_o = 80$ kW
Circulation rate = 3
Max. $\Delta p = 0.3$ bar

The capacity table is based on nominal condition (pressure drop $\Delta p = 0.2$ bar, circulation rate = 4)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 0.3 bar $f_{\Delta p} = 0.82$
Correction factor for circulation rate $f_{rec} = 0.9$

$Q_n = Q_o \times f_{\Delta p} \times f_{rec} = 80 \times 0.82 \times 0.9 = 59$ kW

From the capacity table a ICS 32 with Q_n capacity 60 kW is selected.

US units

Calculation example (R 717 capacities):

An application has following running conditions:

$T_e = -20$ F
$Q_o = 8$ TR
Circulation rate = 3
Max. $\Delta p = 4$ psi

The capacity table is based on nominal condition (pressure drop $\Delta p = 3$ psi, circulation rate = 4)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 4 psi, $f_{\Delta p} = 0.87$
Correction factor for circulation rate $f_{rec} = 0.9$

$Q_n = Q_o \times f_{\Delta p} \times f_{rec} = 8 \times 0.87 \times 0.9 = 6.3$ TR

From the capacity table a ICS 25-20 with Q_n capacity 6.8 TR is selected.

Nominal capacities

Wet suction line

SI units

Capacity table for nominal conditions, Q_N [kW], circulation rate = 4, $\Delta P = 0.2$ bar

R 717

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICS25-5	25	1.7	2.4	3.7	4.9	6.0	7.2	8.5	9.7	11.0
ICS25-10		3.5	5.0	7.6	9.9	12.4	15.0	17.4	20.0	23.0
ICS25-15		6	8.6	13.0	17.0	21.0	25.5	30.0	34.0	39.0
ICS25-20		8	11.4	17.3	23.0	28.0	34.0	40.0	46.0	52.0
ICS25-25		11.5	18.5	25.0	33.0	41.0	49.0	57.0	66.0	75.0
ICS32	32	17	24.4	37.0	48.0	60.0	72.0	85.0	97.0	110.0
ICS40	40	27	38.7	58.0	77.0	95.0	115	134	154	176
ICS50	50	44	63.1	95	125	155	186	219	252	286
ICS65	65	70	100	152	200	247	297	348	401	455

Pressure and temp. rregulators

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], circulation rate = 4, $\Delta P = 3$ psi

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	0.6	1.1	1.4	1.8	2.2	2.6	3.0	3.5
ICS25-10		4.1	1.3	2.2	3.0	3.7	4.5	5.4	6.2	7.1
ICS25-15		7	2.3	3.7	5.1	6.4	7.8	9.2	10.7	12.2
ICS25-20		9.3	3.0	5.0	6.8	8.5	10.3	12.3	14.2	16.2
ICS25-25		13.3	4.4	7.1	9.7	12.2	14.9	17.6	20.4	23.3
ICS32	32	20	6.5	10.5	14.3	18.1	22.0	26.0	30.0	34.5
ICS40	40	31	10.3	16.8	22.8	28.8	35.0	41.4	48.0	55.0
ICS50	50	51	16.8	27.3	37.0	47.0	57.0	67.0	78.0	89.0
ICS65	65	81	26.8	43.5	59.0	75.0	91.0	107	124	142

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

Nominal capacities

Wet suction line

SI units

Capacity table for nominal conditions, Q_N [kW], circulation rate = 4, ΔP = 0.2 bar

R 744

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICS25-5	25	1.7	5.2	6.0	6.7	7.4	8.0	8.3	8.4	7.7
ICS25-10		3.5	10.7	12.2	13.8	15.0	16.3	17.0	17.2	16.0
ICS25-15		6	18.3	21.0	23.6	26.0	28.0	29.2	29.5	27.3
ICS25-20		8	24.4	28.0	31.5	35.0	37.0	39.0	39.3	36.5
ICS25-25		11.5	35.0	40.0	45.0	50.0	54.0	56.0	56.5	52.0
ICS32	32	17	52.0	59.0	67.0	74.0	79.0	83.0	84.0	77.0
ICS40	40	27	82.0	94.0	106	117	126	132	133	123
ICS50	50	44	134	154	173	190	205	215	216	200
ICS65	65	70	213	244	275	303	326	342	344	318

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], circulation rate = 4, ΔP = 3 psi

R 744

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	1.5	1.7	2.0	2.2	2.3	2.4	2.4	1.8
ICS25-10		4.1	3.0	3.5	4.0	4.5	4.8	5.0	4.8	3.7
ICS25-15		7	5.2	6.0	6.9	7.7	8.2	8.6	8.3	6.4
ICS25-20		9.3	6.9	8.1	9.2	10.2	11.0	11.4	11.1	8.5
ICS25-25		13.3	10.0	11.6	13.2	14.7	15.8	16.4	15.9	12.3
ICS32	32	20	14.7	17.2	19.4	21.7	23.3	24.2	23.5	18.2
ICS40	40	31	23.3	27.3	31.0	34.5	37.0	38.5	37.3	28.8
ICS50	50	51	38.0	44.5	50.5	56.0	60.5	62.7	60.8	47.0
ICS65	65	81	60.5	71.0	80.0	89.0	96.0	100	96.7	75.0

Correction factor for ΔP ($f_{\Delta P}$)

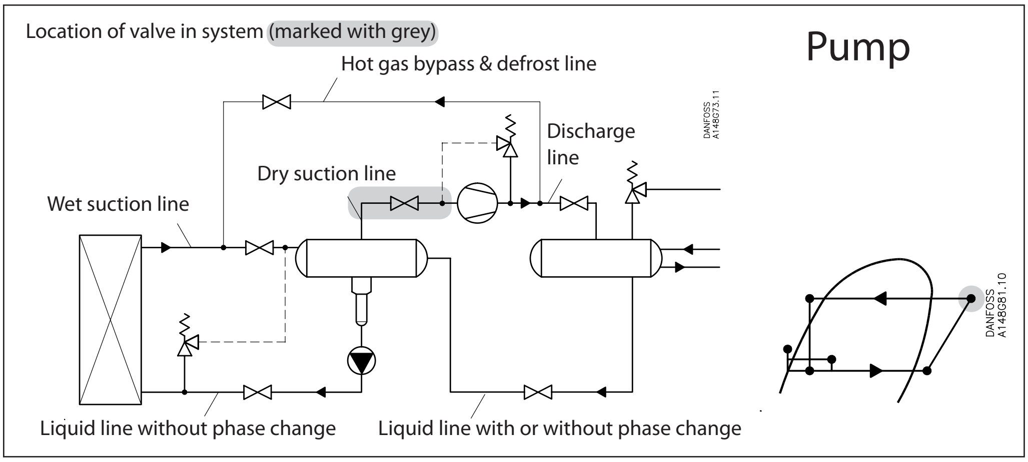
ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

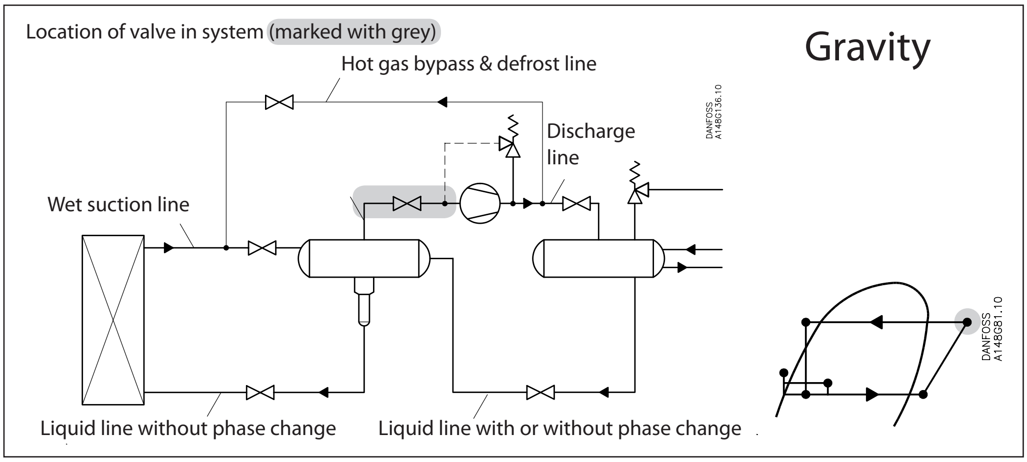
Correction factor for circulation rate (f_{rec})

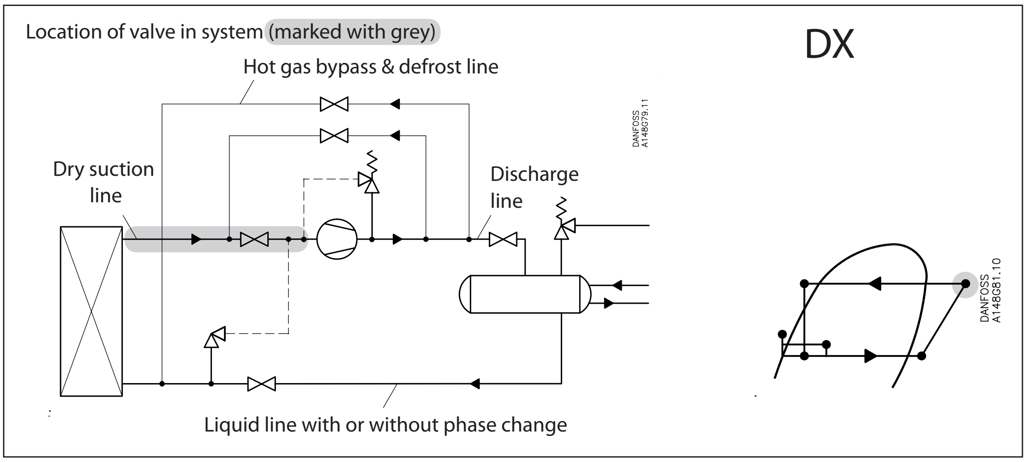
Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

Nominal capacities

Dry suction line







Nominal capacities

Dry suction line

SI units

Calculation example (R 717 capacities):

An application has following running conditions:

$T_e = -20$ °C
$Q_o = 90$ kW
$T_{liq} = 10$°C
Max. $\Delta p = 0.3$ bar

The capacity table is based on nominal condition (pressure drop $\Delta p = 0.2$ bar, $T_{liq} = 30$°C)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 0.3 bar $f_{\Delta p} = 0.82$
Correction factor for liquid temperature $f_{Tliq} = 0.92$

$Q_n = Q_o \times f\,\Delta p \times f_{\,Tliq} = 90 \times 0.82 \times 0.92 = 67.9$ kW

From the capacity table a ICS 32 with Q_n capacity 92 kW is selected.

US units

Calculation example (R 717 capacities):

An application has following running conditions:

$T_e = 0$°F
$Q_o = 20$ TR
$T_{liq} = 50$°F
Max. $\Delta p = 4$ psi

The capacity table is based on nominal condition (pressure drop $\Delta p = 3$ psi, $T_{liq} = 90$°F)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 4 psi, $T_{liq} = 0.87$
Correction factor for liquid temperature $f_{Tliq} = 0.92$

$Q_n = Q_o \times f_{\Delta p} \times f_{\,Tliq} = 20 \times 0.87 \times 0.92 = 16$ TR

From the capacity table a ICS 25-25 with Q_n capacity 18.7 TR is selected.

Nominal capacities

Dry suction line

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 30°C,
ΔP = 0.2 bar
Superheating = 8°C

R 717

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICS25-5	25	1.7	4.4	5.7	7.3	9.2	11.4	14.0	16.5	19.6
ICS25-10		3.5	9.0	11.7	15.0	19.0	23.5	28.5	34.0	40.0
ICS25-15		6	15.5	20.0	26.0	32.5	40.0	49.0	59.0	69.0
ICS25-20		8	20.6	27.0	34.0	43.3	54.0	65.0	78.0	92.0
ICS25-25		11.5	29.7	38.0	49.0	63.0	77.0	94	112	132
ICS32	32	17	44.0	57.0	73.0	92.0	114	139	166	196
ICS40	40	27	70.0	90.0	116	146	181	220	263	311
ICS50	50	44	113	147	189	239	295	359	429	507
ICS65	65	70	181	234	301	380	470	570	682	807

Pressure and temp. rregulators

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 3 psi
Superheating = 12°F

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	1.3	1.6	2.2	2.8	3.5	4.3	5.2	6.2
ICS25-10		4.1	2.5	3.4	4.4	5.7	7.2	8.9	10.7	12.8
ICS25-15		7	4.2	5.7	7.6	9.8	12.3	15.2	18.4	22.0
ICS25-20		9.3	5.6	7.6	10.1	13.0	16.4	20.2	24.5	29.3
ICS25-25		13.3	8.1	11.0	14.5	18.7	23.6	29.0	35.3	42.0
ICS32	32	20	12.0	16.2	21.5	27.7	35.0	43.0	52.0	62.0
ICS40	40	31	19.0	25.8	34.2	44.0	55.5	68.0	83.0	99.0
ICS50	50	51	30.9	42.0	55.7	72.0	90.0	111	135	161
ICS65	65	81	48.2	67.0	89.0	114	144	177	215	256

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for superheat (T_S)

T_s	Correction factor
10°F	1.00
14°F	1.00
18°F	1.00
20°F	1.00

Nominal capacities

Dry suction line

SI units

Capacity table at nominal conditions, Q_N [kW],
T_{liq} = 10°C,
Δp = 0.2 bar
Superheating = 8°C

R 744

Type	Valve body size	K_v (m^3/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICS25-5	25	1.7	6.0	7.3	8.8	10.4	12.0	14.0	15.8	17.7
ICS25-10		3.5	12.3	15.0	18.0	21.5	25.0	28.6	32.5	36.5
ICS25-15		6	21.0	26.0	31.0	37.0	43.0	49.0	56.0	63.0
ICS25-20		8	28.0	34.0	41.0	49.0	57.0	67.0	75.0	84.0
ICS25-25		11.5	40.0	49.0	59.0	70.0	82.0	94.0	107	120
ICS32	32	17	60.0	73.0	88.0	104	121	139	158	177
ICS40	40	27	95.0	116	139	165	192	221	251	281
ICS50	50	44	154	189	227	268	313	360	409	459
ICS65	65	70	245	300	361	427	498	573	650	730

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.52
–10°C	0.67
0°C	0.91
10°C	**1.00**
15°C	1.09

US units

Capacity table at nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 50°F,
Δp = 3 psi
Superheating = 12°F

R 744

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	1.7	2.1	2.6	3.1	3.7	4.2	4.9	5.4
ICS25-10		4.1	3.4	4.3	5.3	6.4	7.5	8.7	10.0	11.2
ICS25-15		7	5.9	7.4	9.1	10.9	12.9	15.0	17.0	19.2
ICS25-20		9.3	7.9	9.9	12.1	14.5	17.2	20.0	22.8	25.5
ICS25-25		13.3	11.3	14.2	17.4	21.0	24.7	28.6	32.8	36.7
ICS32	32	20	16.7	21.0	25.7	31.0	36.5	42.4	48.5	54.3
ICS40	40	31	26.6	33.3	41.0	49.0	58.0	67.0	77.0	86.0
ICS50	50	51	43.3	54.3	66.5	80.0	94.0	110	125	141
ICS65	65	81	69.0	86.5	106	127	150	174	199	223

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for superheat (T_S)

T_s	Correction factor
10°F	1.00
14°F	1.00
18°F	1.00
20°F	1.00

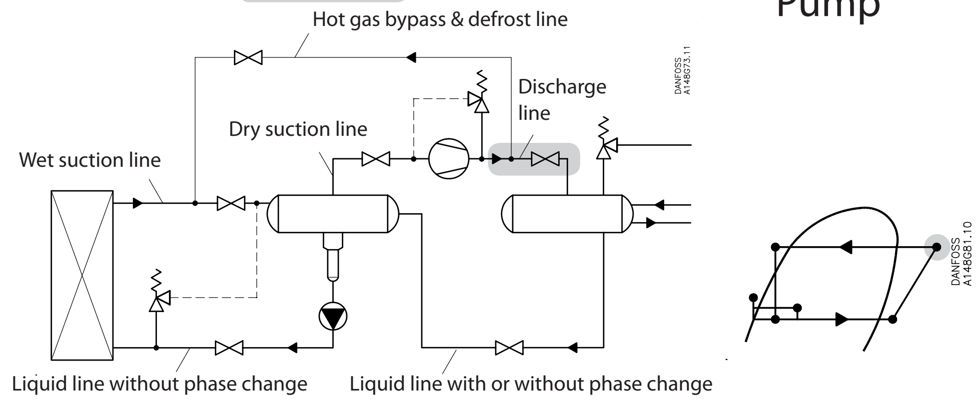
Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.48
10°F	0.64
30°F	0.88
50°F	**1.00**

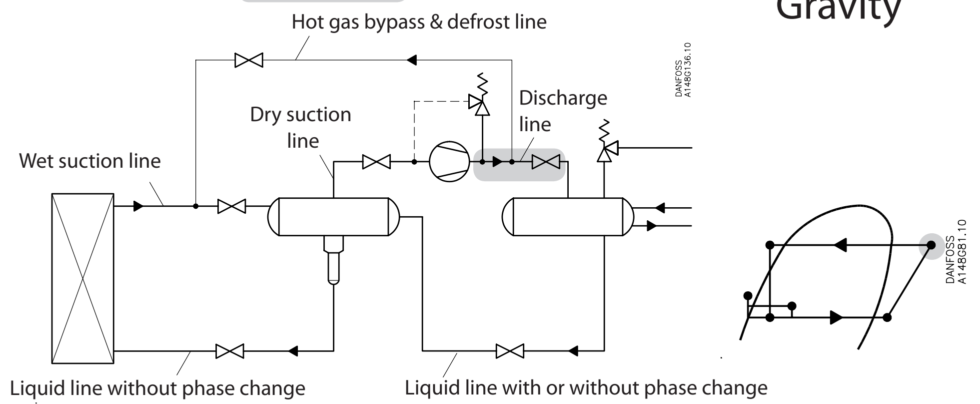
Nominal capacities

Discharge line

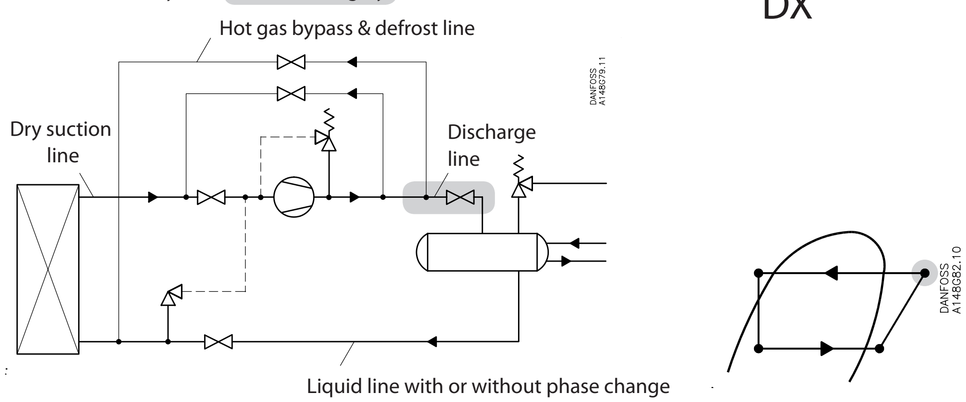
Location of valve in system (marked with grey)



Location of valve in system (marked with grey)



Location of valve in system (marked with grey)



Nominal capacities

Discharge line

SI units

Calculation example (R 717 capacities):

An application has following running conditions:

T_e = –20 °C
Q_o = 90 kW
T_{liq} = 10°C
Max. Δp = 0.4 bar
$T_{disch.}$ = 60°C

The capacity table is based on nominal condition (Δp = 0.2 bar, T_{liq} = 30°C, $P_{disch.}$= 12 bar, $T_{disch.}$= 80°C)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 0.4 bar $f_{\Delta p} = 0.71$
Correction factor for liquid temperature $f_{Tliq} = 0.92$
Correction factor for $T_{disch.}$ 60°C , $f_{disch.} = 0.97$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} \times f_{Tdisch.} =$
$90 \times 0.71 \times 0.92 \times 0.97 = 57$ kW

From the capacity table a ICS 25-15 with Q_n capacity 73 kW is selected.

US units

Calculation example (R 717 capacities):

An application has following running conditions:

T_e = 0°F
Q_o = 18 TR
T_{liq} = 50 °F
Max. Δp = 5.8 psi
$T_{disch.}$ = 120°F

The capacity table is based on nominal conditions (Δp = 3 psi, T_{liq} = 90°F, $P_{disch.}$= 185 psi, $T_{disch.}$= 180°F)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.

Correction factor for Δp 5.8 psi, $f_{\Delta p} = 0.72$
Correction factor for liquid temperature $f_{Tliq} = 0.92$
Correction factor for $T_{disch.}$ 120°C , $f_{disch.} = 0.95$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} \times f_{Tdisch.} =$
$18 \times 0.72 \times 0.92 \times 0.95 = 11.3$ TR

From the capacity table a ICS 25-10 with Q_n capacity 12.0 TR is selected.

Nominal capacities

Discharge line

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 30°C,
$P_{disch.}$ = 12 bar,
ΔP = 0.2 bar,
$T_{disch.}$ = 80°C
Superheat = 8°C

R 717

Type	Valve body size	K_v (m^3/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICS25-5	25	1.7	19.8	20.2	20.5	20.7	20.9	21.1	21.3	21.5
ICS25-10		3.5	40.8	41.5	42.0	42.5	43.0	43.5	44.0	44.2
ICS25-15		6	70.0	71.0	72.0	73.0	74.0	74.8	75.4	76.0
ICS25-20		8	93.0	95.0	96.0	97.5	99.0	99.7	101	101
ICS25-25		11.5	134	136	138	140	142	143	144	145
ICS32	32	17	199	201	205	207	209	211	213	215
ICS40	40	27	315	320	325	329	333	336	339	341
ICS50	50	44	514	521	529	536	542	548	553	556
ICS65	65	70	817	829	843	854	864	872	879	885

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
50°C	0.96
60°C	0.97
80°C	**1.00**
90°C	1.01
100°C	1.03
110°C	1.04
120°C	1.06

Correction factor for liquid temperature (T_{liq}).

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 2.9 psi,
$P_{disch.}$ = 185 psi,
$T_{disch.}$ = 180°F
Superheat = 12°F

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	5.6	5.7	5.8	5.8	5.9	6.0	6.0	6.0
ICS25-10		4.1	11.4	11.6	11.8	12.0	12.1	12.3	12.3	12.4
ICS25-15		7	19.6	20.0	20.3	20.6	20.8	21.0	21.2	21.3
ICS25-20		9.3	26.2	26.6	27.0	27.4	27.8	28.0	28.2	28.3
ICS25-25		13.3	37.6	38.3	39.0	39.4	39.9	40.3	40.5	40.8
ICS32	32	20	55.5	56.5	57.5	58.3	59.0	59.5	60.0	60.3
ICS40	40	31	88.0	90.0	91.0	92.5	94.0	94.5	95.0	95.7
ICS50	50	51	144	146	149	151	153	154	155	156
ICS65	65	81	229	233	237	240	243	245	247	248

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
120°F	0.95
140°F	0.97
180°F	1.00
200°F	1.02
210°F	1.02
230°F	1.04
250°F	1.06

Correction factor for liquid temperature (T_{liq}).

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	1.00
110°F	1.04
130°F	1.09

Nominal capacities

Discharge line

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 10°C,
P_{disch} = 10 bar,
ΔP = 0.2 bar
T_{disch} = 80°C
Superheat = 8°C

R 744

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICS25-5	25	1.7	12.5	12.7	12.8	12.9	12.9	12.9	12.5	12.8
ICS25-10		3.5	25.7	26.2	26.5	26.6	26.6	26.3	25.8	26.4
ICS25-15		6	44.0	45.0	45.3	45.6	45.5	45.1	44.2	45.0
ICS25-20		8	59.0	60.0	60.2	60.7	60.7	60.1	59.0	60.0
ICS25-25		11.5	85.0	86.0	87.0	87.4	87.3	86.5	85.0	87.0
ICS32	32	17	125	127	128	129	129	128	125	128
ICS40	40	27	199	202	204	205	205	203	199	203
ICS50	50	44	324	329	332	334	334	331	324	331
ICS65	65	70	515	523	529	532	531	526	516	527

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
50°C	0.96
60°C	0.97
80°C	**1.00**
90°C	1.01
100°C	1.03
110°C	1.04
120°C	1.06

Correction factor for liquid temperature (T_{liq}).

Liquid temperature	Correction factor
–20°C	0.52
–10°C	0.67
0°C	0.91
10°C	**1.00**
15°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 3 psi
P_{disch} = 120 psi,
T_{disch} = 180°F
Superheat = 12°F

R 744

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60°F	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
ICS25-5	25	2	3.4	3.4	3.5	3.5	3.4	3.3	3.2	3.1
ICS25-10		4.1	6.9	7.0	7.1	7.1	7.0	6.8	6.6	6.4
ICS25-15		7	11.9	12.1	12.2	12.2	12.0	11.7	11.3	11.0
ICS25-20		9.3	15.8	16.1	16.2	16.2	16.0	15.6	15.1	14.7
ICS25-25		13.3	22.8	23.1	23.3	23.3	23.0	22.4	21.8	21.1
ICS32	32	20	33.7	34.1	34.5	34.5	34.0	33.1	32.2	31.2
ICS40	40	31	53.4	54.3	54.7	54.7	54.0	52.5	51.0	49.6
ICS50	50	51	87.0	88.4	89.0	89.0	88.0	85.5	83.3	80.8
ICS65	65	81	138	141	142	142	140	136	132	129

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
120°F	0.95
140°F	0.97
180°F	**1.00**
200°F	1.02
210°F	1.02
230°F	1.04
250°F	1.05

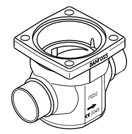
Correction factor for liquid temperature (T_{liq}).

Liquid temperature	Correction factor
–10°F	0.48
10°F	0.64
30°F	0.88
50°F	**1.00**

ICS 25

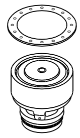
Ordering from the parts programme

Example (select from table I, II and III)



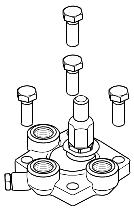
Valve body 25 D (1 in.)
027H2120
Table I

+



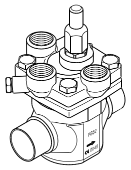
Function module ICS 25-15
027H2203
Table II

+

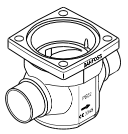


Top cover 3 pilots
027H2173
Table III

=

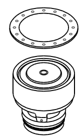


ICV 25 valve body w/different connections *Table I*



20 D (3/4 in.)	25 D (1 in.)	32 D (1 1/4 in.)	40 D (1 1/2 in.)
027H2128	**027H2120**	**027H2129**	**027H2135**
35 SD (1 3/8 in. SA)	28 SA (1 1/8 in.)	22 SA (7/8 in.)	28 SD (1 1/8 in.)
027H2134	**027H2126**	**027H2125**	**027H2124**
22 SD (7/8 in.)	20 A (3/4 in.)	25 A (1 in.)	32 A (1 1/4 in.)
027H2123	**027H2131**	**027H2121**	**027H2130**
20 SOC (3/4 in.)	25 SOC (1 in.)	20 FPT (3/4 in.)	25 FPT (1 in.)
027H2132	**027H2122**	**027H2133**	**027H2127**

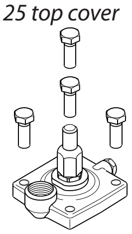
ICS 25 function module *Table II*



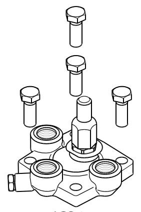
Description	Code Number
ICS 25-5	**027H2201** *)
ICS 25-10	**027H2202** *)
ICS 25-15	**027H2203** *)
ICS 25-20	**027H2204** *)
ICS 25-25	**027H2200** *)

*) Including gasket and O-rings

ICS 25 top cover *Table III*



ICS 1



ICS 3

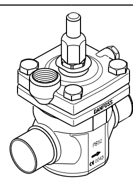
Description	Code Number
Top cover 1 Pilot	**027H2172** *)
Top cover 3 Pilots	**027H2173** **)

*) Including bolts
**) including bolts and one blanking plug

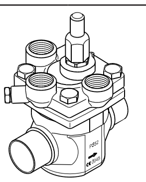
D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Ordering complete factory assembled valve

(body, function module and top cover) *Table A*



1 pilot



3 pilots

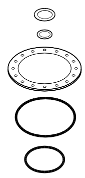
		Available connections							
		20 D (3/4 in.)	25 D (1 in.)	32 D (1 1/4 in.)	40 D (1 1/2 in.)	35 SD (1 3/8 in. SA)	28 SA (1 1/8 in.)	22 SA (7/8 in.)	28 SD (1 1/8 in.)
ICS 25-5	1 Pilot	**027H2028**	**027H2020**				**027H2026**	**027H2025**	**027H2024**
	3 Pilots	**027H2078**	**027H2070**				**027H2076**	**027H2075**	**027H2074**
ICS 25-10	1 Pilot	**027H2038**	**027H2030**				**027H2036**	**027H2035**	**027H2034**
	3 Pilots	**027H2088**	**027H2080**				**027H2086**	**027H2085**	**027H2084**
ICS 25-15	1 Pilot	**027H2048**	**027H2040**				**027H2046**	**027H2045**	**027H2044**
	3 Pilots	**027H2098**	**027H2090**				**027H2096**	**027H2095**	**027H2094**
ICS 25-20	1 Pilot	**027H2058**	**027H2050**				**027H2056**	**027H2055**	**027H2054**
	3 Pilots	**027H2108**	**027H2100**				**027H2106**	**027H2105**	**027H2104**
ICS 25-25	1 Pilot	**027H2068**	**027H2060**				**027H2066**	**027H2065**	**027H2064**
	3 Pilots	**027H2118**	**027H2110**				**027H2116**	**027H2115**	**027H2114**

		22 SD (7/8 in.)	20 A (3/4 in.)	25 A (1 in.)	32 A (1 1/4 in.)	20 SOC (3/4 in.)	25 SOC (1 in.)	20 FPT (3/4 in.)	25 FPT (1 in.)
ICS 25-5	1 Pilot	**027H2023**	**027H2029**	**027H2021**		**027H2140**			
	3 Pilots	**027H2073**	**027H2079**	**027H2071**		**027H2145**			
ICS 25-10	1 Pilot	**027H2033**	**027H2039**	**027H2031**		**027H2141**			
	3 Pilots	**027H2083**	**027H2089**	**027H2081**		**027H2146**			
ICS 25-15	1 Pilot	**027H2043**	**027H2049**	**027H2041**		**027H2142**			
	3 Pilots	**027H2093**	**027H2099**	**027H2091**		**027H2147**			
ICS 25-20	1 Pilot	**027H2053**	**027H2059**	**027H2051**		**027H2143**			
	3 Pilots	**027H2103**	**027H2109**	**027H2101**		**027H2148**			
ICS 25-25	1 Pilot	**027H2063**		**027H2061**			**027H2062**		
	3 Pilots	**027H2113**		**027H2111**			**027H2112**		

Select from parts programme

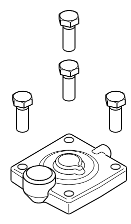
Spare parts and accessories

Spare parts



Spare Parts	Code Number
ICS 25 service kit	**027H2222**

Accessories



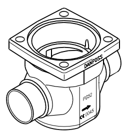
Accessories	Code Number
ICV 25 top cover blind	**027H2174** *)

*) Including bolts and gaskets

ICS 32

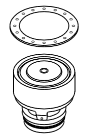
Ordering from the parts programme

Example (select from table I, II and III)



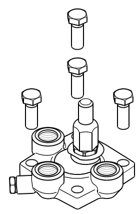
Valve body 32 D ($1^{1}/_{4}$ in.)
027H3120
Table I

+



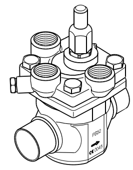
Function module ICS 32
027H3200
Table II

+

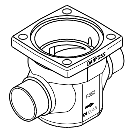


Top cover 3 pilots
027H3173
Table III

=



ICV 32 valve body w/different connections *Table I*

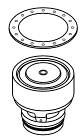


32 D ($1^{1}/_{4}$ in.)	40 D ($1^{1}/_{2}$ in.)	42 SA ($1^{5}/_{8}$ in.)	42 SD ($1^{5}/_{8}$ in.)
027H3120	**027H3125**	**027H3127**	**027H3128**

35 SD ($1^{3}/_{8}$ in. SA)	32 A ($1^{1}/_{4}$ in.)	32 SOC ($1^{1}/_{4}$ in.)	40 A ($1^{1}/_{2}$ in.)
027H3123	**027H3121**	**027H3122**	**027H3126**

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ;
SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

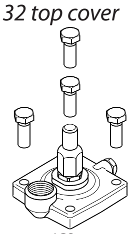
ICS 32 function module *Table II*



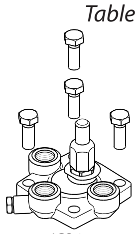
Description	Code Number
ICS 32	**027H3200** *)

*) Including gasket and O-rings

ICS 32 top cover *Table III*



ICS 1



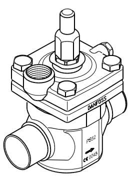
ICS 3

Description	Code Number
Top cover 1 Pilot	**027H3172** *)
Top cover 3 Pilots	**027H3173** **)

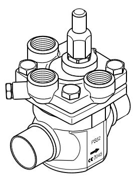
*) Including bolts
**) including bolts and one blanking plug

Ordering complete factory assembled valve

(body, function module and top cover) *Table A*



1 pilot



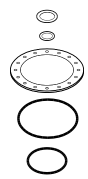
3 pilots

		Available connections							
		32 D ($1^{1}/_{4}$ in.)	40 D ($1^{1}/_{2}$ in.)	42 SA ($1^{5}/_{8}$ in.)	42 SD ($1^{5}/_{8}$ in.)	35 SD ($1^{3}/_{8}$ in. SA)	32 A ($1^{1}/_{4}$ in.)	32 SOC ($1^{1}/_{4}$ in.)	40 A ($1^{1}/_{2}$ in.)
ICS 32	1 Pilot	**027H3020**				**027H3023**	**027H3021**	**027H3022**	
	3 Pilots	**027H3030**				**027H3033**	**027H3031**	**027H3032**	

Select from parts programme

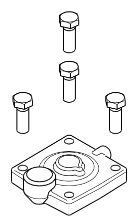
Spare parts and accessories

Spare parts



Spare Parts	Code Number
ICS 32 service kit	**027H3222**

Accessories



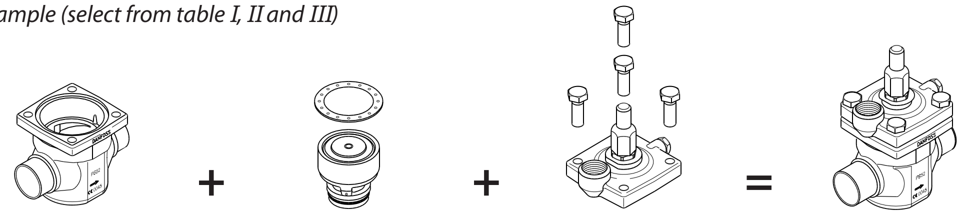
Accessories	Code Number
ICV 32 top cover blind	**027H3174** *)

*) Including bolts and gaskets

ICS 40

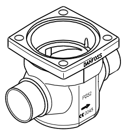
Ordering from the parts programme

Example (select from table I, II and III)



Valve body 50 D (2 in.)	Function module ICS 40	Top cover 1 pilot
027H4126	**027H4200**	**027H4172**
Table I	***Table II***	***Table III***

ICV 40 valve body w/different connections — *Table I*

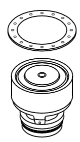


40 D (1 1/2 in.)	50 D (2 in.)	42 SA (1 5/8 in.)	42 SD (1 5/8 in.)
027H4120	**027H4126**	**027H4124**	**027H4123**

40 A (1 1/2 in.)	40 SOC (1 1/2 in.)	50 A (2 in.)	
027H4121	**027H4122**	**027H4127**	

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ;
SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

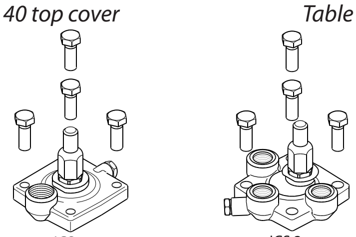
ICS 40 function module — *Table II*



Description	Code Number
ICS 40	**027H4200** *)

*) Including gasket and O-rings

ICS 40 top cover — *Table III*



ICS 1 ICS 3

Description	Code Number
Top cover 1 Pilot	**027H4172** *)
Top cover 3 Pilots	**027H4173** **)

*) Including bolts
**) including bolts and one blanking plug

Pressure and temp. rregulators

Ordering complete factory assembled valve

(body, function module and top cover)

Table A

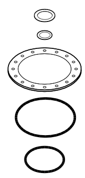
1 pilot 3 pilots

		Available connections						
		40 D (1 1/2 in.)	50 D (2 in.)	42 SA (1 5/8 in.)	42 SD (1 5/8 in.)	40 A (1 1/2 in.)	40 SOC (1 1/2 in.)	50 A (2 in.)
ICS 40	1 Pilot	**027H4020**		**027H4024**	**027H4023**	**027H4021**	**027H4022**	
	3 Pilots	**027H4030**		**027H4034**	**027H4033**	**027H4031**	**027H4032**	

Select from parts programme

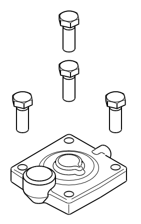
Spare parts and accessories

Spare parts



Spare Parts	Code Number
ICS 40 service kit	**027H4222**

Accessories



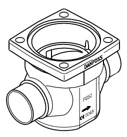
Accessories	Code Number
ICV 40 top cover blind	**027H4174** *)

*) Including bolts and gaskets

ICS 50

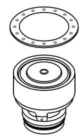
Ordering from the parts programme

Example (select from table I, II and III)



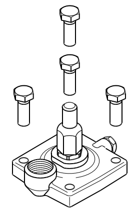
Valve body 65 D ($2^1/_2$ in.)
027H5124
Table I

+



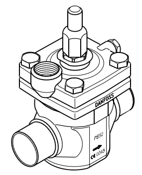
Function module ICS 40
027H5200
Table II

+

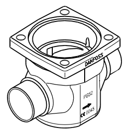


Top cover 1 pilot
027H5172
Table III

=



ICV 50 valve body w/different connections *Table I*

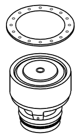


50 D (2 in.)	65 D ($2^1/_2$ in.)	54 SD ($2^1/_8$ in. SA)	50 A (2 in.)
027H5120	**027H5124**	**027H5123**	**027H5121**

50 SOC (2 in.)	65 A ($2^1/_2$ in.)		
027H5122	**027H5125**		

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ;
SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

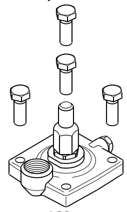
ICS 50 function module *Table II*



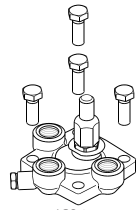
Description	Code Number
ICS 50	**027H5200** *)

*) Including gasket and O-rings

ICS 50 top cover *Table III*



ICS 1



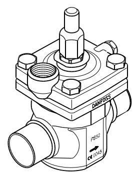
ICS 3

Description	Code Number
Top cover 1 Pilot	**027H5172** *)
Top cover 3 Pilots	**027H5173** **)

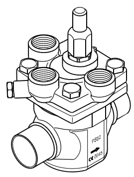
*) Including bolts
**) including bolts and one blanking plug

Ordering complete factory assembled valve

(body, function module and top cover) *Table A*



1 pilot



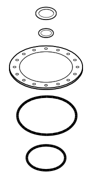
3 pilots

		Available connections					
		50 D (2 in.)	65 D ($2^1/_2$ in.)	54 SD ($2^1/_8$ in. SA)	65 A ($2^1/_2$ in.)	50 A (2 in.)	50 SOC (2 in.)
ICS 50	1 Pilot	**027H5020**		**027H5023**		**027H5021**	**027H5022**
	3 Pilots	**027H5030**		**027H5033**		**027H5031**	**027H5032**

Select from parts programme

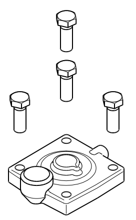
Spare parts and accessories

Spare parts



Spare Parts	Code Number
ICS 50 service kit	**027H5222**

Accessories



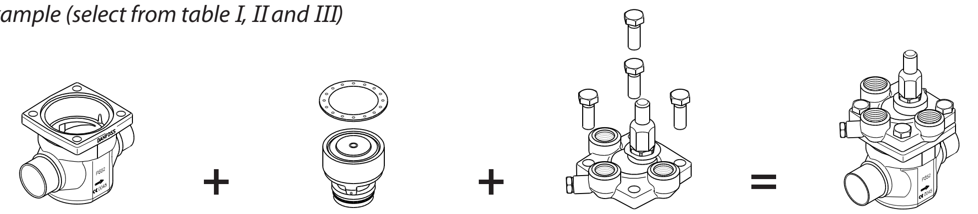
Accessories	Code Number
ICV 50 top cover blind	**027H5174** *)

*) Including bolts and gaskets

ICS 65

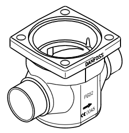
Ordering from the parts programme

Example (select from table I, II and III)



Valve body 76 SD ($2^5/_8$ in.)	Function module ICS 65	Top cover 3 pilots
027H6124	**027H6200**	**027H6173**
Table I	***Table II***	***Table III***

ICV 65 valve body w/different connections — *Table I*

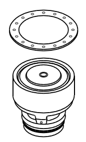


65 D ($2^1/_2$ in.)	65 A ($2^1/_2$ in.)	65 J ($2^1/_2$ in.)	80 D (3 in.)
027H6120	**027H6121**	**027H6122**	**027H6126**

80 A (3 in.)	67 SA ($2^5/_8$ in.)	76 SD (3 in.)	65 SOC ($2^1/_2$ in.)
027H6127	**027H6125**	**027H6124**	**027H6123**

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ;
SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

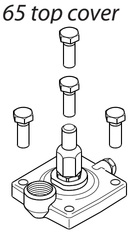
ICS 65 function module — *Table II*



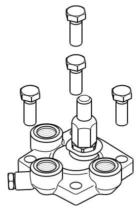
Description	Code Number
ICS 65	**027H6200** *)

*) Including gasket and O-rings

ICS 65 top cover — *Table III*



ICS 1



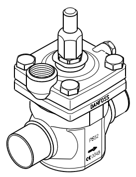
ICS 3

Description	Code Number
Top cover 1 Pilot	**027H6172** *)
Top cover 3 Pilots	**027H6173** **)

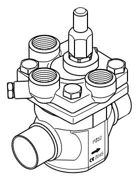
*) Including bolts
**) including bolts and one blanking plug

Ordering complete factory assembled valve

(body, function module and top cover) — *Table A*



1 pilot



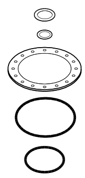
3 pilots

		Available connections							
		65 D ($2^1/_2$ in.)	65 A ($2^1/_2$ in.)	65 SOC ($2^1/_2$ in.)	80 D (3 in.)	80 A (3 in.)	67 SA ($2^5/_8$ in.)	76 SD (3 in.)	65 J ($2^1/_2$ in.)
ICS 65	1 Pilot	**027H6020**	**027H6021**	**027H6023**			**027H6025**	**027H6024**	
	3 Pilots	**027H6030**	**027H6031**	**027H6033**			**027H6035**	**027H6034**	

Select from parts programme

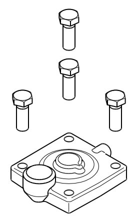
Spare parts and accessories

Spare parts



Spare Parts	Code Number
ICS 65 service kit	**027H6222**

Accessories

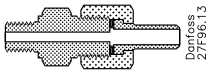


Accessories	Code Number
ICV 65 top cover blind	**027H6174** *)

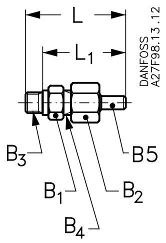
*) Including bolts and gaskets

Accessories

Pressure gauge connection (weld / solder).

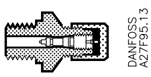


Description	**Code no.**
∅ 6.5 mm / ∅ 10 mm (∅ 0.26 in. / ∅ 0.39 in.) weld / solder	**027B2035**

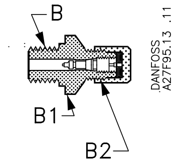


Accessories		L	L_1	B_1	B_2	B_3	B_4	B_5
Pressure gauge connection (weld / solder)								
	mm in.	66 2.60	54 2.13	AF 19	AF 22	G 1/4 A	G 3/8 A	∅6.5 / ∅10

Pressure gauge connection, 1/4 in. flare (self-closing)
Must not be used in R 717 plant.

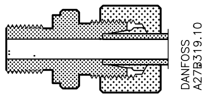


Description	**Code no.**
1/4 in. flare	**027B2041**

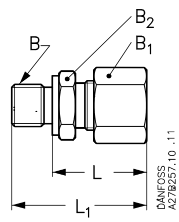


Accessories						B	B_1	B_2
Pressure gauge connection, 1/4 in. flare (self-closing)								
1/4 in. flare	mm in.					G 1/4 A	AF 19	1/4 in. flare

Pressure gauge connection (cutting ring).



Description	**Code no.**
Cutting ring connection, 6 mm Cutting ring connection, 10 mm	**027B2063** **027B2064**



Accessories			L	L_1		B	B_1	B_2
Pressure gauge connection (cutting ring)								
6 mm	mm in.		27 1.06	39 1.54		G 1/4 A	AF 19	AF 14
10 mm	mm in.		29 1.14	40 1.57		G 1/4 A	AF 19	AF 14

Multi-function tool

Description	**Code no.**
Multi-function tool for ICS all sizes	**027H0180 / 027H0181**

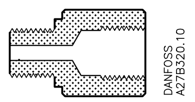
The multi-funktion tool can be used for:

- Removing the ICS function module
- Operating the manual spindle

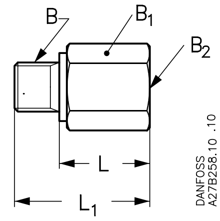
For further information please see the instruction PIHU0A.

Accessories
(continued)

Pressure gauge connection.

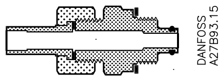


Description	Code no.
1/4 FPT	**027B2062**

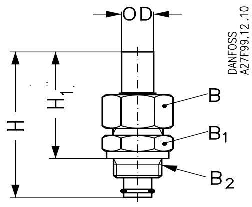


Accessories			L	L_1		B	B_1	B_2
Pressure gauge connection								
	mm in.		23 0.91	35.5 1.40		G 1/4 A	AF 22	1/4 FPT

External pilot connection.

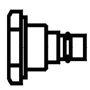


ICS	Description	Code no.
5 - 65	External pilot connection (incl. damping orifice, D: 1.0 mm)	**027F1048**
5 - 65	Accessory bag with seal and O-ring for pilot valve	**027F0666**

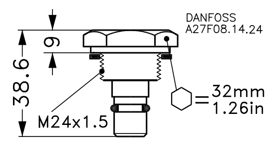


Accessories			H	H_1	OD	B	B_1	B_2
External pilot connection								
	mm in.		90 3.54	66 2.60	18 0.71	AF 32	AF 32	M 24 × 1.5

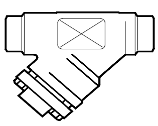
Blanking plug for pilot valves.



Description	Code no.
Blanking plug	**027F1046**



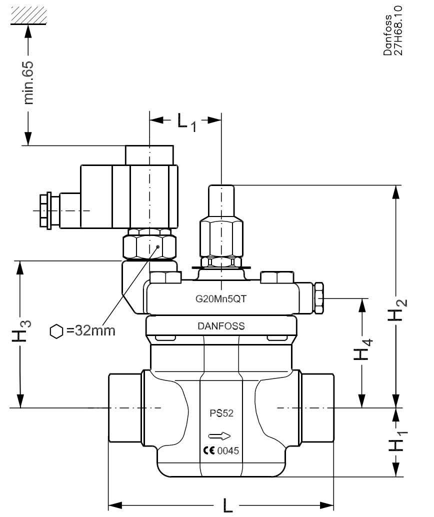
Recommended filters



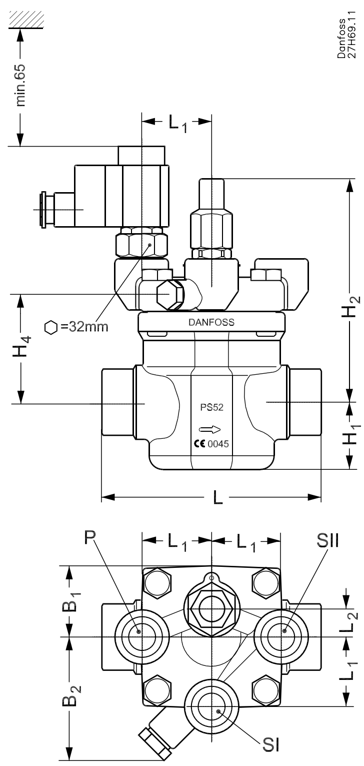
							Filter element for liquid line		Filter element for suction line	
							150 mesh	100 mesh	72 mesh	38 mesh
	Filter Type	Size	D	A	FPT	SOC	100 my	150 my	250 my	500 my
	FIA Straightway	20 (3/4 in.)	**148H3086**	**148H3098**	**148H3116**	**148H3110**	**148H3122**	**148H3124**	**148H3126**	**148H3128**
	FIA Straightway	25 (1 in.)	**148H3087**	**148H3099**	**148H3117**	**148H3111**	**148H3123**	**148H3125**	**148H3127**	**148H3129**
	FIA Straightway	32 (1 1/4 in.)	**148H3088**	**148H3100**	**148H3118**	**148H3112**	**148H3123**	**148H3125**	**148H3127**	**148H3129**
	FIA Straightway	40 (1 1/2 in.)	**148H3089**	**148H3101**		**148H3113**	**148H3123**	**148H3125**	**148H3127**	**148H3129**
	FIA Straightway	50 (2 in.)	**148H3090**	**148H3102**		**148H3114**	**148H3157**	**148H3130**	**148H3138**	**148H3144**
	FIA Straightway	65 (2 1/2 in.)	**148H3091**	**148H3103**				**148H3131**	**148H3139**	**148H3145**
	FIA Straightway	80 (3 in.)	**148H3092**	**148H3104**				**148H3119**	**148H3120**	**148H3121**

Pressure and temp. rregulators

Dimensions and weights - ICS 25-5 to ICS 25-25



ICS 1 pilot

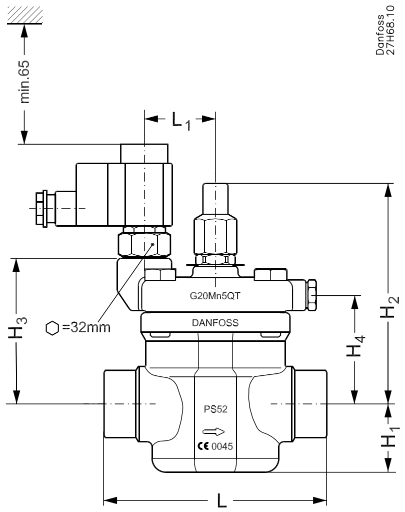


ICS 3 Pilots

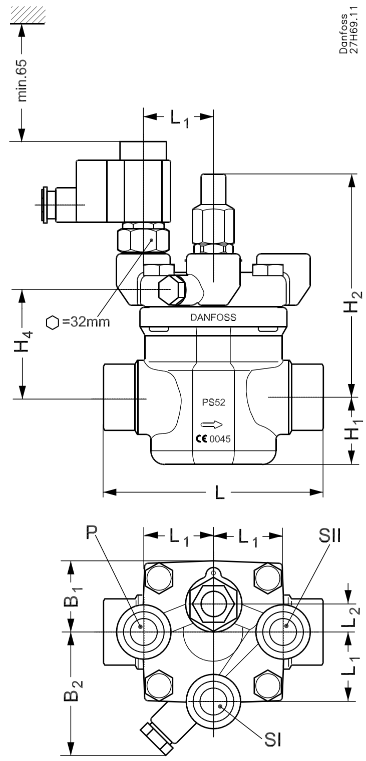
Connection		H_1	H_2	H_3	H_4	L	L_1	L_2	B_1	B_2	Weight ICS 1 Pilot	Weight ICS 3 Pilots
20 D (3/4 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
25 D (1 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
32 D (1 1/4 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
40 D (1 1/2 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
20 A (3/4 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
25 A (1 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
32 A (1 1/4 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
20 SOC (3/4 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
25 SOC (1 in.)	mm	37	138	86	60	147	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.79	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
22 SD (7/8 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
28 SD (1 1/8 in.)	mm	37	138	86	60	147	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.78	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
22 SA (7/8 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
28 SA (1 1/8 in.)	mm	37	138	86	60	147	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.78	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
35 SA (1 3/8 in.)	mm	37	138	86	60	147	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.78	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
20 FPT (3/4 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.
25 FPT (1 in.)	mm	37	138	86	60	135	51	15	42	87	3 kg	3.6 kg
	in.	1.46	5.43	3.39	2.36	5.31	2.00	0.59	1.65	3.43	6.6 lb.	7.92 lb.

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Dimensions and weights - ICS 32



ICS 1 pilot

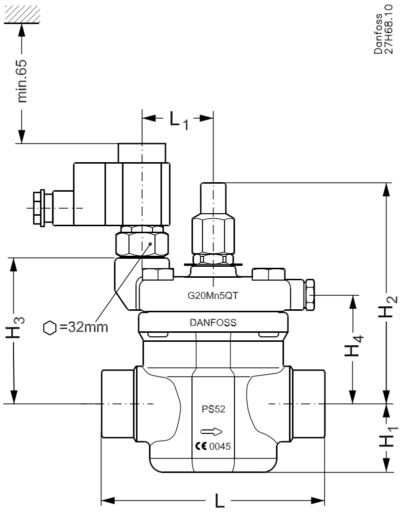


ICS 3 Pilots

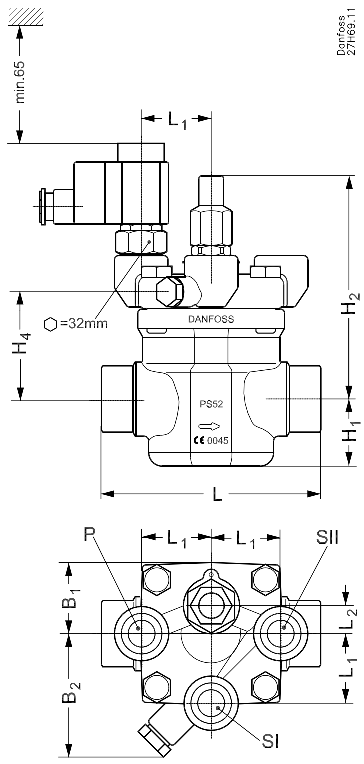
Connection		H_1	H_2	H_3	H_4	L	L_1	L_2	B_1	B_2	Weight ICS 1 Pilot	Weight ICS 3 Pilots
32 D (1/4 in.)	mm	40	153	100	74	145	51	15	51	87	4.5 kg	5 kg
	in.	1.57	6.02	3.93	2.91	5.71	2.00	0.59	2.00	3.43	9.9 lb.	11 lb.
40 D (1 1/2 in.)	mm	40	153	100	74	145	51	15	51	87	4.5 kg	5 kg
	in.	1.57	6.02	3.93	2.91	5.71	2.00	0.59	2.00	3.43	9.9 lb.	11 lb.
32 A (1/4 in.)	mm	40	153	100	74	145	51	15	51	87	4.5 kg	5 kg
	in.	1.57	6.02	3.93	2.91	5.71	2.00	0.59	2.00	3.43	9.9 lb.	11 lb.
40 A (1 1/2 in.)	mm	40	153	100	74	145	51	15	51	87	4.5 kg	5 kg
	in.	1.57	6.02	3.93	2.91	5.71	2.00	0.59	2.00	3.43	9.9 lb.	11 lb.
32 SOC (1 1/4 in.)	mm	40	153	100	74	148	51	15	51	87	4.5 kg	5 kg
	in.	1.57	6.02	3.93	2.91	5.83	2.00	0.59	2.00	3.43	9.9 lb.	11 lb.
35 SD (1 3/8 in. SA)	mm	40	153	100	74	148	51	15	51	87	4.5 kg	5 kg
	in.	1.57	6.02	3.93	2.91	5.83	2.00	0.59	2.00	3.43	9.9 lb.	11 lb.
42 SD (1 5/8 in.)	mm	40	153	100	74	148	51	15	51	87	4.5 kg	5 kg
	in.	1.57	6.02	3.93	2.91	5.83	2.00	0.59	2.00	3.43	9.9 lb.	11 lb.
42 SA (1 5/8 in.)	mm	40	153	100	74	148	51	15	51	87	4.5 kg	5 kg
	in.	1.57	6.02	3.93	2.91	5.83	2.00	0.59	2.00	3.43	9.9 lb.	11 lb.

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Dimensions and weights - ICS 40



ICS 1 pilot

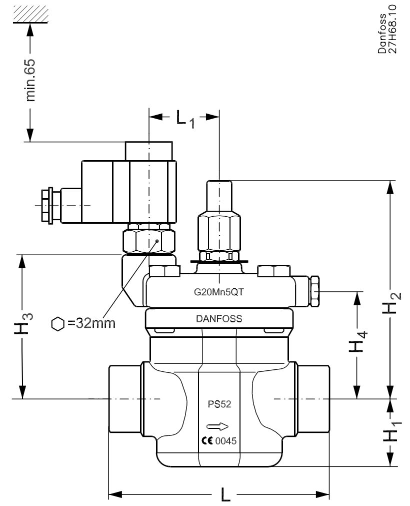


ICS 3 Pilots

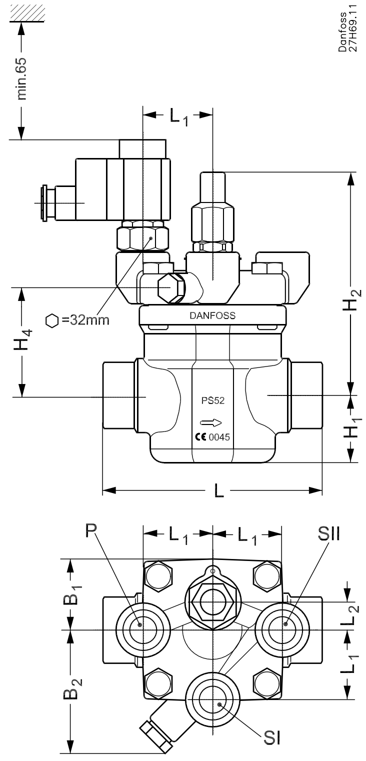
Connection		H_1	H_2	H_3	H_4	L	L_1	L_2	B_1	B_2	Weight ICS 1 Pilot	Weight ICS 3 Pilots
40 D (1$^1/_2$ in.)	mm	49	159	105	78	160	51	15	54	87	5.9 kg	6.3 kg
	in.	1.93	6.26	4.13	3.07	6.30	2.00	0.59	2.13	3.43	13.0 lb.	13.9 lb.
50 D (2 in.)	mm	49	159	105	78	180	51	15	54	87	5.9 kg	6.3 kg
	in.	1.93	6.26	4.13	3.07	7.09	2.00	0.59	2.13	3.43	13.0 lb.	13.9 lb.
40 A (1$^1/_2$ in.)	mm	49	159	105	78	160	51	15	54	87	5.9 kg	6.3 kg
	in.	1.93	6.26	4.13	3.07	6.30	2.00	0.59	2.13	3.43	13.0 lb.	13.9 lb.
50 A (2 in.)	mm	49	159	105	78	180	51	15	54	87	5.9 kg	6.3 kg
	in.	1.93	6.26	4.13	3.07	7.09	2.00	0.59	2.13	3.43	13.0 lb.	13.9 lb.
40 SOC (1$^1/_2$ in.)	mm	49	159	105	78	180	51	15	54	87	5.9 kg	6.3 kg
	in.	1.93	6.26	4.13	3.07	7.09	2.00	0.59	2.13	3.43	13.0 lb.	13.9 lb.
42 SD (1$^5/_8$ in.)	mm	49	159	105	78	180	51	15	54	87	5.9 kg	6.3 kg
	in.	1.93	6.26	4.13	3.07	7.09	2.00	0.59	2.13	3.43	13.0 lb.	13.9 lb.
42 SA (1$^5/_8$ in.)	mm	49	159	105	78	180	51	15	54	87	5.9 kg	6.3 kg
	in.	1.93	6.26	4.13	3.07	7.09	2.00	0.59	2.13	3.43	13.0 lb.	13.9 lb.

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Dimensions and weights - ICS 50



ICS 1 pilot

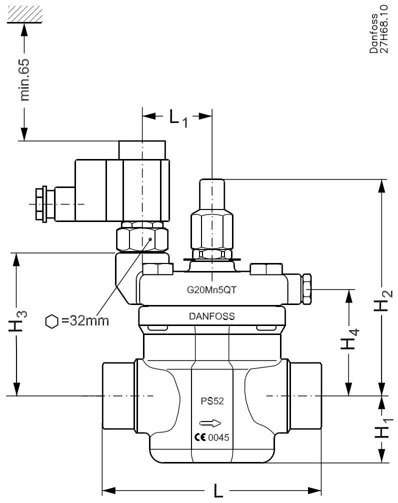


ICS 3 Pilots

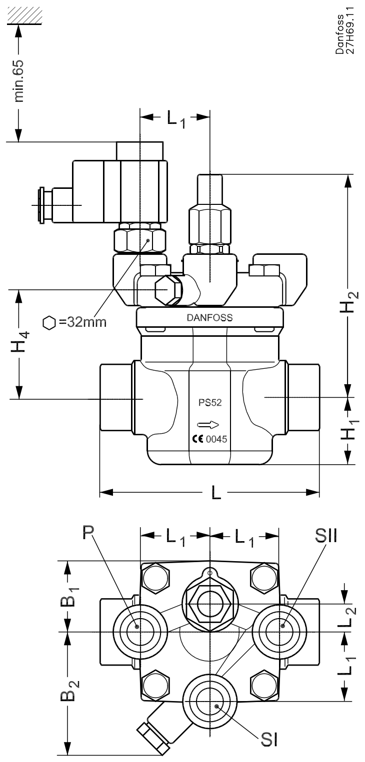
Connection		H_1	H_2	H_3	H_4	L	L_1	L_2	B_1	B_2	Weight ICS 1 Pilot	Weight ICS 3 Pilots
50 D (2 in.)	mm	59	174	120	93	200	51	15	63	91	8.9 kg	9.2 kg
	in.	2.32	6.85	4.72	3.66	7.87	2.00	0.59	2.48	3.58	19.6 lb.	20.2 lb.
65 D (2 1/2 in.)	mm	59	174	120	93	210	51	15	63	91	8.9 kg	9.2 kg
	in.	2.32	6.85	4.72	3.66	8.27	2.00	0.59	2.48	3.58	19.6 lb.	20.2 lb.
50 A (2 in.)	mm	59	174	120	93	200	51	15	63	91	8.9 kg	9.2 kg
	in.	2.32	6.85	4.72	3.66	7.87	2.00	0.59	2.48	3.58	19.6 lb.	20.2 lb.
65 A (2 1/2 in.)	mm	59	174	120	93	210	51	15	63	91	8.9 kg	9.2 kg
	in.	2.32	6.85	4.72	3.66	8.27	2.00	0.59	2.48	3.58	19.6 lb.	20.2 lb.
50 SOC (2 in.)	mm	59	174	120	93	216	51	15	63	91	8.9 kg	9.2 kg
	in.	2.32	6.85	4.72	3.66	8.50	2.00	0.59	2.48	3.58	19.6 lb.	20.2 lb.
54 SD (2 1/8 in. SA)	mm	59	174	120	93	216	51	15	63	91	8.9 kg	9.2 kg
	in.	2.32	6.85	4.72	3.66	8.50	2.00	0.59	2.48	3.58	19.6 lb.	20.2 lb.

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Dimensions and weights - ICS 65



ICS 1 pilot



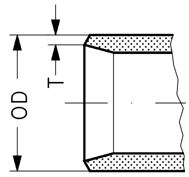
ICS 3 Pilots

Connection		H_1	H_2	H_3	H_4	L	L_1	L_2	B_1	B_2	Weight ICS 1 Pilot	Weight ICS 3 Pilots
65 D (2¹/₂ in.)	mm	65	195	140	115	230	51	15	70	91	13.4 kg	13.5 kg
	in.	2.56	7.68	5.51	4.53	9.06	2.00	0.59	2.76	3.58	29.48 lb.	29.7 lb.
80 D (3 in.)	mm	65	195	140	115	245	51	15	70	91	13.4 kg	13.5 kg
	in.	2.56	7.68	5.51	4.53	9.65	2.00	0.59	2.76	3.58	29.48 lb.	29.7 lb.
65 A (2¹/₂ in.)	mm	65	195	140	115	230	51	15	70	91	13.4 kg	13.5 kg
	in.	2.56	7.68	5.51	4.53	9.06	2.00	0.59	2.76	3.58	29.48 lb.	29.7 lb.
80 A (3 in.)	mm	65	195	140	115	245	51	15	70	91	13.4 kg	13.5 kg
	in.	2.56	7.68	5.51	4.53	9.65	2.00	0.59	2.76	3.58	29.48 lb.	29.7 lb.
65 J (2¹/₂ in.)	mm	65	195	140	115	230	51	15	70	91	13.4 kg	13.5 kg
	in.	2.56	7.68	5.51	4.53	9.06	2.00	0.59	2.76	3.58	29.48 lb.	29.7 lb.
65 SOC (2¹/₂ in.)	mm	65	195	140	115	230	51	15	70	91	13.4 kg	13.5 kg
	in.	2.56	7.68	5.51	4.53	9.06	2.00	0.59	2.76	3.58	29.48 lb.	29.7 lb.
76 SD (3 in.)	mm	65	195	140	115	245	51	15	70	91	13.4 kg	13.5 kg
	in.	2.56	7.68	5.51	4.53	9.65	2.00	0.59	2.76	3.58	29.48 lb.	29.7 lb.
67 SA (2⁵/₈ in.)	mm	65	195	140	115	245	51	15	70	91	13.4 kg	13.5 kg
	in.	2.56	7.68	5.51	4.53	9.65	2.00	0.59	2.76	3.58	29.48 lb.	29.7 lb.

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

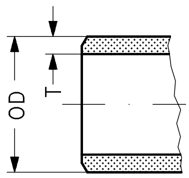
Connections

D: *Butt-weld DIN (2448)*



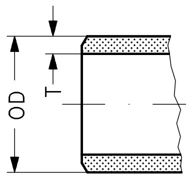
Size mm	Size in.	OD mm	T mm	OD in.	T in.		
20	(3/4)	26.9	2.3	1.059	0.091		
25	(1)	33.7	2.6	1.327	0.103		
32	(1 1/4)	42.4	2.6	1.669	0.102		
40	(1 1/2)	48.3	2.6	1.902	0.103		
50	(2)	60.3	2.9	2.37	0.11		
65	(2 1/2)	76.1	2.9	3	0.11		
80	(3)	88.9	3.2	3.50	0.13		

A: *Butt-weld ANSI (B 36.10)*



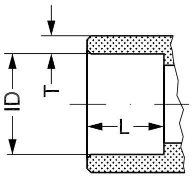
Size mm	Size in.	OD mm	T mm	OD in.	T in.	Schedule	
(20)	3/4	26.9	4.0	1.059	0.158	80	
(25)	1	33.7	4.6	1.327	0.181	80	
(32)	1 1/4	42.4	4.9	1.669	0.193	80	
(40)	1 1/2	48.3	5.1	1.902	0.201	80	
(50)	2	60.3	3.9	2.37	0.15	40	
(65)	2 1/2	73.0	5.2	2.87	0.20	40	
(80)	3	88.9	5.5	3.50	0.22	40	

J: *Butt-weld JIS*



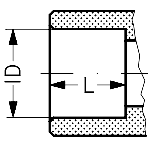
Size mm	Size in.	OD mm	T mm	OD in.	T in.		
(20)	3/4	26.9	4.0	1.059	0.158		
(25)	1	33.7	4.6	1.327	0.181		
(32)	1 1/4	42.4	4.9	1.669	0.193		
(40)	1 1/2	48.3	5.1	1.902	0.201		
(50)	2	60.3	3.9	2.37	0.15		
(65)	2 1/2	76.3	5.2	3.0	0.20		
(80)	3	88.9	5.5	3.50	0.22		

SOC:
Socket welding ANSI (B 16.11)



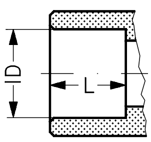
Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.
(20)	3/4	27.2	4.6	1.071	0.181	13	0.51
(25)	1	33.9	7.2	1.335	0.284	13	0.51
(32)	1 1/4	42.7	6.1	1.743	0.240	13	0.51
(40)	1 1/2	48.8	6.6	1.921	0.260	13	0.51
(50)	2	61.2	6.2	2.41	0.24	16	0.63
(65)	2 1/2	74	8.8	2.91	0.344	16	0.63

SD: *Soldering (DIN 2856)*



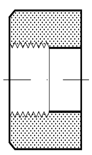
Size mm	Size in.	ID mm		ID in.		L mm	L in.
22		22.08				16.5	
28		28.08				26	
35		35.07				25	
42		42.07				28	
54		54.09				33	
76		76.1				33	

SA: Soldering (ANSI B 16.22)



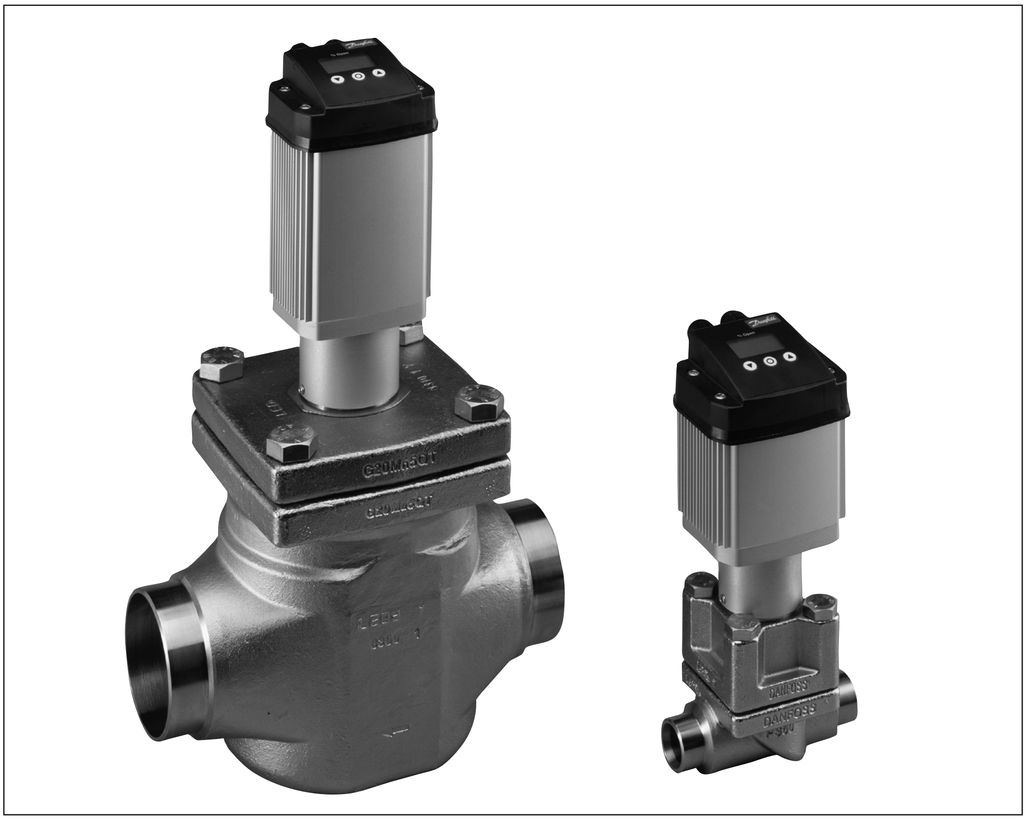
	7/8			0.875			0.650
	1 1/8			1.125			1.024
	1 3/8			1.375			0.984
	1 5/8			1.625			1.102
	2 1/8			2.125			1.300
	2 5/8			2.625			1.300

FPT:
Female pipe thread,
(ANSI/ASME B 1.20.1)



Size mm	Size in.	Inside pipe thread		
(20)	3/4	(3/4 × 14 NPT)		
(25)	1	(1 × 11.5 NPT)		
(32)	1 1/4	(1 1/4 × 11.5 NPT)		

Introduction



ICM motor valves belong to the ICV (Industrial Control Valve) family and are one of two product groups.

ICV types
– ICS - Industrial Control Servo
– ICM - Industrial Control Motor

The motor valve comprises three main components: valve body, combined top cover / function module and actuator.

ICM are direct operated motorised valves driven by actuator type ICAD (Industrial Control Actuator with Display).

ICM valves are designed to regulate an expansion process in liquid lines with or without phase change or control pressure or temperature in dry and wet suction lines and hot gas lines. ICM valves are designed so that the opening and closing forces are balanced, therefore, only two sizes of ICAD actuators are needed for the complete range of ICM from DN 20 to DN 65. The ICM motorised valve and ICAD actuator assembly offers a very compact unit with small dimensions.

The ICM motorised valve and ICAD actuator combinations are as follows:

Actuator	ICAD 600	ICAD 900
Valve size	ICM 20	ICM 40
	ICM 25	ICM 50
	ICM 32	ICM 65

ICAD 600 / ICAD 900
ICAD actuators can be controlled using the following signals:

- 0-20 mA
- 4-20 mA (default)
- 0-10 V
- 2-10 V

ICAD actuators can also operate an ICM valve as an On/Off function supported by a digital input.

The ICM valve can be operated manually via the ICAD actuator or the Multi-function tool for ICM (see the ordering section).

Fail Safe supply options
In the event of a power failure, multiple fail safe options are possible, provided that a ICAD-UPS or similar is used.
During power failure, ICM can be selected to:
- Close ICM
- Open ICM
- Stay in the same position, as when power failure occurs
- Go to a specific ICM valve opening degree

See the section ICAD UPS for further information.

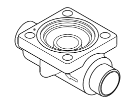
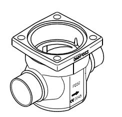
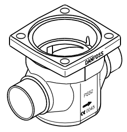
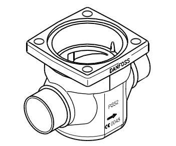
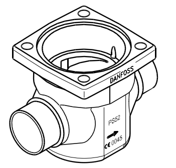
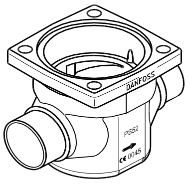
Please note: a fail safe supply (battery or UPS) is required.

The complete technical leaflet (DKRCI.PD.HT0.A) can be downloaded from the Danfoss web site.

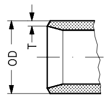
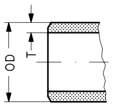
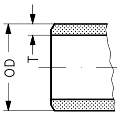
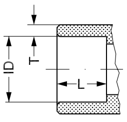
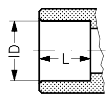
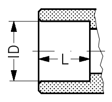
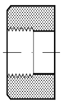
The ICM Concept

The ICM concept is developed around a modular principle. This gives the possibility of combining function modules and top covers with special valve body size that is available in a variety of connection possibilities.

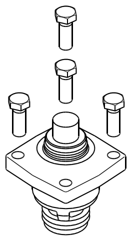
- There are six valve bodies available.

					
ICV 20	ICV 25	ICV 32	ICV 40	ICV 50	ICV 65

- Each valve body is available with a range of undersized through oversized connection sizes and types.

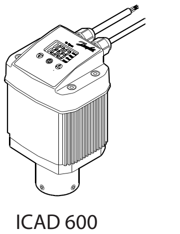
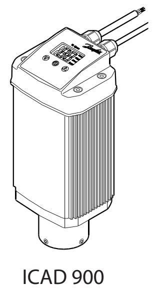
D	A	J	SOC	SD	SA	FPT
						
Butt-weld DIN	Butt-weld ANSI	Butt-weld JIS	Socket weld ANSI	Solder DIN	Solder ANSI	Female Pipe Thread

- Each body may be fitted with multiple function / top cover to give different capacities.



Type	Valve body size	K_v (m³/h)	C_v (USgal/min)
ICM20-A	20	0.6	0.7
ICM20-B		2.4	2.8
ICM20-C		4.6	5.3
ICM25-A	25	6	7.0
ICM25-B		12	13.9
ICM32-A	32	9	10.4
ICM32-B		17	20
ICM40-A	40	15	17
ICM40-B		26	30
ICM50-A	50	23	27
ICM50-B		40	46
ICM65-B	65	70	81

A magnetic coupled actuator is easily installed. Only two actuators are needed to cover the entire ICM program

 ICAD 600	 ICAD 900

Features (valve)

- Designed for Industrial Refrigeration applications for a maximum working pressure of 52 bar / 754 psig.
- Applicable to all common refrigerants including R 717, R 744 (CO2) and non corrosive gases/liquids.
- Direct coupled connections.
- Connection types include butt weld, socket weld, solder and threaded connections.
- Low temperature steel body.
- Low weight and compact design.
- V-port regulating cone ensures optimum regulating accuracy particularly at part load.
- Cavitation resistant valve seat.
- Modular Concept
  - Each valve body is available with several different connection types and sizes.
  - Valve overhaul is performed by replacing the function module.
  - Possible to convert ICM motor valve to ICS servo valve.
- Manual opening possible via ICAD or Multi-function tool.
- PTFE seat provides excellent valve tightness.
- Magnet coupling - real hermetic sealing.
- Heat cartridge kit ICAD 600 / ICAD 900 available for ICM

Design (valve)

Connections
There is a very wide range of connection types available with ICM valves:

- D: Butt weld, DIN (2448)
- A: Butt weld, ANSI (B 36.10)
- J: Butt weld, JIS (B S 602)
- SOC: Socket weld, ANSI (B 16.11)
- SD: Solder connection, DIN (2856)
- SA: Solder connection, ANSI (B 16.22)
- FPT: Female pipe thread (ANSI/ASME B 1.20.1)

Approvals
The ICV valve concept is designed to fulfil global refrigeration requirements.

ICM is CE, UL and CRN approved

For specific approval information, please contact Danfoss.

ICM valves		
Nominal bore	DN≤ 25 (1 in.)	DN 32-65 mm ($1^1/_4$ - $2^1/_2$ in.)
Classified for	Fluid group I	
Category	Article 3, paragraph 3	II

The ICM valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction.

Valve body and top cover material
Low temperature steel

Technical data (valve)

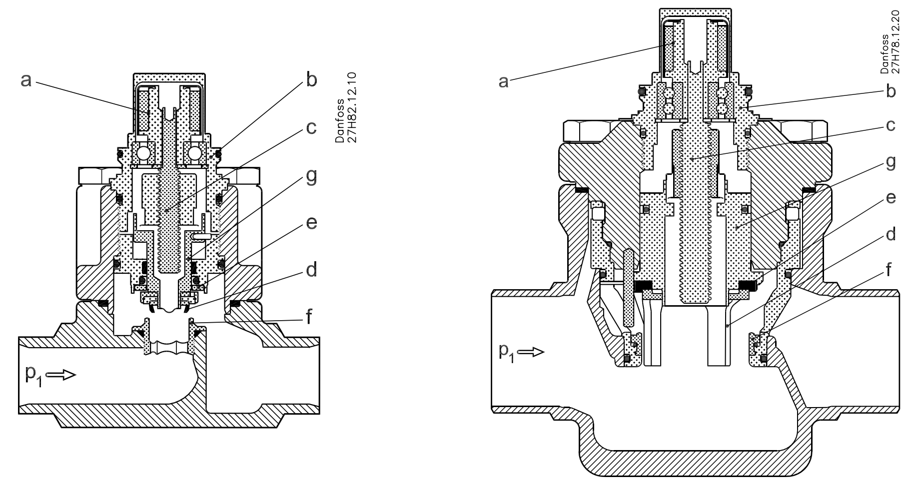
Refrigerants
Applicable to all common refrigerants including R717 and R744 (CO_2) and non- corrosive gases/ liquids.
Use with flammable hydrocarbons cannot be recommended. For further information please contact your local Danfoss sales company.

A Heat cartridge kit is recommended to be installed on ICM, in the following applpcations:

- When media temperature through ICM valve is lower than - 30°C (-22°F)
- When ICM is installed outdoor and media temperature through ICM valve is lower than -10°C (14°F)
- When ICM is installed indoor, with relative humidity higher than 90%, and the media temperature through ICM valve is lower than -10°C (14°F)

- *Temperature range:*
  Media: –60/+120°C (–76/+248°F).
- *Pressure*
  The valve is designed for:
  Max. working pressure: 52 bar g (754 psig)
- *Surface protection*
  ICM 20-65:
  The external surface is zinc-chromated to provide good corrosion protection.
- Max. openening pressure differential (MOPD)
  – ICM 20-32: 52 bar (750 psi)
  – ICM 40: 40 bar (580 psi)
  – ICM 50: 30 bar (435 psi)
  – ICM 65: 20 bar (290 psi)
- Time to move from Closed to Open position or in reverse order with maximum selected speed at ICAD.
  ICM 20: 3 Sec. ICM 40: 10 Sec.
  ICM 25: 7 Sec. ICM 50: 13 Sec.
  ICM 32: 8 Sec. ICM 65: 13 Sec.

Function (valve)



ICM 20 *ICM 25-65*

ICM, Industrial Control Motor valves are designed for use with the ICAD, Industrial Control Actuator with Display.

The driving force from the actuator is transferred via a magnetic coupling (a) through the stainless steel top housing (b) and thus eliminates the need for a packing gland. The rotational movement of the magnetic coupling (a) is transferred to a spindle (c) which in turn provides the vertical movement of the cone (d) and PTFE valve plate (e), to open and close the valve. The closing force of the actuator, combined with the PTFE valve plate (e) and cavitation resistant valve seat (f), provides an effective seal to prevent leakage across the valve port, when the valve is in the closed position. To prevent damage to the PTFE valve plate (e) and seat (f) from system debris, it is recommended that a filter is installed upstream of the valve. Please refer to page 10 for filter sizing and application recommendations.

Valve inlet pressure (P_1) acting on the underside of the PTFE valve plate (e) also passes through the hollow cone assembly (d) on to the top of the piston (g) and balances the pressure acting on the piston (g). Any trapped liquid across the throttle cone (d) is allowed to equalise down to the valve outlet without affecting the valve performance.

There are two sizes of ICAD actuator that cover the range of valves from ICM 20 to ICM 65.
The actuators have a fully weather protected enclosure with none of the moving parts exposed to the environment.

The fast acting actuators and balanced valve design results in the valve being able to move from the fully closed to the fully open position in between 3 to 13 seconds depending on valve size.

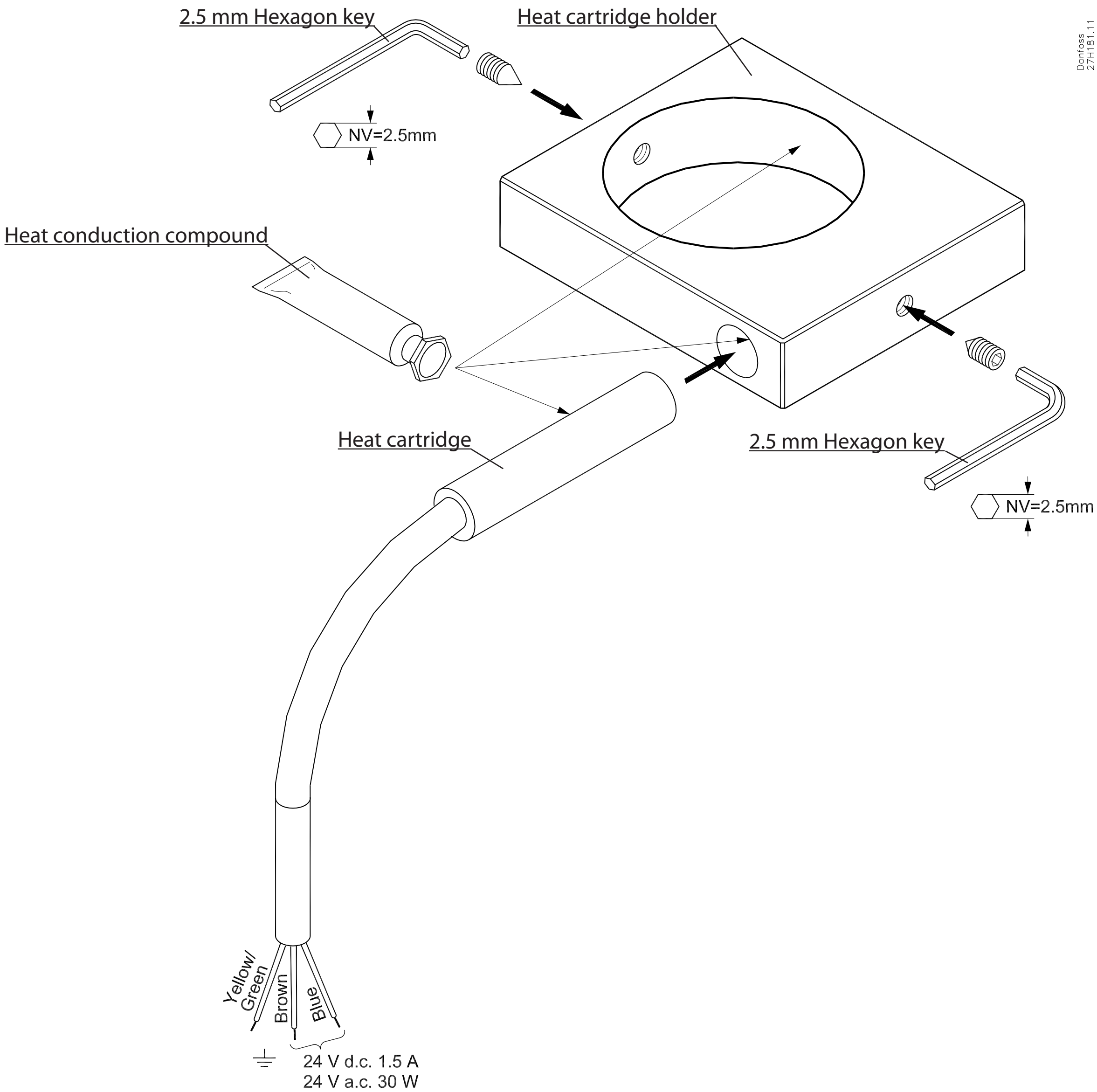
The cone (d) includes V-shaped grooves, which provides stable control regulation, particularly at low load conditions. Each valve size has at least two different function modules capacities to select from.
The function modules are designed for different capacities and are designated A and B, (and C in the case of the ICM 20). In general, "A" modules are for liquid applications. The "B" (C) modules have larger capacities than the "A" modules and are mainly for suction applications.

Technical data (Heat Cartridge kit ICAD 600 / ICAD 900 for ICM)

- *Voltage*
  24 V d. c / 24V a.c
- *Load*
  1.5 A / 30 W

- *Cable*
  The heat cartridge is delivered with1m (39 in.) cable. 3x ~ 20 AWG
  Brown and Blue : 24 V d.c (polarity unimportant) / 24 V a. c
  Yellow /Green : Ground/Earth

Heat Cartridge kit contain:
- **Heat cartridge**
- **Heat cartridge holder**
- **Heat conduction compound**



ICAD

Actuator types ICAD 600 and 900 are dedicated for use with ICM motorised valves. There are only two sizes of ICAD actuators that cover the range of valves from ICM 20 to ICM 65.

The ICAD is controlled via a modulating analogue signal (e.g. 4-20 mA/2-10 V) or a digital ON/OFF signal. ICAD incorporates an advanced MMI (Man Machine Interface), including continuous display of Opening Degree, which gives the user a very advanced and flexible setup procedure that can meet many different applications.

Features (actuator)

- Specifically designed for industrial refrigeration installations
- Advanced and high speed Digital Stepper Motor Technology
- Seven segment LCD display and three programming keys included
- Valve opening degree can be observed continuously.
- Can easily be configured to different applications on-site. (change speed, ON/OFF, modulating valve)
- Open – Close time: 3-13 seconds depending on valve size
- Modulating or ON/OFF operation
- Multiple speed selection during operation
- Logging of old alarms
- Password protection
- Control input signal :
  4-20 mA, 0-20 mA, 0-10 V, 2-10 V
- Position feed back : 0-20 mA, 4-20 mA (ICM)
- 3 Digital ON/OFF feedback
- Resolution: 20 micron/step
  (0.02 mm stroke pr. step)
- Total steps: 250 – 1000 depending on size
- Auto Calibration, Neutral zone
- In the event of a power failure, multiple fail safe options are possible. During power failure, ICM can be selected to:
  Close ICM,
  Open ICM,
  Stay in the same position, as when power failure occurs
  Go to a specific ICM valve opening degree
- Hermetic magnetic motor
- Enclosure: IP65 ~ NEMA 4
- Approvals: CE, UL, CRN

Technical data (actuator)

ICAD 600 and ICAD 900 can be used together with following Danfoss valves.

ICAD 600	ICAD 900
ICM 20	ICM 40
ICM 25	ICM 50
ICM 32	ICM 65

- *Materials*

  Housing
  Aluminium

  Top part of ICAD
  PBT thermo plastic
- *Weight*
  ICAD 600: 1.2 kg (2.64 lb)
  ICAD 900: 1.8 kg (3.96 lb)
- *Temperature range (ambient)*
  –30°C/+50°C (–22°F/122°F)
- *Enclosure*
  IP 65 (~NEMA 4)
- *Cable connection*
  2 cable premounted of 1.8 m length (70.7 in.)

  Supply cable
  3 × 0.34 mm² (3 × ~22 AWG)
  Ø4.4 mm (diameter 0.17”)

  Control cable
  7 × 0.25 mm² (7 × ~24 AWG)
  Ø5.2 mm (diameter 0.20”)

Electrical data
Supply voltage is galvanic isolated from Input/Output.

Supply voltage: 24 V d.c., + 10% / -15%
Load: ICAD 600: 1.2 A
ICAD 900: 2.0 A

Fail safe supply: Min. 19 V d.c, max. 26.4 V d.c.
Load: ICAD 600: 1.2 A
ICAD 900: 2.0 A

Battery capacity:
For each open/closed cycle
ICAD 600: 8.3 mAh
ICAD 900: 11.1 mAh

Analogue Input - Current or Voltage
Current: 0/4-20 mA
Load: 200 Ω
Voltage: 0/2-10 V d.c
Load : 10 kΩ

Analogue Output: 0/4-20 mA
Load : ≤ 250 Ω

Digital input - Digital ON/OFF input by means of volt-free contact (Signal/Telecom relays with gold-plated contacts recommended) – Voltage input used
ON: contact impedance < 50 Ω)
OFF: contact impedance > 100 k Ω

Digital Output - 3 pcs. NPN transistor output
External supply: 5-24 V d.c.
(Same supply as for ICAD can be used, but please note that the galvanically isolated system will then be spoiled)
Output load: 50 Ω
Load: Max. 50 mA

Technical data (cont.)

Cable connection
Two 1.8 m (70.7 in.) cables premounted

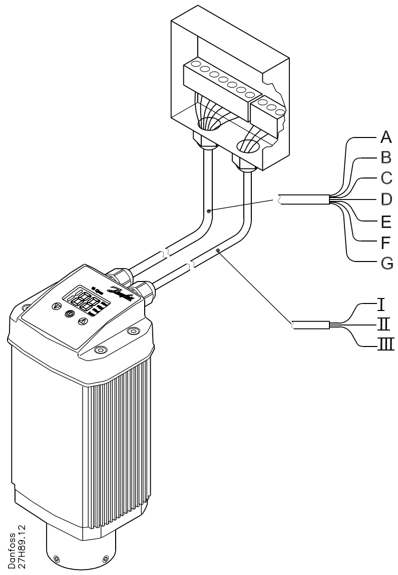


Figure 1

Ref.	Colour		Description	
A	White	–	Common Alarm	Digital Ouput
B	Brown	–	ICM fully open	
C	Green	–	ICM fully closed	
D	Yellow	–	GND ground	
E	Grey	+	0/4 - 20 mA Input	Analogue In/Output
F	Pink	+	0/2 - 10 V Input	
G	Blue	+	0/4 - 20 mA Output	

I	White	+	Fail safe supply Battery / UPS* 19 V d.c.
II	Brown	+	Supply voltage 24 V d.c.
III	Green	–	

* Uninterruptable Power Supply

Approvals

CE according to 89/336 EEC (EMC)
Emission : EN61000-6-3
Immunity: EN61000-6-2
UL
CRN

Function (actuator)

The design of ICAD is based on a digital stepper motor technology combined with an advanced MMI (Man Machine Interface), that gives excellent possibilities for having a high degree of flexibility with the same type of ICAD actuator.

At the ICAD display the Opening Degree (0-100 %) of the actual ICM valve installed can be continuously observed.

The advanced menu system will allow several parameters to be ajusted to obtain the required function. Many different parameters can be configurated, among these:

- Modulating and ON/OFF control
- Analog input
  0- 20 mA or 4-20 mA
  0-10 V or 2-10 V
- Analog output
  0- 20 mA or 4-20 mA
- Automatic or manual control
- Change of ICM valve speed
- Automatic calibration
- Multiple Fail Safe set-up options during power cut

For service all Input and Output signals can be recalled and observed from the ICAD display.

A password protection has been linked to the parameter of entering the correct ICM valve to avoid unintentional and non-authorised operation.

ICAD can manage and display different alarms.
If an alam has been detected the display will alternate between showing: Actual alarm present and Opening Degree of ICM valve. If more than one alarm is active at the same time the alarm with the highest priority will take preference. The alarm with the highest priority is shown on the display.
All alarms will automatically reset when disappearing.

Previous alarms can be recalled for traceability and service purposes.

Any active alarm will activate the common digital alarm output.
All alarms will automatically reset when disappearing.

ICAD provides two digital output signals to 3rd party control equipment (e.g. PLC) indicating if the ICM valve is completely open or completely closed.

The hermetic magnetic motor coupling makes it easy to dismount the ICAD from ICM valve.

ICAD-UPS for ICM 20-125

ICAD-UPS is dedicated for use along with ICM sizes 20-125 installed with ICAD 600 and ICAD 900 actuators.

In the event of power failure, there is a need to make sure that the ICM goes to a safe position.

ICAD-UPS can be connected to the ICAD 600/900.

The solution ICM with ICAD connected to ICAD-UPS will give one of the following possibilities in the event of power failure:
– close ICM
– open ICM
– stay
– go to a specefic ICM Opening Degree

When power supply has been re-established the system will automatically return to normal operation.

Facts and features

- Industrial product.
- *Can support up to*
  - 5 pcs. of ICAD 900 or
  - 8 pcs. of ICAD 600
- Integrated solution - battery and UPS.
- *Industrial approvals:*
  CE, UL, GL (Germanisher Lloyd).
- DIN rail mounting.
- *LED indication*
  - Green (Power ON)
  - Yellow (Flashing:charging, Constant: Buffer mode (Failsafe supply to ICAD))
  - Red (Battery fully discharged/Battery faulty)
- 24 V d.c supply → Same transformer as for ICAD can be used. Only +0,5 A extra load on the transformer.
- Check of battery every 60 sec.
- Adjustable buffer time*. (1, 2, 3, 5, 10, 15, 20, 30 or infinity) = Ensures longer life time of the battery.
- Forced remote shutdown in buffer mode via digital input.
- 3 digital volt free relay change over contacts for signals to PLC systems. (Power OK, Buffer mode (failsafe supply to ICAD), Alarm).

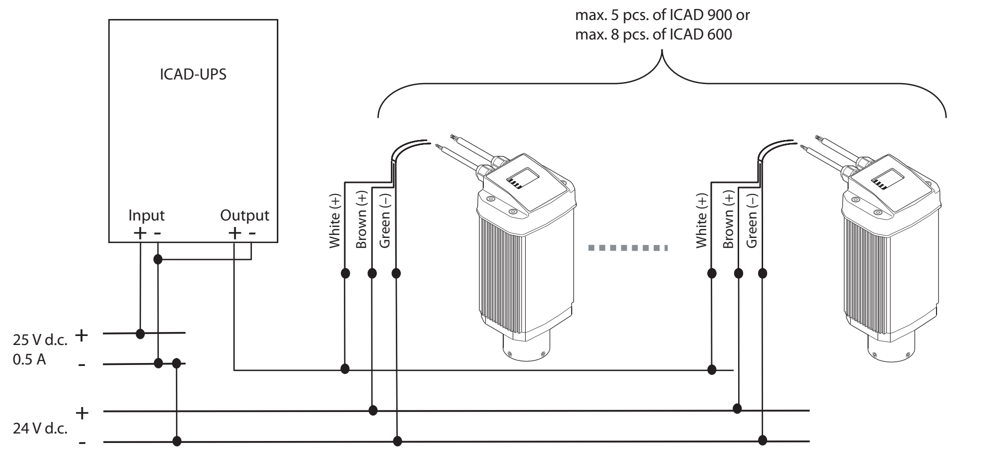
* Buffer time is defined as the period where ICAD is only powered from the ICAD-UPS (i.e. not from main supply). On ICAD-UPS there is an adjustable buffer time setting (1, 2, 3, 5, 10, 15, 20, 30 min. or infinity). If set to 3, ICAD-UPS will switch off power to connected ICAD 600/900, 3 minutes after the power failure occurs. This ensures that the internal battery inside ICAD-UPS do not fully discharge.

Code number: **027H0182**

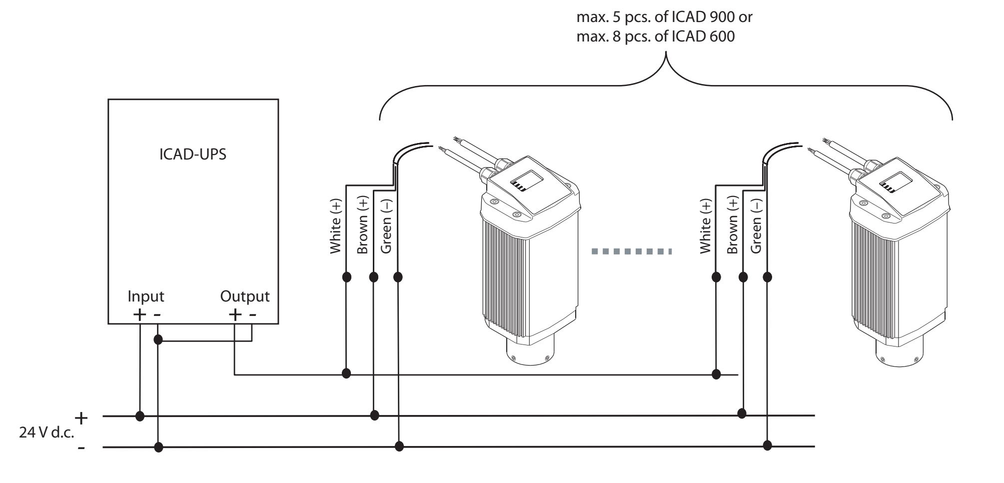
For further information please see the instruction PIHV0B.

ICAD-UPS applications

Seperate 24 V d.c tranformer for both ICAD-UPS and ICAD 600/900

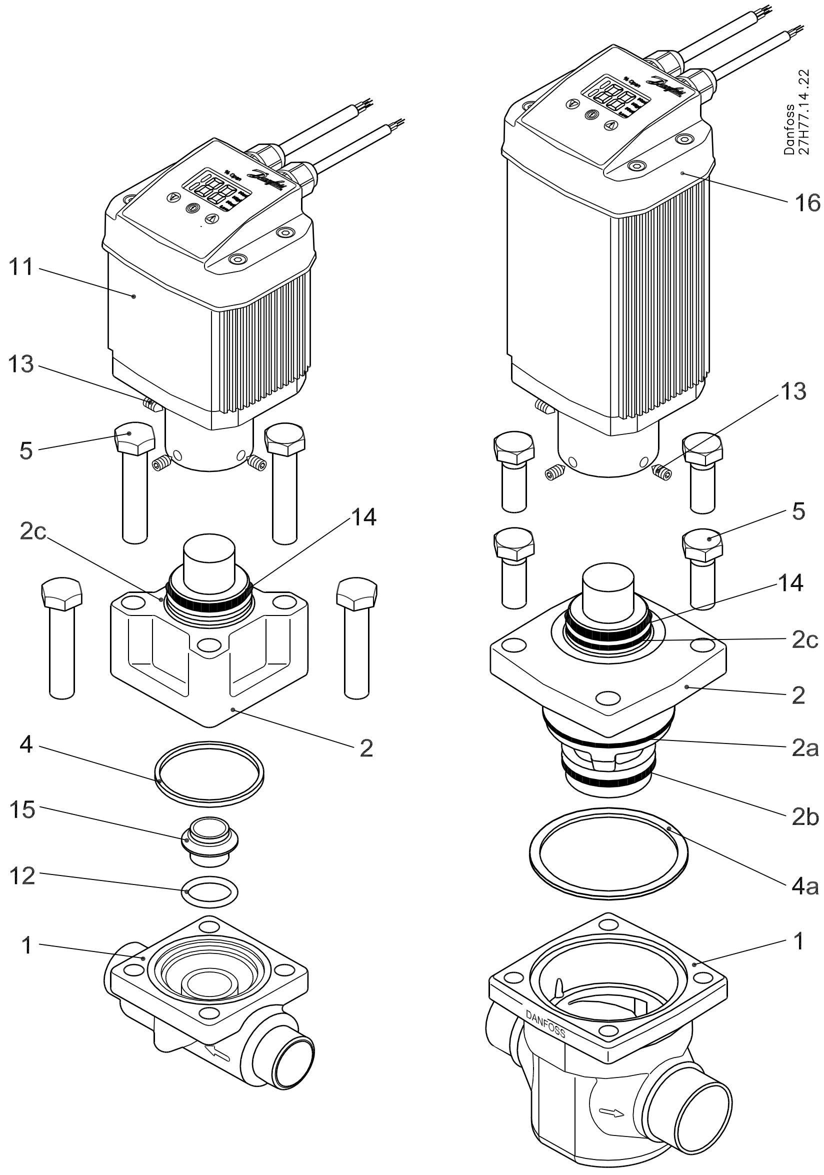


One 24 V d.c tranformer for ICAD-UPS and ICAD 600/900



Pressure and temp. rregulators

Material specification



ICM 20

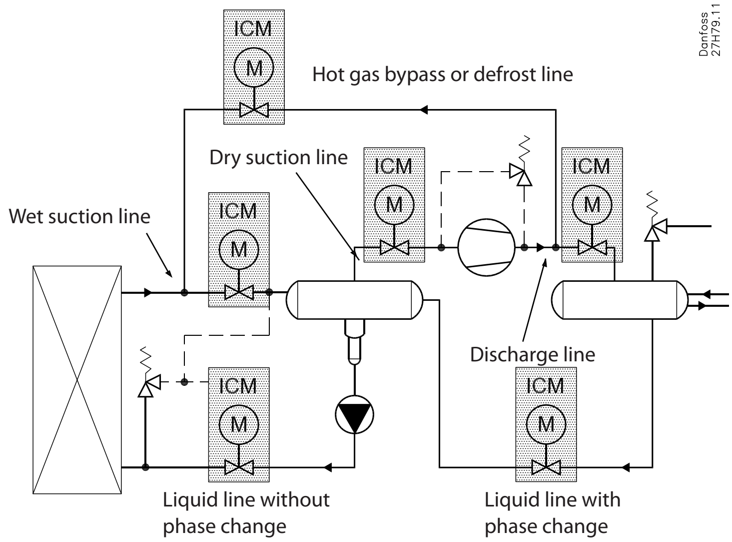
ICM 25-65

Bolt sizes (pos. 5)

Type	Screw
ICM 20	M10 × 55 A2-70 DIN 931
ICM 25	M12 × 30 A2-70 DIN 933
ICM 32	M14 × 35 A2-70 DIN 933
ICM 40	M14 × 35 A2-70 DIN 933
ICM 50	M16 × 40 A2-70 DIN 933
ICM 65	M16 × 40 A2-70 DIN 933

No.	Part	Material	EN	ASTM	JIS
1	Housing	Low temperature steel	G20Mn5QT, EN 10213-3	LCC, A352	SCPL1, G5151
2	Top cover / function module	Low temperature steel	G20Mn5QT, EN 10213-3	LCC, A352	SCPL1, G5151
2a	O-ring	Cloroprene (Neoprene)			
2b	O-ring	Cloroprene (Neoprene)			
2c	O-ring	Cloroprene (Neoprene)			
4	Gasket	Cloroprene (Neoprene)			
4a	Gasket	Fiber, non-asbestos			
5	Bolts	Stainless steel	A2-70, EN 1515-1	Grade B8 A320	A2-70, B 1054
11	Actuator				
12	O-ring	Cloroprene (Neoprene)			
13	Screw	Stainless steel			
14	O-ring	Cloroprene (Neoprene)			
15	Seat	High density polymer			

ICM Application



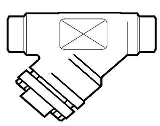
ICM can be used for pressure and temperature regulation in dry and wet suction lines, in hot gas lines and in liquid lines with or without phase change (i.e. where no expansion occurs in the valve).

Valve capacities for different refrigerants and applications are given in the following tables. Selection of ICM / ICS valves will be available with the DIRcalc ver. 1.3 selection program and later. The resultant valve selections will be:- ICM-EXP for expansion valve functions and where the selection criteria has been predefined for expansion valve application: ICM will be for control valve functions and will include for all available function modules as valve pressure drop is the main consideration for valve selection.

The process for identifying the ICM valve solution can be determined from the ordering pages. Initially select the nominal valve size, identify the required valve body and connection types, followed by the module insert and then the correct actuator to suit the module insert and valve body.

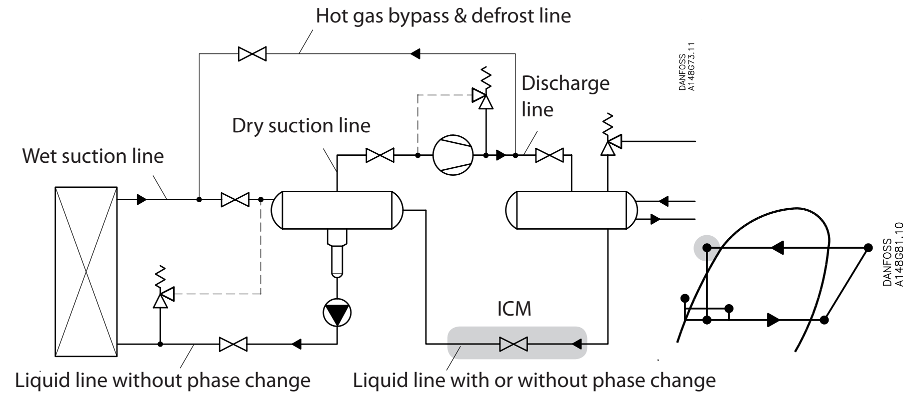
As the ICM and ICS valves use a common body it is possible to install the body without having previously determined whether a servo or motor function is required. A blank top cover complete with fixing screws can be supplied to allow for pressure testing.

Recommended filters

							Filter element for liquid line		Filter element for suction line	
							150 mesh	100 mesh	72 mesh	38 mesh
	Filter Type	Size	D	A	FPT	Soc	100 my	150 my	250 my	500 my
	FIA Straightway	20 ($^3/_4$ in.)	**148H3086**	**148H3098**	**148H3116**	**148H3110**	**148H3122**	**148H3124**	**148H3126**	**148H3128**
	FIA Straightway	25 (1 in.)	**148H3087**	**148H3099**	**148H3117**	**148H3111**	**148H3123**	**148H3125**	**148H3127**	**148H3129**
	FIA Straightway	32 (1$^1/_4$ in.)	**148H3088**	**148H3100**	**148H3118**	**148H3112**	**148H3123**	**148H3125**	**148H3127**	**148H3129**
	FIA Straightway	40 (1$^1/_2$ in.)	**148H3089**	**148H3101**		**148H3113**	**148H3123**	**148H3125**	**148H3127**	**148H3129**
	FIA Straightway	50 (2 in.)	**148H3090**	**148H3102**		**148H3114**	**148H3157**	**148H3130**	**148H3138**	**148H3144**
	FIA Straightway	65 (2$^1/_2$ in.)	**148H3091**	**148H3103**				**148H3131**	**148H3139**	**148H3145**
	FIA Straightway	80 (3 in.)	**148H3092**	**148H3104**				**148H3119**	**148H3120**	**148H3121**

Nominal capacities

Liquid line with/without phase change



SI units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = -20°C$
$Q_o = 250$ kW
$T_{liq} = 10°C$
Max. $\Delta p = 0.3$ bar
Connection: DN20

The capacity table is based on nominal condition (pressure drop $\Delta p = 0.2$ bar, $T_{liq} = 30°C$)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 0.3 bar $f_{\Delta p} = 0.82$
Correction factor for liquid tempereature
$f_{Tliq} = 0.92$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} = 250 \times 0.82 \times 0.92 = 189$ kW

From the capacity table a ICM 20-B with Q_n capacity 249 kW is selected.

US units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = -20°F$
$Q_o = 130$ TR
$T_{liq} = 50°F$
Max. $\Delta p = 3.5$ psi
Connection: $^3/_4$"

The capacity table is based on nominal condition (pressure drop $\Delta p = 3$ psi, $T_{liq} = 90°F$)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 3.5 psi $f_{\Delta p} = 0.91$
Correction factor for liquid tempereature
$f_{Tliq} = 0.92$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} = 130 \times 0.91 \times 0.92 = 109$ TR

From the capacity table a ICM 20-C with Q_n capacity 134 TR is selected.

Nominal capacities

Liquid line with/without phase change

SI units

Capacity table for nominal conditions, Q_N [kW], T_{liq} = 30°C, ΔP = 0.2 bar

R 717

Type	Valve body size	K_v (m^3/h)	Evaporating temperature [°C] –50	–40	–30	–20	–10	0	10	20
ICM20-A	20	0.6	59.5	60.5	61.4	62.2	62.9	63.4	63.9	64.2
ICM20-B		2.4	238	242	245	249	251	254	256	257
ICM20-C		4.6	457	464	471	477	482	486	490	493
ICM25-A	25	6	595	605	614	622	629	634	639	642
ICM25-B		12	1191	1210	1227	1243	1257	1269	1278	1285
ICM32-A	32	9	893	907	921	933	943	952	959	964
ICM32-B		17	1687	1714	1739	1761	1781	1797	1811	1820
ICM40-A	40	15	1489	1512	1534	1554	1571	1586	1598	1606
ICM40-B		26	2580	2622	2659	2694	2724	2749	2769	2784
ICM50-A	50	23	2283	2319	2353	2383	2409	2432	2450	2463
ICM50-B		40	3970	4033	4091	4145	4190	4229	4260	4283
ICM65-B	65	70	6947	7058	7160	7253	7333	7401	7455	7495

Correction factor for ΔP ($f_{ΔP}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], T_{liq} = 90°F, ΔP = 3 psi

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F] -60	-40	-20	0	20	40	60	80
ICM20-A	20	0.7	17.1	17.4	17.7	17.9	18.1	18.3	18.4	18.5
ICM20-B		2.8	68.3	69.5	70.7	71.7	72.5	73.2	73.7	74.0
ICM20-C		5.3	129	132	134	136	137	139	140	140
ICM25-A	25	7	171	174	177	179	181	183	184	185
ICM25-B		14	342	348	353	358	363	366	369	370
ICM32-A	32	10	244	248	252	256	259	261	263	264
ICM32-B		20	488	497	505	512	518	523	527	529
ICM40-A	40	17	415	422	429	435	440	445	448	450
ICM40-B		30	732	745	757	768	777	784	790	793
ICM50-A	50	27	659	670	681	691	699	706	711	714
ICM50-B		46	1122	1142	1161	1177	1191	1203	1211	1216
ICM65-B	65	81	1976	2011	2044	2073	2098	2118	2133	2142

Correction factor for ΔP ($f_{ΔP}$)

ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

Nominal capacities

Liquid line with/without phase change

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 10°C,
ΔP = 0.2 bar

R 744

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICM20-A	20	0.6	14.4	14.6	14.8	14.8	14.7	14.4	13.8	12.8
ICM20-B		2.4	57.8	58.6	59.0	59.1	58.7	57.5	55.3	51.1
ICM20-C		4.6	111	112	113	113	112	110	106	97.8
ICM25-A	25	6	144	146	148	148	147	144	138	128
ICM25-B		12	289	293	295	296	293	288	277	255
ICM32-A	32	9	217	220	221	222	220	216	207	191
ICM32-B		17	409	415	418	419	416	408	392	362
ICM40-A	40	15	361	366	369	369	367	360	346	319
ICM40-B		26	626	634	640	640	636	623	599	553
ICM50-A	50	23	554	561	566	566	562	551	530	489
ICM50-B		40	963	976	984	985	978	959	922	851
ICM65-B	65	70	1685	1708	1722	1724	1711	1678	1613	1489

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.52
–10°C	0.67
0°C	0.91
10°C	**1.00**
15°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 50°F,
ΔP = 3 psi

R 744

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]						
			–60	–40	–20	0	20	40	60
ICM20-A	20	0.7	4.2	4.2	4.3	4.3	4.2	4.1	3.9
ICM20-B		2.8	16.7	17.0	17.1	17.1	16.9	16.5	15.5
ICM20-C		5.3	31.7	32.2	32.5	32.5	32.1	31.1	29.3
ICM25-A	25	7	41.8	42.5	42.9	42.9	42.3	41.1	38.7
ICM25-B		14	83.7	85.0	85.7	85.7	84.7	82.3	77.3
ICM32-A	32	10	59.8	60.7	61.2	61.2	60.5	58.8	55.2
ICM32-B		20	120	121	122	122	121	118	110
ICM40-A	40	17	102	103	104	104	103	100	94
ICM40-B		30	179	182	184	184	181	176	166
ICM50-A	50	27	161	164	165	165	163	159	149
ICM50-B		46	275	279	282	282	278	270	254
ICM65-B	65	81	484	492	496	496	490	476	448

Correction factor for ΔP ($f_{\Delta P}$)

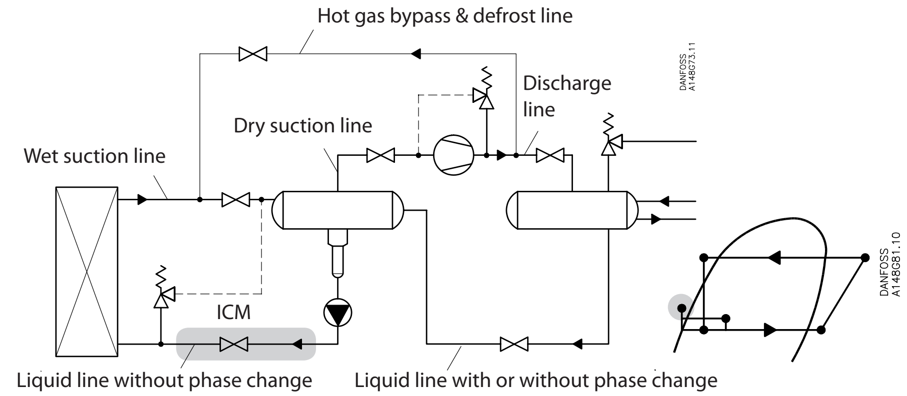
ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.48
10°F	0.64
30°F	0.88
50°F	**1.00**

Nominal capacities

Liquid line without phase change



SI units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = -20°C$
Q_o = 180 kW
Circulation rate = 3
Max. Δp = 0.3 bar
Connection: DN20

The capacity table is based on nominal condition (pressure drop Δp = 0.2 bar, circulation rate = 4)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 0.3 bar $f_{\Delta p} = 0.82$
Correction factor for circulation rate $f_{rec} = 0.75$

$Q_n = Q_o \times f_{\Delta p} \times f_{rec} = 180 \times 0.82 \times 0.75 = 111$ kW

From the capacity table a ICM 20-C with Q_n capacity 153 kW is selected.

US units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = -20°F$
Q_o = 130 TR
Circulation rate = 3
Max. Δp = 3.5 psi
Connection: $1^1/_4$"

The capacity table is based on nominal condition (pressure drop Δp = 3 psi, circulation rate = 4)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 3.5 psi $f_{\Delta p} = 0.91$
Correction factor for circulation rate $f_{rec} = 0.75$

$Q_n = Q_o \times f_{\Delta p} \times f_{rec} = 130 \times 0.91 \times 0.75 = 89$ TR

From the capacity table a ICM 32-B with Q_n capacity 171 TR is selected.

Nominal capacities

Liquid line without phase change

SI units

Capacity table at nominal conditions, Q_N [kW], Circulation rate = 4, Δp = 0.2 bar

R 717

Type	Valve body size	K_v (m^3/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICM20-A	20	0.6	21.9	21.3	20.7	20.0	19.3	18.5	17.8	16.9
ICM20-B		2.4	87.6	85.2	82.7	80.0	77.1	74.2	71.0	67.8
ICM20-C		4.6	168	163	159	153	148	142	136	130
ICM25-A	25	6	219	213	207	200	193	185	178	169
ICM25-B		12	438	426	413	400	386	371	355	339
ICM32-A	32	9	329	320	310	300	289	278	266	254
ICM32-B		17	621	604	586	567	546	525	503	480
ICM40-A	40	15	548	533	517	500	482	464	444	424
ICM40-B		26	949	923	896	867	836	803	770	734
ICM50-A	50	23	840	817	793	767	739	711	681	650
ICM50-B		40	1460	1421	1378	1333	1286	1236	1184	1130
ICM65-B	65	70	2555	2486	2412	2333	2250	2163	2072	1977

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

US units

Capacity table at nominal conditions, Q_N [Tons of Refrigeration], Circulation rate = 4, Δp = 3 psi

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60	–40	–20	0	20	40	60	80
ICM20-A	20	0.7	6.4	6.2	6.0	5.8	5.5	5.3	5.0	4.8
ICM20-B		2.8	25.6	24.8	24.0	23.1	22.2	21.2	20.2	19.1
ICM20-C		5.3	48.4	46.9	45.3	43.7	41.9	40.1	38.1	36.1
ICM25-A	25	7	64.0	62.0	59.9	57.7	55.4	53.0	50.4	47.7
ICM25-B		14	128	124	120	115	111	106	101	95.4
ICM32-A	32	10	91.4	88.5	85.6	82.5	79.1	75.7	72.0	68.1
ICM32-B		20	183	177	171	165	158	151	144	136
ICM40-A	40	17	155	150	145	140	135	129	122	116
ICM40-B		30	274	266	257	247	237	227	216	204
ICM50-A	50	27	247	239	231	223	214	204	194	184
ICM50-B		46	420	407	394	379	364	348	331	313
ICM65-B	65	81	740	717	693	668	641	613	583	552

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

Nominal capacities

Liquid line without phase change

SI units

Capacity table at nominal conditions, Q_N [kW], Circulation rate = 4, Δp = 0.2 bar

R 744

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C] −50	−40	−30	−20	−10	0	10
ICM20-A	20	0.6	6.7	6.3	5.9	5.4	4.8	4.2	3.4
ICM20-B	20	2.4	27.0	25.3	23.5	21.5	19.2	16.7	13.7
ICM20-C	20	4.6	51.7	48.5	45.0	41.1	36.8	32.0	26.4
ICM25-A	25	6	67.5	63.3	58.7	53.7	48.0	41.7	34.4
ICM25-B	25	12	134.9	126.5	117.4	107.3	96.0	83.5	68.7
ICM32-A	32	9	101.2	94.9	88.1	80.5	72.0	62.6	51.6
ICM32-B	32	17	191	179	166	152	136	118	97.4
ICM40-A	40	15	169	158	147	134	120	104	85.9
ICM40-B	40	26	292	274	254	233	208	181	149
ICM50-A	50	23	259	242	225	206	184	160	132
ICM50-B	50	40	450	422	391	358	320	278	229
ICM65-B	65	70	787	738	685	626	560	487	401

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

Pressure and temp. rregulators

US units

Capacity table at nominal conditions, Q_N [Tons of Refrigeration], Circulation rate = 4, Δp = 3 psi

R 744

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F] −60	−40	−20	0	20	40	60
ICM20-A	20	0.7	2.0	1.8	1.7	1.5	1.3	1.1	0.9
ICM20-B	20	2.8	7.9	7.4	6.8	6.1	5.4	4.5	3.4
ICM20-C	20	5.3	15.0	13.9	12.8	11.6	10.1	8.5	6.5
ICM25-A	25	7	19.8	18.4	16.9	15.3	13.4	11.2	8.6
ICM25-B	25	14	39.5	36.8	33.9	30.5	26.8	22.5	17.2
ICM32-A	32	10	28.2	26.3	24.2	21.8	19.1	16.1	12.3
ICM32-B	32	20	56.4	52.6	48.4	43.6	38.3	32.1	24.6
ICM40-A	40	17	48.0	44.7	41.1	37.1	32.5	27.3	20.9
ICM40-B	40	30	84.7	78.9	72.6	65.4	57.4	48.2	37.0
ICM50-A	50	27	76.2	71.0	65.3	58.9	51.7	43.4	33.3
ICM50-B	50	46	130	121	111	100	88.0	73.9	56.7
ICM65-B	65	81	229	213	196	177	155	130	100

Correction factor for ΔP ($f_{\Delta P}$)

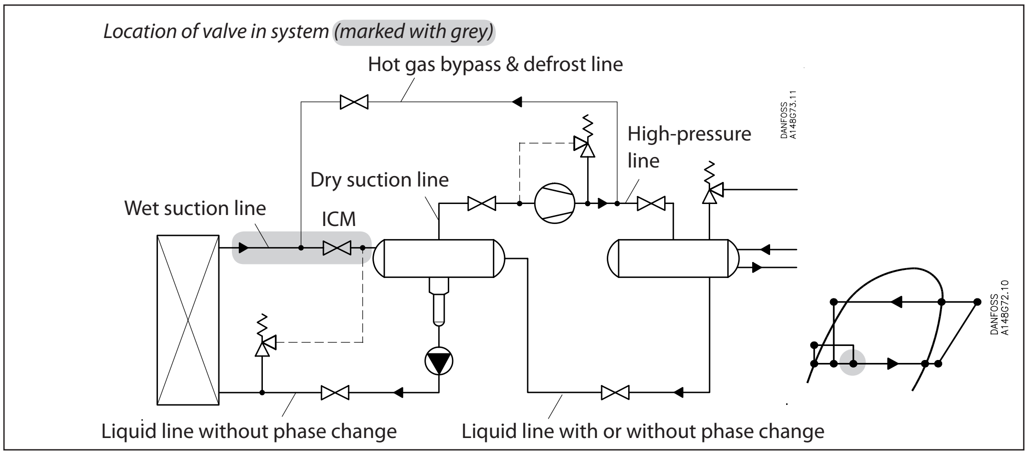
ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

Nominal capacities

Wet suction line



SI units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = -20$ C
$Q_o = 80$ kW
Circulation rate = 3
Max. $\Delta p = 0.3$ bar
Connection: DN32

The capacity table is based on nominal condition (pressure drop $\Delta p = 0.2$ bar, recirculation rate = 4)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 0.3 bar $f_{\Delta p} = 0.82$
Correction factor for circulation rate $f_{rec} = 0.9$

$Q_n = Q_o \times f_{\Delta p} \times f_{rec} = 80 \times 0.82 \times 0.9 = 59$ kW

From the capacity table a ICM 32-B with Q_n capacity 60.1 kW is selected.

US units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = -20$ F
$Q_o = 8$ TR
Circulation rate = 3
Max. $\Delta p = 3.5$ psi
Connection: 1″

The capacity table is based on nominal condition (pressure drop $\Delta p = 3$ psi, recirculation rate = 4)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 3.5 psi $f_{\Delta p} = 0.91$
Correction factor for circulation rate $f_{rec} = 0.9$

$Q_n = Q_o \times f_{\Delta p} \times f_{rec} = 8 \times 0.91 \times 0.9 = 6.6$ TR

From the capacity table a ICM 25-B with Q_n capacity 10.2 TR is selected.

Nominal capacities

SI units

Capacity table at nominal conditions, Q_N [kW], Circulation rate = 4, Δp = 0.2 bar

R 717 — Wet suction line

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICM20-A	20	0.6	0.9	1.3	1.7	2.1	2.5	3.0	3.4	3.9
ICM20-B		2.4	3.4	5.2	6.8	8.5	10.2	11.9	13.7	15.6
ICM20-C		4.6	6.6	10.0	13.1	16.3	19.5	22.9	26.4	29.9
ICM25-A	25	6	8.6	13.0	17.1	21.2	25.5	29.8	34.4	39.0
ICM25-B		12	17.2	26.0	34.2	42.4	50.9	59.7	68.7	78.0
ICM32-A	32	9	12.9	19.5	25.7	31.8	38.2	44.7	51.6	58.5
ICM32-B		17	24.4	36.8	48.5	60.1	72.1	84.5	97.4	111
ICM40-A	40	15	21.5	32.5	42.8	53.0	63.6	74.6	85.9	97.5
ICM40-B		26	37.3	56.3	74.1	91.9	110	129	149	169
ICM50-A	50	23	33.0	49.8	65.6	81.3	97.6	114	132	150
ICM50-B		40	57.4	86.6	114	141	170	199	229	260
ICM65-B	65	70	101	152	200	248	297	348	401	455

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

US units

Capacity table at nominal conditions, Q_N [Tons of Refrigeration], Circulation rate = 4, Δp = 3 psi

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60	–40	–20	0	20	40	60	80
ICM20-A	20	0.7	0.2	0.4	0.5	0.6	0.8	0.9	1.1	1.2
ICM20-B		2.8	0.9	1.5	2.0	2.6	3.1	3.7	4.3	4.9
ICM20-C		5.3	1.8	2.8	3.9	4.9	5.9	7.0	8.1	9.3
ICM25-A	25	7	2.3	3.8	5.1	6.4	7.8	9.3	10.8	12.3
ICM25-B		14	4.6	7.5	10.2	12.9	15.7	18.5	21.5	24.5
ICM32-A	32	10	3.3	5.4	7.3	9.2	11.2	13.2	15.4	17.5
ICM32-B		20	6.6	10.7	14.6	18.4	22.4	26.5	30.7	35.0
ICM40-A	40	17	5.6	9.1	12.4	15.6	19.0	22.5	26.1	29.8
ICM40-B		30	9.9	16.1	21.9	27.6	33.5	39.7	46.1	52.5
ICM50-A	50	27	8.9	14.5	19.7	24.8	30.2	35.8	41.5	47.3
ICM50-B		46	15.2	24.7	33.5	42.3	51.4	60.9	70.7	80.5
ICM65-B	65	81	26.8	43.5	59.0	74.5	90.6	107	125	142

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

Nominal capacities

Wet suction line

SI units

Capacity table at nominal conditions, Q_N [kW], Circulation rate = 4, Δp = 0.2 bar

R 744

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]						
			–50	–40	–30	–20	–10	0	10
ICM20-A	20	0.6	1.8	2.1	2.4	2.6	2.8	2.9	2.9
ICM20-B		2.4	7.3	8.4	9.4	10.4	11.2	11.7	11.8
ICM20-C		4.6	14.0	16.1	18.1	19.9	21.5	22.5	22.6
ICM25-A	25	6	18.3	21.0	23.6	26.0	28.0	29.3	29.5
ICM25-B		12	36.5	41.9	47.1	51.9	56.0	58.6	59.0
ICM32-A	32	9	27.4	31.4	35.4	39.0	42.0	44.0	44.2
ICM32-B		17	51.7	59.4	66.8	73.6	79.3	83.1	83.5
ICM40-A	40	15	45.6	52.4	58.9	64.9	70.0	73.3	73.7
ICM40-B		26	79.1	90.8	102	113	121	127	128
ICM50-A	50	23	70.0	80.3	90.4	100	107	112	113
ICM50-B		40	122	140	157	173	187	195	197
ICM65-B	65	70	213	245	275	303	327	342	344

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

US units

Capacity table at nominal conditions, Q_N [Tons of Refrigeration], Circulation rate = 4, Δp = 3 psi

R 744

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]						
			–60	–40	–20	0	20	40	60
ICM20-A	20	0.7	0.5	0.6	0.7	0.8	0.8	0.9	0.8
ICM20-B		2.8	2.1	2.4	2.8	3.1	3.3	3.4	3.3
ICM20-C		5.3	4.0	4.6	5.3	5.8	6.3	6.5	6.3
ICM25-A	25	7	5.2	6.1	7.0	7.7	8.3	8.6	8.4
ICM25-B		14	10.5	12.2	13.9	15.4	16.6	17.2	16.7
ICM32-A	32	10	7.5	8.7	9.9	11.0	11.9	12.3	11.9
ICM32-B		20	14.9	17.4	19.9	22.0	23.7	24.6	23.9
ICM40-A	40	17	12.7	14.8	16.9	18.7	20.1	20.9	20.3
ICM40-B		30	22.4	26.1	29.8	33.0	35.6	36.9	35.8
ICM50-A	50	27	20.2	23.5	26.8	29.7	32.0	33.2	32.2
ICM50-B		46	34.4	40.1	45.7	50.7	54.5	56.6	54.9
ICM65-B	65	81	60.5	70.6	80.5	89.2	96.0	100	97

Correction factor for ΔP ($f_{\Delta P}$)

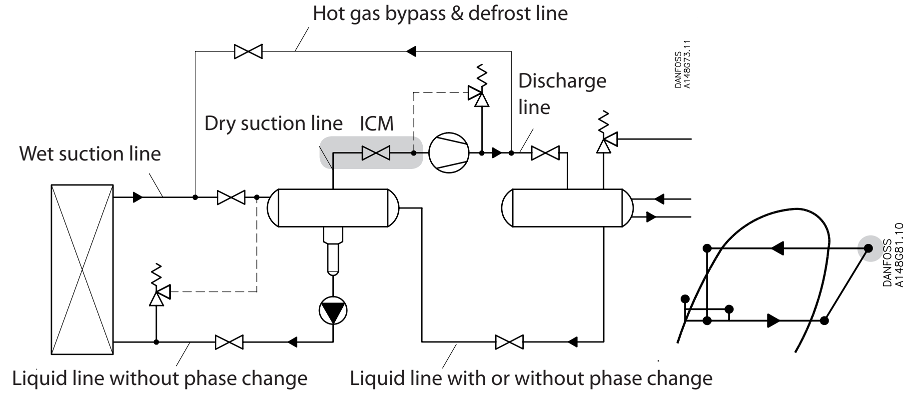
ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

Nominal capacities

Dry suction line



SI units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = -20°C$
$Q_o = 90$ kW
$T_{liq} = 10°C$
Max. $\Delta p = 0.3$ bar
Connection: DN32

The capacity table is based on nominal condition (pressure drop $\Delta p = 0.2$ bar, $T_{liq} = 30°C$)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 0.3 bar $f_{\Delta p} = 0.82$
Correction factor for liquid temperature $f_{Tliq} = 0.92$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} = 90 \times 0.82 \times 0.92 = 68$ kW

From the capacity table a ICM 32-B with Q_n capacity 92.3 kW is selected.

US units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = 0°F$
$Q_o = 20$ TR
$T_{liq} = 50°F$
Max. $\Delta p = 3.5$ psi
Connection: $1^1/_4$"

The capacity table is based on nominal condition ($\Delta p = 3$ psi, $T_{liq} = 90°F$)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 3.5 psi $f_{\Delta p} = 0.91$
Correction factor for liquid temperature $f_{Tliq} = 0.92$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} = 20 \times 0.91 \times 0.92 = 16.7$ TR

From the capacity table a ICM 32-B with Q_n capacity 28.2 TR is selected.

Nominal capacities

SI units

Capacity table at nominal conditions, Q_N [kW],
T_{liq} = 30°C,
Δp = 0.2 bar
Superheating = 8°C

Dry suction line

R 717

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICM20-A	20	0.6	1.6	2.0	2.6	3.3	4.0	4.9	5.9	6.9
ICM20-B		2.4	6.2	8.0	10.3	13.0	16.1	19.5	23.4	27.7
ICM20-C		4.6	11.9	15.3	19.8	25.0	30.9	37.5	44.9	53.0
ICM25-A	25	6	15.5	20.0	25.8	32.6	40.3	48.9	58.5	69.2
ICM25-B		12	31.0	40.0	51.6	65.1	80.6	97.7	117	138
ICM32-A	32	9	23.3	30.0	38.7	48.9	60.4	73.3	87.8	104
ICM32-B		17	44.0	56.7	73.1	92.3	114	138	166	196
ICM40-A	40	15	38.8	50.0	64.5	81.4	101	122	146	173
ICM40-B		26	67.2	86.7	112	141	175	212	254	300
ICM50-A	50	23	59.5	76.7	98.9	125	154	187	224	265
ICM50-B		40	103	133	172	217	269	326	390	461
ICM65-B	65	70	181	234	301	380	470	570	683	807

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

US units

Capacity table at nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
Δp = 3 psi
Superheating = 12°F

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60	–40	–20	0	20	40	60	80
ICM20-A	20	0.7	0.5	0.6	0.8	1.0	1.2	1.5	1.9	2.2
ICM20-B		2.8	1.9	2.3	3.1	3.9	5.0	6.1	7.4	8.8
ICM20-C		5.3	3.5	4.4	5.8	7.5	9.4	11.6	14.0	16.8
ICM25-A	25	7	4.7	5.8	7.6	9.9	12.4	15.3	18.5	22.1
ICM25-B		14	9.3	11.6	15.3	19.7	24.8	30.6	37.1	44.2
ICM32-A	32	10	6.7	8.3	10.9	14.1	17.7	21.9	26.5	31.6
ICM32-B		20	13.3	16.5	21.9	28.2	35.5	43.8	53.0	63.2
ICM40-A	40	17	11.3	14.0	18.6	23.9	30.1	37.2	45.0	53.7
ICM40-B		30	20.0	24.8	32.8	42.3	53.2	65.6	79.4	94.8
ICM50-A	50	27	18.0	22.3	29.5	38.0	47.9	59.1	71.5	85.3
ICM50-B		46	30.7	38.0	50.3	64.8	81.6	101	122	145
ICM65-B	65	81	54.0	66.9	88.5	114	144	177	215	256

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for superheat (T_S)

T_s	Correction factor
10°F	1.00
14°F	1.00
18°F	1.00
20°F	1.00

Nominal capacities

Dry suction line

SI units

Capacity table at nominal conditions, Q_N [kW],
T_{liq} = 10°C,
Δp = 0.2 bar
Superheating = 8°C

R 744

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C] –50	–40	–30	–20	–10	0	10
ICM20-A	20	0.6	2.1	2.6	3.1	3.7	4.3	4.9	5.6
ICM20-B		2.4	8.4	10.3	12.4	14.6	17.1	19.6	22.3
ICM20-C		4.6	16.1	19.7	23.7	28.1	32.7	37.7	42.8
ICM25-A	25	6	21.0	25.8	30.9	36.6	42.7	49.1	55.8
ICM25-B		12	42.1	51.5	61.9	73.2	85.4	98.2	112
ICM32-A	32	9	31.6	38.6	46.4	54.9	64.0	73.7	83.7
ICM32-B		17	59.6	73.0	87.7	104	121	139	158
ICM40-A	40	15	52.6	64.4	77.4	91.5	107	123	140
ICM40-B		26	91.2	112	134	159	185	213	242
ICM50-A	50	23	80.7	98.7	119	140	164	188	214
ICM50-B		40	140	172	206	244	285	327	372
ICM65-B	65	70	246	301	361	427	498	573	651

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.52
–10°C	0.67
0°C	0.91
10°C	**1.00**
15°C	1.09

US units

Capacity table at nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 50°F,
Δp = 3 psi
Superheating = 12°F

R 744

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F] –60	–40	–20	0	20	40	60
ICM20-A	20	0.7	0.6	0.7	0.9	1.1	1.3	1.5	1.7
ICM20-B		2.8	2.4	3.0	3.7	4.4	5.2	6.0	6.9
ICM20-C		5.3	4.5	5.7	6.9	8.3	9.8	11.4	13.0
ICM25-A	25	7	6.0	7.5	9.1	11.0	13.0	15.1	17.2
ICM25-B		14	11.9	14.9	18.3	22.0	26.0	30.2	34.5
ICM32-A	32	10	8.5	10.7	13.1	15.7	18.5	21.5	24.6
ICM32-B		20	17.0	21.3	26.1	31.4	37.1	43.1	49.2
ICM40-A	40	17	14.5	18.1	22.2	26.7	31.5	36.6	41.8
ICM40-B		30	25.5	32.0	39.2	47.1	55.6	64.6	73.9
ICM50-A	50	27	23.0	28.8	35.3	42.4	50.1	58.2	66.5
ICM50-B		46	39.1	49.1	60.1	72.2	85.3	99.1	113
ICM65-B	65	81	68.9	86.4	106	127	150	175	199

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for superheat (T_S)

T_s	Correction factor
10°F	1.00
14°F	1.00
18°F	1.00
20°F	1.00

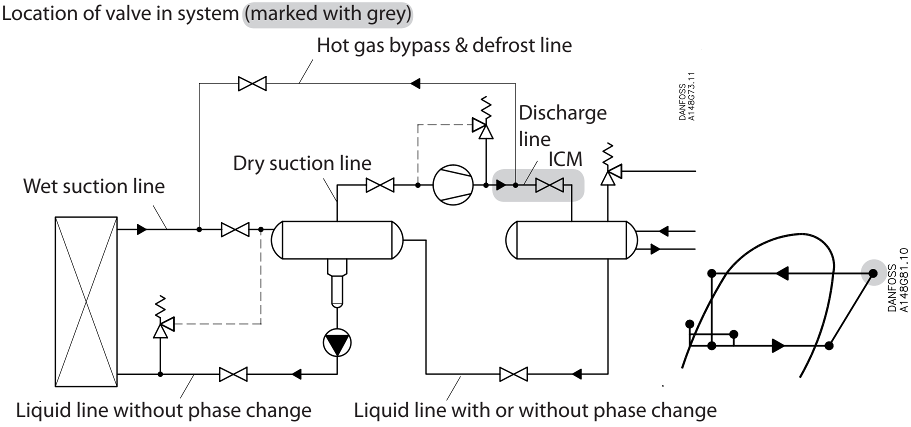
Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.48
10°F	0.64
30°F	0.88
50°F	**1.00**

Pressure and temp. rregulators

Nominal capacities

Discharge line



SI units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = -20°C$
$Q_o = 90$ kW
$T_{liq} = 10°C$
Max. $\Delta p = 0.4$ bar
$T_{disch.} = 60°C$
Connection: DN25

The capacity table is based on nominal condition ($\Delta p = 0.2$ bar, $T_{liq} = 30°C$, $P_{disch.} = 12$ bar, $T_{disch.} = 80°C$)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 0.4 bar $f_{\Delta p} = 0.72$
Correction factor for liquid temperature $f_{Tliq} = 0.92$
Correction factor for $T_{disch.}$ 60°C, $f_{disch.} = 0.97$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} \times f_{Tdisch.} =$
$90 \times 0.72 \times 0.92 \times 0.97 = 58$ kW

From the capacity table a ICM 25-A with Q_n capacity 73.2 kW is selected.

US units

Calculation example (R717 capacities):

An application has following running conditions:

$T_e = 0°F$
$Q_o = 8$ TR
$T_{liq} = 50°F$
Max. $\Delta p = 4.5$ psi
$T_{disch.} = 120°F$
Connection: $^3/_4$"

The capacity table is based on nominal condition ($\Delta p = 3$ psi, $T_{liq} = 90°F$, $P_{disch.} = 185$ psi, $T_{disch.} = 180°F$)

Therefore the actual capacity must be corrected to nominal condition by means of correction factors.
Correction factor for Δp 4.5 psi $f_{\Delta p} = 0.81$
Correction factor for liquid temperature $f_{Tliq} = 0.92$
Correction factor for $T_{disch.}$ 120°F, $f_{disch.} = 0.95$

$Q_n = Q_o \times f_{\Delta p} \times f_{Tliq} \times f_{Tdisch.} =$
$8 \times 0.81 \times 0.92 \times 0.95 = 5.7$ TR

From the capacity table a ICM 20-B with Q_n capacity 8.4 TR is selected.

Nominal capacities

Discharge line

SI units

Capacity table at nominal conditions, Q_N [kW],
T_{liq} = 30°C,
Δp = 0.2 bar,
$P_{disch.}$ = 12 bar,
$T_{disch.}$ = 80°C
Superheating = 8°C

R 717

Type	Valve body size	K_v (m³/h)	Evaporating temperature [°C]							
			–50	–40	–30	–20	–10	0	10	20
ICM20-A	20	0.6	7.0	7.1	7.2	7.3	7.4	7.5	7.5	7.6
ICM20-B	20	2.4	28.0	28.5	28.9	29.3	29.6	29.9	30.1	30.3
ICM20-C	20	4.6	53.7	54.5	55.4	56.1	56.8	57.3	57.8	58.1
ICM25-A	25	6	70.0	71.1	72.3	73.2	74.1	74.7	75.3	75.8
ICM25-B	25	12	140	142	145	146	148	149	151	152
ICM32-A	32	9	105	107	108	110	111	112	113	114
ICM32-B	32	17	198	202	205	207	210	212	213	215
ICM40-A	40	15	175	178	181	183	185	187	188	189
ICM40-B	40	26	303	308	313	317	321	324	326	328
ICM50-A	50	23	268	273	277	281	284	287	289	290
ICM50-B	50	40	467	474	482	488	494	498	502	505
ICM65-B	65	70	817	830	843	854	864	872	879	884

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
50°C	0.96
60°C	0.97
80°C	**1.00**
90°C	1.01
100°C	1.03
110°C	1.04
120°C	1.06

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

US units

Capacity table at nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
Δp = 2.9 psi,
$P_{disch.}$ = 185 psi,
$T_{disch.}$ = 180°F
Superheating = 12°F

R 717

Type	Valve body size	C_v (USgal/min)	Evaporating temperature [°F]							
			–60	–40	–20	0	20	40	60	80
ICM20-A	20	0.7	2.0	2.0	2.1	2.1	2.1	2.2	2.2	2.2
ICM20-B	20	2.8	8.0	8.2	8.3	8.4	8.5	8.6	8.7	8.7
ICM20-C	20	5.3	15.2	15.4	15.7	15.9	16.1	16.3	16.4	16.5
ICM25-A	25	7	20.0	20.4	20.7	21.0	21.3	21.5	21.7	21.8
ICM25-B	25	14	40.1	40.8	41.5	42.0	42.6	43.0	43.4	43.6
ICM32-A	32	10	28.6	29.1	29.6	30.0	30.4	30.7	31.0	31.2
ICM32-B	32	20	57.3	58.3	59.3	60.0	60.9	61.5	62.0	62.3
ICM40-A	40	17	48.7	49.5	50.4	51.0	51.7	52.3	52.7	53.0
ICM40-B	40	30	85.9	87.4	88.9	90.0	91.3	92.2	93.0	93.5
ICM50-A	50	27	77.3	78.7	80.0	81.0	82.2	83.0	83.7	84.2
ICM50-B	50	46	132	134	136	138	140	141	143	143
ICM65-B	65	81	232	236	240	243	247	249	251	253

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
120°F	0.95
140°F	0.97
180°F	**1.00**
200°F	1.02
210°F	1.02
230°F	1.04
250°F	1.05

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

Nominal capacities

Discharge line

SI units

Capacity table at nominal conditions, Q_N [kW],
T_{liq} = 10°C,
Δp = 0.2 bar,
$P_{disch.}$ = 10 bar,
$T_{disch.}$ = 80°C
Superheating = 8°C

R 744

Type	Valve body size	K_v (m^3/h)	Evaporating temperature [°C]						
			–50	–40	–30	–20	–10	0	10
ICM20-A	20	0.6	4.4	4.5	4.5	4.6	4.6	4.5	4.4
ICM20-B		2.4	17.7	17.9	18.1	18.2	18.2	18.0	17.7
ICM20-C		4.6	33.8	34.4	34.8	34.9	34.9	34.6	33.9
ICM25-A	25	6	44.1	44.8	45.3	45.5	45.5	45.1	44.2
ICM25-B		12	88.3	89.7	90.7	91.0	91.0	90.2	88.5
ICM32-A	32	9	66.2	67.2	68.0	68.3	68.3	67.6	66.3
ICM32-B		17	125	127	128	129	129	128	125
ICM40-A	40	15	110	112	113	114	114	113	111
ICM40-B		26	191	194	196	197	197	195	192
ICM50-A	50	23	169	172	174	174	174	173	170
ICM50-B		40	294	299	302	303	303	301	295
ICM65-B	65	70	515	523	529	531	531	526	516

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.05	2.00
0.1	1.41
0.2	**1.00**
0.3	0.82
0.4	0.71
0.5	0.63

Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
50°C	0.96
60°C	0.97
80°C	**1.00**
90°C	1.01
100°C	1.03
110°C	1.04
120°C	1.06

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.52
–10°C	0.67
0°C	0.91
10°C	**1.00**
15°C	1.09

US units

Capacity table at nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
Δp = 3 psi,
$P_{disch.}$ = 120 psi,
$T_{disch.}$ = 180°F
Superheating = 12°F

R 744

Type	Valve body size	C_v (USgal/ min)	Evaporating temperature [°F]						
			–60	–40	–20	0	20	40	60
ICM20-A	20	0.7	1.2	1.3	1.3	1.3	1.3	1.2	1.2
ICM20-B		2.8	4.9	5.0	5.1	5.1	5.1	5.0	5.0
ICM20-C		5.3	9.3	9.5	9.6	9.7	9.6	9.5	9.5
ICM25-A	25	7	12.3	12.6	12.7	12.8	12.7	12.5	12.5
ICM25-B		14	24.7	25.1	25.4	25.5	25.4	25.0	25.0
ICM32-A	32	10	17.6	18.0	18.1	18.2	18.1	17.8	17.8
ICM32-B		20	35.3	35.9	36.3	36.5	36.3	35.7	35.7
ICM40-A	40	17	30.0	30.5	30.9	31.0	30.9	30.3	30.3
ICM40-B		30	52.9	53.9	54.4	54.7	54.4	53.5	53.5
ICM50-A	50	27	47.6	48.5	49.0	49.2	49.0	48.2	48.2
ICM50-B		46	81.1	82.6	83.5	83.9	83.5	82.1	82.1
ICM65-B	65	81	143	145	147	148	147	145	145

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
0.75	1.97
1.5	1.39
3	**1.00**
3.5	0.91
4	0.85
4.5	0.81

Correction factor for discharge temperature (T_{disch}).

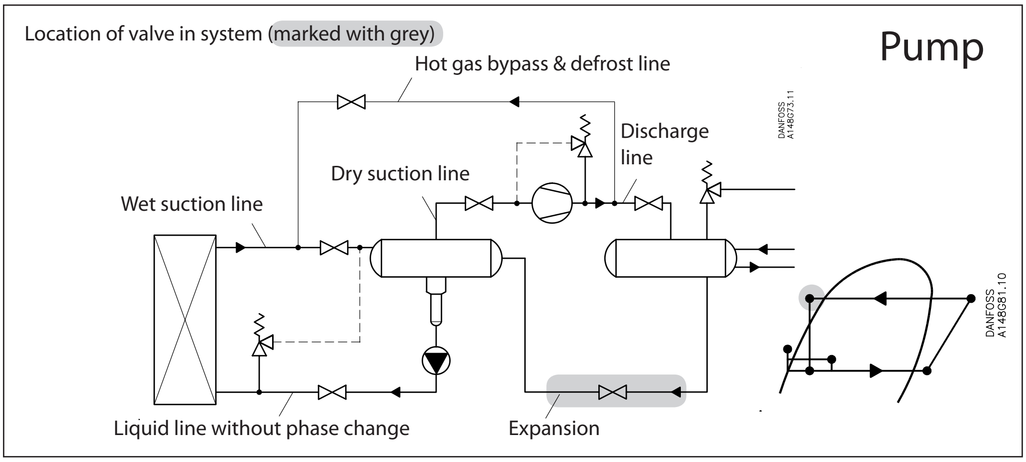
Discharge temperature	Correction factor
120°F	0.95
140°F	0.97
180°F	**1.00**
200°F	1.02
210°F	1.02
230°F	1.04
250°F	1.05

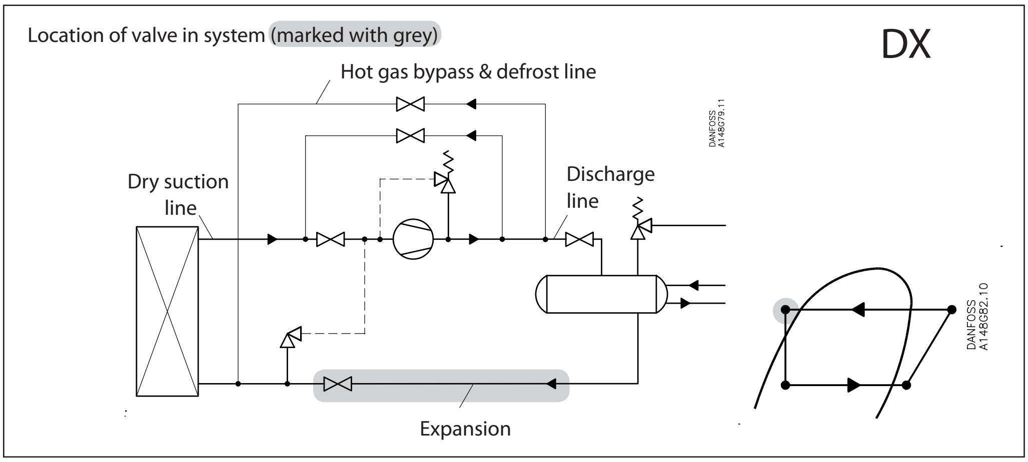
Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–10°F	0.48
10°F	0.64
30°F	0.88
50°F	**1.00**

Nominal capacities

Expansion - ICM





Correction factors
When dimensioning, multiply the evaporator capacity by a correction factor k dependent on the subcooling Δt_{sub} just ahead of the valve.
The corrected capacity* can then be found in the capacity table.

Correction factors for subcooling

Subcooling K	2	4	10	15	20	25	30	35	40
R717	1.01	1	0.98	0.96	0.94	0.92	0.91	0.89	0.87
R744	1.02	1	0.95	0.90	0.86	0.82	0.79	0.75	0.73

* The capacity table is based on nominal conditions of subcooling just ahead of the valve of 4°K.

Calculation example:
An application has the following operating conditions:

Refrigerant R717
$T_e = -10°C$
$T_c = +30°C$
$Q_0 = 1500$ kW
$\Delta t_{sub} = 20°K$

Correction factor for subcooling: 0.94

Pressure drop across the valve:
11.7 bar - 2.9 bar = 8.8 bar

Corrected capacity: 1500 x 0.94 = 1410 kW

From the R717 capacity table ICM 20-C is selected with Q_{nom} capacity 1990 kW at 8 bar.

Expansion

Capacities for nominal conditions, Q_n (kW)

R 717

Type			Pressure drop across valve Δp bar						Pressure drop across valve Δp bar					
			1	2	4	8	12	16	1	2	4	8	12	16
			Evaporating temperature 10°C						**Evaporating temperature 0°C**					
ICM20-A	DN20	0.6	85.9	119	163	217	253	279	90	123	167	221	256	282
ICM20-B	DN20	2.4	498	686	930	1230	1435	1587	515	705	950	1245	1450	1594
ICM20-C	DN20	4.6	824	1124	1507	1990	2310	2550	850	1145	1525	2000	2320	2560
ICM25-A	DN25	6	1274	1739	2337	3080	3575	3970	1310	1773	2370	3100	3600	3980
ICM32-A	DN32	9	1834	2515	3400	4490	5220	5775	1890	2580	3450	4530	5250	5790
ICM40-A	DN40	15	3410	4630	6200	8150	9450	10450	3500	4700	6250	8170	9480	10450
ICM50-A	DN50	23	5960	8050	10750	14100	16300	18100	6100	8150	10800	14100	16300	18100
			Evaporating temperature –10°C						**Evaporating temperature –20°C**					
ICM20-A	DN20	0.6	92	127	170	224	258	284	94.5	129	172	225	258	284
ICM20-B	DN20	2.4	527	715	955	1253	1452	1594	535	718	957	1250	1450	1594
ICM20-C	DN20	4.6	859	1152	1520	1990	2310	2550	860	1140	1505	1975	2290	2525
ICM25-A	DN25	6	1332	1780	2360	3090	3590	3960	1332	1770	2345	3070	3570	3940
ICM32-A	DN32	9	1930	2600	3450	4520	5240	5780	1935	2590	3440	4510	5220	5750
ICM40-A	DN40	15	3550	4715	6220	8140	9450	10430	3520	4650	6140	8050	9350	10350
ICM50-A	DN50	23	6150	8150	10700	14000	16300	18000	6070	8000	10550	13850	16100	17800
			Evaporating temperature –30°C						**Evaporating temperature –40°C**					
ICM20-A	DN20	0.6	96	130	173	225	258	282	97	131	173	224	256	280
ICM20-B	DN20	2.4	532	716	950	1240	1435	1580	527	705	940	1230	1420	1555
ICM20-C	DN20	4.6	840	1111	1480	1950	2270	2505	815	1085	1450	1920	2230	2470
ICM25-A	DN25	6	1310	1740	2310	3030	3530	3880	1270	1690	2270	2990	3480	3830
ICM32-A	DN32	9	1920	2560	3400	4460	5150	5700	1870	2500	3350	4400	5100	5630
ICM40-A	DN40	15	3430	4530	6030	7950	9250	10200	3300	4400	5900	7820	9120	10100
ICM50-A	DN50	23	5900	7800	10350	13650	15900	17600	5670	7550	10150	13400	15700	17400
			Evaporating temperature –50°C											
ICM20-A	DN20	0.6	97.5	131	172	222	253	276						
ICM20-B	DN20	2.4	512	690	925	1210	1400	1535						
ICM20-C	DN20	4.6	780	1055	1425	1890	2200	2430						
ICM25-A	DN25	6	1220	1650	2220	2950	3420	3780						
ICM32-A	DN32	9	1810	2450	3280	4325	5030	5540						
ICM40-A	DN40	15	3170	4280	5800	7710	8950	9900						
ICM50-A	DN50	23	5430	7350	9900	13200	15400	17100						

Expansion

Capacities for nominal conditions, Q_n (TR)

R 717

Type			Pressure drop across valve Δp psi						Pressure drop across valve Δp psi					
			15	30	60	120	180	240	15	30	60	120	180	240
			Evaporating temperature 60°F						**Evaporating temperature 40°F**					
ICM20-A	DN20	0.7	24.5	33.9	46.3	61.8	72	79.3	25.3	35	47.6	63	73	80.4
ICM20-B	DN20	2.8	142	196	265	352	410	451	147	201	271	358	415	458
ICM20-C	DN20	5.3	235	321	432	570	660	730	243	328	438	574	665	735
ICM25-A	DN25	7	363	497	670	880	1025	1130	375	510	680	888	1030	1140
ICM32-A	DN32	10	523	720	970	1280	1490	1645	539	735	985	1294	1500	1655
ICM40-A	DN40	17	975	1325	1780	2330	2705	3000	1000	1350	1800	2344	2715	3010
ICM50-A	DN50	27	1695	2310	3070	4030	4690	5170	1745	2350	3100	4050	4700	5200
			Evaporating temperature 20°F						**Evaporating temperature 0°F**					
ICM20-A	DN20	0.7	26.3	36.2	48.8	64	74	81.4	27.1	37	49.5	64.5	74.3	81.5
ICM20-B	DN20	2.8	151	206	275	360	416	459	154	207	276	360	416	458
ICM20-C	DN20	5.3	248	332	439	574	665	734	249	330	435	570	660	728
ICM25-A	DN25	7	383	515	681	888	1030	1135	385	513	678	884	1025	1130
ICM32-A	DN32	10	553	746	993	1299	1510	1657	560	747	990	1293	1500	1650
ICM40-A	DN40	17	1020	1360	1795	2346	2715	3005	1022	1345	1775	2325	2700	2970
ICM50-A	DN50	27	1770	2350	3100	4040	4680	5170	1770	2320	3050	4000	4650	5130
			Evaporating temperature –20°F						**Evaporating temperature –40°F**					
ICM20-A	DN20	0.7	27.7	37.5	50	64.5	74	81	28	37.8	50	64.3	73.5	79.9
ICM20-B	DN20	2.8	154	206	274	357	413	454	152	203	270	353	408	446
ICM20-C	DN20	5.3	244	323	428	560	653	720	235	313	418	553	642	710
ICM25-A	DN25	7	380	503	665	875	1015	1120	366	488	653	860	1000	1100
ICM32-A	DN32	10	555	740	978	1285	1485	1635	540	723	965	1265	1465	1610
ICM40-A	DN40	17	995	1315	1740	2290	2660	2945	955	1270	1700	2250	2615	2900
ICM50-A	DN50	27	1720	2255	2985	3930	4570	5050	1640	2180	2920	3870	4500	4990
			Evaporating temperature –60°F											
ICM20-A	DN20	0.7	28.1	37.6	49.5	63.7	72.5	79						
ICM20-B	DN20	2.8	147	199	266	347	400	440						
ICM20-C	DN20	5.3	225	304	410	544	630	695						
ICM25-A	DN25	7	352	475	640	845	980	1080						
ICM32-A	DN32	10	520	703	943	1246	1440	1585						
ICM40-A	DN40	17	910	1230	1660	2210	2570	2850						
ICM50-A	DN50	27	1560	2110	2850	3800	4430	4900						

Expansion

Capacities for nominal conditions, Q_n (kW)

R 744

Type			Pressure drop across valve Δp bar 1	2	4	8	12	16
			Evaporating temperature 10°C					
ICM20-A	DN20	0.6	18.7	26.2	36.1	48.3	56	61
ICM20-B	DN20	2.4	109	152	209	280	324	353
ICM20-C	DN20	4.6	180	251	347	465	535	583
ICM25-A	DN25	6	277	389	535	718	826	900
ICM32-A	DN32	9	400	560	770	1030	1190	1300
ICM40-A	DN40	15	743	1040	1435	1920	2215	2400
ICM50-A	DN50	23	1295	1810	2500	3340	3850	4180
			Evaporating temperature –10°C					
ICM20-A	DN20	0.6	24.7	34.5	47.5	63.6	74	81
ICM20-B	DN20	2.4	143	200	275	368	428	470
ICM20-C	DN20	4.6	238	331	455	608	705	770
ICM25-A	DN25	6	368	513	705	940	1090	1195
ICM32-A	DN32	9	528	735	1015	1355	1570	1720
ICM40-A	DN40	15	980	1370	1880	2510	2910	3180
ICM50-A	DN50	23	1710	2380	3280	4380	5050	5550
			Evaporating temperature –30°C					
ICM20-A	DN20	0.6	29.7	41	56.3	75	86.8	95
ICM20-B	DN20	2.4	172	238	325	432	500	545
ICM20-C	DN20	4.6	285	395	536	710	820	895
ICM25-A	DN25	6	440	610	828	1100	1270	1380
ICM32-A	DN32	9	632	880	1195	1585	1830	2000
ICM40-A	DN40	15	1175	1630	2220	2920	3370	3680
ICM50-A	DN50	23	2050	2850	3850	5080	5850	6400
			Evaporating temperature –50°C					
ICM20-A	DN20	0.6	33.3	46	62.5	82.5	94.8	103
ICM20-B	DN20	2.4	193	266	359	472	540	588
ICM20-C	DN20	4.6	319	438	587	765	880	955
ICM25-A	DN25	6	494	678	910	1190	1360	1480
ICM32-A	DN32	9	710	980	1320	1720	1980	2155
ICM40-A	DN40	15	1320	1810	2420	3150	3610	3940
ICM50-A	DN50	23	2300	3150	4210	5450	6250	6800

Pressure drop across valve Δp bar 1	2	4	8	12	16
Evaporating temperature 0°C					
22.4	31	42.5	56.8	66	72
130	179	246	329	381	417
215	297	408	542	630	686
333	460	630	838	975	1065
478	660	905	1210	1400	1530
890	1230	1680	2250	2600	2830
1550	2140	2940	3900	4530	4750
Evaporating temperature –20°C					
27.1	37.8	52	69.6	81	88.5
157	219	302	402	468	512
260	363	497	665	770	840
402	563	770	1025	1190	1300
580	810	1110	1480	1715	1880
1075	1500	2060	2740	3160	3470
1870	2620	3580	4750	5500	6030
Evaporating temperature –40°C					
32.1	44	60	79	91.2	99.5
186	256	345	455	525	571
308	422	570	745	855	930
478	655	880	1155	1325	1444
685	940	1270	1670	1915	2090
1275	1750	2350	3060	3530	3830
2220	3050	4080	5330	6100	6650

Pressure and temp. rregulators

Expansion

Capacities for nominal conditions, Q_n (TR)

R 744

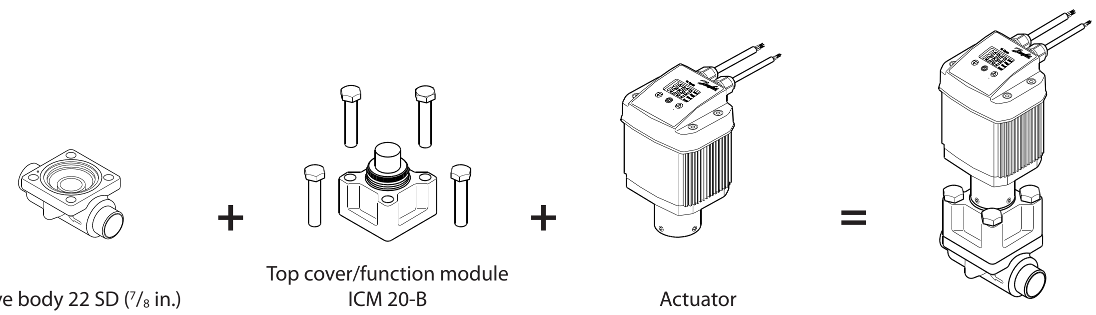
Type			Pressure drop across valve Δp psi 15	30	60	120	180	240
			Evaporating temperature 60°F					
ICM20-A	DN20	0.7	4.8	6.7	9.2	12.3	14.2	15.3
ICM20-B	DN20	2.8	27.8	39	53.7	71.5	82	88.8
ICM20-C	DN20	5.3	46	64.5	89	118	136	146
ICM25-A	DN25	7	71.1	100	137	183	210	226
ICM32-A	DN32	10	102	144	198	264	303	327
ICM40-A	DN40	17	191	267	368	490	561	605
ICM50-A	DN50	27	332	465	640	855	976	1055
			Evaporating temperature 20°F					
ICM20-A	DN20	0.7	6.8	9.6	13.2	17.7	20.5	22.4
ICM20-B	DN20	2.8	39.9	55.7	76.5	102	118	130
ICM20-C	DN20	5.3	66	92	126	169	195	214
ICM25-A	DN25	7	102	142	196	261	303	330
ICM32-A	DN32	10	147	205	281	376	437	476
ICM40-A	DN40	17	273	381	524	699	805	880
ICM50-A	DN50	27	475	663	910	1215	1400	1535
			Evaporating temperature –20°F					
ICM20-A	DN20	0.7	8.4	11.7	16	21.4	24.7	27
ICM20-B	DN20	2.8	48.9	68	93	123	142	155
ICM20-C	DN20	5.3	81	112	153	203	233	255
ICM25-A	DN25	7	125	174	237	313	362	395
ICM32-A	DN32	10	180	250	341	453	523	570
ICM40-A	DN40	17	335	464	633	835	960	1050
ICM50-A	DN50	27	584	810	1100	1450	1670	1820
			Evaporating temperature –60°F					
ICM20-A	DN20	0.7	9.6	13.3	18.1	23.7	27.3	29.5
ICM20-B	DN20	2.8	56	77	104	136	156	169
ICM20-C	DN20	5.3	92.8	127	170	221	253	275
ICM25-A	DN25	7	143	197	263	342	391	425
ICM32-A	DN32	10	206	284	380	496	568	618
ICM40-A	DN40	17	383	524	700	907	1040	1130
ICM50-A	DN50	27	667	915	1215	1570	1800	1950

Pressure drop across valve Δp psi 15	30	60	120	180	240
Evaporating temperature 40°C					
5.8	8.2	11.3	15.2	17.6	19.2
33.9	47.6	66	88.3	102	111
56	79	109	146	169	184
87	122	169	226	261	285
125	176	242	325	376	410
232	326	450	603	699	760
405	570	785	1050	1215	1320
Evaporating temperature 0°C					
7.7	10.7	14.7	19.7	22.8	25
44.7	62.3	85.5	114	132	144
74.3	103	141	188	217	237
115	159	218	290	335	367
165	230	315	418	485	528
307	426	585	775	895	975
535	745	1015	1350	1555	1700
Evaporating temperature –40°C					
9.1	12.6	17.2	22.7	26.2	28.5
53	73.3	99	131	150	164
87.8	121	163	214	245	267
135	187	253	331	380	414
195	270	365	480	549	600
362	500	675	878	1010	1100
633	870	1170	1530	1750	1900

ICM 20 / ICAD 600

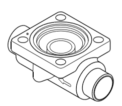
Ordering from the parts programme

Example (select from table I, II and III)



Valve body 22 SD ($^7/_8$ in.)	Top cover/function module ICM 20-B	Actuator
027H1154	**027H1181**	**027H1200**
Table I	***Table II***	***Table III***

ICV 20 valve body w/different connections *Table I*



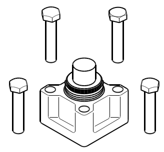
20 D ($^3/_4$ in.)	25 D (1 in.)	20 A ($^3/_4$ in.)	20 SOC ($^3/_4$ in.)
027H1145	**027H1163**	**027H1148**	**027H1151**

16 SA ($^5/_8$ in.)	22 SA ($^7/_8$ in.)	16 SD ($^5/_8$ in.)	22 SD ($^7/_8$ in.)
027H1129	**027H1160**	**027H1132**	**027H1154**

20 FPT ($^3/_4$ in.)		25 A (1 in.)	
027H1157		**027H1166**	

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ;
SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

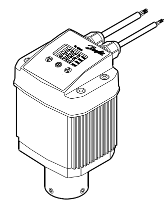
ICM 20 function module / top cover *Table II*



Description	Code Number	Code Number for Refrigerant: CO2, R22, R507 and R404A
ICM 20-A	**027H1180** *)	**027H1183** *)
ICM 20-B	**027H1181** *)	**027H1184** *)
ICM 20-C	**027H1182** *)	**027H1185** *)

*) Including gasket, bolts and O-rings

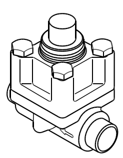
ICAD 600 actuator *Table III*



Description	Code Number
ICAD 600	**027H1200**

Ordering complete factory assembled valve without actuator

(body, function module/top cover) *Table A*



	Available connections								
	20 D ($^3/_4$ in.)	25 D (1 in.)	20 A ($^3/_4$ in.)	20 SOC ($^3/_4$ in.)	16 SA ($^5/_8$ in.)	22 SA ($^7/_8$ in.)	16 SD ($^5/_8$ in.)	22 SD ($^7/_8$ in.)	20 FPT ($^3/_4$ in.)
ICM 20-A	**027H1030**	**027H1020**	**027H1035**	**027H1040**		**027H1050**		**027H1045**	
ICM 20-B	**027H1031**	**027H1021**	**027H1036**	**027H1041**		**027H1051**		**027H1046**	
ICM 20-C	**027H1032**	**027H1022**				**027H1052**		**027H1047**	

	25 A (1 in.)
ICM 20-A	
ICM 20-B	
ICM 20-C	**027H1025**

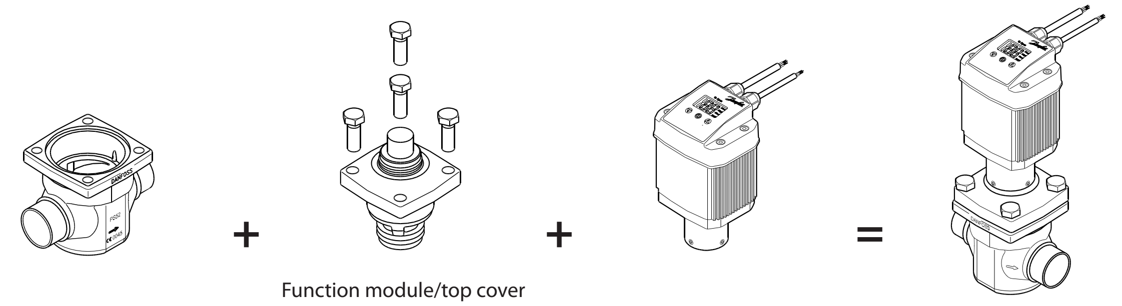
from parts programme

Please observe that if ICM is used for the refrigerants: CO2, R22, R507 or R 404A it has to be ordered from parts programme. (Valve body, Function module and Actuator)

ICM 25 / ICAD 600

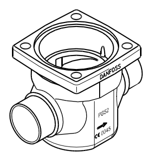
Ordering from the parts programme

Example (select from table I, II and III)



Valve body 32 D (1 1/4 in.)	Function module/top cover ICM 25-B	Actuator
027H2129	**027H2181**	**027H1200**
Table I	***Table II***	***Table III***

ICV 25 valve body w/different connections — *Table I*



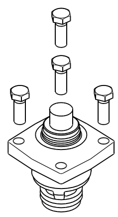
20 D (3/4 in.)	25 D (1 in.)	32 D (1 1/4 in.)	40 D (1 1/2 in.)
027H2128	**027H2120**	**027H2129**	**027H2135**

35 SD (1 3/8 in. SA)	28 SA (1 1/8 in.)	22 SA (7/8 in.)	28 SD (1 1/8 in.)
027H2134	**027H2126**	**027H2125**	**027H2124**

22 SD (7/8 in.)	20 A (3/4 in.)	25 A (1 in.)	32 A (1 1/4 in.)
027H2123	**027H2131**	**027H2121**	**027H2130**

20 SOC (3/4 in.)	25 SOC (1 in.)	20 FPT (3/4 in.)	25 FPT (1 in.)
027H2132	**027H2122**	**027H2133**	**027H2127**

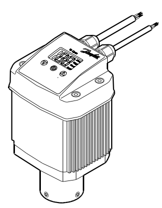
ICM 25 function module / top cover — *Table II*



Description	Code Number	Code Number for Refrigerant: CO2, R22, R507 and R404A
ICM 25-A	**027H2180** *)	**027H2183** *)
ICM 25-B	**027H2181** *)	**027H2184** *)

*) Including gasket and O-rings

ICAD 600 actuator — *Table III*



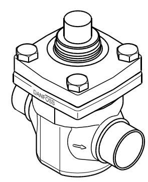
Description	Code Number
ICAD 600	**027H1200**

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Ordering complete factory assembled valve without actuator

(body, function module/top cover)

Table A



	Available connections							
	20 D (3/4 in.)	25 D (1 in.)	32 D (1 1/4 in.)	40 D (1 1/2 in.)	35 SD (1 3/8 in. SA)	28 SA (1 1/8 in.)	22 SA (7/8 in.)	28 SD (1 1/8 in.)
ICM 25-A		**027H2000**		**027H2016**	**027H2014**	**027H2012**	**027H2010**	**027H2008**
ICM 25-B		**027H2001**			**027H2015**	**027H2013**	**027H2011**	**027H2009**

	22 SD (7/8 in.)	20 A (3/4 in.)	25 A (1 in.)	32 A (1 1/4 in.)	20 SOC (3/4 in.)	25 SOC (1 in.)	20 FPT (3/4 in.)	25 FPT (1 in.)
ICM 25-A	**027H2006**		**027H2002**			**027H2004**		
ICM 25-B	**027H2007**		**027H2003**			**027H2005**		

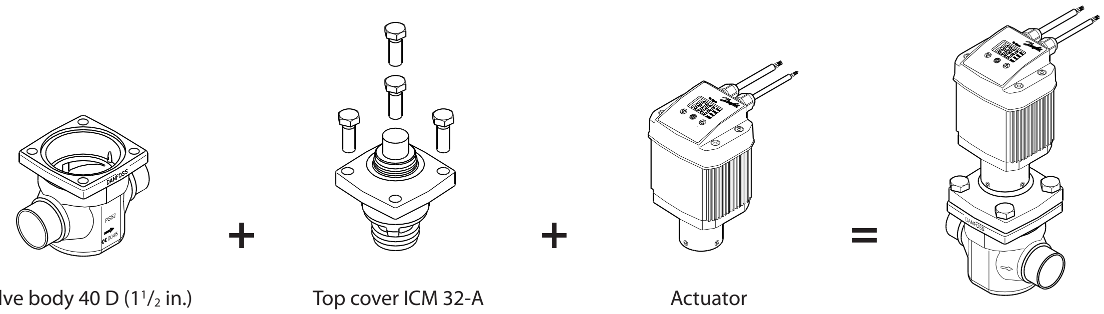
(shaded) Select from parts programme

Please observe that if ICM is used for the refrigerants: CO2, R22, R507 or R 404A it has to be ordered from parts programme. (Valve body, Function module and Actuator)

ICM 32 / ICAD 600

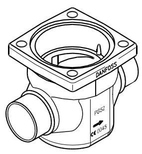
Ordering from the parts programme

Example (select from table I, II and III)



Valve body 40 D (1 1/2 in.)	Top cover ICM 32-A	Actuator
027H3125	**027H3180**	**027H1200**
Table I	***Table II***	***Table III***

ICV 32 valve body w/different connections *Table I*

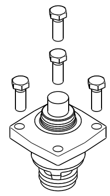


32 D (1 1/4 in.)	40 D (1 1/2 in.)	42 SA (1 5/8 in.)	42 SD (1 5/8 in.)
027H3120	**027H3125**	**027H3127**	**027H3128**

35 SD (1 3/8 in. SA)	32 A (1 1/4 in.)	32 SOC (1 1/4 in.)	40 A (1 1/2 in.)
027H3123	**027H3121**	**027H3122**	**027H3126**

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ;
SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

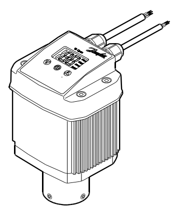
ICM 32 function module / top cover *Table II*



Description	Code Number	Code Number for Refrigerant: CO2, R22, R507 and R404A
ICM 32-A	**027H3180** *)	**027H3183** *)
ICM 32-B	**027H3181** *)	**027H3184** *)

*) Including gasket and O-rings

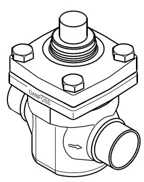
ICAD 600 actuator *Table III*



Description	Code Number
ICAD 600	**027H1200**

Ordering complete factory assembled valve without actuator

(body, function module/top cover) *Table A*



	Available connections							
	32 D (1 1/4 in.)	40 D (1 1/2 in.)	42 SA (1 5/8 in.)	42 SD (1 5/8 in.)	35 SD (1 3/8 in. SA)	32 A (1 1/4 in.)	32 SOC (1 1/4 in.)	40 A (1 1/2 in.)
ICM 32-A	**027H3000**	**027H3012**	**027H3008**		**027H3006**	**027H3002**	**027H3004**	
ICM 32-B	**027H3001**		**027H3009**		**027H3007**	**027H3003**	**027H3005**	

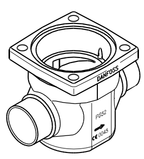
Select from parts programme

Please observe that if ICM is used for the refrigerants: CO2, R22, R507 or R 404A it has to be ordered from parts programme. (Valve body, Function module and Actuator)

ICM 40 / ICAD 900

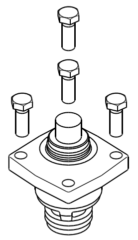
Ordering from the parts programme

Example (select from table I, II and III)



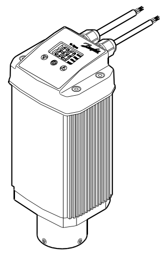
Valve body A 40 ($1\frac{1}{2}$ in.)
027H4121
Table I

+



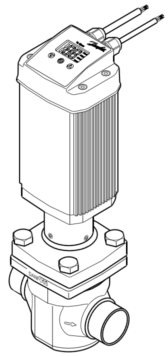
Top cover ICM 40-A
027H4180
Table II

+

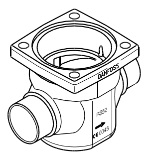


Actuator
027H1201
Table III

=



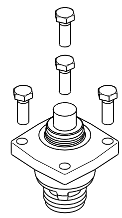
ICV 40 valve body w/different connections — *Table I*



40 D ($1\frac{1}{2}$ in.)	50 D (2 in.)	42 SA ($1\frac{5}{8}$ in.)	42 SD ($1\frac{5}{8}$ in.)
027H4120	**027H4126**	**027H4124**	**027H4123**

40 A ($1\frac{1}{2}$ in.)	40 SOC ($1\frac{1}{2}$ in.)	50 A (2 in.)	
027H4121	**027H4122**	**027H4127**	

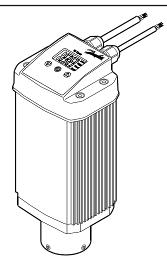
ICM 40 function module / top cover — *Table II*



Description	Code Number	Code Number for Refrigerant: CO2, R22, R507 and R404A
ICM 40-A	**027H4180** *)	**027H4183** *)
ICM 40-B	**027H4181** *)	**027H4184** *)

*) Including gasket and O-rings

ICAD 900 actuator — *Table III*



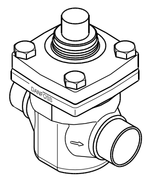
Description	Code Number
ICAD 900	**027H1201**

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ;
SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Ordering complete factory assembled valve without actuator

(body, function module/top cover)

Table A



	Available connections						
	40 D ($1\frac{1}{2}$ in.)	50 D (2 in.)	42 SA ($1\frac{5}{8}$ in.)	42 SD ($1\frac{5}{8}$ in.)	40 A ($1\frac{1}{2}$ in.)	40 SOC ($1\frac{1}{2}$ in.)	50 A (2 in.)
ICM 40-A	**027H4000**	**027H4010**	**027H4006**	**027H4008**	**027H4002**	**027H4004**	
ICM 40-B	**027H4001**		**027H4007**	**027H4009**	**027H4003**	**027H4005**	

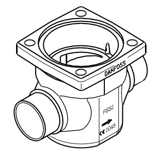
Select from parts programme

Please observe that if ICM is used for the refrigerants: CO2, R22, R507 or R 404A it has to be ordered from parts programme. (Valve body, Function module and Actuator)

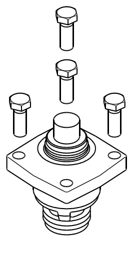
ICM 50 / ICAD 900

Ordering from the parts programme

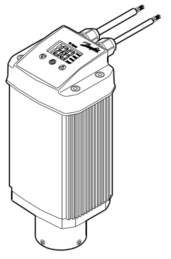
Example (select from table I, II and III)



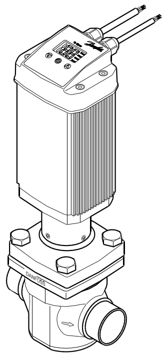
+



+

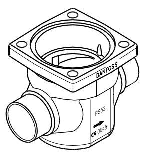


=



Valve body 65 D ($2^{1}/_{2}$ in.)	Top cover ICM 50-A	Actuator
027H5124	**027H5180**	**027H1201**
Table I	***Table II***	***Table III***

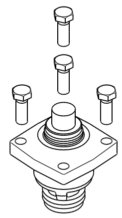
ICV 50 valve body w/different connections *Table I*



50 D (2 in.)	65 D ($2^{1}/_{2}$ in.)	54 SD ($2^{1}/_{8}$ in. SA)	50 A (2 in.)
027H5120	**027H5124**	**027H5123**	**027H5121**

50 SOC (2 in.)	65 A ($2^{1}/_{2}$ in.)		
027H5122	**027H5125**		

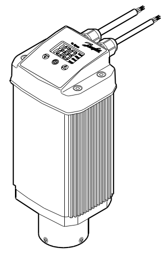
ICM 50 function module / top cover *Table II*



Description	Code Number	Code Number for Refrigerant: CO2, R22, R507 and R404A
ICM 50-A	**027H5180** *)	**027H5183** *)
ICM 50-B	**027H5181** *)	**027H5184** *)

*) Including gasket and O-rings

ICAD 900 actuator *Table III*



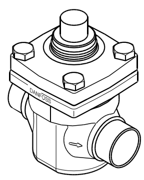
Description	Code Number
ICAD 900	**027H1201**

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ;
SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Ordering complete factory assembled valve without actuator

(body, function module/top cover)

Table A



	Available connections					
	50 D (2 in.)	65 D ($2^{1}/_{2}$ in.)	54 SD ($2^{1}/_{8}$ in. SA)	50 A (2 in.)	50 SOC (2 in.)	65 A ($2^{1}/_{2}$ in.)
ICM 50-A	**027H5000**	**027H5008**	**027H5006**	**027H5002**	**027H5004**	
ICM 50-B	**027H5001**		**027H5007**	**027H5003**	**027H5005**	

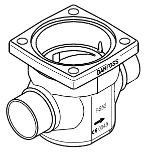
(shaded cell) Select from parts programme

Please observe that if ICM is used for the refrigerants: CO2, R22, R507 or R 404A it has to be ordered from parts programme. (Valve body, Function module and Actuator)

ICM 65 / ICAD 900

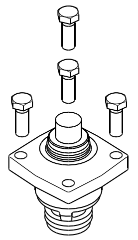
Ordering from the parts programme

Example (select from table I, II and III)



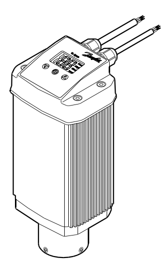
Valve body 65 J ($2^1/_2$ in.)
027H6122
Table I

+



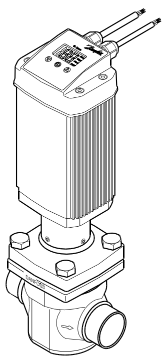
Top cover ICM 65-B
027H6181
Table II

+

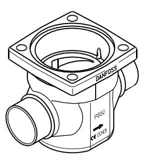


Actuator
027H1201
Table III

=



ICV 65 valve body w/different connections *Table I*

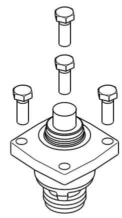


65 D ($2^1/_2$ in.)	65 A ($2^1/_2$ in.)	65 J ($2^1/_2$ in.)	80 D (3 in.)
027H6120	**027H6121**	**027H6122**	**027H6126**

80 A (3 in.)	67 SA ($2^5/_8$ in.)	76 SD (3 in.)	65 SOC ($2^1/_2$ in.)
027H6127	**027H6125**	**027H6124**	**027H6123**

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ;
SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

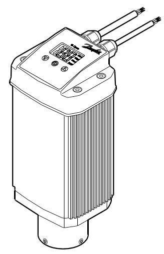
ICM 65 Function module / top cover *Table II*



Description	Code Number	Code Number for Refrigerant: CO2, R22, R507 and R404A
ICM 65-B	**027H6181** *)	**027H6184** *)

*) Including gasket and O-rings

ICAD 900 actuator *Table III*

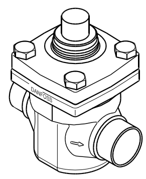


Description	Code Number
ICAD 900	**027H1201**

Ordering complete factory assembled valve without actuator

(body, function module/top cover)

Table A



	Available connections							
	65 D ($2^1/_2$ in.)	65 A ($2^1/_2$ in.)	65 J ($2^1/_2$ in.)	80 D (3 in.)	80 A (3 in.)	67 SA ($2^5/_8$ in.)	76 SD (3 in.)	65 SOC ($2^1/_2$ in.)
ICM 65-B	**027H6001**	**027H6003**				**027H6007**	**027H6009**	**027H6005**

Select from parts programme

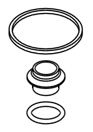
Please observe that if ICM is used for the refrigerants: CO2, R22, R507 or R 404A it has to be ordered from parts programme. (Valve body, Function module and Actuator)

ICM 20 / ICAD 600

Spare parts and accessories

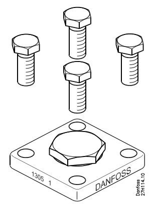
Please observe, when used in CO_2, that the o-rings on the ICM module can swell (grow). At service it is recommend that new o-rings are installed before the ICM functions module again is installed in the ICV valve body.

Spare parts



Description	**Code Number**
Service kit	**027H1190**

Accessories



Description	**Code Number**
Top cover blind	**027H1174*)**

*) including bolts and garskets

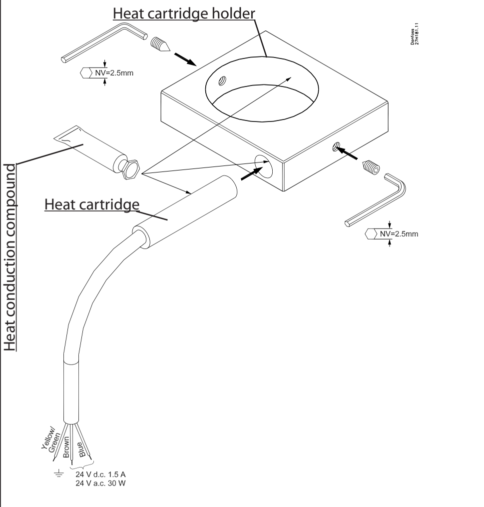
Accessories

Description	**Code Number**
ICAD-UPS	**027H0182**

Accessories

Description	**Code Number**
Multi-function tool	**027H0180**

Accessories



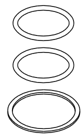
Description	**Code Number**
ICM heater Heat cartridge kit ICAD 600	**027H1209**

ICM 25-32 / ICAD 600

Spare parts and accessories

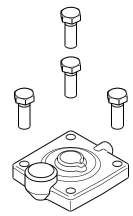
Please observe, when used in CO2, that the o-rings on the ICM module can swell (grow). At service it is recommend that new o-rings are installed before the ICM functions module again is installed in the ICV valve body.

Spare parts



Description	Code Number
ICM 25 Service kit	**027H2220**
ICM 32 Service kit	**027H3220**

Accessories



Description	Code Number
ICV 25 top cover blind	**027H2174*)**
ICV 32 top cover blind	**027H3174*)**

*) including bolts and garskets

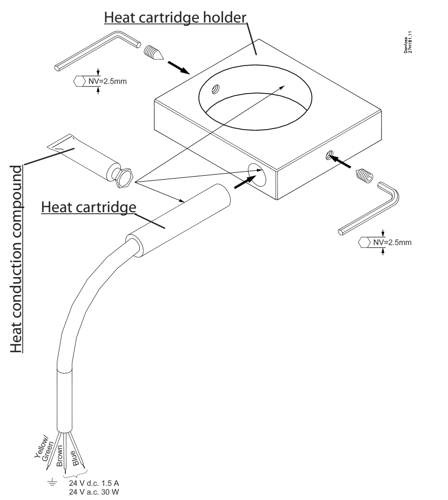
Accessories

Description	Code Number
ICAD-UPS	**027H0182**

Accessories

Description	Code Number
Multi-function tool	**027H0180**

Accessories



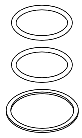
Description	Code Number
ICM heater Heat cartridge kit ICAD 600	**027H1209**

ICM 40-50-65 / ICAD 900

Spare parts and accessories

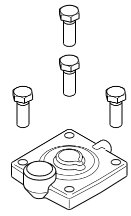
Please observe, when used in CO2, that the o-rings on the ICM module can swell (grow). At service it is recommend that new o-rings are installed before the ICM functions module again is installed in the ICV valve body.

Spare parts



Description	Code Number
ICM 40 Service kit	**027H4220**
ICM 50 Service kit	**027H5220**
ICM 65 Service kit	**027H6220**

Accessories



Description	Code Number
ICV 40 top cover blind	**027H4174*)**
ICV 50 top cover blind	**027H5174*)**
ICV 65 top cover blind	**027H6174*)**

*) including bolts and garskets

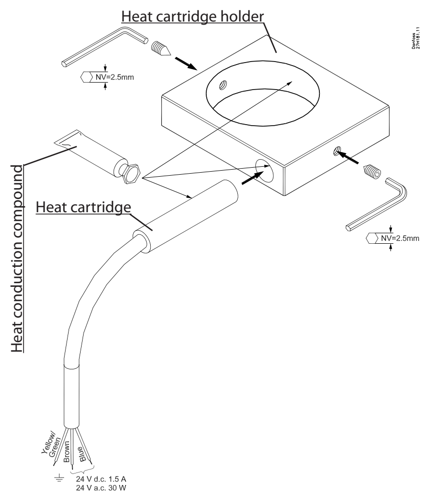
Accessories

Description	Code Number
ICAD-UPS	**027H0182**

Accessories

Description	Code Number
Multi-function tool	**027H0181**

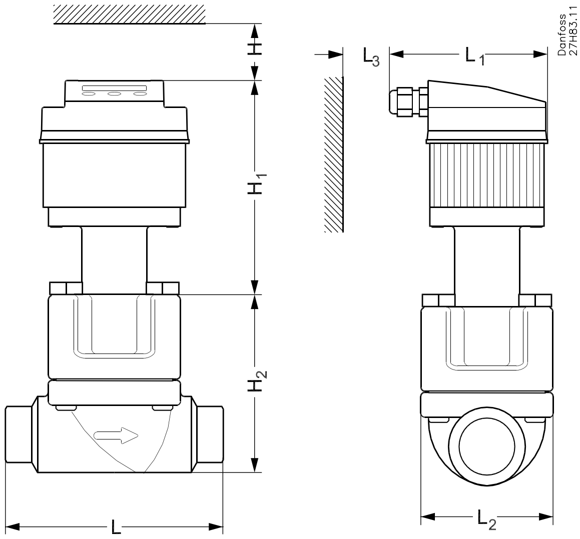
Accessories



Description	Code Number
ICM heater Heat cartridge kit ICAD 900	**027H1219**

ICM 20 / ICAD 600

Dimensions



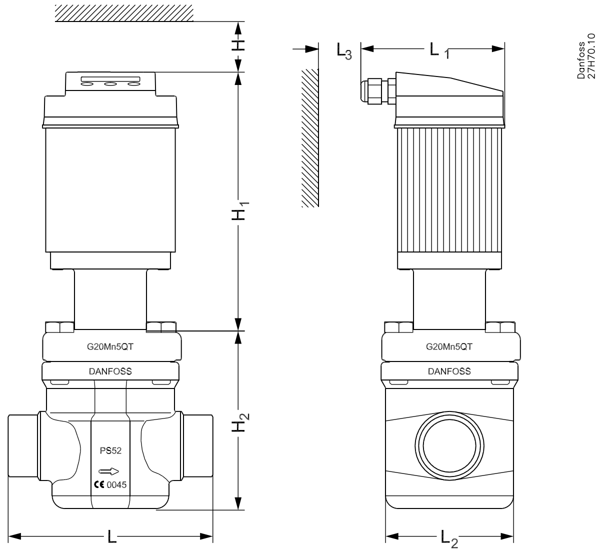
ICM 20 / ICAD 600

Connection		H	H_1	H_2	L	L_1	L_2	Weight ICM incl. ICAD
20 D (3/4 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.
25 D (1 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.
25 A (1 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.
20 A (3/4 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.
20 SOC (3/4 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.
16 SD (5/8 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.
22 SD (7/8 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.
16 SA (5/8 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.
22 SA (7/8 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.
20 FPT (3/4 in.)	mm	40	146	85	107	87	65	3 kg
	in.	1.58	5.75	3.35	4.21	3.43	2.56	6.6 lb.

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

ICM 25 / ICAD 600

Dimensions *(continued)*



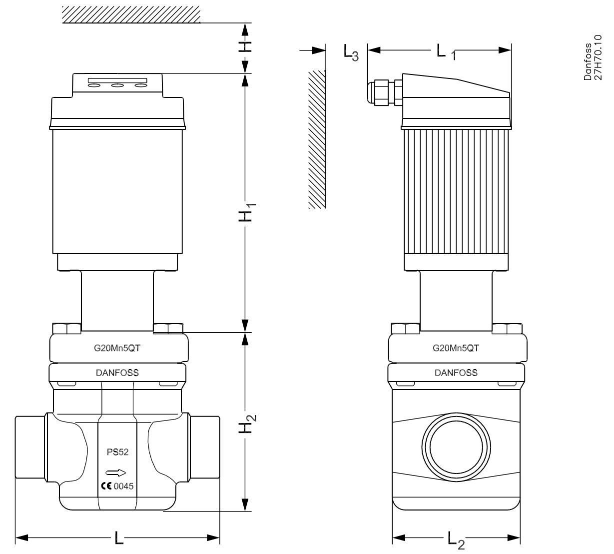
ICM 25 / ICAD 600

Connection		H	H_1	H_2	L	L_1	L_2	Weight ICM incl. ICAD
20 D (3/4 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
25 D (1 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
32 D (1 1/4 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
40 D (1 1/2 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
20 A (3/4 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
25 A (1 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
32 A (1 1/4 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
20 SOC (3/4 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
25 SOC (1 in.)	mm	40	153	99	148	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.83	3.43	3.31	8.8 lb.
22 SD (7/8 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
28 SD (1 1/8 in.)	mm	40	153	99	147	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.79	3.43	3.31	8.8 lb.
22 SA (7/8 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
28 SA (1 1/8 in.)	mm	40	153	99	147	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.79	3.43	3.31	8.8 lb.
35 SD (1 3/8 in. SA)	mm	40	153	99	147	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.79	3.43	3.31	8.8 lb.
20 FPT (3/4 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.
25 FPT (1 in.)	mm	40	153	99	135	87	84	4.1 kg
	in.	1.58	6.02	3.90	5.31	3.43	3.31	8.8 lb.

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

ICM 32 / ICAD 600

Dimensions *(continued)*



ICM 32 / ICAD 600

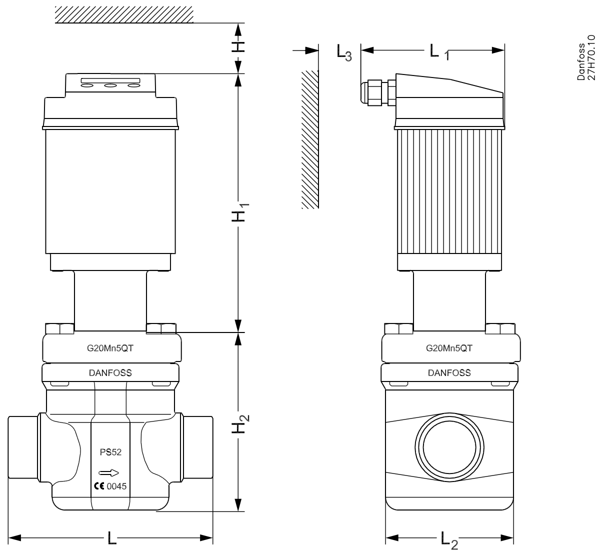
Connection		H	H_1	H_2	L	L_1	L_2	Weight ICM incl. ICAD
32 D (1$^1/_4$ in.)	mm	40	146	117	145	87	102	5.8 kg
	in.	1.58	5.75	4.61	5.71	3.43	4.02	11.0 lb.
40 D (1$^1/_2$ in.)	mm	40	146	117	145	87	102	5.8 kg
	in.	1.58	5.75	4.61	5.71	3.43	4.02	11.0 lb.
32 A (1$^1/_4$ in.)	mm	40	146	117	145	87	102	5.8 kg
	in.	1.58	5.75	4.61	5.71	3.43	4.02	11.0 lb.
40 A (1$^1/_2$ in.)	mm	40	146	117	145	87	102	5.8 kg
	in.	1.58	5.75	4.61	5.71	3.43	4.02	11.0 lb.
32 SOC (1$^1/_4$ in.)	mm	40	146	117	147	87	102	5.8 kg
	in.	1.58	5.75	4.61	5.79	3.43	4.02	11.0 lb.
35 SD (1$^3/_8$ in. SA)	mm	40	146	117	148	87	102	5.8 kg
	in.	1.58	5.75	4.61	5.83	3.43	4.02	11.0 lb.
42 SD (1$^5/_8$ in.)	mm	40	146	117	148	87	102	5.8 kg
	in.	1.58	5.75	4.61	5.83	3.43	4.02	11.0 lb.
42 SA (1$^5/_8$ in.)	mm	40	146	117	148	87	102	5.8 kg
	in.	1.58	5.75	4.61	5.83	3.43	4.02	11.0 lb.

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Pressure and temp. rregulators

ICM 40 / ICAD 900

Dimensions *(continued)*



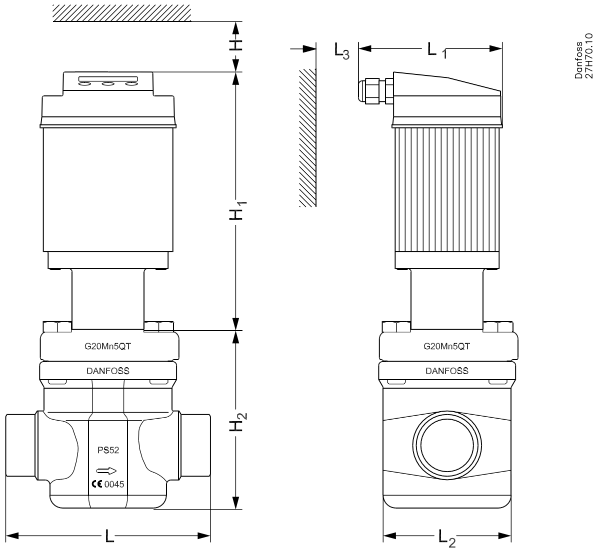
ICM 40 / ICAD 900

Connection		H	H_1	H_2	L	L_1	L_2	Weight ICM incl. ICAD
40 D (1¹/₂ in.)	mm	45	184	131	160	87	107	7.8 kg
	in.	1.77	7.24	5.16	6.30	3.43	4.21	17.2 lb
50 D (2 in.)	mm	45	184	131	180	87	107	7.8 kg
	in.	1.77	7.24	5.16	7.09	3.43	4.21	17.2 lb
40 A (1¹/₂ in.)	mm	45	184	131	160	87	107	7.8 kg
	in.	1.77	7.24	5.16	6.30	3.43	4.21	17.2 lb
50 A (2 in.)	mm	45	184	131	180	87	107	7.8 kg
	in.	1.77	7.24	5.16	7.09	3.43	4.21	17.2 lb
40 SOC (1¹/₂ in.)	mm	45	184	131	180	87	107	7.8 kg
	in.	1.77	7.24	5.16	7.09	3.43	4.21	17.2 lb
42 SD (1⁵/₈ in.)	mm	45	184	131	180	87	107	7.8 kg
	in.	1.77	7.24	5.16	7.09	3.43	4.21	17.2 lb
42 SA (1⁵/₈ in.)	mm	45	184	131	180	87	107	7.8 kg
	in.	1.77	7.24	5.16	7.09	3.43	4.21	17.2 lb

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

ICM 50 / ICAD 900

Dimensions *(continued)*



ICM 50 / ICAD 900

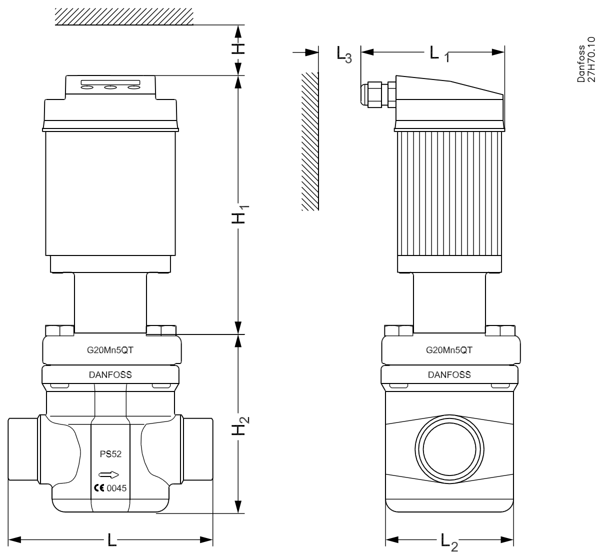
Connection		H	H_1	H_2	L	L_1	L_2	Weight ICM incl. ICAD
50 D (2 in.)	mm	45	176	159	200	87	125	11.1
	in.	1.77	6.93	6.26	7.87	3.43	4.92	24.4
65 D (2$^1/_2$ in.)	mm	45	176	159	210	87	125	11.1
	in.	1.77	6.93	6.26	8.27	3.43	4.92	24.4
50 A (2 in.)	mm	45	176	159	200	87	125	11.1
	in.	1.77	6.93	6.26	7.87	3.43	4.92	24.4
65 A (2$^1/_2$ in.)	mm	45	176	159	210	87	125	11.1
	in.	1.77	6.93	6.26	8.27	3.43	4.92	24.4
50 SOC (2 in.)	mm	45	176	159	216	87	125	11.1
	in.	1.77	6.93	6.26	8.50	3.43	4.92	24.4
54 SD (2$^1/_8$ in. SA)	mm	45	176	159	216	87	125	11.1
	in.	1.77	6.93	6.26	8.50	3.43	4.92	24.4

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

Pressure and temp. rregulators

ICM 65 / ICAD 900

Dimensions *(continued)*



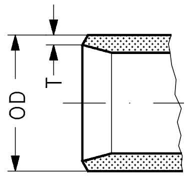
ICM 65 / ICAD 900

Connection		H	H_1	H_2	L	L_1	L_2	Weight ICM incl. ICAD
65 D ($2^1/_2$ in.)	mm	45	176	188	230	87	139	16.6 kg
	in.	1.77	6.93	7.40	9.06	3.43	5.47	36.5 lb
80 D (3 in.)	mm	45	176	188	245	87	139	16.6 kg
	in.	1.77	6.93	7.40	9.65	3.43	5.47	36.5 lb
65 A ($2^1/_2$ in.)	mm	45	176	188	230	87	139	16.6 kg
	in.	1.77	6.93	7.40	9.06	3.43	5.47	36.5 lb
80 A (3 in.)	mm	45	176	188	245	87	139	16.6 kg
	in.	1.77	6.93	7.40	9.65	3.43	5.47	36.5 lb
65 J ($2^1/_2$ in.)	mm	45	176	188	230	87	139	16.6 kg
	in.	1.77	6.93	7.40	9.06	3.43	5.47	36.5 lb
65 SOC ($2^1/_2$ in.)	mm	45	176	188	230	87	139	16.6 kg
	in.	1.77	6.93	7.40	9.06	3.43	5.47	36.5 lb
76 SD (3 in.)	mm	45	176	188	245	87	139	16.6 kg
	in.	1.77	6.93	7.40	9.65	3.43	5.47	36.5 lb
67 SA ($2^5/_8$ in.)	mm	45	176	188	245	87	139	16.6 kg
	in.	1.77	6.93	7.40	9.65	3.43	5.47	36.5 lb

D = Butt-weld DIN ; A = Butt-weld ANSI ; J = Butt-weld JIS ; SOC = Socket weld ANSI ; SD = Solder DIN ; SA = Solder ANSI ; FPT = Female Pipe Thread

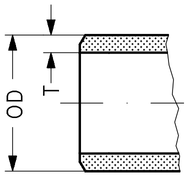
Connections

D: *Butt-weld DIN (2448)*



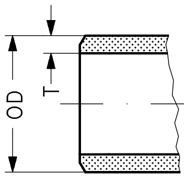
Size mm	Size in.	OD mm	T mm	OD in.	T in.		
20	($^3/_4$)	26.9	2.3	1.059	0.091		
25	(1)	33.7	2.6	1.327	0.103		
32	($1^1/_4$)	42.4	2.6	1.669	0.102		
40	($1^1/_2$)	48.3	2.6	1.902	0.103		
50	(2)	60.3	2.9	2.37	0.11		
65	($2^1/_2$)	76.1	2.9	3	0.11		
80	(3)	88.9	3.2	3.50	0.13		

A: *Butt-weld ANSI (B 36.10)*



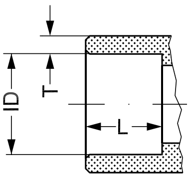
Size mm	Size in.	OD mm	T mm	OD in.	T in.	Schedule	
(20)	$^3/_4$	26.9	4.0	1.059	0.158	80	
(25)	1	33.7	4.6	1.327	0.181	80	
(32)	$1^1/_4$	42.4	4.9	1.669	0.193	80	
(40)	$1^1/_2$	48.3	5.1	1.902	0.201	80	
(50)	2	60.3	3.9	2.37	0.15	40	
(65)	$2^1/_2$	73.0	5.2	2.87	0.20	40	
(80)	3	88.9	5.5	3.50	0.22	40	

J: *Butt-weld JIS*



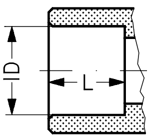
Size mm	Size in.	OD mm	T mm	OD in.	T in.		
(20)	$^3/_4$	26.9	4.0	1.059	0.158		
(25)	1	33.7	4.6	1.327	0.181		
(32)	$1^1/_4$	42.4	4.9	1.669	0.193		
(40)	$1^1/_2$	48.3	5.1	1.902	0.201		
(50)	2	60.3	3.9	2.37	0.15		
(65)	$2^1/_2$	76.3	5.2	3.0	0.20		
(80)	3	88.9	5.5	3.50	0.22		

SOC:
Socket welding ANSI (B 16.11)



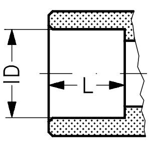
Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.
(20)	$^3/_4$	27.2	4.6	1.071	0.181	13	0.51
(25)	1	33.9	7.2	1.335	0.284	13	0.51
(32)	$1^1/_4$	42.7	6.1	1.743	0.240	13	0.51
(40)	$1^1/_2$	48.8	6.6	1.921	0.260	13	0.51
(50)	2	61.2	6.2	2.41	0.24	16	0.63
(65)	$2^1/_2$	74	8.8	2.91	0.344	16	0.63

SD: *Soldering (DIN 2856)*



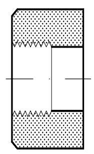
Size mm	Size in.	ID mm		ID in.		L mm	L in.
16		16.07				15	
22		22.08				16.5	
28		28.08				26	
35		35.07				25	
42		42.07				28	
54		54.09				33	
76		76.1				33	

SA: Soldering (ANSI B 16.22)



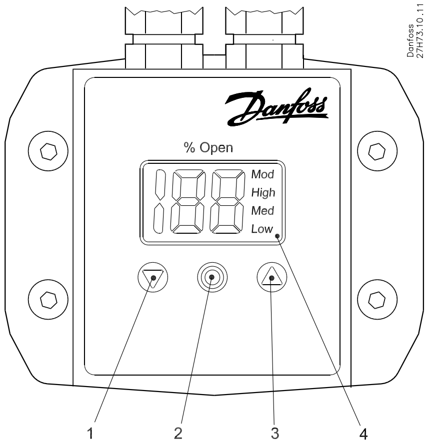
	$^5/_8$			0.625			0.591
	$^7/_8$			0.875			0.650
	$1^1/_8$			1.125			1.024
	$1^3/_8$			1.375			0.984
	$1^5/_8$			1.625			1.102
	$2^1/_8$			2.125			1.300
	$2^5/_8$			2.625			1.300

FPT:
Female pipe thread,
(ANSI/ASME B 1.20.1)



Size mm	Size in.	Inside pipe thread		
(20)	$^3/_4$	($^3/_4$ x 14 NPT)		
(25)	1	(1 x 11.5 NPT)		
(32)	$1^1/_4$	($1^1/_4$ x 11.5 NPT)		

General operation



1. "Down" arrow push button
2. Enter
3. "Up" arrow push button
4. Display

Fig. 2

ICAD is equipped with an MMI (Man Machine Interface) from which it is possible to monitor and change the setting of parameters to adapt the ICAD and the corresponding ICM to the actual refrigeration application.

The setting of parameters is managed by means of the integrated ICAD MMI (see fig. 2 and fig. 3) and consists of:

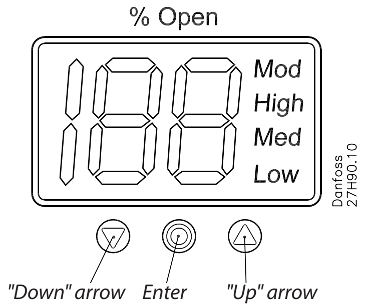


Fig. 3

- "Down" arrow push button (fig. 2, pos. 1)
  - Decreases parameter number by 1 at each activation
- "Up" arrow pushbutton (fig. 2, pos. 3)
  - Increases parameter number by 1 at each activation
- Enter push button (fig. 2, pos. 2)
  - Gives access to the **Parameter list** by keeping the push button activated for 2 seconds. A **Parameter list** example is shown below (parameter **¡08**, fig. 4).

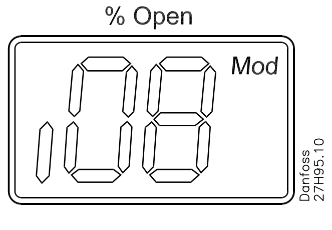


Fig. 4

  - Gives access to change a value once the **Parameter list** has been accessed.
  - Acknowledge and save change of value of a parameter.
  - To exit from the **Parameter list** and return to the display of Opening Degree (OD) keep the push button activated for 2 seconds.
- Display (fig. 2, pos. 4)
  - Normally the Opening Degree (OD) 0 - 100 % of the ICM valve is displayed. No activation of push buttons for 20 seconds means that the display will always show OD (see fig. 5).

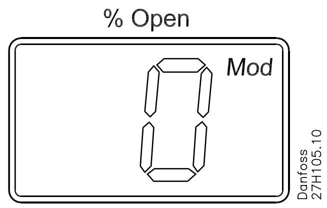


Fig. 5

- Displays the parameter.
- Displays the actual value of a parameter.
- Displays the function status by means of text (fig. 2, pos. 4)
  - ***Mod*** represents that ICAD is positioning the ICM valve according to an analog input signal (Current or Voltage)
  - ***Low*** represents that ICAD is operating the ICM valve like an ON/OFF solenoid valve with low speed according to a digital input signal.
  - ***Med*** represents that ICAD is operating the ICM valve like an ON/OFF solenoid valve with medium speed according to a digital input signal.
  - ***High*** represents that ICAD is operating the ICM valve like an ON/OFF solenoid valve with high speed according to a digital input signal (see fig. 6).

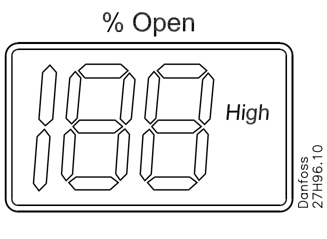


Fig. 6

Alarms

ICAD can handle and display different alarms.

Description	ICM alarm text	Comments
No valve type selected	**A1**	At start-up **A1** and **CA** will be displayed
Controller fault	**A2**	Internal fault inside electronics
All input error	**A3**	Not active if **¡01** = 2 or **¡02** = 2 When **¡03** = 1 and AI A > 22 mA When **¡03** = 2 and AI A > 22 mA or AI A < 2 mA When **¡03** = 3 and AI A >12 V When **¡03** = 4 and AI A >12 V or AI A < 1 V
Low voltage of fail safe supply	**A4**	If 5 V d.c. < Fail safe supply < 18 V d.c.
Check Supply to ICAD	**A5**	If supply voltage < 18 V d.c.

If an alarm has been detected the ICAD display (fig. 2) will alternate between showing Actual alarm and present Opening Degree.

If more than one alarm is active at the same time the alarm with the highest priority will take preference. **A1** has the highest priority, **A5** the lowest.

Any active alarm will activate the Common Digital Alarm output (Normally Open).

All alarms will automatically reset them-selves when they physically disappear.

Old alarms (alarms that have been active, but have physically disappeared again) can be found in parameter **¡11**.

Parameter list

Description	Display name	Min.	Max.	Factory setting	Unit	Comments
ICM OD (Opening Degree)	-	0	100	-	%	ICM valve Opening Degree is displayed during normal operation. Running display value (see **¡01**, **¡05**).
Main Switch	**¡01**	1	2	1	-	Internal main switch 1: Normal operation 2: Manual operation. Valve Opening Degree will be flashing. With the down arrow and the up arrow push buttons the OD can be entered manually.
Mode	**¡02**	1	2	1	-	Operation mode 1: Modulating – ICM positioning according to Analogue Input (see **¡03**) 2: ON/OFF - operating the ICM valve like an ON/OFF solenoid valve controlled via Digital Input. See also **¡09**.
Analogue Input signal	**¡03**	1	4	2	-	Type of Analogue Input signal from external controller 1: 0 - 20 mA 2: 4 - 20 mA 3: 0 - 10 V 4: 2 - 10 V
Speed at ON/OFF and Modulating Mode	**¡04**	1	100	100	%	Speed can be decreased. Max. speed is 100 % Not active when **¡01** = 2 If **¡02** = 2 the display will indicate speed in display. **Low**, **Med** and **High** also means ON/OFF operation. If **¡04** < = 33, **Low** is displayed 33 < If **¡04** < = 66, **Med** is displayed If **¡04** > = 67 **High** is displayed
Automatic calibration	**¡05**	0	1	0	-	Not active before **¡26** has been operated. Always auto reset to 0. **CA**" will flash in the display during calibration, if Enter push button has been activated for two seconds.
Analogue Output signal	**¡06**	0	2	2	-	Type of A0 signal for ICM valve position 0: No signal 1: 0 - 20 mA 2: 4 - 20 mA
Fail safe	**¡07**	1	4	1	-	Define condition at power cut when fail safe is installed. 1: Close valve 2: Open valve 3: Maintain valve position 4: Go to OD given by **¡12**
Digital Input function	**¡09**	1	2	1		Define function when DI is ON (short circuited DI terminals) when **¡02** = 2 1: Open ICM valve (DI = OFF = > Close ICM valve) 2: Close ICM valve (DI = OFF = > Open ICM valve)
Password	**¡10**	0	199	0	-	Enter number to access password protected parameters: **¡26**
Old Alarms	**¡11**	A1	A99	-	-	Old alarms will be listed with the latest shown first. Alarm list can be reset by means of activating down arrow and up arrow at the same time for 2 seconds.
OD at powercut	**¡12**	0	100	50	-	Only active if **¡07** = 4 If fail safe supply is connected and powercut occurs ICM will go to entered OD.
ICM configuration	**¡26**	0	6	0		**NB:** Password protected. Password = **11** At first start up **A1** will flash in display. Enter valve type 0: No valve selected. Alarm **A1** will become active. 1: ICM20 with ICAD 600 2: ICM25 with ICAD 600 3: ICM32 with ICAD 600 4: ICM40 with ICAD 900 5: ICM50 with ICAD 900 6: ICM65 with ICAD 900

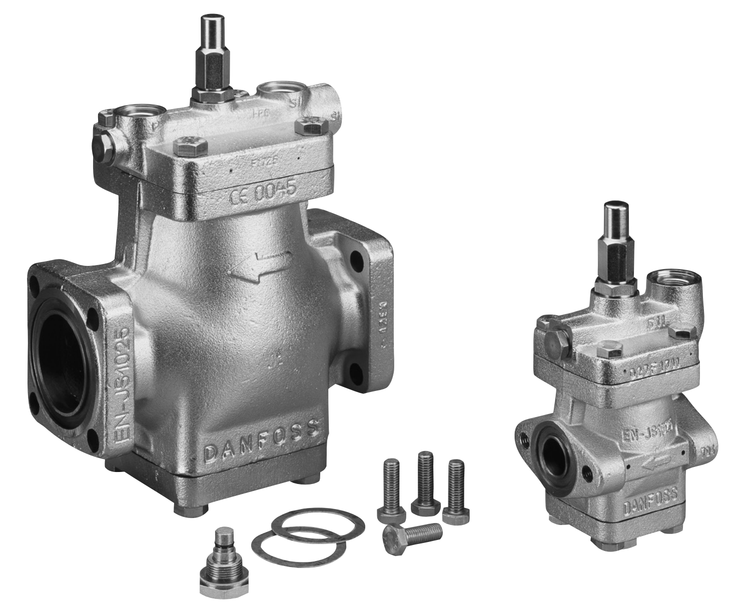
Parameter list *(continued)*

Service

Description	Display name	Min.	Max.	Factory setting	Unit	Comments
OD %	**¡50**	0	100	-	%	ICM valve Opening Degree
AI [mA]	**¡51**	0	20	-	mA	Analog Input signal
AI [V]	**¡52**	0	10	-	V	Analog Input signal
AO [mA]	**¡53**	0	20	-	mA	Analog Output signal
DI	**¡54**	0	1	-	-	Digital Input signal
DO Close	**¡55**	0	1	-	-	Digital Output Closed status. ON when OD < 3 %
DO Open	**¡56**	0	1	-	-	Digital Output Open status. ON when OD > 97 %
DO Alarm	**¡57**	0	1	-	-	Digital Output alarm status. ON when an alarm is detected
MAS mP SW ver.	**¡58**	0	100	-	-	Software version for MASTER Microprocessor
SLA mP SW ver.	**¡59**	0	100	-	-	Software version for SLAVE Microprocessor

Reset to factory setting :

1. Remove the power supply.
2. Activate down arrow and up arrow push buttons at the same time.
3. Connect the power supply.
4. Release down arrow and up arrow push buttons.
5. When the display on ICAD (fig. 2) is alternating between showing: **CA** and **A1** the factory resetting is complete.



Introduction

PM valves are pilot operated main valves for regulating pressure and temperature in refrigeration systems.
PM main valves can be used on the high and low-pressure sides, in wet and dry suction lines, and in liquid lines without phase change (i.e. where no expansion takes place in the valve).
The function of a PM valve depends solely on the pilot pressure applied to the valve, either from pilot valves or in the form of external pilot pressure.
PM 1 has one connection for pilot pressure/pilot valve, while PM 3 has three pilot pressure/pilot valve connections.
The associated Danfoss pilot valves can either be screwed direct into the main valve or be connected via an external pilot line. Several pilot valves can be used on one main valve to give a large number of different functions.

The PM valve top cover has a pressure gauge connection so that the inlet pressure can be measured when, for example, main valve function must be set or adjusted in relation to the system regulation performed by the pilot valves.
The spindle in the top cover of the main PM valve can be used to manually open and close the valve (although PM 65-125 cannot be opened fully in this way).
The main valve bottom plug can be replaced by an AKS 45 electronic position indicator so that the position of the regulating cone can be read electronically.

Features

- Can be used for all normal, non-flammable refrigerants, including R 717, and non-corrosive gases/liquids - assuming seals of the correct material are used.
- Large range of flanges with connection dimensions in accordance with standards: DIN, ANSI, SOC, SA and FPT.
- Performs as a multifunction valve when several pilot valves are connected to the same main valve.
- All pilot valves can be used on all sizes of PM main valves. They can be screwed direct into the main valve so that there is no need for weld or solder connections, or separate pilot lines.
- The valve has a pressure gauge connection so that inlet pressure can be measured.
- The valve has a built-in filter and a teflon seat to give excellent tightness.
- The PM main valve top cover can be oriented in any direction without the function of pilot valves being affected.
- The valve can be equipped with an AKS 45 electronic position indicator as an accessory.

The complete technical leaflet (DKRCI.PD.HL0.A) can be downloaded from the Danfoss web site.

Design

Connections
There is a very wide range of connection possibilities with PM main valves:

- Welding, DIN (2448)
- Welding, ANSI (B 36.10)
- Welding socket, ANSI (B 16.11)
- Solder connection, DIN (2856)
- Solder connection, ANSI (B 16.22)
- FPT internal thread, NPT (ANSI/ASME B 1.20.1)

PM main valves are designed as pilot operated valves that can be fully opened with a very small differential pressure (0.2 bar/ 2.9 psi).
The valve design means that it will only fully close in the direction of flow.

Pressure Equipment Directive (PED)
The PM-valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.

For further details / restrictions - see Installation Instruction

PM 1 will accept one pilot valve mounted direct on the valve, while PM 3 will accept three pilot valves.

Two of the PM 3 pilot valve connections (S1 and S2) are series connected while the third pilot connection (P) is connected in parallel. Thus, with different combinations of pilot valves it is possible to obtain a very large number of different functions from one PM main valve.

The PM main valve has a logarithmic or v-shaped throttle cone that ensures optimum regulating accuracy.

The PM main valve top cover can be oriented in any direction without the function of pilot valves being affected.

Valve body
EN-GJS-400-18-LT

Seals
Do not contain asbestos.

CE

PM valves			
Nominal bore	DN≤ 25 (1 in.)	DN 32-125 mm (1 1/4 - 5 in.)	DN 150 mm (6 in.)
Classified for	Fluid group I		
Category	Article 3, paragraph 3	II	III

Technical data

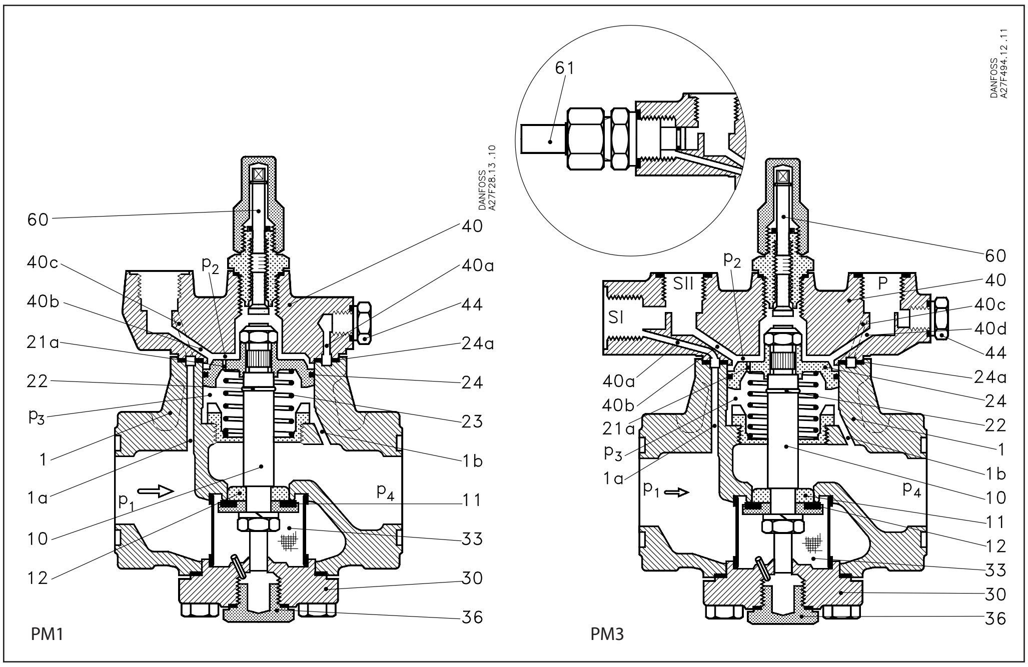
- *Refrigerants*
  Can be used for all normal, non-flammable refrigerants, including R 717, and non-corrosive gases/liquids - assuming seals of the correct material are used.
  Use with flammable hydrocarbons cannot be recommended; please contact Danfoss.
- *Temperature range*
  –60/+120°C (–76/+248°F).
- *Surface*
  PM 5 - 65:
  The external surface is zinc-chromated to give good protection against corrosion.
  PM 80 - 125:
  The surface of the PM 80 - 125 is treated with a multi-layer painting.
- *Pressure range*
  The valve is designed for:
  Max. working pressure: 28 bar g (406 psig)
  Test pressure: 42 bar g (609 psig)

  Opening differential pressure:
  Fully open: Min. 0.2 bar g (min. 2.9 psig)
  Max. (MOPD), solenoid valves only
  (10 W a.c. and 20 W d.c.):
  21 bar g (305 psig)
- *Built-in filter*
  PM 5 - 40 mesh: 950 μ (18 mesh/in.)
  PM 50 - 125 mesh: 1500 μ (10 mesh/in.)

Design, function

PM 1 and PM 3

1.	Valve body
1 a	Channels in valve body 1
1 b	Channels in valve body 1
10.	Valve spindle
11.	Teflon valve plate
12.	Throttle cone
21a.	Equalisation hole in servo piston 24
22.	Locking ring
24.	Servo piston
24a.	Gasket
30.	Bottom cover
33.	Strainer
36.	Plug
40.	Cover
40 a	Channels in cover 40
40 b	Channels in cover 40
40 c	Channels in cover 40
40 d	Channels in cover 40
44.	Pressure gauge connection
60.	Manual operating spindle
61.	External pilot connection
S I, S II	Pilot valve connections in series connection holes
P.	Pilot valve connection in parallel connection hole



The PM main valve is a pilot operated valve whose function is determined by the pilot valve used. The main valve with pilot valve(s) controls refrigerant flow by modulation or on/off in accordance with the pilot valve or main valve status.

The degree of opening of the main valve is determined by the pressure difference (differential pressure) between pressure p_2, which acts on top of the servo piston (24), and pressure p_3, which acts on the underside of the servo piston.

If this pressure difference is 0, the main valve will be fully closed.
If the pressure difference is 0.2 bar (2.9 psi) or more, the main valve will be fully open.
At pressure differences (p_2 - p_3) between 0.07 bar (1 psi) and 0.2 bar (2.9 psi), the degree of opening will be correspondingly proportional.

The shape of the throttle cone (12) is logarithmic, which gives an ideal regulation characteristic to pilot operated main valves. Because of valve body channel (1b), pressure p_3 acting on the underside of the servo piston (24) is equal to the main valve discharge pressure p_4.
The degree of opening of the main valve is thus controlled by the application of a pressure, p_2, on top of the servo piston which is equal to or greater than the discharge pressure, p_4.

$p_2 = p_4$ ~ closed
$p_2 = p_4 + 0.2$ bar (2.9 psi)~ fully open
$p_4 \le p_2 \le p_4 + 0.2$ bar (2.9 psi) ~ proportional degree of opening.

The maximum pressure, p_2, that can be built up on the top of the servo piston (24) normally corresponds to the pressure, p_1, acting on the main valve inlet side.
Inlet pressure p_1 is led, via the drilled channels (1a, 40a, 40b, 40c, 40d) in the valve body (1) and cover (40) through the individual pilot valves and onto the top of the servo piston (24).
The degree of opening of the individual pilot valves determines the size of pressure p_2 and thus the degree of opening of the main valve, i.e. the equalisation hole (21a) in the servo piston (24) ensures that pressure p_2 is balanced in accordance with the degree of opening of the pilot valve.

Note:
When main valve type PM 3 is used with an external pilot connection (61), the internal pilot pressure will be shut off.

The PM 1 main valve can be fitted with just one screwed-on pilot valve. The degree of opening of the main valve will be in accordance with the control status from the pilot valve.

PM 1 is fully closed when the pilot valve is fully closed and fully open when the pilot valve is fully open. Otherwise the degree of opening of the main valve is proportional to the degree of opening of the pilot valve.

The PM 3 main valve can be fitted with either one, two, or three pilot valves so that up to three regulating functions are possible.

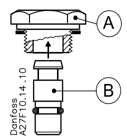
Design, function
(continued)

The relations between the functions of the screwed-in pilot valves are as follows:

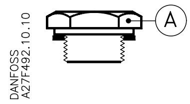
A. The pilot valves fitted in ports SI and SII are connected in series.
   The PM 3 main valve will be fully closed if just one of the series-connected pilot valves is closed. The main valve can only open if both pilot valves are fully open at the same time.
B. The pilot valve fitted in port P is connected in parallel to the pilot valves in ports SI and SII.

The PM3 main valve will be fully open if the pilot valve in P is fully open, irrespective of the degree of opening of pilot valves SI and SII.
The PM 3 main valve will be fully closed if the pilot valve in P is fully closed and at least one of the valves in SI or SII is fully closed at the same time. The relation between the pilot valves in ports SI, SII and P is shown in the table above.

Pilot valve			PM 3 main valve
SI	SII	P	
Open	Open	Closed	Open
Open	Open	Open	Open
Open	Closed	Closed	Closed
Open	Closed	Open	Open
Closed	Open	Closed	Closed
Closed	Open	Open	Open
Closed	Closed	Closed	Closed
Closed	Closed	Open	Open



Blanking plug
A + B



Blanking plug A

If the PM 3 is not fitted with three pilot valves, the unused port(s) must be sealed off with a blanking plug.
If the blanking plug is fitted as an assembled unit, A + B, the channels from the port concerned will be closed.
If only the top part, A, of the plug is fitted, the channels from the ports in question will be open.
If the degree of opening of the PM main valve is not to be a function of the main valve inlet pressure, or if more than three regulating functions are required, ports SI, SII or P can be fitted with a nipple for the connection of external pilot pressure. This applies to both PM 1 and PM 3.
Pressure p_2 on top of the servo piston will then be determined by the pressure to which the external pilot line is connected. The main valve function will be determined by the pilot valves fitted in that external pilot line. Pilot valves installed in external lines must be mounted in a type CVH housing.

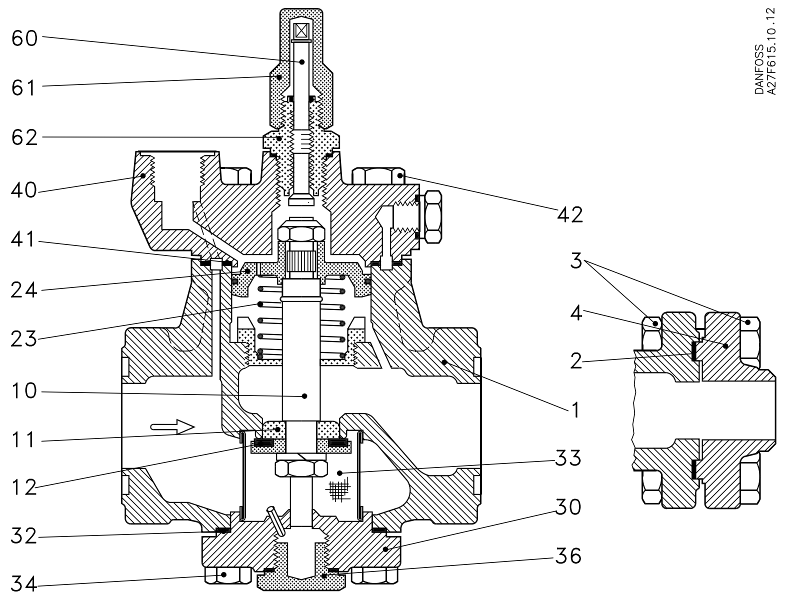
Depending on the function of the pilot valves, the PM regulating characteristic becomes:

on/off
proportional
integral or
cascade.

PM main valves are therefore especially suitable for all forms of temperature and pressure regulating systems.

Application examples are given in the ICS section of this catalogue.

Material specification



Material specification for PM valves

No.	Part	Material	DIN	ISO	ASTM
1	Valve body	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563		
2	Gasket between body and flange	Non-metal Non-asbestos			
3	Bolts for flange	Stainless steel	A2-70	A2-70	TYPE 308
4	Flange PM 5 - 65	Steel	RSt. 37-2, 10025	Fe360 B, 630	Grade C, A 283
4	Flange PM 80 - 125	Steel	TSTE 355, 2635 / 3159		
10	Valve spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
11	Trottle cone	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
12	Valve seat	Teflon [PTFE]			
23	Spring	Steel			
24	Servo piston	Cast iron	GG-25	Grade 250	Class 40B
30	Bottom cover	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563		
32	Gasket between body and bottom cover	Non-metal Non-asbestos			
33	Strainer	Stainless steel			
34	Bolts for bottom cover	Stainless steel	A2-70	A2-70	TYPE 308
36	Plug	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
40	Cover	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563		
41	Gasket	Non-metal Non-asbestos			
42	Bolts for top cover	Stainless steel	A2-70	A2-70	TYPE 308
60	Manual operating spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
61	Cap for manual operating spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
62	Spindle seal	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403

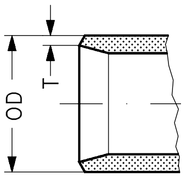
Flange connections

Danfoss flange sets are specially made for the Danfoss product range and must only be used for the purpose described.

When ordering PM valves, first select the valve according to the capacity required. Then select the suitable flanges.

Gaskets, bolts and nuts are supplied with the PM valve.

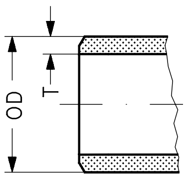
DIN



Butt welding DIN (2448)

For use with valve type	Size mm	Size in.	OD mm	T mm	OD in.	T in.	Flange type	Code no.
PM 5, 10, 15, 20, 25	20 25 32	3/4 1 1 1/4	26.9 33.7 42.4	2.3 2.6 2.6	1.059 1.327 1.669	0.091 0.103 0.102	3	**027N1220** **027N1225** **027N1230**
PM 32	32 40	1 1/4 1 1/2	42.4 48.3	2.6 2.6	1.669 1.902	0.102 0.103	10	**027N2332** **027N2340**
PM 40	40 50	1 1/2 2	48.3 60.3	2.6 2.9	1.902 2.370	0.103 0.110	11	**027N2440** **027N2450**
PM 50	50 65	2 2 1/2	60.3 76.1	2.9 2.9	2.370 3.000	0.110 0.110	12	**027N2550** **027N2565**
PM 65	65 80	2 1/2 3	76.1 88.9	2.9 3.2	3.000 3.500	0.110 0.130	13	**027N2665** **027N2680**
PM 80	100	4	114.3	3.6	4.500	0.140	14A	**027F2123**
PM 100	125	5	139.7	4.0	5.500	0.160	14B	**027F2124**
PM 125	150	6	168.3	4.5	6.630	0.180	14C	**027F2125**

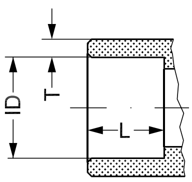
ANSI



Butt welding ANSI B 36.10

For use with valve type	Size mm	Size in.	OD mm	T mm	OD in.	T in.	Flange type	Schedule	Code no.
PM 5, 10, 15, 20, 25	20 25 32	3/4 1 1 1/4	26.9 33.7 42.4	4.0 4.6 4.9	1.059 1.327 1.669	0.158 0.181 0.193	3	80 80 80	**027N3031** **027N3032** **027N3033**
PM 32	32 40	1 1/4 1 1/2	42.4 48.3	4.9 5.1	1.669 1.902	0.193 0.201	10	80 80	**027N3034** **027N3035**
PM 40	40 50	1 1/2 2	48.3 60.3	5.1 3.9	1.902 2.370	0.201 0.150	11	80 40	**027N3036** **027N3037**
PM 50	50 65	2 2 1/2	60.3 73.0	3.9 5.2	2.370 2.870	0.150 0.200	12	40 40	**027N3038** **027N3039**
PM 65	65 80	2 1/2 3	73.0 88.9	5.2 5.5	2.870 3.500	0.200 0.220	13	40 40	**027N3040** **027N3041**
PM 80	100	4	114.3	6.0	4.500	0.240	14A	40	**027N3042**
PM 100	125	5	141.3	6.6	5.560	0.260	14B	40	**027N3043**
PM 125	150	6	168.3	7.1	6.630	0.280	14C	40	**027N3044**

SOC

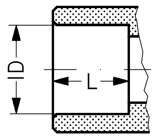


Socket welding ANSI (B 16.11)

For use with valve type	Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.	Flange type	Code no.
PM 5, 10, 15, 20, 25	20 25	3/4 1	27.2 33.9	4.9 5.7	1.071 1.335	0.193 0.224	13 13	0.512 0.512	3	**027N2001** **027N2002**
PM 32	32	1 1/4	42.7	6.05	1.681	0.238	13	0.512	10	**027N2003**
PM 40	40	1 1/2	48.8	6.35	1.921	0.250	13	0.512	11	**027N2004**
PM 50	50	2	61.2	6.95	2.409	0.274	16	0.630	12	**027N2005**
PM 65	65	2 1/2	74.0	8.75	2.913	0.344	16	0.630	13	**027N2006**

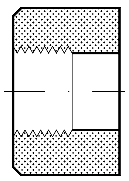
Flange connections

SA



For use with valve type	Size mm	Size in.	ID mm		ID in.		L mm	L in.	Flange type	Code no.
Soldering DIN (2856)										
PM 5, 10, 15, 20, 25	22 28		22.08 28.08				16.5 26		3	**027L1222** **027L1228**
PM 32	35		35.07				25		10	**027L2335**
PM 40	42		42.09				28		11	**027L2442**
PM 50	54		54.09				33		12	**027L2554**
PM 65	76		76.1				33		13	**027L2676**
Soldering (ANSI B 16.22)										
PM 5, 10, 15, 20, 25		$\frac{7}{8}$ $1\frac{1}{8}$			0.875 1.125			0.650 1.024	3	**027L1223** **027L1229**
PM 32		$1\frac{3}{8}$			1.375			0.984	10	**027L2335**
PM 40		$1\frac{5}{8}$			1.625			1.102	11	**027L2441**
PM 50		$2\frac{1}{8}$			2.125			1.300	12	**027L2554**
PM 65		$2\frac{5}{8}$			2.625			1.300	13	**027L2666**

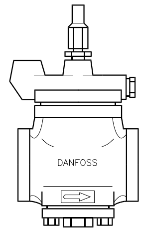
FPT



For use with valve type	Size mm	Size in.	Inside pipe thread	Flange type	Code no.
FPT inside pipe thread, NPT (ANSI/ASME B 1.20.1)					
PM 5, 10, 15, 20, 25	20 25	$\frac{3}{4}$ 1	($\frac{3}{4} \times$ 14 NPT) (1 × 11.5 NPT)	3	**027G1001** **027G1002**

Ordering PM valves

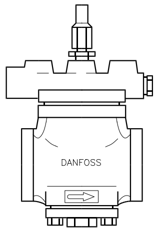
Main valve type PM 1
(for single pilot valve only)



Code number includes: PM 1 valve with flange gaskets and bolts (but without flanges)

Valve type	Code no.
	EN-GJS-400-18-LT*
PM 1-5	**027F3001**
PM 1-10	**027F3002**
PM 1-15	**027F3003**
PM 1-20	**027F3004**
PM 1-25	**027F3005**
PM 1-32	**027F3006**
PM 1-40	**027F3007**
PM 1-50	**027F3008**
PM 1-65	**027F3009**

Main valve type PM 3
(for up to three pilot valves)

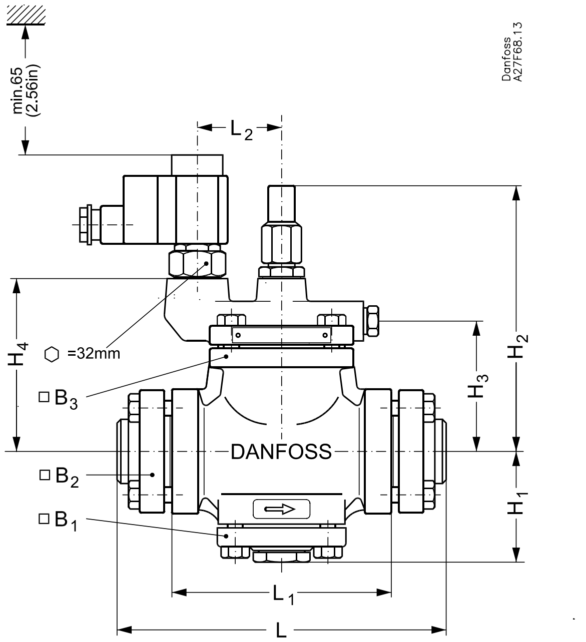


Code number includes: PM 3 valve with flange gaskets and bolts (but without flanges)

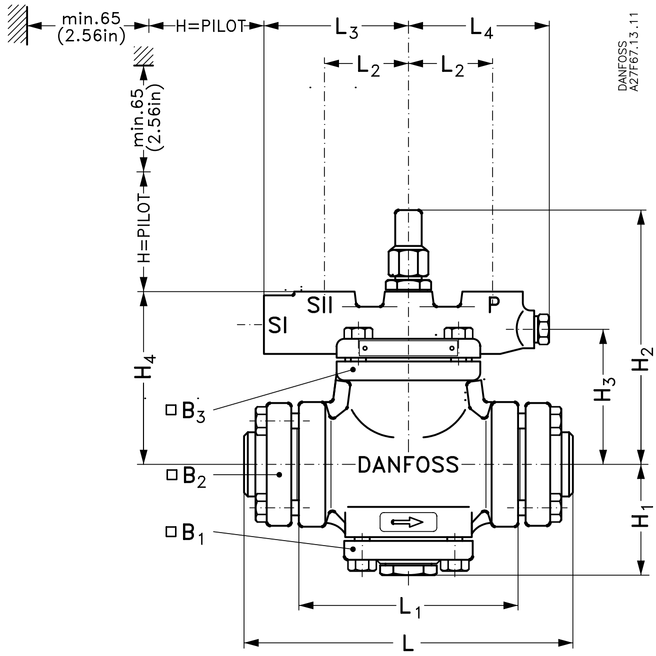
Valve type	Code no.
	EN-GJS-400-18-LT*
PM 3-5	**027F3010**
PM 3-10	**027F3011**
PM 3-15	**027F3012**
PM 3-20	**027F3013**
PM 3-25	**027F3014**
PM 3-32	**027F3015**
PM 3-40	**027F3016**
PM 3-50	**027F3017**
PM 3-65	**027F3018**
PM 3-80	**027F1271**
PM 3-100	**027F1276**
PM 3-125	**027F1281**

* CE marked

Dimensions and weights



PM 1



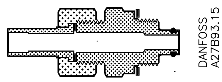
PM 3

Valve size		H_1	H_2	H_3	H_4	L	L_1	L_2	L_3	L_4	B_1	B_2	B_3	Weight [1])	Weight [1])
PM 1 and PM 3 valve body with flanges														PM 1	PM 3
PM 5 - 25 (DN 20 - 25 - 32)	mm in.	66 2.60	162 6.38	79 3.11	101 3.98	177 6.97	106 4.17	52 2.05	94 3.70	89 3.50	75 2.95	Oval flange	87 3.43	6.5 kg. 14.3 lb	7 kg. 15.4 lb
PM 32 (DN 32 - 40)	mm in.	72 2.83	178 7.01	96 3.78	118 4.65	240 9.45	170 6.69	52 2.05	94 3.70	89 3.50	84 3.31	82 3.23	94 3.70	10.8 kg. 23.8 lb	11.3 kg. 24.9 lb
PM 40 (DN 40 - 50)	mm in.	79 3.11	187 7.36	105 4.13	127 5.00	254 10.00	170 6.69	55 2.17	97 3.82	92 3.62	94 3.70	89 3.50	102 4.02	13.7 kg. 30.2 lb	14 kg. 30.9 lb
PM 50 (50 - 65)	mm in.	95 3.74	205 8.07	123 4.84	144 5.67	288 11.34	200 7.87	55 2.17	97 3.82	92 3.62	104 4.09	106 4.17	113 4.45	19.5 kg. 43.0 lb	19.8 kg. 43.7 lb
PM 65 (65 - 80)	mm in.	109 4.29	227 8.94	146 5.75	167 6.57	342 13.46	250 9.84	60 2.36	102 4.02	97 3.82	127 5.00	113 4.45	135 5.31	28 kg. 61.7 lb	28.3 kg. 62.4 lb
PM 80 (DN 100)	mm in.	152 5.98	365 14.37	214 8.43	238 9.37	437 17.20	310 12.20	69 2.72	115 4.53	119 4.69	190 7.48	235 9.25	210 8.27		80 kg. 176.4 lb
PM 100 (DN 125)	mm in.	173 6.81	396 15.59	246 9.69	269 10.59	489 19.25	350 13.78	83 3.27	125 4.92	133 5.24	226 8.90	270 10.63	243 9.57		120 kg. 264.6 lb
PM 125 (DN 150)	mm in.	208 8.19	453 17.83	301 11.85	325 12.80	602 23.70	455 17.91	99 3.90	151 5.94	155 6.10	261 10.28	300 11.81	286 11.26		170 kg. 374.8 lb

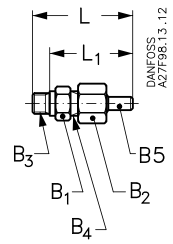
[1]) PM valve with flanges but without pilot valves

Accessories

Pressure gauge connection (weld / solder).

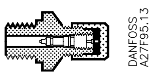


Description	Code no.
∅ 6.5 mm / ∅ 10 mm (∅ 0.26 in. / ∅ 0.39 in.) weld / solder	**027B2035**

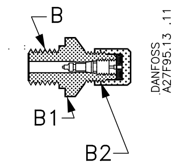


Accessories		L	L_1	B_1	B_2	B_3	B_4	B_5
Pressure gauge connection (weld / solder)								
	mm in.	66 2.60	54 2.13	AF 19	AF 22	G 1/4 A	G 3/8 A	∅6.5 / ∅10

Pressure gauge connection, 1/4 in. flare (self-closing)
Must not be used in ammonia plant.

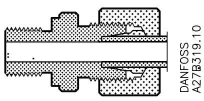


Description	Code no.
1/4 in. flare	**027B2041**

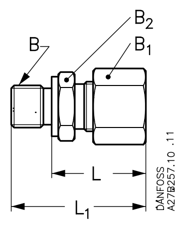


Accessories						B	B_1	B_2
Pressure gauge connection, 1/4 in. flare (self-closing)								
1/4 in. flare	mm in.					G 1/4 A	AF 19	1/4 in. flare

Pressure gauge connection (cutting ring).



Description	Code no.
Cutting ring connection, 6 mm Cutting ring connection, 10 mm	**027B2063** **027B2064**

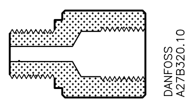


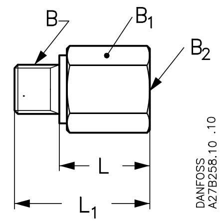
Accessories			L	L_1		B	B_1	B_2
Pressure gauge connection (cutting ring)								
6 mm	mm in.		27 1.06	39 1.54		G 1/4 A	AF 19	AF 14
10 mm	mm in.		29 1.14	40 1.57		G 1/4 A	AF 19	AF 14

Stainless steel: flanges, bolts for flanges and bolts for top and bottom covers, see flange connections for ordering.

Accessories
(continued)

Pressure gauge connection ($^1/_4$ FPT).

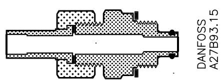


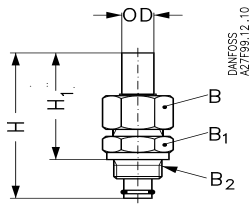


Description	Code no.
$^1/_4$ FPT	**027B2062**

Accessories			L	L_1		B	B_1	B_2
Pressure gauge connection								
	mm in.		23 0.91	35.5 1.40		G $^1/_4$ A	AF 22	$^1/_4$ FPT

External pilot connection.

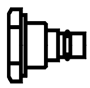


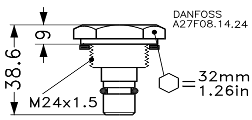


PM	Description	Code no.
5 - 65	External pilot connection (incl. damping orifice, D: 1.0 mm)	**027F1048**
80 - 125	External pilot connection (incl. damping orifice, D: 1.8 mm)	**027F1049**
5 - 125	Accessory bag with seal and O-ring for pilot valve	**027F0666**

Accessories			H	H_1	OD	B	B_1	B_2
External pilot connection								
	mm in.		90 3.54	66 2.60	18 0.71	AF 32	AF 32	M 24 × 1.5

Blanking plug for pilot valves.





Description	Code no.
Blanking plug	**027F1046**

Stainless steel: flanges, bolts for flanges and bolts for top and bottom covers, see flange connections for ordering.

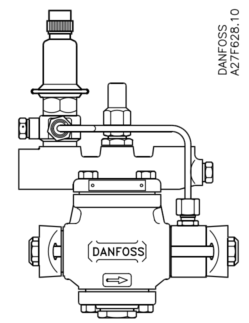
Pressure and temp. rregulators

Accessories
(continued)

Mounting set for:
- PMC + CVC (hot gas bypass)
- PM + CVC (max. suction pressure regulation).

The mounting set contains all necessary parts for mounting a CVC pilot valve on a PM main valve.

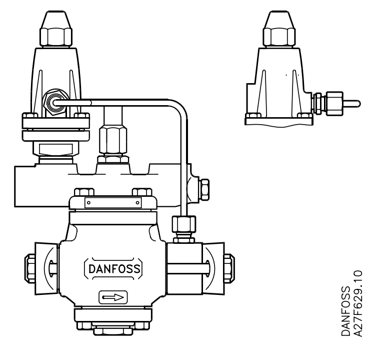
Main valve	Pilot valve	**Code no.**
PMC 5 - 25 PM 5 - 25	CVC	**027F3190**
PM 32	CVC	**027F3191**
PM 40	CVC	**027F3192**
PM 50	CVC	**027F3193**
PM 65	CVC	**027F3194**



Mounting set PM + CVPP (HP).

The mounting set contains all necessary parts for mounting a CVP (HP) pilot valve on a PM main valve.

Main valve	Pilot valve	**Code no.**
PM 5 - 25	CVPP (HP)	**027F3195**
PM 32	CVPP (HP)	**027F3196**
PM 40	CVPP (HP)	**027F3197**
PM 50	CVPP (HP)	**027F3198**
PM 65	CVPP (HP)	**027F3199**

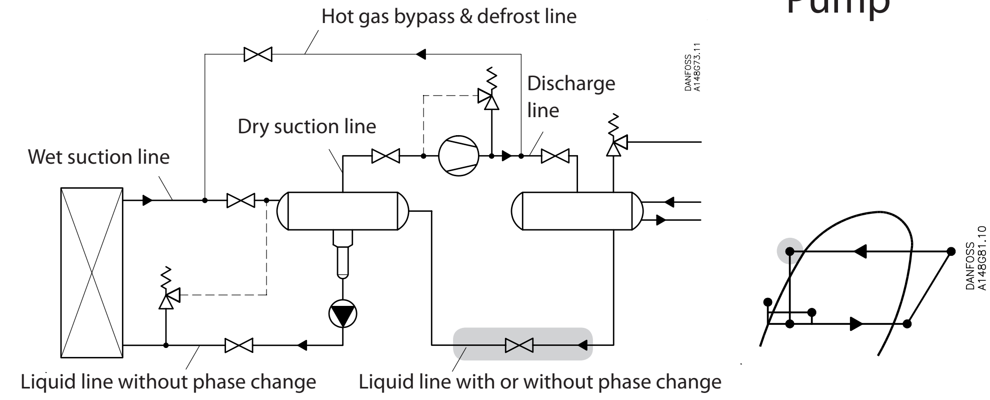


Nominal capacities

Liquid line

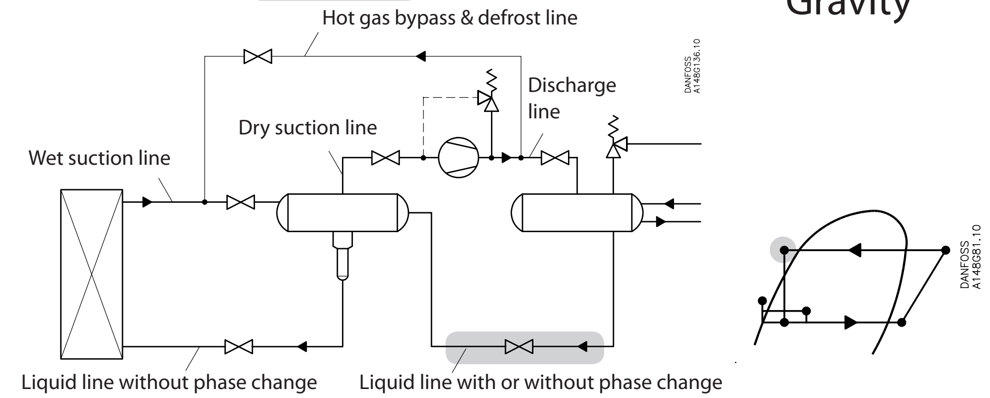
Location of valve in system (marked with grey)

Pump



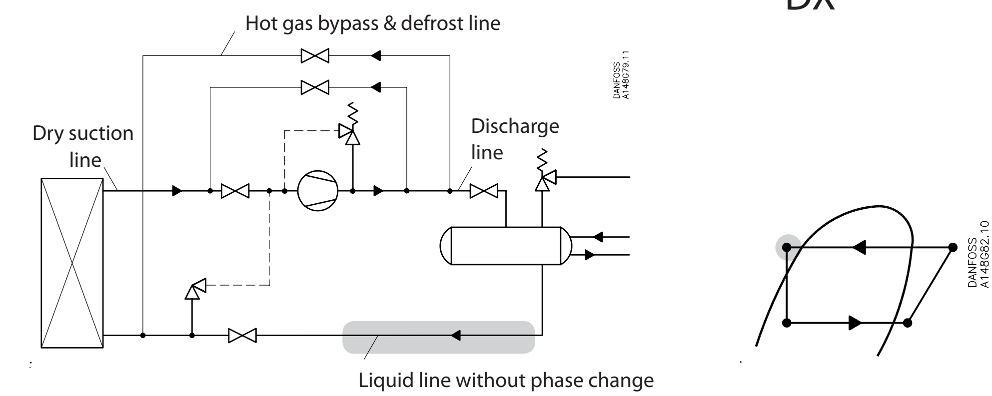
Location of valve in system (marked with grey)

Gravity



Location of valve in system (marked with grey)

DX



Pressure and temp. rregulators

Nominal capacities

Liquid line

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 30°C,
ΔP = 0.2 bar

R 717

Type	k_v m³/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
PM 5	1.6	161	164	166	168	170	172	174	175
PM 10	3	302	307	311	316	319	322	325	328
PM 15	4	403	410	415	421	426	430	434	437
PM 20	7	706	717	727	736	745	752	759	765
PM 25	11.5	1159	1177	1194	1210	1224	1236	1247	1256
PM 32	17.2	1734	1761	1786	1809	1830	1849	1865	1879
PM 40	30	3025	3071	3115	3156	3192	3225	3253	3277
PM 50	43	4335	4402	4465	4523	4576	4622	4663	4697
PM 65	79	7965	8088	8203	8310	8406	8492	8567	8629
PM 80	141	14216	14435	14640	14831	15004	15157	15290	15401
PM 100	205	20669	20987	21286	21563	21814	22036	22231	22392
PM 125	329	33171	33682	34161	34605	35009	35365	35677	35936

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 3 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
PM 5	1.9	46	47	47	48	48	49	49	49
PM 10	3.5	86	88	89	90	90	91	92	92
PM 15	4.6	115	117	118	119	121	121	122	122
PM 20	8.1	202	204	207	209	211	212	214	214
PM 25	13.3	331	336	340	343	347	349	351	352
PM 32	20	495	502	508	514	518	522	525	527
PM 40	35	864	876	886	896	904	911	915	919
PM 50	50	1238	1255	1271	1284	1296	1305	1312	1317
PM 65	92	2275	2306	2334	2359	2381	2398	2411	2419
PM 80	164	4060	4116	4166	4211	4249	4280	4303	4317
PM 100	238	5902	5984	6057	6122	6178	6223	6256	6277
PM 125	382	9473	9603	9721	9825	9914	9987	10040	10074

* 2°F below min. operating temperature.

Correction factor for liquid temperature (T_{liq})

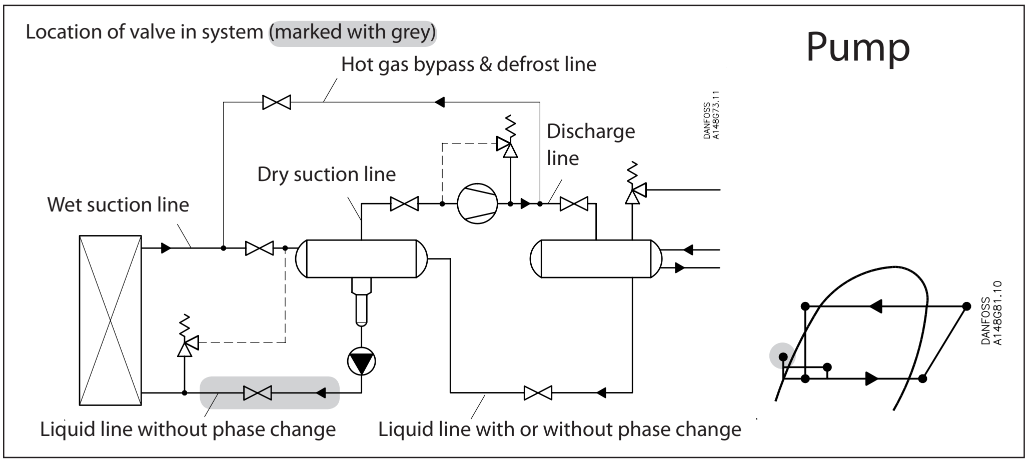
Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Nominal capacities

Pumped liquid line



SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20°C$
$Q_0 = 180$ kW
circulation rate = 3
Max. $\Delta P = 0.3$ bar

The capacity table is based on nominal conditions (pressure drop $\Delta P = 0.3$ bar, circulation rate = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 0.3 bar $f_{\Delta P} = 0.82$
Correction factor for circulation rate $f_{rec} = 0.75$.

$Q_n = Q_0 \times f_{\Delta p} \times f_{rec} = 180 \times 0.82 \times 0.75 = 111$ kW

From the capacity table a PM 15 with $Q_n = 133$ kW is the correct selection for the application.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20°F$
$Q_0 = 130$ TR
Circulation rate = 3
Max. $\Delta P = 5$ psi

The capacity table is based on nominal conditions (pressure drop $\Delta p = 3$ psi, circulation rate = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 5 psi $f_{\Delta p} = 0.79$
Correction factor for circulation rate $f_{rec} = 0.75$.

$Q_n = Q_0$ x $f_{\Delta P}$ x $f_{circ} = 140 \times 0.79 \times 0.75 = 83$ TR

From the capacity table a PM 25 with $Q_n = 114$ TR is the correct selection for the application.

Nominal capacities

Pumped liquid line

SI units

Capacity table for nominal conditions, Q_N [kW], circulation rate = 4, ΔP = 0.2 bar

R 717

Type	k_v m^3/h	Evaporating temperature T_e							
		−50°C	−40°C	−30°C	−20°C	−10°C	0°C	10°C	20°C
PM 5	1.6	58	57	55	53	51	50	48	46
PM 10	3	109	106	103	100	96	93	89	85
PM 15	4	146	142	137	133	129	124	119	114
PM 20	7	255	248	241	233	225	217	208	199
PM 25	11.5	420	407	395	383	370	356	342	328
PM 32	17.2	628	609	591	572	553	533	512	490
PM 40	30	1095	1063	1031	998	964	929	893	855
PM 50	43	1569	1523	1478	1431	1382	1332	1280	1225
PM 65	79	2883	2798	2715	2629	2539	2448	2351	2251
PM 80	141	5146	4994	4847	4691	4532	4369	4197	4017
PM 100	205	7482	7261	7046	6821	6589	6351	6102	5841
PM 125	329	12007	11654	11309	10947	10575	10193	9793	9374

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], circulation rate = 4, ΔP = 3 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		−60°F*	−40°F	−20°F	0°F	20°F	40°F	60°F	80°F
PM 5	1.9	16.9	16.4	15.9	15.3	14.7	14.1	13.4	12.8
PM 10	3.5	32	31	30	29	28	26	25	24
PM 15	4.6	42	41	40	38	37	35	34	32
PM 20	8.1	74	72	69	67	64	62	59	56
PM 25	13.3	121	118	114	110	106	101	96	92
PM 32	20	182	176	170	165	158	152	144	137
PM 40	35	317	307	297	287	276	264	251	239
PM 50	50	454	440	426	411	395	379	360	343
PM 65	92	834	809	783	756	726	696	662	630
PM 80	164	1489	1443	1397	1349	1295	1242	1182	1124
PM 100	238	2165	2098	2031	1961	1883	1806	1718	1634
PM 125	382	3474	3367	3260	3148	3022	2898	2757	2623

* 2°F below min. operating temperature.

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for circulation rate (f_{rec})

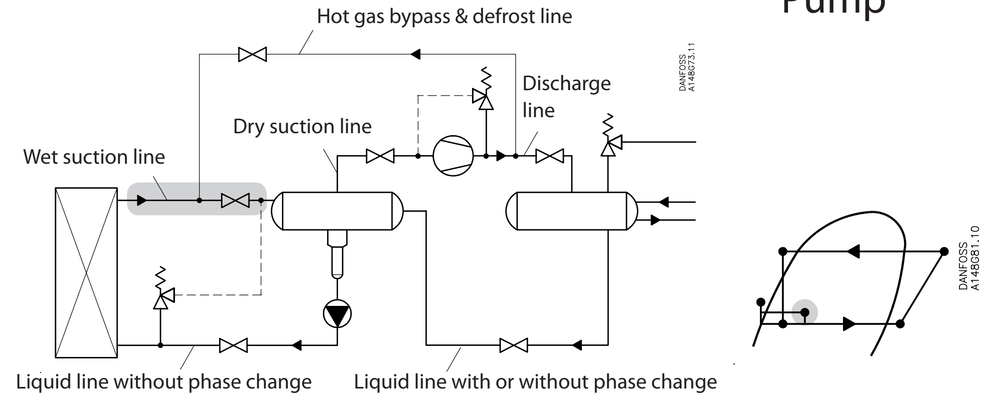
Circulation rate	Correction factor
2	0.5
3	0.75
4	**1**
6	1.5
8	2
10	2.5

Nominal capacities

Wet suction line

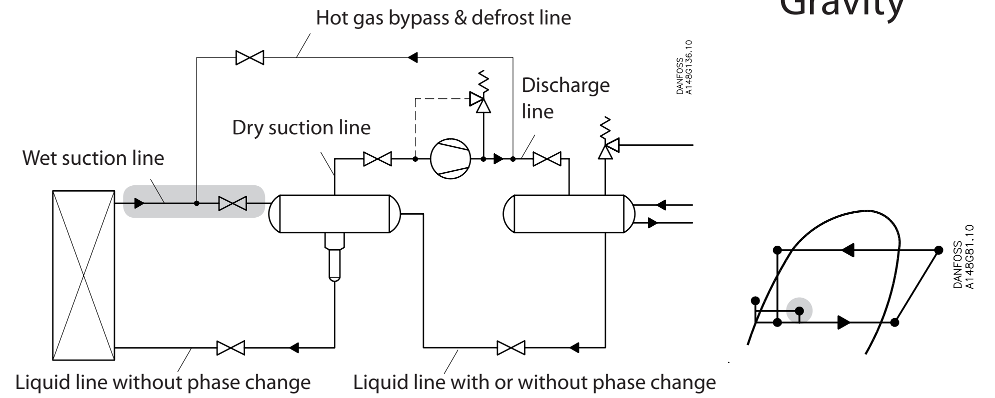
Location of valve in system (marked with grey)

Pump



Location of valve in system (marked with grey)

Gravity



Pressure and temp. rregulators

Nominal capacities

Wet suction line

SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20°C$
$Q_0 = 100$ kW
Circulation rate = 3
Max. $\Delta P = 0.3$ bar

The capacity table is based on nominal conditions (pressure drop $\Delta P = 0.2$ bar, circulation rate = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 0.3 bar $f_{\Delta P} = 0.82$
Correction factor for circulation rate $f_{rec} = 0.9$.

$Q_n = Q_0 \times f_{\Delta P} \times f_{rec} = 100 \times 0.82 \times 0.9 = 73{,}8$ kW.

From the capacity table a PM 40 with $Q_n = 107$ kW is the correct selection for the application.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20°F$
$Q_0 = 10$ TR
Circulation rate = 3
Max. $\Delta P = 5$ psi

The capacity table is based on nominal conditions (pressure drop $\Delta P = 3$ psi, circulation rate = 4).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 5 psi $f_{\Delta p} = 0.79$
Correction factor for circulation rate $f_{rec} = 0.9$.

$Q_n = Q_0 \times f_{\Delta P} \times f_{circ} = 10 \times 0.79 \times 0.9 = 7.1$ TR

From the capacity table a PM 25 with $Q_n = 10.0$ TR is the correct selection for the application.

Nominal capacities

Wet suction line

SI units

Capacity table for nominal conditions, Q_N [kW], circulation rate = 4, ΔP = 0.2 bar

R 717

Type	k_v m^3/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
PM 5	1.6	2.9	3.8	4.7	5.7	6.8	8.0	9.2	10.4
PM 10	3	5.5	7.1	8.8	10.7	12.8	15.0	17.2	19.6
PM 15	4	7.3	9.5	11.8	14.3	17.0	19.9	23.0	26.1
PM 20	7	12.8	16.6	20.6	25.0	29.8	34.9	40	46
PM 25	11.5	21.0	27.2	33.8	41	49	57	66	75
PM 32	17.2	31.4	41	51	61	73	86	99	112
PM 40	30	55	71	88	107	128	150	172	196
PM 50	43	79	102	126	154	183	214	247	281
PM 65	79	144	187	232	282	336	394	454	516
PM 80	141	258	334	415	504	600	703	810	920
PM 100	205	375	485	603	733	873	1022	1177	1338
PM 125	329	601	779	968	1176	1401	1640	1890	2147

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for circulation rate (f_{rec})

Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], circulation rate = 4, ΔP = 3 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
PM 5	1.9	0.8	1.1	1.4	1.7	2.1	2.5	2.8	3.2
PM 10	3.5	1.5	2.1	2.6	3.2	3.9	4.6	5.3	6.1
PM 15	4.6	2.0	2.7	3.5	4.3	5.2	6.2	7.1	8.1
PM 20	8.1	3.6	4.8	6.1	7.6	9.1	10.8	12.4	14.2
PM 25	13.3	5.9	7.9	10.0	12.4	15.0	17.7	20	23
PM 32	20	8.8	11.8	14.9	18.6	22	26	31	35
PM 40	35	15.3	21	26	32	39	46	53	61
PM 50	50	22	29	37	46	56	66	76	87
PM 65	92	40	54	69	85	103	122	140	160
PM 80	164	72	96	122	152	184	217	251	286
PM 100	238	104	140	178	221	267	315	365	415
PM 125	382	168	225	285	355	428	506	585	666

* 2°F below min. operating temperature.

Correction factor for ΔP ($f_{\Delta P}$)

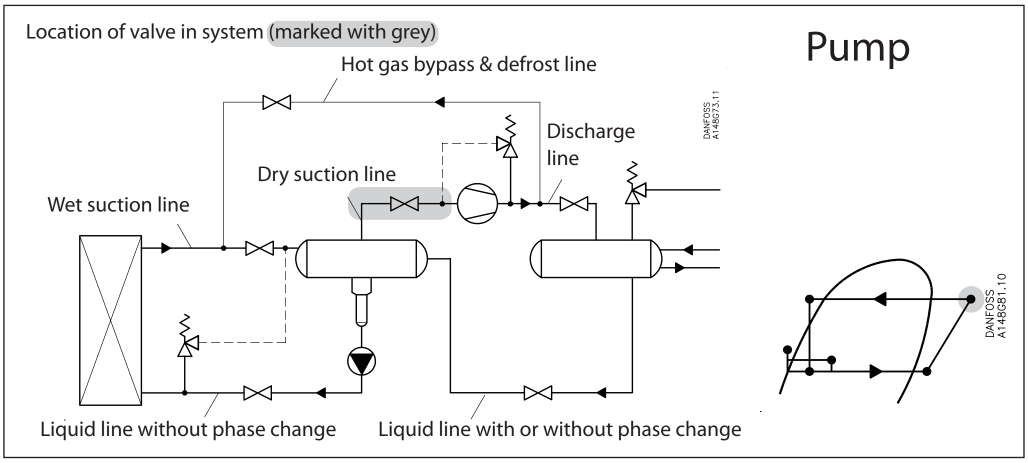
ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

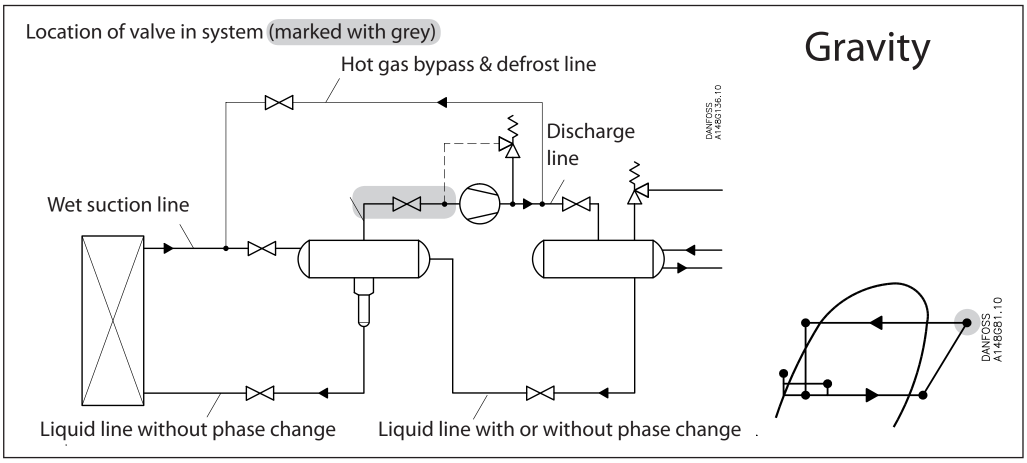
Correction factor for circulation rate (f_{rec})

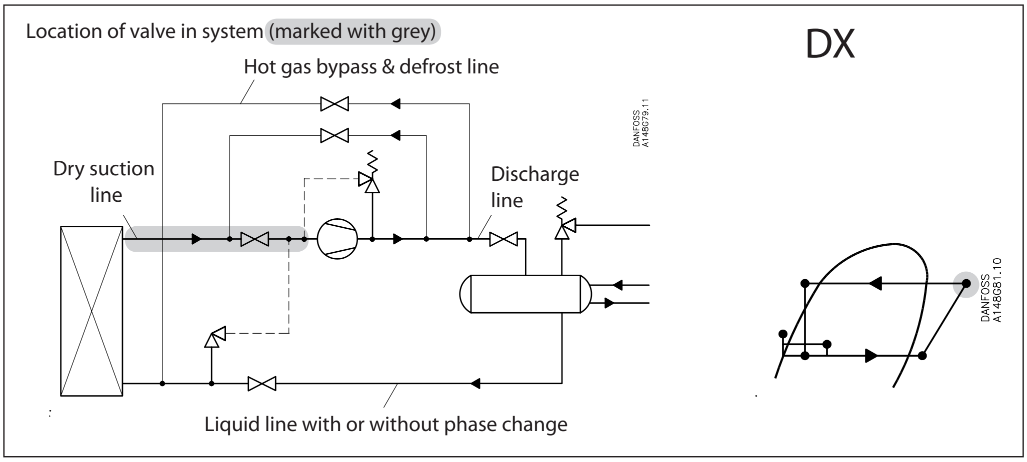
Circulation rate	Correction factor
2	0.77
3	0.90
4	**1**
6	1.13
8	1.20
10	1.25

Nominal capacities

Dry suction line







Nominal capacities

Dry suction line

SI units

Capacity table for nominal conditions, Q_N [kW], T_{liq} = 30°C, ΔP = 0.2 bar

R 717

Type	k_v m³/h	Evaporating temperature T_e							
		−50°C	−40°C	−30°C	−20°C	−10°C	0°C	10°C	20°C
PM 5	1.6	4.1	5.4	7.0	8.8	10.8	13.1	15.7	18.5
PM 10	3	7.7	10.2	13.1	16.5	20	25	29	35
PM 15	4	10.3	13.6	17.4	22	27	33	39	46
PM 20	7	18.1	24	31	38	47	57	69	81
PM 25	11.5	30	39	50	63	78	94	113	133
PM 32	17.2	44	59	75	94	116	141	169	199
PM 40	30	77	102	131	165	202	246	294	348
PM 50	43	111	146	187	236	290	352	422	498
PM 65	79	204	269	344	434	533	647	775	915
PM 80	141	364	480	615	774	952	1155	1383	1634
PM 100	205	529	698	894	1126	1384	1680	2011	2375
PM 125	329	848	1120	1435	1807	2221	2696	3227	3812

Pressure and temp. rregulators

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.25	0.89
0.3	0.82
0.4	0.71
0.5	0.63
0.6	0.58

Correction factor for superheat (T_S)

T_s	Correction factor
6°C	1.00
8°C	1.00
10°C	1.00
12°C	1.00

Correction factor for liquid temperature (T_{liq})

Liquid temperature	Correction factor
−20°C	0.82
−10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration], T_{liq} = 90°F, ΔP = 3 psi

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		−60°F*	−40°F	−20°F	0°F	20°F	40°F	60°F	80°F
PM 5	1.9	1.1	1.6	2.1	2.6	3.3	4.1	4.9	5.9
PM 10	3.5	2.1	2.9	3.9	4.9	6.2	7.7	9.2	11.0
PM 15	4.6	2.9	3.9	5.1	6.6	8.3	10.2	12.3	14.7
PM 20	8.1	5.0	6.9	9.0	11.5	14.5	17.9	22	26
PM 25	13.3	8.2	11.3	14.8	18.9	24	29	35	42
PM 32	20	12.3	16.9	22	28	36	44	53	63
PM 40	35	21	29	39	49	62	77	92	110
PM 50	50	30.8	42	55	71	89	110	132	158
PM 65	92	56.5	78	101	130	164	202	243	290
PM 80	164	100.9	139	181	231	292	361	434	517
PM 100	238	146.6	202	263	336	425	525	631	752
PM 125	382	235	323	423	540	682	843	1013	1207

* 2°F below min. operating temperature.

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
4	0.87
5	0.79
6	0.72
7	0.66
8	0.62

Correction factor for superheat (T_S)

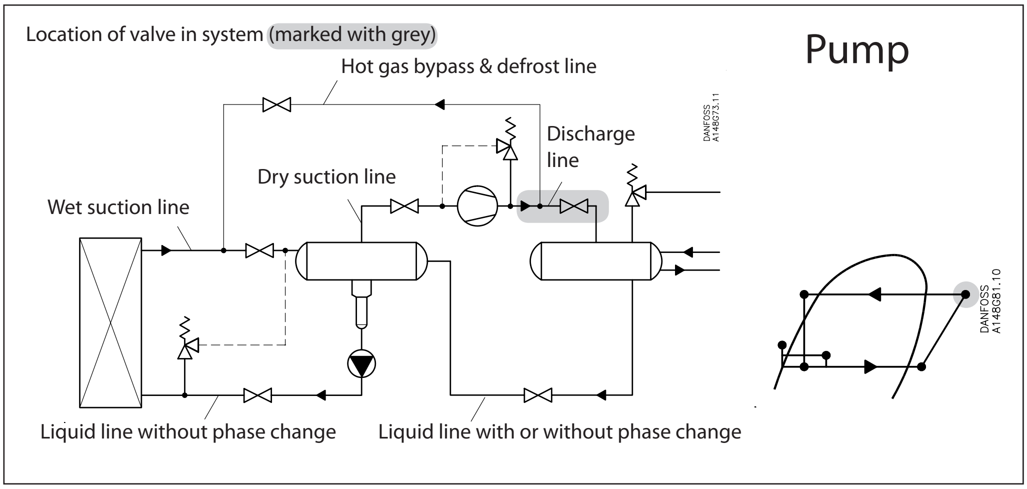
T_s	Correction factor
10°F	1.00
14°F	1.00
18°F	1.00
20°F	1.00

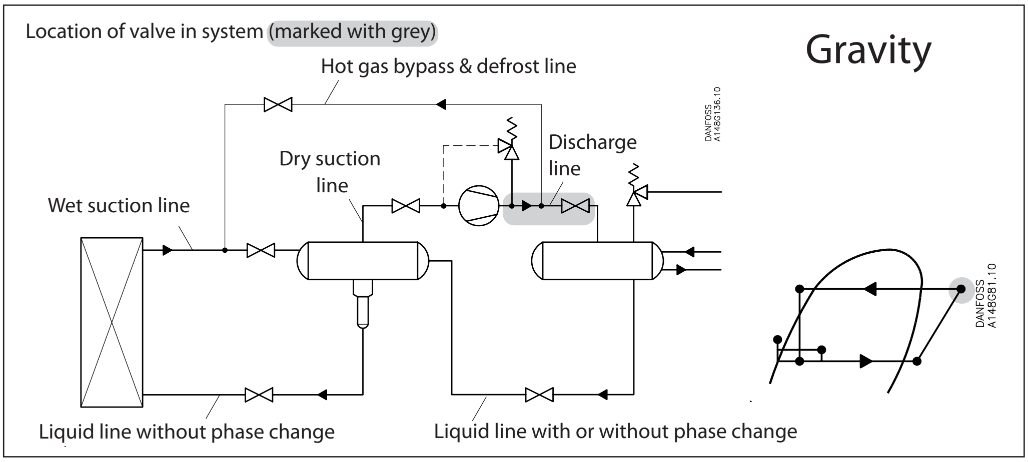
Correction factor for liquid temperature (T_{liq})

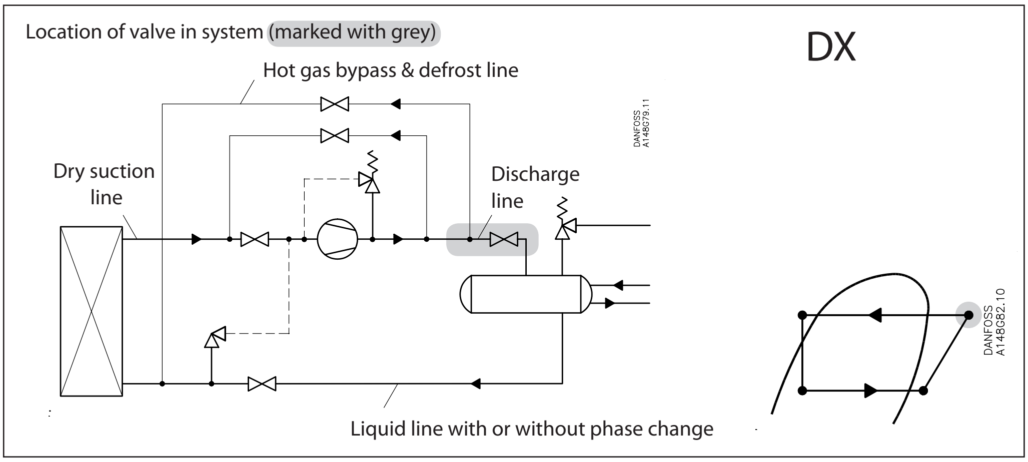
Liquid temperature	Correction factor
−10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

Nominal capacities

Discharge line







Nominal capacities

Discharge line

SI units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = -20$ °C
$Q_o = 90$ kW
$T_{liq} = 10$ °C
Max. $\Delta P = 0.4$ bar
$T_{disch} = 60$°C

The capacity table is based on nominel conditions ($\Delta P = 0.2$ bar, $T_{liq} = 30$°C, P_{disch}= 12 bar, $T_{disch} = 80$°C).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 0.4 bar $f_{\Delta P} = 0.72$.
Correction factor for liquid temperature $f_{Tliq} = 0.92$.
Correction factor for T_{disch} 60°C, $f_{disch} = 0.97$.
Correction factor for P_{disch} 12 bar, $f_{pdisch} = 1.0$.

$Q_n = Q_o \times f_{\Delta P} \times f_{Tliq} \times f_{Tdisch} \times f_{Pdisch}$
$= 90 \times 0.72 \times 0.92 \times 0.97 \times 1.0 = 58$ kW.

From the capacity table a PM 20 with $Q_n = 80$ kW is the correct selection for the application.

US units

Calculation example (R 717 capacities):

Running conditions in a plant are as follows:

$T_e = 0$°F
$Q_o = 18$ TR
$T_{liq} = 50$ °F
Max. $\Delta P = 7$ psi
$T_{disch} = 120$°F

The capacity table is based on nominel conditions ($\Delta P = 3$ psi, $T_{liq} = 90$ °F, P_{disch}= 185 psi, $T_{disch} = 180$°F).

The actual capacity must therefore be corrected to a nominal condition by multiplication with correction factors.

Correction factor for ΔP 7 psi $f_{\Delta P} = 0.67$.
Correction factor for liquid temperature $f_{Tliq} = 0.92$.
Correction factor for T_{disch} 120°F, $f_{disch} = 0.95$.
Correction factor for P_{disch} 185 psi, $f_{pdisch} = 1.0$.

$Q_n = Q_o \times f_{\Delta P} \times f_{Tliq} \times f_{circ} \times f_{Pdisch}$
$= 18 \times 0.67 \times 0.92 \times 0.95 \times 1.0 = 10.5$ TR

From the capacity table a PM15 with $Q_n = 13.1$ TR is the correct selection for the application.

Pressure and temp. rregulators

Nominal capacities

Discharge line

SI units

Capacity table for nominal conditions, Q_N [kW],
T_{liq} = 30°C,
$P_{disch.}$ = 12 bar,
ΔP = 0.2 bar,
$T_{disch.}$ = 80°C

R 717

Type	k_v m^3/h	Evaporating temperature T_e							
		–50°C	–40°C	–30°C	–20°C	–10°C	0°C	10°C	20°C
PM 5	1.6	17.5	17.8	18.0	18.3	18.5	18.7	18.8	18.9
PM 10	3	33	33	34	34	35	35	35	35
PM 15	4	44	44	45	46	46	47	47	47
PM 20	7	77	78	79	80	81	82	82	83
PM 25	11.5	126	128	130	131	133	134	135	136
PM 32	17.2	188	191	194	196	199	201	203	203
PM 40	30	328	333	338	343	347	350	353	354
PM 50	43	471	478	485	491	497	502	506	507
PM 65	79	865	878	891	902	913	922	930	932
PM 80	141	1543	1567	1590	1610	1629	1645	1660	1664
PM 100	205	2244	2279	2311	2341	2369	2392	2414	2419
PM 125	329	3601	3657	3709	3757	3802	3839	3874	3882

Correction factor for discharge pressure (P_{disch})

P_{disch} (bar)	Correction factor
12	**1.00**
16	0.87
20	0.78

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (bar)	Correction factor
0.2	**1.00**
0.4	0.72
0.6	0.59
0.8	0.52
1	0.46
1.5	0.39
2	0.34
4	0.27

Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
50°C	0.96
60°C	0.97
80°C	**1.00**
90°C	1.01
100°C	1.03
110°C	1.04
120°C	1.06

Correction factor for liquid temperature (T_{liq}).

Liquid temperature	Correction factor
–20°C	0.82
–10°C	0.86
0°C	0.88
10°C	0.92
20°C	0.96
30°C	**1.00**
40°C	1.04
50°C	1.09

US units

Capacity table for nominal conditions, Q_N [Tons of Refrigeration],
T_{liq} = 90°F,
ΔP = 3 psi,
$P_{disch.}$ = 185 psi,
$T_{disch.}$ = 180°F

R 717

Type	C_v USgal/min	Evaporating temperature T_e							
		–60°F*	–40°F	–20°F	0°F	20°F	40°F	60°F	80°F
PM 5	1.9	5.1	5.1	5.2	5.2	5.3	5.3	5.4	5.4
PM 10	3.5	9.5	9.6	9.8	9.8	9.9	10.0	10.0	10.1
PM 15	4.6	12.7	12.8	13.0	13.1	13.2	13.4	13.4	13.5
PM 20	8.1	22	22	23	23	23	23	23	24
PM 25	13.3	36	37	37	38	38	38	38	39
PM 32	20.0	54	55	56	56	57	57	58	58
PM 40	35	95	96	98	98	99	100	100	101
PM 50	50	136	138	140	141	142	144	144	145
PM 65	92	250	253	257	259	261	264	264	266
PM 80	164	446	452	458	463	466	471	472	474
PM 100	238	648	658	667	673	678	685	686	689
PM 125	382	1041	1055	1070	1080	1088	1099	1101	1107

* 2°F below min. operating temperature.

Correction factor for discharge pressure (P_{disch})

P_{disch} (psi)	Correction factor
185	**1.00**
240	0.87
300	0.78

Correction factor for ΔP ($f_{\Delta P}$)

ΔP (psi)	Correction factor
3	**1.00**
5	0.79
7	0.67
10	0.56
15	0.47
20	0.41
30	0.35
60	0.28

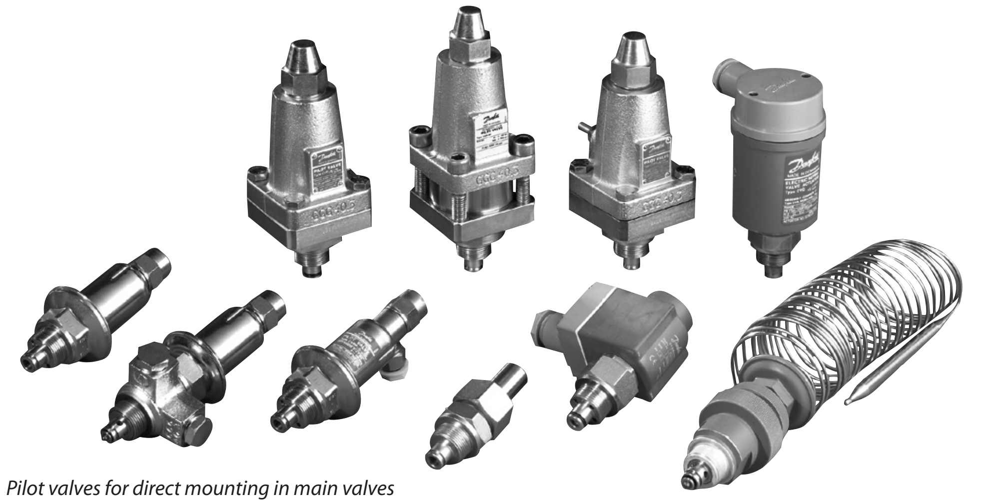
Correction factor for discharge temperature (T_{disch}).

Discharge temperature	Correction factor
120°F	0.95
140°F	0.97
180°F	**1.00**
200°F	1.02
210°F	1.02
230°F	1.04
250°F	1.06

Correction factor for liquid temperature (T_{liq}).

Liquid temperature	Correction factor
–10°F	0.82
10°F	0.85
30°F	0.88
50°F	0.92
70°F	0.96
90°F	**1.00**
110°F	1.04
130°F	1.09

Introduction



Pilot valves for direct mounting in main valves

The range of pilot valves consists of:

- Constant-pressure pilot valve, type CVP (LP) and CVP (HP)
- Differential-pressure pilot valve, type CVPP (LP) and CVPP (HP)
- High pressure pilot valve, type CVP (XP) ideal for CO_2 hot gas defrosting
- Pressure-operated pilot valve with reference pressure connection, type CVC
- Temperature-operated pilot valve, type CVT/CVTO (pressure-independent)
- Electronically operated constant-pressure pilot valve, type CVQ (pressure-dependent)
- Motor-operated constant-pressure pilot valve, type CVPM (pressure-dependent)
- Solenoid pilot valve, type EVM (NC)
- Solenoid pilot valve, type EVM (NO)
- Housing, type CVH for pilot valves, for mounting in external pilot lines

Features

- Applicable to all common non flammable refrigerants including R 717 and non corrosive gases/liquids dependent on sealing material compatability.
- The pilot valves can be screwed direct into the main valve, thus avoiding the necessity of welding, soldering and separate pilot lines.
- The pilot valves can be mounted direct in a ICS or PM main valve or be connected via an external pilot line and a CVH housing.
- All pilot valves can be used on all sizes of main valves.
- Extremely accurate pressure and temperature control.
- Several pilot valves can be connected in series or in parallel to provide many functions in the same ICS or PM main valve.

Design

Each pilot valve is designed to give the optimum control accuracy within the specific function range of the valve.

Several pilot valves can be mounted in series and/or in parallel on a ICS or PM main valve to give a very large number of functions.

Mounted in a CVH housing, the pilot valves can be used in external lines, either as independently operating valves or as external control valves for the main valve.

The pilot valves can be used for all sizes of ICS or PM main valves.

Technical data

- *Refrigerants*
  Applicable to all common non flammable refrigerants including R 717 and non corrosive gases/liquids dependent on sealing material compatability.

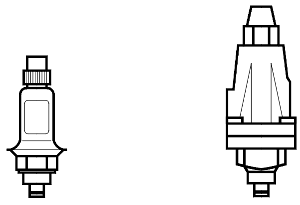
  For further information please see installation instruction for ICS valves or PM valves.

  Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.
- Temperature and pressure ranges are given separately for the specific pilot valve.

The complete technical leaflet (DKRCI.PD.HN0.A) can be downloaded from the Danfoss web site.

Constant-pressure pilot valve, type CVP (LP) and CVP (HP)

Design and function



CVP (LP) Low-pressure version | CVP (HP) High-pressure version

CVP is a constant-pressure pilot valve available in low-pressure and high-pressure versions.

The pilot valve is used to maintain a constant pressure on the ICS or PM main valve inlet side. The low-pressure version (LP) must not be subjected to pulsation.

When a CVP is mounted in a CVH housing, it can be used as a separate constant-pressure valve or a pressure relief valve (e.g. to prevent hydraulic overpressure in an entrapped liquid).

MWP: Maximum working pressure.

The k_v/C_v value is measured with the pilot valve mounted in a CVH housing for external pilot lines. The value can vary slightly, depending on the setting value.

When CVP (HP) is used at a temperature lower than –50°C (–58°F) the bolts must be replaced with stainless steel bolts (type 4, quality 80).

*Technical data, **SI units***

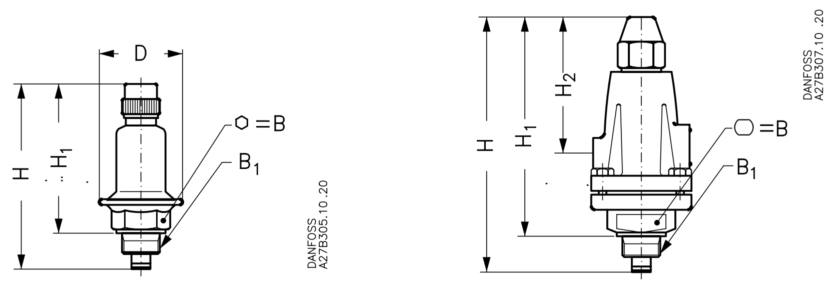
Valve type	MWP	k_v-value	Temperature range	Pressure range	**Code no.**
Low-pressure version					
CVP (LP)	17 bar g	0.40 m³/h	–50 to 120°C	0 bar g to 7 bar g	**027B1100**
CVP (LP)	17 bar g	0.40 m³/h	–50 to 120°C	–0.66 bar g to 2 bar g	**027B1101**
High-pressure version					
CVP (HP)	28 bar g	0.40 m³/h	–50 to 120°C	4 bar g to 22 bar g	**027B1160**
CVP (HP)	28 bar g	0.40 m³/h	–50 to 120°C	4 bar g to 28 bar g	**027B1161**
CVP (HP)	28 bar g	0.40 m³/h	–50 to 120°C	–0.66 bar g to 7 bar g	**027B1164**

*Technical data, **US units***

Valve type	MWP	C_v-value	Temperature range	Pressure range	**Code no.**
Low-pressure version					
CVP (LP)	247 psi g	0.46 US gal/min	–58 to 248°F	0 psi g to 102 psi g	**027B1100**
CVP (LP)	247 psi g	0.46 US gal/min	–58 to 248°F	19.5 in. Hg to 29 psi g	**027B1101**
High-pressure version					
CVP (HP)	406 psi g	0.46 US gal/min	–58 to 248°F	58 psi g to 319 psi g	**027B1160**
CVP (HP)	406 psi g	0.46 US gal/min	–58 to 248°F	58 psi g to 406 psi g	**027B1161**
CVP (HP)	406 psi g	0.46 US gal/min	–58 to 248°F	19.5 in. Hg to 102 psi g	**027B1164**

P-band for a valve system regulated by CVP and ICS or PM main valve: < 0.2 bar g (2.9 psi g)

Dimensions and weights



CVP (LP) | CVP (HP)

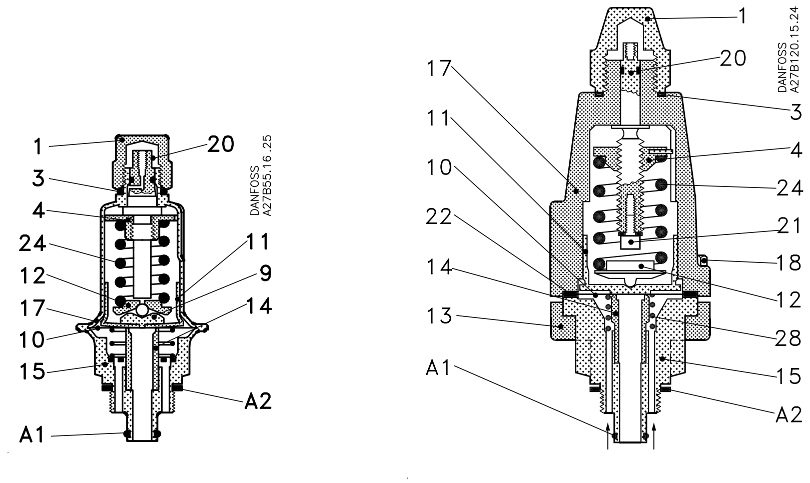
Valve type		H	H_1	H_2		D		B	B_1	Weight
Low-pressure version										
CVP (LP)	mm	122	98			53		32	M 24 × 1.5	0.4 kg
	in.	4.80	3.86			2.09				0.88 lb.
High-pressure version										
CVP (HP)	mm	170	146	90				32	M 24 × 1.5	1.7 kg
	in.	6.69	5.75	3.54						3.75 lb.

Weights are approximate values only

Constant-pressure pilot valve, type CVP (LP) and CVP (HP)

(continued)

Material specification



CVP (LP) CVP (HP)

CVP (LP)

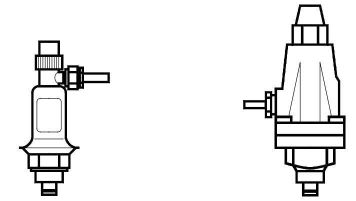
No.	Part	Material
A1	O-ring	Cloroprene (Neoprene)
A2	Seal	Non-asbestos
1	Protective cap	Steel
3	Seal	Cloroprene (Neoprene)
4	Nut	Stainless steel
9	Ball socket	Stainless steel
10	Diaphragm	Stainless steel
11	Thrust pad	Steel
12	Spring guide	Stainless steel
14	Orifice	Stainless steel
15	Base	Steel
17	Valve bonnet	Low temperature cast iron (spherical)
20	Setting spindle	Stainless steel
24	Spring	Steel

CVP (HP)

No.	Part	Material
A1	O-ring	Cloroprene (Neoprene)
A2	Seal	Non-asbestos
1	Protective cap	Steel
3	Seal	Non-asbestos
4	Nut	Stainless steel
10	Diaphragm	Stainless steel
11	Thrust pad	Stainless steel
12	Spring guide	Stainless steel
13	Flange	Low temperature cast iron (spherical)
14	Orifice	Stainless steel
15	Base	Steel
17	Valve bonnet	Low temperature cast iron (spherical)
18	Cover bolt	Steel
20	Setting spindle	Stainless steel
21	Screw (M6 × 10)	Steel
22	Cover gasket	Non-asbestos
24	Spring	Steel
28	Spring	Steel

Differential-pressure pilot valve, type CVPP (LP) and CVPP (HP)

Design and function



CVPP (LP)
Low-pressure version

CVPP (HP)
High-pressure version

CVPP is a differential-pressure pilot valve available in low-pressure and high-pressure versions.

The pilot valve is used to maintain a constant differential pressure between the CVPP valve reference pressure connection and the ICS or PM main valve inlet pressure.

CVPP incorporates a diaphragm so that the reference pressure and the refrigerant in the valve are physically separated. The pilot valve can therefore also be used as a pneumatic control valve either to control a ICS or PM main valve or as a separate pneumatic valve mounted in a CVH housing.

MWP: Maximum working pressure.

The k_v/C_v value is measured with the pilot valve mounted in a CVH housing for external pilot lines. The value can vary slightly, depending on the setting value.

When CVPP (HP) is used at a temperature lower than –50°C (–58°F) the bolts must be replaced with stainless steel bolts (type 4, quality 80).

*Technical data, **SI units***

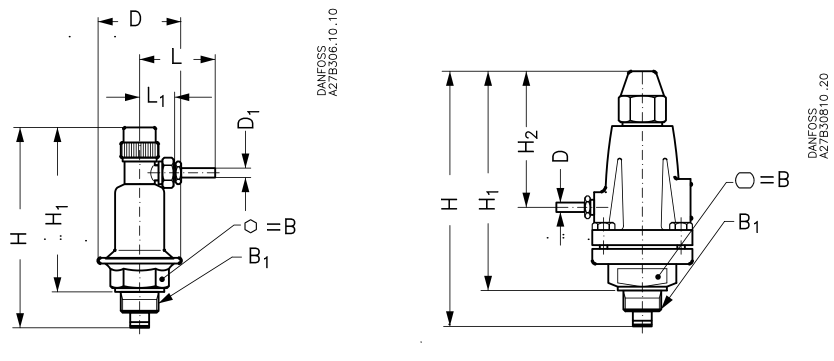
Valve type	MWP	k_v-value	Temperature range	Pressure range (Δp)	**Code no.**
Low-pressure version					
CVPP (LP)	17 bar g	0.40 m³/h	–50 to 120°C	Δp = 0 to 7 bar g	**027B1102**
High-pressure version					
CVPP (HP)	28 bar g	0.40 m³/h	–50 to 120°C	Δp = 0 to 7 bar g	**027B1162**
CVPP (HP)	28 bar g	0.40 m³/h	–50 to 120°C	Δp = 4 to 22 bar g	**027B1168**
CVPP (HP)	40 bar g	0.40 m³/h	–50 to 120°C	Δp = 4 to 22 bar g	**027B1268**

*Technical data, **US units***

Valve type	MWP	C_v-value	Temperature range	Pressure range (Δp)	**Code no.**
Low-pressure version					
CVPP (LP)	247 psi g	0.46 USgal/min	–58 to 248°F	Δp = 0 to 102 psi g	**027B1102**
High-pressure version					
CVPP (HP)	406 psi g	0.46 USgal/min	–58 to 248°F	Δp = 0 to 102 psi g	**027B1162**
CVPP (HP)	406 psi g	0.46 USgal/min	–58 to 248°F	Δp = 58 to 319 psi g	**027B1168**
CVPP (HP)	580 psi g	0.46 USgal/min	–58 to 248°F	Δp = 58 to 319 psi g	**027B1268**

P-band for a valve system regulated by CVPP and ICS or PM main valve: <0.2 bar g (2.9 psi g).

Dimensions and weights



CVPP (LP)

CVPP (HP)

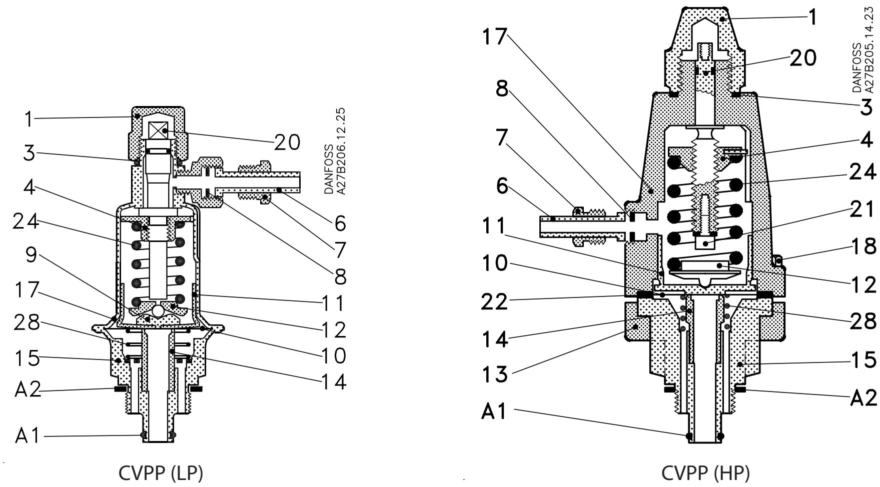
Valve type		H	H_1	H_2	L	L_1	D	B	B_1	Weight
Low-pressure version										
CVPP (LP)	mm	136	112		53	26	53	32	M 24 × 1.5	0.5 kg
	in.	5.35	4.41		2.09	1.02	2.09			1.1 lb.
High-pressure version										
CVPP (HP)	mm	170	146	90			6	32	M 24 × 1.5	1.7 kg
	in.	6.69	5.75	3.54			0.24			3.7 lb.

Weights are approximate values only

Differential-pressure pilot valve, type CVPP (LP) and CVPP (HP)

(continued)

Material specification



CVPP (LP)

No.	Part	Material
A1	O-ring	Cloroprene (Neoprene)
A2	Seal	Non-asbestos
1	Protective cap	Steel
3	Seal	Cloroprene (Neoprene)
4	Nut	Stainless steel
6	Nipple	Steel
7	Union nut	Steel
8	Seal	Aluminium
9	Ball socket	Stainless steel
10	Diaphragm	Stainless steel
11	Thrust pad	Steel
12	Spring guide	Stainless steel
14	Orifice	Stainless steel
15	Base	Steel
17	Valve bonnet	Low temperature cast iron (spherical)
20	Setting spindle	Stainless steel
24	Spring	Steel
28	Spring	Steel

CVPP (HP)

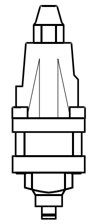
No.	Part	Material
A1	O-ring	Cloroprene (Neoprene)
A2	Seal	Non-asbestos
1	Protective cap	Steel
3	Seal	Non-asbestos
4	Nut	Stainless steel
6	Nipple	Steel
7	Union nut	Steel
8	Seal	Aluminium
10	Diaphragm	Stainless steel
11	Thrust pad	Stainless steel
12	Spring guide	Stainless steel
13	Flange	Low temperature cast iron (spherical)
14	Orifice	Stainless steel
15	Base	Steel
17	Valve bonnet	Low temperature cast iron (spherical)
18	Cover bolt	Steel (8.8)
20	Setting spindle	Stainless steel
21	Screw (M6 × 10)	Steel
22	Cover gasket	Non-asbestos
24	Spring	Steel
28	Spring	Steel

High pressure pilot valve, type CVP (XP)

MWP: Maximum working pressure.

The k_v/C_v value is measured with the pilot valve mounted in a CVH housing for external pilot lines. The value can vary slightly, depending on the setting value.

Design and function



CVP (XP)
High pressure pilot valve

CVP (XP) is a constant-pressure pilot valve available in high-pressure version. The CVP (XP) ensures an efficient and stable CO_2 hot gas defrost process.

The pilot valve is used to maintain a constant pressure on the ICS or PM main valve inlet side.

When a CVP is mounted in a CVH housing, it can be used as a separate constant-pressure valve or a pressure relief valve (e.g. to prevent hydraulic overpressure in an entrapped liquid).

*Technical data, **SI units***

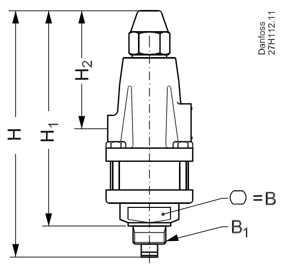
Valve type	MWP	k_v-value	Temperature range	Pressure range	**Code no.**
High-pressure version					
CVP (XP)	52 bar g	0.45 m³/h	–50 to 120°C	25 bar g to 52 bar g	**027B0080**

*Technical data, **US units***

Valve type	MWP	C_v-value	Temperature range	Pressure range	**Code no.**
High-pressure version					
CVP (XP)	754 psi g	0.52 USgal/min	–58 to 248°F	363 psi g to 754 psi g	**027B0080**

P-band for a valve system regulated by CVP and ICS or PM main valve: < 1.6 bar g (23.2 psi g)

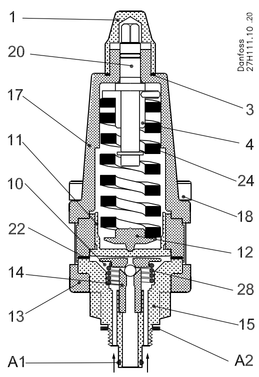
Dimensions and weights



CVP (XP)

Valve type		H	H1	H2	B	B1	Weight
CVP-XP	mm	190	166	90	32	M24 × 1.5	1.9 kg
	in.	7.48	6.54	3.54			4.2 lb

Material specification



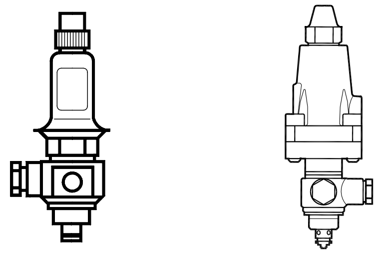
CVP (XP)

CVP (XP)

No.	Part	Material
1	Protective cap	Steel
3	Seal	Cloroprene (Neoprene)
4	Nut	Stainless steel
10	Diaphragm	Stainless steel
11	Thrust pad	Steel
12	Spring guide	Stainless steel
13	Flange	Low temperature cast iron (spherical)
14	Orifice	Stainless steel
15	Base	Steel
17	Valve bonnet	Low temperature cast iron (spherical)
18	Cover bolt	Stainless steel
20	Setting spindle	Stainless steel
22	Cover gasket	Non-asbestos
24	Spring	Steel
28	Spring	Steel
A1	O-ring	Cloroprene (Neoprene)
A2	Seal	Non-asbestos

Pressure-operated pilot valve with reference pressure connection, type CVC

Design and function



CVC (LP)
Low-pressure version

CVC (XP)
High-pressure version

CVC is a pressure-operated pilot valve with a connection that can be used to obtain an indication of the system reference pressure. CVC valves are used:

- together with a PMC main valve to regulate capacity using hot gas bypass;
- together with a ICS or PM main valve to regulate max. suction pressure, e.g. as a compressor crankcase pressure regulator;
- together with a ICS or PM main valve as a pressure limiter, e.g. for hot gas defrost of hot gas lines.

The maximum working pressure (MWP) refers to the high-pressure side of the valve (28/52 bar); the reference pressure (17/28 bar) refers to the low-pressure side of the system.

The reference pressure must be connected to the low-pressure side of the system.

The k_v/C_v value is measured with the pilot valve mounted in a CVH housing for external pilot lines. The value can vary slightly, depending on the setting value.

*Technical data, **SI units***

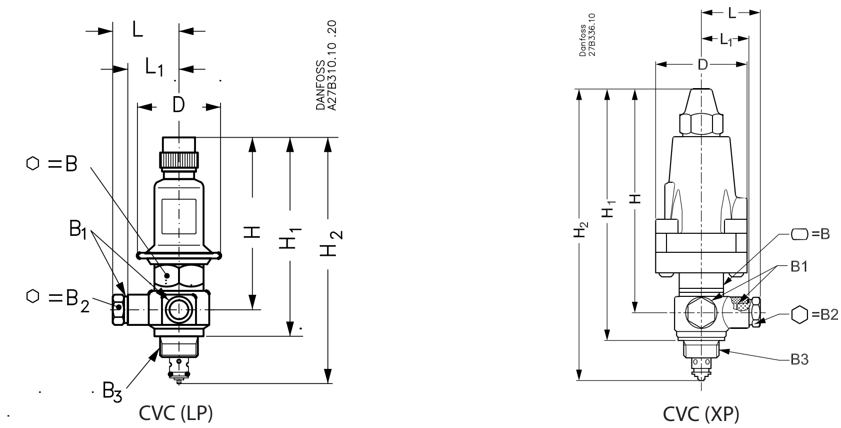
Valve type	MWP	k_v-value	Temperature range	Pressure range	**Code no.**
Low-pressure version					
CVC	28/17 bar g	0.20 m³/h	–50 to 120°C	–0.45 bar g to 7 bar g	**027B1070**
High-pressure version					
CVC	52/28 bar g	0.20 m³/h	–50 to 120°C	4 bar g to 28 bar g	**027B0087**

*Technical data, **US units***

Valve type	MWP	C_v-value	Temperature range	Pressure range	**Code no.**
Low-pressure version					
CVC	406/247 psi g	0.23 USgal/min	–58 to 248°F	13.3 in. Hg to 102 psi g	**027B1070**
High-pressure version					
CVC	754/406 psi g	0.23 USgal/min	–58 to 248°F	70.0 in. Hg to 406 psi g	**027B0087**

P-band for a valve system regulated by CVC and ICS/PM/PMC: < 0.3 bar g (4.4 psi g)

Dimensions and weights



CVC (LP)

CVC (XP)

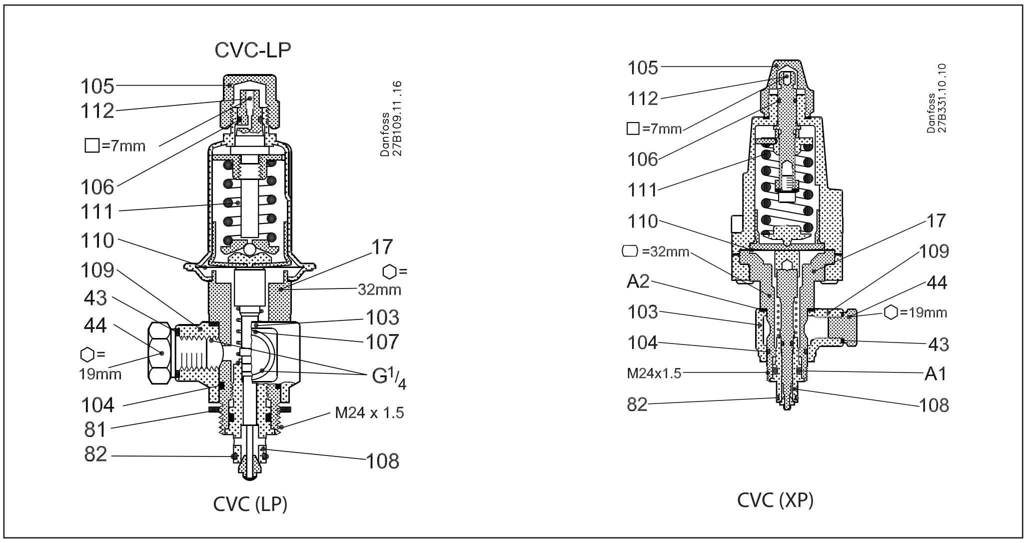
Valve type		H	H_1	H_2	L	L_1	D	B	B_1	B_2	B_3	Weight
Low-pressure version												
CVC	mm	110	129	153	43	33	53	32	G 1/4	19	M 24 × 1.5	0.7 kg
	in	4.33	5.08	6.02	1.69	1.30	2.09					1.5 lb.
High-pressure version												
CVC	mm	158	178	206	41	33	65	32	G 1/4	19	M 24 × 1.5	2.0 kg
	in	6.22	7.00	8.11	1.61	1.30	2.56					4.4 lb.

Weights are approximate values only

Pressure-operated pilot valve with reference pressure connection, type CVC

(continued)

Material specification



CVC (LP)

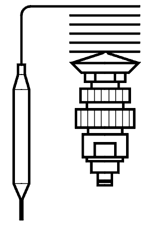
No.	Part	Material
43	Seal	Aluminium
44	Blanking plug for pressure gauge connection	Stainless steel
81	Seal	Non-asbestos
82	O-ring	Cloroprene (Neoprene)
103	Banjo fitting	Steel
104	O-ring	Cloroprene (Neoprene)
105	Protective cap	Steel
106	O-ring	Cloroprene (Neoprene)
107	Signal connection	
108	Pilot orifice	Stainless steel
109	Connector on banjo fitting 103	Steel
110	Diaphragm	Stainless steel
111	Spring	Steel
112	Setting spindle	Stainless steel
17	Valve body	Stainless steel

CVC (XP)

No.	Part	Material
43	Seal	Aluminium
44	Blanking plug for pressure gauge connection	Stainless steel
81	Seal	Non-asbestos
82	O-ring	Cloroprene (Neoprene)
103	Banjo fitting	Steel
104	O-ring	Cloroprene (Neoprene)
105	Protective cap	Steel
106	O-ring	Cloroprene (Neoprene)
107	Signal connection	
108	Pilot orifice	Stainless steel
109	Connector on banjo fitting 103	Steel
110	Diaphragm	Stainless steel
111	Spring	Steel
112	Setting spindle	Stainless steel
17	Valve body	Stainless steel
A1	O-ring	Cloroprene (Neoprene)
A2	Seal	Non-asbestos

Temperature-operated pilot valve (pressure-independent), type CVT/CVTO

Design and function



CVT/CVTO

CVT/CVTO is a temperature-operated pilot valve that operates through its sensor temperature, independently of pressure changes in the system regulated by the valve.

CVT opens on rising temperature.
CVTO closes on rising temperature.

Length of capillary tube: 5 m (197 in.)

MWP: Maximum working pressure.

The k_v/C_v value is measured with the pilot valve mounted in a CVH housing for external pilot lines. The value can vary slightly, depending on the setting value.

*Technical data, **SI units***

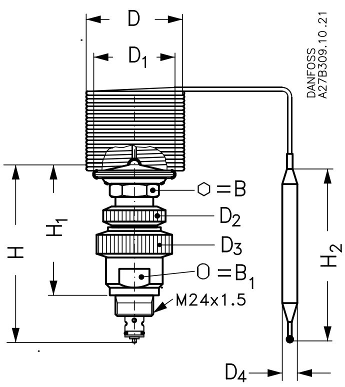
Valve type	MWP	k_v-value	Max.temperature	Temperature range	**Code no.**
Opens on rising temperature					
CVT	22 bar g	0.20 m³/h	Max. 150°C	–40 to 0°C	**027B1110**
CVT	22 bar g	0.20 m³/h	Max. 150°C	–10 to 25°C	**027B1111**
CVT	22 bar g	0.20 m³/h	Max. 150°C	20 to 60°C	**027B1112**
CVT	22 bar g	0.20 m³/h	Max. 150°C	80 to 140°C	**027B1116**
Closes on rising temperature					
CVTO	22 bar g	0.20 m³/h	Max. 150°C	–40 to 0°C	**027B1117**
CVTO	22 bar g	0.20 m³/h	Max. 150°C	–10 to 25°C	**027B1118**
CVTO	22 bar g	0.20 m³/h	Max. 150°C	20 to 60°C	**027B1119**

*Technical data, **US units***

Valve type	MWP	C_v-value	Max.temperature	Temperature range	**Code no.**
Opens on rising temperature					
CVT	319 psi g	0.23 USgal/min	Max. 302°F	–40 to 32°F	**027B1110**
CVT	319 psi g	0.23 USgal/min	Max. 302°F	14 to 77°F	**027B1111**
CVT	319 psi g	0.23 USgal/min	Max. 302°F	68 to 140°F	**027B1112**
CVT	319 psi g	0.23 USgal/min	Max. 302°F	176 to 284°F	**027B1116**
Closes on rising temperature					
CVTO	319 psi g	0.23 USgal/min	Max. 302°F	–40 to 32°F	**027B1117**
CVTO	319 psi g	0.23 USgal/min	Max. 302°F	14 to 77°F	**027B1118**
CVTO	319 psi g	0.23 USgal/min	Max. 302°F	68 to 140°F	**027B1119**

P-band for a valve system regulated by CVT/CVTO and ICS or PM: <5°C (41°F)

Dimensions and weights



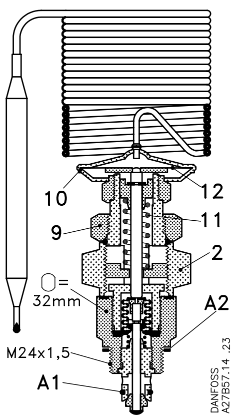
CVT/CVTO

Valve type		H	H_1	H_2	D	D_1	D_2	D_3	D_4	B	B_1	Weight
Opens on rising temperature												
CVT	mm	117	90	110	65	53	42	50	9.5	27	32	0.8 kg
	in.	4.61	3.54	4.33	2.56	2.09	1.65	1.97	0.37			1.8 lb.
Closes on rising temperature												
CVTO	mm	117	90	110	65	53	42	50	9.5	27	32	0.8 kg
	in.	4.61	3.54	4.33	2.56	2.09	1.65	1.97	0.37			1.8 lb.

Temperature-operated pilot valve (pressure-independent), type CVT/CVTO

continued)

Material specification

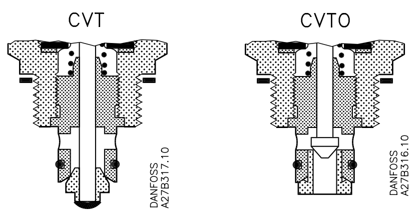


CVT/CVTO

CVT/CVTO

No.	Part	Material
2	Setting ring	Aluminium
A2	Seal	Non-asbestos
A1	O-ring	Cloroprene (Neoprene)
9	Locking ring	Aluminium
10	Thermostatic element	Stainless steel
11	Spring	Stainless steel
12	Diaphragm	Stainless steel

Design and function

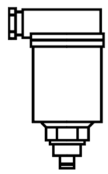


Accessories

Description	Code no.
Valve body type CVH Connection: Ød/ØD = Ø12.7/Ø18 mm	**27F1047**
Valve body type CVH Connection: G 1/4 (USASB2.1-1960)	**27F1159**
Sensor pocket, brass Connection: G 1/2 A l = 112 mm, ØD = 11 mm	**993N3568**
Sensor pocket, stainless steel 18/8 Connection: G 1/4 A l = 112 mm, ØD = 11 mm	**993N3615**

Electronically operated constant-pressure pilot valve, type CVQ (pressure-dependent)

Design and function



CVQ

CVQ is an electronically operated constant-pressure pilot valve that functions together with the EKC 361 electronic system or an EKC 366 controller.

CVQ enables the electronic (and thus the remote) control of a ICS or PM main valve.

The CVQ valve is used to maintain a constant pressure at the ICS or PM main valve inlet side and can, via suction pressure regulation, very accurately control the temperature of a medium from an air or liquid cooler, etc.

MWP: Maximum working pressure.

The k_v/C_v value is measured with the pilot valve mounted in a CVH housing for external pilot lines. The value can vary slightly, depending on the setting value.

*Technical data, **SI units***

Valve type	MWP	k_v-value		Pressure range	**Code no.**
CVQ	17 bar g	0.45 m³/h		–1 bar g to 5 bar g	**027B1139**
CVQ	17 bar g	0.45 m³/h		0 bar g to 6 bar g	**027B1140**
CVQ	17 bar g	0.45 m³/h		1.7 bar g to 8 bar g	**027B1141**

*Technical data, **US units***

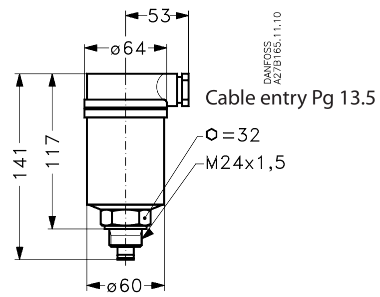
Valve type	MWP	C_v-value		Pressure range	**Code no.**
CVQ	246 psi g	0.52 USgal/min		–29.5 in. Hg to 72.5 psi g	**027B1139**
CVQ	246 psi g	0.52 USgal/min		0 psi g to 87 psi g	**027B1140**
CVQ	246 psi g	0.52 USgal/min		24.7 psi g to 116 psi g	**027B1141**

The P-band for a valve system regulated by CVQ and ICS or PM depends on the control parameters of the EKC 361 or EKC 366.

Electrical data

Supply voltage	24V a.c. ±10%
Frequency	50 to 60 Hz
Power consumption, operation start	50 VA 75 VA
Enclosure	NEMA 3 / IP 55
Cable entry	Pg 13.5
Ambient temperature, operation transport	–30 to 50°C (–22 to 122°F) –50 to 70°C (–58 to 158°F)
CE -marking	EMC-Directive 89/336/EEC, EMC-Directiv 89/336/ EN 50081-1 and EN 50082-1

Dimensions and weights



CVQ

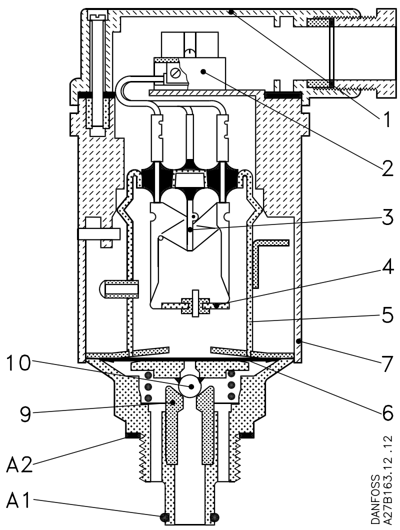
Valve type		H	H1	L		D	D1	B	B1	Weight
CVQ	mm	141	117	53		64	60	32	M 24 × 1.5	0.4 kg
	in.	5.55	4.61	2.09		2.52	2.36			0.9 lb.

Pressure and temp. rregulators

Electronically operated constant-pressure pilot valve, type CVQ (pressure-dependent)

(continued)

Material specification



CVQ

Design and function
CVQ consists of a reservoir containing a charge at a given pressure, a heating element and a temperature sensor.

When the temperature in the container is regulated, the corresponding and precise pressure change created changes the degree of opening of the orifice (9 and 10) and thus the control pressure sent by the CVQ valve to the connected ICS or PM main valve.

If pressure in the container becomes too high, an internal protection system short-circuits the heating element and thus stops pressure build-up.

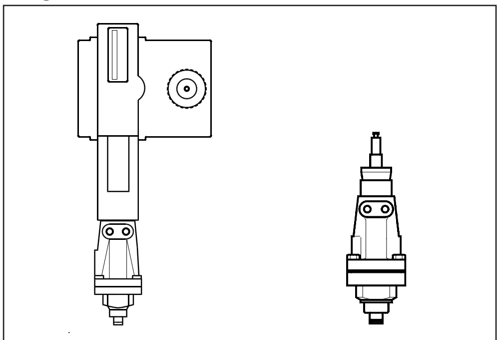
CVQ

No.	Part	Material
1	Cover	Plastic
2	Connection terminals	
3	NTC resistor	
4	PTC resistor (heating element)	
5	Reservoir	Steel
6	Diaphragm	Stainless steel
7	Capsule	Plastic
9	Orifice	Stainless steel
10	Thrust pad with throttle ball	Stainless steel
A1	O-ring	Cloroprene (Neoprene)
A2	Seal	Non-asbestos

Motor-operated constant-pressure pilot valve, type CVPM (pressure-dependent)

Pilot valve for motor-operated constant-pressure pilot valve, type CVP(M)

Design and function



CVPM is a complete motor-operated pressure-dependent pilot valve comprising an AMV 523 motor and a CVP(M) pilot valve.

MWP: Maximum working pressure.

The k_v/C_v value is measured with the pilot valve mounted in a CVH housing for external pilot lines. The value can vary slightly, depending on the setting value.

Technical data, ***SI units***

Valve type	MWP	k_v-value		Pressure range	**Code no.**
Motor-operated constant-pressure pilot valve, 220 V a.c., 50/60 Hz					
CVPM	28 bar g	0.40 m³/h		–0.66 to 7 bar g	**027B1171**
Motor-operated constant-pressure pilot valve, 24 V a.c.					
CVPM	28 bar g	0.40 m³/h		–0.66 to 7 bar g	**027B1173**
Pilot valve for motor-operated constant-pressure pilot valve					
CVP(M)	28 bar g	0.40 m³/h		–0.66 to 7 bar g	**027B1170**

Technical data, ***US units***

Valve type	MWP	C_v-value		Pressure range	**Code no.**
Motor-operated constant-pressure pilot valve, 220 V a.c., 50/60 Hz					
CVPM	406 psi g	0.46 USgal/min		19.5 in. Hg to 102 psi g	**027B1171**
Motor-operated constant-pressure pilot valve, 24 V a.c.					
CVPM	406 psi g	0.46 USgal/min		19.5 in. Hg to 102 psi g	**027B1173**
Pilot valve for motor-operated constant-pressure pilot valve					
CVP(M)	406 psi g	0.46 USgal/min		19.5 in. Hg to 102 psi g	**027B1170**

P-band for a valve system regulated by CVP(M) and ICS or PM: < 0.2 bar g (2.9 psi g)

Technical data AMV 523

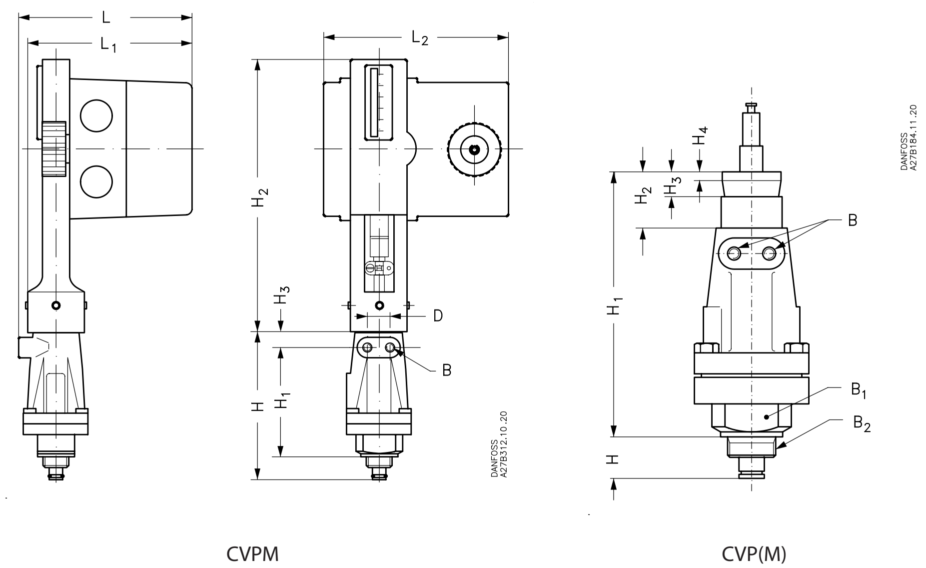
Supply voltage	24V a.c. ± 10% 230/240 V a.c. +6% / –10%
Frequency	50 Hz / 60 Hz
Power consumption	24V a.c: 12 VA 230/240 V a.c.: 12VA
Function	3-point (open, neutral, closed) Optional 0 to 10 V, 0 to 20 mA with AMES modul installed
Spindle force	1200 N (270 lb.)
Nominal spindle travel	0 to 50 mm (0 to 1.97 in.)
Spindle travel	50 Hz: 11 s/mm (279 s/in.) 60 Hz: 9.25 s/mm (235 s/in.)
Enclosure	IP 55 (NEMA 3)
Cable entry	2 × Pg 9, 2 × Pg 13.5
Ambient temperature, operation transport	–15 to 50°C (5 to 122°F) –40 to 70°C (–40 to 158°F)
Weight	3.3 kg (7.3 lb)
CE - marking	EMC-Directiv 89/336/EEC, 92/31/EEC, 93/68/EEC, EN 50081-1 and EN 50082-1, in accordance with Low Current Directive 73/23/EEC and 93/68/EEC,EN 60730/2/14.

Motor-operated constant-pressure pilot valve, type CVPM (pressure-dependent)

Pilot valve for motor-operated constant-pressure pilot valve, type CVP(M)

(continued)

Dimensions and weights

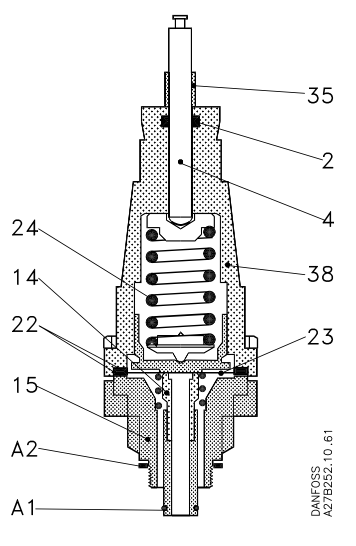


CVPM CVP(M)

Valve type		H	H1	H2	H3	L	L1	L2	D		B	Weight
Motor-operated constant-pressure pilot valve												
CVPM	mm	138	148	246	14	153	145	163	20		M 8	5.0 kg
	in.	5.43	5.83	9.69	0.55	6.02	5.71	6.42	0.79			11.3 lb.

Valve type		H	H1	H2	H3	H4	B	B1		B2	Weight
Pilot valve for motor-operated constant-pressure pilot valve											
CVP(M)	mm	24	148	35.5	15	5	M 8	32		M 24 × 1.5	1.7 kg
	in	0.94	5.83	1.40	0.59	0.20					3.7 lb.

Material specification



CVP(M)

CVP(M)

No.	Part	Material
A1	O-ring	Cloroprene (Neoprene)
A2	Seal	Non-asbestos
2	Spindle seal	Cloroprene (Neoprene)
4	Spindle	Stainless steel
14	Spring	Stainless steel
15	Base	Stainless steel
22	Cover gasket	Non-asbestos
23	Diaphragm	Stainless steel
35	Bush	Brass
38	Valve bonnet	Low temperature cast iron (spherical)
24	Spring	Steel

Solenoid pilot valve, type EVM (NC)

Solenoid pilot valve, type EVM (NO)

Design and function

EVM is a solenoid pilot valve for use when on/off operation of the ICS or PM main valve is required. EVM valves are intended for use with Danfoss solenoid valve coils ("Coils for solenoid valves", datasheet RD3JB).
Together with CVH, an EVM can also be used as an independent solenoid valve.

MWP: Maximum working pressure.

The k_v/C_v value is measured with the pilot valve mounted in a CVH housing for external pilot lines.

MOPD: Maximum opening differential pressure with a 10 W a.c. coil.

MCPD: Maximum closing differential pressure with a 12 W a.c. coil.

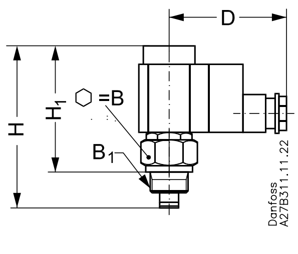
*Technical data, **SI units***

Valve type	MWP	k_v-value		Pressure range	**Code no.**
Normally closed					
EVM (NC)	35 bar g	0.37 m^3/h		MOPD: 21 bar g	**027B1120**
EVM (NC)	65 bar g	0.37 m^3/h		MOPD: 21 bar g	**032F8011**
Normally open					
EVM (NO)	35 bar g	0.12 m^3/h		MCPD: 21 bar g	**027B1130**

*Technical data, **US units***

Valve type	MWP	C_v-value		Pressure range	**Code no.**
Normally closed					
EVM (NC)	508 psi g	0.43 USgal/min		MOPD: 305 psi g	**027B1120**
EVM (NC)	942 psi g	0.43 USgal/min		MOPD: 305 psi g	**032F8011**
Normally open					
EVM (NO)	508 psi g	0.14 USgal/min		MCPD: 305 psi g	**027B1130**

Dimensions and weights



EVM

Valve type		H	H_1	B	B_1	D (12 W a.c./d.c.)	D (10 W a.c.)	Weight
EVM	mm	107	83	32	M 24 × 1.5	82	72	0.5 kg
	in.	4.21	3.27			3.23	2.83	1.1 lb.

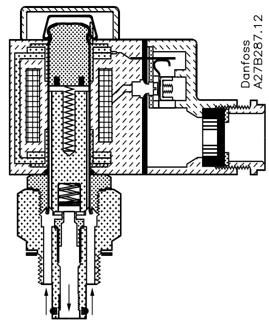
Pressure and temp. rregulators

Solenoid pilot valve, type EVM (NC)

Solenoid pilot valve, type EVM (NO)

(continued)

Material specification

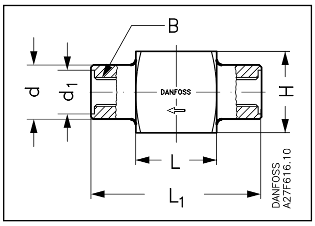


EVM

EVM

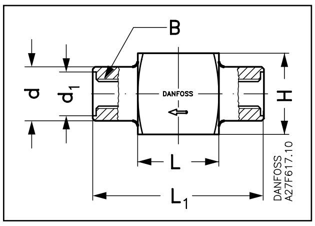
No.	Part	Material
1	Coil	
2	Armature	Stainless steel
3	Armature tube	Stainless steel
A2	Seal	Non-asbestos
A1	O-ring	Cloroprene (Neoprene)
6	Seal	Aluminium
7	Spacing ring	
8	Nut	
9	Lock button	
10	Valve body	Steel
11	Valve seat	Teflon (PTFE)

Housing for pilot valves, type CVH, for mounting in external pilot lines



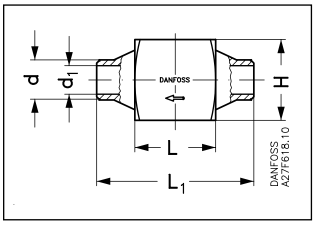
DN		d	d1	H	L	L1	B	Standard	Material	Code no.
Internal pipe thread										
6	mm	24	19.5	36	36	76	¹/₄ in. NPT	ANSI B1.20.1	DIN 9SMnPb 28 W no. 1.0718	**027F1159**
	in.	0.94	0.77	1.42	1.42	2.99				

Weight: 0.4 kg. (0.9 lb.)



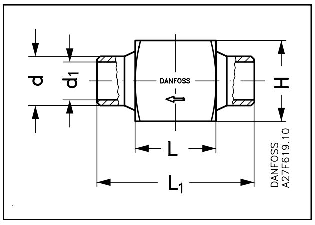
DN		d	d1	H	L	L1	B	Standard	Material	Code no.
Internal pipe thread										
6	mm	24	19.5	36	36	76	G ¹/₄ A	ISO 228-1	DIN 9SMnPb 28 W no. 1.0718	**027F1160**
	in.	0.94	0.77	1.42	1.42	2.99				

Weight: 0.4 kg. (0.9 lb.)



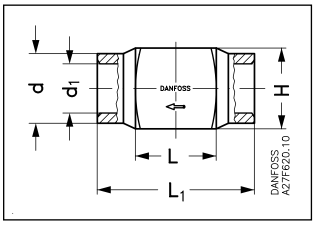
DN		d	d1	H	L	L1		Standard	Material	Code no.
³/₈ in. butt weld										
10	mm	18	12.7	36	36	70		Weld connection DIN 2559 - 22	DIN. CK 15. W no. 1.1141	**027F1047**
	in.	0.71	0.5	1.42	1.42	2.76				

Weight: 0.4 kg. (0.9 lb.)



DN		d	d1	H	L	L1		Standard	Material	Code no.
¹/₂ in. butt weld										
15	mm	22	17	36	36	70		Weld connection DIN 2559 - 22	DIN. CK 15. W no. 1.1141	**027F1090**
	in.	0.87	0.67	1.42	1.42	2.76				

Weight: 0.4 kg. (0.9 lb.)



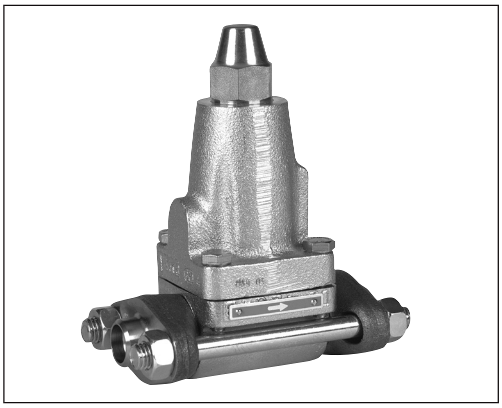
DN		d	d1	H	L	L1		Standard	Material	Code no.
¹/₂ in. socket weld										
15	mm	31	22	36	36	70		DIN 3259 - T2 ASME B.16.113M	DIN. CK 15. W no. 1.1141	**027F1091**
	in.	1.22	0.87	1.42	1.42	2.76				

Weight: 0.4 kg. (0.9 lb.)

Constant pressure valve, type CVMD

Introduction

CVMD is a constant pressure regulator for refrigeration and freezing plant in applications such as;
– Hot gas defrosting (drain lines)
– Refrigerant pump bypass (to ensure min. flow in refrigerant pumps).



Technical data

Refrigerants
R 717, R 22, R 134a, R 404A, R 407C etc.

Range
0 → 7 bar

Max. working pressure
PB = 28 bar

Test pressure
p' = 36 bar

Temperature range
–50 → 120°C

k_v value
1.5 m^3/h

The k_v value is the flow of water in m^3/h at a pressure drop across valve of 1 bar, ρ = 1000 kg/m^3.

Ordering

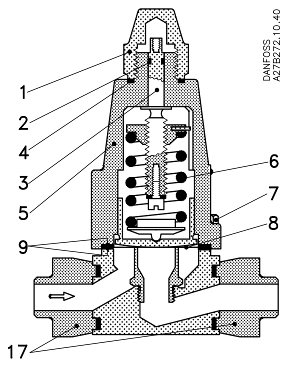
CVMD incl. $^1/_2$ in. weld flange,
code no. **027B1038**.

Materials

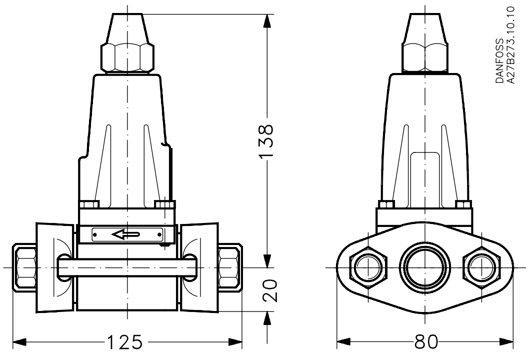
- Gaskets are non asbestos
- Valve housing made of GGG 40.3

Construction

1. Protection cap
2. O-ring
3. Spindle
4. Gasket
5. Cover
6. Spring
7. Screw
8. Diaphragm
9. Gasket
17. Flanges



Dimensions and weight



CVMD

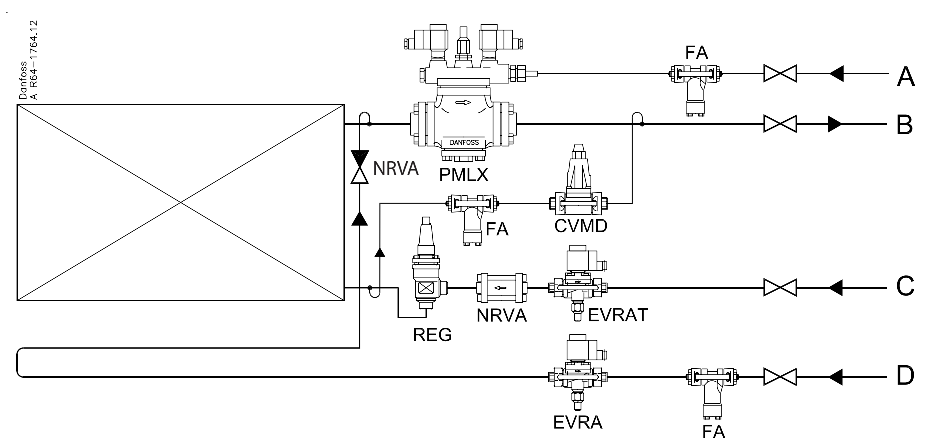
Weight:
2.7 kg

The complete technical leaflet (RD4BA) can be downloaded from the Danfoss web site.

Application

Example

Hot gas defrosting of evaporator with pump circulation



The figure shows the low pressure side of an R 717 refrigeration plant with flooded evaporator with pump circulation.

In this application, the constant pressure valve, type CVMD, is mounted as a pressure regulator in the bypass line between evaporator and downstream wet suction line after the solenoid valve, type PMLX.

Pos. A on the drawing is the pilot line from the high pressure side to PMLX.
Pos. B is the liquid/gas return line.
Pos. C is the liquid line to the evaporator.
Pos. D is the hot gas line for hot gas defrosting of the evaporator.

The CVMD can be used in this application for evaporators with capacities up to:

R 717

Defrost temperature	+10°C				
Evaporating temperature	–10°C	–20°C	–30°C	–40°C	–50°C
(Drainline capacity kg/h)	(1666)	(1906)	(2059)	(2156)	(2216)
Max. $Q_{Evaporator}$ (kW)	240	281	311	333	349

Based on:
$\Delta P_{over} = 1$, $k_v = 1.5$ m^3/h
Defrost capacity (kW) = $2.5 \times Q_{Evaporator}$

Use PM + CVP (HP) valves for higher capacities.

Introduction

OFV are angle-way over flow valves, which have ajustable opening pressure and cover the differential pressure range (ΔP): 2 - 8 bar (29 - 116 psi). The valve can be closed manually, e.g. during plant service and have backseating, enabling the spindle seal to be replaced with the valve still under pressure.

The valves are especially designed to prevent fluttering due to low velocity and/or low density. In consequence it is possible to apply the valves with wide fluctuations in capacity demands, i.e. from maximum performance to part load. A flexible O-ring provides perfect sealing over the seat.

Features

- Applicable to all common non flammable refrigerants including R717 and non corrosive gases/liquids dependent on sealing material compatability.
- Full temperature range packing gland –50/+150°C (–58/+302°F)
- Maximum operating pressure: 40 bar g (580 psig)
- Three functions in one valve. The OFV valve combines the functions of an overflow valve, a check valve and a stop valve
- Classification: To get an updated list of certification on the products please contact your local Danfoss Sales Company.
- Special features for OFV-SS
  - Low temperature stainless steel housing and bonnet
  - Low temperature packing gland -60/+150°C (–76/+302°F)
  - Maximum operating pressure 52 bar (754 psi g)

The complete technical leaflet (DKRCI.PD.HQ0.A) can be downloaded from the Danfoss web site.

Design

Connections
Available with the following connections:
- Welding DIN (EN 10220)
- Welding ANSI (B 36.10 Schedule 80)

Packing gland OFV
The "full temperature range" packing gland consists of a double O-ring sealing arrangement combined with permanent lubrication from a grease reservoir. This ensures perfect tightness throughout the whole range: –50/+150°C (–58/+302°F).
Flexible O-ring provides perfect sealing over the seat.

Packing gland OFV-SS
The stainless steel packing gland comprises a spring loaded seal packing gland which ensures a perfect tightness in the range:
-60/+150°C (-76/+302°F).
The packing glands are equipped with a scraper ring to prevent penetration of dirt and ice into the packing gland.

Pressure Equipment Directive (PED)
OFV valves are approved and CE-marked in accordance with the Pressure Equipment Directive - 97/23/EC.

For further details / restrictions - see Installation Instruction

	OFV
Nominal bore	DN≤ 25 mm (1 in.)
Classified for	Fluid group I
Category	Article 3, paragraph 3

Installation
The valve is designed to resist very high internal pressure, but as to the pipe system in general, hydraulic pressure caused by thermal expansions in entrapped refrigerants should be avoided. For further information please see OFV installation instruction.

Example of Marking Ring, Valve type OFV.

Technical data

- Refrigerants

Applicable for all refrigerants and non corrosive gases/liquids, dependent on sealing material combability.
Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.

- Temperature range

OFV: –50/+150°C (–58/+302°F)
OFV-SS: –60/+150°C (–76/+302°F)

- Pressure range

Maximum operating pressure:
OFV: 40 bar g (580 psig)
OFV-SS: 52 bar (754 psi g)

- Set pressure (Δp): 2 - 8 bar (29 - 116 psi).

Understanding the OFV in practice
(when working in a defrosting application)

How the OFV works
The opening pressure of the OFV can be adjusted to a specific differential pressure ΔP_{set} by turning the spindle. ΔP_{set} indirectly determines the defrosting pressure. As illustrated in fig. 1 the OFV will work at a pressure somewhat higher than ΔP_{set}, namely the ΔP_{total} which will be situated somewhere in the area marked with grey in fig. 1.

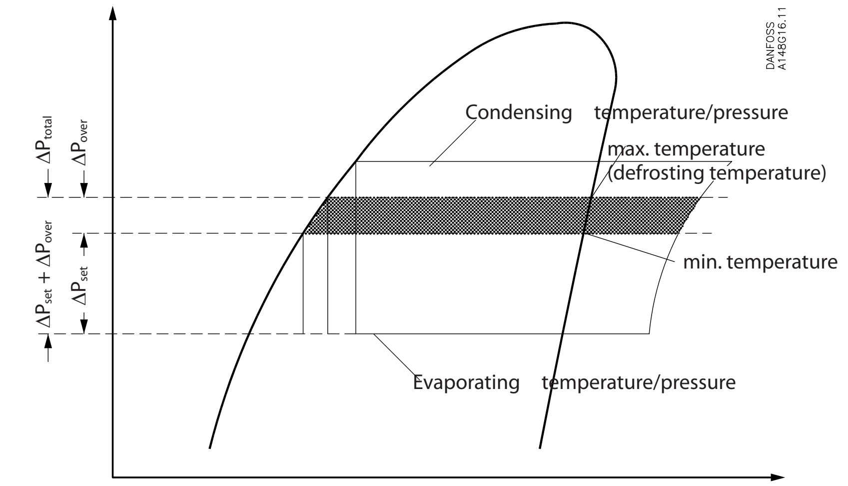


Fig. 1

As ΔP_{over} is plant specific, it follows that the total working pressure ($\Delta P_{total} = \Delta P_{set} + \Delta P_{over}$) is plant specific too. By adjusting the opening differential pressure ΔP_{set} it is possible to adjust the working pressure $\Delta P_{set} + \Delta P_{over}$ until you get the required defrosting pressure.

Defrosting pressure ≈ Evaporating pressure + $\Delta P_{set} + \Delta P_{over}$.

Important!
The OFV valve is **back pressure** dependent.

Adjusting set pressure

The set pressure is the pressure at which the valve starts to open.

The set pressure is adjustable in the range 2 - 8 bar differential pressure. When the valve is delivered, a distance piece is supplied seperately with the valve. The distance piece can be mounted under the spring, thus increasing the initial tension of the spring. Therefore the valve covers the complete range 2 - 8 bar differential pressure, as follows:

2 - 6.5 bar differential pressure without distance piece.
3.5 - 8 bar differential pressure with distance piece.

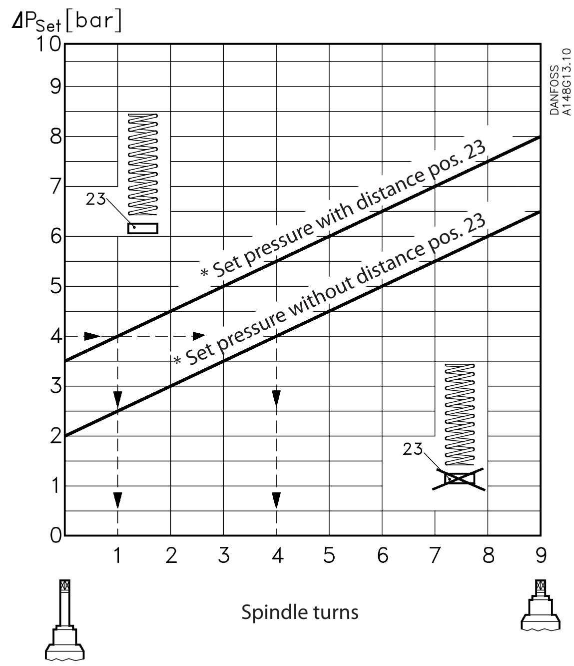


Fig. 2
Set pressure as a function of the spindle turns

* see material specification and installation an maintenance instruction for OFV.

Computation and selection

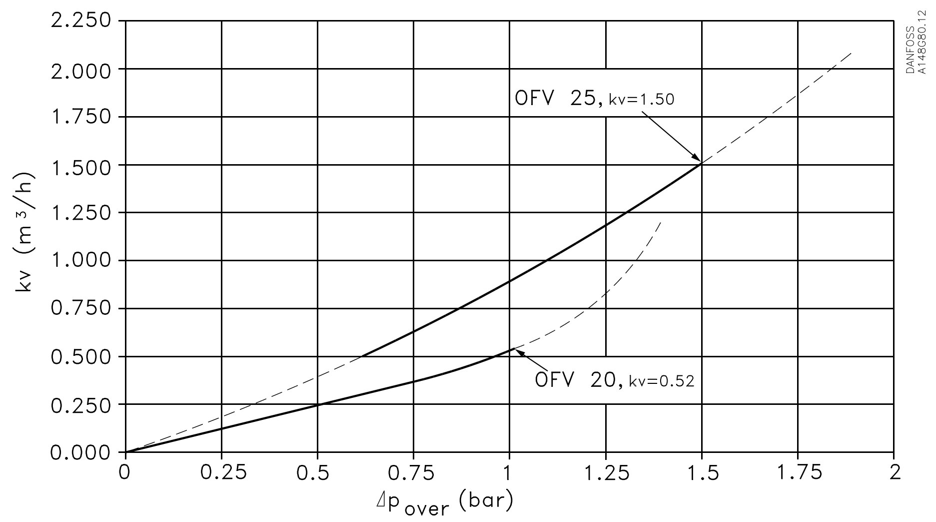


Fig. 3.
k_v values for OFV 20 - 25

The capacity of the OFV valves can be calculated by the following formulas:

Liquids without phase change

$$G = k_v \sqrt{\rho \times \Delta P_{total} \times 1000}$$

Liquids with phase change (e.g. pressure control during defrost)

$$G = k_v \times 0.78 \sqrt{\rho \times \Delta P_{total} \times 1000}$$

G: mass flow (kg/h)

k_v: flow rate (m^3/h) (the k_v value is dependent on ΔP_{over}, see fig. 3).

ρ: density, liquid (kg/m^3)

ΔP_{bar} = differential pressure (bar)
ΔP_{bar} = $\Delta P_{set} + \Delta P_{over}$

Defrosting pressure ≈ Evaporating pressure + $\Delta P_{set} + \Delta P_{over}$

Capacity calculation for defrost pressure regulating

Table 1: Max. mass flow (G_{OFV}) for OFV 20 and OFV 25 with R717

Evaporating temperature	–10°C	–20°C	–30°C	–40°C	–50°C
Defrosting temperature	10°C				

OFV 20

Mass flow $G_{OFV\ 20}$ (kg/h) (ΔP_{over} = 1 bar ⇒ k_v = 0.52 m^3/h)	577	661	714	747	768

OFV 25

Mass flow $G_{OFV\ 25}$ (kg/h) (ΔP_{over} = 1.5 bar ⇒ k_v = 1.5 m^3/h)	1666	1906	2059	2156	2216

Note: the calculation is based on formula for "liquids with phase change" in the paragraph "Computation and selection".

Table 2: Calculating of refrigerant mass flow G_0

Evaporating temperature	–10°C	–20°C	–30°C	–40°C	–50°C
Mass flow G_0 (kg/h)	2.780 × Q_0	2.712 × Q_0	2.651 × Q_0	2.595 × Q_0	2.544 × Q_0

Q_0: Capacity of the evaporator (kW)
Note: the calculation is based on pump circulating system (Liquid temperature = Evaporating temperature)

Guide line: Defrost capacity G_{OFV} ~ (2 – 3) × G_0

Example:
An evaporator in a refrigerant plant has a capacity of Q_o = 150 kW and a evaporating temperature of –40°C.
The defrosting temperature has to be controlled with an OFV valve.

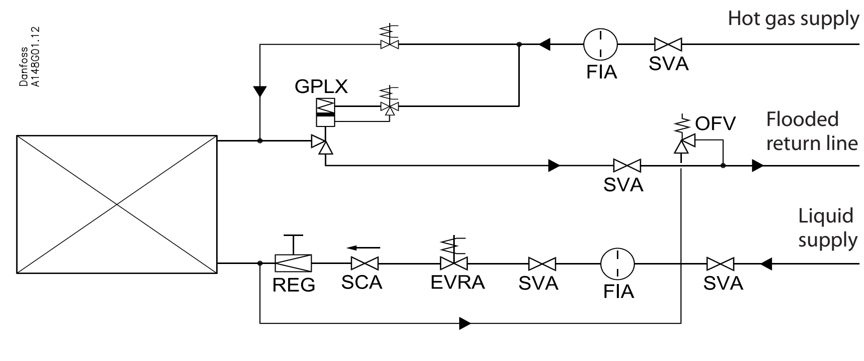
Table 2: G_0= 2.595 × Q_0 = 389 kg/h
The defrosting capacity in this example is 2.5 × G_0.
G_{OFV} ≥ 2.5 × 389 = 972 kg/h.
OFV 25 is selected ($G_{OFV\ 25\ max.}$ = 2156 kg/h (table 1)).

Plant applications

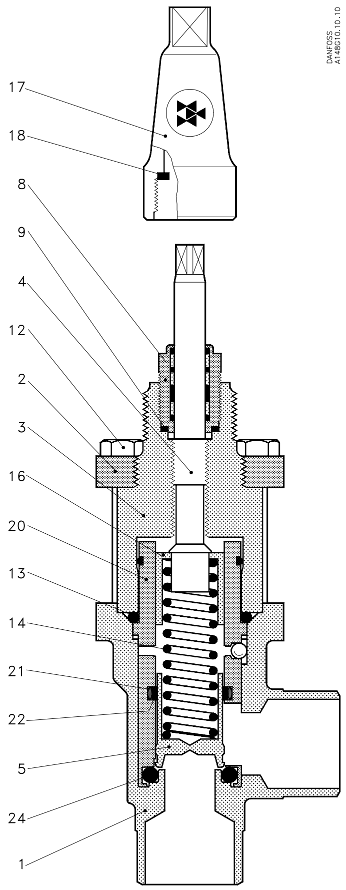
Pressure/temperature control during hot gas defrosting

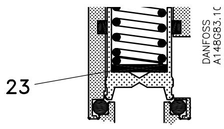
In order to obtain efficient hot gas defrosting the temperature (pressure) must be increased to approx. 10°C (50°F). The OFV is the optimal solution for controlling the defrosting pressure and thus the corresponding temperature. It is recommended to start the defrosting cycle by closing the GPS valve in the liquid supply line and allowing some of the cold liquid contained in the evaporator to return to the liquid separator. Close the GPS valve in the suction line and after a delay open the solenoid valve in the hot gas supply in order to build up the defrosting pressure in the evaporator. When the defrosting pressure reaches the set OFV-pressure, the OFV will open and the defrosting pressure will increase to the working pressure $\Delta P_{set} + \Delta P_{over}$.

After defrosting, it is normal practice to open the GPS in the return line to equalize the pressure to the suction side before opening to the pump side.



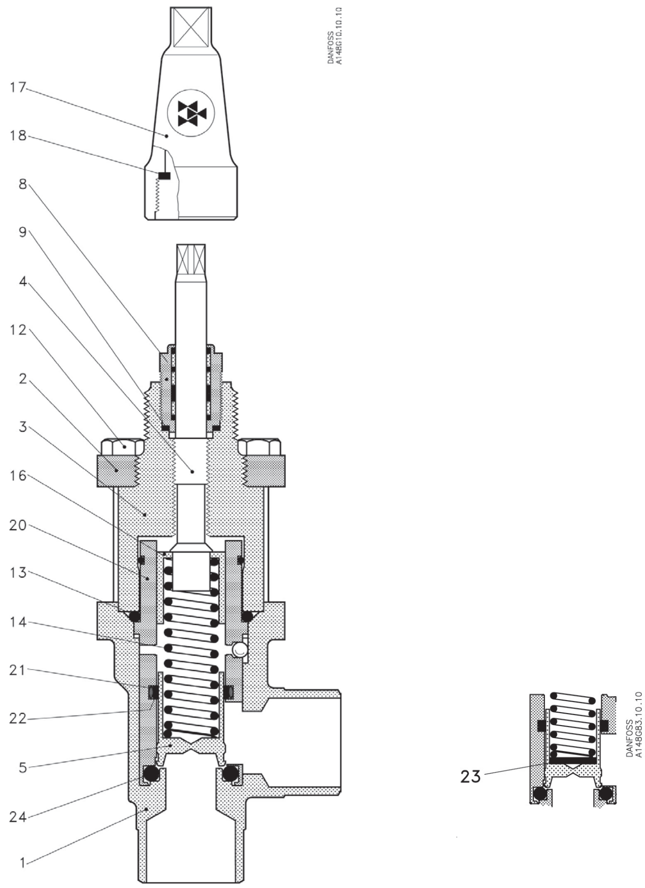
Material specification





No.	Part	Material	EN	ISO	ASTM
1	Housing	Steel	P285 QH EN10222-4		LFA350
2	Bonnet, Flange	Steel	P275 NL1 EN10028-3		
3	Bonnet, Insert	Steel			
4	Spindle	Stainless steel	X10 CrNi S18-9 17440	Type 17 683/13	AISI 303
5	Cone	Steel			
8	Packing gland	Steel			
9	Packing washer	Aluminium			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
14	Spring	Steel			
16	Spring washer	Steel			
17	Cap	Aluminium			
18	Gasket for cap	Nylon			
20	Guide piece	Steel			
21	O-ring	Cloroprene (Neoprene)			
22	Sealing ring	PTFE (Teflon)			
23	Distance piece	Steel			
24	O-ring	Cloroprene (Neoprene)			

Material specification



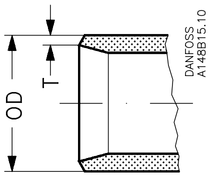
OFV-SS 20 - 25 (3/4 - 1")

No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing	Stainless steel	X5CrNi18-10 EN10088		AISI 304
2	Bonnet, Flange	Stainless steel	X5CrNi18-10 EN10088		AISI 304
3	Bonnet, Insert	Stainless steel			
4	Spindle	Stainless steel	X8CrNiS18-9 DIN 17440	Type 17, 683/13	AISI 303
5	Cone	Steel	9SMn28	Type 2	1213
8	Packing gland	Stainless steel			
9	Packing washer	Non asbestos			
12	Bolts	Stainless steel	A2-70	A2-70	Type 308
13	O-ring	Cloroprene (Neoprene)			
14	Spring	Steel			
16	Spring washer	Steel	Steel		
17	Spindle seal cap	Aluminium			
18	Seal cap gasket	Nylon			
20	Guide piece	Steel			
21	O-ring	Cloroprene (Neoprene)			
22	Sealing ring	PTFE (Teflon)			
23	Distance piece	Steel			
24	O-ring	Cloroprene (Neoprene)			

Connections

Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v-angle m³/h		C_v-angle USgal/min	

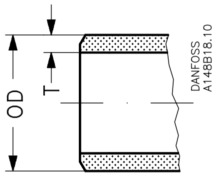
DIN



Welding DIN (EN 10220)

Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v-angle m³/h		C_v-angle USgal/min	
20 25	³/₄ 1	26.9 33.7	2.3 2.6	1.059 1.327	0.091 0.103			0 - 0.52 0 - 1.50		0 - 0.60 0 - 1.74	

ANSI

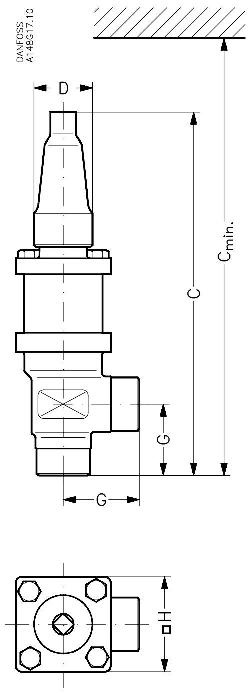


Welding ANSI (B 36.10 Schedule 80)

Size mm	Size in.	OD mm	T mm	OD in.	T in.			k_v-angle m³/h		C_v-angle USgal/min	
20 25	³/₄ 1	26.9 33.7	4.0 4.6	1.059 1.327	0.158 0.181			0 - 0.52 0 - 1.50		0 - 0.60 0 - 1.74	

Dimensions and weights

OFV 20 - 25



Valve size			G	C	C_{min}		∅D		□H		Weight
OFV 20 - 25											
OFV 20 (¾ in.)	mm in.		45 1.77	230 9.1	290 11.4		38 1.5		60 2.4		2.0 kg
OFV 25 (1 in.)	mm in.		45 1.77	230 9.1	290 11.4		38 1.5		60 2.4		2.0 kg

Specified weights are approximate values only.

Ordering

How to order
The table below is used to identify the valve required.

Please note that the type codes only serve to identify the valves, some of which may not form part of the standard product range.

For further information please contact your local Danfoss Sales Company.

Example for type codes

OFV	**25**	**D**	**1**	**3**	**3**

Type codes

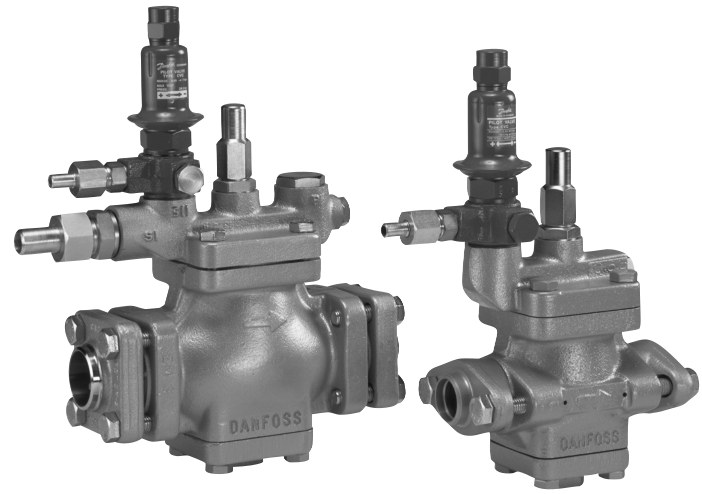
Valve type	**OFV**	Over Flow Valve
Nominal size in mm	**20** **25**	DN 20 DN 25
Connections	**A** **D**	Welding branches: ANSI B 31.5 schedule 80 Welding branches: DIN 2448
Valve housing	**1**	Angle flow
Materials	**3**	Housing: P285 QH, Bonnet: P275 NL1
Other equipment	**3**	Cap, short spindle with Cloroprene (Neoprene) O-ring

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

Opening differential pressure
2-8 bar (29-116 psi):

Size mm	Size in	Type	**Code No.**
20	¾	OFV 20 A 133	**2412+185**
20	¾	OFV 20 D 133	**2412+183**
20	¾	OFV-SS 20 D ANG OVER FLOW VALVE 52BAR	**148G3194**
25	1	OFV 25 A 133	**2412+186**
25	1	OFV 25 D 133	**2412+184**
25	1	OFV-SS 25 D ANG OVER FLOW VALVE 52BAR	**148G3195**

Introduction



The PMC and CVC is used for capacity regulation in refrigeration, freezing and air conditioning plant for ammonia and fluorinated refrigerants. The PMC is a servo-operated regulator with screwed-on pilot valves.

PMC and CVC can be used in all types of refrigeration plant:
- With direct expansion
- With pump recirculation
- With natural circulation

The function of the capacity regulator is to match the fixed output of the compressor and the varying load on the system. This function is obtained when the PMC and CVC is installed in a bypass line between the discharge and suction sides of the compressor.
If the load on the evaporator, and with it the load on the compressor, falls, an "artificial" load in the form of hot gas from the high pressure side of the compressor is applied to the evaporator or compressor.

Features

- Accurate regulation
- High capacity and operating range
- Independent of condensing pressure variations
- High flexibility
- Screw in pilot
- Simple adjustment and build-up

Materials

- Gaskets are non-asbestos
- Valve body
  EN-GJS-400-18-LT or cast iron GG 25

CE

Pressure Equipment Directive (PED)
The PMC and CVC valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked. For further details / restrictions - see Installation Instruction.

PMC and CVC valves	
Nominal bore	DN ≤ 25 (1 in.)
Classified for	Fluid group I
Category	Article 3, paragraph 3

Technical data

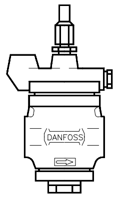
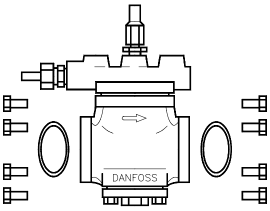
Type		Refrigerants [1]	Opening diff. pressure Δp bar	P-band	Temperature of medium °C	Max. working pressure PS [2] bar	Max. test pressure p' bar
PMC 1 and PMC 3		R22 R134a R404A R717 (NH_3) R12 R502 ect.		With built-on CVC: Approx. 0.2 bar	–50 → +120	28	42.0
CVC					–50 → +120	17/28	26.5/42.0
EVM	a.c.: 10W d.c.: 20W		a.c.: 0 → 21 d.c.: 0 → 14		–50 → +120	35	46.0

[1]) In addition to the refrigerants specified, other fluorinated refrigerants can be used within the pressure or temperature range of the valves.
[2]) Max. working and test pressures refers to the high pressure side connection (PS: 28 and p': 42 bar) and reference pressure (PS: 17 and p': 26.5 bar) which must be connected to the low pressure side of the system.

The complete technical leaflet (RD4ED) can be downloaded from the Danfoss web site.

Ordering

PMC main valves

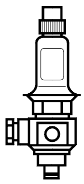
	PMC 1 		*PMC 3* 	
Size	GG-25	EN-GJS-400-18-LT	GG-25	EN-GJS-400-18-LT
PMC 5	**027F0140**	**027F3045**	**027F0150**	**027F3049**
PMC 8	**027F0141**	**027F3046**	**027F0151**	**027F3050**
PMC 12	**027F0142**	**027F3047**	**027F0152**	**027F3051**
PMC 20	**027F0143**	**027F3048**	**027F0153**	**027F3052**

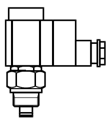
Valve size	Rated replacement capacity in kW						k_v value
	R22	R134a	R404A	R12	R502	R717	m^3/h [1]
PMC 5	36	19	36	20	34	96	1.7
PMC 8	67	35	65	37	61	179	3.2
PMC 12	82	47	88	51	83	244	4.2
PMC 20	140	74	136	78	130	367	6.5

1) The k_v value is the water flow in m^3/h at a pressure drop across the valve of 1 bar (ρ = 1000 kg/m^3).

The code nos. stated apply to main valve type PMC incl. flange gaskets and bolts.

The rated capacity is given for an evaporating temperature of $t_e = -10°C$, a condensing temperature of $t_c = +32°C$ and an offset (= suction temperature reduction Δt_s) of 4 K.

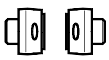




Pilot valves

Description	Range	**Code no.**
Pilot valve type CVC with ∅ 6.5/10 mm weld signal connection	−0.45 → +7 bar	**027B1070** 1)
Pilot valve type EVM	a.c.	**027B1122** 2)
	d.c.	**027B1124** 2)

1) The code no. stated apply to pilot valve type CVC incl. pilot signal connector.
2) When ordering, please state code no., voltage and frequency.



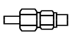
Flange sets

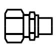
Valve type	Flange type	Weld flange set		Solder flange set			
		in.	**Code no.** 1)	in.	**Code no.** 1)	mm	**Code no.** 1)
PMC 1 and 3	12	3/4	**027N1220**	7/8	**027L1223**	22	**027L1222**
		1	**027N1225**	1 1/8	**027L1229**	28	**027L1228**
		1 1/4	**027N1230**				

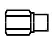
1) Code no. applies to a flange set consisting of one inlet flange and one outlet flange.

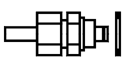
Example
PMC 3 size 12, code no. **027F0152**
+ 1 in. flange set, code no. **027N1225**
+ CVC, code no. **027B1070**
+ EVM, code no. **027B1122**, 220 V, 50 Hz
+ ∅ 6.5 / 10 mm pressure gauge connection, code no. **027B2035**.

Accessories



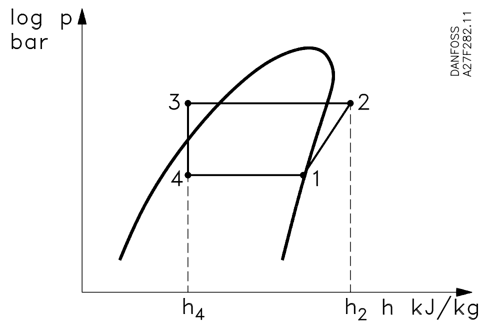






Description		**Code no.**
Pressure gauge connector Ø 6.5 / Ø 10 mm weld / solder		**027B2035**
Pressure gauge connector ¼ in. flare (self-closing) Must not be used for ammonia		**027B2041**
Pressure gauge connector, cutting ring connection	6 mm 10 mm	**027B2063** **027B2064**
Pressure gauge connector	¼ NPT	**027B2062**
External pilot connection		**027F1048**

Sizing



Q_h	=	$\dot{m}_b(h_2-h_4)$ (kW) where
Q_h	=	hot gas capacity or replacement capacity given in table in kW
$\dot{m}_b$	=	flow through PMC in kg/s
h_2-h_4	=	enthalpy difference in kJ/kg

The stated PMC hot gas capacities assume that the hot gas is injected ahead of the evaporator. The thermostatic expansion valve compensates for the heat the hot gas transfers to the evaporator by increasing liquid injection. In this way the superheat at the evaporator outlet is kept more or less constant.
Capacities are thus made up of the PMC regulator capacity + expansion valve compensation.
Capacities are given for an offset (= suction temperature reduction Δt_s) of 4 K.

Suction pressures in the table relates to suction pressure / suction temperature after the reduction.
If a smaller offset than 4 K is required, multiply the capacity found at Δt_s = 4 K by a correction factor k.
If the correction factors are not changed as a function of the suction temperature reduction Δt_s, the proportional band of the regulator is fully utilized.
The proportional band of the regulator is approx. 0.2 bar.

Selection example
An R134a unit for compressed air drying must be capacity regulated from 100% to 0% using hot gas injection direct into the evaporator after the expansion valve. The compressor has no internal capacity regulation.
Compressor capacity, Q_c = 12 kW at
t_e = 0°C and t_c = +30°C.
Min. suction temperature, t_s min. = 0°C.
Max. off-set, Δt_s max. = 2 K.
Min. evaporator load, Q_e min. = 0 kW.
Necessary PMC replacement capacity,
Q_h = 12 – 0 = 12 kW.
From the capacity table, it can be seen that PMC size 5 produces 19 kW at t_s = 0°C,
t_c = +30°C and Δt_s = 4 K.
Correction factor k for off-set Δt_s = 2 K is given as 0.7.
The final replacement capacity Q_h for PMC size 5 thus become 19 × 0.7 = 13.3.
A PMC size 5 will therefore produce the same as the compressor, i.e. 12 kW at an off-set a little lower than 2 K.

Hot gas capacity

Hot gas / replacement capacity for suction temperature reduction, off-set $\Delta t_s = 4$ K.

R717 (NH_3)

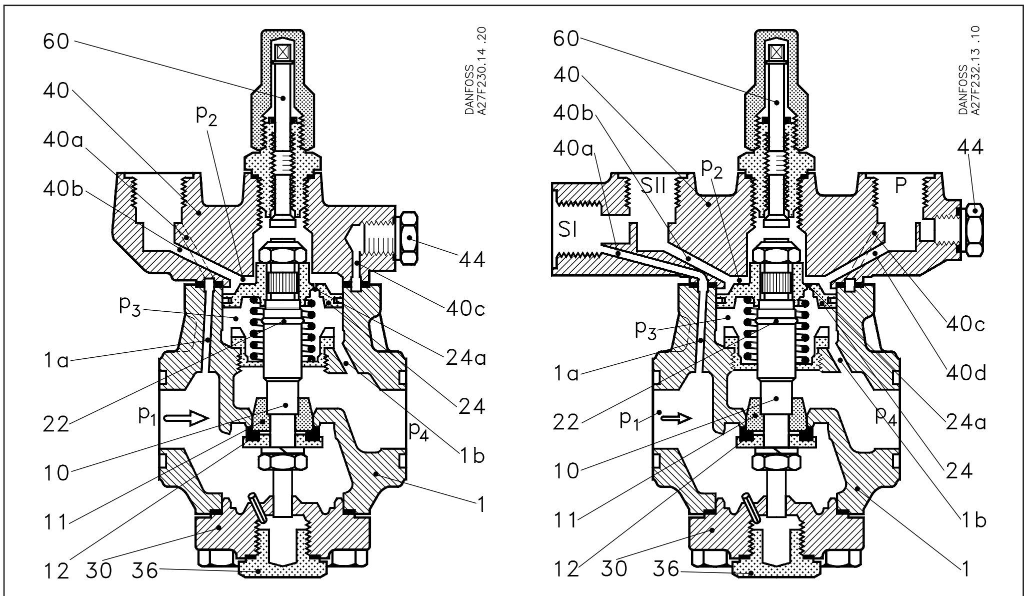
5	+10	0.05	0.077	0.098	0.125	63	96	124	158
	0	0.057	0.073	0.097	0.123	73	96	124	158
	–10	0.055	0.072	0.094	0.121	73	96	124	158
	–20	0.054	0.071	0.094	0.121	73	96	124	158
	–30	0.054	0.071	0.094	0.121	73	96	124	158
	–40	0.054	0.071	0.094	0.121	73	96	124	158
8	+10	0.087	0.14	0.18	0.23	111	179	230	282
	0	0.102	0.136	0.178	0.227	141	179	230	282
	–10	0.101	0.133	0.173	0.224	141	179	230	282
	–20	0.1	0.132	0.173	0.224	141	179	230	282
	–30	0.1	0.132	0.173	0.195	141	179	230	243
	–40	0.1	0.115	0.129	0.137	141	154	166	179
12	+10	0.109	0.189	0.245	0.312	139	244	313	383
	0	0.139	0.183	0.241	0.306	186	244	313	383
	–10	0.137	0.181	0.234	0.303	186	244	313	383
	–20	0.135	0.179	0.234	0.266	186	244	313	336
	–30	0.135	0.177	0.19	0.196	186	244	255	244
	–40	0.11	0.122	0.13	0.139	151	162	174	174
20	+10	0.144	0.287	0.377	0.48	184	356	475	583
	0	0.213	0.283	0.372	0.473	281	367	475	583
	–10	0.211	0.279	0.362	0.359	281	367	475	454
	–20	0.207	0.244	0.27	0.27	281	324	356	346
	–30	0.172	0.189	0.197	0.185	238	248	259	238
	–40	0.12	0.121	0.126	0.099	162	162	173	130

Correction factor k for different off-set (suction temperature reductions)

Refrigerant	Suction temp. t_s after temperature reduction °C	t_c = 20°C and 30°C				t_c = 40°C and 50°C			
		Suction temperature reduction Δt_s K							
		1	2	3	4	1	2	3	4
R717 (NH_3)	+10	0.4	0.8	0.9	1.0	0.5	0.8	1.0	1.0
	0	0.5	0.8	1.0	1.0	0.4	0.7	0.9	1.0
	–10	0.5	0.8	1.0	1.0	0.4	0.6	0.8	1.0
	–20	0.4	0.6	0.8	1.0	0.4	0.6	0.8	1.0
	–30	0.3	0.6	0.8	1.0	0.4	0.6	0.8	1.0
	–40	0.2	0.6	0.8	1.0	0.2	0.6	0.8	1.0

Design/Function

1. Valve body
1a and 1b. Channels in valve body
10. Regulating spindle
11. Throttling cone
12. Valve seat
22. Locking ring
24. Servo piston
24 a. Equalizing hole in servo piston
30. Bottom cover
36. Plug
40. Cover
40 a, b, c and d. Channels in cover
44. Blanking plug for pressure gauge connection
60. Manual operating spindle



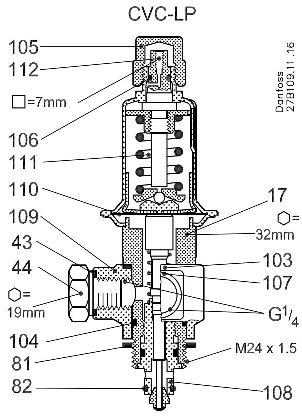
PMC 1 PMC 3

The PMC regulator is a servo-operated main valve whose function is determined by the pilot valve. The main valve with pilot valve controls refrigerant flow by modulation in accordance with the pilot valve impulse.
The degree of opening of the PMC is determined by the pressure difference (differential pressure) between pressure p_2, which acts on the top of the servo piston (24), and pressure p_3, which acts on the underside of the servo piston.
Because of the channel (1b) in the valve body, pressure p_3 acting on the underside of the servo piston (24) is equal to the regulator discharge pressure, p_4.
If this pressure difference is 0, the regulator will be fully closed.
If the pressure difference is approximately 0.7 bar or more, the regulator will be fully open.
At pressure differences (p_2 - p_4) between approximately 0.3 bar and 0.7 bar the opening degree of the regulator will be correspondingly proportional. The shape of the throttling hole (11) gives an ideal regulation characteristic to servo-operated regulators.

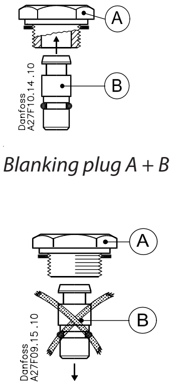
The degree of opening of the regulator is thus controlled by applying a pressure, p_2, on the top of the servo piston which is equal to or greater than the discharge pressure, p_4.
$p_2 = p_4 \sim$ closed position.
$p_2 = p_4 + 0.7$ bar $\sim$ completely open position.
$p_4 \leq p_2 \leq p_4 + 0.7$ bar $\sim$ proportional degree of opening.
The maximum pressure, p_2, that can be built up on the top of the servo piston (24) normally corresponds to the pressure, p_1, acting on the regulator inlet side. Inlet pressure p_1 is led, via the drilled channels (1a, 40a, 40b, 40c, 40d) in the valve body (1) and cover (40) through the individual pilot valves and on the top of the servo piston (24).
The degree of opening of the individual pilot valves determines the size of pressure p_2 and thus the degree of opening of the regulator, i.e. the equalisation hole (24a) in the servo piston (24) ensures that pressure p_2 is balanced in accordance with the degree of opening of the pilot valve.

Design
Function
(continued)

43. Gasket
44. Blanking plug for pressure gauge connection
81. Gasket
82. O-ring
103. Banjo fitting
104. O-ring
105. Protective cap
106. O-ring
107. Signal connection
108. Pilot orifice
109. Banjo fitting connector
110. Diaphragm
111. Spring
112. Setting spindle



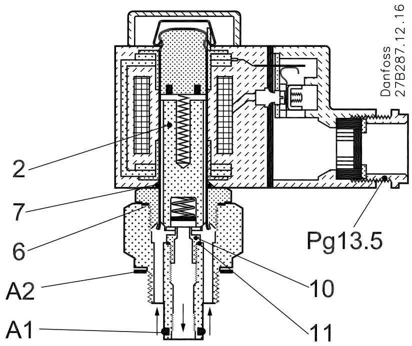
CVC



Blanking plug A + B

Blanking plug A

1. Coil
2. Armature
3. Armature tube
4. Gasket
5. O-ring
6. Seal ring
7. Spacing ring
8. Nut
9. Locking knob
10. Union nut
11. Valve seat

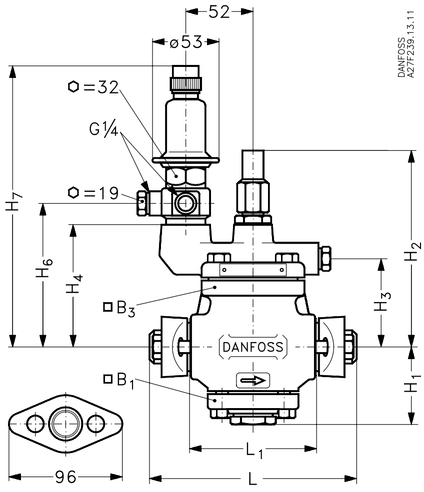


EVM

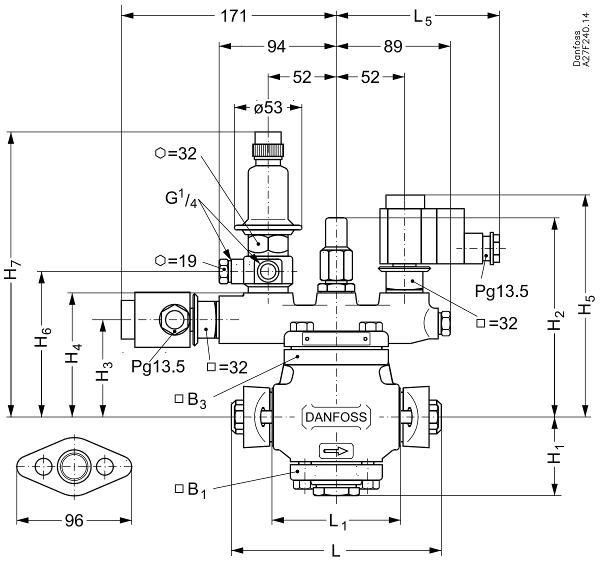
PMC opens when the pressure p_s in the signal connection (107) is below set point.
The PMC 3 has three connections for pilot valves, two in series (marked "SI" and "SII") and one in parallel (marked "P").

If only two pilot valves are necessary for the required function, the third pilot port must be blanked with the blanking plug provided. Fitting instructions accompany the blanking plug.

Dimensions and weights



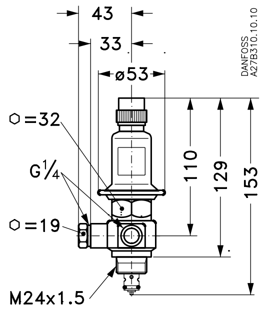
PMC 1 and CVC



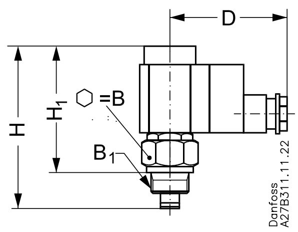
PMC 3, CVC and EVM

Type	Size	H_1	H_2	H_3	H_4	H_5	H_6	H_7	L	L_1	L_5 max.		B_1	B_3	Weight with flanges but without pilot valves		
											10 W	20 W			PMC 1	PMC 3	Flangeset
PMC 1	5 - 20	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	kg	kg
PMC 3		66	162	79	101	178	117	228	177	106	122	132	75	87	6.5	7.0	1.1

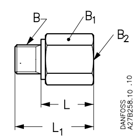
Pilot valve type	Weight kg
CVC	0.7
EVM	0.5



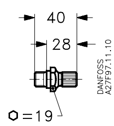
CVC



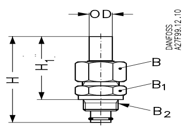
EVM



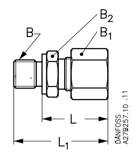
Pressure gauge connector, ¼ NPT



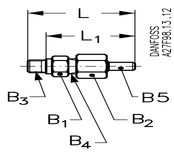
Pressure gauge connector, flare



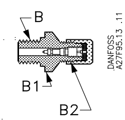
External pilot connection



Pressure gauge connector, cutting ring connection



Pressure gauge connector



Pressure gauge connector, self-closing

Size	A	B	L	M
6 mm	19	14	39	27
10 mm	19	19	40	29

Introduction

ORV are 3-way industrial valves for maintaining a constant oil temperature in gas compressor systems, by mixing hot and cold oil in the lubricating system of e.g. screw or turbo type compressors.
The ORV valves are with few components and with extended cylindrical connections, to ensure ease of installation and service.
The thermostatic element has a built-in temperature setting of 49°C (120°F) as standard.
For other temperatures please have a look at page 11.

Features

- Stainless steel nickel plated thermostatic element.
- Butt-weld (DIN, ANSI) or socket weld (SOC) connection.
- No manual adjustment.
- Plug and Play design.
- Optimised flow characteristics.
- Sturdy construction.
- High resistance against vibrations or shock.
- Can be mounted in any direction.
- Service friendly. Easy to dismantle and service when required.

Technical data

Oils:
Applicable to all common refrigeration oils.

Refrigerants:
Applicable to all common non-flammable refrigerants, including R717 and noncorrosive gases/liquids dependent on sealing material compatibility.
Flammable hydrocarbons are not recommended.
For further information please refer to installation instruction for ORV.

Temperature range:
Minimum operating temperature:
≥ –10°C (+14°F)
Continuous operation:
≤ +85°C (+185°F)
Short operating periods:
≤ +120°C (+248°F)

Pressure range:
The valves are designed for a max. working pressure of 40 bar g (580 psig)

The complete technical leaflet (DKRCI.PD.HP0.A) can be downloaded from the Danfoss web site.

Design

Connections
Available with the following connections:

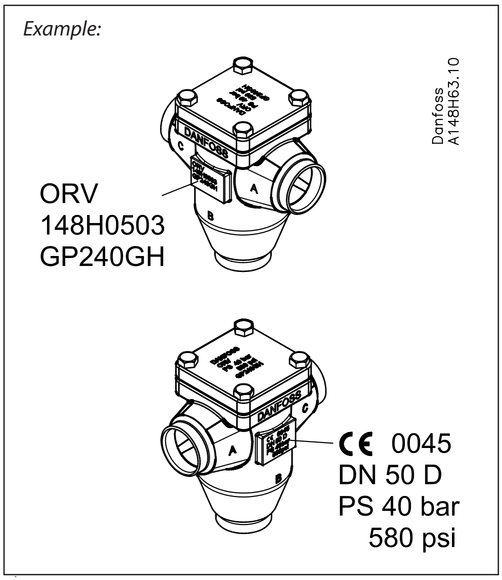
- Butt weld DIN (EN 10220),
  – DN 25-80 (1-3 in.)
- Butt weld ANSI (B 36.10 Schedule 80),
  – DN 25 - 40 (1 - 1½ in.)
- Butt weld ANSI (B 36.10 Schedule 40),
  – DN 50 - 80 (2 - 3 in.)
- Socket Weld (ANSI B 16.11),
  – DN 25 - 50 (1 - 2 in.)

Housing
Made of special, cold resistant steel approved for low temperature operations.

Installation
Installation of the valve depends on the way it should operate.

Pressure Equipment Directive (PED)
ORV valves are approved according to the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction.

Identification



Function

Mixing operation

ORV valve can work as a mixing or diverting valve. The ORV oil regulating valve utilises the high coefficient of thermal expansion of wax to create the internal movement necessary to have a cold and a hot inlet mixing to a common outlet. The outlet temperature will correspond to the nominal temperature of the thermostatic element.

The valve house has three ports:

- Port A is used for the common outlet
- Port B is for the hot inlet
- Port C is for the cold inlet

When the compressor unit is cold at start up, the thermostatic element will be contracted to let the full flow from port B pass until the nominal temperature (minus 5 K / 10°F) is reached (fig. 1.1). The thermostatic element will then begin to extract to let the outlet become a mixture of hot and cold oil.

When the nominal temperature is reached, the element is positioned in approximately half open position (fig. 1.2). If the temperature is reaching approximately the nominal temperature plus 5 K, the thermostatic element has been extracted to its fully open position (fig. 1.3). In this position the oil temperature will only come from the cold inlet port (C) from oil cooler.

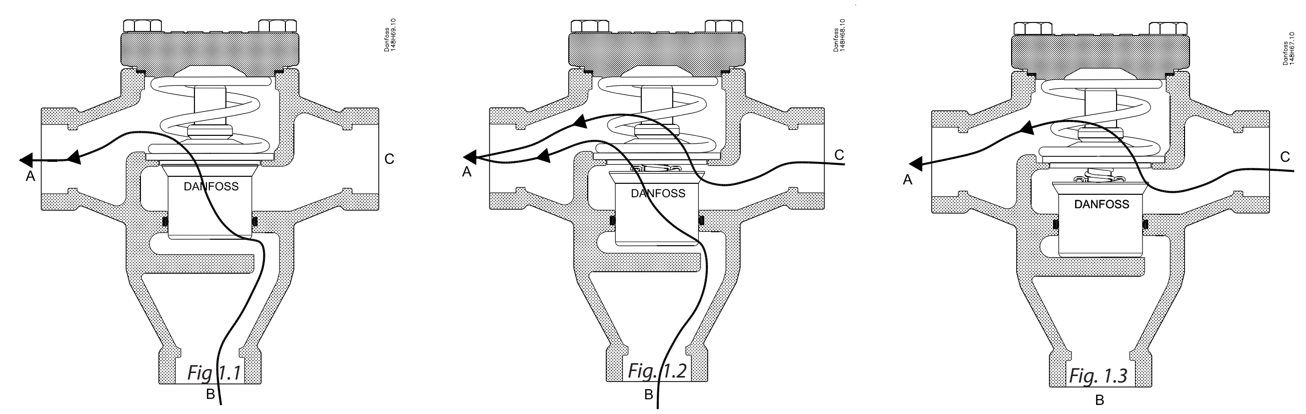


Fig 1.1 *Fig. 1.2* *Fig. 1.3*

From figure 1, it can be seen how the sleeve on the element is sliding in a vertical movement. The thermostatic element is kept in position by a spring.

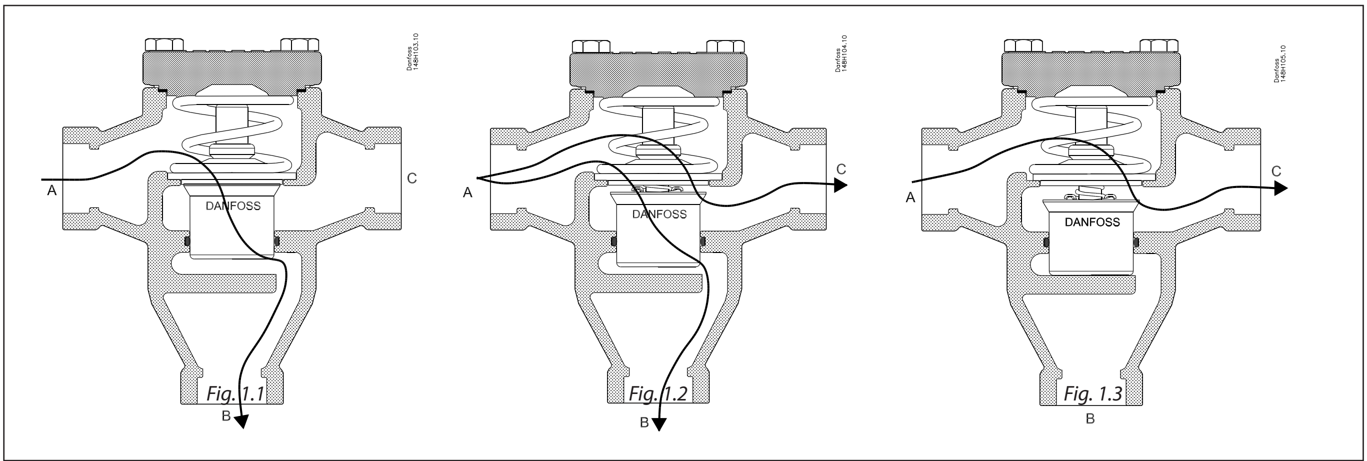
Function

Diverting operation

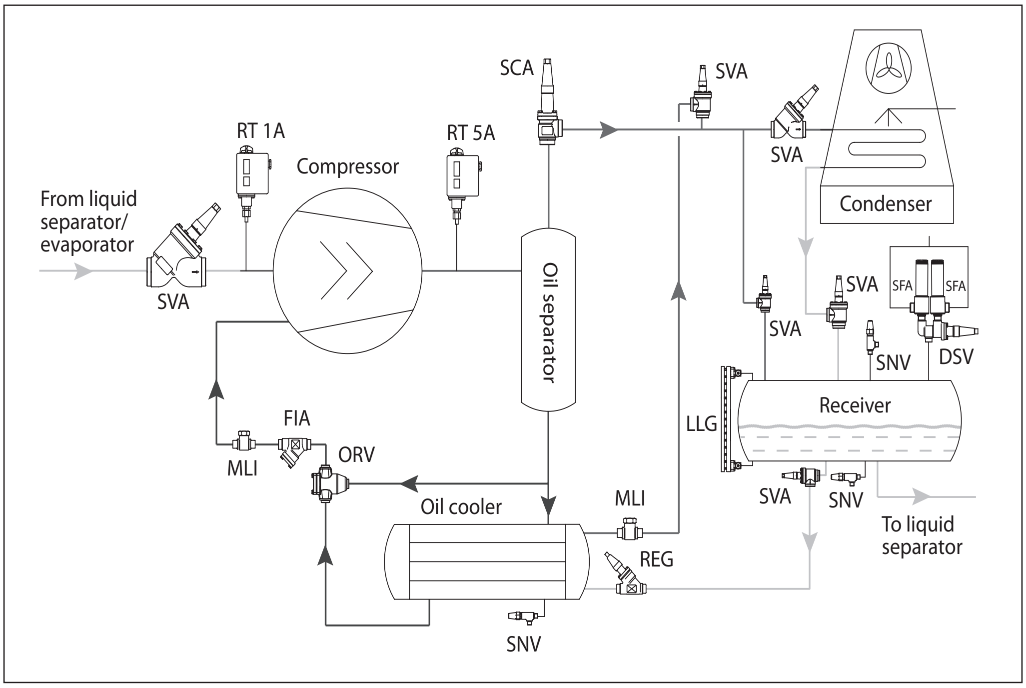
Diverting operation is similar to the mixing operation. It is carried out with separation in to two of the fluid with single temperature. Due to that the temperature on the inlet is very stable fact the regulation is very smooth. The inlet temperature would correspond to the nominal temperature of the thermostatic element.
The valve house has three ports:

- Port A is used for the common inlet
- Port B is for the cold outlet
- Port C is for the warm outlet

The diverting operation otherwise is similar to the mixing operation.

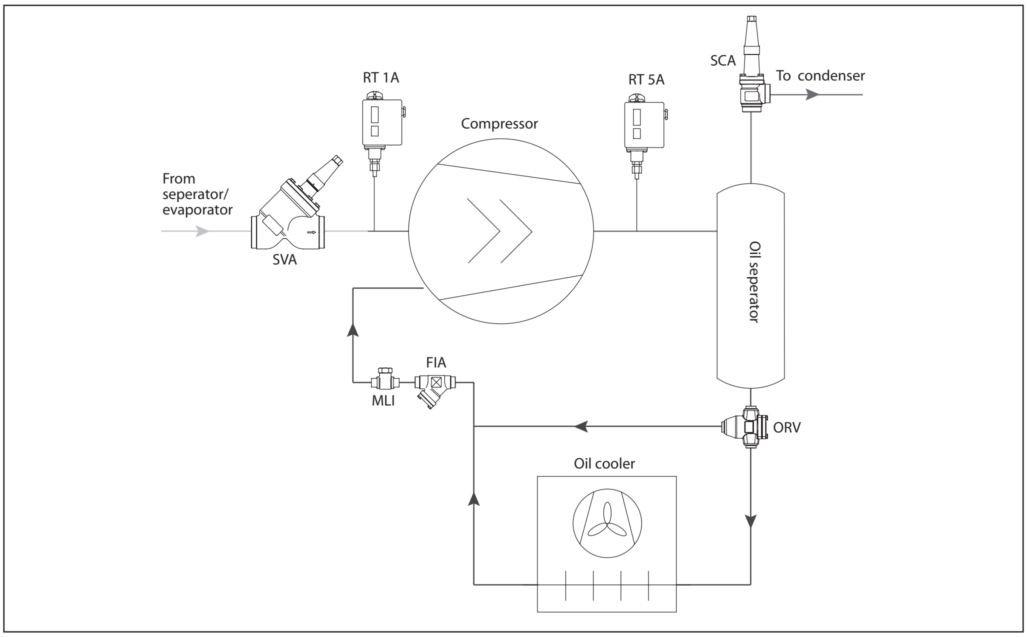


Application example



Example of the system with ORV for mixing operation.

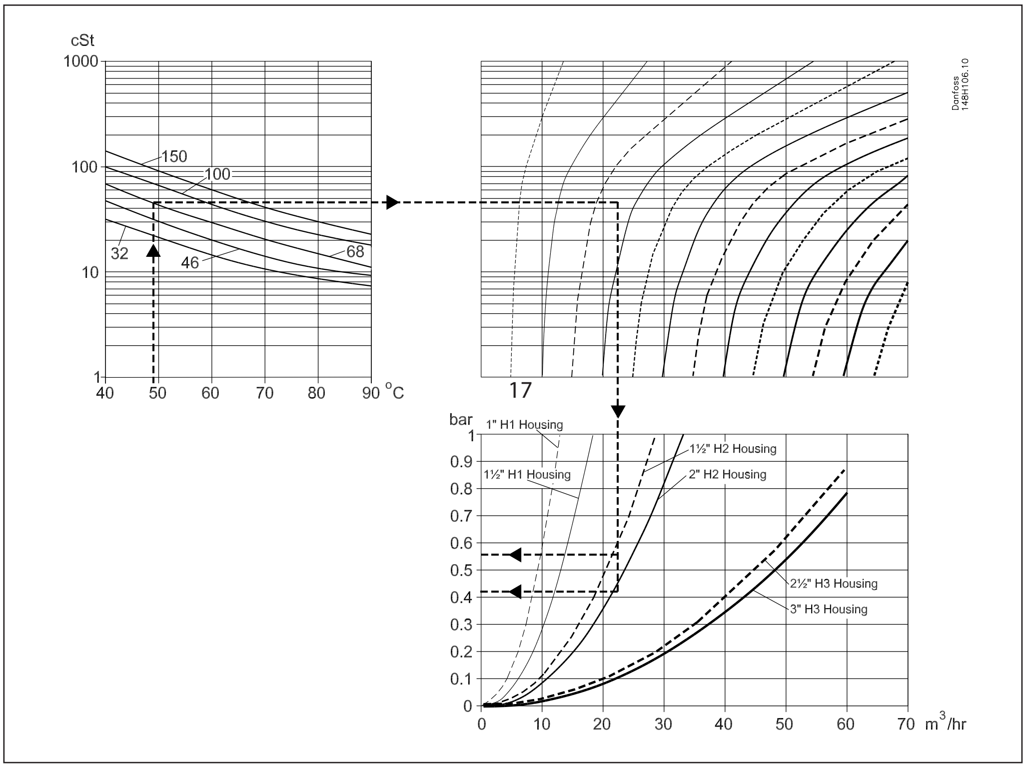
Application example



Example of the system with ORV for diverting operation

Capacities

SI units



Selection example

Oil type:	Grade 68
Required flow:	17 m^3/h
Nominal oil temperature:	49°C
Pipe dimension:	40 mm

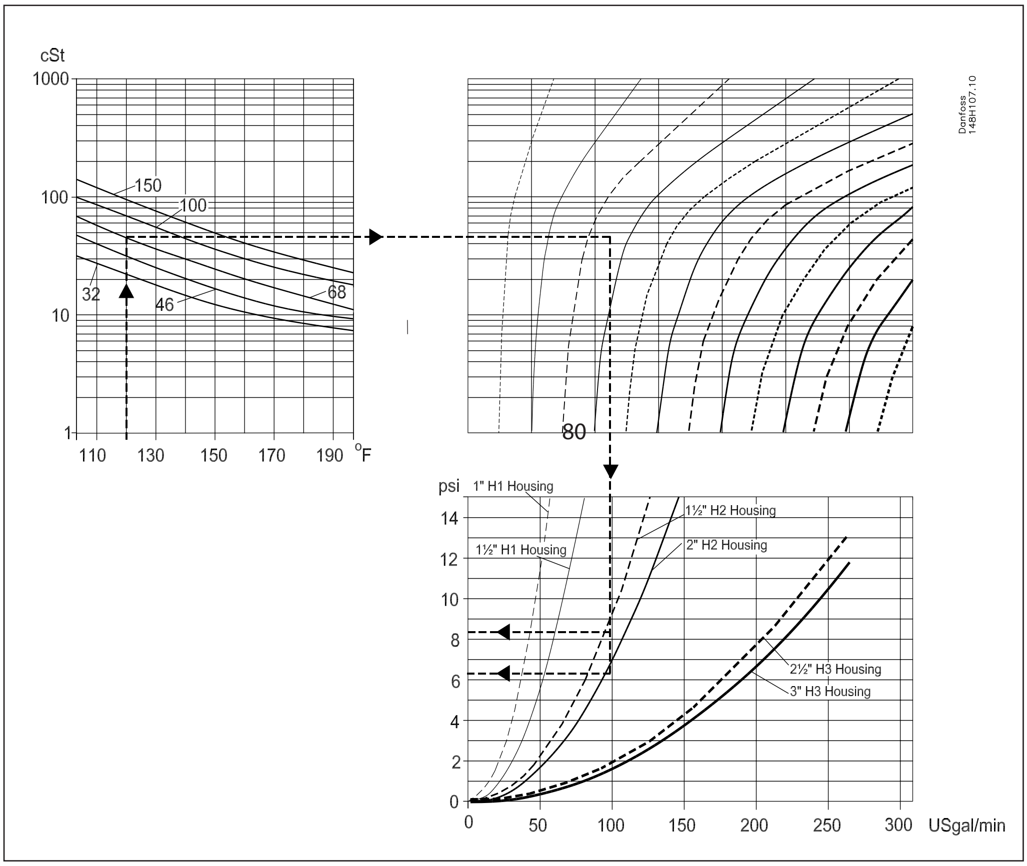
The upper left curve shows the viscosity of different grades of oil as a function of the temperature. The viscosity is continued into the upper right curve where the 17 m^3/h must be found. The line is drawn vertically downwards into the capacity table for the ORV valve models.

As shown two selections can be made: Either ORV 40 H2 with pressure drop at approx. 0.56 bar or ORV 50 H2 with pressure drop at 0.42 bar.

The final selection will depend on the available pressures in the system. If the pressures are low (or can be low at certain loads) the ORV 50 H2 might be preferred. If the pressures are constantly available the pipe dimension may be taken into account and the ORV 40 H2 might be preferred.

Capacities

US units



Selection example

Oil type:	Grade 68
Required flow:	80 USgal/min.
Nominal oil temperature:	120°F
Pipe dimension:	1½″

The upper left curve shows the viscosity of different grades of oil as a function of the temperature. The viscosity is continued into the upper right curve where the 80 USgal/min. must be found. The line is drawn vertically downwards into the capacity table for the ORV valve models.

As shown three selections can be made:
Either
- ORV 1½″H1 with pressure drop 6.2 psi or
- ORV 1½H2 with pressure drop 3 psi or
- ORV 2″H2 with pressure drop 2.2 psi

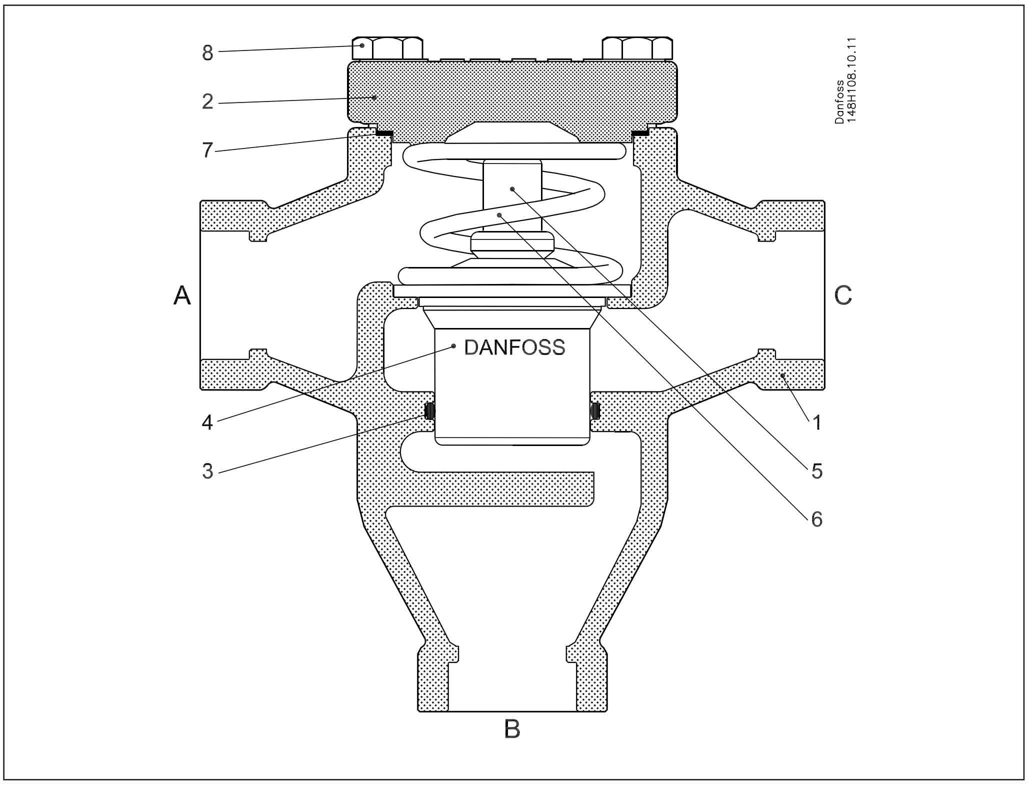
The fourth possible selection of ORV 1″H1 with pressure drop of more than 10 psi could not be recommended. The recommended operational span would be from 2 to 7 psi.

Unless the pipeline was 2″ the ORV 2″H2 would not be a practical selection.

The selection between the 1½″H1 or 1½″H2 house would be a consideration of the available pressure in the system. If the pressures are constantly at a high level the H1 house would be sufficient, but if the pressure at any given operating condition could be low, the bigger H2 house with lesser pressure drop would be preferred.

Material specification

ORV 25-80

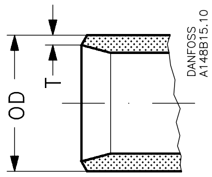


No.	Part	Material	EN		ASTM standard		JIS standard	
1	Housing	Steel	GP240GH	10213-2	WCB	A 216	SCPH 1	G 5151
2	Cover	Steel	GP240GH	10213-2	WCB	A 216	SCPH 1	G 5151
3	Guiding tape	PTFE						
4	Element*)	Stainless steel						
5	Element top	Ni plated Cu plated						
6	Spring	Steel	DIN17223	10270-1				
7	Gasket	Non asbestos						
8	Bolts	Steel	Quality 8.8	ISO4017	Grade 5		8.8	B 1051

*) The thermostatic element may look differently from one shown on the picture. All types of thermostats used by Danfoss have the same function, temperature setting and P-band.

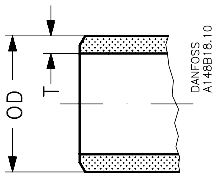
Connections

DIN



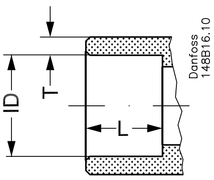
Size mm	Size in	OD mm	T mm	OD in	T in			K_v / C_v H1 housing		K_v / C_v H2 housing		K_v / C_v H3 housing	
Butt-weld DIN (EN10220)								K_v m^3/h	C_v Usgal/min	K_v m^3/h	C_v Usgal/min	K_v m^3/h	C_v Usgal/min
25	1	33.7	2.6	1.327	0.103			15	17	-	-	-	-
40	1½	48.3	2.6	1.902	0.103			22	26	30	35	-	-
50	2	60.3	2.9	2.37	0.11			-	-	36	42	-	-
65	2½	76.1	2.9	3	0.11			-	-	-	-	65	75
80	3	88.9	3.2	3.5	0.13			-	-	-	-	75	87

ANSI



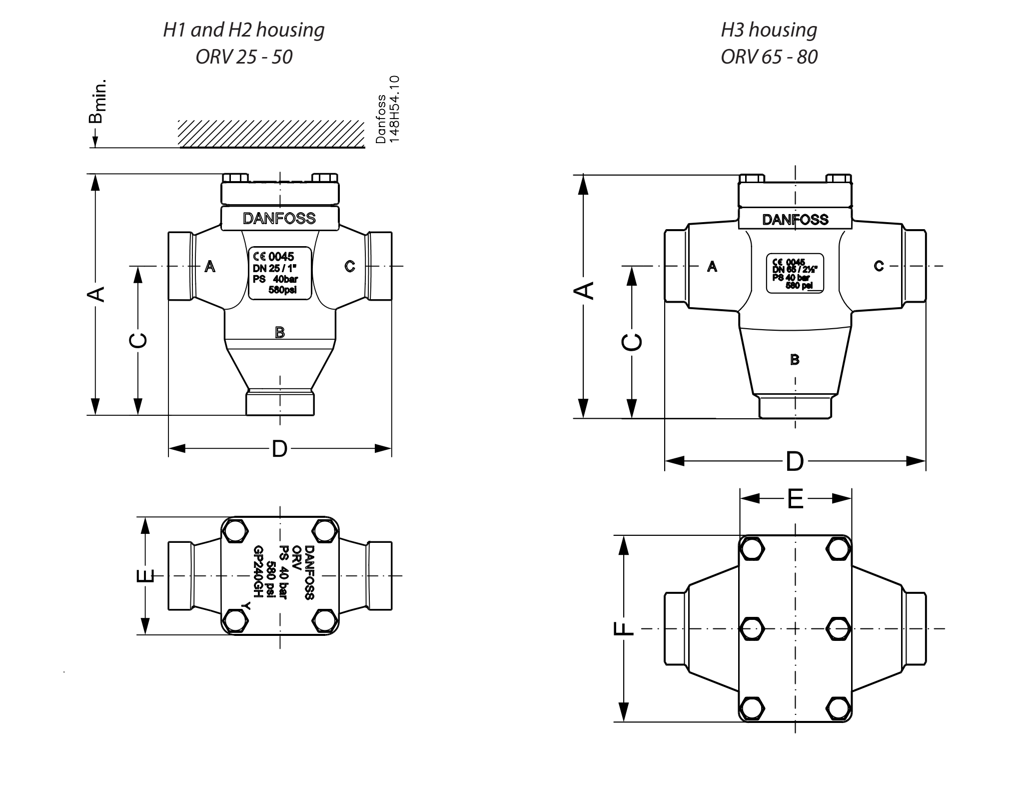
Size mm	Size in	OD mm	T mm	OD in	T in			K_v / C_v H1 housing		K_v / C_v H2 housing		K_v / C_v H3 housing	
Butt-weld ANSI (B 36.10 Schedule 80)								K_v m^3/h	C_v Usgal/min	K_v m^3/h	C_v Usgal/min	K_v m^3/h	C_v Usgal/min
25	1	33.7	4.6	1.327	0.181			15	17	-	-	-	-
40	1½	48.3	5.1	1.902	0.201			22	26	30	35	-	-
Butt-weld ANSI (B 36.10 Schedule 40)								K_v m^3/h	C_v Usgal/min	K_v m^3/h	C_v Usgal/min	K_v m^3/h	C_v Usgal/min
50	2	60.3	3.9	2.37	0.15			-	-	36	42	-	-
65	2½	73	5.2	2.87	0.2			-	-	-	-	65	75
80	3	88.9	5.5	3.5	0.22			-	-	-	-	75	87

SOC



Size mm	Size in	ID mm	T mm	ID in	T in	L mm	L in	K_v / C_v H1 housing		K_v / C_v H2 housing		K_v / C_v H3 housing	
Socket welding ANSI (B 16.11)								K_v m^3/h	C_v Usgal/min	K_v m^3/h	C_v Usgal/min	K_v m^3/h	C_v Usgal/min
25	1	33.9	7.2	1.335	0.284	13	0.51	15	17	-	-	-	-
40	1½	48.8	6.6	1.921	0.26	13	0.51	-	-	30	35	-	-
50	2	61.2	6.2	2.41	0.24	16	0.63	-	-	36	42	-	-

Dimensions and weights



Valve size	Valve size		A	BMIN.	C	D	E	F	Weight
H1 housing	ORV 25-40	mm	178	75	110	165	87	-	4.5 kg
	(1-1½)	in.	7.00	3.00	4.33	6.50	3.43	-	10 lb
H2 housing	ORV 40-50	mm	215	80	138	196	110	-	9.0 kg
	(1½-2)	in.	8.46	3.15	5.43	7.72	4.33	-	20 lb
H3 housing	ORV 65-80	mm	252	80	155	266	115	190	18 kg
	(2½-3)	in.	9.92	3.15	6.10	10.47	4.53	7.48	40 lb

Ordering

Type codes

Valve type	ORV	Oil regulating valve, high specification				
Nominal size in mm (valve size measured on the connection diameter)			Available connections			
			DIN	ANSI	SOC	
	25		X	X	X	
	40		X	X	X	
	50		X	X	X	
	65		X	X		
	80		X	X		
Connection	**A** **D** **SOC**	Butt weld connection: ANSI Butt weld connection: DIN Socket welding				
Valve housing	**3-WAY**	3-WAY				

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of ordering.

Code numbers

Example:
ORV 40 DIN H2 49°C/120°F = **148H3230**

	43°C / 110°F	49°C / 120°F	54°C / 130°F	60°C / 140°F	66°C / 150°F	77°C / 170°F
25 DIN H1 (1")	148H3320	148H3227	148H3258	148H3321	148H3259	148H3322
25 SOC H1 (1")	148H3327	148H3229	148H3328	148H3329	148H3330	148H3331
25 ANSI H1 (1")	148H3323	148H3228	148H3262	148H3324	148H3325	148H3326
40 DIN H1 (1½")	148H3364	148H3241			148H3260	
40 DIN H2 (1½")	148H3332	148H3230	148H3333	148H3334	148H3335	148H3336
40 SOC H2 (1½")	148H3337	148H3232	148H3338	148H3339	148H3340	148H3341
40 ANSI H1 (1½")		148H3242				
40 ANSI H2 (1½")		148H3231				
50 DIN H2 (2")	148H3342	148H3233	148H3343	148H3344	148H3345	148H3261
50 SOC H2 (2")	148H3346	148H3235	148H3347	148H3348	148H3349	148H3350
50 ANSI H2 (2")		148H3234				
65 DIN H3 (2½")	148H3351[1)]	148H3236[1)]	148H3352[1)]	148H3353[1)]	148H3354[1)]	148H3355[1)]
65 ANSI H3 (2½")	148H3356[1)]	148H3237[1)]	148H3357[1)]	148H3358[1)]	148H3359[1)]	148H3360[1)]
80 DIN H3 (3")		148H3239[1)]				
80 ANSI H3 (3")		148H3240[1)]				

D = Butt-weld DIN
A = Butt-weld ANSI
SOC = Socket welding

1) For valve housing H3 there are two thermostats and one seal

Code numbers

Spare parts

Part	Spare parts for	Code no.
Thermostat 43°C/110°F and gasket + guide ring	ORV 25 and ORV 40 H1	**148H3250**
	ORV 40 and ORV 50 H2	**148H3254**
	ORV 65 and ORV 80 H3	**148H3393**[1)]
Thermostat 49°C/120°F and gasket + guide ring	ORV 25 and ORV 40 H1	**148H3243**
	ORV 40 and ORV 50 H2	**148H3244**
	ORV 65 and ORV 80 H3	**148H3245**[1)]
Thermostat 54°C/130°F and gasket + guide ring	ORV 25 and ORV 40 H1	**148H3251**
	ORV 40 and ORV 50 H2	**148H3255**
Thermostat 60°C/140°F and gasket + guide ring	ORV 25 and ORV 40 H1	**148H3252**
	ORV 40 and ORV 50 H2	**148H3256**
Thermostat 66°C/150°F and gasket + guide ring	ORV 25 and ORV 40 H1	**148H3276**
	ORV 40 and ORV 50 H2 / ORV 65 and ORV 80 H3	**148H3298**[1)]
Thermostat 77°C/170°F and gasket + guide ring	ORV 25 and ORV 40 H1	**148H3253**
	ORV 40 and ORV 50 H2	**148H3257**

Part	Spare parts for	Code no.
Gasket and guide ring	ORV 25 and ORV 40 H1	**148H3246**
	ORV 40 and ORV 50 H2	**148H3247**
	ORV 65 and ORV 80 H3	**148H3248**[1)]

[1)] For valve housing H3 there are two thermostats, two guide rings, and one seal.

Part	Spare parts for	Code no.
Complete valve housing without an element	ORV 40 DIN H1	**148H3361**
	ORV 80 DIN H3	**148H3362**

Introduction

Based on advanced technology the new ICF control solution incorporates several functions in one housing, which can replace a series of conventional mechanical, electro-mechanical and electronically operated valves.

This solution not only provides a number of advantages in the design phase of a refrigeration plant but also in the installation, service and maintenance.

The ICF solutions are designed for low and high pressure refrigerants and can be used in liquid lines, compressor injection lines and hot gas lines.

Supplied as a complete assembly, it is leak tested at high pressure and its functions are tested under factory controlled conditions.

One code number equals one application solution.

Features

- Designed for industrial refrigeration applications for a maximum working pressure of 52 bar/754 psig.
- Applicable to all common non flammable refrigerants including R717, R744 (CO_2) and non corrosive gases/liquids dependent on sealing material compatibility.
- Direct weld connections.
- Connection types include butt weld, socket weld.
- Low temperature steel housing.
- Low weight and compact design.
- V-port regulating cones on the control modules ensure optimum regulating accuracy particularly at part load.
- *Modular Concept*
  Each housing is available with several different connection types and sizes.
  Valve service is performed by replacing the function module.
- Optional side ports can be specified for the connection of pressure gauges, transmitters, sight glasses etc.

CE

ICF control solution		
Nominal bore	DN≤ 25 (1 in.)	DN 32-40 (1 ¼ - 1 ½”)
Classified for	Fluid group I	
Category	Article 3, paragraph 3	II

Technical data

- *Refrigerants*
  Applicable to all common non flammable refrigerants including R717, R744 (CO_2) and non corrosive gases/liquids dependent on sealing material compatibility.

  For further information please refer to installation instruction for ICF.
  Use of the ICF control solution with flammable hydrocarbons is not recommended.
  For further information please contact the local Danfoss sales company.
- *Temperature range*
  –60/+150°C (–76/+302°F).
  ICF with ICM/ICAD: +120°C (+248°F)
- *Surface protection*
  The external surface is zinc-chromated to provide corrosion protection.
  Additional on-site corrosion protection is recommended.
- *Pressure*
  The ICF is designed for:
  Max. working pressure: 52 bar g (754 psig)

  Opening differential pressure:
  Please refer to the individual function module data.

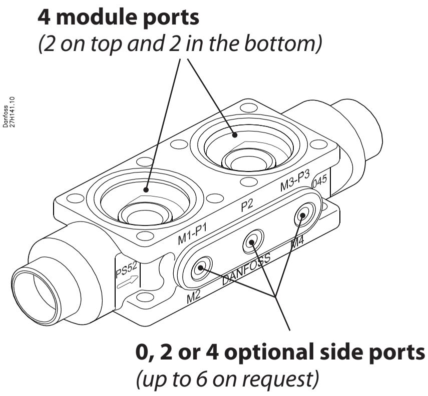
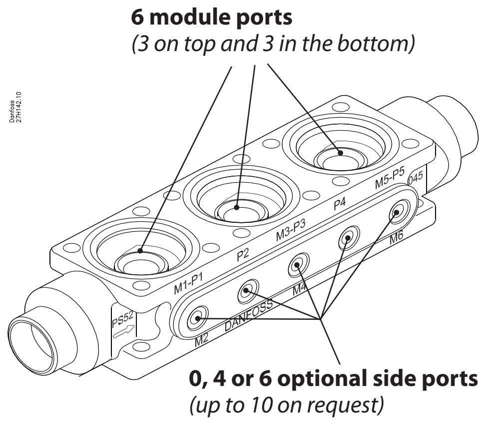
The complete technical leaflet (DKRCI.PD.FT0.A) can be downloaded from the Danfoss web site.

Design

The main components of the ICF solution are:
- A housing
- A maximum of four or six function modules

Housing

There are two housing variants:

<table>
<tr><td>ICF with 4 module ports (ICF 20 example)</td><td>ICF with 6 module ports (ICF 20 example)</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>The ICF housing includes:
– Module ports M1 to M4
– Side ports P1 to P6 depending on model</td><td>The ICF housing includes:
– Module ports M1 to M6
– Side ports P1 to P10 depending on model</td></tr>
</table>

Function modules

Each housing accommodates a maximum of four or six function modules, of the following types:
- Stop valve module
- Manual regulating valve module
- Filter module
- Solenoid valve module
- Electronic expansion valve module
- Manual opening module
- Check valve module
- Stop/check valve module
- Motor valve module
- External welding connection module
- Blank top cover

Optional:
The housing can be supplied with a maximum of six side ports for the following:
- Sight glass
- Temperature or pressure sensor
- Pressure gauge
- Side exit for drain or bypass.

The design allows maximum capacity and minimum pressure drop, using advanced technology and double seats – offering higher capacity than conventional systems using individual valves and components.

The ICF solution is multifunctional.

ICF solution offers compact dimensions and shortened installation time due to the reduced number of direct welded connections.

Supplied as a complete assembly, it is leak tested at high pressure and its functions are tested under factory controlled conditions.

Connections
There is a very wide range of connection types available with ICF solutions:
- D: Butt weld, DIN (EN 10220)
- A: Butt weld, ANSI (B 36.10)
- SOC: Socket weld, ANSI (B 16.11)

Approvals
The ICF concept is designed to fulfil global refrigeration requirements.
For specific approval information, please contact Danfoss.

Housing and function module material
Low temperature steel

When using TIG/MIG welding technology, it is possible to install the ICF solution without prior removal of the function modules from the housing. If using other welding methods the modules must be disassembled.

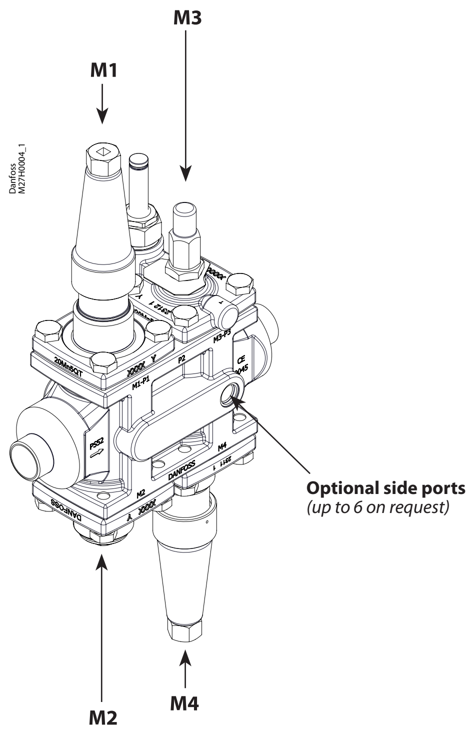
Please consult the product instruction for more details.

Function module configurations

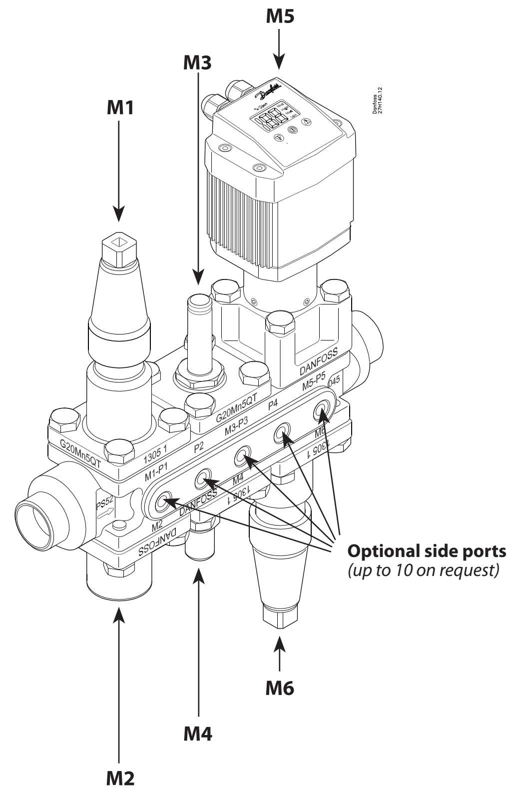
Function Module Type		Can be installed in these locations					
ICFS	Stop valve module	M1	M2	M3	M4	M5	M6
ICFR	Manual regulating valve module	M1	M2	M3	M4	M5	M6
ICFF	Filter (strainer) module		M2		M4		M6
ICFE	Solenoid valve module			M3			
ICFC	Check valve module				M4		M6
ICFN	Stop/check valve module				M4		M6
ICM	Motor valve module	M1		M3		M5	
ICFB	Blank top cover	M1	M2	M3	M4	M5	M6
ICFA	Electronic expansion valve module (for ICF 20 only)	M1		M3		M5	
ICFE20H	Solenoid valve module (for ICF 20 only)	M1		M3		M5	
ICFO	Manual opening module				M4		
ICFW	Welding module (for ICF 25-40 only)	M1	M2	M3	M4	M5	M6

Module locations are indicated by M1, M2, M3, M4, M5 and M6. With respect to refrigerant flow, M1 is closest to inlet.

4-module configuration example, ICF (25-40)-4-9:
This application can be used as a hot gas or liquid line solenoid valve station.



6-module configuration example, ICF 20-6-5:
This application can be used for direct expansion, liquid injection to compressor, or as liquid makeup to keep a level in a separator.



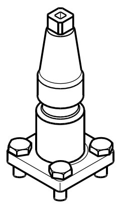
Control solutions

ICF 20

Description of the function modules for ICF 20

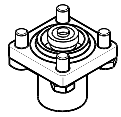
ICFS 20
Stop valve module
This module has the function of a stop valve.

ICFR 20A
Manual regulating valve module
This module has the function of a hand regulating valve.



ICFS 20 / ICFR 20A

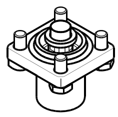
ICFC 20
Check valve module
This module has the function of a check valve.



ICFC 20

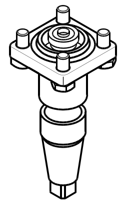
ICFF 20
Filter module
This module has the function of a filter.

Filter size:
Pleated 150μ (100 mesh) / 45 cm^2 (7.0 in^2) for ICF with DIN and ANSI connections
Pleated 250μ (72 mesh) / 45 cm^2 (7.0 in^2) for ICF with SOC connections



ICFF 20

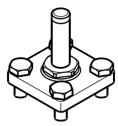
ICFN 20
Stop/check valve module
This module has the function of a combined stop and check valve.



ICFN 20

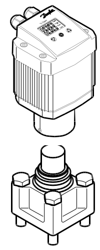
ICFE 20
Solenoid valve module
This module has the function of a normally closed solenoid valve for controlling the refrigerant flow.

ICFA 10
Electronic expansion valve module
This module has the function of an electronic pulse width modulating (PWM) expansion valve.



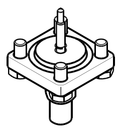
ICFE 20 / ICFA 10

ICM 20-A, B or C
Motor valve module
This module is a stepper motor actuator valve for on/off and modulating control of the refrigerant flow.



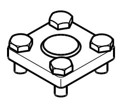
ICM 20-A, B or C

ICFO 20
Manual opening module
This module facilitates the manual opening of the solenoid valve (type ICFE).



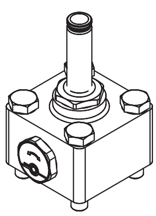
ICFO 20

ICFB 20
Blank top cover
This provides a blanking cover for unused module ports.



ICFB 20

ICFE 20H
Solenoid valve module with integrated manual opener
This module has the function of a normally closed solenoid valve for controlling the refrigerant flow.

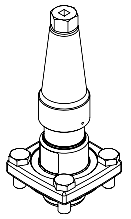


ICFE 20H

ICF 25-40

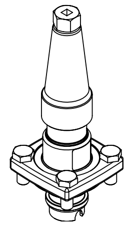
Description of the function modules for ICF 25-40

ICFS 25-40
Stop valve module
This module has the function of a stop valve.



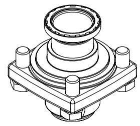
ICFS 25-40

ICFR 25-40
Manual regulating valve module
This module has the function of a hand regulating valve.



ICFR 25-40

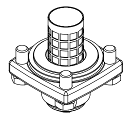
ICFC 25-40
Check valve module
This module has the function of a check valve.



ICFC 25-40

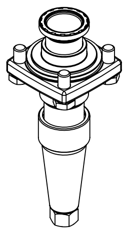
ICFF 25-40
Filter module
This module has the function of a filter.

The filter has a 150μ mesh and a 50μ internal run-in filter to be removed after start-up.



ICFF 25-40

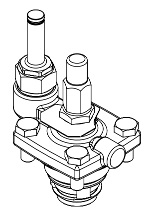
ICFN 25-40
Stop/check valve module
This module has the function of a combined stop and check valve.



ICFN 25-40

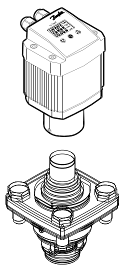
ICFE 25-40
Solenoid valve module
This module has the function of a normally closed solenoid valve for controlling the refrigerant flow.

It has a built-in manual opening function.



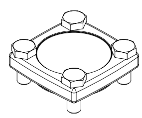
ICFE 25-40

ICM 25-A or B
Motor valve module
This module is a stepper motor actuator valve for on/off and modulating control of the refrigerant flow.



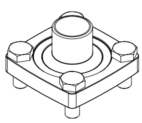
ICM 25-A or B

ICFB 25-40
Blank top cover
This provides a blanking cover for unused module ports.



ICFB 25-40

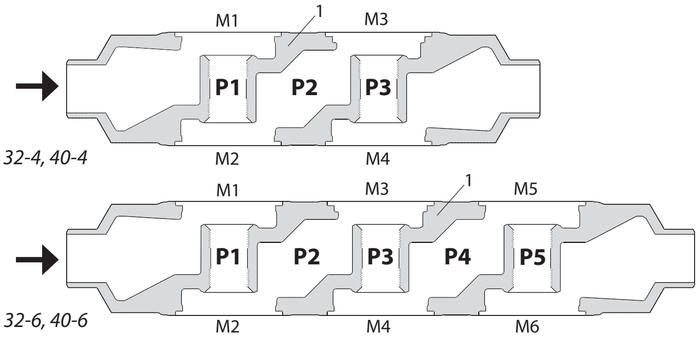
ICFW 25-40
Welding module, 25 DIN
This module is used for drain connection during hot-gas defrosting - in case of high capacity.



ICFW 25-40

Material specification

ICF housing

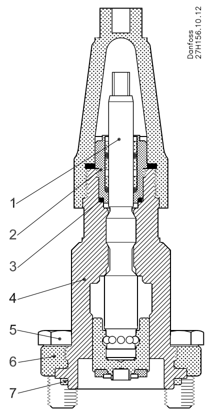


ICF 20-4, 25-4, 32-4, 40-4

ICF 20-6, 25-6, 32-6, 40-6

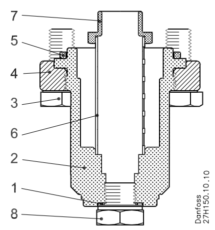
Pos.	Part	Material	EN	ASTM	JIS
1	Housing	Cast steel low temperature	G20MN5QT EN 10213-3	LCC, A352	SCPL1, G5151

ICFS 20 stop valve module



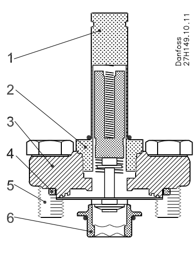
Pos.	Part	Material	EN	ASTM	JIS
1	Spindle	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
2	Thread part	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
3	AL-gasket/ Refrig. gasket		AL99 alloy no. 1200 DIN 1712 BL.3		
4	Bonnet	Steel	S235JRG2 EN 10025	A283	G3101
5	Hex-head bolt M10 × 25	Stainless steel	A2-70 EN 24017	A320	A2-70
6	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
7	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			

ICFF 20 filter module



Pos.	Part	Material	EN	ASTM	JIS
1	Gasket	AL 99 F11			
2	Bonnet	Steel	S235JRG2 EN 10025	A283	G3101
3	Hex-head bolt M10 × 25	Stainless steel	A2-70 EN 24017	A320	A2-70
4	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
5	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
6	Filter element	Steel 150 + 50			
7	Plug	Steel			
8	Plug $^{1}/_{4}$″ RG for butt-weld $^{3}/_{8}$″ NPT for socket weld	Stainless steel	A2-70 EN 24017	A320	A2-70

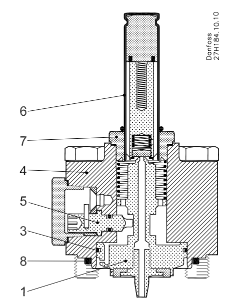
ICFE 20 solenoid valve module



Pos.	Part	Material	EN	ASTM	JIS
1	Armature tube	Stainless steel	X2CrNi19-11 EN 10088		
2	Armature tube nut	Stainless steel	X8CrNiS18-9 EN 10088		
3	Flange	Cast Steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
4	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
5	Hex-Head bolt M10 × 25	Stainless steel	A2-70 EN 24017	A320	A2-70
6	Seat	High density polymer			

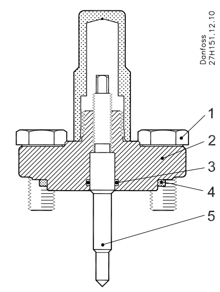
Material specification
(continued)

ICFE 20H solenoid valve module



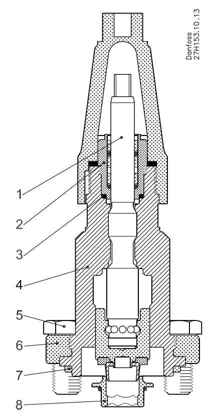
Pos.	Part	Material	EN	ASTM	JIS
1	Piston	Steel	11SMn30 EN EN 10025		
2	Seat	Teflon			
3	Piston ring				
4	Bonnet cylinder	Steel	P285QH EN 10222	A350	G3205
5	Manual opener	Steel			
6	Armature tube	Stainless steel	X2CrNi19-11 EN10028		
7	Armature tube nut	Stainless steel	X2CrNi19-11 EN10216	A320	A2-70
8	Gasket	Chloroprene (Neoprene)			

ICFO 20 manual opening module



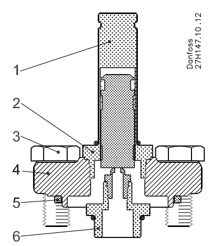
Pos.	Part	Material	EN	ASTM	JIS
1	Hex-head bolt M10 × 25	Stainless steel	A2-70 EN 24017	A320	A2-70
2	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
3	O-ring	Chloroprene			
4	Rubber gasket	Chloroprene rubber			
5	Spindle	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304

ICFR 20 manual regulating valve module



Pos.	Part	Material	EN	ASTM	JIS
1	Spindle	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
2	Thread part	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
3	AL-gasket		AL99 alloy no. 1200 DIN 1712 BL.3		
4	Bonnet	Steel	S235JRG2 EN 10025	A283	G3101
5	Hex-head bolt M10 × 25	Stainless steel	A2-70 EN 24017	A320	A2-70
6	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
7	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
8	Seat	High density polymer			

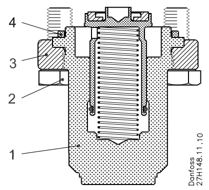
ICFA 10 electronic expansion valve module



Pos.	Part	Material	EN	ASTM	JIS
1	Armature tube	Stainless steel	X2CrNi19-11 EN 10088		
2	Armature tube nut	Stainless steel	X8CrNiS18-9 EN 10088		
3	Hex-head bolt M10 × 25	Stainless steel	A2-70 EN 24017	A320	A2-70
4	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
5	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
6	Adaptor	Steel			

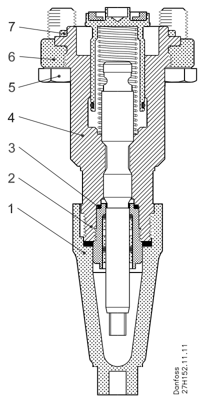
Material specification
(continued)

ICFC 20 check valve module



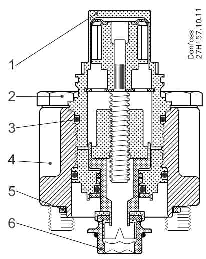
Pos.	Part	Material	EN	ASTM	JIS
1	Bonnet	Steel	S235JRG2	A283	G3101
2	Hex-head bolt M10 × 25	Stainless steel	A2-70 EN 24017	A320	A2-70
3	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	AG5152
4	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			

ICFN 20 stop/check valve module



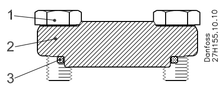
Pos.	Part	Material	EN	ASTM	JIS
1	Spindle	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
2	Thread part	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
3	AL-gasket		AL99 alloy no. 1200 DIN 1712 BL.3		
4	Bonnet	Steel	S235JRG2 EN 10025	A283	G3101
5	Hex-head bolt M10 × 25	Stainless steel	A2-70 EN 24017	A320	A2-70
6	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
7	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			

ICM 20-A, 20-B or 20-C motor valve module



Pos.	Part	Material	EN	ASTM	JIS
1	Adapter	Stainless steel	X5CrNi18-10 EN 10088	A240	G4303 G4304
2	Hex-head bolt M10 × 50	Stainless steel	A2-70 EN 24014	A320	A2-70
3	O-ring	Chloroprene			
4	Bonnet	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
5	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
6	Seat	High density polymer			

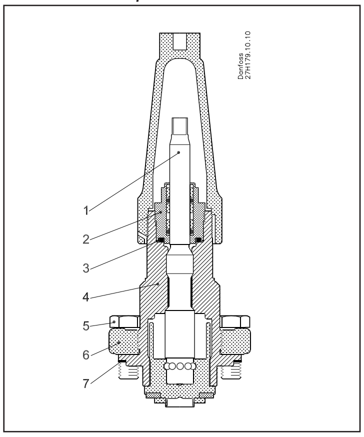
ICFB 20 blank top cover



Pos.	Part	Material	EN	ASTM	JIS
1	Hex-head bolt M10 × 25	Stainless Steel	A2-70 EN 24017	A320	A2-70
2	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
3	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			

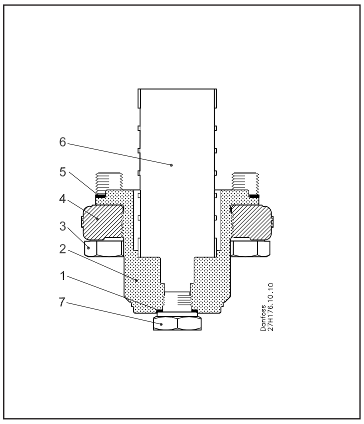
Material specification
(continued)

ICFS 25-40 stop valve module



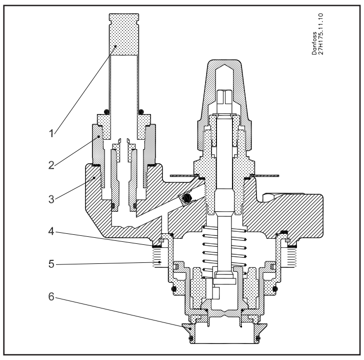
Pos.	Part	Material	EN	ASTM	JIS
1	Spindle	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
2	Thread part	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
3	O-ring	Chloroprene			
4	Bonnet	Steel	S235JRG2 EN 10025	A283	G3101
5	Hex-head bolt M12 × 30	Stainless steel	A2-70 EN 24017	A320	A2-70
6	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
7	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			

ICFF 25-40 filter module



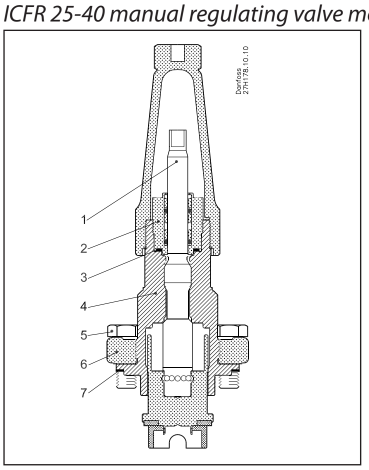
Pos.	Part	Material	EN	ASTM	JIS
1	Al. Gasket	AL 99 F11			
2	Bonnet	Steel	S235JRG2 EN 10025	A283	G3101
3	Hex-head bolt M12 × 30	Stainless steel	A2-70 EN 24017	A320	A2-70
4	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
5	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
6	Filter element	Steel 150μ + 50μ			
7	Plug 1/4" RG for butt-weld 3/8" NPT for socket weld	Stainless steel	A2-70 EN 24017	A320	A2-70

ICFE 25-40 solenoid valve module



Pos.	Part	Material	EN	ASTM	JIS
1	Armature tube	Stainless steel	X2CrNi19-11 EN 10088		
2	Armature tube nut	Stainless steel	X8CrNiS18-9 EN 10088		
3	Bonnet	Cast steel low temperature	G20Mn5QT EN10213-3	A352	G5152
4	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
5	Hex-Head bolt M10 × 25	Stainless steel	A2-70 EN 24017	A320	A2-70
6	Seat	High density polymer			

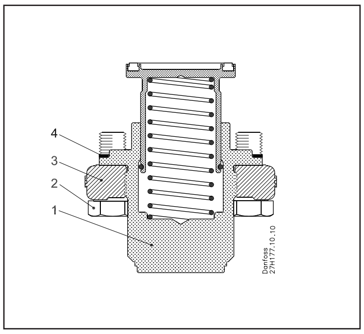
ICFR 25-40 manual regulating valve module



Pos.	Part	Material	EN	ASTM	JIS
1	Spindle	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
2	Thread part	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
3	O-ring	Chloroprene			
4	Bonnet	Steel	S235JRG2 EN 10025	A283	G3101
5	Hex-head bolt M12 × 30	Stainless steel	A2-70 EN 24017	A320	A2-70
6	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
7	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
8	Seat	High density polymer			

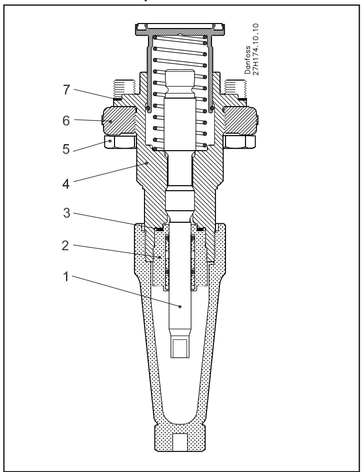
Material specification *(continued)*

ICFC 25-40 check valve module



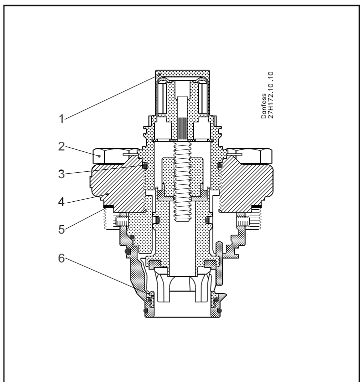
Pos.	Part	Material	EN	ASTM	JIS
1	Bonnet	Steel	S235JRG2	A283	G3101
2	Hex-head bolt M12 × 30	Stainless steel	A2-70 EN 24017	A320	A2-70
3	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	AG5152
4	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			

ICFN 25-40 stop/check valve module



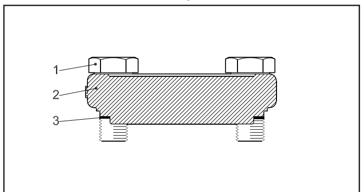
Pos.	Part	Material	EN	ASTM	JIS
1	Spindle	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
2	Thread part	Stainless steel	X8CrNiS 18-9 EN 10088		G4303 G4304
3	O-ring	Chloroprene			
4	Bonnet	Steel	S235JRG2 EN 10025	A283	G3101
5	Hex-head bolt M12 × 30	Stainless steel	A2-70 EN 24017	A320	A2-70
6	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
7	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			

ICM 25-A or B motor valve module



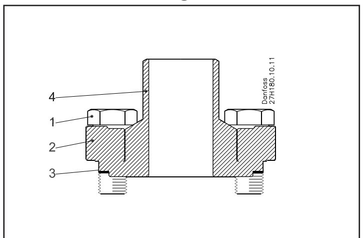
Pos.	Part	Material	EN	ASTM	JIS
1	Adapter	Stainless steel	X5CrNi18-10 EN 10088	A240	G4303 G4304
2	Hex-head bolt M12 × 30	Stainless steel	A2-70 EN 24014	A320	A2-70
3	O-ring	Chloroprene			
4	Bonnet	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
5	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
6	Seat	High density polymer			

ICFB 25-40 blank top cover



Pos.	Part	Material	EN	ASTM	JIS
1	Hex-head bolt M10 × 25	Stainless Steel	A2-70 EN 24017	A320	A2-70
2	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
3	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			

ICFW 25-40 welding module, 25 DIN



Pos.	Part	Material	EN	ASTM	JIS
1	Hex-head bolt M10 × 25	Stainless Steel	A2-70 EN 24017	A320	A2-70
2	Flange	Cast steel low temperature	G20Mn5QT EN 10213-3	A352	G5152
3	Gasket	Chloroprene (Neoprene)/ Fiber non asbestos			
4	Weld connection	Steel	S235JRG2 EN 10025	A283	G3101

Code number selection

To determine the correct ICF solution follow steps 1 through 5.

Step 1 **Determine application and function requirements:**
- Line: Liquid DX, flooded or hot gas
- Control: On/off solenoid valve, motorised valve
- Defrost: Electric or hot gas

From the above determine the application reference number (see pages 14, 15, 16 and 17):

Step 2 **Selection criteria**
- Refrigerant
- Capacity
- Temperature
- Circulation rate

From the above determine the solution required, e.g.: ICF 20 complete with ICM 20-C

Step 3 **Establish connection sizes and type**
- DIN butt-weld, ANSI butt-weld or SOC weld
- 20 (¾ in.), 25 (1 in.), 32 (1 ¼ in.) or 40 (1 ½ in.)

Step 4 **Establish number of side ports:**
- ICF 20-4, 25-4, 32-4, 40-4: 0, 2 or 4 side ports
- ICF 20-6, 25-6, 32-6, 40-6: 0, 4 or 6 side ports

Step 5 **Establish code number**
(See pages 22, 23, 24 and 25)

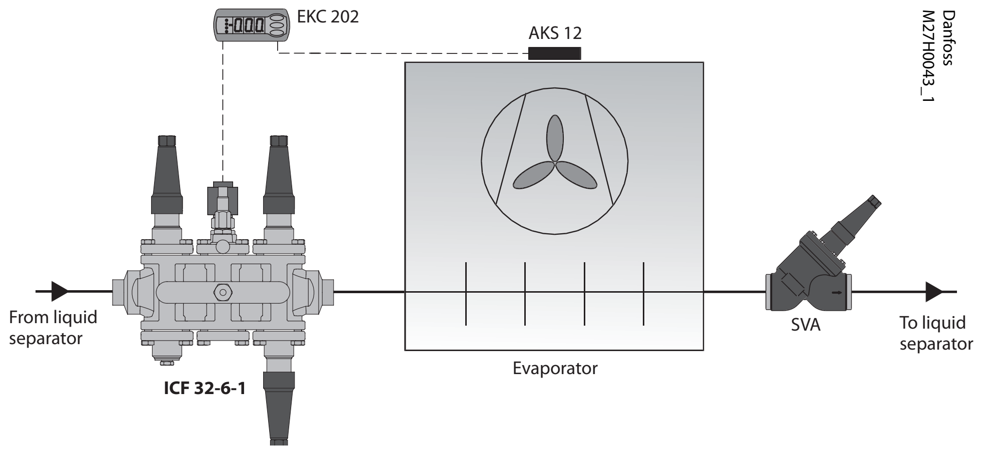
Application example A

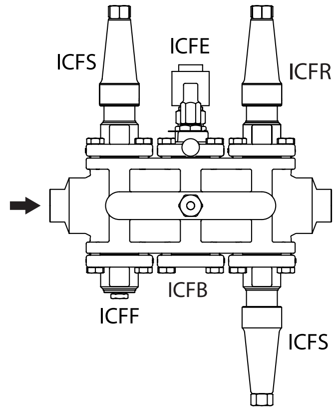
A valve combination for a flooded evaporator operating on/off from a thermostat and with electric defrost is required. Manual override of the solenoid valve is requested. Pipe dimension is 32 mm, and there is a demand for butt weld DIN connections.

There are no requirements for any sight glass or side connections for drain or pressure gauges.

For this application **ICF 32-6-1A**, code number **027L4004** is recommended.

Example A





ICF32-6-1A
027L4004

Application example B

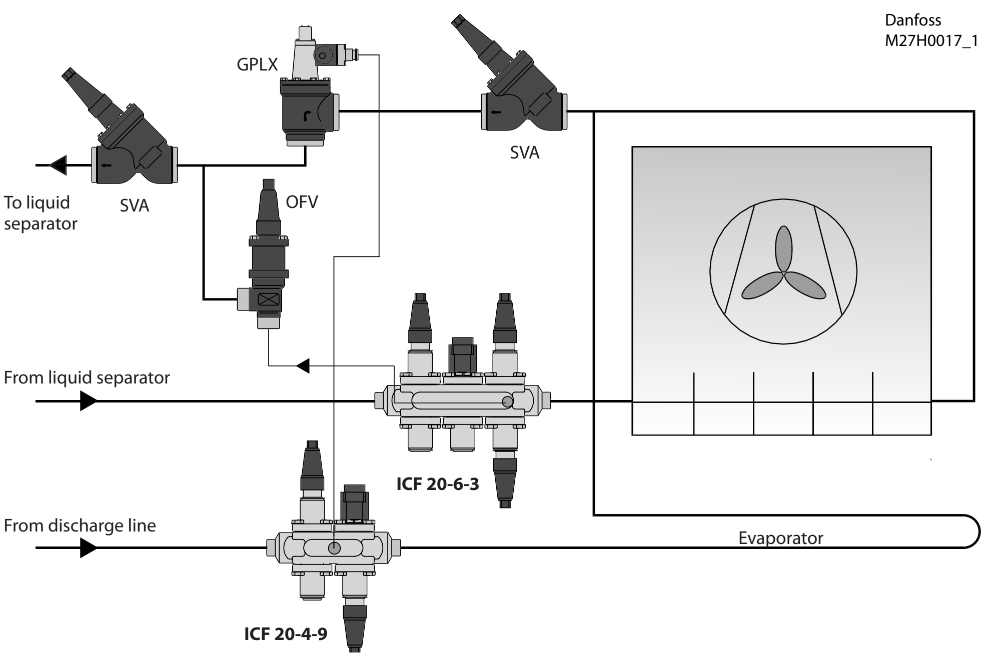
A valve combination for a flooded evaporator operating on/off from a thermostat and with hot gas defrost is required. Pipe dimension is 25 mm, and there is a demand for butt weld DIN connections. It is a request to have 4 sideports for external connectors.

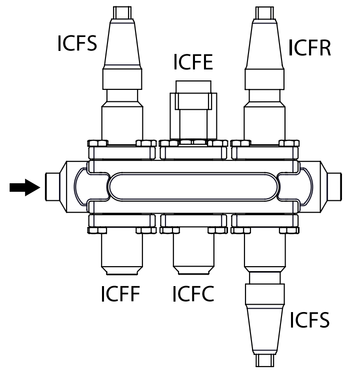
For this application **ICF 20-6-3**, code number **027L3020** is recommended.

On the same evaporator a hot gas valve to inject the gas into is needed. Pipe dimension is 32 mm, and there is a demand for butt weld DIN connections. It is a request to have 2 sideports for external connectors.

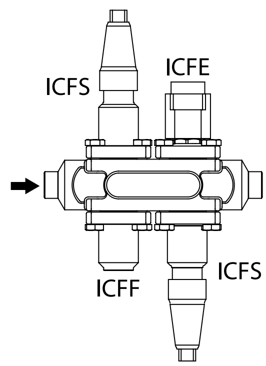
For this application **ICF 20-4-9**, code number **027L3068** is recommended.

Example B





ICF 20-6-3
027L3020



ICF 20-4-9
027L3068

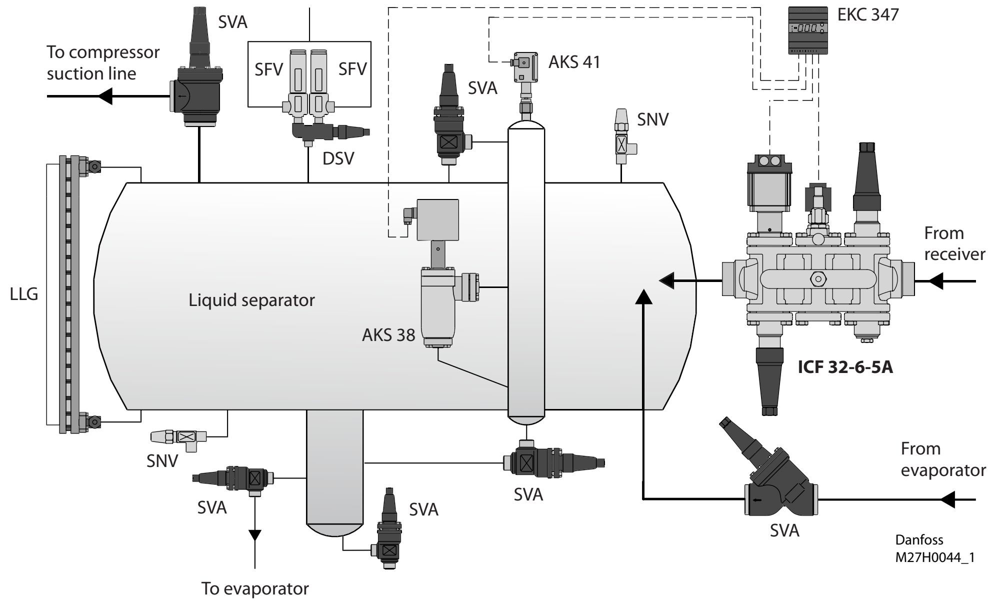
Application example C

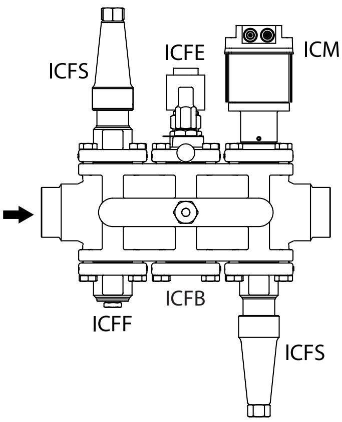
A valve combination for liquid injection to separator with electronic injection valve is required. It is requested to have a solenoid valve in front of the control valve. Pipe dimension is 32 mm, and there is a demand for socket weld connections.

There are requirements for sight glass or side connections for drain or pressure gauges.

For this application **ICF 32-6-5A**, code number **027L4044** is recommended.

Example C





ICF 32-6-5A
027L4044

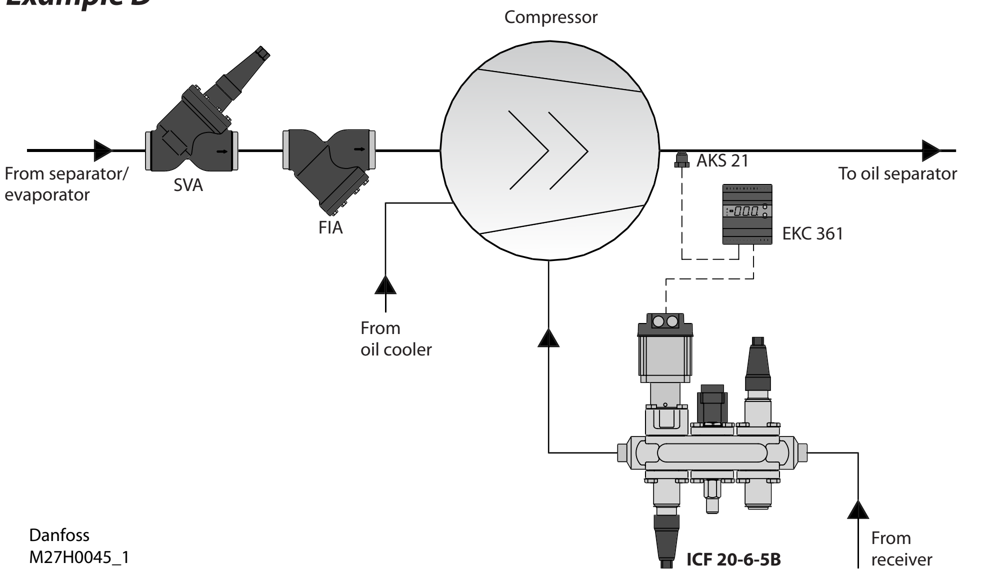
Application example D

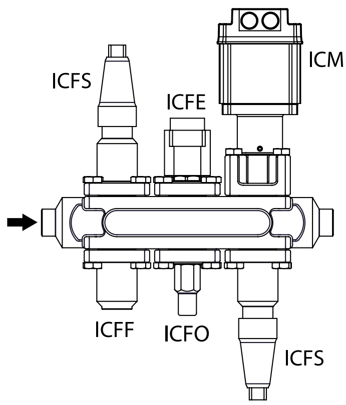
A valve combination for compressor liquid injection with electronic injection valve is required. It is a required to have a solenoid valve in front of the control valve. Pipe dimension is 25 mm, and there is a demand for socket weld connections.

There are no requirements for sight glass or side connections for drain or pressure gauges.

For this application **ICF 20-6-5B**, code number **027L3044** is recommended.

Example D



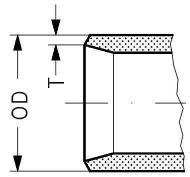


ICF 20-6-5B
027L3044

Control solutions

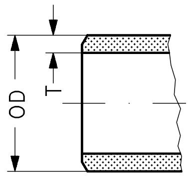
Connections

D: *Butt-weld DIN (EN 10220)*



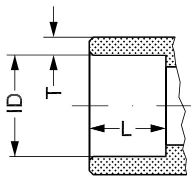
Size mm	Size in.	OD mm	T mm	OD in.	T in.		
20	($^3/_4$)	26.9	2.3	1.059	0.091		
25	(1)	33.7	2.6	1.327	0.103		
32	($1^1/_4$)	42.4	2.6	1.669	0.102		
40	($1^1/_2$)	98.3	2.6	1.902	0.103		

A: *Butt-weld ANSI (B 36.10)*



Size mm	Size in.	OD mm	T mm	OD in.	T in.	Schedule	
(20)	$^3/_4$	26.9	4.0	1.059	0.158	80	
(25)	1	33.7	4.6	1.327	0.181	80	
(32)	$1^1/_4$	42.4	4.9	1.669	0.193	80	
(40)	$1^1/_2$	98.3	5.1	1.902	0.201	80	

SOC:
Socket welding ANSI (B 16.11)



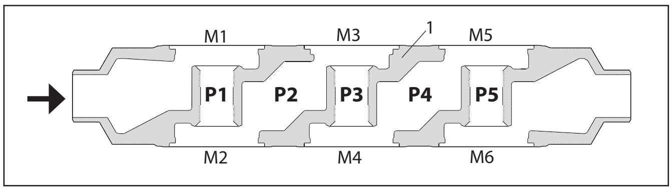
Size mm	Size in.	ID mm	T mm	ID in.	T in.	L mm	L in.
(20)	$^3/_4$	27.2	4.6	1.071	0.181	13	0.51
(25)	1	33.9	7.2	1.335	0.284	13	0.51
(32)	$1^1/_4$	42.7	6.1	1.743	0.240	13	0.51
(40)	$1^1/_2$	98.8	6.6	1.921	0.260	13	0.51

Ordering ICF 20 with six function modules
The code numbers refer to one complete assembled control solution.

ICF 20-6

Nomenclature: **ICF 20 - 6 - 4 - H**

- H: Capacity
- 4: Application reference number (see the below overview)
- 6: Number of module ports
- 20: Housing size
- ICF: Type



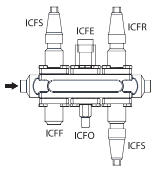
Application overview

Application #	FUNCTION MODULE LOCATION M1	M2	M3	M4	M5	M6
1	ICFS	ICFF	ICFE	ICFO	ICFR	ICFS
1H	ICFS	ICFF	ICFE20H	ICFB	ICFR	ICFS
2	ICFS	ICFF	ICFE	ICFO	ICFR	ICFN
2H	ICFS	ICFF	ICFE20H	ICFB	ICFR	ICFN
3	ICFS	ICFF	ICFE	ICFC	ICFR	ICFS
3H	ICFS	ICFF	ICFE20H	ICFC	ICFR	ICFS
4	ICFS	ICFF	ICFE	ICFO	ICFB	ICFS

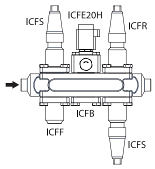
Application #	FUNCTION MODULE LOCATION M1	M2	M3	M4	M5	M6
5A	ICFS	ICFF	ICFE	ICFO	ICM20A	ICFS
5AH	ICFS	ICFF	ICFE20H	ICFB	ICM20A	ICFS
5B	ICFS	ICFF	ICFE	ICFO	ICM20B	ICFS
5BH	ICFS	ICFF	ICFE20H	ICFB	ICM20B	ICFS
5C	ICFS	ICFF	ICFE	ICFO	ICM20C	ICFS
5CH	ICFS	ICFF	ICFE20H	ICFB	ICM20C	ICFS
6	ICFS	ICFF	ICFE	ICFO	ICFA	ICFS
7	ICFS	ICFF	ICFA	ICFC	ICFB	ICFS

ICF 20-6-1 and ICF 20-6-1H

Connection	Side ports [#]	ICF 20-6-1 Application #1	ICF 20-6-1H Application #1H
20 D ($^{3}/_{4}$ in.)	4	**027L3000**	
25 D (1 in.)	None	**027L3001**	**027L3301**
	4	**027L3002**	**027L3302**
32 D ($1^{1}/_{4}$ in.)	4	**027L3003**	**027L3303**
20 A ($^{3}/_{4}$ in.)	4	**027L3004**	
20 SOC ($^{3}/_{4}$ in.)	6	**027L3005**	
	None	**027L3125**	
25 SOC (1 in.)	None	**027L3006**	**027L3304**
	6	**027L3007**	**027L3305**
32 SOC ($1^{1}/_{4}$ in.)	6	**027L3008**	**027L3306**
	None	**027L3128**	**027L3307**



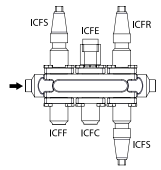
ICF 20-6-1



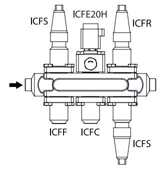
ICF 20-6-1H

ICF 20-6-3 and ICF 20-6-3H

Connection	Side ports [#]	ICF 20-6-3 Application #3	ICF 20-6-3H Application #3H
20 D ($^{3}/_{4}$ in.)	4	**027L3018**	
25 D (1 in.)	None	**027L3019**	**027L3315**
	4	**027L3020**	**027L3316**
32 D ($1^{1}/_{4}$ in.)	4	**027L3021**	**027L3317**
20 A ($^{3}/_{4}$ in.)	4	**027L3022**	
20 SOC ($^{3}/_{4}$ in.)	6	**027L3023**	
	None		
25 SOC (1 in.)	None	**027L3024**	**027L3318**
	6	**027L3025**	**027L3319**
32 SOC ($1^{1}/_{4}$ in.)	6	**027L3026**	**027L3320**
	None		



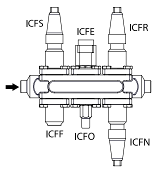
ICF 20-6-3



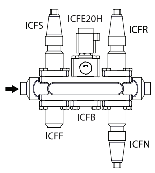
ICF 20-6-3H

ICF 20-6-2 and ICF 20-6-2H

Connection	Side ports [#]	ICF 20-6-2 Application #2	ICF 20-6-2H Application #2H
20 D ($^{3}/_{4}$ in.)	4	**027L3009**	
25 D (1 in.)	None	**027L3010**	**027L3308**
	4	**027L3011**	**027L3309**
32 D ($1^{1}/_{4}$ in.)	4	**027L3012**	**027L3310**
20 A ($^{3}/_{4}$ in.)	4	**027L3013**	
20 SOC ($^{3}/_{4}$ in.)	6	**027L3014**	
	None	**027L3126**	
25 SOC (1 in.)	None	**027L3015**	**027L3311**
	6	**027L3016**	**027L3312**
32 SOC ($1^{1}/_{4}$ in.)	6	**027L3017**	**027L3313**
	None	**027L3129**	**027L3314**



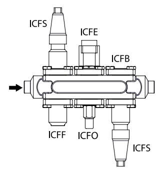
ICF 20-6-2



ICF 20-6-2H

ICF 20-6-4

Connection	Side ports [#]	ICF 20-6-4 Application #4
20 D ($^{3}/_{4}$ in.)	4	
25 D (1 in.)	None	**027L3027**
	4	**027L3028**
32 D ($1^{1}/_{4}$ in.)	4	**027L3029**
20 A ($^{3}/_{4}$ in.)	4	**027L3030**
20 SOC ($^{3}/_{4}$ in.)	6	**027L3124**
	None	
25 SOC (1 in.)	None	**027L3031**
	6	**027L3032**
32 SOC ($1^{1}/_{4}$ in.)	6	**027L3033**
	None	



ICF 20-6-4

ICAD and coils are not included and must be ordered separately. Please refer to the section "Ordering accessories".

D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

▭ Not available

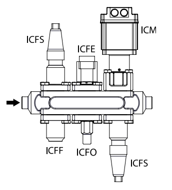
* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10.
Six side ports include six blind plugs. Side ports in P2/P7, P4/P9 and P5/P10.
Side ports are $^{3}/_{8}$" G for butt weld connection or $^{3}/_{8}$" NPT for socket weld connection.

Ordering ICF 20 with six function modules *(continued)*
The code numbers refer to one complete assembled control solution.

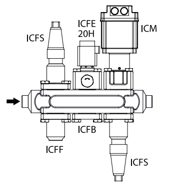
ICF 20-6

ICF 20-6-5A and ICF 20-6-5AH

Connection	Side ports [#]	ICF 20-6-5A Application #5A		ICF 20-6-5AH Application #5AH	
			For CO_2		For CO_2
20 D ($^{3}/_{4}$ in.)	4	027L3034	027L3500		
25 D (1 in.)	None	027L3035	027L3501	027L3321	027L3539
	4	027L3036	027L3502	027L3322	027L3540
32 D (1$^{1}/_{4}$ in.)	4				
20 A ($^{3}/_{4}$ in.)	4	027L3037	027L3503		
20 SOC ($^{3}/_{4}$ in.)	6	027L3038	027L3504		
	None				
25 SOC (1 in.)	None	027L3039	027L3505		
	6	027L3040	027L3506	027L3323	027L3541
32 SOC (1$^{1}/_{4}$ in.)	6				
	None				



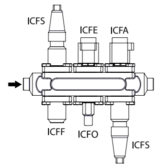
ICF 20-6-5A



ICF 20-6-5AH

ICF 20-6-6

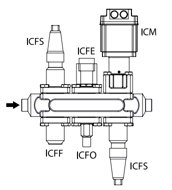
Connection	Side ports [#]	ICF 20-6-6 Application #6
20 D ($^{3}/_{4}$ in.)	4	027L3053
25 D (1 in.)	None	
	4	
32 D (1$^{1}/_{4}$ in.)	4	
20 A ($^{3}/_{4}$ in.)	4	027L3054
20 SOC ($^{3}/_{4}$ in.)	6	027L3055
	None	
25 SOC (1 in.)	None	
	6	
32 SOC (1$^{1}/_{4}$ in.)	6	
	None	



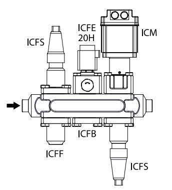
ICF 20-6-6

ICF 20-6-5B and ICF 20-6-5BH

Connection	Side ports [#]	ICF 20-6-5B Application #5B		ICF 20-6-5BH Application #5BH	
			For CO_2		For CO_2
20 D ($^{3}/_{4}$ in.)	4				
25 D (1 in.)	None	027L3041	027L3507	027L3324	027L3542
	4	027L3042	027L3508	027L3325	027L3543
32 D (1$^{1}/_{4}$ in.)	4				
20 A ($^{3}/_{4}$ in.)	4	027L3043	027L3509		
20 SOC ($^{3}/_{4}$ in.)	6	027L3127	027L3538		
	None				
25 SOC (1 in.)	None	027L3044	027L3510		
	6	027L3045	027L3511	027L3326	027L3544
32 SOC (1$^{1}/_{4}$ in.)	6				
	None				



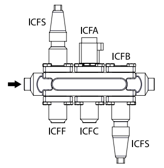
ICF 20-6-5B



ICF 20-6-5BH

ICF 20-6-7

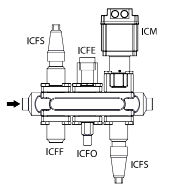
Connection	Side ports [#]	ICF 20-6-7 Application #7
20 D ($^{3}/_{4}$ in.)	4	027L3056
25 D (1 in.)	None	
	4	
32 D (1$^{1}/_{4}$ in.)	4	
20 A ($^{3}/_{4}$ in.)	4	027L3057
20 SOC ($^{3}/_{4}$ in.)	6	027L3058
	None	
25 SOC (1 in.)	None	
	6	
32 SOC (1$^{1}/_{4}$ in.)	6	
	None	



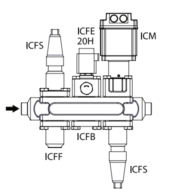
ICF 20-6-7

ICF 20-6-5C and ICF 20-6-5CH

Connection	Side ports [#]	ICF 20-6-5C Application #5C		ICF 20-6-5CH Application #5CH	
			For CO_2		For CO_2
20 D ($^{3}/_{4}$ in.)	4				
25 D (1 in.)	None	027L3046	027L3512	027L3327	027L3545
	4	027L3047	027L3513	027L3328	027L3546
32 D (1$^{1}/_{4}$ in.)	4	027L3048	027L3514	027L3329	027L3547
20 A ($^{3}/_{4}$ in.)	4	027L3049	027L3515		
20 SOC ($^{3}/_{4}$ in.)	6				
	None				
25 SOC (1 in.)	None	027L3050	027L3516		
	6	027L3051	027L3517	027L3330	027L3548
32 SOC (1$^{1}/_{4}$ in.)	6	027L3052	027L3518	027L3331	027L3549
	None				



ICF 20-6-5C



ICF 20-6-5CH

* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10.
Six side ports include six blind plugs. Side ports in P2/P7, P4/P9 and P5/P10.
Side ports are $^{3}/_{8}$" G for butt weld connection or $^{3}/_{8}$" NPT for socket weld connection.

Please Note:
When used in CO_2, the o-rings on the ICM module can swell (grow).
At service, it is recommended to install new o-rings, before the ICM function module is re-installed in the ICF valve body.

ICAD and coils are not included and must be ordered separately. Please refer to the section "Ordering accessories".

D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

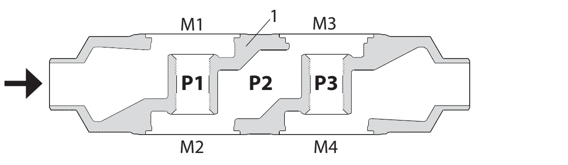
(grey box) Not available

Ordering ICF 20 with four function modules
The code numbers refer to one complete assembled control solution.

ICF 20-4

Nomenclature: **ICF 20 - 4 - 9 - H**

- H: Capacity
- 9: Application reference number (see the below overview)
- 4: Number of module ports
- 20: Housing size
- ICF: Type



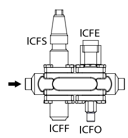
Application overview

Application #	FUNCTION MODULE LOCATION			
	M1	M2	M3	M4
8	ICFS	ICFF	ICFE	ICFO
9	ICFS	ICFF	ICFE	ICFS
9H	ICFS	ICFF	ICFE20H	ICFS
10	ICFS	ICFF	ICFE	ICFR
10H	ICFS	ICFF	ICFE20H	ICFR
11	ICFS	ICFF	ICFE	ICFC

Application #	FUNCTION MODULE LOCATION			
	M1	M2	M3	M4
11H	ICFS	ICFF	ICFE20H	ICFC
12	ICFS	ICFF	ICFA	ICFS
13	ICFS	ICFF	ICFA	ICFN
14A	ICFS	ICFF	ICM20A	ICFS
14B	ICFS	ICFF	ICM20B	ICFS
14C	ICFS	ICFF	ICM20C	ICFS

ICF 20-4-8

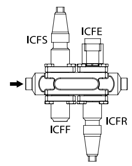
Connection	Side ports [#]	ICF 20-4-8 Application #8
20 D (3/4 in.)	2	
25 D (1 in.)	None	**027L3059**
	2	**027L3060**
32 D (1 1/4 in.)	2	**027L3061**
20 A (3/4 in.)	2	**027L3062**
20 SOC (3/4 in.)	4	
25 SOC (1 in.)	None	**027L3063**
	4	**027L3064**
32 SOC (1 1/4 in.)	4	**027L3065**



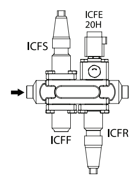
ICF 20-4-8

ICF 20-4-10 and ICF 20-4-10H

Connection	Side ports [#]	ICF 20-4-10 Application #10	ICF 20-4-10H Application #10H
20 D (3/4 in.)	2	**027L3073**	
25 D (1 in.)	None	**027L3074**	**027L3338**
	4	**027L3075**	**027L3339**
32 D (1 1/4 in.)	4	**027L3076**	**027L3340**
20 A (3/4 in.)	2	**027L3077**	
20 SOC (3/4 in.)	4	**027L3078**	
25 SOC (1 in.)	None	**027L3079**	**027L3341**
	4	**027L3080**	**027L3342**
32 SOC (1 1/4 in.)	4	**027L3081**	**027L3343**



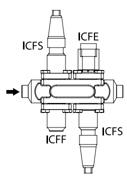
ICF 20-4-10



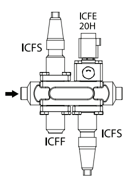
ICF 20-4-10H

ICF 20-4-9 and ICF 20-4-9H

Connection	Side ports [#]	ICF 20-4-9 Application #9	ICF 20-4-9H Application #9H
20 D (3/4 in.)	2		
25 D (1 in.)	None	**027L3066**	**027L3332**
	2	**027L3067**	**027L3333**
32 D (1 1/4 in.)	2	**027L3068**	**027L3334**
20 A (3/4 in.)	2	**027L3069**	
20 SOC (3/4 in.)	4		
25 SOC (1 in.)	None	**027L3070**	**027L3335**
	4	**027L3071**	**027L3336**
32 SOC (1 1/4 in.)	4	**027L3072**	**027L3337**



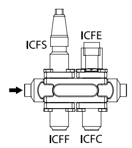
ICF 20-4-9



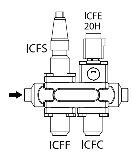
ICF 20-4-9H

ICF 20-4-11 and ICF 20-4-11H

Connection	Side ports [#]	ICF 20-4-11 Application #11	ICF 20-4-11H Application #11H
20 D (3/4 in.)	2		
25 D (1 in.)	None	**027L3082**	**027L3344**
	2	**027L3083**	**027L3345**
32 D (1 1/4 in.)	2	**027L3084**	**027L3346**
20 A (3/4 in.)	2	**027L3085**	
20 SOC (3/4 in.)	4		
25 SOC (1 in.)	None	**027L3086**	**027L3347**
	4	**027L3087**	**027L3348**
32 SOC (1 1/4 in.)	4	**027L3088**	**027L3349**



ICF 20-4-11



ICF 20-4-11H

ICAD and coils are not included and must be ordered separately. Please refer to the section "Ordering accessories".

D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

(grey box) Not available

* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10.
Side ports are 3/8" G for butt weld connection or 3/8" NPT for socket weld connection.

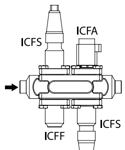
Control solutions

Ordering ICF 20 with four function modules *(continued)*
The code numbers refer to one complete assembled control solution.

ICF 20-4

ICF 20-4-12

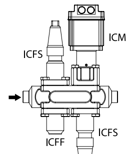
Connection	Side ports [#]	ICF 20-4-12 Application #12
20 D ($^3/_4$ in.)	2	**027L3089**
25 D (1 in.)	None	
25 D (1 in.)	2	
32 D (1$^1/_4$ in.)	2	
20 A ($^3/_4$ in.)	2	**027L3090**
20 SOC ($^3/_4$ in.)	4	**027L3091**
25 SOC (1 in.)	None	
25 SOC (1 in.)	4	
32 SOC (1$^1/_4$ in.)	4	



ICF 20-4-12

ICF 20-4-14B

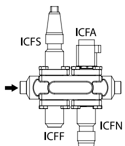
Connection	Side ports [#]	ICF 20-4-14B Application #14B	For CO_2
20 D ($^3/_4$ in.)	2		
25 D (1 in.)	None	**027L3102**	**027L3526**
25 D (1 in.)	2	**027L3103**	**027L3527**
32 D (1$^1/_4$ in.)	2		
20 A ($^3/_4$ in.)	2	**027L3104**	**027L3528**
20 SOC ($^3/_4$ in.)	4		
25 SOC (1 in.)	None	**027L3105**	**027L3529**
25 SOC (1 in.)	4	**027L3106**	**027L3530**
32 SOC (1$^1/_4$ in.)	4		



ICF 20-4-14B

ICF 20-4-13

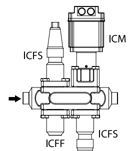
Connection	Side ports [#]	ICF 20-4-13 Application #13
20 D ($^3/_4$ in.)	2	**027L3092**
25 D (1 in.)	None	
25 D (1 in.)	2	
32 D (1$^1/_4$ in.)	2	
20 A ($^3/_4$ in.)	2	**027L3093**
20 SOC ($^3/_4$ in.)	4	**027L3094**
25 SOC (1 in.)	None	
25 SOC (1 in.)	4	
32 SOC (1$^1/_4$ in.)	4	



ICF 20-4-13

ICF 20-4-14C

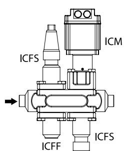
Connection	Side ports [#]	ICF 20-4-14C Application #14C	For CO_2
20 D ($^3/_4$ in.)	2		
25 D (1 in.)	None	**027L3107**	**027L3531**
25 D (1 in.)	2	**027L3108**	**027L3532**
32 D (1$^1/_4$ in.)	2	**027L3109**	**027L3533**
20 A ($^3/_4$ in.)	2	**027L3110**	**027L3534**
20 SOC ($^3/_4$ in.)	4		
25 SOC (1 in.)	None	**027L3111**	**027L3535**
25 SOC (1 in.)	4	**027L3112**	**027L3536**
32 SOC (1$^1/_4$ in.)	4	**027L3113**	**027L3537**



ICF 20-4-14C

ICF 20-4-14A

Connection	Side ports [#]	ICF 20-4-14A Application #14A	For CO_2
20 D ($^3/_4$ in.)	2	**027L3095**	**027L3519**
25 D (1 in.)	None	**027L3096**	**027L3520**
25 D (1 in.)	2	**027L3097**	**027L3521**
32 D (1$^1/_4$ in.)	2		
20 A ($^3/_4$ in.)	2	**027L3098**	**027L3522**
20 SOC ($^3/_4$ in.)	4	**027L3099**	**027L3523**
25 SOC (1 in.)	None	**027L3100**	**027L3524**
25 SOC (1 in.)	4	**027L3101**	**027L3525**
32 SOC (1$^1/_4$ in.)	4		



ICF 20-4-14A

Please Note:
When used in CO_2, the o-rings on the ICM module can swell (grow).
At service, it is recommended to install new o-rings, before the ICM function module is re-installed in the ICF valve body.

ICAD and coils are not included and must be ordered separately. Please refer to the section "Ordering accessories".

D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

(grey box) Not available

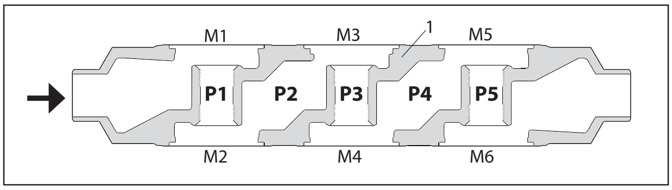
* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10. Side ports are $^3/_8$" G for butt weld connection or $^3/_8$" NPT for socket weld connection.

Ordering ICF 25-40 with six function modules
The code numbers refer to one complete assembled control solution.

ICF 25-6 → 40-6

Nomenclature: **ICF 25 - 6 - 3**

- Application reference number
  See the below overview
- Number of module ports
- Housing size
- Type

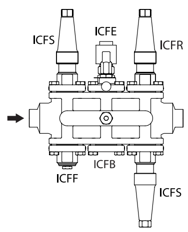


Application overview

Application #	FUNCTION MODULE LOCATION					
	M1	M2	M3	M4	M5	M6
1A	ICFS	ICFF	ICFE	ICFB	ICFRA	ICFS
1B	ICFS	ICFF	ICFE	ICFB	ICFRB	ICFS
3A	ICFS	ICFF	ICFE	ICFC	ICFRA	ICFS
3B	ICFS	ICFF	ICFE	ICFC	ICFRB	ICFS

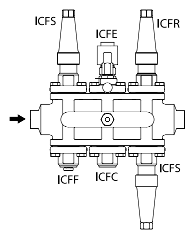
Application #	FUNCTION MODULE LOCATION					
	M1	M2	M3	M4	M5	M6
5A	ICFS	ICFF	ICFE	ICFB	ICM20A	ICFS
5B	ICFS	ICFF	ICFE	ICFB	ICM20B	ICFS
15A	ICFS	ICFF	ICFE	ICFC	ICFW	ICFRA
15B	ICFS	ICFF	ICFE	ICFC	ICFW	ICFRB

ICF 25-6-1A and ICF 32-6-1A		
Connection	**Side ports [#]**	**ICF 25-6-1A ICF 32-6-1A** Application #1A
25 D (1 in.)	None	**027L4000**
32 D (1 $^1/_4$ in.)	None	**027L4004**
25 D (1 in.)	4	**027L4002**
32 D (1 $^1/_4$ in.)	4	**027L4006**
25 SOC (1 in.)	None	**027L4001**
32 SOC (1 $^1/_4$ in.)	None	**027L4005**
25 SOC (1 in.)	6	**027L4003**
32 SOC (1 $^1/_4$ in.)	6	**027L4008**
32 A (1 $^1/_4$ in.)	4	**027L4007**



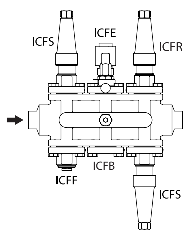
ICF 25-6-1A
ICF 32-6-1A

ICF 25-6-3A and ICF 32-6-3A		
Connection	**Side ports [#]**	**ICF 25-6-3A ICF 32-6-3A** Application #3A
25 D (1 in.)	None	**027L4018**
32 D (1 $^1/_4$ in.)	None	**027L4022**
25 D (1 in.)	4	**027L4020**
32 D (1 $^1/_4$ in.)	4	**027L4024**
25 SOC (1 in.)	None	**027L4019**
32 SOC (1 $^1/_4$ in.)	None	**027L4023**
25 SOC (1 in.)	6	**027L4021**
32 SOC (1 $^1/_4$ in.)	6	**027L4026**
32 A (1 $^1/_4$ in.)	4	**027L4025**



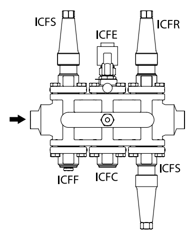
ICF 25-6-3A
ICF 32-6-3A

ICF 32-6-1B and ICF 40-6-1B		
Connection	**Side ports [#]**	**ICF 32-6-1B ICF 40-6-1B** Application #1B
32 D (1 $^1/_4$ in.)	None	**027L4009**
40 D (1 $^1/_2$ in.)	None	**027L4014**
32 D (1 $^1/_4$ in.)	4	**027L4011**
40 D (1 $^1/_2$ in.)	4	**027L4016**
32 SOC (1 $^1/_4$ in.)	None	**027L4010**
40 SOC (1 $^1/_2$ in.)	None	**027L4015**
32 SOC (1 $^1/_4$ in.)	6	**027L4013**
40 SOC (1 $^1/_2$ in.)	6	**027L4017**
32 A (1 $^1/_4$ in.)	4	**027L4012**



ICF 32-6-1B
ICF 40-6-1B

ICF 32-6-3B and ICF 40-6-3B		
Connection	**Side ports [#]**	**ICF 32-6-3B ICF 40-6-3B** Application #3B
32 D (1 $^1/_4$ in.)	None	**027L4027**
40 D (1 $^1/_2$ in.)	None	**027L4032**
32 D (1 $^1/_4$ in.)	4	**027L4029**
40 D (1 $^1/_2$ in.)	4	**027L4034**
32 SOC (1 $^1/_4$ in.)	None	**027L4028**
40 SOC (1 $^1/_2$ in.)	None	**027L4033**
32 SOC (1 $^1/_4$ in.)	6	**027L4031**
40 SOC (1 $^1/_2$ in.)	6	**027L4035**
32 A (1 $^1/_4$ in.)	4	**027L4030**



ICF 32-6-3B
ICF 40-6-3B

Please Note:
When used in CO_2, the o-rings on the ICM module/ICFE 25-40 solenoid module can swell (grow).
At service, it is recommended to install new o-rings, before the modules is re-installed in the ICF valve body.

ICAD and coils are not included and must be ordered separately. Please refer to the section “Ordering accessories”.

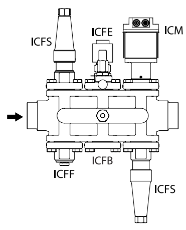
D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10.
Six side ports include six blind plugs. Side ports in P2/P7, P4/P9 and P5/P10.
Side ports are $^3/_8$“ G for butt weld connection or $^3/_8$” NPT for socket weld connection.

Ordering ICF 25-40 with six function modules *(continued)*
The code numbers refer to one complete assembled control solution.

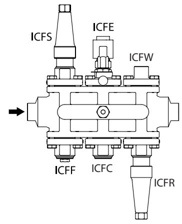
ICF 25-6 → 40-6

ICF 25-6-5A and ICF 32-6-5A			
Connection	**Side ports [#]**	**ICF 25-6-5A ICF 32-6-5A** Application #5A	
			For CO_2
25 D (1 in.)	None	**027L4036**	**027L4500**
32 D (1 1/4 in.)	None	**027L4040**	**027L4504**
25 D (1 in.)	4	**027L4038**	**027L4502**
32 D (1 1/4 in.)	4	**027L4042**	**027L4506**
25 SOC (1 in.)	None	**027L4037**	**027L4501**
32 SOC (1 1/4 in.)	None	**027L4041**	**027L4505**
25 SOC (1 in.)	6	**027L4039**	**027L4503**
32 SOC (1 1/4 in.)	6	**027L4044**	**027L4508**
32 A (1 1/4 in.)	4	**027L4043**	**027L4507**



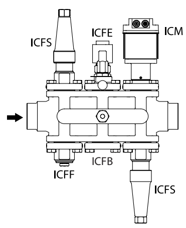
ICF 25-6-5A
ICF 32-6-5A

ICF 25-6-15A		
Connection	**Side ports [#]**	**ICF 25-6-15A** Application #15A
25 D (1 in.)	None	**027L4119**
32 D (1 1/4 in.)	None	
25 D (1 in.)	4	**027L4121**
32 D (1 1/4 in.)	4	
25 SOC (1 in.)	None	**027L4120**
32 SOC (1 1/4 in.)	None	
25 SOC (1 in.)	6	**027L4122**
32 SOC (1 1/4 in.)	6	
32 A (1 1/4 in.)	4	



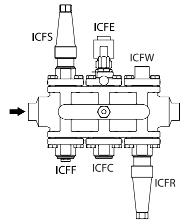
ICF 25-6-15A

ICF 32-6-5B and ICF 40-6-5B			
Connection	**Side ports [#]**	**ICF 32-6-5B ICF 40-6-5B** Application #5B	
			For CO_2
32 D (1 1/4 in.)	None	**027L4045**	**027L4509**
40 D (1 1/2 in.)	None	**027L4050**	**027L4514**
32 D (1 1/4 in.)	4	**027L4047**	**027L4511**
40 D (1 1/2 in.)	4	**027L4052**	**027L4516**
32 SOC (1 1/4 in.)	None	**027L4046**	**027L4510**
40 SOC (1 1/2 in.)	None	**027L4051**	**027L4515**
32 SOC (1 1/4 in.)	6	**027L4049**	**027L4513**
40 SOC (1 1/2 in.)	6	**027L4053**	**027L4517**
32 A (1 1/4 in.)	4	**027L4048**	**027L4512**



ICF 32-6-5B
ICF 40-6-5B

ICF 32-6-15B and ICF 40-6-15B		
Connection	**Side ports [#]**	**ICF 32-6-15B ICF 40-6-15B** Application #15B
32 D (1 1/4 in.)	None	**027L4123**
40 D (1 1/2 in.)	None	**027L4128**
32 D (1 1/4 in.)	4	**027L4126**
40 D (1 1/2 in.)	4	**027L4130**
32 SOC (1 1/4 in.)	None	**027L4124**
40 SOC (1 1/2 in.)	None	**027L4129**
32 SOC (1 1/4 in.)	6	**027L4127**
40 SOC (1 1/2 in.)	6	**027L4131**
32 A (1 1/4 in.)	4	**027L4125**



ICF 32-6-15B
ICF 40-6-15B

Please Note:
When used in CO_2, the o-rings on the ICM module/ICFE 25-40 solenoid module can swell (grow).
At service, it is recommended to install new o-rings, before the modules is re-installed in the ICF valve body.

ICAD and coils are not included and must be ordered separately. Please refer to the section "Ordering accessories".

D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

(grey box) Not available

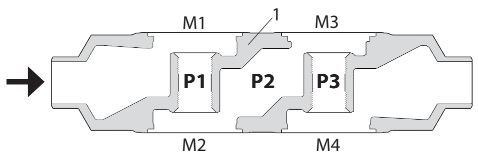
* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10.
Six side ports include six blind plugs. Side ports in P2/P7, P4/P9 and P5/P10.
Side ports are 3/8" G for butt weld connection or 3/8" NPT for socket weld connection.

Ordering ICF 25-40 with four function modules
The code numbers refer to one complete assembled control solution.

ICF 25-4 → ICF 40-4

Nomenclature: **ICF 25 - 4 - 9**

- 9: Application reference number. See the below overview
- 4: Number of module ports
- 25: Housing size
- ICF: Type



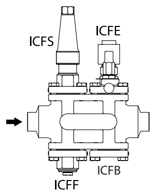
Application overview

Application #	FUNCTION MODULE LOCATION			
	M1	M2	M3	M4
8	ICFS	ICFF	ICFE	ICFB
9	ICFS	ICFF	ICFE	ICFS
10A	ICFS	ICFF	ICFE	ICFRA
10B	ICFS	ICFF	ICFE	ICFRB

Application #	FUNCTION MODULE LOCATION			
	M1	M2	M3	M4
11	ICFS	ICFF	ICFE	ICFC
14A	ICFS	ICFF	ICM25A	ICFS
14B	ICFS	ICFF	ICM25B	ICFS

ICF (25-40)-4-8

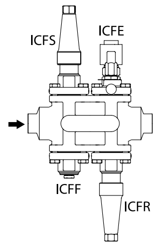
Connection	Side ports [#]	ICF 25-4-8 ICF 32-4-8 ICF 40-4-8 Appl. #8
25 D (1 in.)	None	**027L4054**
32 D (1 $^1/_4$ in.)	None	**027L4056**
40 D (1 $^1/_2$ in.)	None	**027L4059**
25 D (1 in.)	2	
32 D (1 $^1/_4$ in.)	2	
40 D (1 $^1/_2$ in.)	2	
25 SOC (1 in.)	None	**027L4055**
32 SOC (1 $^1/_4$ in.)	None	**027L4057**
40 SOC (1 $^1/_2$ in.)	None	**027L4060**
25 SOC (1 in.)	4	
32 SOC (1 $^1/_4$ in.)	4	
40 SOC (1 $^1/_2$ in.)	4	
32 A (1 $^1/_4$ in.)	None	**027L4058**
32 A (1 $^1/_4$ in.)	2	



ICF 25-4-8
ICF 32-4-8
ICF 40-4-8

ICF (25-40)-4-10A

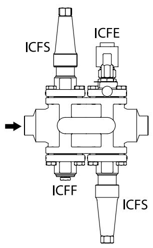
Connection	Side ports [#]	ICF 25-4-10A ICF 32-4-10A ICF 40-4-10A Appl. #10A
25 D (1 in.)	None	**027L4074**
32 D (1 $^1/_4$ in.)	None	**027L4078**
40 D (1 $^1/_2$ in.)	None	
25 D (1 in.)	2	**027L4076**
32 D (1 $^1/_4$ in.)	2	**027L4080**
40 D (1 $^1/_2$ in.)	2	
25 SOC (1 in.)	None	**027L4075**
32 SOC (1 $^1/_4$ in.)	None	**027L4079**
40 SOC (1 $^1/_2$ in.)	None	
25 SOC (1 in.)	4	**027L4077**
32 SOC (1 $^1/_4$ in.)	4	**027L4082**
40 SOC (1 $^1/_2$ in.)	4	
32 A (1 $^1/_4$ in.)	None	
32 A (1 $^1/_4$ in.)	2	**027L4081**



ICF 25-4-10A
ICF 32-4-10A
ICF 40-4-10A

ICF (25-40)-4-9

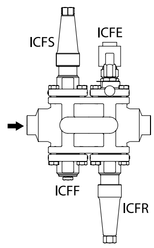
Connection	Side ports [#]	ICF 25-4-9 ICF 32-4-9 ICF 40-4-9 Appl. #9
25 D (1 in.)	None	**027L4061**
32 D (1 $^1/_4$ in.)	None	**027L4065**
40 D (1 $^1/_2$ in.)	None	**027L4070**
25 D (1 in.)	2	**027L4063**
32 D (1 $^1/_4$ in.)	2	**027L4067**
40 D (1 $^1/_2$ in.)	2	**027L4072**
25 SOC (1 in.)	None	**027L4062**
32 SOC (1 $^1/_4$ in.)	None	**027L4066**
40 SOC (1 $^1/_2$ in.)	None	**027L4071**
25 SOC (1 in.)	4	**027L4064**
32 SOC (1 $^1/_4$ in.)	4	**027L4069**
40 SOC (1 $^1/_2$ in.)	4	**027L4073**
32 A (1 $^1/_4$ in.)	None	
32 A (1 $^1/_4$ in.)	2	**027L4068**



ICF 25-4-9
ICF 32-4-9
ICF 40-4-9

ICF (25-40)-4-10B

Connection	Side ports [#]	ICF 25-4-10B ICF 32-4-10B ICF 40-4-10B Appl. #10B
25 D (1 in.)	None	
32 D (1 $^1/_4$ in.)	None	**027L4083**
40 D (1 $^1/_2$ in.)	None	**027L4088**
25 D (1 in.)	2	
32 D (1 $^1/_4$ in.)	2	**027L4085**
40 D (1 $^1/_2$ in.)	2	**027L4090**
25 SOC (1 in.)	None	
32 SOC (1 $^1/_4$ in.)	None	**027L4084**
40 SOC (1 $^1/_2$ in.)	None	**027L4089**
25 SOC (1 in.)	4	
32 SOC (1 $^1/_4$ in.)	4	**027L4087**
40 SOC (1 $^1/_2$ in.)	4	**027L4091**
32 A (1 $^1/_4$ in.)	None	
32 A (1 $^1/_4$ in.)	2	**027L4086**



ICF 25-4-10B
ICF 32-4-10B
ICF 40-4-10B

Please Note:
When used in CO_2, the o-rings on the ICM module/ICFE 25-40 solenoid module can swell (grow).
At service, it is recommended to install new o-rings, before the modules is re-installed in the ICF valve body.

ICAD and coils are not included and must be ordered separately. Please refer to the section "Ordering accessories".

D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

[ ] Not available

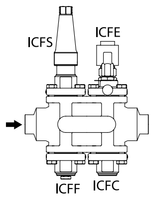
* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10. Side ports are $^3/_8$" G for butt weld connection or $^3/_8$" NPT for socket weld connection.

Ordering ICF 25-40 with four function modules *(continued)*

The code numbers refer to one complete assembled control solution.

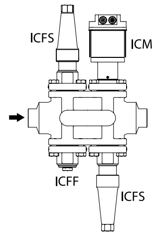
ICF 25-4 → ICF 40-4

ICF (25-40)-4-11		
Connection	**Side ports [#]**	**ICF 25-4-11 ICF 32-4-11 ICF 40-4-11** Appl. #11
25 D (1 in.)	None	
32 D (1 1/4 in.)	None	**027L4092**
40 D (1 1/2 in.)	None	**027L4097**
25 D (1 in.)	2	
32 D (1 1/4 in.)	2	**027L4094**
40 D (1 1/2 in.)	2	**027L4099**
25 SOC (1 in.)	None	
32 SOC (1 1/4 in.)	None	**027L4093**
40 SOC (1 1/2 in.)	None	**027L4098**
25 SOC (1 in.)	4	
32 SOC (1 1/4 in.)	4	**027L4096**
40 SOC (1 1/2 in.)	4	**027L4100**
32 A (1 1/4 in.)	None	
32 A (1 1/4 in.)	2	**027L4095**



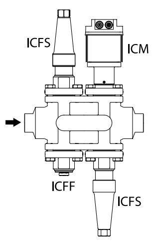
ICF 25-4-11
ICF 32-4-11
ICF 40-4-11

ICF (25-40)-4-14B			
Connection	**Side ports [#]**	**ICF 25-4-14B ICF 32-4-14B ICF 40-4-14B** Appl. #14B	
			For CO_2
25 D (1 in.)	None		
32 D (1 1/4 in.)	None	**027L4110**	**027L4527**
40 D (1 1/2 in.)	None	**027L4115**	**027L4532**
25 D (1 in.)	2		
32 D (1 1/4 in.)	2	**027L4112**	**027L4529**
40 D (1 1/2 in.)	2	**027L4117**	**027L4534**
25 SOC (1 in.)	None		
32 SOC (1 1/4 in.)	None	**027L4111**	**027L4528**
40 SOC (1 1/2 in.)	None	**027L4116**	**027L4533**
25 SOC (1 in.)	4		
32 SOC (1 1/4 in.)	4	**027L4114**	**027L4531**
40 SOC (1 1/2 in.)	4	**027L4118**	**027L4535**
32 A (1 1/4 in.)	None		
32 A (1 1/4 in.)	2	**027L4113**	**027L4530**



ICF 25-4-14B
ICF 32-4-14B
ICF 40-4-14B

ICF (25-40)-4-14A			
Connection	**Side ports [#]**	**ICF 25-4-14A ICF 32-4-14A ICF 40-4-14A** Appl. #14A	
			For CO_2
25 D (1 in.)	None	**027L4101**	**027L4518**
32 D (1 1/4 in.)	None	**027L4105**	**027L4522**
40 D (1 1/2 in.)	None		
25 D (1 in.)	2	**027L4103**	**027L4520**
32 D (1 1/4 in.)	2	**027L4107**	**027L4524**
40 D (1 1/2 in.)	2		
25 SOC (1 in.)	None	**027L4102**	**027L4519**
32 SOC (1 1/4 in.)	None	**027L4106**	**027L4523**
40 SOC (1 1/2 in.)	None		
25 SOC (1 in.)	4	**027L4104**	**027L4521**
32 SOC (1 1/4 in.)	4	**027L4109**	**027L4526**
40 SOC (1 1/2 in.)	4		
32 A (1 1/4 in.)	None		
32 A (1 1/4 in.)	2	**027L4108**	**027L4525**



ICF 25-4-14A
ICF 32-4-14A
ICF 40-4-14A

Please Note:
When used in CO_2, the o-rings on the ICM module/ICFE 25-40 solenoid module can swell (grow).
At service, it is recommended to install new o-rings, before the modules is re-installed in the ICF valve body.

ICAD and coils are not included and must be ordered separately. Please refer to the section “Ordering accessories”.

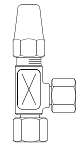
D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

(shaded) Not available

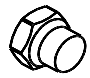
* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10.
Side ports are 3/8" G for butt weld connection or 3/8" NPT for socket weld connection.

Ordering accessories

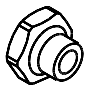
Stop valve type SNV-ST

	Quantity	Code no.
	1	**148B3778**

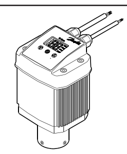
Sight glass

	Quantity	Code no.
	2 pcs. 3/8" RG	**027L1267**

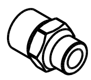
Blind plug

	Quantity	Code no.
	2 pcs. 3/8" RG 2 pcs. 3/8" NPT	**027L1265** **027L1268**

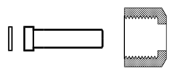
ICAD 600

	Quantity	Code no.
	1	**027H1200**

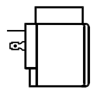
Connector 1/2 in. - 3/8 in.

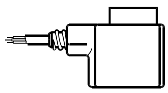
	Quantity	Code no.
	2	**027L1266**

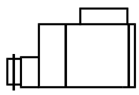
1/2 in. weld connector

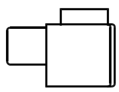
	Quantity	Code no.
	2	**148B4184**

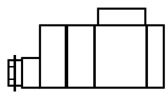
Coils





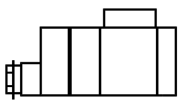






Valve type	Voltage V	Frequency Hz	Code no. With 1 m 3-core cable IP 67	Code no. With terminal box IP 67	Code no. With DIN plugs**)	Appendix no.*)	Power consumption
Alternating current a.c.							
ICFE	12	50	**018F6256**	**018F6706**		15	Holding: 10 W 21 VA Inrush: 44 VA
	24	50	**018F6257**	**018F6707**	**018F7358**	16	
	220-230	50	**018F6251**	**018F6701**	**018F7351**	31	
	115	60	**018F6260**	**018F6710**		20	
Direct current d.c. *(can not be used for ICF 20 configurations with ICM module)*							Coil type I
ICFE/ICFA	12			**018F6856**		01	20 W
	24			**018F6857**		02	

Special coils for ICFE *(can not be used for ICF 20 configurations with ICM module)*



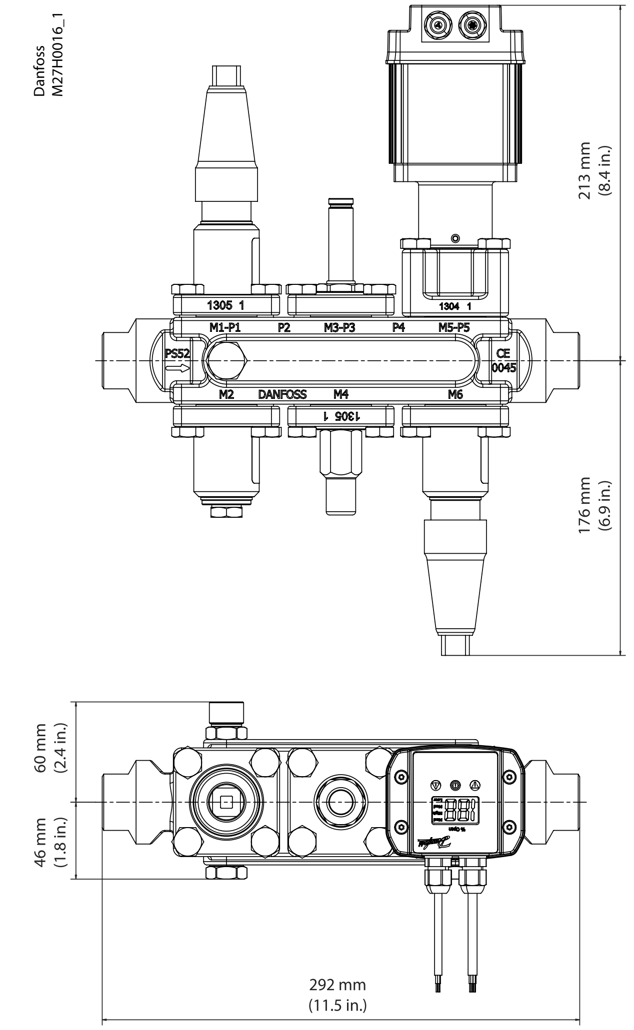
Valve type	Voltage V	Frequency Hz	Code no. With terminal box IP 67	Appendix no. Indicates voltage and frequency	Power consumption
Alternating current a.c.					
ICFE	24	50	**018F6807**	16	Holding: 12 W 26 VA Inrush: 55 VA
	110	50	**018F6811**	22	
	220-230	50	**018F6801**	31	

For other coil types please refer to the technical leaflets for EVRA or AKVA valves.

Dimensions and weight

ICF 20-6

This example indicates the maximum dimensions for the ICF control solutions.



Weight

Connection	Number of side ports*	ICF 20-6-1		ICF 20-6-2		ICF 20-6-3		ICF 20-6-4		ICF 20-6-5A**		ICF 20-6-5B**		ICF 20-6-5C**		ICF 20-6-6		ICF 20-6-7	
		kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs
20 D ($^3/_4$ in.)	4	8.7	19.3	8.8	19.3	8.9	19.6			9.9	21.8	9.9	21.8	9.9	21.8	8.2	18.1	8.3	18.3
25 D (1 in.)	None	8.7	19.3	8.8	19.3	8.9	19.6	8.2	18.03	9.9	21.8	9.9	21.8	9.9	21.8				
	4	8.7	19.3	8.8	19.3	8.9	19.6	8.2	18.03	9.9	21.8	9.9	21.8	9.9	21.8				
32 D ($1^1/_4$ in.)	4	8.7	19.3	8.8	19.3	8.9	19.6	8.2	18.03	10.1	22.3	10.1	22.3	10.1	22.3				
20 A ($^3/_4$ in.)	4	8.7	19.3	8.8	19.3	8.9	19.6	8.2	18.03	9.9	21.8	9.9	21.8	9.9	21.8	8.2	18.1	8.3	18.3
20 SOC ($^3/_4$ in.)	6	9.0	19.9	9.1	20.0	9.2	20.2			9.9	21.8	9.9	21.8	9.9	21.8	8.5	18.7	8.6	19.0
25 SOC (1 in.)	None	9.0	19.9	9.1	20.0	9.2	20.2	8.5	18.70	10.1	22.3	10.1	22.3	10.1	22.3				
	6	9.0	19.9	9.1	20.0	9.2	20.2	8.5	18.70	10.1	22.3	10.1	22.3	10.1	22.3				
32 SOC ($1^1/_4$ in.)	6	9.0	19.9	9.1	20.0	9.2	20.2	8.5	18.70	10.2	22.5	10.2	22.5	10.2	22.5				

D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

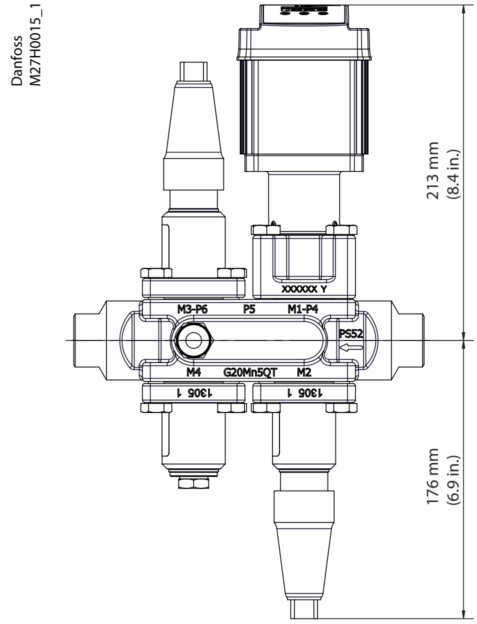
* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10.
Six side ports include six blind plugs. Side ports in P2/P7, P4/P9 and P5/P10.

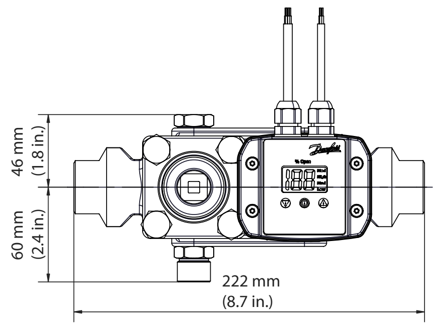
** Including ICAD 600 actuator

Dimensions and weight

ICF 20-4

This example indicates the maximum dimensions for the ICF control solutions.





Weight

Connection	Number of side ports*	ICF 20-4-8		ICF 20-4-9		ICF 20-4-10		ICF 20-4-11		ICF 20-4-12		ICF 20-4-13		ICF 20-4-14A**		ICF 20-4-14B**		ICF 20-4-14C**	
		kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs
20 D ($^3/_4$ in.)	2					5.9	12.9			5.9	12.9	5.9	12.9	6.4	14.2				
25 D (1 in.)	None	5.4	12	5.9	12.9	5.9	12.9	5.6	12.2					6.4	14.2	6.4	14.2	6.4	14.2
	2	5.4	12	5.9	12.9	5.9	12.9	5.6	12.2					6.4	14.2	6.4	14.2	6.4	14.2
32 D ($1^1/_4$ in.)	2	5.4	12	5.9	12.9	5.9	12.9	5.6	12.2									6.4	14.2
20 A ($^3/_4$ in.)	2	5.4	12	5.9	12.9	5.9	12.9	5.6	12.2	5.9	12.9	5.9	12.9	6.4	14.2	6.4	14.2	6.4	14.2
20 SOC ($^3/_4$ in.)	4					6.0	13.3			6.0	13.2	6.0	13.3	6.6	14.5				
25 SOC (1 in.)	None	5.6	6.6	6.0	13.3	6.0	13.3	5.7	12.6					6.6	14.5	6.6	14.5	6.6	14.5
	4	5.6	6.6	6.0	13.3	6.0	13.3	5.7	12.6					6.6	14.5	6.6	14.5	6.6	14.5
32 SOC ($1^1/_4$ in.)	4	5.6	6.6	6.0	13.3	6.0	13.3	5.7	12.6									6.6	14.5

D = Butt-weld DIN (2448)
A = Butt-weld ANSI (B 36.10)
SOC = Socket welding ANSI (B 16.11)

* Two side ports include two blind plugs and one ½ in. connector. Side ports in P2/P5.
Four side ports include four blind plugs. Side ports in P2/P5 and P3/P6.

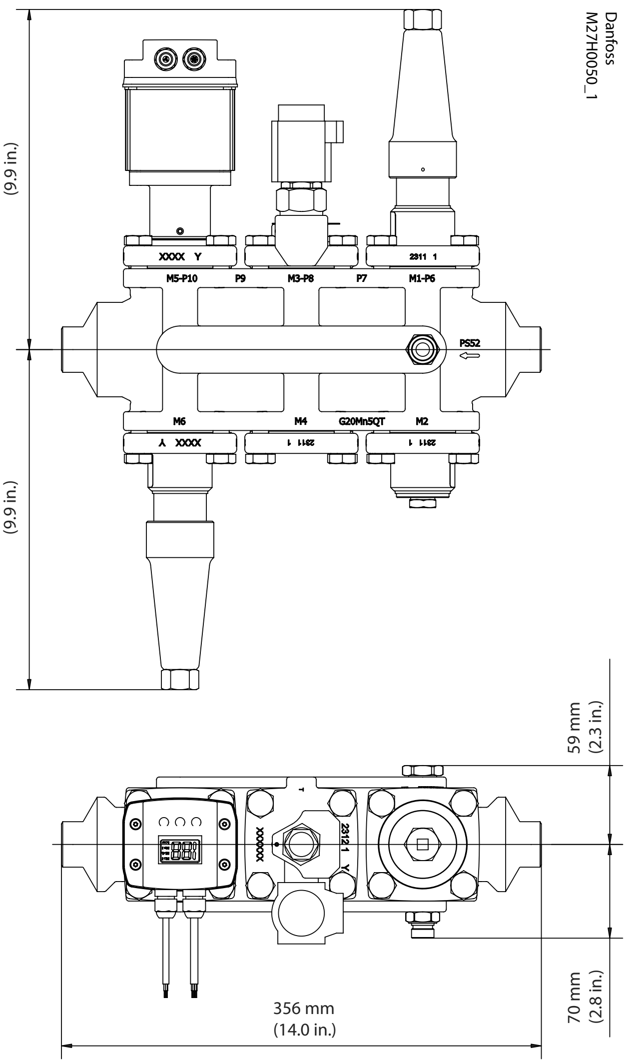
** Including ICAD 600 actuator

Control solutions

Dimensions and weight

ICF 25-6 → ICF 40-6

This example indicates the maximum dimensions for the ICF control solutions.



Weight

Connection	Number of side ports*	ICF 25-6-1A ICF 32-6-1A/B ICF 40-6-1B		ICF 25-6-3A ICF 32-6-3A/B ICF 40-6-3B		ICF 25-6-5A** ICF 32-6-5A/B** ICF 40-6-5B**		ICF 25-6-15A ICF 32-6-15B ICF 40-6-15B	
		kg	lbs	kg	lbs	kg	lbs	kg	lbs
25 D (1 in.)	None	23.6	52.0	23.8	52.5	23.8	52.5	23.6	52.0
32 D (1$^1/_4$ in.)	None	23.8	52.5	24.0	52.9	24.0	52.9	23.8	52.5
40 D (1$^1/_2$ in.)	None	24.0	52.9	24.2	53.4	24.2	53.4	24.0	52.9
25 D (1 in.)	4	23.6	52.0	23.8	52.5	23.8	52.5	23.6	52.0
32 D (1$^1/_4$ in.)	4	23.8	52.5	24.0	52.9	24.0	52.9	23.8	52.5
40 D (1$^1/_2$ in.)	4	24.0	52.9	24.2	53.4	24.2	53.4	24.0	52.9
25 SOC (1 in.)	None	23.6	52.0	23.8	52.5	23.8	52.5	23.6	52.0
32 SOC (1$^1/_4$ in.)	None	23.8	52.5	24.0	52.9	24.0	52.9	23.8	52.5
40 SOC (1$^1/_2$ in.)	None	24.0	52.9	24.2	53.4	24.2	53.4	24.0	52.9
25 SOC (1 in.)	6	23.6	52.0	23.8	52.5	23.8	52.5	23.6	52.0
32 SOC (1$^1/_4$ in.)	6	23.8	52.5	24.0	52.9	24.0	52.9	23.8	52.5
40 SOC (1$^1/_2$ in.)	6	24.0	52.9	24.2	53.4	24.2	53.4	24.0	52.9
32 A (1$^1/_4$ in.)	4	23.8	52.5	24.0	52.9	24.0	52.9	23.8	52.5

D = Butt-weld DIN (2448) – A = Butt-weld ANSI (B 36.10) – SOC = Socket welding ANSI (B 16.11)

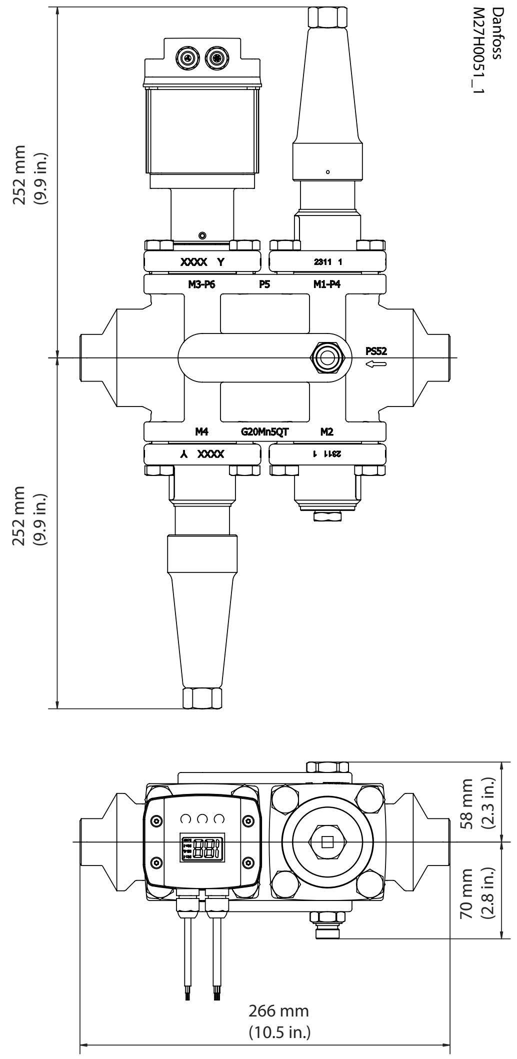
* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10.
Six side ports include six blind plugs. Side ports in P2/P7, P4/P9 and P5/P10.

** Including ICAD 600 actuator

Dimensions and weight

ICF 25-4 → ICF 40-4

This example indicates the maximum dimensions for the ICF control solutions.



Weight

Connection	Number of side ports*	ICF 25-4-8 ICF 32-4-8 ICF 40-4-8		ICF 25-4-9 ICF 32-4-9 ICF 40-4-9		ICF 25-4-10A ICF 32-4-10A/B ICF 40-4-10B		ICF 25-4-11 ICF 32-4-11 ICF 40-4-11		ICF 25-4-14A** ICF32-4-14A/B** ICF40-4-14B**	
		kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs
25 D (1 in.)	None	14.6	32.2	14.8	32.6	14.8	32.6	14.8	32.6	14.8	32.6
32 D (1$^{1}/_{4}$ in.)	None	14.8	32.6	15.1	33.3	15.1	33.3	15.1	33.3	15.1	33.3
40 D (1$^{1}/_{2}$ in.)	None	15.2	33.5	15.4	34.0	15.4	34.0	15.4	34.0	15.4	34.0
25 D (1 in.)	2	14.6	32.2	14.8	32.6	14.8	32.6	14.8	32.6	14.8	32.6
32 D (1$^{1}/_{4}$ in.)	2	14.8	32.6	15.1	33.3	15.1	33.3	15.1	33.3	15.1	33.3
40 D (1$^{1}/_{2}$ in.)	2	15.2	33.5	15.4	34.0	15.4	34.0	15.4	34.0	15.4	34.0
25 SOC (1 in.)	None	14.6	32.2	14.8	32.6	14.8	32.6	14.8	32.6	14.8	32.6
32 SOC (1$^{1}/_{4}$ in.)	None	14.8	32.6	15.1	33.3	15.1	33.3	15.1	33.3	15.1	33.3
40 SOC (1$^{1}/_{2}$ in.)	None	15.2	33.5	15.4	34.0	15.4	34.0	15.4	34.0	15.4	34.0
25 SOC (1 in.)	4	14.6	32.2	14.8	32.6	14.8	32.6	14.8	32.6	14.8	32.6
32 SOC (1$^{1}/_{4}$ in.)	4	14.8	32.6	15.1	33.3	15.1	33.3	15.1	33.3	15.1	33.3
40 SOC (1$^{1}/_{2}$ in.)	4	15.2	33.5	15.4	34.0	15.4	34.0	15.4	34.0	15.4	34.0
32 A (1$^{1}/_{4}$ in.)	None	14.8	32.6	15.0	33.1	15.0	33.1	15.0	33.1	15.0	33.1
32 A (1$^{1}/_{4}$ in.)	2	14.8	32.6	15.0	33.1	15.0	33.1	15.0	33.1	15.0	33.1

D = Butt-weld DIN (2448) – A = Butt-weld ANSI (B 36.10) – SOC = Socket welding ANSI (B 16.11)

* Four side ports include four blind plugs and one ½ in. connector. Side ports in P2/P7 and P5/P10.
Six side ports include six blind plugs. Side ports in P2/P7, P4/P9 and P5/P10.

** Including ICAD 600 actuator

Introduction

KP thermostats are single-pole, double-throw (SPDT) temperature-operated electric switches.
A KP thermostat can be connected directly to a single-phase alternating current motor of up to approx. 2 kW or installed in the control circuit of direct current motors and large alternating current motors.
KP thermostats are used for regulation, but can also be seen in safety monitoring systems. It is here that the electronic mechanism shows its superiority.
KP thermostats are available with vapour charge or with adsorption charge.
With vapour charge the differential is very small.
KP thermostats with adsorption charge are widely used to give frost protection.

Features

- Wide regulating range
- Can be used for deep freeze, refrigeration and air conditioning plant
- Welded bellows elements mean increased reliability
- Small dimensions
  Easy to install in refrigerated counters or cold rooms.
- Ultra-short bounce times
  This gives long operating life, reduces wear to a minimum and increases reliability.
- Standard versions with changeover switch
  Possible to obtain opposite contact function or to connect a signal.
- Electrical connection at the front of the unit
  Facilitates rack mounting.
  Saves space.
- Suitable for alternating and direct current
- Cable entry of soft thermoplastic for cables from 6 to 14 mm diameter.
- Extensive and wide range

Approvals

CE-marked in accordance with EN 60947-4/-5 for sale in Europe.

GL, Germanischer Lloyd, Germany

DNV, Det Norske Veritas, Norway

UL approval for USA and Canada

RINA, Registro Italiano Navale, Italy

BV, Bureau Veritas, France

LR, Lloyd’s Register, UK

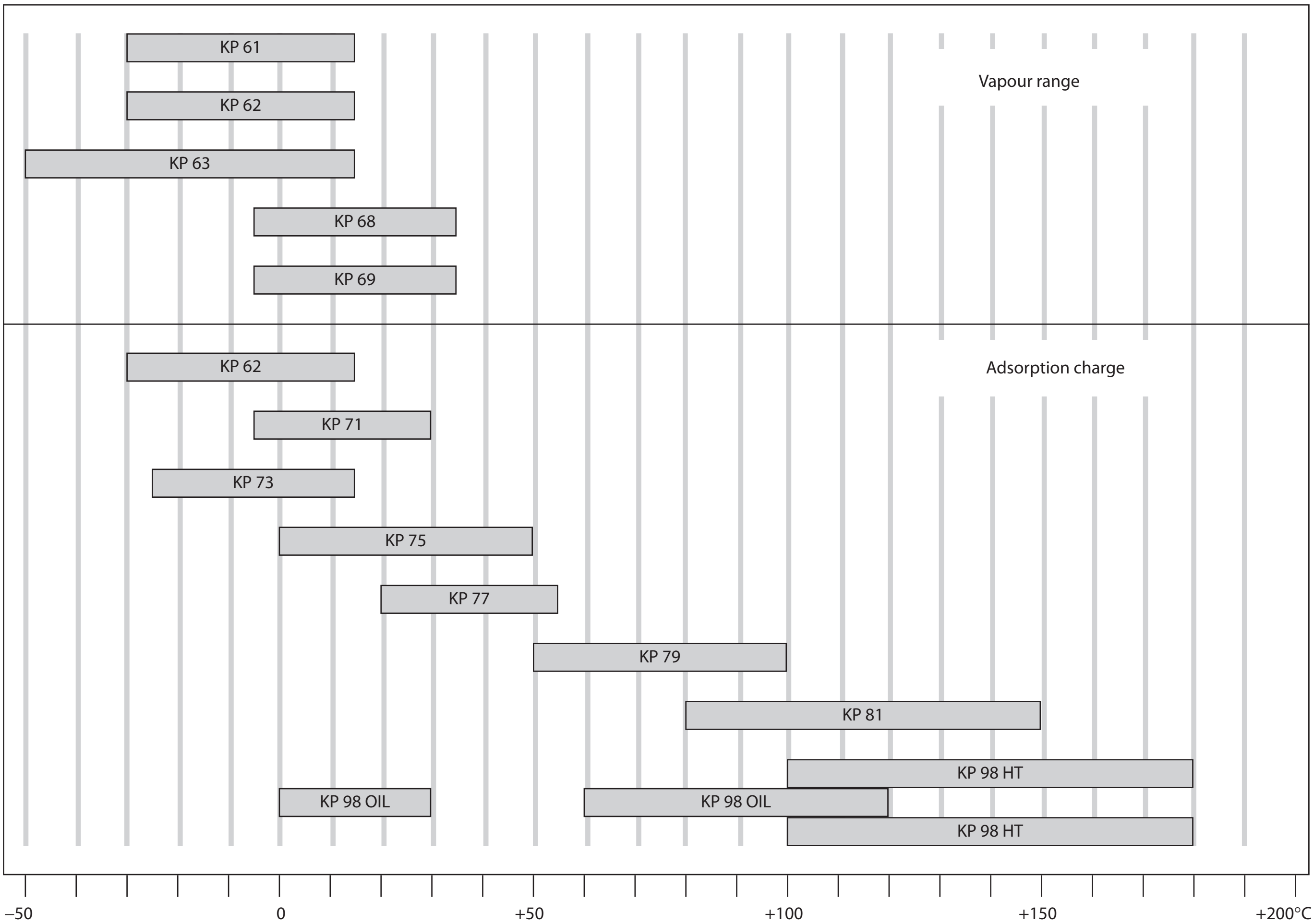
RMRS, Russian Maritime Register of Shipping, Russia

CCC, China Compulsory Certificate

Note: Marine Approvals do not cover KP98 dual thermostat

The complete technical leaflet (RD5DC) can be downloaded from the Danfoss web site.

Regulating range



Technical data

Ambient temperature
–40 → +65°C (+80°C for max. 2 hours).

Switch
Single-pole, double-throw (SPDT) changeover switch.

Contact load
Alternating current:
AC1: 16 A, 400 V
AC3: 16 A, 400 V
AC15: 10 A, 400 V
Max. starting current (L.R.): 112 A, 400 V
Direct current:
DC13: 12 W, 220 V control current

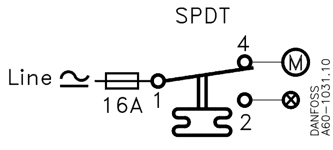
Properties according to EN 60947:

Wire dimensions solid/stranded flexible, w/out ferrules flexible, with ferrules flexible, with ferrules	 0.75 - 2.5 mm² 0.7 - 2.5 mm² 0.5 - 1.5 mm²
Tightning torque	max. 2 NM
Rated impulse voltage	4 kV
Pollution degree	3
Short circuit protection, fuse	10 Amp
Insulation	400 V
IP	30/44

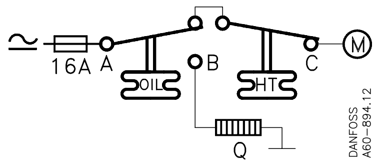
Cable connection
Cable entry for cables 6 → 14 mm dia.
A Pg 13.5 screwed cable entry can be used for 6 → 14 mm dia. cables.
With 8 → 16 mm cables a standard Pg 16 screwed cable entry can be used.

Enclosure
IP 30 to EN 60529 / IEC 529
This grade of enclosure is obtained when the unit is mounted on a flat surface or bracket. The bracket must be fixed so that all unused holes are covered.

Contact systems

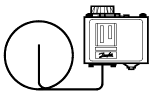


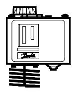
KP thermostats

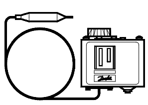


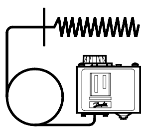
KP 98

Ordering









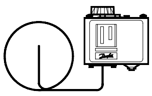
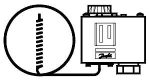
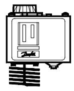
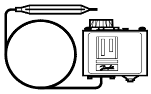
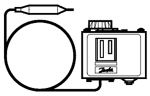
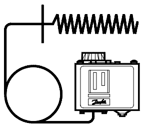
Charge	Type	Bulb type	Setting - range °C	Differential Δt Lowest temperature °C	Differential Δt Highest temperature °C	Reset	Max. bulb temp. °C	Capillary-tube length m	**Code no.**
Vapour [1]	KP 61	A	– 30 → 15	5.5 → 23	1.5 → 7	aut.	120	2	**060L110066**
	KP 61	A	– 30 → 15	5.5 → 23	1.5 → 7	aut.	120	5	**060L110166**
	KP 61	B	– 30 → 13	4.5 → 23	1.2 → 7	aut.	120	2	**060L110266**
	KP 61	B	– 30 → 15	5.5 → 23	1.5 → 7	aut.	120	2	**060L110366 [3])**
	KP 61	B	– 30 → 15	5.5 → 23	1.5 → 7	aut.	120	2	**060L112866[3]) [4])**
	KP 61	A	– 30 → 15	Fixed 6	Fixed 2	min.	120	5	**060L110466**
	KP 61	B	– 30 → 15	Fixed 6	Fixed 2	min.	120	2	**060L110566**
	KP 62	C 1	– 30 → 15	6.0 → 23	1.5 → 7	aut.	120		**060L110666**
	KP 63	A	– 50 → – 10	10.0 → 70	2.7 → 8	aut.	120	2	**060L110766**
	KP 63	B	– 50 → – 10	10.0 → 70	2.7 → 8	aut.	120	2	**060L110866**
	KP 68	C 1	– 5 → 35	4.5 → 25	1.8 → 7	aut.	120		**060L111166**
	KP 69	B	– 5 → 35	4.5 → 25	1.8 → 7	aut.	120	2	**060L111266**
Adsorb-tion [2])	KP 62	C 2	– 30 → 15	5.0 → 20	2.0 → 8	aut.	80		**060L111066[3]) [4])**
	KP 71	E 2	– 5 → 20	3.0 → 10	2.2 → 9	aut.	80	2	**060L111366**
	KP 71	E 2	– 5 → 20	Fixed 3	Fixed 3	min.	80	2	**060L111566**
	KP 73	E 1	– 25 → 15	12.0 → 70	8.0 → 25	aut.	80	2	**060L111766**
	KP 73	D 1	– 25 → 15	4.0 → 10	3.5 → 9	aut.	80	2	**060L111866 [3])**
	KP 73	D 1	– 25 → 15	Fixed 3.5	Fixed 3.5	min.	80	2	**060L113866**
	KP 73	D 2	– 20 → 15	4.0 → 15	2.0 → 13	aut.	55	3	**060L114066**
	KP 73	D 1	– 25 → 15	3.5 → 20	3.25 → 18	aut.	80	2	**060L114366**
	KP 75	F	0 → 35	3.5 → 16	2.5 → 12	aut.	110	2	**060L112066**
	KP 75	E 2	0 → 35	3.5 → 16	2.5 → 12	aut.	110	2	**060L113766**
	KP 77	E 3	20 → 60	3.5 → 10	3.5 → 10	aut.	130	2	**060L112166**
	KP 77	E 3	20 → 60	3.5 → 10	3.5 → 10	aut.	130	3	**060L112266**
	KP 77	E 2	20 → 60	3.5 → 10	3.5 → 10	aut.	130	5	**060L116866**
	KP 79	E 3	50 → 100	5.0 → 15	5.0 → 15	aut.	150	2	**060L112666**
	KP 81	E 3	80 → 150	7.0 → 20	7.0 → 20	aut.	200	2	**060L112566**
	KP 81	E 3	80 → 150	Fixed 8	Fixed 8	max.	200	2	**060L115566**
	KP 98	E 2	OIL: 60 → 120	OIL: Fixed 14	OIL: Fixed 14	max.	150	1	**060L113166**
		E 2	HT: 100 → 180	HT: Fixed 25	HT: Fixed 25	max.	250	2	

[1]) Bulb must always be placed colder than the thermostat housing and capillary tube. The thermostat will then regulate independent of ambient temperature.
[2]) Bulb can be placed warmer or colder than thermostat housing and capillary tube, but variations from +20°C ambient temperature will influence the scale accuracy.
[3]) With manual switch, not isolating switch.
[4]) Panel mounting model with top plate.

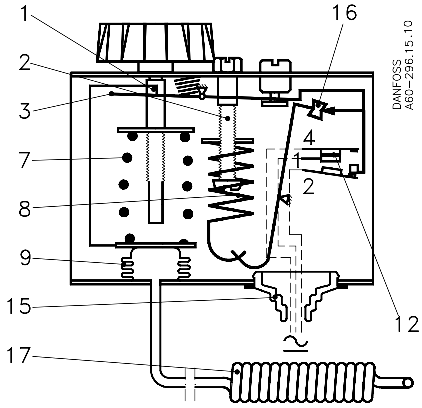
Electromechanical controls

Ordering
(continued)

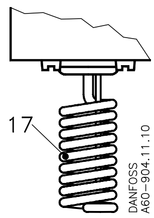
Thermostat bulb types

A		Straight capillary tube
B		∅ 9.5 × 70 mm remote air coil
C		C1: ∅ 40 × 30 mm air coil C2: ∅ 25 × 67 mm air coil (integral with thermostat)
D		D1: ∅ 10 × 85 mm double contact remote bulb D2: ∅ 16 × 170 mm double contact remote bulb Note! Cannot be used in sensor (bulb) pocket
E		E1: ∅ 6.4 × 95 mm remote bulb E2: ∅ 9.5 × 115 mm remote bulb E3: ∅ 9.5 × 85 mm remote bulb
F		∅ 25 × 125 mm remote duct coil

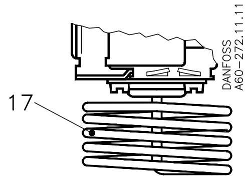
Design
Function



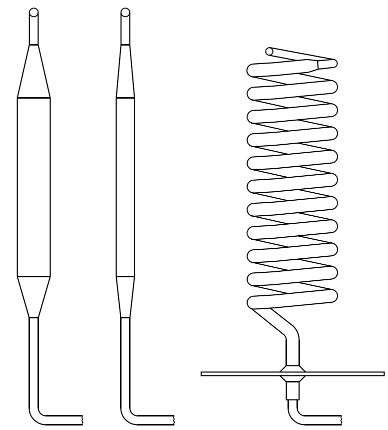
Key sketch of KP thermostats



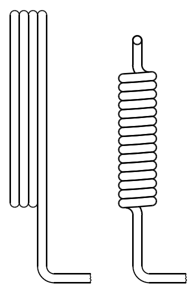
Adsorption charge



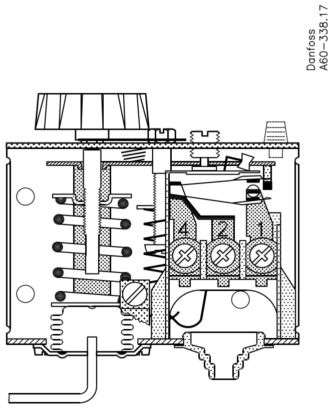
Vapour charge



Adsorption charge



Vapour charge



1. Temperature setting spindle
2. Differential setting spindle
3. Main arm
7. Main spring
8. Differential spring
9. Bellows
12. Switch
13. Terminals
14. Earth terminal
15. Cable entry
16. Tumbler
17. Sensor

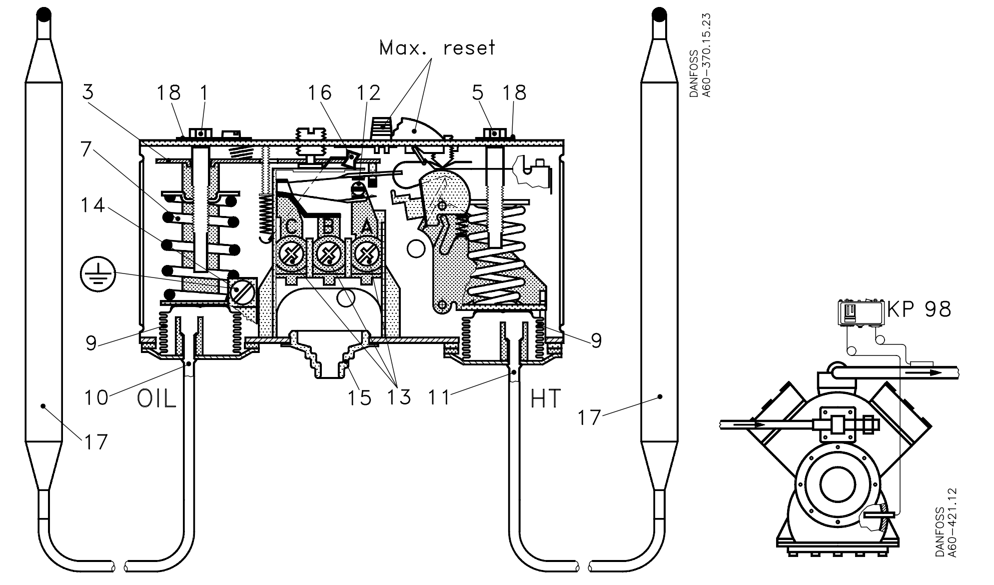
The switch in the KP has a snap-action function and the bellows move only when the cut-in or cut-out value is reached.

The design of the KP thermostat affords the following advantages:

- high contact load
- ultra-short bounce time
- vibration resistance up to 4 g in the range 0-1000 Hz
- long mechanical and electrical life.

Design
Function
(continued)

1. Temperature setting spindle, OIL
3. Main arm
5. Temperature setting spindle, HT
7. Main spring
9. Bellows
10. Capillary tube, OIL
11. Capillary tube, HT
12. Switch
13. Terminals
14. Earth terminal
15. Cable entry
16. Tumbler
17. Sensor (bulb)
18. Locking plate



KP 98, dual thermostat

Dual thermostat KP 98 is used to provide protection against excessively high discharge gas temperature and to ensure a suitable oil temperature in the compressor.
To avoid the temperature of the hot gas exceeding the maximum permissible value during extreme operating conditions (low evaporating pressure, high condensing pressure, high suction vapour superheat) a KP 98 thermostat can be used on the high temperature side (HT). If the temperature of the hot gas becomes too high the refrigerant will break down and the compressor discharge valve will become damaged.

The risk is greatest in refrigeration systems that operate on a high compression ratio (e.g. in systems with NH_3 or R22) and in applications with hot gas bypass.
This unit has two separate thermostat functions.
The HT sensor that controls the discharge gas temperature is fitted on the discharge tube immediately after the compressor.
For larger compressors, the sensor can be built into the discharge line.
The OIL sensor that controls the oil temperature is located in the compressor oil sump.

Terminology

Differential
The differential is the difference between the make and break temperatures.
A differential is necessary for satisfactory automatic operation of the plant.

Mechanical differential (intrinsic differential)
The mechanical differential is the differential set by the differential spindle.

Operating differential (thermal differential)
The operating differential is the differential the plant operates on. Operating differential is the sum of the mechanical differential and the differential produced by the time constant.

Reset
1. Manual reset:
   Units with manual reset can only be restarted after the reset button has been activated.
   On min. reset units the set value is equal to the cut-out value for falling temperature.
   On max. reset units the set value is equal to the cut-out value for rising temperature.

2. Automatic reset:
   These units are automatically reset after operational stop.

Setting

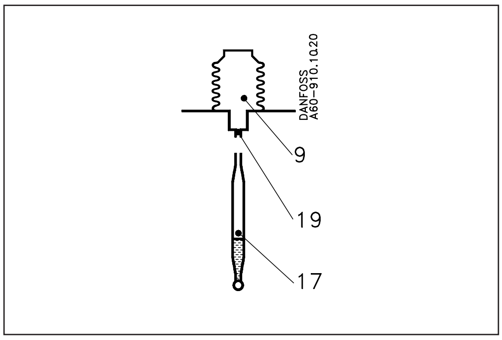
Thermostats with automatic reset
Set the upper activating temperature on the range scale.
Set the differential on the "DIFF" scale.
The temperature setting on the range scale will then correspond to the temperature at which the refrigeration compressor will be started on rising temperature. The compressor will be stopped when the temperature has fallen in relation to the differential setting.
Note that the differential depends on the range setting. Therefore, the differential scale must only be used as guideline.
If with low stop temperature settings the compressor will not stop, check whether the differential is set at too high a value!

Thermostats with minimum reset
Set the stop temperature on the range scale.
The differential is a fixed setting.
The compressor can be restarted by pressing the "Reset button" after the temperature on the thermostat sensor has risen by a value equal to the fixed differential setting.

Thermostats with maximum reset
Set the stop temperature on the range scale.
The differential is a fixed setting.
The compressor can be restarted by pressing the "Reset button" after the temperature on the thermostat sensor has fallen to a value equal to the fixed differential setting.

Charges

1. Vapour charge



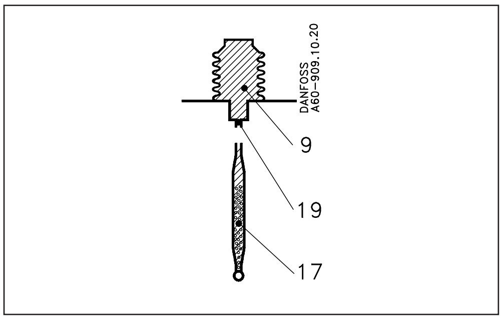
9. Bellows element
17. Sensor (bulb)
19. Capillary tube

Here the interdependence between the pressure and temperature of saturated vapour is utilized, i.e. the element is charged with saturated vapour plus a small amount of liquid.
The charge is pressure-limited; a further increase in pressure after evaporation of all the liquid in the sensor (17) will only result in a small pressure increase in the element.

This principle can be utilized in thermostats for low temperature, etc. where evaporation must be able to take place from the free liquid surface in the sensor (within the operating range of the thermostat), and where at the same time, the bellows must be protected against deformation when kept at normal ambient temperatures.
Since the pressure in the element depends on the temperature at the free liquid surface, the thermostat must always be placed so that the sensor is colder than the rest of the thermostatic element.
The evaporated liquid will recondense at the coldest point, i.e. the sensor. Thus, as intended, the sensor becomes the temperature-controlling part of the system.

Note: When the sensor is coldest, the ambient temperature has no effect on regulating accuracy.

2. Adsorption charge

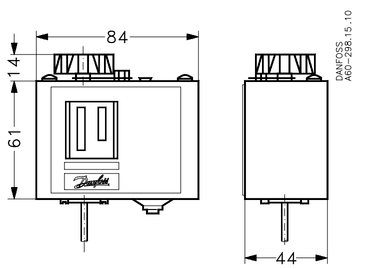


9. Bellows element
17. Sensor (bulb)
19. Capillary tube

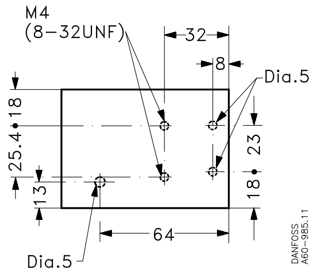
In this case the charge consists partly of a superheated gas and partly of a solid having a large adsorption surface.
The solid is concentrated in the sensor (17) and it is therefore always the sensor that is the temperature-controlling part of the thermostatic element.
The sensor can be placed warmer or colder than thermostat housing and capillary tube, but variations from +20°C ambient temperature will influence the scale accuracy.

Electromechanical controls

Dimensions and weights

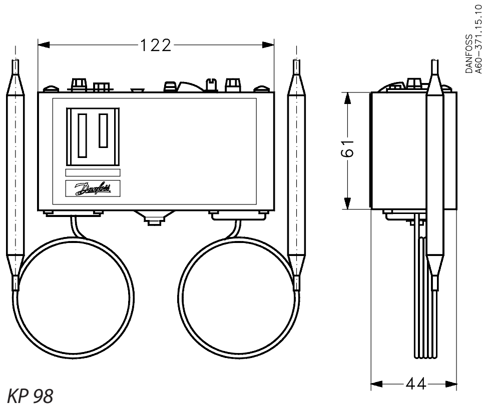


KP 61-81

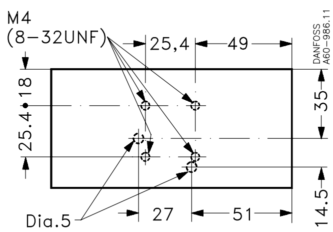


Mounting holes (back of KP)

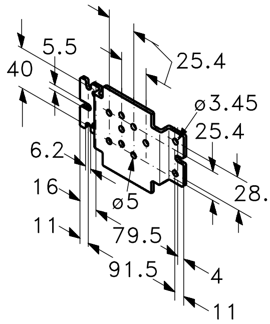
Weight
KP 61-81: approx. 0.4 kg
KP 98: approx. 0.6 kg



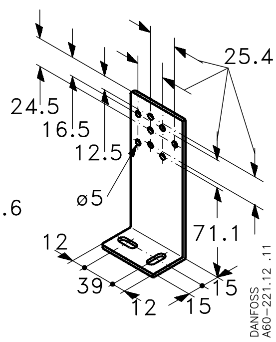
KP 98



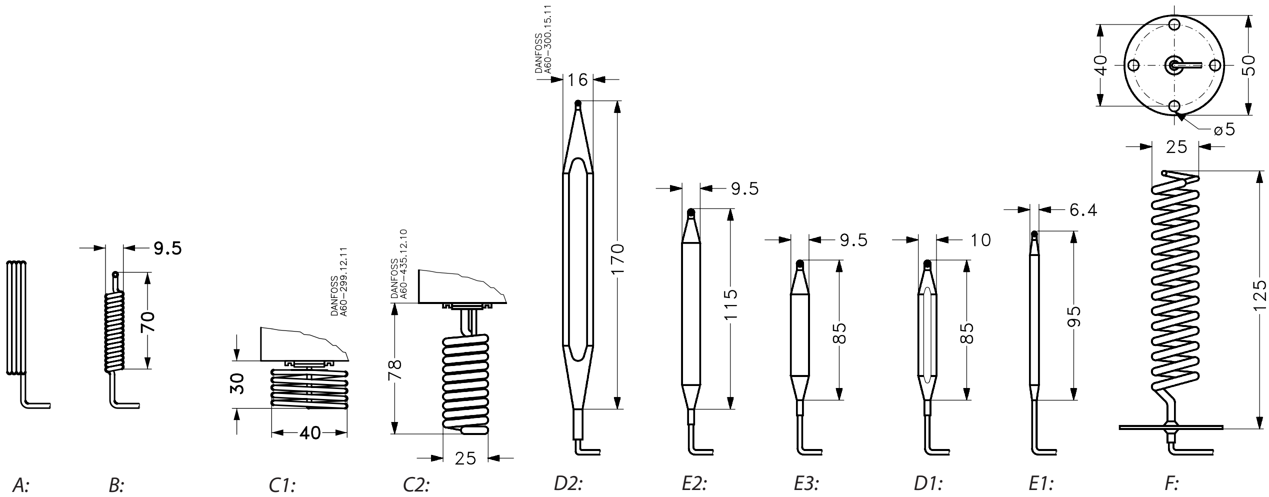
Mounting holes (back of KP)



Wall bracket



Angle bracket



A: KP 61, KP 63

B: KP 61, KP 63, KP 69

C1: KP 62, KP 68

C2: KP 62

D2: KP 73

E2: KP 71

E3: KP 77 KP 73 KP 75 KP 77 KP 98

D1: KP 73 KP 79 KP 81

E1: KP 73

F: KP 75

Introduction

An RT thermostat is fitted with a single-pole changeover switch.
The position of the contacts depends on the bulb temperature and the set scale value.
The RT series includes thermostats for general applications within industrial and marine refrigeration.
The RT series also includes differential thermostats, thermostats for neutral zone regulation, and special thermostats with gold-plated contact surface for PLC applications.

Features

- Waterproof versions, enclosure IP 66
- Wide regulating range
- Wide range of units for industrial and marine applications
- Suitable for alternating and direct current
- Interchangeable contact system
- Special versions for PLC applications

Technical data

Cable connection
Pg 13.5. Cable diameter 6 → 14 mm.

Enclosure
IP 66 to EN 60529 / IEC 60529, except for versions with ext. reset which are to IP 54.

Properties according to EN 60947:

Wire dimensions	
solid/stranded	0.2 - 2.5 mm^2
flexible, w/out ferrules	0.2 - 2.5 mm^2
flexible, with ferrules	0.2 - 1.5 mm^2
Tightening torque	max. 1.5 NM
Rated impulse voltage	4 kV
Pollution degree	3
Short circuit protection, fuse	10 Amp
Insulation	400 V
IP	54/66

Permissible ambient temperature
–50 → +70°C for thermostat housing.

Switches
See "Ordering switches".

Electromechanical controls

The complete technical leaflet (RD5EA) can be downloaded from the Danfoss web site.

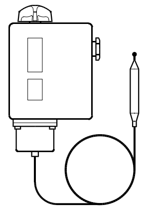
Approvals

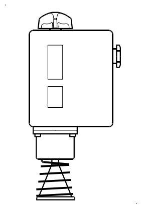
RT 2	RT 3	RT 4	RT 7	RT 8	RT 8L	RT 9	RT 10	RT 11	RT 12	RT 13	RT 14	RT 14L	RT 15	RT 16L	RT 17	RT 23	RT 24	RT 34	RT 101	RT 102	RT 107	RT 140	RT 140L	RT 270	
																					•				Lloyd's Reg. of Shipping, UK
	•		•	•	•	•	•		•	•	•	•	•						•		•				Germanischer Lloyd, Germany
																					•				Det norske Veritas, Norway
																			•						Bureau Veritas, France
•	•	•	•	•		•	•	•	•	•	•		•		•	•		•	•		•	•		•	RINA, Registro Italiano Navale, Italy
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	RMRS Russian Maritime Register of Shipping
•	•		•	•		•	•		•	•	•		•			•			•		•				NKK, Japan
																					•				Korean Register of Shipping, Korea
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	Conformity with EN 60730-2-1 to 9
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	CE mark according to EN 60947-4, -5
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	CCC, China Compulsory Certificate

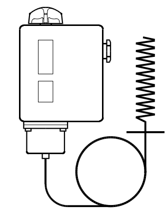
Overview

−50 0 +50 +100 +150 +200 +250 +300°C	Range °C	Type
Vapour-charged with remote bulb (bulb coldest)	−60 → -25	RT 10
	−45 → −15	RT 9
	−30 → 0	RT 13
	−25 → +15	RT 3
Adsorption-charged with remote bulb (bulb warmest or coldest)	−25 → +15	RT 2, 7
	−20 → +12	RT 8
	−5 → +10	RT 12
	−5 → +30	RT 14
	+5 → +22	RT 23
	+8 → +32	RT 15
	+15 → +34	RT 24
	+15 → +45	RT 140
	+25 → +90	RT 101, 102
Partial charge with remote bulb (bulb warmest)	+70 → +150	RT 107
Vapour-charged with coiled capillary tube sensor (room thermostats)	−50 → −15	RT 17
	−30 → 0	RT 11
	−5 → +30	RT 4
Adsorption-charged with coiled capillary tube sensor (room thermostats)	−25 → +15	RT 34
Adsorption-charged dead zone thermostats with remote bulb (bulb warmest or coldest)	−20 → +12	RT 8L
	−5 → +30	RT 14L
	+15 → +45	RT 140L
Vapour-charged dead zone thermostat (room thermostat)	0 → +38	RT 16L
Adsorption-charged differential thermostats with remote bulb (bulb warmest or coldest)	−30 → +40	RT 270
−50 0 +50 +100 +150 +200 +250 +300°C		

Ordering







Thermostats

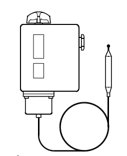
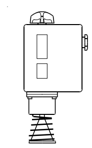
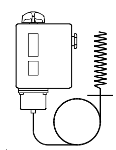
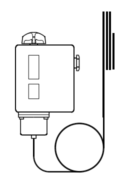
Charge	Type	Bulb type	Regulation range °C	Differential Δ t		Reset	Max. bulb temp. °C	Capillary tube length m	**Code no.**
				Lowest temp. setting K	Highest temp. setting K				
Vapour [1])	RT 10	A	–60 → –25	1.7→ 7.0	1.0→ 3.0	aut.	150	2	**017-507766**
	RT 9	A	–45 → –15	2.2→10.0	1.0→ 4.5	aut.	150	2	**017-506666**
	RT 3	A	–25 → +15	2.8→10.0	1.0→ 4.0	aut.	150	2	**017-501466**
	RT 17	B	–50 → –15	2.2→ 7.0	1.5→ 5.0	aut.	100		**017-511766**
	RT 11	B	–30 → 0	1.5→ 6.0	1.0→ 3.0	aut.	66		**017-508366**
	RT 4	B	–5 → +30	1.5→ 7.0	1.2→ 4.0	aut.	75		**017-5036 66** **017-503766[4])**
Adsorption [2])	RT 13	A	–30 → 0	1.5→ 6.0	1.0→ 3.0	aut.	150	2	**017-509766**
	RT 2	A	–25 → +15	5.0→18.0	6.0→20.0	aut.	150	2	**017-500866**
	RT 8	A	–20 → +12	1.5→ 7.0	1.5→ 7.0	aut.	145	2	**017-506366**
	RT 12	A	–5 → +10	1.0→ 3.5	1.0→ 3.0	aut.	65	2	**017-508966**
	RT 23	A	+5 → +22	1.1→ 3.5	1.0→ 3.0	aut.	85	2	**017-527866**
	RT 15	A	+8 → +32	1.6→ 8.0	1.6→ 8.0	aut.	150	2	**017-511566**
	RT 24	A	+15 → +34	1.4→ 4.0	1.4→ 3.5	aut.	105	2	**017-528566**
	RT 140	C	+15 → +45	1.8→ 8.0	2.5→11.0	aut.	240	2	**017-523666**
	RT 102	D	+25 → +90	2.4→10.0	3.5→20.0	aut.	300	2	**017-514766**
	RT 34	B	–25 → +15	2.0→10.0	2.0→12.0	aut.	100		**017-511866**
	RT 7	A	–25 → +15	2.0→10.0	2.5→14.0	aut.	150	2	**017-505366**
	RT 14	A	–5 → +30	2.0→ 8.0	2.0→10.0	aut.	150	2	**017-509966**
	RT 101	A	+25 → +90	2.4→10.0	3.5→20.0	aut.	300	2	**017-500366**
Partial [3])	RT 107	A	+70 → +150	6.0→25.0	1.8→ 8.0	aut.	215	2	**017-513566**

[1]) The sensor must be located colder than thermostat housing and capillary tube. [2]) The sensor can be located warmer or colder than thermostat housing. [3]) The sensor must be located warmer than thermostat housing and capillary tube.
[4]) With built-in heating coil – reduces the thermal differential.

Thermostats with adjustable dead zone

Charge	Type	Bulb type	Regulation range °C	Differential K	Dead zone NZ		Max. bulb temp. °C	Capillary tube length m	**Code no.**
					Lowest temp. setting K	Highest temp. setting K			
Vapour	RT 16L	B	0 → +38	1.5 / 0.7	1.5 → 5.0	0.7 → 1.9	100		**017L002466**
Adsorption	RT 8L	A	–20 → +12	1.5	1.5 → 4.4	1.5 → 4.9	145	2	**017L003066**
	RT 14L	A	–5 → +30	1.5	1.5 → 5.0	1.5 → 5.0	150	2	**017L003466**
	RT 140L	C	+15 → +45	1.8 / 2.0	1.8 → 4.5	2.0 → 5.0	240	2	**017L003166**
	RT 101L	A	+25 → +90	2.5 / 3.5	2.5 → 7.0	3.5 → 12.5	300	2	**017L006266**

Type of bulb / sensor

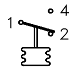
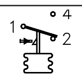
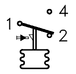
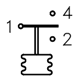
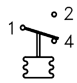
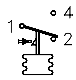
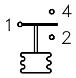
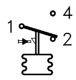
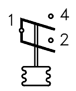
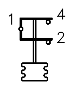
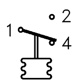
A	B	C	D
			
Cylindrical remote sensor	*Room sensor*	*Duct sensor*	*Capillary tube sensor*

Special versions
RT can be supplied with special switches.
See next page.

When ordering, please state
1. Type
2. Code no. of standard unit
3. Code no. of special switch

Ordering
(continued)

Switches

Version	Symbol	Description	Contact rating	Reset	**Code no.**
Standard	 SPDT	Single-pole changeover switch with terminal board proof against leakage current. **Fitted in all standard versions of type RT.** Snap action changeover contacts.	Alternating current *Ohmic:* AC1 = 10 A, 400 V *Inductive:* AC3 = 4 A, 400 V AC15 = 3 A, 400 V *Dir. current:* DC13 = 12 W, 220 V	Aut.	**017-403066**
Man. reset	 SPDT	For manual reset of unit after contact changeover on rising temperature. **For units with reset facility.**		Max.	**017-404266**
Man. reset	 SPDT	For manual reset of unit after contact changeover on falling temperature. **For units with reset facility.**		Min.	**017-404166**
Dead zone	 SPDT	Single-pole changeover switch with dead zone and terminal board proof against leakage current.			Available only as a component part of RT controls with adjustable dead zone
Standard	 SPDT	Single-pole changeover switch with gold plated (oxide-free) contact surfaces. Increases cut-in reliability on alarm and monitoring systems, etc. Snap action changeover contacts. Terminal board proof against leakage current.	Alternating current *Ohmic:* AC1 = 10 A, 400 V *Inductive:* AC3 = 2 A, 400 V AC15 = 1 A, 400 V *Dir. current:* DC13 = 12 W, 220 V	Aut.	**017-424066**
Man. reset	 SPDT	Single-pole changeover switch with gold plated (oxide-free) contact surfaces. Increases cut-in reliability on alarm and monitoring systems, etc. Snap action changeover contacts. Terminal board proof against leakage current.		Max.	**017-404866**
Dead zone	 SPDT	Single-pole changeover switch with dead zone and gold plated (oxide-free) contact surfaces. Increase cut-in reliability on alarm and monitoring systems, etc. Snap action changeover contacts. Terminal board proof against leakage current.			Available only as a component part of RT controls with adjustable dead zone
Man. reset	 SPDT	Single-pole changeover switch with gold plated (oxide-free) contact surfaces. Increases cut-in reliability on alarm and monitoring systems, etc. Snap action changeover contacts. Terminal board proof against leakage current.		Min.	**017-404766**
Cuts in two circuits simultane-ously	 SPST	Single-pole changeover switch that cuts in two circuits simultaneously on rising temperature. Snap action changeover contacts. Terminal board proof against leakage current.	Alternating current *Ohmic:* AC1 = 10 A, 400 V *Inductive:* AC3 = 3 A, 400 V AC15 = 2 A, 400 V *Dir. current*: DC13 = 12 W, 220 V [1]	Max.	**017-403466**
Cuts out two circuits simultane-ously	 SPST	Single-pole changeover switch that cuts out two circuits simultaneously on rising temperature. Snap action changeover contacts. Terminal board proof against leakage current.		Min.	**017-403666**
With non-snap action change-over contacts	 SPDT	Single-pole changeover switch with non-snap action changeover contacts.	*Alternating or direct current* 25 VA, 24 V		**017-018166**

[1]) If current is led through contacts 2 and 4, i.e. terminals 2 and 4 connected but not 1, max. permissible load is increased to 90 W, 220 V.

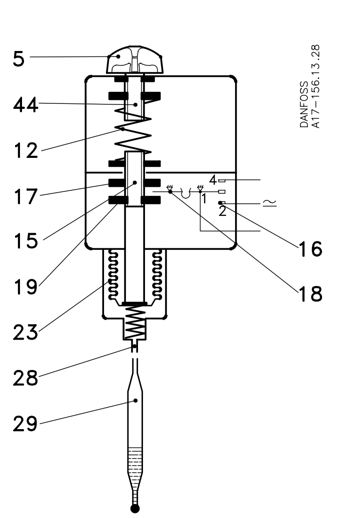
The switches are shown in the position they assume on falling temperature, i.e. after downward movement of the RT main spindle. The setting pointer of the control shows the scale value at which contact changeover occurs on falling temperature.

An exception is RT with switch, code no. 017-404266, with max. reset where the setting pointer shows the scale value at which contact changeover occurs on rising temperature.

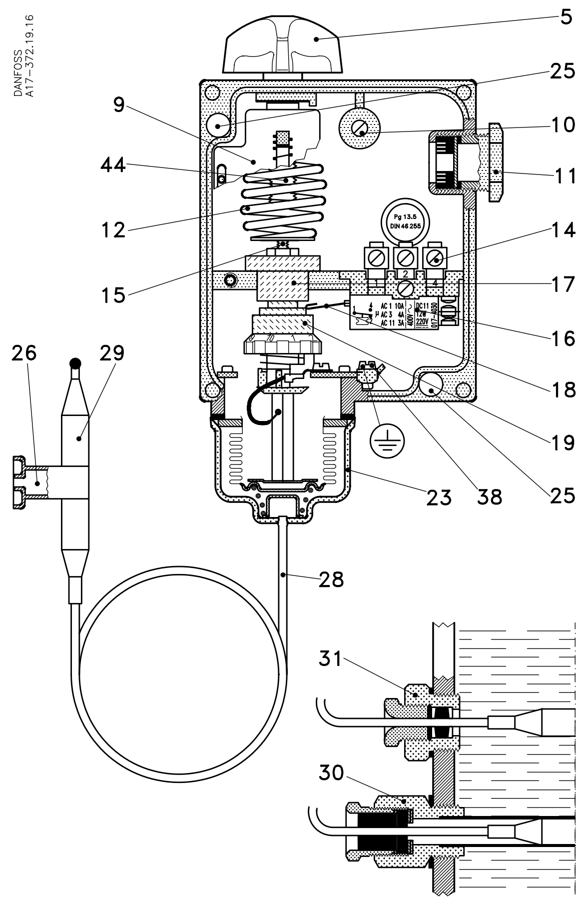
Spare parts and accessories,
see spare parts catalogue RX.5E.A2.02.

Design
Function

Thermostat type RT



Key sketch of RT thermostat



RT thermostat

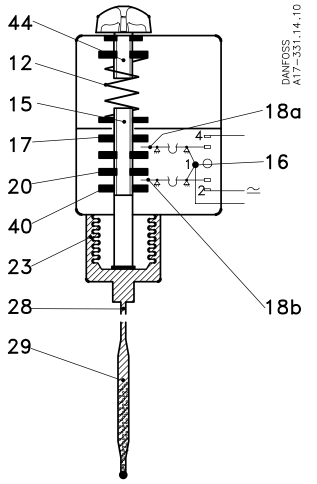
5. Setting knob
9. Regulation range scale
10. Loop terminal
11. Pg 13.5 screwed cable entry
12. Main spring
14. Terminals
15. Main spindle
16. Switch
17. Upper guide bush
18. Contact arm
19. Differential temperature setting nut
23. Bellows element
25. Fixing hole
26. Sensor (bulb) clip
28. Capillary tube
29. Sensor (bulb)
30. Sensor (bulb) pocket
31. Capillary tube gland
38. Earth terminal
44. Temperature setting spindle

The thermostatic element consists of a sensor (29) capillary tube (28) and bellows element (23). The element contains a charge that reacts to temperature variations at the sensor so that the pressure on the moving bellows rises when temperature rises.
By turning the setting knob (5) the main spring (12) can be set to balance the pressure in the element.

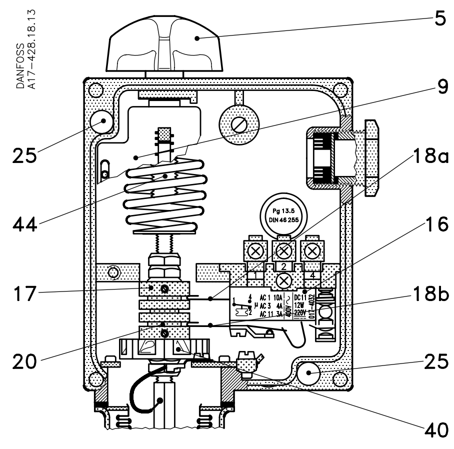
A rise in temperature at the sensor compresses the bellows and moves the main spindle (15) upwards until spring force and element pressure are in equilibrium.
The main spindle (15) is fitted with a guide bush (17) and a differential setting nut (19) that together transfer the main spindle movement to the switch (16).

Design
Function
(continued)

Thermostats with neutral zone, type RT L



Key sketch RT L thermostat



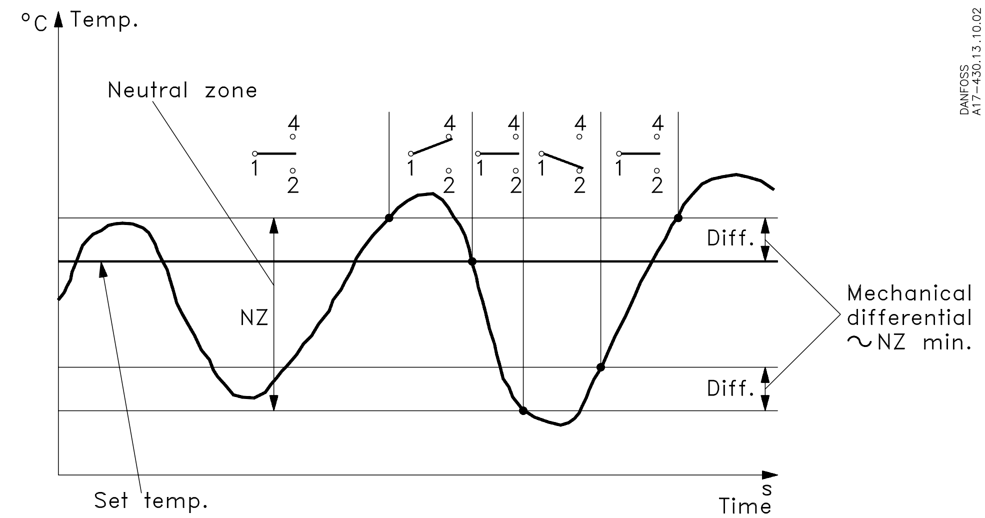
RT L thermostat

5. Setting knob
9. Regulation range scale
12. Main spring
15. Main spindle
16. Switch
17. Upper guide bush

18a and 18b. Contact arm

20. Lower guide bush
23. Bellows element
25. Fixing hole
28. Capillary tube
29. Sensor (bulb)
40. Neutral zone setting nut
44. Temperature setting spindle

RT L pressure controls are fitted with a switch (17-4032) with an adjustable neutral zone. This enables the units to be used for floating control. The neutral zone switch contact arms (18a) and (18b) are operated by the spindle guide bushes (17) and (20). The upper guide bush (17) is fixed while the lower guide bush (20) can be moved up or down by the setting nut (40). In this way the neutral zone can be varied between a minimum value (equal to the mechanical differential of the unit) and a maximum value (depending on the type of RT unit).



Terminology

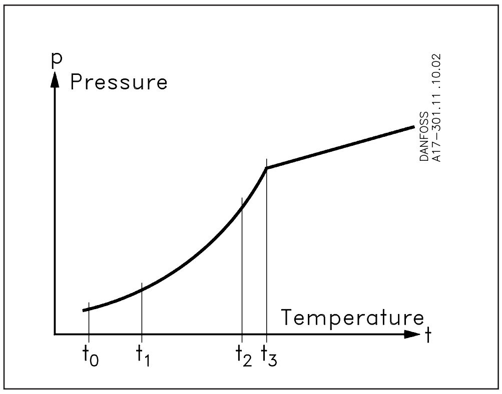
Floating control
A form of delayed control where the correcting element (e.g. valve, damper, or similar) moves towards one extreme position at a rate independent of the magnitude of the error when the error exceeds a definite positive value, and towards the opposite extreme position when the error exceeds a definite negative value.

Hunting
Periodic variations of the controlled variable from the fixed reference.

Neutral zone
The interval between the make points of the two contacts.

Charges

1. Vapour charge

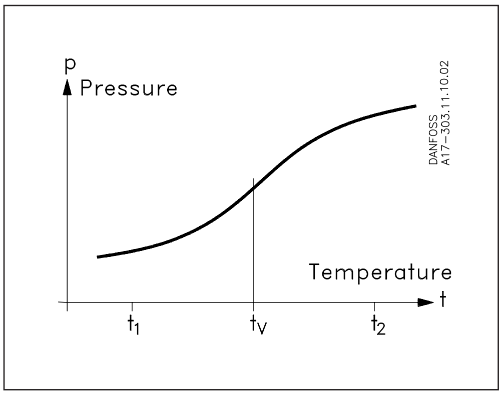


Here the interdependence between the pressure and temperature of saturated vapour is utilized, i.e. the element is charged with saturated vapour plus a small amount of liquid.
The charge is pressure-limited; a further increase in pressure after evaporation of all the liquid in the bulb, will only result in a small pressure increase in the element.

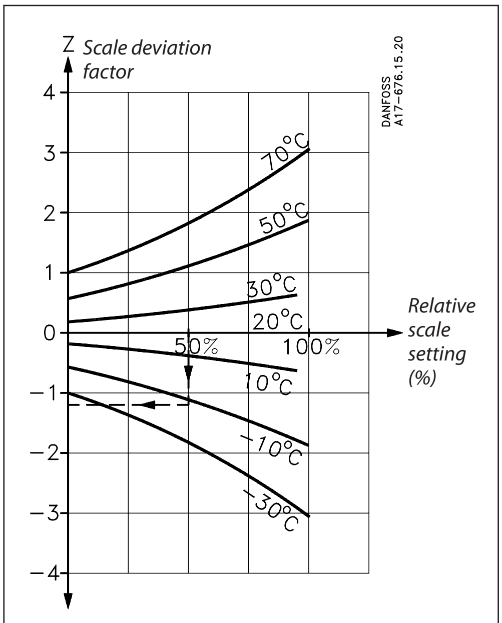
This principle can be utilized in thermostats for low temperature, etc., where evaporation must be able to take place from the free liquid surface in the bulb (within the operation range of the thermostat), and where at the same time, the bellows must be protected against deformation when kept at normal ambient temperatures.
Since the pressure in the element depends on the temperature at the free liquid surface, the thermostat must always be placed so that the bulb is colder than the rest of the thermostatic element.
The evaporated liquid will recondense at the coldest point, i.e. the bulb. Thus, as intended, the bulb becomes the temperature-controlling element in the system.

Note:
When the bulb is coldest, the ambient temperature has no effect on regulating accuracy.

2. Adsorption charge



In this case the charge consists partly of a superheated gas and partly of a solid having a large adsorption surface.
The solid is concentrated in the bulb and it is therefore always the bulb that is the temperature-controlling part of the thermostatic element.
The bulb can thus be placed warmer or colder than the rest of the thermostatic element.
Such a charge is however to some extent sensitive to changes in the temperature of the bellows element and capillary tube.
Under normal conditions this is not important, but if the thermostat is used in extreme conditions, scale deviation will occur.
The scale can be corrected by using the graph and the table.
Scale correction = Z × a.
Z can be found in the graph and "a" in the table.



Curves for different ambient temperatures.
0% ~ lowest scale setting temperature,
100% ~ highest scale setting temperature.

Type	Regulating range °C	Correction factor a
RT 2	−25 → +15°C	2.3
RT 7	−25 → +15°C	2.9
RT 8, RT 8L	−20 → +12°C	1.7
RT 12	−5 → +10°C	1.2
RT 14, RT 14L	−5 → +30°C	2.4
RT 15	+8 → +32°C	1.2
RT 23	+5 → +22°C	0.6
RT 24	+15 → +34°C	0.8
RT 101, RT 102	+25 → +90°C	5.0
RT 140, RT 140L	+15 → +45°C	3.1

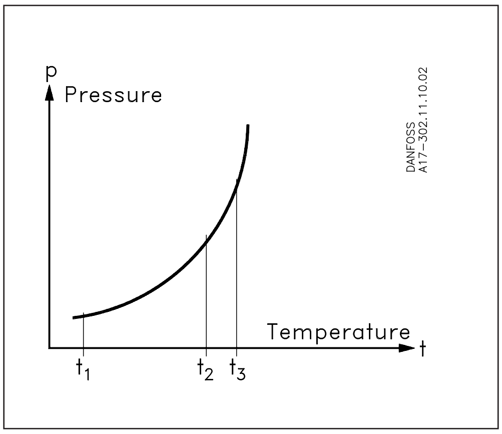
Electromechanical controls

Charges
(continued)

Example
Scale correction on an RT 14 (range –5 to +30°C) at activating temperature +12°C and ambient temperature –10°C.
The scale temperature, +12°C, lies approximately in the middle of the scale range, i.e. relative scale setting of 50%.
The factor Z can be found in the graph from 50% and the curve for –10°C, i.e. approx. –1.2.

The correction factor "a" can be found in the table for an RT 14, i.e. 2.4.
The scale correction = Z × a = –1.2 × 2.4 = –2.88.
If activation at +12°C for the same conditions is required, the thermostat must be set at +12 × 2.88 = 9.12 ≈ 9.1.

3. Partial charge



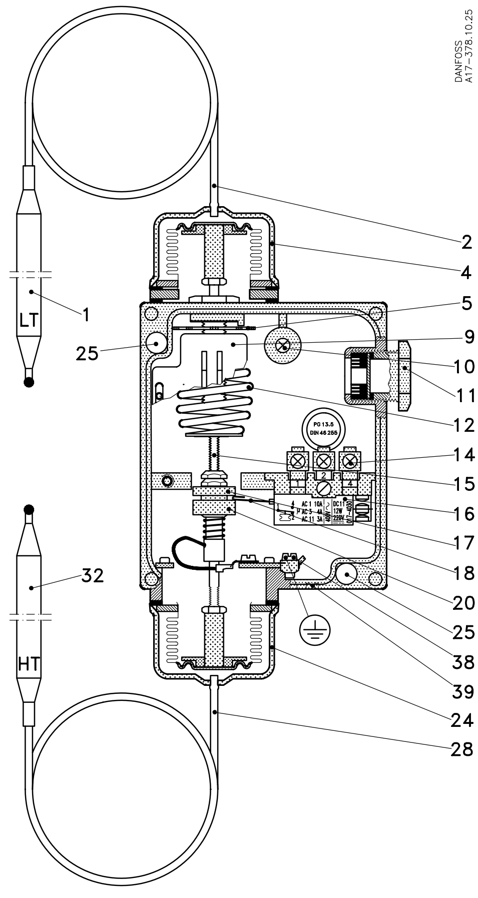
Partial charge is used in RT units having a range lying higher than ambient temperature.

As with the vapour charge, the partial charge utilizes the interdependence between the pressure and temperature of saturated vapour. The partial charge is of such a volume that the bellows housing, capillary tube and a small part of the bulb are filled when the thermostat is in operation. The bulb is thus the warmest part of the system.
The liquid will condense in the remaining, coldest, part of the system but because of the volume of the charge the free liquid surface will always be in the bulb. In this way, the bulb becomes the temperature-controlling part of the system.

Note:
When the bulb is placed warmest, the ambient temperature has no effect on regulating accuracy.

Design Function

RT differential thermostat



RT differential thermostat

1. LT sensor (bulb)
2. Capillary tube
4. LT bellows element
5. Setting disc
9. Regulation range scale
10. Loop terminal
11. Pg 13.5 screwed cable entry
12. Main spring
14. Terminals
15. Main spindle
16. Switch
17. Upper guide bush
18. Contact arm
20. Lower guide bush
24. HT bellows element
25. Fixing hole
28. Capillary tube
32. HT sensor (bulb)
38. Earth terminal
39. Blow-out disc

An RT differential thermostat contains a single-pole changeover switch that makes or breaks depending on the temperature difference between the two sensors of the unit.
The RT 270 is for use in process plant, ventilation plant, and refrigeration and heating plant where there is need to maintain a certain temperature differential, 0 - 15°C, between two media. One sensor is used as a reference and the other as a control sensor. The temperature differential is the direct controlled variable.

The figure shows a cross-section of the RT 270.

The differential thermostat contains two bellows elements: the LT element whose sensor must be placed in the medium having the lowest temperature, and the HT element whose sensor must be placed in the medium having the highest temperature.
The main spring has a rectilinear characteristic. Within the operating range the RT 270 can be set for different temperature differentials by the setting disc (5).
When the differential between LT and HT sensor temperature falls, the main spindle (15) moves downwards.
The contact arm (18) is moved downwards by the guide (17) so that contacts (1-4) break and contacts (1-2) make when the set temperature differential is reached.
The contacts changeover again when the temperature differential rises to the set value plus the fixed contact differential of approx. 2°C.

Example
Set differential = 4°C.
Switch breaks at 4°C differential and remakes at 4 + 2 = 6°C.

Terminology

Regulation range
The temperature differential between LT and HT sensors within which the unit can be set to operate. Indicated on the thermostat scale.

Scale indication
The difference between the temperature on LT and HT sensors at the moment when the switch contacts change over as a result of the downward movement of the spindle.

Operating range
The temperature range of the LT sensor, within which the differential thermostat can operate.

Contact differential
The temperature rise on the HT sensor over the set temperature differential which causes the switch contacts to make or break.

Reference sensor
The sensor that is placed in the medium whose temperature is not affected by the function of the thermostat (HT- or LT sensor).

Control sensor
The sensor that is placed in the medium whose temperature must be controlled (LT- or HT sensor).

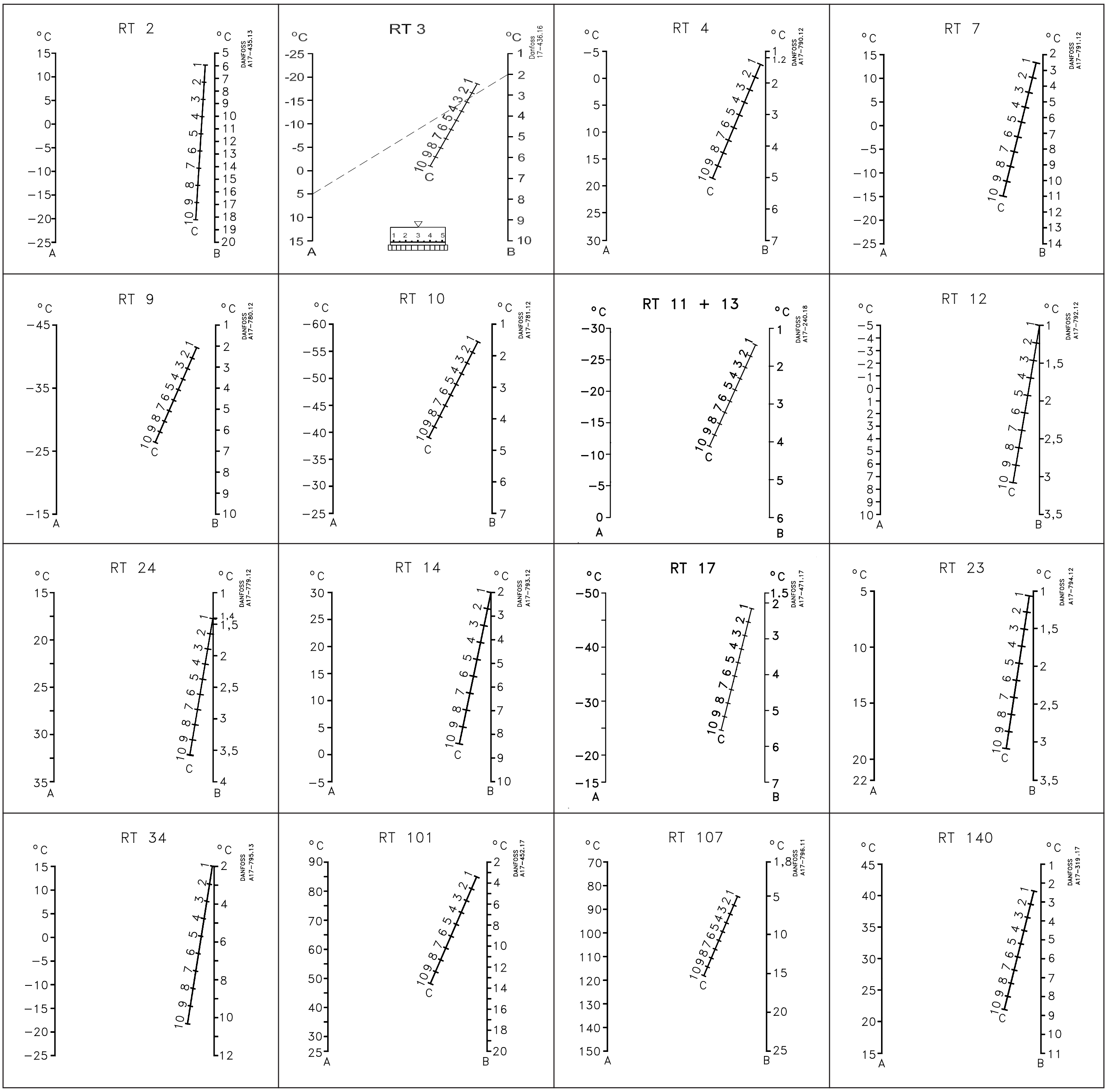
Setting of differential

The knob can be used to make a setting on the range scale for the lowest temperature at which the contact system must be activated (cut-out or cut-in).

The differential roller 19 must then be used to set the differential. The highest activating temperature at the sensor is equal to the activating temperature + the set differential.

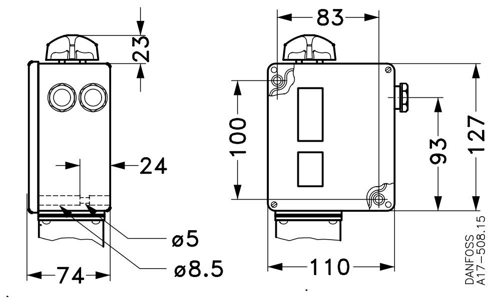
Nomograms for obtained differentials

A = Range setting
B = Obtained differential
C = Differential setting

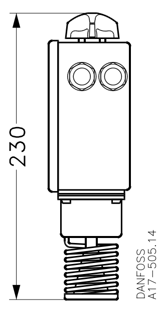


Dimensions and weight

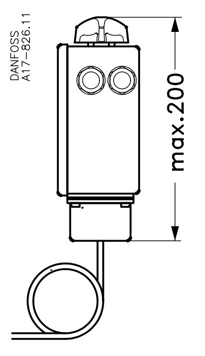
Weight approx. 1 kg



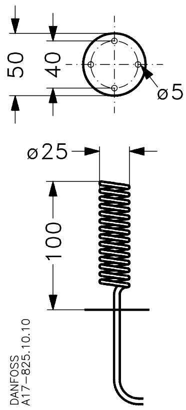
RT thermostat housing



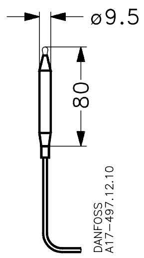
RT 4, 11, 16L, 17, 34



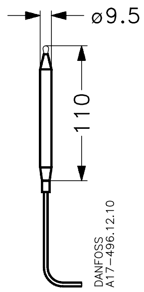
RT thermostat housing



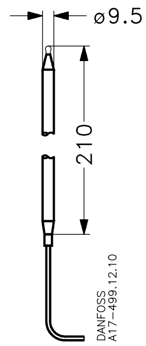
RT 140, 140L



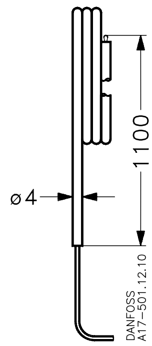
RT 2, 3, 7, 9, 10, 13, 101



RT 8, 8L, 14, 14L, 15, 107, 270



RT 12, 23, 24



RT 102

Introduction

MP 54 and MP 55 oil differential pressure controls are used as safety switches to protect refrigeration compressors against low lubricating oil pressure.
If the oil pressure fails the oil differential pressure control stops the compressor after a certain time period.
MP 54 and 55 are used in refrigerating systems using fluorinated refrigerants.
MP 55A is used in refrigerating systems with R717 (NH_3). MP 55A can also be used in systems with fluorinated refrigerant.
MP 54 has a fixed differential pressure setting.
It also incorporates a thermal time relay with a fixed release time setting.
MP 55 and 55A have adjustable differential pressure and are available both with and without thermal time relay.

Features

- Wide regulating range
- Can be used for deep freeze, refrigeration and air conditioning plant
- Can be used for all normal fluorinated refrigerants
- Electrical connection at the front of the unit
- Suitable for both alternating and direct current
- Screwed cable entry for cables from 6 to 14 mm diameter
- Small contact differential
- Meets the requirements of EN 60947

Approvals

CE mark according to EN 60947-5

Versions having UL and CSA approvals can be supplied to special order.

CCC, China Compulsory Certificate

GL, Germanischer Lloyd, Germany

RINA, Registro Italiano Navale, Italy

Materials in contact with the medium

Unit type	Material
MP 54 MP 55	Stainless steel 19/11, no. 1.4306 to DIN 17440 Deep-drawn steel plate, no. 1.0338 to DIN 1624 Free cutting steel, no. 1.0718 to DIN 1651
MP 55A	Stainless steel 19/11, no. 1.4306 to DIN 17440 Deep-drawn steel plate, no. 1.0338 to DIN 1624 Free cutting steel, no. 1.0401 to DIN 1652

The complete technical leaflet (RD5CA) can be downloaded from the Danfoss web site.

Technical data

Control voltage
230 V or 115 V a.c. or d.c.

Permissible voltage variation
+10 → –15%

Max. working pressure
PB = 17 bar

Max. test pressure
p′ = 22 bar

Temperature compensation
The time relay is temperature-compensated in the range –40 to +60°C

Screwed cable entry
Pg 13.5

Cable diameter
6 → 14 mm

Max. bellows temperature
100°C

Enclosure
IP 20 to IEC 529 / EN 60529

Contact loads
Type A:
On time relay output contacts M-S:
AC15: 2 A, 250 V
DC13: 0,2 A, 250 V

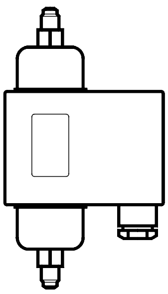
Type B without time relay:
AC15: 0,1 A, 250 V
DC13: 12 W, 125 V

Type C without time relay:
AC1: 10 A, 250 V
AC3: 4 A, 250 V
DC13: 12 W, 125 V

Properties according to EN 60947:

Wire dimensions	
solid/stranded	0.2 - 1.5 mm²
flexible, w/out ferrules	0.2 - 1.5 mm²
flexible, with ferrules	0.2 - 1 mm²
Tightening torque	max. 1.2 NM
Rated impulse voltage	4 kV
Pollution degree	3
Short circuit protection, fuse	2 Amp
Insulation	250 V
IP	20

Ordering



For fluorinated refrigerants

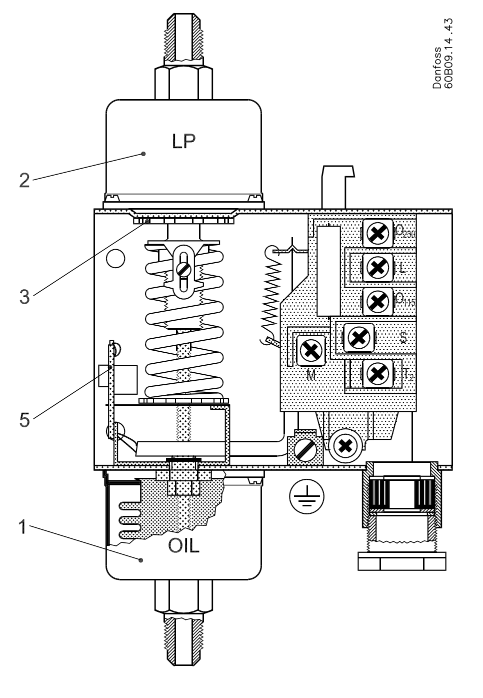
Type	Differential Δp bar	Switch differential max. Δp bar	Operation range, LP side bar	Time relay release time s	Contact load (see technical data)	Code no. Connection 1/4 in./6 mm Flare	Code no. Connection 1 m cap.tube 1/4 in. ODF solder	Code no. Connection Cutting ring 6 mm
MP 54	Fixed 0.65	0.2	–1 → +12	0[2])	B	**060B029766**		
	Fixed 0.65	0.2	–1 → +12	45	A	**060B016666**		
	Fixed 0.9	0.2	–1 → +12	60	A	**060B016766**		
	Fixed 0.65	0.2	–1 → +12	90	A	**060B016866**		
	Fixed 0.65	0.2	–1 → +12	120	A	**060B016966[3])**		
MP 55	0.3 → 4.5	0.2	–1 → +12	45	A	**060B017066**	**060B013366**	
	0.3 → 4.5	0.2	–1 → +12	60	A	**060B017166**		**060B018866**
	0.3 → 4.5	0.2	–1 → +12	60	A	**060B017866[1])**		
	0.3 → 4.5	0.2	–1 → +12	90	A	**060B017266**		
	0.3 → 4.5	0.2	–1 → +12	120	A	**060B017366**	**060B013666**	
	0.3 → 4.5	0.2	–1 → +12	0[2])	B	**060B029966**		**060B029566**
	0.65 → 4.5	0.4	–1 → +12	0[2])	C	**060B029466[4])**		

For fluorinated refrigerants and R717 (NH_3)

Type	Differential Δp bar	Switch differential max. Δp bar	Operation range, LP side bar	Time relay release time s	Contact load (see technical data)	Code no. Connection ∅ 6,5 / ∅ 10 mm weld nipple	Code no. Connection Cutting ring 6 mm
MP 55A	0.3 → 4.5	0.2	–1 → +12	45	A	**060B017466**	**060B018266**
	0.3 → 4.5	0.2	–1 → +12	60	A	**060B017566**	**060B018366**
	0.3 → 4.5	0.2	–1 → +12	60	A	**060B017966 [1])**	
	0.3 → 4.5	0.2	–1 → +12	90	A	**060B017666**	**060B018466**
	0.3 → 4.5	0.2	–1 → +12	120	A	**060B017766**	**060B018566**
	0.3 → 4.5	0.2	–1 → +12	0[2])	B	**060B029866 [2])**	**060B029666**

1) With operational light that remains on during normal operation.
Note: If the operational light goes out, the compressor should not run longer than the release time.
2) Versions without time relay are for applications where an external time relay is required - perhaps with a different release time than the one specified.
3) 060B0169 meets Copeland specifications. UL-approved versions can be supplied.
4) Approved according to EN 60947-4, -5.

Design



MP 55

1. Connection to pressure side of lubrication system, OIL
2. Connection to suction side of refrigeration plant, LP
3. Setting disc
4. Reset buttom
5. Test device

The operation of the pressure control is conditional only on the differential pressure, i.e. the difference in pressure between the two counteracting bellows, whereas it is independent of the absolute pressure acting on both bellows.
The MP 55 and 55A can be set for different differential pressures by the setting disc (3).
The set differential pressure can be read from the internal scale.
The MP 54 has a fixed differential and has no pressure setting disc.
The factory-set differential pressure is stamped on the front plate of the control.

Terminology

Differential range
The pressure difference between LP and OIL connections within which the control can be set to operate.

Scale reading
The differential between the oil pump pressure and the pressure in the crankcase that exists at the moment the contact system cuts in current to the time relay on falling oil pressure.

Operating range
The pressure range on the LP connection within which the control can operate.

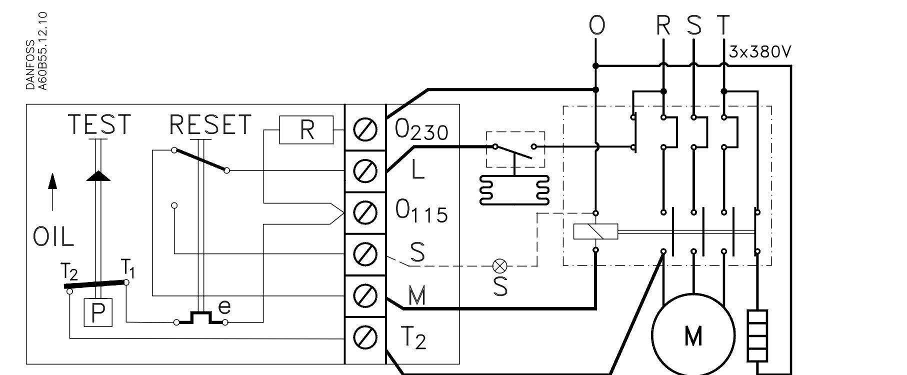
Contact differential
The pressure rise above the set differential pressure (scale reading) necessary to cut off current to the time relay.

Release time
The period for which the differential pressure control allows the compressor to run with too low an oil pressure during start-up and operation.

Function

If there is no oil pressure on starting, or if the oil pressure falls below the set pressure during operation, the compressor will stop after the release time has elapsed.
The electrical circuit is divided into two completely separate circuits, a safety circuit and an operational circuit.

The timer (e) in the safety circuit is activated when the effective lubricating oil pressure, *the oil differential pressure* (the difference between the oil pump pressure and suction pressure), is lower than the set value.
The timer is deactivated when the oil differential pressure is more than the set value plus the contact differential.

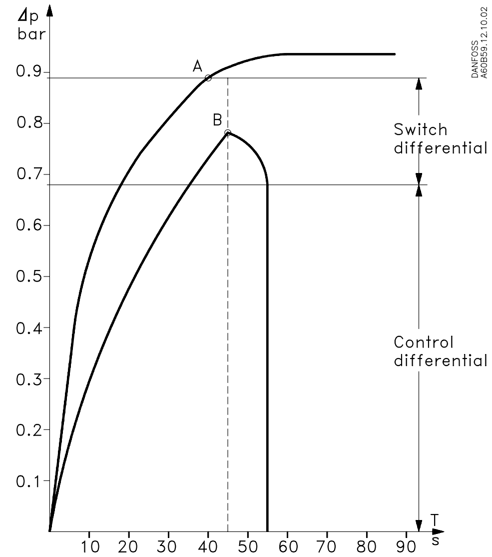


Electrical diagram

Function
(continued)

The two diagrams below explain the terms "oil differential pressure" and "contact differential", both have to be considered when using oil differential pressure controls.

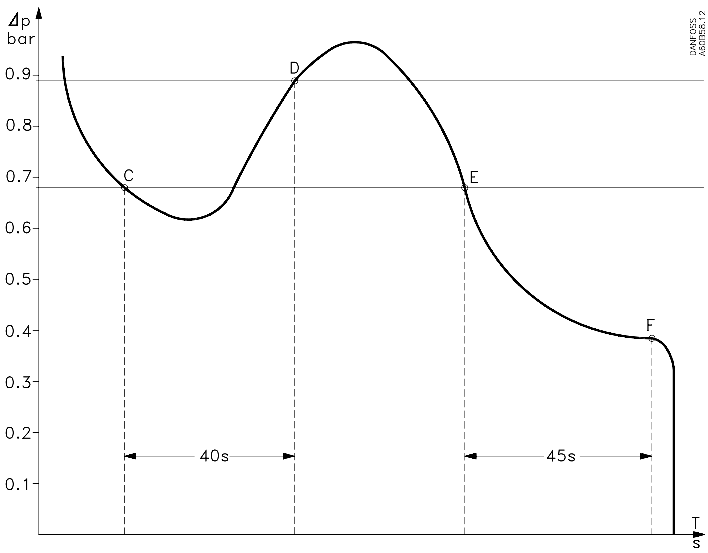
The first diagram shows the function of the differential control during start; the second shows the function of the control during operation.



On start-up

Pos. A: Normal start-up
The lubricating oil pressure is built up during start to the set/fixed differential plus the contact differential, before the timer cuts out (in this example, after 45 seconds).
At point A contacts T_1-T_2 open and timer (e) is stopped, i.e. normal
lubricating oil conditions for the compressor have been established.

Pos. B: *The lubricating oil pressure does not reach the set/fixed differential plus the contact differential before the timer period elapses. At point B the timer cuts out operational circuit L-M and the compressor stops.*
If a signal source is connected to terminal S, it will be activated. Restart can only be performed after about 2 minutes by activation of the reset button, provided the cause of the fault has been determined.



During operation

Pos. C: *The lubricating oil pressure falls during operation to a value lower than the set/fixed differential.*
At point C, safety circuit T_1-T_2 cuts in and the timer is activated.

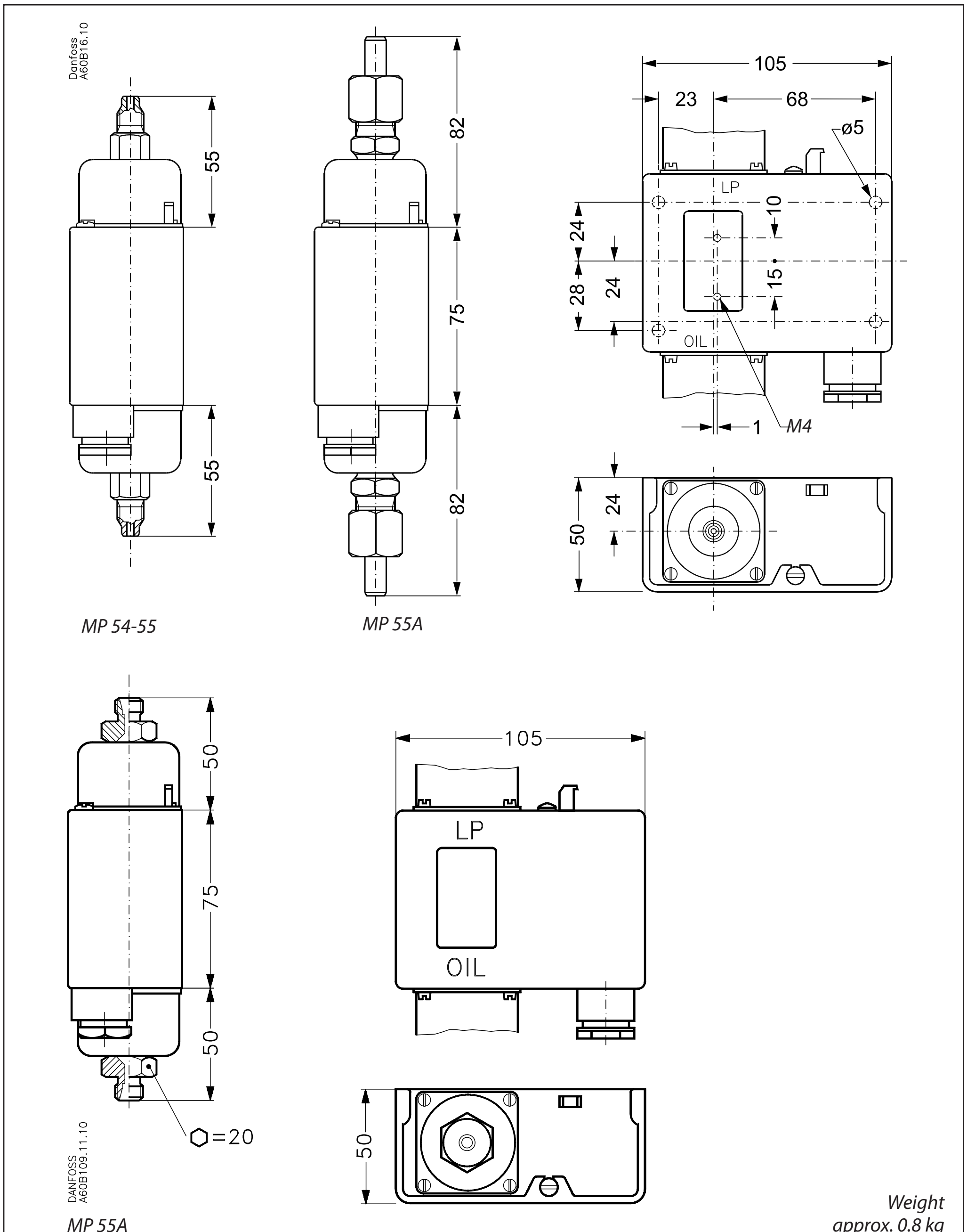
Pos. D: *The lubricating oil pressure reaches the set/fixed ifferential plus the contact differential before the timer period elapses.*
At point D, safety circuit T_1-T_2 cuts out and the timer is stopped, i.e. normal lubricating oil conditions for the compressor have been established.

Pos. E: *The lubricating oil pressure falls to a value lower than the set/fixed differential during operation.*
At point E, safety circuit T_1-T_2 cuts in and the timer is activated.

Pos. F: *The lubricating oil pressure remains lower than the set/fixed differential. At point F the timer cuts out operational circuit L-M and the compressor stops.*
If a signal source is connected to terminal S, it will be activated. Restart can only be performed after about 2
minutes by activation of the reset button, provided the cause of the fault has been determined.

After start-up
It is important that a function check should be made to ensure that the differential pressure control is operating as it should.
This check can be made by pressing the test device (inside the unit on the left hand side).
When the test device is pressed down and held in this position the compressor motor should stop after the release time determined by the time relay has elapsed.

Dimensions and weight



Weight approx. 0.8 kg

Introduction

KP pressure controls are for use in refrigeration and air conditioning systems to give protection against excessively low suction pressure or excessively high discharge pressure.
KP pressure controls are also used for starting and stopping refrigeration compressors and fans on air-cooled condensers.
KP pressure controls are fitted with a single-pole double-throw (SPDT) switch. The position of the switch is determined by the pressure control setting and the pressure at the connector.
KP pressure controls are available in IP 30 and IP 44 enclosures.

Features

- Ultra-short bounce times
- Reduces wear to a minimum and increases reliability.
- Manual control
- Electrical contact function can be tested without the use of tools.
- KP 2 with low differential for low-pressure regulation
- KP 6 for HP refrigerants (R 410A, CO_2)
- KP 6, 7 and 17 with fail-safe bellows element
- Vibration and shock resistant
- Compact design
- Fully welded bellows element
- High reliability both electronically and mechanically.

Approvals

CE-marked in accordance with LVD 73/23/EC and EN 60947-4-5 for sale in Europe.

KP 1, 2, 6, 7 and KP 17: CE marked in accordance with PED 97/23/EC, category IV, safety equipment and EN 12263, DIN 32733

Germanischer Lloyd, Germany

UL approval for USA and Canada

DNV, Det Norske Veritas, Norway

RINA, Registro Italiano Navale, Italy

BV, Bureau Veritas, France

LR, Lloyd's Register, UK

RMRS, Russian Maritime Register of Shipping, Russia

CCC, China Compulsory Certificate

Materials in contact with the medium

Unit type	Material
KP 1, 2, 5, 6, 7, 15 and 17	Tinbronze, no. 2.1020 to DIN 17662 Free cutting steel, no. 1.0737 / 1.0718 to DIN 1651
KP 1A, 5A, 6, 7A and 15A only	Stainless steel 18/8, no. 1.0737 / 1.0718 to DIN 17440 Free cutting steel, no. 1.0719 to DIN 1651 Steel, no. 1.0330 to DIN 1624 Aluminium, no. 3.0255 to DIN 1712

The complete technical leaflet (DKRCC.PD.CD0.A) can be downloaded from the Danfoss web site.

Technical data

Ambient temperature
–40 → +65°C (+80°C for max. 2 hours).

DIN-approved units:
–25 → +65°C (+80°C for max. 2 hours).

Max. working pressure
LP: PB = 17 bar
HP: PB = 35 bar
KP 6: PB = 46.5 bar

Max. test pressure
LP: p’ = 20 bar
HP: p’ = 35 bar
KP 6: p' = 46.5 bar

Contact load
Alternating current:
AC1: 16 A, 400 V
AC3: 16 A, 400 V
AC15: 10 A, 400 V
Max. starting current (L.R.): 112 A, 400 V

Direct current:
DC13: 12 W, 220 V control current

Properties according to EN 60947:

Wire dimensions	
solid/stranded	0.75 - 2.5 mm²
flexible, w/out ferrules	0.7 - 2.5 mm²
flexible, with ferrules	0.5 - 1.5 mm²
Tightning torque	max. 2 NM
Rated impulse voltage	4 kV
Pollution degree	3
Short circuit protection, fuse	20 Amp
Insulation	400 V
IP	30/44

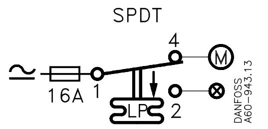
Cable connection
The cable entry can be used for 6 → 14 mm dia. cables.
A Pg 13.5 screwed cable entry can also be used for 6 → 14 mm cable. With 8 → 16 mm cable a standard Pg 16 screwed cable entry can be used.

Enclosure
IP 30 to EN 60529 / IEC 60529
Enclosure IP 30 is obtained when the units without top cover are mounted on a flat surface or bracket. The bracket must be fixed to the unit so that all unused holes are covered.

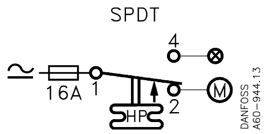
IP 44 to EN 60529 / IEC 60529
Enclosure IP 44 is obtained when the units with top cover are mounted on a flat surface or bracket. The bracket must be fixed to the unit so that all unused holes are covered.
KP pressure controls with auto reset are supplied with top cover. For KP pressure controls with manual reset, the top cover must be separately ordered.

IP 55 to EN 60529 / IEC 60529
IP 55 is obtained when the KP pressure controls are mounted in an IP 55 enclosure, **(code no. 060-033066** for single pressure controls and **code no. 060-035066** for dual pressure controls). IP 55 enclosure has to be ordered separately.

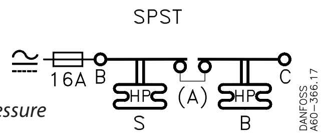
Contact systems



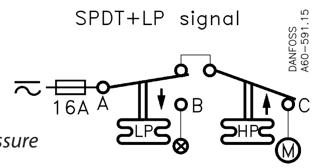
Low pressure (LP)



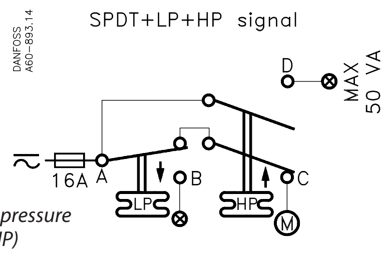
High pressure (HP)



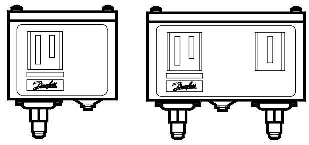
Dual pressure (HP/HP)



Dual pressure (LP/HP)



Dual pressure (LP/HP)



Ordering

Pressure	Type	Low pressure (LP) Regulating range bar	Low pressure (LP) Differential Δp bar	High pressure (HP) Regulating range bar	High pressure (HP) Differential Δp bar	Reset Low pressure LP	Reset High pressure HP	Contact system	Code no. ¼ in. 6 mm flare	Code no. ¼ in. ODF solder	Code no. 6 mm ODF solder
For fluorinated refrigerants											
Low	KP 1	–0.2 → 7.5	0.7 → 4.0			Aut.		SPDT	**060-110166[3]**	**060-111266[3]**	**060-111066[3]**
Low	KP 1	–0.2 → 7.5	0.7 → 4.0			Aut.			**060-114166[1][3]**		
Low	KP 1	–0.9 → 7.0	Fixed 0.7			Man.			**060-110366**	**060-111166**	**060-110966**
Low	KP 2	–0.2 → 5.0	0.4 → 1.5			Aut.			**060-112066[3]**		**060-112366[3]**
High	KP 5			8 → 32	1.8 → 6.0		Aut.		**060-117166[3]**	**060-117966[3]**	**060-117766[3]**
High	KP 5			8 → 32	Fixed 3		Man.		**060-117366**	**060-118066**	**060-117866**
Dual	KP 15	–0.2 → 7.5	0.7 → 4.0	8 → 32	Fixed 4	Aut.	Aut.	SPDT + LP signal	**060-124166[3]**	**060-125466[3]**	
Dual	KP 15	–0.2 → 7.5	0.7 → 4.0	8 → 32	Fixed 4	Aut.	Man.		**060-124366**		
Dual	KP 15	–0.2 → 7.5	0.7 → 4.0	8 → 32	Fixed 4	Aut.	Man.		**060-114866[1]**		
Dual	KP 15	–0.9 → 7.0	Fixed 0.7	8 → 32	Fixed 4	Man.	Man.		**060-124566**		
Dual	KP 15	–0.9 → 7.0	Fixed 0.7	8 → 32	Fixed 4	Conv.[2]	Conv.[2]		**060-126166**		
Dual	KP 15	–0.2 → 7.5	0.7 → 4.0	8 → 32	Fixed 4	Aut.	Aut.	SPDT + LP and HP signal	**060-126566[3]**	**060-129966[3]**	
Dual	KP 15	–0.2 → 7.5	0.7 → 4.0	8 → 32	Fixed 4	Aut.	Man.		**060-126466**	**060-128466**	
Dual	KP 15	–0.2 → 7.5	0.7 → 4.0	8 → 32	Fixed 4	Conv.[2]	Conv.[2]		**060-115466[3]**	**060-001066[3]**	
Dual	KP 15	–0.9 → 7.0	Fixed 0.7	8 → 32	Fixed 4	Conv.[2]	Conv.[2]		**060-122066**		

Pressure	Type	Low pressure (LP) Regulating range bar	Low pressure (LP) Differential Δp bar	High pressure (HP) Regulating range bar	High pressure (HP) Differential Δp bar	Reset LP/HP	Contact system	Code no. M10 × 0.75	Code no. 1 m cap. tube with M10 × 0.75
For fluorinated refrigerants and R 717 (NH_3)									
Low	KP 1A	–0.2 → 7.5	0.7 → 4.0			Aut.	SPDT	**060-116266**	**060-116066[3]**
Low	KP 1A	–0.9 → 7.0	Fixed 0.7			Man.			**060-116166**
High	KP 5A			8 → 32	1.8 → 6.0	Aut.			**060-123066[3]**
High	KP 5A			8 → 32	Fixed 3	Man.		**060-115366**	**060-123166**
Dual	KP 15A	–0.2 → 7.5	0.7 → 4.0	8 → 32	Fixed 4	Aut./Aut.	SPDT + LP and HP signal	**060-129566**	**060-129366[3]**
Dual	KP 15A	–0.2 → 7.5	0.7 → 4.0	8 → 32	Fixed 4	Aut./Man.		**060-129666**	**060-129466**
Dual	KP 15A	–0.9 → 7.0	Fixed 0.7	8 → 32	Fixed 4	Conv./Conv.[2]	SPDT LP signal		**060-128366**

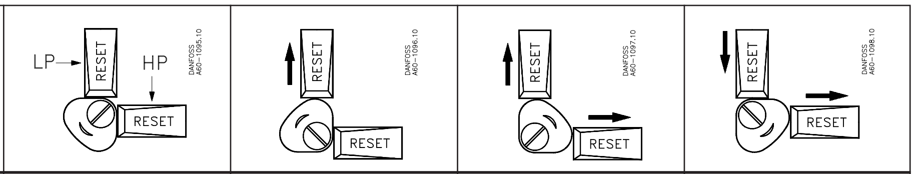
[1]) Pressure controls with gold-plated contacts
[2]) Conv.: optional automatic or manual reset
[3]) Enclosure IP 44

Accessories for KP pressure controls with M10 × 0.75 connections:
Weld connections: M10 × 0.75 nut and ∅6 × 150 mm seamless steel pipe, **code no. 060-005766**
Steel cap. tube: 1 m with 2 × M10 × 0.75 nuts, **code no. 060-007866**
Steel cap. tube: 1 m with 1 × M10 × 0.75 and G ³/₈ nut, **code no. 060-008266**
Adaptor: M 10 × 0.75 ¹/₄ to ¹/₈ NPT int. thread, **code no. 060-014166**
IP 55 enclosure for single pressure controls, **code no. 060-033066**
IP 55 enclosure for dual pressure controls, **code no. 060-035066**

For other accessories: see "Spare parts and accessories", RX5AB302

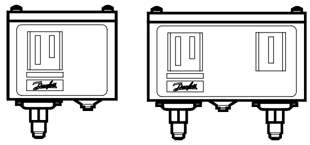
Ordering
(continued)

Pressure control setting with convertible reset



Low press.	Manual reset [1])	Automatic reset	Automatic reset	Manual reset
High press.	Manual reset [1])	Manual reset	Automatic reset	Automatic reset

[1]) Factory setting



Pressure controls with EN 12263 and DIN 32733 approval [1])

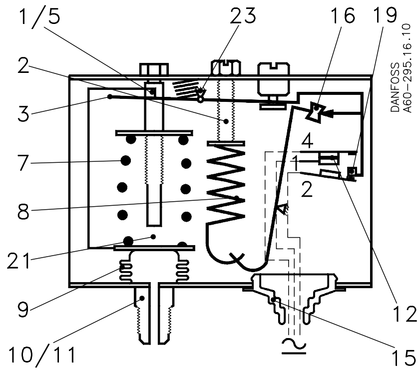
Pressure	Type [2])	Low pressure (LP) Regulating range bar	Low pressure (LP) Differential Δp bar	High pressure (HP) Regulating range bar	High pressure (HP) Differential Δp bar	Reset LP/HP	Contact system	Code no. 1/4 in. 6 mm flare	Code no. 6 mm ODF solder
For fluorinated refrigerants									
Low	KP 1	–0.2 → 7.5	0.7 → 4.0			Aut.	SPDT	**060-110166[3])**	**060-111066[3])**
Low	KP 1	–0.9 → 7	Fixed 0.7			Man.	SPDT	**060-110366**	**060-110966**
Low	KP 1	–0.5 → 3.0	Fixed 0.7			Aut.	SPDT		**060-111766**
Low	KP 2	–0.2 → 5	0.4 → 1.5			Aut.	SPDT	**060-112066[3])**	**060-112366[3])**
High	KP 6W			8 → 42	4 → 10	Aut.	SPDT	**060-519066[3])**	
High	KP 6B			8 → 42	Fixed 4	Man.	SPDT	**060-519166**	
High	KP 7W			8 → 32	4 → 10	Aut.	SPDT	**060-119066[3])**	**060-120366[3])**
High	KP 7B			8 → 32	Fixed 4	Man.	SPDT	**060-119166**	
High	KP 7S			8 → 32	Fixed 4	Man.	SPDT	**060-119266[3])**	
Dual	KP 7BS			8 → 32	Fixed 4	Man. / Man.	SPST	**060-120066**	
Dual	KP 17W	–0.2 → 7.5	0.7 → 4	8 → 32	Fixed 4	Aut. / Aut.	SPDT + LP and HP signal	**060-127566[3])**	**060-127666[3])**
Dual	KP 17W	–0.2 → 7.5	0.7 → 4	8 → 32	Fixed 4	Aut. / Aut.	SPDT	**060-126766[3])**	
Dual	KP 17B	–0.2 → 7.5	0.7 → 4	8 → 32	Fixed 4	Aut. / Man.	SPDT	**060-126866**	**060-127466**
Dual	KP 17WB	–0.2 → 7.5	0.7 → 4	8 → 32	Fixed 4	Aut./Conv.[5])	SPDT + LP and HP signal	**060-539766**[3])[4])	

Pressure controls with EN 12263 and DIN 32733 approval [1])

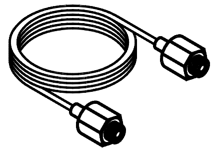
Pressure	Type [2])	Low pressure (LP) Regulating range bar	Low pressure (LP) Differential Δp bar	High pressure (HP) Regulating range bar	High pressure (HP) Differential Δp bar	Reset LP/HP	Contact system	Code no. M10 × 0.75	Code no. 1 m cap. tube with M10 × 0.75
For ammonia									
Low	KP 1A	-0.2 → 7.5	0.7→ 4.0			Aut.	SPDT	**060-116266**	**060-116066[3])**
Low	KP 1A	0.9 → 7	Fixed 0.7			Man.	SPDT		**060-116166**
High	KP 7ABS			8 → 32	Fixed 4	Man./Man.	SPST		**060-120566**

[1]) Meets the requirements in VBG 20 dealing with safety equipment and excess pressures.
KP 1, 2, 6, 7 and KP 17 are CE marked acc. to PED, Pressure Equipment Directive.
[2]) W = Wächter (pressostat), B = Begrenzer (pressure control with ext. reset), S = Sicherheitsdruckbegrenzer (pressure control with int. reset).
[3]) Enclosure IP 44
[4]) factory setting: LP side: Range 1 bar Pe, Diff. 1 bar; HP side: Range 18 bar Pe, Diff. 4 bar fixed
[5]) Conv.: optional automatic or manual reset

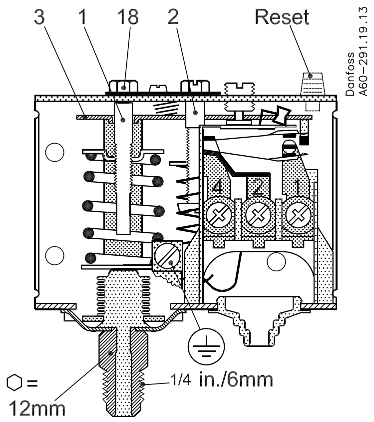
Design / Function



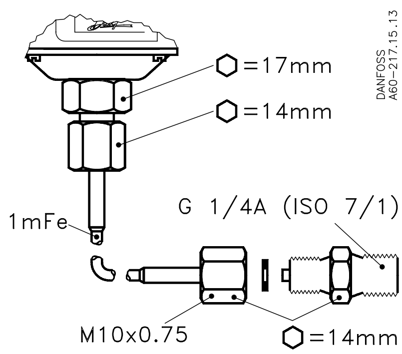
Key sketch of KP pressure control



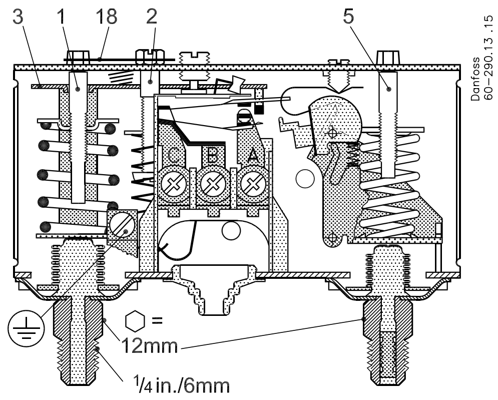
Capillary tube



KP 1



Capillary tube for KP 1A, 5A and 15A



KP 15

1. Low pressure (LP) setting spindle
2. Differential setting spindle, LP
3. Main arm
5. High pressure (HP) setting spindle
7. Main spring
8. Differential spring
9. Bellows
10. LP connection
11. HP connection
12. Switch
13. Terminals
14. Earth terminal
15. Cable entry
16. Tumbler
18. Locking plate
19. Arm
30. Reset button

The switch in the KP has a snap-action function and the bellows moves only when the cut-in or cut-out value is reached.

The bellows becomes connected to the low or high pressure side of the plant through connection (10) or (11).

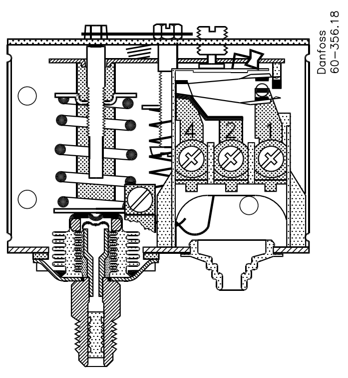
The design of the KP affords the following advantages:

- high contact load
- ultra-short bounce time
- high resistance to pulsation
- vibration resistance up to 4 g in the range 0-1000 Hz
- long mechanical and electrical life

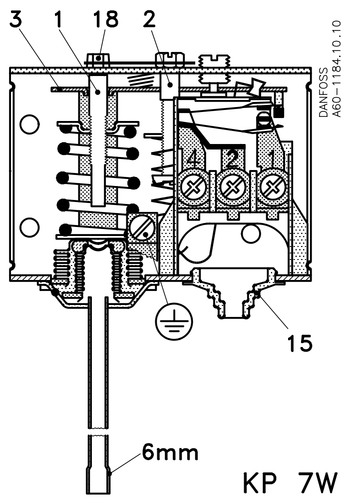
Design
(continued)

KP1, KP1A, KP2, KP6, KP6A, KP7 and KP17 units with designat-ion W, B or S have been tested and approved by TÜV, Rheinland in accordance with DIN 32733 and EN 12263
W = Wächter (pressure control)
B = Begrenzer
(pressure control with external reset)
S = Sicherheitsdruckbegrenzer
(pressure control with internal reset).

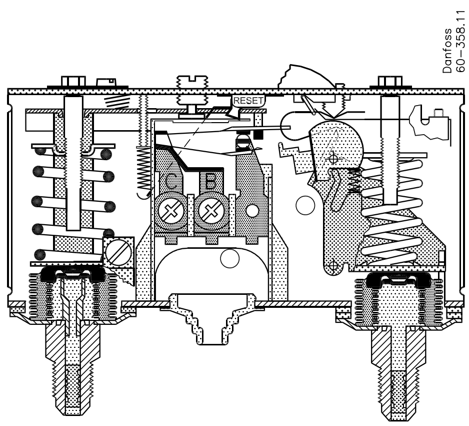
KP6, KP6A, KP7 and KP17 have a double bellows: an outer bellows and a regulating bellows. When system pressure exceeds the set value, the KP will automatically stop the plant. The double bellows system prevents loss of charge in the event of bellows rupture.
A rupture in the inner bellows will cause the control cut-out pressure to fall about 3 times less the set value, thus the refrigeration plant compressor will stop.
A rupture in the outer bellows will cause the control cut-out pressure to fall to about 3 bar under the set value, thus providing a fail-safe function.
Versions with designation W or AW cut in again automatically when the pressure has fallen to the set value minus the differential.
Versions with designation B or AB can be cut in manually with the external reset button when the pressure in KP1 has raised 0.7 bar above set value and in KP6 and KP7 has fallen 4 bar under the set value.
Versions with designation S or AS can be cut in manually with the internal reset arm when the pressure has fallen 4 bar under the set value.
All KP pressure controls, including those which are PED-approved, operate independently of changes in the ambient temperature around the control housing. Therefore the set cut-out pressure and differential are held constant provided the permissible ambient temperatures are not exceeded.



KP 7W, flare



KP 7W, solder



KP 7BS

1. Pressure setting spindle
2. Differential setting spindle
3. Main arm
5. Pressure setting spindle, DBK
15. Cable entry
18. Locking plate
19. Arm
25. Int. reset arm
30. Ext. reset button

Terminology

Reset
1. *Manual reset:*
   Units with manual reset can only be reset during operation by activation of the reset button.
2. *Automatic reset:*
   After operational stop, these units reset automatically.
3. *Convertible reset:*
   Units with optional reset can be activated by automatic and/or manual reset.

Permissible working pressure
The permissible working pressure is determined by the pressure that can be safely allowed in the refrigerating system or any of the units within it. The permissible working pressure is designated PB (Der zulässige Betriebsüberdruck).

Test pressure
The test pressure is the pressure used in strength tests and/or leakage tests on refrigerating systems or individual parts in systems. The test pressure is designated p'.

"Snap function"
A certain contact force is maintained until irrevocable "snap" is initiated. The time during which the contact force approaches zero is thus limited to a very few milliseconds. Therefore contact bounce cannot occur as a result of, for example, slight vibrations, before the cut-out point. Contact systems with "Snap function" will change over even when micro-welds are created between the contacts during cut-in. A very high force is created during cut-out to separate the contacts. This force immediately shears off all the welds. Thus the cut-out point of the unit remains very accurate and completely independent of the magnitude of the current load.

Setting

Pressure controls with automatic reset - LP:
Set the LP start pressure on the "CUT-IN" scale (range scale).
One rotation of the low pressure spindle ~ 0.7 bar.
Set the LP differential on the "DIFF" scale. One rotation of the differential spindle ~ 0.15 bar.
The LP stop pressure is the LP start pressure minus the differential.

Note:
The LP stop pressure must be above absolute vacuum ($p_e = -1$ bar)!

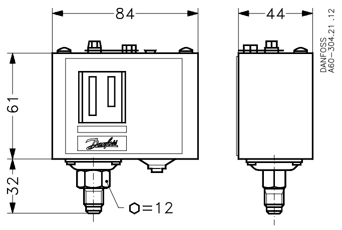
If with low stop pressure the refrigeration compressor will not stop, check to ensure that the differential value has not been set too high!

Pressure controls with automatic reset - HP:
Set the HP pressure on the "CUT-OUT" scale.
One rotation of the HP spindle ~ 2.3 bar.
Set the HP differential on the "DIFF" scale.
One rotation of the differential spindle ~ 0.3 bar.
The HP start pressure is the HP stop pressure minus the differential.
Start and stop pressures for both the LP and HP sides of the system should always be checked with an accurate pressure gauge.

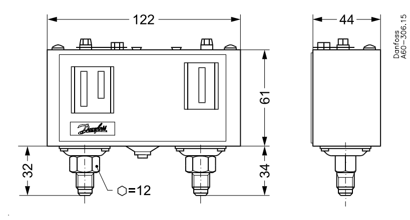
Pressure controls with manual reset
Set the stop pressure on "CUT-OUT" scale (range scale).
Low pressure controls can be manually reset when the pressure is equal to the stop pressure plus the differential.
High pressure controls can be manually reset when the pressure is equal to the stop pressure minus the differential.

Dimensions and weights

Flare connection

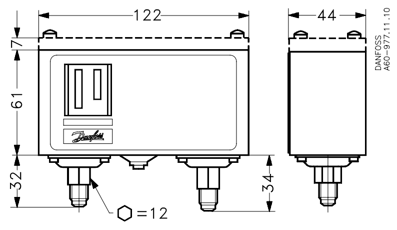


KP 1, 2, 5, 6, 7B, 7S and 7W

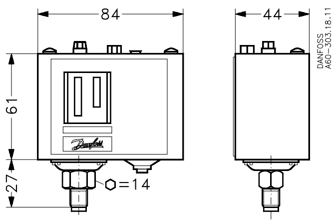


KP 15 and 17W

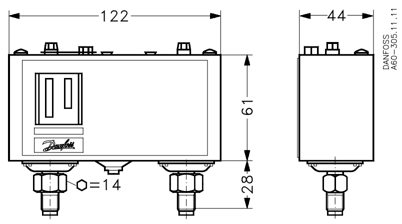
KP with top cover



M10 × 0.75 connection

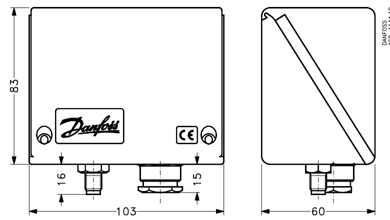


KP 1A, 2A and 5A

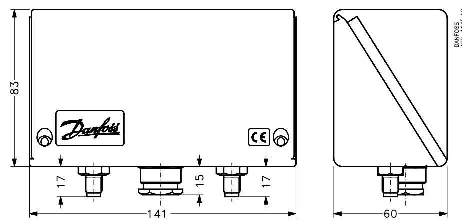


KP 15A, 7 AS and 7ABS

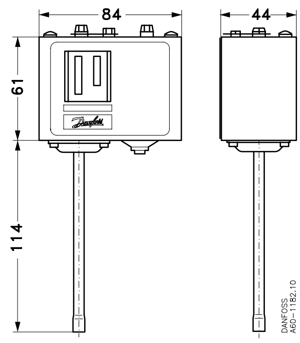
KP with IP 55 enclosure



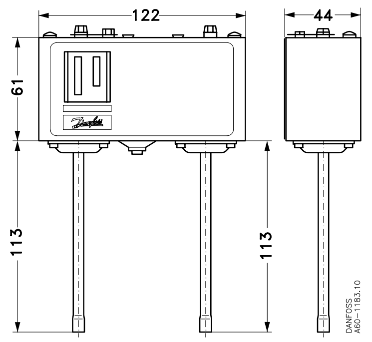
KP with IP 55 enclosure



Solder connection

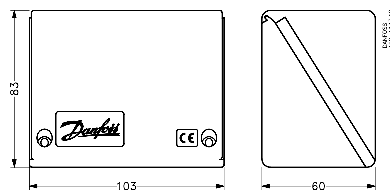


KP 1, 2, 5, 7B, 7S and 7W

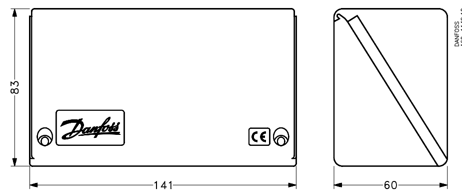


KP 15, 17W

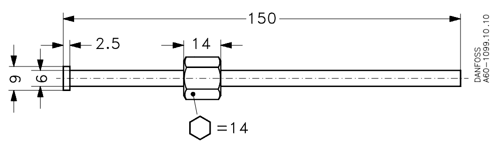
IP 55 enclosure



IP 55 enclosure



Weld nipple for KP-A



Weight
KP 1, 2, 5 and 7: approx. 0.3 kg
KP 15, 17 and 7BS: approx. 0.5 kg
KP 1A and 5A: approx. 0.3 kg
KP 15A and 7ABS: approx. 0.5 kg

Introduction

An RT pressure control contains a pressure operated single-pole changeover contact, the position of which depends on the pressure in the inlet connection and the set scale value.
The RT series includes pressure controls for general applications within industrial and marine refrigeration.
The RT series also includes differential pressure controls, pressure controls for neutral zone regulation, and special pressure controls with gold-plated contact surfaces for PLC applications.

Features

- Waterproof versions
- Wide regulating range
- Wide range of units for industrial and marine applications
- Suitable for alternating and direct current
- Interchangeable contact system
- Special versions for PLC applications

Technical data

Cable connection
Pg 13.5.
Cable diameter 6 → 14 mm

Enclosure
IP 66 to EN 60529 / IEC 529, except for versions with ext. reset which are to IP 54.

Ambient temperature
–50 to +70°C for pressure control housing.

Switches
See "Ordering, switches".

Properties according to EN 60947:

Wire dimensions	
solid/stranded	0.2 - 2.5 mm^2
flexible, w/out ferrules	0.2 - 2.5 mm^2
flexible, with ferrules	0.2 - 1.5 mm^2
Tightening torque	max. 1.5 NM
Rated impulse voltage	4 kV
Pollution degree	3
Short circuit protection, fuse	10 Amp
Insulation	400 V
IP	54/66

Approvals

RT 1	RT 1A	RT 1AL	RT 5A	RT 6W, 6B, 6S	RT 6AW, 6AB, 6AS	RT 30AW, 30AB, 30AS	RT 36B, 36S	RT 117	RT 117L	RT 200	RT 200L	RT 260A	RT 262A	
									•		•			Lloyd's Register of Shipping, UK
•				•		•		•		•				Germanischer Lloyd, Germany
							•							Vd TÜV, Germany
								•		•				Det norske Veritas, Norway
								•		•				Bureau Veritas, France
•	•							•		•		•	•	RINA, Registro Italiano Navale, Italy
•	•	•	•	•	•	•	•	•	•	•	•	•	•	RMRS, Russian Maritime Register of Shipping
				•	•	•	•							DIN CERTCO, Germany
•	•		•					•		•				NKK, Japan
						•		•		•				Korean Register of Shipping
•	•	•	•	•	•	•	•	•	•	•	•	•	•	CE marked according to 60947-4, -5
				•	•	•	•							CE marked acc. to PED 97/23/EC category IV, safety equipm.
•	•	•	•	•	•	•	•	•	•	•	•	•	•	CCC, China Compulsory Certificate

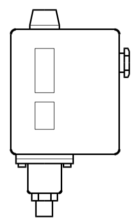
Electromechanical controls

The complete technical leaflet (DKRCC.PD.CB0.A) can be downloaded from the Danfoss web site.

Materials in contact with the medium

Type	Material	W. no.	To DIN	Comments
RT 117, RT 117L RT 200, RT 200L	Stainless steel 18/8 Stainless steel 17/7 Brass Brass	1.4306 1.4568 2.0402 2.0321	17440 17224 1782 17660	
RT 1A, RT 1AL RT 5A, RT 5AL RT 260A, RT 262A RT 265A	Stainless steel 18/8 Plain carbon steel Deep drawing steel Plain carbon steel Case-hardened steel Aluminium	1.4306 1.0338 1.0402 1.0401 3.0255	17440 17223 1624 1652 17210 1712	 Zinc plated, passivated (RT 1A, RT 1AL only) Nickel-plated, tinned Zinc plated, passivated Nickel-plated
RT 1	Stainless steel 18/8 Plain carbon steel Deep drawing steel	1.4306 1.0338	17440 17223 1624	 Zinc plated, passivated (RT 1 only) Nickel-plated, tinned
RT 6W, 6B, 6S RT 6AW, 6AB, 6AS	Stainless steel 18/8 Deep drawing steel Case-hardened steel Free-cutting steel Plain carbon steel Aluminium	1.4306 1.0338 1.1141 1.0718 1.0402 3.0255	17440 1624 1652 1651 1652 1712	 Nickel-plated, tinned Nickel-plated Nickel-plated Zinc plated, passivated (RT 6AW, 6AB, 6AS only) (RT 6AW, 6AB, 6AS)
RT 30AW, 30AB, 30AS RT 36B, 36S	Stainless steel 18/8 Stainless steel 17/7 Deep drawing steel Stainless steel 18/8 STW 22 Free-cutting steel	1.4306 1.4568 1.0338 1.4305 1.0332 1.0718	17440 17224 1624 17440 1614 1651	 Nickel-plated, tinned Nickel-plated Nickel-plated

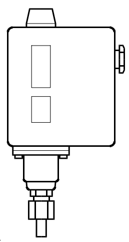
Ordering



Pressure controls for fluorinated refrigerants

Pressure	Type	Regulation range bar	Differential Δp bar	Reset	Max. working pressure PB bar	Max. test pressure p´ bar	**Code no.** Connection 1/4 in. / 6mm flare	 G 3/8 A [1])
Low	RT 1	– 0.8 → 5	0.5 → 1.6	aut.	22	25	**017-524566**	
		– 0.8 → 5	fixed 0.5	man.	22	25	**017-524666**	
	RT 200	0.2 → 6	0.25 → 1.2	aut.	22	25		**017-523766**
High	RT 117	10 → 30	1 → 4	aut.	42	47		**017-529566**

[1]) BSP ext. thread, ISO 228/1.



Safety - Pressure controls for R 717 (NH_3) and fluorinated refrigerants

Pressure	Type	Regulation range bar	Differential Δp bar	Reset	Max. working Pressure PB bar	Max. test pressure p´ bar	**Code no.** Connection Cutting ring ∅ 6 mm	 G 3/8 A [1]) + weld nipple ∅ 6.5/10 mm
Low	RT 1A	– 0.8 → 5	0.5 → 1.6	aut.	22	25	**017-501966**	**017-500166**
		– 0.8 → 5	fixed 0.5	man.	22	25	**017-502766**	**017-500266**
		– 0.8 → 5	1.3 → 2.4	aut.	22	25		**017-500766**
High	RT 5A	4 → 17	1.2 → 4	aut.	22	25	**017-505266**	**017-504666**
		4 → 17	fixed 1.2	man.	22	25	**017-506166**	**017-504766**

[1]) BSP ext. thread, ISO 228/1.

Ordering
(continued)

*) Meets the requirements in VBG 20 on safety equipment and excess pressures.
W = Wächter (pressure control).
B = Begrenzer (pressure control with external reset).
S = Sicherheitsdruckbegrenzer (pressure control with internal reset).
A rupture in the bellows system of the unit will cause the compressor to stop.

Safety pressure controls w EN 12263 / DIN 32733 appr. and CE marked acc. PED, Pressure Equipment Directive)*

Pressure	Type	Regulation range bar	Differential (fixed) Δp bar	Reset	Max. working pressure PB bar	Max. test pressure p´ bar	Code no. Connection 1/4 in./ 6 mm flare	Cutting ring ∅6 mm	G 3/8 A [1] + weld nipple ∅6.5/10 mm	G 1/2 A [1]
High	RT 36B[2]	0 → 2.5	max. 0.2	man.	22	25	**017-525866**			
	RT 36S[2]	0 → 2.5	max. 0.2	man.	22	25	**017-525966**			
High	RT 6W[2]	5 → 25	2.0 - 3.0	aut.	34	38	**017-503166**			
	RT 6B[2]	10 → 28	max. 1.0	man.	34	38	**017-503466**			
	RT 6S[2]	10 → 28	max. 1.0	man.	34	38	**017-507566**			
High	RT 30AW[3]	1 → 10	0.2 - 0.8	aut.	22	25				**017-518766**
	RT 30AB[3]	1 → 10	max. 0.4	man.	22	25				**017-518866**
	RT 30AS[3]	1 → 10	max. 0.4	man.	22	25				**017-518966**
High	RT 6AW[3]	5 → 25	2.0 - 3.0	aut.	34	38		**017-513166**	**017-503266**	
	RT 6AB[3]	10 → 28	max. 1.5	man.	34	38		**017-513366**	**017-503566**	
	RT 6AS[3]	10 → 28	max. 1.5	man.	34	38		**017-514666**	**017-507666**	

[1] BSP ext. thread, ISO 228/1.
[2] Pressure controls for fluorinated refrigerants.
[3] Pressure controls for R 717 (NH3) and fluorinated refrigerants

Pressure controls with adjustable dead zone for R 717(NH_3) and fluorinated refrigerants

Pressure	Type	Regulation range bar	Differential Δp bar	Dead zone NZ Δp bar	Max. working pressure PB bar	Max. test pressure p´ bar	Code no. Connection Cutting ring ∅ 6 mm	G 3/8 A [1] + weld nipple ∅6.5/10 mm
Low	RT 1AL[2]	– 0.8 → 5	fixed 0.2	0.2 → 0.9	22	25	**017L001666**	**017L003366**
	RT 200L[3]	0.2 → 6	fixed 0.25	0.25 → 0.7	22	25		**017L003266**
High	RT 5AL[2]	4 → 17	fixed 0.35	0.35 → 1.4	22	25	**017L001766**[4]	**017L004066**[4]
	RT 117L[3]	10 → 30	fixed 1.0	1 → 3.0	42	47		**017L004266**[4]

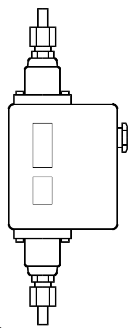
[1] BSP ext thread, ISO 228/1.
[2] Pressure controls for (R 717 NH_3) and fluorinated refrigerants
[3] Pressure controls for fluorinated refrigerants
[4] Without nipple

Electromechanical controls

Differential pressure controls for R 717(NH_3) and fluorinated refrigerants

Type	Regulation range bar	Differential Δp bar	Operating range for LP bellows bar	Max. working pressure PB bar	Max. test pressure p' bar	Code no. Connection Cutting ring ∅ 6 mm	G 3/8 A [1] + weld nipple ∅ 6.5/10 mm
RT 260A	0.5 → 4	fixed 0.3	– 1 → 18	22	25	**017D001466**	**017D002166**
	0.5 → 4	fixed 0.3	– 1 → 18	22	25		**017D002266**[2]
	0.5 → 6	fixed 0.5	– 1 → 36	42	47	**017D001566**	**017D002366**
	1.5 → 11	fixed 0.5	– 1 → 31	42	47	**017D001666**	**017D002466**
RT 252A	0.1 → 1.5	fixed 0.1	– 1 → 9	22	13	**017D001366**	**017D002566**
RT 265A[3]	1 → 6	fixed 0.5	– 1 → 36	42	47		**017D007266**

[1] BSP ext thread, ISO 228/1.
[2] Man. reset.
[3] Filter monitor: Alarm Δp = 0.8 bar, cut-out Δp = 1 bar (factory setting).



Differential pressure controls with adjustable dead zone for R 717(NH_3) and fluorinated refrigerants

Type	Regulation range bar	Differential Δp bar	Dead zone NZ bar	Operating range for LP bellows bar	Max. working pressure PB bar	Max. test pressure p´ bar	Code no. Connection G 1/2 A [1] + Weld nipple ∅ 6.5/10 mm
RT 262 AL	0.1 → 1.5	Fixed 0.1	0.1 → 0.33	–1 → 9	11	13	**017D004366** [2]

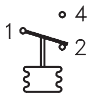
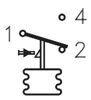
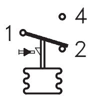
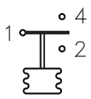
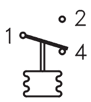
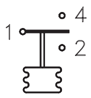
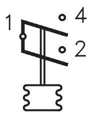
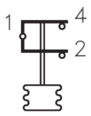
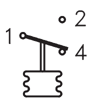
[1] BSP ext thread, ISO 228/1.
[2] Differential pressure control for R 717 (NH_3) and fluorinated refrigerants.

Ordering
(continued)

Special versions
RT can be supplied with special switches as follows.

When ordering, please state:
1. Type
2. Code no. of standard unit
3. Code no. of special switch

Switches ¹)

Version	Symbol	Description	Contact load	**Code no.**
Standard	 SPDT	Single-pole changeover switch with terminal board proof against leakage current Fitted in all standard versions of type RT. Snap action changeover contacts.	Alternating current ²) *Ohmic:* AC 1 = 10 A, 400 V *Inductive:* AC 3 = 4 A, 400 V AC 15 = 3 A, 400 V *Direct current* DC 13 = 12 W, 220 V	**017-403066**
With man. reset	 SPDT	For manual reset of unit after contact changeover on rising pressure. For HP units prepared for reset facility.		**017-404266** with man. reset
With man. reset	 SPDT	For manual reset of unit after contact changeover on falling pressure. For LP-units prepared for reset facility.		**017-404166** with man. reset
With dead zone	 SPDT	Single-pole changover switch with dead zone and terminal board proof against leakage current.		Available only as a component part of RT controls with adjustable dead zone
Standard	 SPDT	Single-pole changeover switch with gold plated (oxide-free) contact surfaces. Increases cut-in reliability on alarm and monitoring systems, etc. Snap action changeover contacts. Terminal board proof against leakage current.	Alternating current ²) *Ohmic:* AC 1 = 10 A, 400 V *Inductive:* AC 3 = 2 A, 400 V AC 15 = 1 A, 400 V *Direct current* DC 13 = 12 W, 220 V	**017-424066**
With dead zone	 SPDT	Single-pole changeover switch with dead zone and gold plated (oxide-free) contact surfaces. Increases cut-in reliability on alarm and monitoring systems, etc. Snap action changeover contacts. Terminal board proof against leakage current.		Available only as a component part of RT controls with adjustable dead zone
Cuts in two circuits simultaneously	 SPDT	Single-pole changeover switch that cuts in two circuits simultaneously on rising pressure. Snap action changeover contacts. Terminal board proof against leakage current.	Alternating current ²) *Ohmic:* AC 1 = 10 A, 400 V *Inductive:* AC 3 = 3 A, 400 V AC 15 = 1 A, 400 V *Direct current* DC 13 = 12 W, 220 V ³)	**017-403466**
Cuts out two circuits simultaneously	 SPDT	Single-pole changeover switch that cuts out two circuits simultaneously on rising pressure. Snap action changeover contacts. Terminal board proof against leakage current.		**017-403666**
With non-snap action changeover contacts	 SPDT	Single-pole changeover switch with non-snap action changeover contacts.	*Alternating or direct current* 25 VA, 24 V	**017-018166**

¹) RT pressure controls meet the conditions of EN 60947-2-9.
²) Max. starting current (L.R.) = 7 × AC 3.
³) If current is led through the contacts 2 and 4, i.e. terminals and 4 connected but not terminal 1, the max. permissible load is increased by 90 W, 220V.

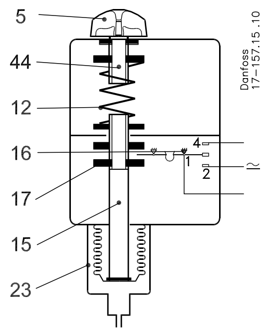
The switches are shown in the position they assume on falling pressure, i.e. after downward movement of the RT main spindle.

The setting pointer of the control shows the scale value at which contact changeover occurs on falling pressure. An exception is RT with switch **code no. 017-404266** with Man. reset, where the setting pointer shows the scale value at which contact changeover occurs on rising pressure.

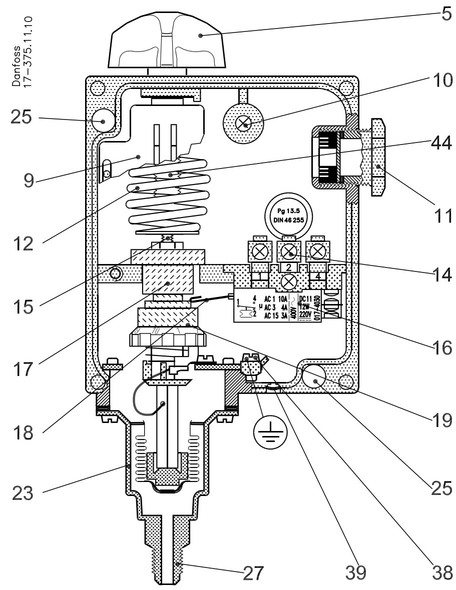
Design
Function

5. Setting knob
9. Regulation range scale
10. Loop terminal
11. Pg 13.5 screwed cable entry
12. Main spring
14. Terminals
15. Main spindle
16. Switch
17. Guide bush
18. Contact arm
19. Differential setting nut
23. Bellows element
25. Fixing hole
27. Connection
38. Earth terminal
39. Blow-out disc
44. Pressure setting spindle

Pressure control type RT



Key sketch RT pressure control



RT pressure control

The bellows in the RT pressure control is connected to the low or high pressure side of the controlled system via the connection.
By turning the setting knob (5) the main spring (12) can be set to balance the pressure in the bellows.
A rise in pressure compresses the bellows and moves the main spindle (15) upwards until spring and bellows pressure are in equilibrium. The main spindle (15) is fitted with a guide bush (17) and a differential pressure setting nut (19) that together transfer the main spindle movement to the switch (16).

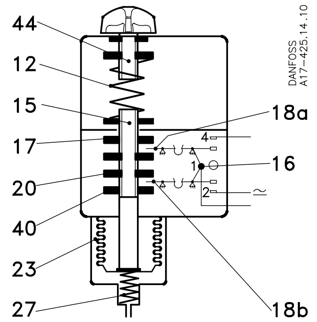
The RT 6W, 6B, 6S, RT 6AW, 6AB, 6AS, RT 30AW, 30AB, 30AS, RT 36B, 36S are equipped with a double bellows (an outer bellows and a regulating bellows).
These units have been tested and approved by TÜV (Technischer Überwachungs Verein, Germany) according to EN 12263 / DIN 32733.
W = Wächter (pressure controls)
B = Begrenzer
(pressure controls with external reset)
S = Sicherheitsdruckbegrenzer
(pressure controls with internal reset).

General for EN 12263 / DIN 327333 approved units
1. The units are equipped with a double bellows system. When pressure in the plant exceeds the set value, the unit will automatically stop the plant.
The double bellows system prevents loss of system charge in the event of bellows rupture.
2. Versions with designation W or AW cut in again automatically when the pressure has fallen to the set value minus the differential.
3. Versions with designation B or AB are cut in manually with the external reset button. This is possible when the pressure has fallen by a value corresponding to the differential under the set value.
4. Versions with designation S or AS can be cut in manually with the internal reset arm when the pressure has fallen by a value corresponding to the differential under the set value.

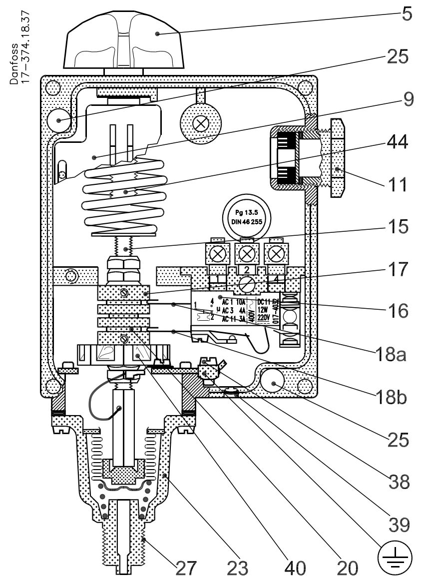
As laid down by EN 12263 / DIN 32733 requirements, if a rupture occurs in the regulating bellows of the unit the refrigerating system compressor will be stopped and can only be restarted when the pressure control has been replaced.
A rupture in the outer bellows will cause the cut-out pressure of RT 36 to fall 2.5 bar, and the cut-out pressure of RT 6 and RT 30 to fall 4.5 bar under the set value.
This means that the unit cuts out at normal condensing pressure and thus provides a fail-safe function.
All RT pressure controls, including those which are EN 12263 / DIN 32733 approved, operate independently of changes in the ambient temperature around the control housing.
Therefore the set cut-out pressure and differential are held constant provided the permissible ambient temperatures are not exceeded.

Design
Function
(continued)

Pressure control with dead zone, type RT L



Key sketch RT L pressure control

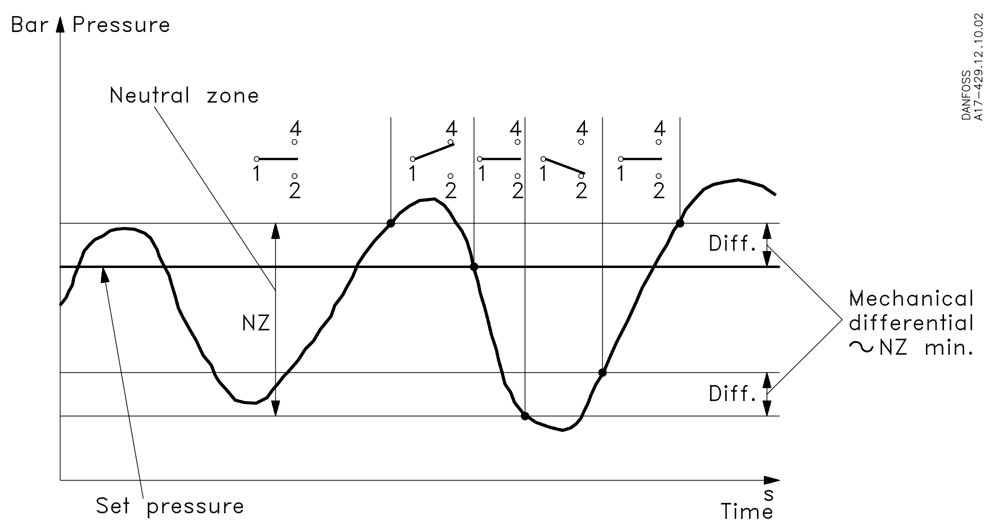


RT L pressure control

5. Setting knob
9. Regulation range scale
11. Pg 13.5 screwed cable entry
12. Main spring
15. Main spindle
16. Switch
17. Upper guide bush
18. 18a, 18b. Contact arm
20. Lower guide bush
23. Bellows element
25. Fixing hole
27. Connection
38. Earth terminal
39. Blow-out disc
40. Neutral zone setting nut
44. Pressure setting spindle

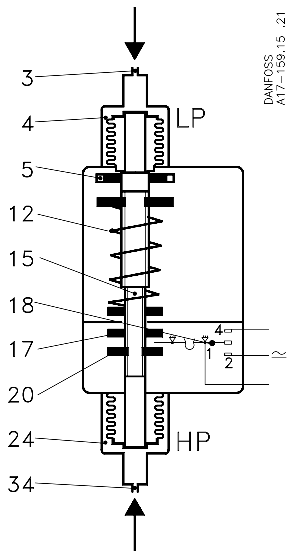
RT L pressure controls are fitted with a switch (17-4032) with an adjustable neutral zone. This enables the units to be used for floating control. The neutral zone switch contact arms (18a) and (18b) are operated by the spindle guide bushes (17) and (20).

The upper guide bush (17) is Fixed while the lower guide bush (20) can be moved up or down by the setting nut (40). In this way the neutral zone can be varied between a minimum value (equal to the mechanical differential of the unit) and a maximum value (depending on the type of RT unit).

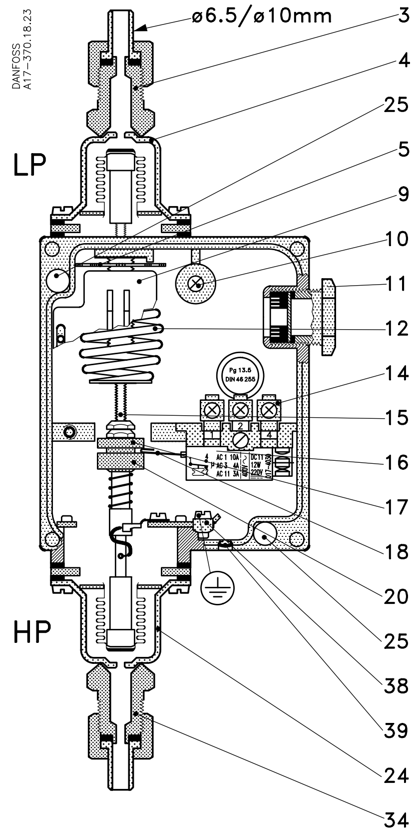


Design
Function
(continued)

Differential pressure control, type RT



Key sketch RT differential pressure control



RT differential pressure control

3. LP connection
4. LP bellows element
5. Setting disc
9. Regulation range scale
10. Coil clamp
11. Pg 13.5 screwed cable entry
12. Main spring
14. Terminals
15. Main spindle
16. Switch
17. Upper guide bush
18. Contact arm
20. Lower guide bush
24. HP bellows element
25. Fixing hole
34. HP connection
38. Earth terminal
39. Blow-out disc

An RT differential pressure control contains a single-pole changeover switch that makes or breaks depending on the pressure differential between two counteracting bellows elements (LP and HP).

Differential pressure controls are used primarily as protection against too low a differential pressure across liquid circulation pumps.
A secondary application is the safeguarding of lubricating oil pressure in refrigeration compressors.

The function of the pressure control is conditional only on the differential pressure, i.e. the difference in pressure between the two counteracting bellows, whereas it is independent of the absolute pressure on both bellows.
The bellows (4) and (24) are respectively connected to the LP port (lowest pressure) and the HP port (highest pressure).
The main spring (12) can be set for different differential pressures by the setting disc (5).

If the differential pressure between highest and lowest pressures falls, the spindle (15) moves downwards and via the upper guide bush (17) actuates the switch contact arm (18).
The reverse function occurs if the differential pressure rises.

For RT 260A controls used on screw compressors the following applies [1])

1. Max. pressure in low pressure bellows ~ condensing pressure = 21 bar.
2. Max. pressure in high pressure bellows ~ lubricating oil pressure = 24 bar.
3. Differential between condensing pressure and lubricating oil pressure must not exceed 3 bar.
4. Pressure change in the low and high pressure bellows from start to normal operation must not exceed 8 bar.

[1]) Since the operating conditions given, are out side the operating range of the unit, the life of the bellows will be reduced to approx. 10 000 operations as against approx. the normal 400 000.

Electromechanical controls

Terminology

Floating control
A form of delayed control where the correcting element (e.g. valve, damper, or similar) moves towards one extreme position at a rate independent of the magnitude of the error when the error exceeds a definite positive value, and towards the opposite extreme position when the error exceeds a definite negative value.

Hunting
Periodic variations of the controlled variable from the Fixed reference.

Neutral zone
The interval between the make points of the two contacts.

"Snap function"
A certain contact force is maintained until irrevocable "snap" is initiated. The time during which the contact force approaches zero is thus limited to a very few milliseconds. Therefore contact bounce cannot occur as a result of, for example, slight vibrations, before the cut-out point.
Contact systems with "Snap function" will change over even when micro-welds are created between the contacts during cut-in. A very high force is created during cut-out to separate the contacts. This force immediately shears off all the welds. Thus the cut-out point of the unit remains very accurate and completely independent of the magnitude of the current load.

Setting

RT with automatic reset - LP
The knob is used to set the lowest pressure at which the contact system must be activated (cut-out or cut-in).
This value can be read on the main scale of the unit.
The differential roller must be used to set the differential.
Highest activating pressure = lowest activating pressure + set differential.

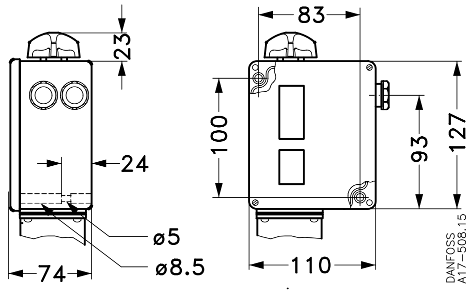
RT with manual reset - LP
RT pressure controls RT 1 and RT 1A are obtainable in versions with min. reset. When the pressure falls to the setting value the pressure control cuts out.
Manual reset becomes possible when the pressure in the bellows system has risen to a value corresponding to the set value + the differential.
On falling pressure the follower activates the contact system arm and the contact changes over.
The scale is calibrated so that the scale value corresponds to contact changeover on falling pressure.

RT with automatic reset - HP
The knob can be used to set the lowest pressure at which the contact system must be activated (cut-out or cut-in).
This value can be read on the main scale of the unit.
The differential must be set with the differential roller. Highest activating pressure = lowest activating pressure + set differential.

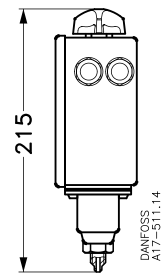
RT with manual reset - HP
Pressure control RT 5A is obtainable with max. reset. When the pressure has risen to the set value the pressure control cuts out.
Manual reset only becomes possible when the pressure has fallen to a value corresponding to the set pressure minus the differential.
The differential roller is then used as a follower.
On rising pressure the differential roller activates the contact system arm and the contact changes over.
The scale is calibrated so that the scale values correspond to contact changeover on rising pressure, which is opposite to RT units with automatic reset.

Dimensions and weight

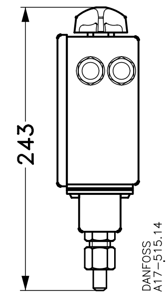
Weight approx. 1 kg



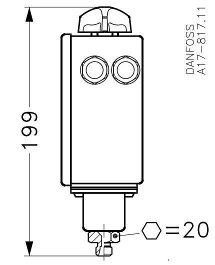
RT pressure control housing



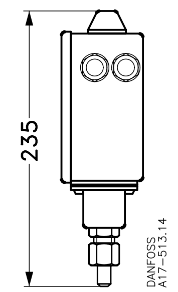
RT 1



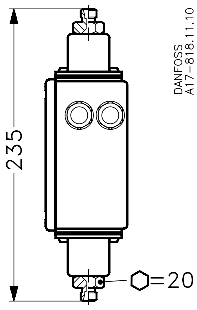
RT 1A, 1AL



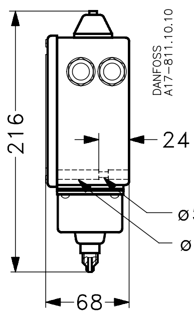
RT 1A, 1AL



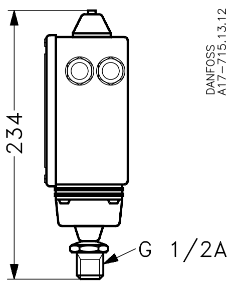
RT 6A



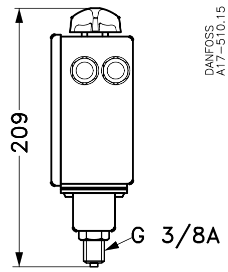
RT 6A



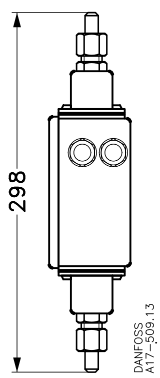
RT 6, 36



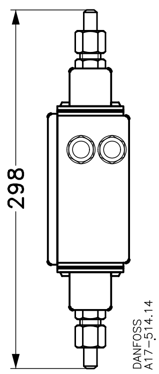
RT 30A



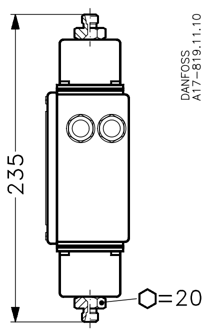
RT 117, 117L, 200, 200L



RT 260A



RT 262A



RT 260A, 262A

Electromechanical controls

Introduction

SFA 15 are standard, **back pressure dependent** safety relief valves in angle-way execution, specially designed for protection of vessels and other components against excessive pressure.

The valve is designed to meet the strict quality demands and safety requirements for refrigeration installations, specified by the international classification societies.

The valve is recommended as an external and internal safety relief valve in refrigeration plants. The spring housing is closed tightly to avoid refrigerant leakage.

The inlet flow diameters of the valves are:
- 13 mm (½ in.) for SFA 15

The valves can be delivered with set pressures between 10 and 40 bar g (145 and 580 psi g).

Standard pressure setting valves having "TÜV Pressure Setting Certificate" with each valve, are also available.

Features

- Applicable for the refrigerants R717 (ammonia, NH_3), HFC, HCFC (e.g. R22, R134a, R404A) and other refrigerants (dependent on sealing materials compatibility) within a temperature range of –30°C/+100°C (–22°F/+212°F).
- Classification: To get an updated list of certification on the products please contact your local Danfoss Sales Company.

The complete technical leaflet (DKRCI.PD.IF0.A) can be downloaded from the Danfoss web site.

Technical data

- Refrigerants
  Applicable for the refrigerants R717 (ammonia, NH_3), HFC, HCFC (e.g. R22, R134a, R404A) and other refrigerants dependent on sealing material compatibility within a temperature range of –30°C/+100°C (–22°F/+212°F). Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.
- Pressure
  Pressure setting range: 10 - 40 bar g (145 - 580 psi g). For further information please contact your local Danfoss Sales Company.

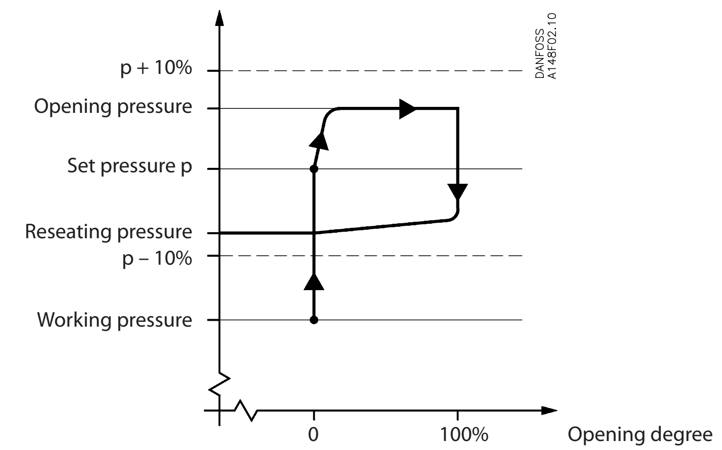
  Important: The SFA safety relief valve is dependent on the back pressure (if the back pressure is higher than the atmospheric pressure, the opening pressure will be higher than stated set pressure).
  Special circumstances such as vibrations (which should be avoided) and oscillating pressure may require an increased difference between the operational pressure and the closing pressure.
- Pressure setting
  The operating pressure of the plant should be at least 15% below the set pressure. This allows a perfect re-seating of the safety relief valve after having been activated.
- Temperature range
  –30/+100°C (–22/+212°F)

Pressure Equipment Directive (PED)
The SFA valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction

CE

SFA valves	
Nominal bore	13 mm (0.512 in.)
Classified for	Fluid group I
Category	IV

Design



SFA is designed as a **standard safety relief valve** (DIN 3320), which is recommended for refrigeration plants. On a rise in pressure above the set pressure, the safety relief valve will initially start opening slightly, to minimise the outlet of refrigerant. If the pressure continues to increase, the valve will open fully. The safety relief valve will be fully open before the pressure is 10% higher than set pressure, and fully closed before the pressure is 10% below set pressure.

Connections
Available with the following connections:

- Outside pipe thread T (ISO 228/1)
- Welding fittings (DIN 2448)

Housing
Made of special steel approved for low temperature operation. Spindle, cone, and seat are made of stainless steel, to ensure precise operation even during extraordinary conditions. The gasket of the valve cone is made of a special cloroprene (neoprene) compound.

Installation
To ensure exact operation of the safety relief valve it should be installed with the spring housing upwards. If the valve is mounted as an internal safety relief valve without any demand for exact opening pressure, the valve may be fitted with the spring housing in other positions. When the valve is mounted, it is important to avoid the influence of static, dynamic and thermal stress.

A very precise technique has been applied for the production of the seal. However, this seal can still be damaged, if dirt is blown from the pipe system into the valve.

It is recommended that safety relief valves exhaust into the open air with a U-pipe filled with oil on the discharge branch, to prevent dirt from penetrating into the valve. It is also recommended that the valves be installed in pairs in conjunction with the double stop valve type DSV 1 or 2. For further information please see the technical leaflet for DSV.

Re-calibration/servicing
In certain countries the authorities demand that the valves are readjusted at least once a year (see local rules).

Control/Identification
After adjustment of the set pressure at Danfoss, the valves are sealed. For that reason Danfoss can only guarantee correct operation, as long as the seal remains unbroken.

All valves are provided with a metal plate with the following information:
- Flow diameter
- Set pressure
- Date of production
- Production number
- Type approved code.

Transport/Handling
The valves are fitted with special protection covers and packed into purpose made transportation cartons.

It is important that the cover remains fitted around the valve until it is installed.

To ensure the exact and precise operation of the valve it must be handled with care.

Safety valve	Double stop valve		Max. pressure
	CE marked	Not CE marked	
SFA 15	DSV 1		40 bar (580 psi)
	DSV 2		40 bar (580 psi)
		DSV 15	25 bar (363 psi)

Capacity

The design and construction of the safety relief valve has been tested and approved by TÜV. This test comprises control of the function of the valve as well as measuring of the capacity, which is the basis of the curves and tables on the following pages. The values in the table are based on saturated gas.

If e.g. back pressure or superheated gas have to be taken into consideration, the formulas or the Danfoss computation program (DIRcalc™) can be used.

Table 1.

Valve	Nominal size		Flow diameter d_o	Flow area A_0	De-rated, certified coefficient of discharge K_{dr}
	Inlet	Outlet			
SFA 15	15 mm	20 mm	13 mm	133 mm²	0.73
	½ in.	¾ in.	0.512 in.	0.206 in²	

The discharge capacity of the safety relief valves are based on (IS0 4126-1/EN 1268-1 / prEN 1313 6 (1998)).

$$q_m = 0.2883 \times C \times A_0 \times K_{dr} \times K_b \sqrt{\frac{p}{v}}$$

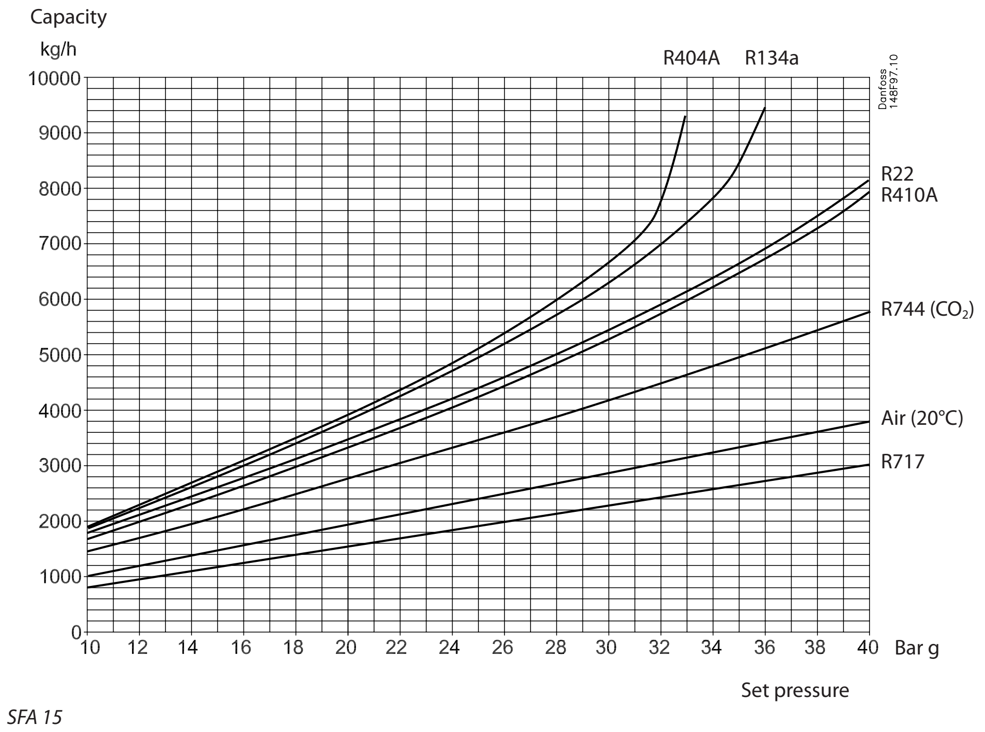
q_m Discharge capacity (kg/h).
C Discharge function depending of the actual refrigerant (κ) see table 2 (-).
A_0 Flow area of the safety relief valve (mm^2).
K_{dr} De-rated coefficient of discharge ($K_{dr} = K_d \times 0.9$), (the K_{dr} is certified by TÜV) see table 1 (-).
K_b Correction factor for sub-critical flow (-).
$K_b = 1.0$ when the back pressure is lower than approx. $0.5 \times$ relieving pressure ($P_b < 0.5 \times p$).
For all SFV safety valves $K_b = 1.0$
v Specific volume of the vapour at the releiving pressure p. (m^3/kg).
p_{set} Set pressure, the predetermined pressure at which a pressure relief valve under operation starts to open (p_{set} is indicated on the metal plate on the safety relief valve). (bar gauge)
p_{atm} Atmospheric pressure (1 bar).
p Relieving pressure, $p = p_{set} \times 1.1 + P_{atm}$ (bar absolute).

For further details see the above-mentioned ISO or EN standards.

Table 2. Properties of refrigerants

Refrigerant	Isentropic exponent κ	Discharge function C
R22	1.17	2.54
R134a	1.12	2.50
R404A	1.12	2.49
R410A	1.17	2.54
R717 (Ammonia)	1.31	2.64
R744 (CO_2)	1.30	2.63
Air	1.40	2.70

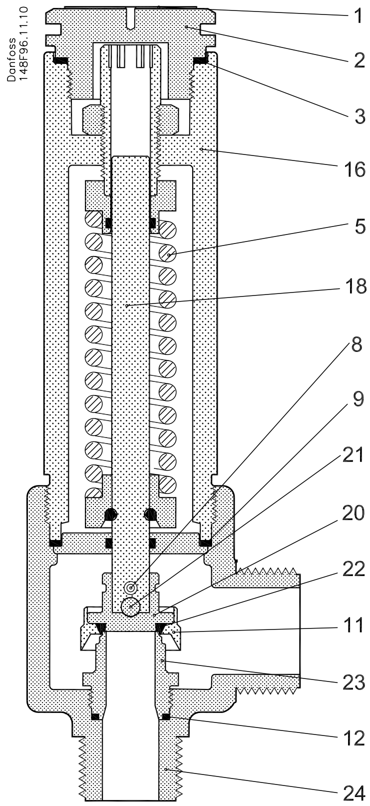
Capacity



Capacity

Set pressure	qm	R22	R134a	R404A	R410A	R717	R744 (CO_2)	Air (20°C)
SFA 15								
10 bar g 145 psi g	kg/h lb/min	1749 64	1881 69	1888 69	1652 61	779 29	1424 52	1003 37
15 bar g 218 psi g	kg/h lb/min	2592 95	2793 103	2842 104	2459 90	1135 42	2072 76	1462 54
20 bar g 290 psi g	kg/h lb/min	3471 128	3804 140	3883 143	3305 121	1492 55	2747 101	1922 71
25 bar g 363 psi g	kg/h lb/min	4409 162	4921 181	5101 187	4248 156	1853 68	3441 126	2381 87
30 bar g 435 psi g	kg/h lb/min	5437 200	6269 230	6659 245	5250 193	2227 82	4163 153	2841 104
35 bar g 508 psi g	kg/h lb/min	6633 244	8370 308		6450 237	2608 96	4936 181	3301 121
40 bar g 580 psi g	kg/h lb/min	8104 298			7911 291	2989 110	5718 210	3760 138

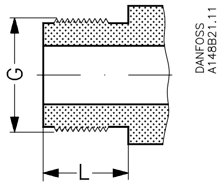
Material specification



No.	Part	Material	DIN	ISO	ASTM
1	Marking label	Stainless steel			
2	Threaded plug	Steel			
3	Packing washer	Aluminium (Non-asbestos gasket)			
5	Spring	Steel	Class C, DIN17223		
9	Packing washer	Aluminium (Non-asbestos gasket)			
11	Retainer	Stainless steel	X8CrNiS 18 9		AISI 303, A276
12	Packing washer	Aluminium (Non-asbestos gasket)			
16	Valve top	Steel	G20Mn5QT Alt. S235JRG2 Alt. S355J2G3	 Fe360BFN Fe510D1	LCC, A352 A284C A572-50
18	Valve spindle	Stainless steel	X5CrNi 18 10		AISI 304, A276
20	Valve cone	Stainless steel	X8CrNiS 18 9		AISI 303, A276
22	Valve cone seal	Cloroprene (Neoprene)			
23	Valve seat	Stainless steel	X8CrNiS 18 9		AISI 303, A276
24	Valve housing	Steel	G20Mn5QT Alt. P285QH		LCC, A352 LF2, A350

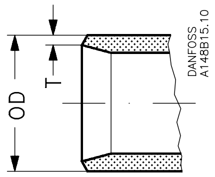
Connections

T



Size mm	Size in.	Inlet	Outlet				L mm	L in.	
T outside pipe thread, (ISO 228/1)									
15	½	G ¾	G 1				15	0.59	

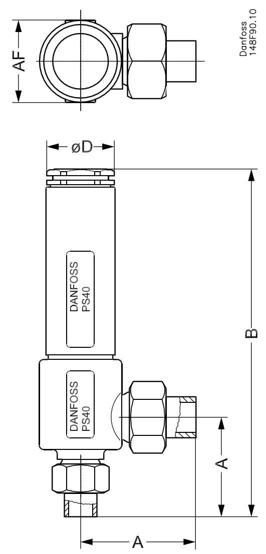
DIN



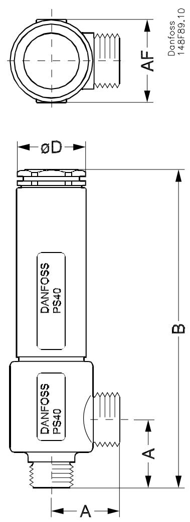
Size	Size	Inlet (mm)		Inlet (in.)		Outlet (mm)		Outlet (in.)	
mm	in.	OD	T	OD	T	OD	T	OD	T
Welding fittings, DIN (2448)									
15	½	21.3	2.3	0.839	0.091	26.9	2.3	1.059	0.091

Dimensions and weights

SFA 15 with welding fittings



SFA 15 T



Valve size			A	B		ØD		AF		Weight
SFA 15 T, with threaded connections ISO 228/1 pipe threads										
SFA 15 (½ in.)	mm in.		45 1.77	210 8.27		45 1.81		55 2.17		2.2 kg 4.9 lbs
SFA with welding fittings, DIN 2448										
SFA 15 (½ in.)	mm in.		83 3.27	248 9.76		45 1.81		55 2.17		2.5 kg 5.5 lbs

Specified weights are approximate values only.

Ordering

Certified SFA valves with standard set pressure

Size mm	Size in.	Type	Set pressure bar g (psi g)	Code number
15	½	SFA 15 T 210	10 (145)	**148F3210**
15	½	SFA 15 T 211	11 (160)	**148F3211**
15	½	SFA 15 T 212	12 (174)	**148F3212**
15	½	SFA 15 T 213	13 (189)	**148F3213**
15	½	SFA 15 T 214	14 (203)	**148F3214**
15	½	SFA 15 T 215	15 (218)	**148F3215**
15	½	SFA 15 T 216	16 (232)	**148F3216**
15	½	SFA 15 T 217	17 (247)	**148F3217**
15	½	SFA 15 T 218	18 (261)	**148F3218**
15	½	SFA 15 T 219	19 (276)	**148F3219**
15	½	SFA 15 T 220	20 (290)	**148F3220**
15	½	SFA 15 T 221	21 (305)	**148F3221**
15	½	SFA 15 T 222	22 (319)	**148F3222**
15	½	SFA 15 T 223	23 (334)	**148F3223**
15	½	SFA 15 T 224	24 (348)	**148F3224**
15	½	SFA 15 T 225	25 (363)	**148F3225**
15	½	SFA 15 T 226	26 (377)	**148F3226**
15	½	SFA 15 T 227	27 (392)	**148F3227**
15	½	SFA 15 T 228	28 (406)	**148F3228**
15	½	SFA 15 T 229	29 (421)	**148F3229**
15	½	SFA 15 T 230	30 (435)	**148F3230**
15	½	SFA 15 T 231	31 (450)	**148F3231**
15	½	SFA 15 T 232	32 (464)	**148F3232**
15	½	SFA 15 T 233	33 (479)	**148F3233**
15	½	SFA 15 T 234	34 (493)	**148F3234**
15	½	SFA 15 T 235	35 (508)	**148F3235**
15	½	SFA 15 T 236	36 (522)	**148F3236**
15	½	SFA 15 T 237	37 (537)	**148F3237**
15	½	SFA 15 T 238	38 (551)	**148F3238**
15	½	SFA 15 T 239	39 (566)	**148F3239**
15	½	SFA 15 T 240	40 (580)	**148F3240**

Certified SFA valves with standard set pressure and TÜV pressure setting certificate with each valve

Size mm	Size in.	Type	Set pressure bar g (psi g)	Code number
15	½	SFA 15 T 310	10 (145)	**148F3310**
15	½	SFA 15 T 311	11 (160)	**148F3311**
15	½	SFA 15 T 312	12 (174)	**148F3312**
15	½	SFA 15 T 313	13 (189)	**148F3313**
15	½	SFA 15 T 314	14 (203)	**148F3314**
15	½	SFA 15 T 315	15 (218)	**148F3315**
15	½	SFA 15 T 316	16 (232)	**148F3316**
15	½	SFA 15 T 317	17 (247)	**148F3317**
15	½	SFA 15 T 318	18 (261)	**148F3318**
15	½	SFA 15 T 319	19 (276)	**148F3319**
15	½	SFA 15 T 320	20 (290)	**148F3320**
15	½	SFA 15 T 321	21 (305)	**148F3321**
15	½	SFA 15 T 322	22 (319)	**148F3322**
15	½	SFA 15 T 323	23 (334)	**148F3323**
15	½	SFA 15 T 324	24 (348)	**148F3324**
15	½	SFA 15 T 325	25 (363)	**148F3325**
15	½	SFA 15 T 326	26 (377)	**148F3326**
15	½	SFA 15 T 327	27 (392)	**148F3327**
15	½	SFA 15 T 328	28 (406)	**148F3328**
15	½	SFA 15 T 329	29 (421)	**148F3329**
15	½	SFA 15 T 330	30 (435)	**148F3330**
15	½	SFA 15 T 331	31 (450)	**148F3331**
15	½	SFA 15 T 332	32 (464)	**148F3332**
15	½	SFA 15 T 333	33 (479)	**148F3333**
15	½	SFA 15 T 334	34 (493)	**148F3334**
15	½	SFA 15 T 335	35 (508)	**148F3335**
15	½	SFA 15 T 336	36 (522)	**148F3336**
15	½	SFA 15 T 337	37 (537)	**148F3337**
15	½	SFA 15 T 338	38 (551)	**148F3338**
15	½	SFA 15 T 339	39 (566)	**148F3339**
15	½	SFA 15 T 340	40 (580)	**148F3340**

Repair kit

Type	Code number
Repair kit SFA 15	**148F3036**

Nipples and gaskets

Type	Code number
Nipples + gaskets set for SFV 15/SFA 15	**148F3019**

Safety relief valves, type SFV 20 - 25

Introduction

SFV 20 - 25 are standard, **back pressure dependent** safety relief valves in angle-way execution, specially designed for protection of vessels and other components against excessive pressure.

The valve is designed to meet the strict quality demands and safety requirements for refrigeration installations, specified by the international classification societies.

The valve is recommended as an external and internal safety relief valve in refrigeration plants. The spring housing is closed tightly to avoid refrigerant leakage.

The inlet flow diameters of the valves are:
- 18 mm (3/4 in.) for SFV 20, and
- 23 mm (1 in.) for SFV 25.

The valves can be delivered with set pressures between 10 and 25 bar g (145 and 363 psi g).

Standard pressure setting valves having "TÜV Pressure Setting Certificate" with each valve, are also available.

Features

- Applicable for the refrigerants R717 (ammonia, NH_3), HFC, HCFC (e.g. R22, R134a, R404A) and other refrigerants (dependent on sealing materials compatibility) within a temperature range of –30°C/+100°C (–22°F/+212°F).
- Classification: To get an updated list of certification on the products please contact your local Danfoss Sales Company.

Technical data

- Refrigerants
  Applicable for the refrigerants R717 (ammonia, NH_3), HFC, HCFC (e.g. R22, R134a, R404A) and other refrigerants dependent on sealing material compatibility within a temperature range of –30°C/+100°C (–22°F/+212°F). Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.
- Pressure
  Pressure setting range: 10 - 25 bar g (145 - 363 psi g). For further information please contact your local Danfoss Sales Company.

  The valves are designed for:
  Strength test: 43 bar g (624 psi g)
  Leakage safety: Same as set pressure

  Important: The SFV safety relief valve is dependent on the back pressure (if the back pressure is higher than the atmospheric pressure, the opening pressure will be higher than stated set pressure).

  Special circumstances such as vibrations (which should be avoided) and oscillating pressure may require an increased difference between the operational pressure and the closing pressure.
- Pressure setting
  The operating pressure of the plant should be at least 15% below the set pressure. This allows a perfect re-seating of the safety relief valve after having been activated.
- Temperature range
  –30/+100°C (–22/+212°F)

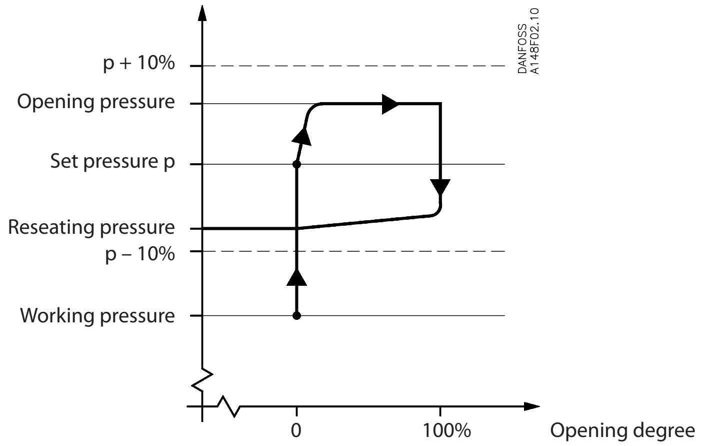
Pressure Equipment Directive (PED)
The SFV-valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction

SFV valves		
Nominal bore	18 mm (0.709 in.)	23 mm (0.906 in.)
Classified for	Fluid group I	
Category	IV	

The complete technical leaflet (DKRCI.PD.IB0.A) can be downloaded from the Danfoss web site.

Safety valves

Design



SFV is designed as a **standard safety relief valve** (DIN 3320), which are recommended for refrigeration plants. On a rise in pressure above the set pressure, the safety relief valve will initially start opening slightly, to minimise the outlet of refrigerant. If the pressure continues to increase, the valve will open fully. The safety relief valve will be fully open before the pressure is 10% higher than set pressure, and fully closed before the pressure is 10% below set pressure.

Connections
Available with the following connections:
- Outside pipe thread T (ISO 228/1)
- Welding fittings (DIN 2448)

Housing
Made of special steel approved for low temperature operation. Spindle and seat are made of stainless steel, to ensure precise operation even during extraordinary conditions. The gasket of the valve cone is made of a special cloroprene (neoprene) compound.

Installation
To ensure exact operation of the safety relief valve it should be installed with the spring housing upwards. If the valve is mounted as an internal safety relief valve without any demand for exact opening pressure, the valve may be fitted with the spring housing in other positions. When the valve is mounted, it is important to avoid the influence of static, dynamic and thermal stress.

A very precise technique has been applied for the production of the seal. However, this seal can still be damaged, if dirt is blown from the pipe system into the valve.

It is recommended that safety relief valves exhaust into the open air with a U-pipe filled with oil on the discharge branch, to prevent dirt from penetrating into the valve. It is also recommended that the valves be installed in pairs in conjunction with the double stop valve type DSV. For further information please see the DSV data sheet.

Re-calibration/servicing
In certain countries the authorities demand that the valves are readjusted at least once a year (see local rules).

Control/Identification
After adjustment of the set pressure at Danfoss, the valves are sealed. For that reason Danfoss can only guarantee correct operation, as long as the seal remains unbroken.

All valves are provided with a metal plate with the following information:
- Flow diameter
- Set pressure
- Date of production
- Production number
- Type approved code.

Transport/Handling
The valves are fitted with special protection covers and packed into purpose made transportation cartons.

It is important the cover remains fitted around the valve until it is installed.

To ensure the exact and precise operation of the valve it must be handled with care.

Capacity

The design and construction of the safety relief valve has been tested and approved by TÜV. This test comprises control of the function of the valve as well as measuring of the capacity, which is the basis of the curves and tables on the following pages. The values in the table are based on saturated gas.

If e.g. back pressure or superheated gas have to be taken into consideration, the formulas or the Danfoss computation program (DIRcalc™) can be used.

Table 1.

Valve	Nominal size		Flow diameter d_o	Flow area A_0	De-rated, certified coefficient of discharge K_{dr}
	Inlet	Outlet			
SFV 20	20 mm	25 mm	18 mm	254 mm²	0.54
	¾ in.	1 in.	0.709 in.	0.394 in²	
SFV 25	25 mm	32 mm	23 mm	415 mm²	0.48
	1 in.	1¼	0.906 in.	0.643 in²	

The discharge capacity of the safety relief valves are based on (IS0 4126-1 / prEN 1313 6 (1998)).

$$q_m = 0.2883 \times C \times A_0 \times K_{dr} \times K_b \sqrt{\frac{p}{v}}$$

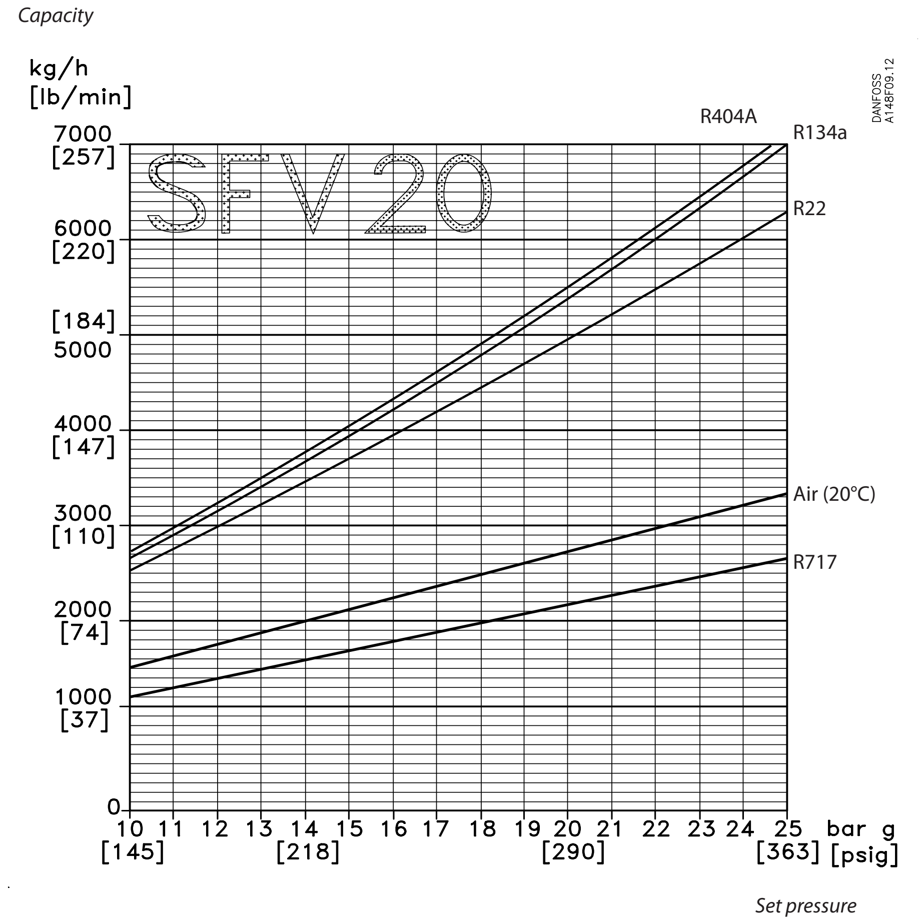
q_m Discharge capacity (kg/h)
C Discharge function depending of the actual refrigerant (κ) see table 2 (-)
A_0 Flow area of the safety relief valve (mm²).
K_{dr} De-rated coefficient of discharge ($K_{dr} = K_d \times 0.9$), (the K_{dr} is certified by TÜV) see table 1 (-)
K_b Correction factor for sub-critical flow. (-)
$K_b = 1.0$ when the back pressure is lower than approx. 0.5 × relieving pressure ($P_b < 0.5 \times p$)
For all SFV safety valves $K_b = 1.0$
v Specific volume of the vapour at the releiving pressure p. (m³/kg)
p_{set} Set pressure, the predetermined pressure at which a pressure relief valve under operation starts to open (p_{set} is indicated on the metal plate on the safety relief valve).
(bar gauge)
p_{atm} Atmospheric pressure. (1 bar)
p Relieving pressure, $p = p_{set} \times 1.1 + P_{atm}$ (bar absolute)

For further details see the above-mentioned ISO or EN standards.

Table 2. Properties of Refrigerants

Refrigerant	Isentropic exponent κ	Discharge function C
R22	1.17	2.54
R134a	1.12	2.50
R404A	1.12	2.49
R410A	1.17	2.54
R717 (Ammonia)	1.31	2.64
R744 (CO_2)	1.30	2.63
Air	1.40	2.70

Capacity
(cont.)

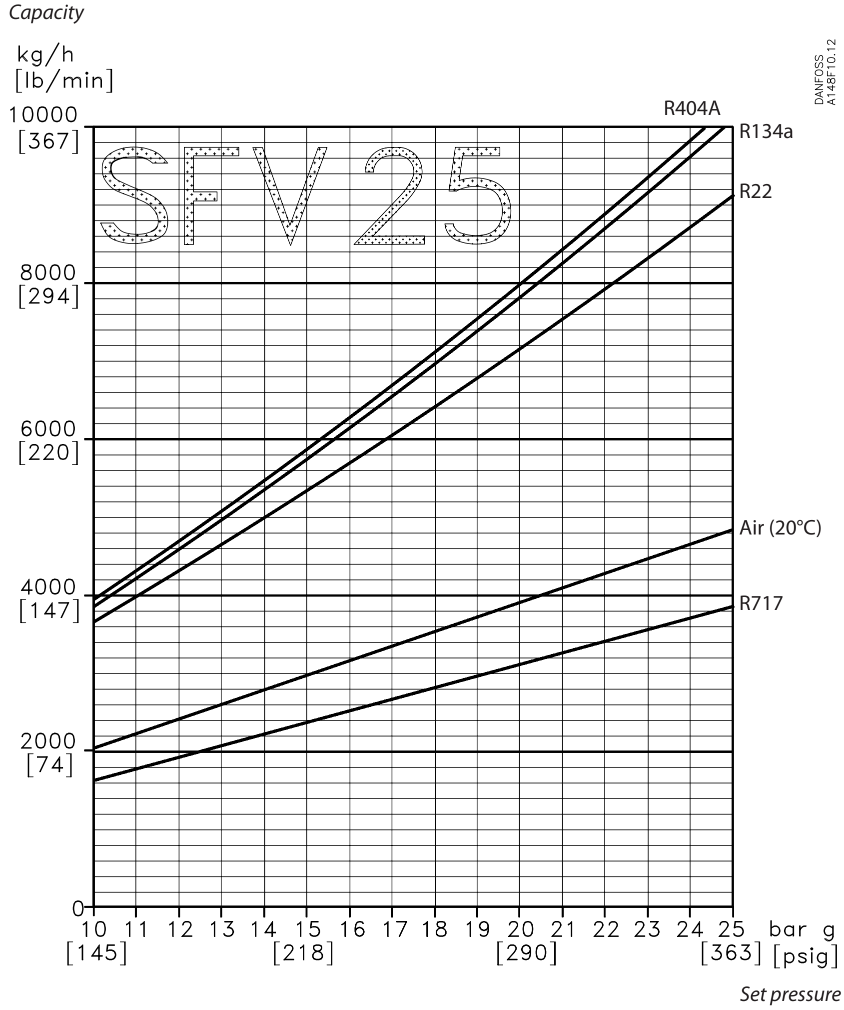


SFV 20

Capacity

Set pressure		R22	R134a	R404A	R717	Air (20°C)
SFV 20						
13 bar g 189 psi g	kg/h lb/min	3220 118	3430 126	3500 129	1415 52	1790 66
18 bar g 261 psi g	kg/h lb/min	4440 163	4800 176	4900 180	1925 71	2435 89
21 bar g 305 psi g	kg/h lb/min	5215 192	5680 209	5770 212	2235 82	2820 104
25 bar g 363 psi g	kg/h lb/min	6285 231	6980 257	7125 262	2660 98	3335 122

Capacity
(cont.)

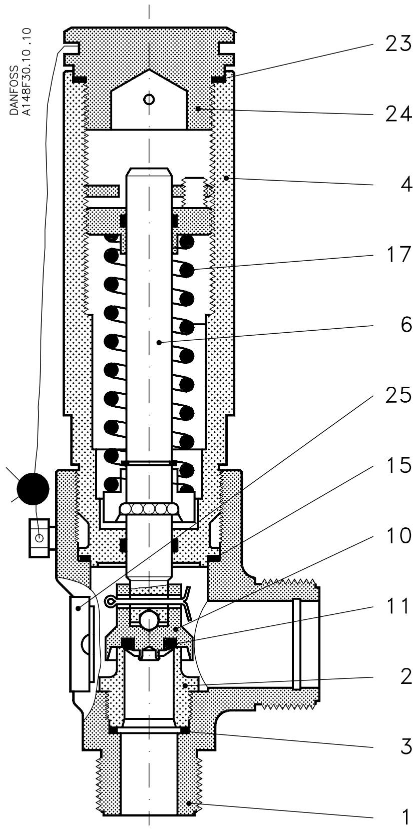


SFV 25

Capacity

Set pressure		R22	R134a	R404A	R717	Air (20°C)
SFV 25						
13 bar g 189 psi g	kg/h lb/min	4670 172	4980 183	5075 186	2050 75	2600 96
18 bar g 261 psi g	kg/h lb/min	6445 237	6965 256	7115 261	2790 103	3530 130
21 bar g 305 psi g	kg/h lb/min	7565 278	8240 303	8370 308	3240 119	4090 150
25 bar g 363 psi g	kg/h lb/min	9120 335	10135 372	10340 380	3860 142	4835 178

Material specification

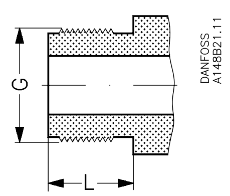


No.	Part	Material	DIN	ISO	ASTM
1	Housing	Steel	TT St 35 N, 17173	TW 6, 2604/3-75	Grade 1, A333, A334 * A350 LF2
2	Valve seat	Stainless steel	X10CrNiS189, 17440	Type 17, 683/13	AISI 303
3	Packing washer	Aluminium *Non-asbestos gasket			
4	Valve top	Steel	St. 37.2, 1652	Fe 360 B, 660	Grade C, A 283
6	Valve spindle	Stainless steel	X10CrNiS189, 17440	Type 17, 683/13	AISI 303
10	Valve cone	Steel			
11	Valve cone seal	Cloroprene (Neoprene)			
15	Packing washer	Aluminium *Non-asbestos gasket			
17	Spring	Steel	Class C	A 679, 17223	
23	Packing washer	Aluminum *Non-asbestos gasket			
24	Plug	Steel	9S Mn28, 1651 *R St 37.2, 17100	Type 2, R 683 Fe 360 B, 630	 Grade C, A 283
25	Marking label	Aluminium			

* Alternative material

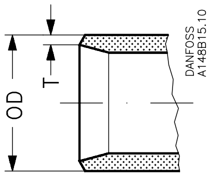
Connections

T



Size mm	Size in.	Inlet	Outlet		L mm	L in.		
T outside pipe thread, (ISO 228/1)								
20	¾	G 1¼	G 1½		20	0.79		
25	1	G 1¼	G 1½		20	0.79		

DIN

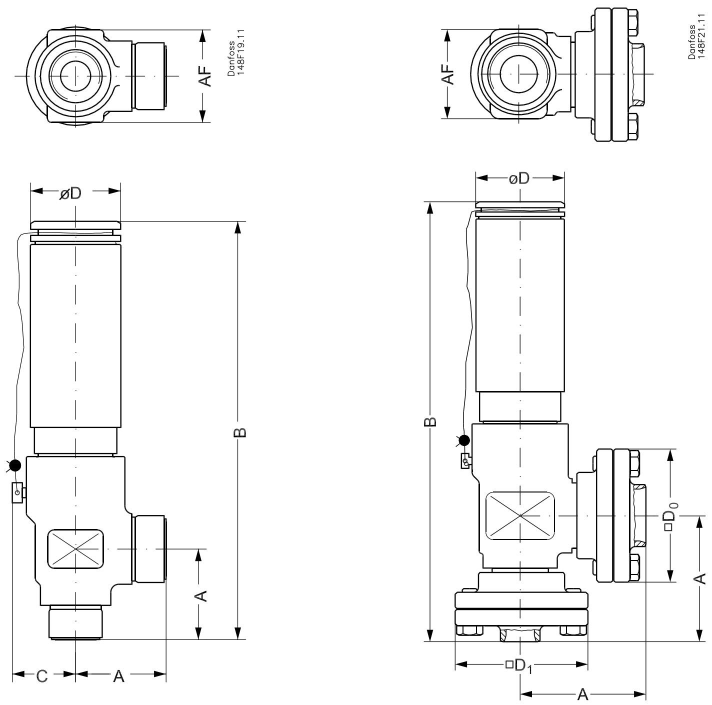


Size	Size	Inlet (mm)		Inlet (in.)		Outlet (mm)		Outlet (in.)			
mm	in.	OD	T	OD	T	OD	T	OD	T		
Welding fittings DIN (2448)											
20	$^{3}/_{4}$	26.9	2.3	1.059	0.091	33.7	2.6	1.337	0.102		
25	1	33.7	2.6	1.327	0.102	42.4	2.6	1.669	0.102		

Dimensions and weights

SFV 20 - 25 T

SFV 20 - 25 with welding fittings (flanges)



Valve size			A	B	C	□ D_0	øD	□ D_1	AF		Weight
SFV 20 - 25 T, with threaded connections ISO 228/1 pipe threads											
SFV 20 ($^{3}/_{4}$ in.)	mm in.		55 2.17	270 10.63	40 1.57		60 2.36		60 2.36		4.2 kg
SFV 25 (1 in.)	mm in.		55 2.17	270 10.63	40 1.57		60 2.36		60 2.36		4.2 kg
SFV with welding fittings, DIN 2448											
SFV 20 ($^{3}/_{4}$ in.)	mm in.		85 3.35	300 11.81		90 3.54	60 2.36	90 3.54	60 2.36		6.0 kg
SFV 25 (1 in.)	mm in.		85 3.35	300 11.81		90 3.54	60 2.36	90 3.54	60 2.36		6.0 kg

Specified weights are approximate values only.

Ordering

How to order
The table below is used to identify the valve required.

Please note that the type codes only serve to identify the valves, some of which may not form part of the standard product range. For further information please contact your local Danfoss Sales Company.

Example for type codes

SFV	**20**	**T**	**210**

Type codes

Valve type	SFV	Safety relief valve		
Nominal size in mm			Available connections	
			T	DIN welding fitting
(valve size measured on the connection diameter)	**20**	DN 20	×	×
	25	DN 25	×	×
Connections	**T**	Outside threaded connections: ISO 228/1 Pipe thread - The welding fittings for single mounted safety relief valve must be ordered separately		
Pressure setting		*Standard pressure setting: 2××*		
			SFV 20	*SFV 25*
	210	10 bar g (145 psi g)	×	×
	211	11 bar g (160 psi g)	×	×
	212	12 bar g (174 psi g)	×	×
	213	13 bar g (188 psi g)	×	×
	214	14 bar g (203 psi g)	×	×
	215	15 bar g (218 psi g)	×	×
	216	16 bar g (232 psi g)	×	×
	217	17 bar g (247 psi g)	×	×
	218	18 bar g (261 psi g)	×	×
	219	19 bar g (276 psi g)	×	×
	220	20 bar g (290 psi g)	×	×
	221	21 bar g (305 psi g)	×	×
	222	22 bar g (319 psi g)	×	×
	223	23 bar g (334 psi g)	×	×
	224	24 bar g (348 psi g)	×	×
	225	25 bar g (363 psi g)	×	×
		Standard pressure setting with TÜV certificate: 3××		
			SFV 20	*SFV 25*
	310	10 bar g (145 psi g)	×	×
	311	11 bar g (160 psi g)	×	×
	312	12 bar g (174 psi g)	×	×
	313	13 bar g (188 psi g)	×	×
	314	14 bar g (203 psi g)	×	×
	315	15 bar g (218 psi g)	×	×
	316	16 bar g (232 psi g)	×	×
	317	17 bar g (247 psi g)	×	×
	318	18 bar g (261 psi g)	×	×
	319	19 bar g (276 psi g)	×	×
	320	20 bar g (290 psi g)	×	×
	321	21 bar g (304 psi g)	×	×
	322	22 bar g (319 psi g)	×	×
	323	23 bar g (334 psi g)	×	×
	324	24 bar g (348 psi g)	×	×
	325	25 bar g (362 psi g)	×	×

Important!
Where products need to be certified according to specific certification societies, the relevant information should be included at the time of order.

Ordering
(cont.)

Certified SFV valves with standard set pressure

Size		Construction and test facilities are approved by TÜV		
mm	in.	Type	Bar g (psi g)	**Part no.**
20	$^{3}/_{4}$	SFV20 T 210	10 (145)	**2416+254**
20	$^{3}/_{4}$	SFV20 T 211	11 (160)	**2416+255**
20	$^{3}/_{4}$	SFV20 T 212	12 (174)	**2416+256**
20	$^{3}/_{4}$	SFV20 T 213	13 (189)	**2416+150**
20	$^{3}/_{4}$	SFV20 T 214	14 (203)	**2416+257**
20	$^{3}/_{4}$	SFV20 T 215	15 (218)	**2416+258**
20	$^{3}/_{4}$	SFV20 T 216	16 (232)	**2416+259**
20	$^{3}/_{4}$	SFV20 T 217	17 (247)	**2416+260**
20	$^{3}/_{4}$	SFV20 T 218	18 (261)	**2416+151**
20	$^{3}/_{4}$	SFV20 T 219	19 (276)	**2416+261**
20	$^{3}/_{4}$	SFV20 T 220	20 (290)	**2416+262**
20	$^{3}/_{4}$	SFV20 T 221	21 (305)	**2416+152**
20	$^{3}/_{4}$	SFV20 T 222	22 (319)	**2416+241**
20	$^{3}/_{4}$	SFV20 T 223	23 (334)	**2416+263**
20	$^{3}/_{4}$	SFV20 T 224	24 (348)	**2416+264**
20	$^{3}/_{4}$	SFV20 T 225	25 (363)	**2416+183**

Certified SFV valves with standard set pressure and TÜV pressure setting certificate with each valve

Size		Each valve is certified by a representative from TÜV		
mm	in.	Type	Bar g (psi g)	**Part no.**
20	$^{3}/_{4}$	SFV20 T 310	10 (145)	**2416+285**
20	$^{3}/_{4}$	SFV20 T 311	11 (160)	**2416+286**
20	$^{3}/_{4}$	SFV20 T 312	12 (174)	**2416+287**
20	$^{3}/_{4}$	SFV20 T 313	13 (189)	**2416+160**
20	$^{3}/_{4}$	SFV20 T 314	14 (203)	**2416+288**
20	$^{3}/_{4}$	SFV20 T 315	15 (218)	**2416+289**
20	$^{3}/_{4}$	SFV20 T 316	16 (232)	**2416+290**
20	$^{3}/_{4}$	SFV20 T 317	17 (247)	**2416+291**
20	$^{3}/_{4}$	SFV20 T 318	18 (261)	**2416+161**
20	$^{3}/_{4}$	SFV20 T 319	19 (276)	**2416+292**
20	$^{3}/_{4}$	SFV20 T 320	20 (290)	**2416+293**
20	$^{3}/_{4}$	SFV20 T 321	21 (305)	**2416+162**
20	$^{3}/_{4}$	SFV20 T 322	22 (319)	**2416+294**
20	$^{3}/_{4}$	SFV20 T 323	23 (334)	**2416+295**
20	$^{3}/_{4}$	SFV20 T 324	24 (348)	**2416+296**
20	$^{3}/_{4}$	SFV20 T 325	25 (363)	**2416+186**

Certified SFV valves with standard set pressure

Size		Construction and test facilities are approved by TÜV		
mm	in.	Type	Bar g (psi g)	**Part no.**
25	1	SFV25 T 210	10 (145)	**2416+265**
25	1	SFV25 T 211	11 (160)	**2416+266**
25	1	SFV25 T 212	12 (174)	**2416+267**
25	1	SFV25 T 213	13 (189)	**2416+153**
25	1	SFV25 T 214	14 (203)	**2416+268**
25	1	SFV25 T 215	15 (218)	**2416+269**
25	1	SFV25 T 216	16 (232)	**2416+270**
25	1	SFV25 T 217	17 (247)	**2416+271**
25	1	SFV25 T 218	18 (261)	**2416+154**
25	1	SFV25 T 219	19 (276)	**2416+272**
25	1	SFV25 T 220	20 (290)	**2416+273**
25	1	SFV25 T 221	21 (305)	**2416+155**
25	1	SFV25 T 222	22 (319)	**2416+242**
25	1	SFV25 T 223	23 (334)	**2416+274**
25	1	SFV25 T 224	24 (348)	**2416+275**
25	1	SFV25 T 225	25 (363)	**2416+184**

Certified SFV valves with standard set pressure and TÜV pressure setting certificate with each valve

Size		Each valve is certified by a representative from TÜV		
mm	in.	Type	Bar g (psi g)	**Part no.**
25	1	SFV25 T 310	10 (145)	**2416+297**
25	1	SFV25 T 311	11 (160)	**2416+298**
25	1	SFV25 T 312	12 (174)	**2416+299**
25	1	SFV25 T 313	13 (189)	**2416+163**
25	1	SFV25 T 314	14 (203)	**2416+300**
25	1	SFV25 T 315	15 (218)	**2416+301**
25	1	SFV25 T 316	16 (232)	**2416+302**
25	1	SFV25 T 317	17 (247)	**2416+303**
25	1	SFV25 T 318	18 (261)	**2416+164**
25	1	SFV25 T 319	19 (276)	**2416+304**
25	1	SFV25 T 320	20 (290)	**2416+305**
25	1	SFV25 T 321	21 (305)	**2416+165**
25	1	SFV25 T 322	22 (319)	**2416+306**
25	1	SFV25 T 323	23 (334)	**2416+307**
25	1	SFV25 T 324	24 (348)	**2416+308**
25	1	SFV25 T 325	25 (363)	**2416+187**

Flanges and gaskets

Type	**Code No.**
Flanges + gaskets set for SFV 20	**148F3020**
Flanges + gaskets set for SFV 25	**148F3021**

Repair kit

Type	**Code No.**
Repair kit for SFV 20 (gaskets and cone)	**2453+082**
Repair kit for SFV 25 (gaskets and cone)	**2453+083**

Introduction

DSV 1 and DSV 2 are 3-way valves, which are designed to meet all industrial refrigeration application requirements.

DSV valves are designed specifically for use with double safety valve systems.

The valves are designed to give favourable flow characteristics and are easy to dismantle for servicing. The valve cone is designed to ensure perfect closing, even with minimum torque the valve will close effectively. All valves are equipped with vented cap and nipple/flange connections, which permit easy inspection or replacement of safety valves.

Features

- Applicable to all common non flammable refrigerants including R717 and non corrosive gases/liquids dependent on sealing material compatibility.
- Each valve type is clearly marked with type, size and performance range.
- The valves and caps are prepared for sealing, to prevent operation by unauthorised persons, using a seal wire.
- Can accept flow in both directions.
- Housing and bonnet are made from low temperature steel according to requirements of the Pressure Equipment Directive and other international classification authorities.
- Max. operating pressure:
  DSV 1 and DSV 2: 40 bar g (580 psi g)
- Temperature range:
  DSV 1 and DSV 2: -50/+100°C (-58/+212°F)
- **DSV 1** when fitted with 2 x SFA 15 or
  DSV 2 when fitted with a combination of either 2 x SFA 15, or 2 x SFV 20, or 2 x SFV 25, meet the requirements according to EN13136 "Safety Valves Calculations" regarding max. 3% pressure drop in upstream line.
- Classification:
  To get an updated list of certification on the products please contact your local Danfoss Sales Company.

The complete technical leaflet (DKRCI.PD.IE0.A) can be downloaded from the Danfoss web site.

Design

Connections
Available with the following connections: -
Weld branch/nipples/flanges - DIN 2448
Note: DSV valves are supplied c/w DSV inlet connection fittings, DSV outlet connection fittings, and SFA/SFV outlet connection fittings. Please refer to ordering section.

Housing and bonnet
Made from special, cold resistant steel approved for low temperature operation.

Valve cone
A Teflon tightening ring provides perfect sealing with a minimum closing torque.

Spindle
Made of polished stainless steel, which is ideal for O-ring sealing.

Packing gland
The "full temperature range" packing gland ensures perfect tightness in the whole temperature range: –50/+100°C (–58/+212°F). The packing gland is equipped with a scraper ring to prevent penetration of dirt and other foreign bodies.

Pressure Equipment Directive (PED)
DSV valves are approved and CE-marked in accordance with Pressure Equipment Directive - 97/23/EC.

For further details / restrictions - see Installation Instruction.

	DSV 1 valves	DSV 2 valves
Nominal bore	DN ≤ 25 mm (1 in.)	DN32 mm (1¼ in.)
Classified for	Fluid group I	
Category	Article 3, paragraph 3	II

Technical data

- Refrigerants
  Applicable to all common non-flammable refrigerants, including R717 and non corrosive gases/liquids, dependent on sealing material compatability. Flammable hydrocarbons are not recommended. The valve is only recommended for use in closed circuits.

  For further information please contact Danfoss.
- Temperature range
  –50/+100°C (–58/+212°F).
- Pressure
  The valves are designed for:
  Max. operating pressure: 40 bar g (580 psig)

  Valves for higher design pressure are available on request.
- Capacity

Type	K_v-value	C_v-value
	m^3/h	Usgal/min
DSV 1	17.5	20.3
DSV 2	30.0	34.8

- Installation
  DSV are used as changeover valves between two SFA/SFV safety valves. When the spindle is turned clockwise (fig. 1) the inlet port C is connected to B. When the spindle is turned anticlockwise (fig. 1) the inlet port C is connected to A. For further information refer to installation instruction for DSV.

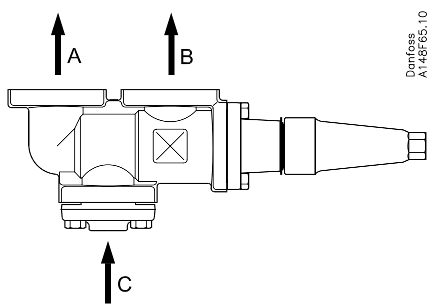
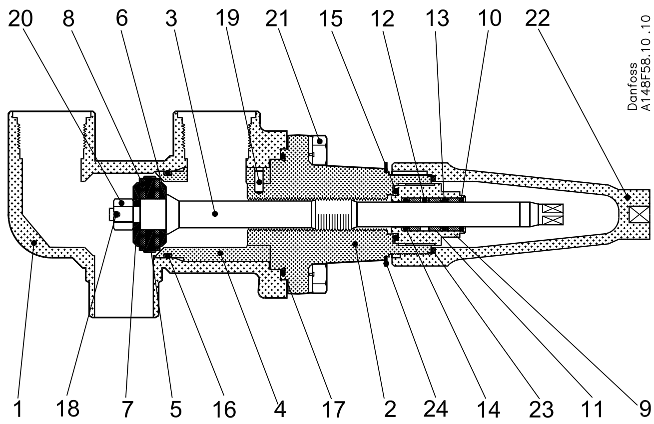


Fig. 1

Material specification

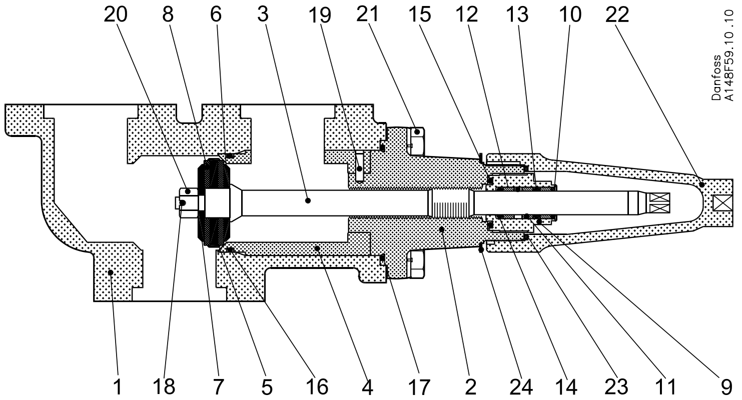
DSV 1



No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing	Steel	P285QH, EN10222-4		LF2A350
2	Bonnet	Steel	P285QH, EN10222-4		LF2A350
3	Spindle	Stainless steel	X10CrNiS 18 9 17440	Type 17 683/13	AISI 303
4	Seat	Steel	9 SMn28, 1651	Type2, R683/9	1213, SAEJ 403
5	Cone, Middle	Steel	9 SMn28, 1651	Type2, R683/9	1213, SAEJ 403
6	Cone, Back	Steel	9 SMn28, 1651	Type2, R683/9	1213, SAEJ 403
7	Cone, Front	Steel	9 SMn28, 1651	Type2, R683/9	1213, SAEJ 403
8	Cone seal	Teflon(PTFE)			
9	Packing gland	Steel	9SMn28, 1651	Type 2, R683/9	1213,SAE J403
13-17	O-ring	Cloroprene (Neoprene)			
20	Slotted nut	Steel			
21	Screw	Steel	A2-70	A2-70	Type 308
22	Seal cap	Aluminium			
23	Gasket for seal cap	Nylon			
24	Idenfication ring	Stainless steel			

Material specification

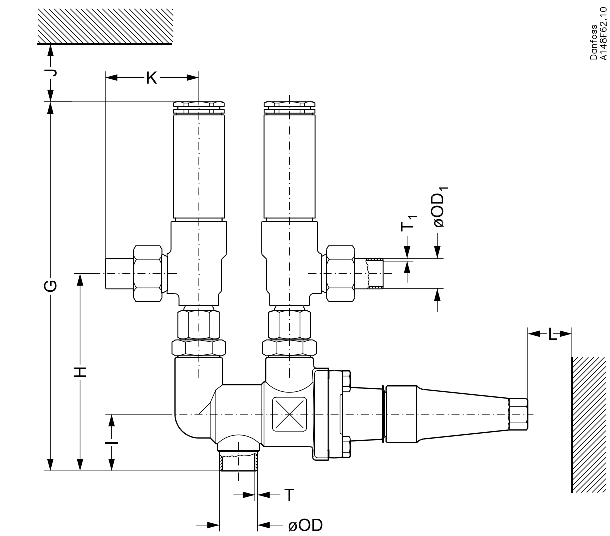
DSV 2



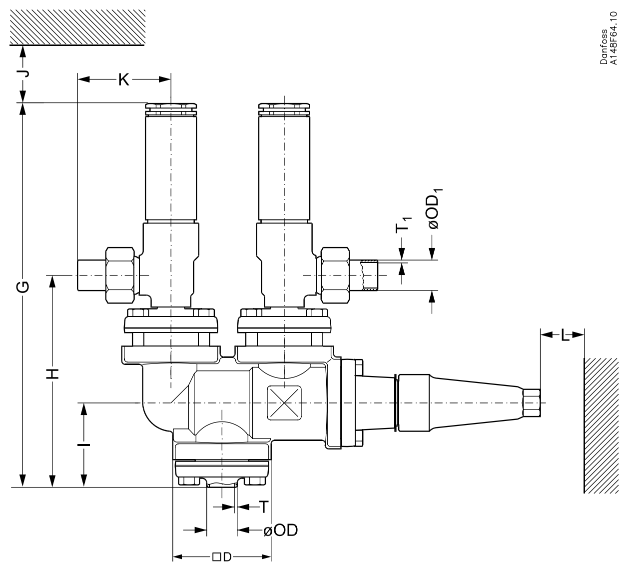
No.	Part	Material	DIN/EN	ISO	ASTM
1	Housing	Steel	P285QH, EN10222-4		LF2A350
2	Bonnet	Steel	P285QH, EN10222-4		LF2A350
3	Spindle	Stainless steel	X10CrNiS 18 9 17440	Type 17 683/13	AISI 303
4	Seat	Steel	9 SMn28, 1651	Type2, R683/9	1213, SAEJ 403
5	Cone, Middle	Steel	9 SMn28, 1651	Type2, R683/9	1213, SAEJ 403
6	Cone, Back	Steel	9 SMn28, 1651	Type2, R683/9	1213, SAEJ 403
7	Cone, Front	Steel	9 SMn28, 1651	Type2, R683/9	1213, SAEJ 403
8	Cone seal	Teflon(PTFE)			
9	Packing gland	Steel	9SMn28, 1651	Type 2, R683/9	1213,SAE J403
13-17	O-ring	Cloroprene (Neoprene)			
20	Slotted nut	Steel			
21	Screw	Steel	A2-70	A2-70	Type 308
22	Seal cap	Aluminium			
23	Gasket for seal cap	Nylon			
24	Idenfication ring	Stainless steel			

Dimensions and weights for double safety valve systems

DSV 1 + SFA 15



DSV 2 + SFA 15



Valve size		DN		ØOD	ØOD1	T	T1			G	H	I	J	K	L	Weight
		SFA 15														
DSV 1	mm	25		33.7	26.9	2.6	2.3			339	174	50	40	82.5	80	4.55 kg
(D25)	in.	1		1.33	1.06	0.10	0.09			13.35	6.85	1.97	1.58	3.25	3.15	10.03 lb

Valve size		DN		ØOD	ØOD1	T	T1	□D		G	H	I	J	K	L	Weight
		SFA 15														
DSV 2	mm	20		26.9	26.9	2.3	2.3	82.5		351	186	73.5	10	82.5	80	9.3 kg
(FD20)	in.	¾		1.06	1.06	0.09	0.09	3.25		13.82	7.32	2.89	0.39	3.25	3.15	20.5 lb

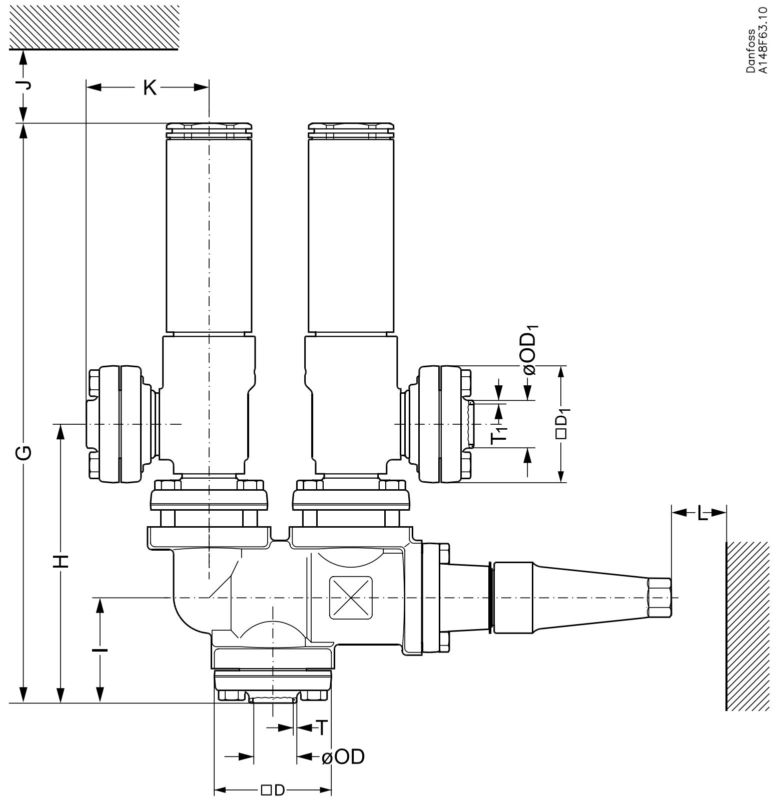
Valve size		DN		ØOD	ØOD1	T	T1	□D		G	H	I	J	K	L	Weight
		SFA 15														
DSV 2	mm	25		33.7	26.9	2.6	2.3	82.5		351	186	73.5	10	82.5	80	9.3 kg
(FD25)	in.	1		1.33	1.06	0.10	0.09	3.25		13.82	7.32	2.89	0.39	3.25	3.15	20.5 lb

Valve size		DN		ØOD	ØOD1	T	T1	□D		G	H	I	J	K	L	Weight
		SFA 15														
DSV 2	mm	32		42.4	26.9	2.6	2.3	82.5		351	186	73.5	10	82.5	80	9.3 kg
(FD32)	in.	1¼		1.67	1.06	0.10	0.09	3.25		13.82	7.32	2.89	0.39	3.25	3.15	20.5 lb

Specified weights (incl. all fittings and excl. SFA / SFV) are approximate values only.

Dimensions and weights for double safety valve systems

DSV 2 + SFV 20 / SFV 25



Valve size		DN		ØOD	ØOD1	T	T1	□D	□D1	G	H	I	J	K	L	Weight
		SFV 20														
DSV 2	mm	25		33.7	33.7	2.6	2.6	82.5	82.5	412	197	73.5	10	85	80	11.9 kg
(FD25)	in.	1		1.33	1.33	0.10	0.10	3.25	3.25	16.22	7.76	2.89	0.39	3.35	3.15	26.23 lb

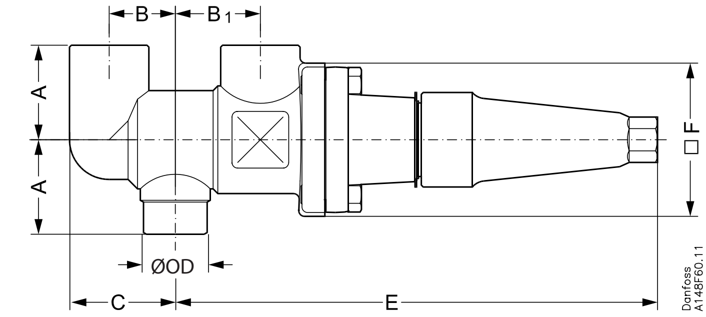
Valve size		DN		ØOD	ØOD1	T	T1	□D	□D1	G	H	I	J	K	L	Weight
		SFV 20														
DSV 2	mm	32		42.4	33.7	2.6	2.6	82.5	82.5	412	197	73.5	10	85	80	11.9 kg
(FD32)	in.	1¼		1.67	1.33	0.10	0.10	3.25	3.25	16.22	7.76	2.89	0.39	3.35	3.15	26.23 lb

Valve size		DN		ØOD	ØOD1	T	T1	□D	□D1	G	H	I	J	K	L	Weight
		SFV 25														
DSV 2	mm	32		42.4	42.4	2.6	2.6	82.5	82.5	412	197	73.5	10	85	80	11.9 kg
(FD32)	in.	1¼		1.67	1.67	0.10	0.10	3.25	3.25	16.22	7.76	2.89	0.39	3.35	3.15	26.23 lb

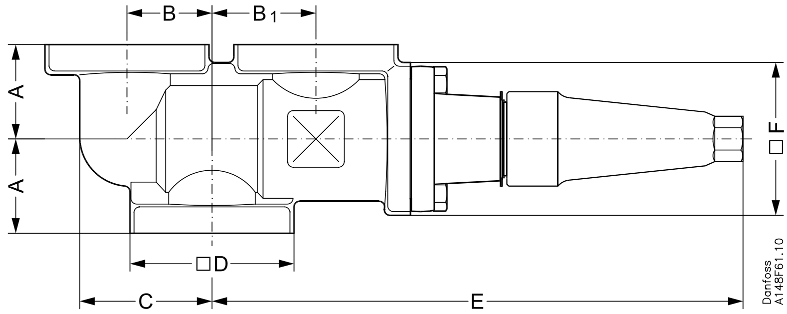
Specified weights (incl. all fittings and excl. SFA / SFV) are approximate values only.

Dimensions and weights

DSV 1



DSV 2



Valve size		A	B	B_1	C		ØOD	E	□F	Weight
DSV 1	mm	50	35	45	56		33.7	255	77	3.6 kg
	in.	2	1.38	1.77	2.20		1.33	10.04	3.03	7.94 lb

Valve size		A	B	B_1	C	□D		E	□F	Weight
DSV 2	mm	50	45	55	70	82,5		281	77	6.1 kg
	in.	2	1.77	2.17	2.76	3.25		11.06	3.03	13.45 lb

Specified weights are approximate values only.

Ordering

How to order
The table below is used to identify the valve required.

Please note that the type codes only serve to identify the valves, some of which may not form part of the standard product range. For further information please contact your local Danfoss Sales Company.

Example

DSV 2 FD20 SFA15 = 148F3006

DSV2 = Valve type
FD20 = DSV inlet connection
SFA15 = Safety valve combination

Type codes

Valve type		DSV inlet connection	DSV outlet connection	SFV outlet connection	Safety valve combination	**Code No.**
DSV	1	D25 (1 in.)	G ¾" Union	ND20 (¾ in.)	SFA15	**148F3005**
DSV	2	FD20 (¾ in.)	G ¾" thread flange	ND20 (¾ in.)	SFA15	**148F3006**
DSV	2	FD25 (1 in.)	G ¾" thread flange	ND20 (¾ in.)	SFA15	**148F3007**
DSV	2	FD32 (1¼ in.)	G ¾" thread flange	ND20 (¾ in.)	SFA15	**148F3008**
DSV	2	FD25 (1 in.)	G 1¼" thread flange	FD25 (1 in.)	SFV20	**148F3009**
DSV	2	FD32 (1¼ in.)	G 1¼" thread flange	FD25 (1 in.)	SFV20	**148F3010**
DSV	2	FD32 (1¼ in.)	G 1¼" thread flange	FD32 (1¼ in.)	SFV25	**148F3011**
Connection fittings:	D	Weld branches DIN 2448		DSV valves are supplied c/w DSV inlet connection fittings, DSV outlet connection fittings, and SFA/SFV outlet connection fittings.		
	ND	Weld nipples DIN 2448				
	FD	Weld flanges DIN 2448				

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

Fittings and gaskets

Type	**Code No.**
Nipples + gaskets set for 25D/ND20 DSV1/SFA 15	**148F3037**
Flanges + gaskets set for FD20/ND20 DSV2/SFA 15	**148F3038**
Flanges + gaskets set for FD25/ND20 DSV2/SFA 15	**148F3039**
Flanges + gaskets set for FD32/ND20 DSV2/SFA 15	**148F3040**
Flanges + gaskets set for FD25/FD25 DSV2/SFV 20	**148F3041**
Flanges + gaskets set for FD32/FD25 DSV2/SFV 20	**148F3042**
Flanges + gaskets set for FD32/FD32 DSV2/SFV 25	**148F3043**

Introduction

BSV is a standard, back pressure **independent** safety relief valve, especially designed for protection of small components against excessive pressure and as a pilot valve for the pilot operated internal safety valve, type POV.

BSV is an angle-way safety relief valve which can operate with a very high back pressure. The valve is designed to meet the strict quality demands and safety requirements for refrigeration installations, specified by the international classification societies.

As the valve is not dependent on the back pressure, it is recommended for use as an internal safety relief valve. However, the valve can also be used as an external safety relief valve. The spring housing is tightly sealed to avoid refrigerant leakage.

The inlet flow diameter of the BSV 8 is 8.0 mm ($^{5}/_{16}$ in.).

The valves can be delivered with set pressures between 10 and 25 bar g (145 and 363 psi g).

Standard pressure setting valves having "TÜV Pressure Setting Certificate" with each valve are also available.

Features

- Applicable for the refrigerants R717 (ammonia), HFC, HCFC (e.g. R22, R134a, R404a) and other refrigerants dependent on sealing material compatibility.
- Classification: To get an updated list of certification on the products please contact your local Danfoss Sales Company.

The complete technical leaflet (RD7FB) can be downloaded from the Danfoss web site.

Technical data

- Refrigerants
  Applicable for the refrigerants R717 (ammonia, NH_3), HFC, HCFC (e.g. R22, R134a, R404A) and other refrigerants dependent on sealing material compatibility.
  Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.
- Pressure
  Pressure setting range: 10 - 25 bar g (145 - 363 psi g), For further information please contact your local Danfoss Sales Company.

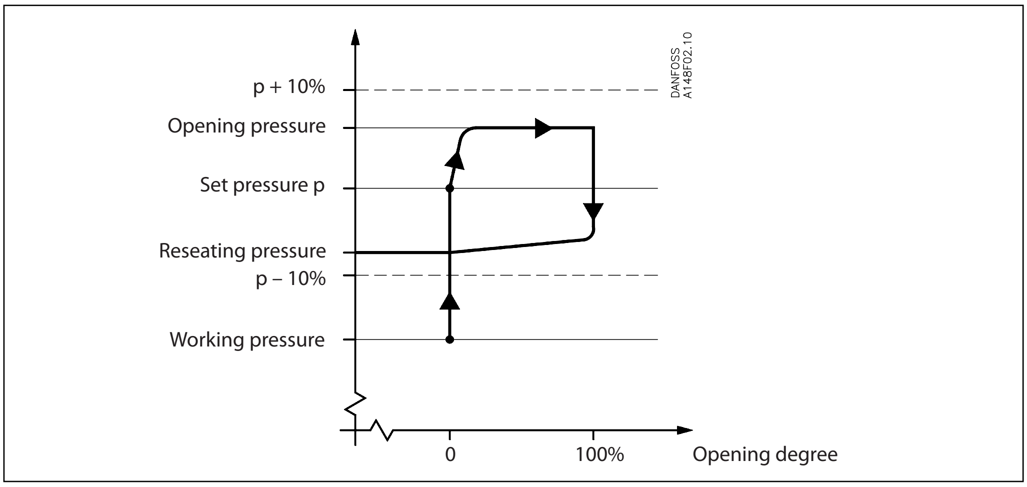
  The valves are designed for:
  Strength test: 43 bar g (624 psi g)
  Leakage safety: 25 bar g (363 psi g)

  Special circumstances such as vibrations (which should be avoided) and oscillating pressure may require an increased difference between the operational pressure and the closing pressure.
- Pressure setting
  The operating pressure of the plant should be at least 15% below the set pressure. This allows a perfect re-seating of the safety relief valve after having been activated.
- Temperature range for BSV used as an external safety relief valve:
  –30/+100°C (–22/+212°F)
- Temperature range for BSV used as a pilot valve for POV:
  –50/+100°C (–58/+212°F)

Pressure Equipment Directive (PED)
The BSV-valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction

	BSV 8
Nominal bore	8 mm (0.315 in.)
Classified for	Fluid group I
Category	IV

Design



BSV is designed as a standard safety relief valve (DIN 3320) which are recommended for refrigeration plants. On a rise in pressure above the set pressure, the safety relief valve will initially start opening slightly, to minimise the outlet of refrigerant. If the pressure continues to increase, the valve will open fully. The safety relief valve will be fully open before the pressure is 10% higher than set pressure, and fully closed before the pressure is 10% below set pressure.

The valve is recommended as an internal safety relief valve because its function is independent of the back pressure. The valve can also be used as an external safety relief valve.

Connections
Available with the following connections:

- Outside pipe thread T (ISO 228/1)

Housing
Made of special steel approved for low temperature application. Spindle and seat are made of stainless steel, to ensure precise operation even during extraordinary conditions. The gasket of the valve cone is made of a special neoprene compound.

Installation
To ensure exact operation of the safety relief valve it should be installed with the spring housing upwards. If the valve is mounted as an internal safety relief valve without any demand for exact opening pressure, the valve may be fitted with the spring housing in other positions. When the valve is mounted, it is important to avoid the influence of static, dynamic and thermal stress.

A very precise technique has been applied for the production of the seal. However, this seal can still be damaged, if dirt is blown from the pipe system into the valve.

Re-calibration/servicing
In certain countries the authorities demand that the valves are readjusted at least once a year (see local rules).

Control/Identification
After adjustment of the set pressure at Danfoss, the valves are sealed. For that reason Danfoss can only guarantee correct operation, as long as the seal remains unbroken.

All valves are provided with a metal plate with the following information:
- Flow diameter
- Set pressure
- Date of production
- Production number
- Type approved code.

Transport/Handling
The valves are fitted with special protection covers and packed in purpose made transportation cartons. It is important that the cover remains fitted around the valve until it is installed.

To ensure the exact and precise operation of the valve it must be handled with care.

Capacity

The design and construction of the safety relief valve has been tested and approved by TÜV. This test comprises control of the function of the valve as well as measuring of the capacity, which is the basis of the curves and tables on the following pages. The values in the table are based on saturated gas.

If e.g. back pressure or superheated gas have to be taken into consideration, the formulas or the Danfoss computation program (DIRcalc™) can be used.

Table 1.

Valve	Nominal size		Flow diameter d_0	Flow area A_0	De-rated, certified coefficient of discharge K_{dr}
	Inlet	Outlet			
BSV 8	15 mm $^1/_2$ in.	20 mm $^3/_4$ in.	8 mm 0.315 in.	50 mm² 0.078 in²	0.46

The discharge capacity of the safety relief valves are based on (IS0 4126-1/EN 1268-1 / prEN 1313 6 (1998)).

$$q_m = 0.2883 \times C \times A_0 \times K_{dr} \times K_b \times \sqrt{\frac{p}{v}}$$

q_m Discharge capacity (kg/h)
C Discharge function depending of the actual refrigerant (κ) see table 2.
A_0 Flow area of the safety relief valve (mm²).
K_{dr} De-rated coefficient of discharge ($K_{dr} = K_d \times 0.9$), (the K_{dr} is certified by TÜV) see table 1.
K_b Correction factor for sub-critical flow. (-)
$K_b = 1.0$ when the back pressure is lower than approx. 0.5 × relieving pressure ($P_b < 0.5 \times p$).
v Specific volume of the vapour. (m³/kg)
p_{set} Set pressure, the predetermined pressure at which a pressure relief valve under operation starts to open (p_{set} is indicated on the metal plate on the safety relief valve). (bar g)
p_{atm} Atmospheric pressure. (1 bar)
p Relieving pressure, $p = p_{set} \times 1.1 + P_{atm}$ (bar a)

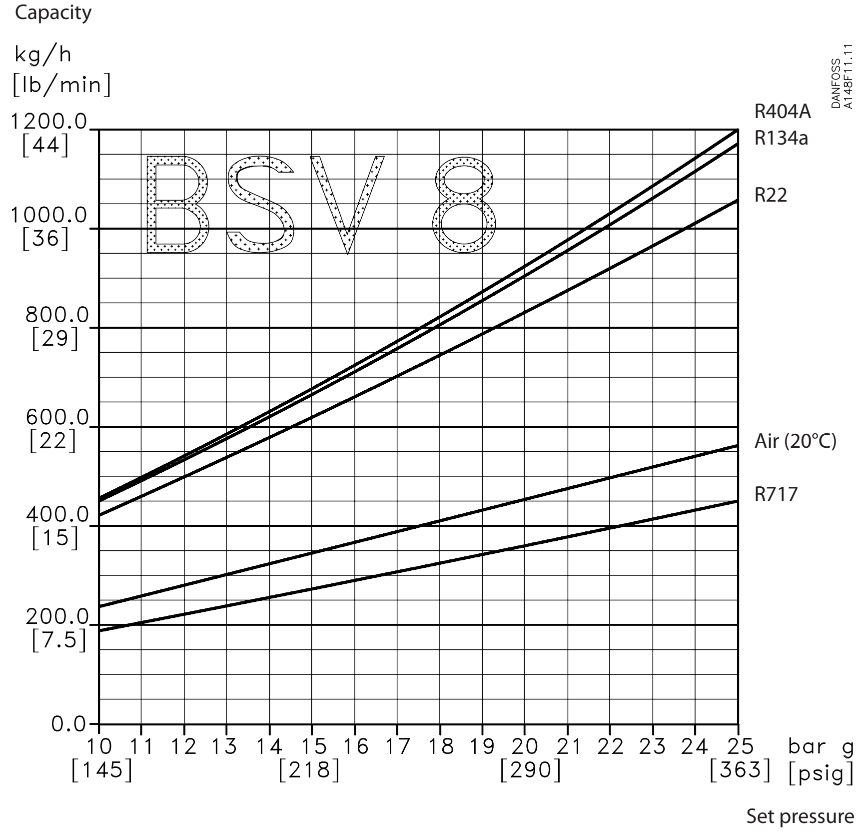
For further details see the above mentioned ISO or EN standards.

Important!
For back pressure higher than 0.5 × p, the Danfoss computer program (DIRcalc™) or the above mentioned standard must be used when calculating the capacity.

Table 2. Properties of Refrigerants

Refrigerant	Isentropic exponent κ	Discharge function C
R22	1.17	2.54
R134a	1.12	2.50
R404A	1.12	2.49
R410A	1.17	2.54
R717 (Ammonia)	1.31	2.64
R44 (CO^2)	1.30	2.63
Air	1.40	2.70

Capacity



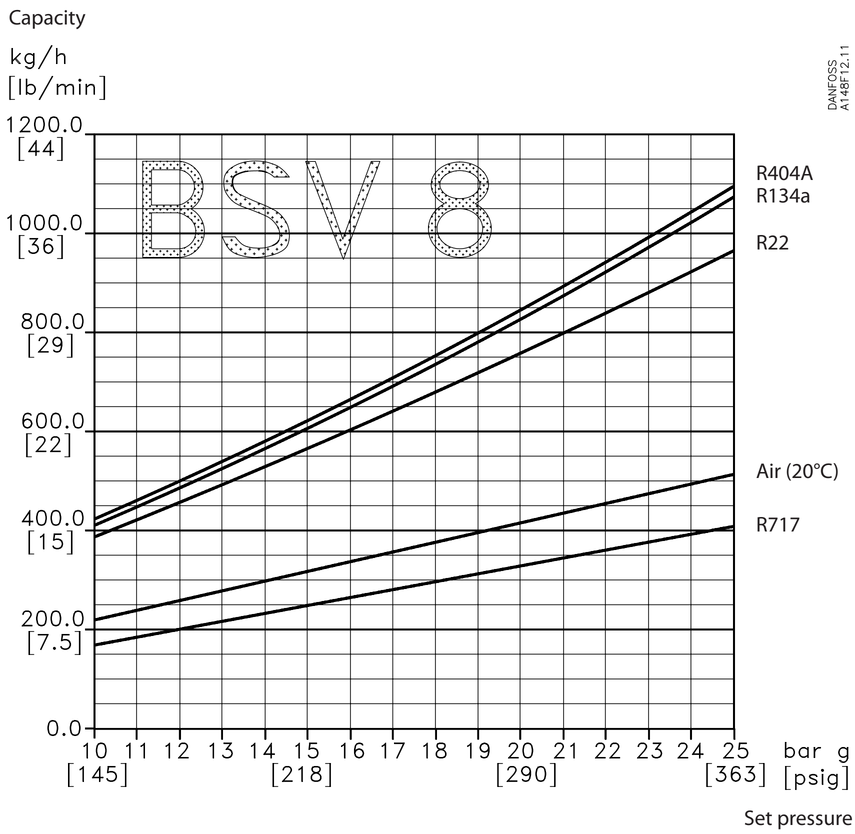
BSV 8, back pressure = atmosphere pressure

Capacity

Set pressure		R22	R134a	R404A	R717	Air (20°C)
BSV 8. back pressure = atmosphere pressure						
13 bar g 189 psi g	kg/h lb/min	540 19.9	575 21.2	590 21.6	240 8.7	300 11.1
18 bar g 261 psi g	kg/h lb/min	745 27.5	810 29.7	825 30.3	325 11.9	410 15.0
21 bar g 305 psi g	kg/h lb/min	875 32.2	955 35.1	970 35.7	375 13.8	475 17.4
25 bar g 363 psi g	kg/h lb/min	1060 38.9	1175 43.2	1200 44.0	445 16.4	560 20.6

The capacity calculation is based on ISO 4126 - 1 / EN 1268 - 1 /prEN 13136 (1998)

Capacity



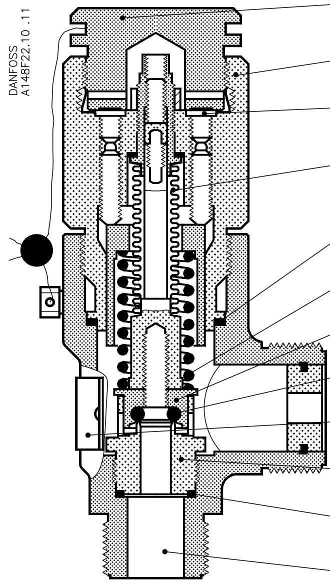
BSV 8, back pressure = 0.6 × set pressure (bar g/psi g)

Capacity

Set pressure		R22	R134a	R404A	R717	Air (20°C)
BSV 8. back pressure = 0.6 x set pressure (bar g/psi g)						
13 bar g	kg/h	495	525	535	215	275
189 psi g	lb/min	18.2	19.4	19.7	8.0	10.1
18 bar g	kg/h	680	740	755	295	375
261 psi g	lb/min	25.1	27.1	27.7	10.9	13.7
21 bar g	kg/h	800	875	885	345	435
305 psi g	lb/min	29.4	32.1	32.6	12.6	15.9
25 bar g	kg/h	965	1075	1095	410	510
363 psi g	lb/min	35.5	39.4	40.2	15.0	18.8

The capacity calculation is based on ISO 4126 - 1 / EN 1268 - 1 /prEN 13136 (1998)

Material specification



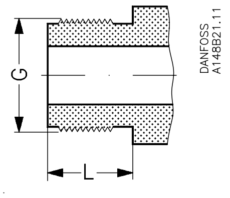
No.	Part	Material	DIN	ISO	ASTM
1	Housing	Steel	TT St 35 N/V, 17173	TW 6, 2604/3-75	Grade 1, A333, A334 A350 LF2 [1])
2	Threaded plug	Steel	9S Mn28, 1651 - 88	11S Mn28 630/9 - 88	1213 SAE J 403
3	Valve top	Steel	St. 37.2, 1652 - 2 - 90	Fe 360 B, 660 - 80	Grade C, A 283
6	Bellow	Stainless steel			
7	Gasket	Aluminium			
8	Valve seat	Stainless steel			
10	O-ring	Cloroprene (Neoprene)			
11	Valve cone	Steel			
12	Spring	Steel	Class C, 17223-1-84		A 679SAE J 403
13	Gasket	Aluminium			
17	Gasket	Aluminium			
21	Marking label	Aluminium			

[1]) Alternative material

Safety valves

Connections

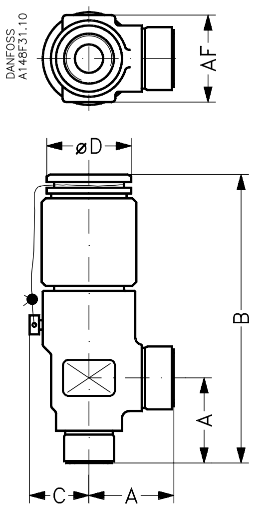
T



Size mm	Size in.	Inlet	Outlet		L mm	L in.		
T outside pipe thread, (ISO 228/1)								
8	5/16	G 3/4	G 1		17	0.67		

Dimension and weight

BSV 8



Valve size			A	B	C		∅D		AF		Weight
BSV 8, with threaded connections ISO 228/1 pipe threads											
BSV 8 (5/16 in.)	mm in.		45 1.77	150 5.91	32 1.26		50 1.97		46 1.81		1.5 kg 3.3 lb

Specified weights are approximate values only.

Ordering

How to order
The table below is used to identify the valve required.

Please note that the type codes only serve to identify the valves, some of which may not form part of the standard product range. For further information please contact your local Danfoss Sales Company.

Example for type codes

BSV	**8**	**T**	**211**

Type codes

Valve type	**BSV**	Back pressure independent safety valve
Nominal size in mm	**8**	DN 8
Connections	**T**	Outside threaded connections: ISO 228/1 Pipe thread - Fittings for connections must be ordered seperately - Fittings for pilot operation - The welding fittings for single mounted safety relief valve must be ordered seperately
Pressure setting		*Standard pressure setting: 2××*
	210	10 bar g (145 psi g)
	211	11 bar g (160 psi g)
	212	12 bar g (174 psi g)
	213	13 bar g (189 psi g)
	214	14 bar g (203 psi g)
	215	15 bar g (218 psi g)
	216	16 bar g (232 psi g)
	217	17 bar g (247 psi g)
	218	18 bar g (261 psi g)
	219	19 bar g (276 psi g)
	220	20 bar g (290 psi g)
	221	21 bar g (305 psi g)
	222	22 bar g (319 psi g)
	223	23 bar g (334 psi g)
	224	24 bar g (348 psi g)
	225	25 bar g (363 psi g)
		Standard pressure setting with TÜV certificate: 3××
	310	10 bar g (145 psi g)
	311	11 bar g (160 psi g)
	312	12 bar g (174 psi g)
	313	13 bar g (188 psi g)
	314	14 bar g (203 psi g)
	315	15 bar g (218 psi g)
	316	16 bar g (232 psi g)
	317	17 bar g (247 psi g)
	318	18 bar g (261 psi g)
	319	19 bar g (276 psi g)
	320	20 bar g (290 psi g)
	321	21 bar g (304 psi g)
	322	22 bar g (319 psi g)
	323	23 bar g (334 psi g)
	324	24 bar g (348 psi g)
	325	25 bar g (362 psi g)

Important!
Where products need to be certified according to specific certification societies, the relevant information should be included at the time of order.

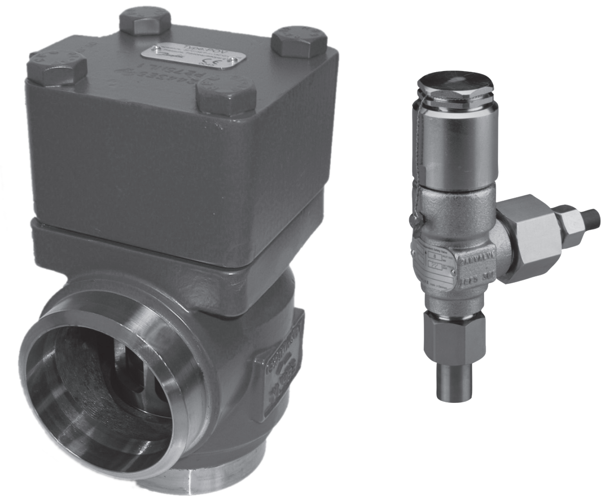
Certified BSV valves with standard set pressure

Size		Construction and test facilities are approved by TÜV		
mm	in.	Type	bar g (psi g)	**Part No.**
8	5/16	BSV8 T 210	10 (145)	**2416+200**
8	5/16	BSV8 T 211	11 (160)	**2416+309**
8	5/16	BSV8 T 212	12 (174)	**2416+310**
8	5/16	BSV8 T 213	13 (189)	**2416+201**
8	5/16	BSV8 T 214	14 (203)	**2416+311**
8	5/16	BSV8 T 215	15 (218)	**2416+312**
8	5/16	BSV8 T 216	16 (232)	**2416+221**
8	5/16	BSV8 T 217	17 (247)	**2416+313**
8	5/16	BSV8 T 218	18 (261)	**2416+202**
8	5/16	BSV8 T 219	19 (276)	**2416+225**
8	5/16	BSV8 T 220	20 (290)	**2416+203**
8	5/16	BSV8 T 221	21 (305)	**2416+204**
8	5/16	BSV8 T 222	22 (319)	**2416+224**
8	5/16	BSV8 T 223	23 (334)	**2416+314**
8	5/16	BSV8 T 224	24 (348)	**2416+315**
8	5/16	BSV8 T 225	25 (363)	**2416+205**

Certified BSV valves with standard set pressure and TÜV pressure setting certificate with each valve

Size		Each valve is certified by a representative from TÜV		
mm	in.	Type	bar g (psi g)	**Part No.**
8	5/16	BSV8 T 310	10 (145)	**2416+316**
8	5/16	BSV8 T 311	11 (160)	**2416+317**
8	5/16	BSV8 T 312	12 (174)	**2416+318**
8	5/16	BSV8 T 313	13 (189)	**2416+206**
8	5/16	BSV8 T 314	14 (203)	**2416+319**
8	5/16	BSV8 T 315	15 (218)	**2416+320**
8	5/16	BSV8 T 316	16 (232)	**2416+222**
8	5/16	BSV8 T 317	17 (247)	**2416+321**
8	5/16	BSV8 T 318	18 (261)	**2416+207**
8	5/16	BSV8 T 319	19 (276)	**2416+322**
8	5/16	BSV8 T 320	20 (290)	**2416+208**
8	5/16	BSV8 T 321	21 (305)	**2416+209**
8	5/16	BSV8 T 322	22 (319)	**2416+210**
8	5/16	BSV8 T 323	23 (334)	**2416+323**
8	5/16	BSV8 T 324	24 (348)	**2416+324**
8	5/16	BSV8 T 325	25 (363)	**2416+211**

Introduction



The POV pilot operated safety valve is used in conjunction with the BSV back pressure independent safety valve and is specifically designed for protecting compressors against excessive pressure.

Features

- Applicable for the refrigerants R 717 (ammonia), HFC, HCFC (e.g. R 22, R 134a, R 404a) and other refrigerants (dependent on sealing material compability).
- The Pilot Operated Internal Safety Valve System POV + BSV is available in sizes from DN 40 to DN 80.
- POV + BSV is an internal safety system thus eliminating the risk of refrigerant leakage to the atmosphere.
- The system renders full protection of the compressor even on increasing back pressure.
- The pilot operated safety valve (main valve) has a very large capacity even with high back pressure when compared to direct operating back pressure independent safety valves.
- Small dimensions mean easy handling and installation.
- Type approved by TÜV.
- Classification: To get an updated list of certification on the products please contact your local Danfoss Sales Company.

The complete technical leaflet (DKRCI.PD.ID0.A) can be downloaded from the Danfoss web site.

Design

Connections
Available with the following connections:

- Welding DIN (2448)
- Welding ANSI (B 36.10):
  DN 40, Schedule 80,
  DN 65 - 80, Schedule 40

Control/Identification
All pilot valves (BSV 8 Safety Relief Valves) are adjusted, tested and sealed before leaving Danfoss A/S. For that reason Danfoss can only guarantee correct operation, as long as the seal remains unbroken.

Transport/Handling
POV and BSV are supplied separately from Danfoss. BSV safety valves are fitted with special protection covers and packed in purpose made cartons. POV valves are provided with protection covers. It is important that the protective covers remain fitted until the valve is installed.

To ensure the exact and precise operation of the valve it must be handled with care.

Installation
To ensure exact operation of the valve it should be installed with the spring housing upwards (refer to "Installation of compressor safety valve POV + BSV" on the following pages).

When the valve is mounted, it is important to avoid the influence of static, dynamic and thermal stress.

Re-calibration/servicing
In certain countries the authorities demand that the valves are readjusted at least once a year (see local rules).

Capacity
The design and construction of the safety relief valve has been tested and approved by TÜV. This test comprises control of the function of the valve as well as measuring of the capacity, which is the basis of the curves and tables on the following pages.

Pressure Equipment Directive (PED)
POV valves are approved according to the European standard specified in the Pressure Equipment Directive and are CE marked.

For further details / restrictions - see Installation Instruction.

POV valves		
Nominal bore	DN40 mm (1½ in.)	DN65-80 mm (2½ - 3 in.)
Classified for	Fluid group I	
Category	I	II

Technical data

- Refrigerants
  Applicable for the refrigerants R 717 (ammonia), HFC, HCFC (e.g. R 22, R 134a, R 404a) and other refrigerants dependent on sealing material compability.
  Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.
- Pressure
  The valve is designed for:
  Pressure setting range:
  15 - 25 bar g (218 - 363 psi g)
  Strength test: 50 bar g (725 psig)
  Leakage test: 25 bar g (363 psig)
  PB/MWP: 40 bar (580 psig)
- Temperature range
  –50/+150°C (–58/+302°F)

Function

Pilot valve BSV 8
The pilot valve is actuated by the high pressure P_1 and the back pressure $P_{2'}$. The reference pressure in the stainless steel bellow (1) P_0 is the atmospheric pressure. The effective area of the bellows is equivalent to the area of the valve seating, so the back pressure $P_{2'}$ does not affect the opening pressure of the valve.

Main valve POV
The main valve is of the normally closed (N.C.) type. The high pressure P_1 acts on the valve inlet side of the valve cone (2). P_1 pressure also passes through the piston rod (3) to the upper chamber (4) of the valve, acting on the top of the piston (5). The area of the piston is larger than the area of the valve seat and this together with the spring pressure keeps the valve closed.

System BSV 8 + POV
When the pressure P_1 reaches the set pressure of the pilot valve, it starts opening. The pressure of the pilot line $P_{2'}$ and of the lower chamber (6) of the main valve increases. The pressure of the lower chamber is limited by flow through the nozzle (7). When the flow through the pilot valve exceeds the capacity of the nozzle, the pressure of the chamber (6) increases, providing the opening of the main valve. When the pressure P_1 is reduced, the pilot valve closes, and the pressure $P_{2'}$ is equalized through the nozzle (7). The closing time is ≤30 seconds.

fig. 1, Inactive system (closed valve)

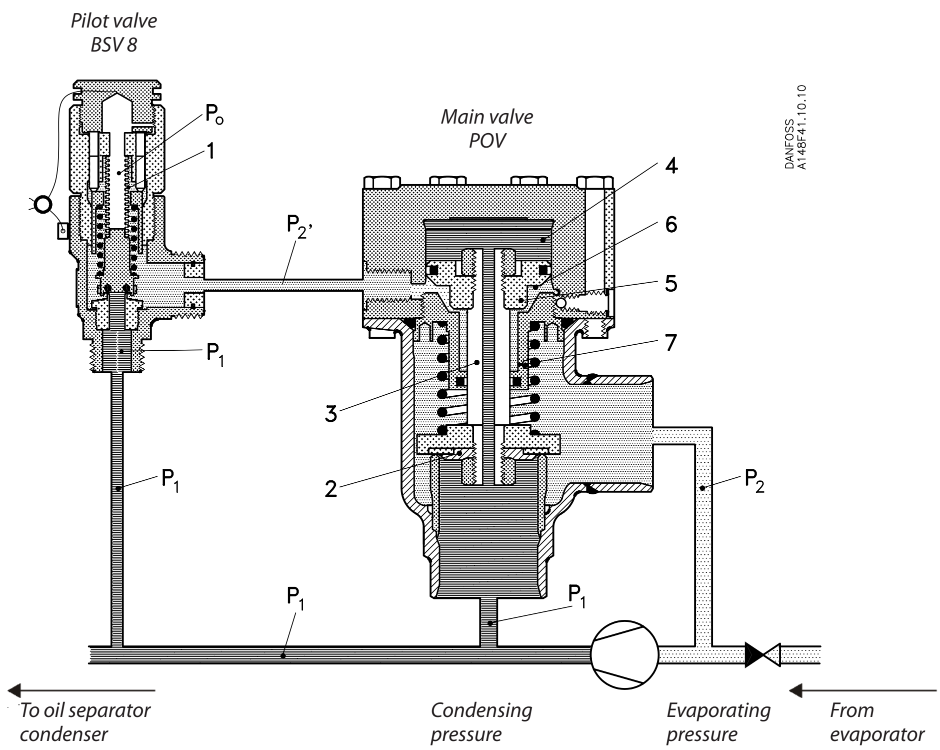
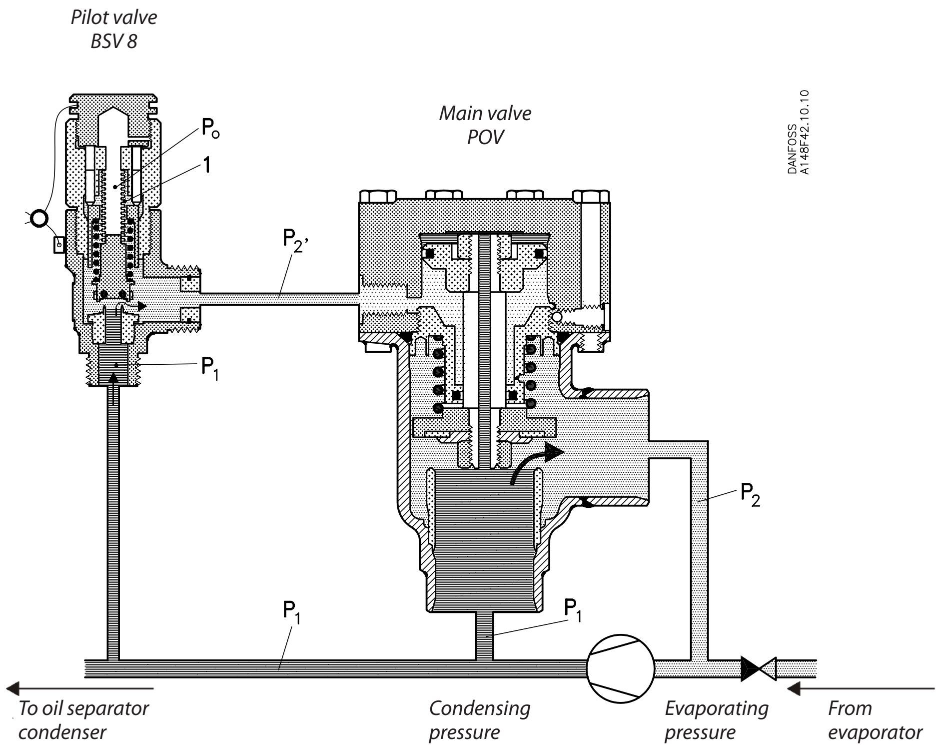


fig. 2, Active system (open valve)



Installation of compressor safety valve POV + BSV

Set pressure
The BSV 8 set pressure is factory set in the range 15 - 25 bar g (145 - 363 psi g), where 15 bar g is the minimum value for this application (fig 4).

Standard set pressures: 18.0, 21.0, or 25.0 bar g (261, 305 or 363 psi g).

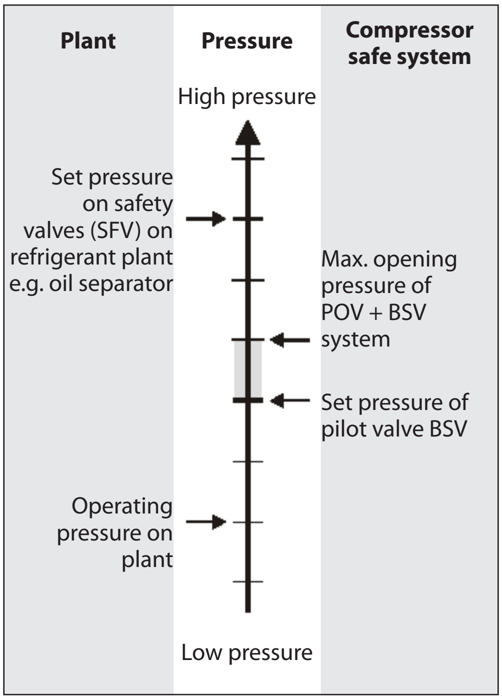
The operational pressure of the plant should be at least 15% below the set pressure of the pilot valve, and the opening pressure of the pilot valve (p_{set} + 10%) must be below the reseating pressure of the safety valve protecting the plant. This implies a perfect operation of the plant.

Back pressure
$P_{2\text{-}0}$ is the effective back pressure of the POV main valve $P_{2\text{-}0} = P_{2\text{-}1} + \Delta P_{outlet}$ where ΔP_{outlet} is the pressure loss in the outlet line of POV (2).

$P_{2\text{-}1}$ Is normally equal to the evaporating pressure. $P_{2\text{-}0}$ must not exceed the limits in fig 4.

Pressure loss in inlet line
The pressure loss in the inlet line of the POV (1) will not affect the function of the POV + BSV system, but a high pressure drop will reduce the capacity.
If the pressure drop in the inlet line ΔP_{inlet} exceed 3% of the opening pressure, the capacity reduction must be taken into consideration by calculation.

Pressure drop in the pilot inlet line
In order to ensure a proper function of the POV + BSV system, the pilot valve must be activated by the plant pressure. It is important that the inlet line of the pilot valve is mounted in a way which ensures that the pilot pressure is identical with the plant pressure. If the pilot pressure is mounted in the inlet line of the POV valve, it must be verified that the pressure drop in the pilot inlet line (3) $\Delta P_{P\text{-}inlet}$ does not exceed 3% of the opening pressure.



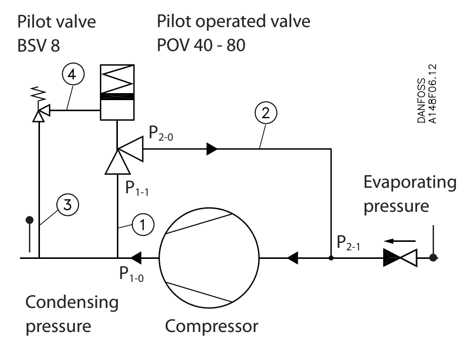


Fig. 3.

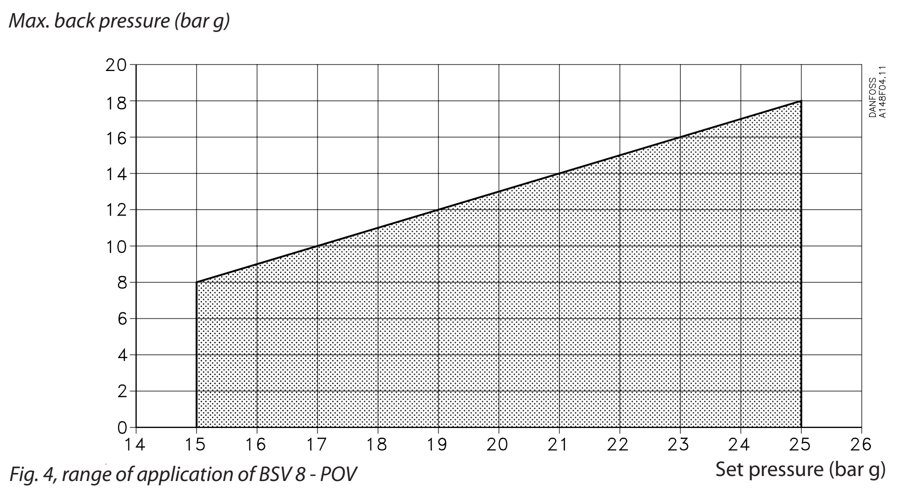


Fig. 4, range of application of BSV 8 - POV

Installation of compressor safety valve POV + BSV *(continued)*

Important: When locating the inlet line to the pilot valve, it is important that the connection is mounted in the gas phase and not in an oil phase, if any.

Pressure drop in the pilot outlet line
The pressure loss in the BSV outlet line (4) $\Delta P_{P\text{-outlet}}$ is not critical.
Minimum internal diameter of the pilot outlet line 8 mm (0.314 in.)
Maximum length of pilot outlet line 1 m (3.25 ft)

Note: The Above mentioned guide lines are securing a safe function of the POV + BSV system, but there might be restrictions from national authorities.

Fig. 5 shows a typical application of the POV + BSV system. In the example a non return valve has been mounted in the suction line, as well as a stop valve in the pressure line. It is good practise and a demand from the authorities of most countries to mount a safety valve on the oil separator.

If the stop valve in the pressure line is closed, and all regulation equipment fails, the pressure after the compressor will rise, and the BSV + POV system is activated. Provided that the required motor effect is present, there will be a rise in temperature caused by the compression work, followed by a rise in pressure. Therefore, the safety valve of the oil separator must, besides being dimensioned for "normal" heat input, also be dimensioned for heat input, corresponding to the effect of the motor.

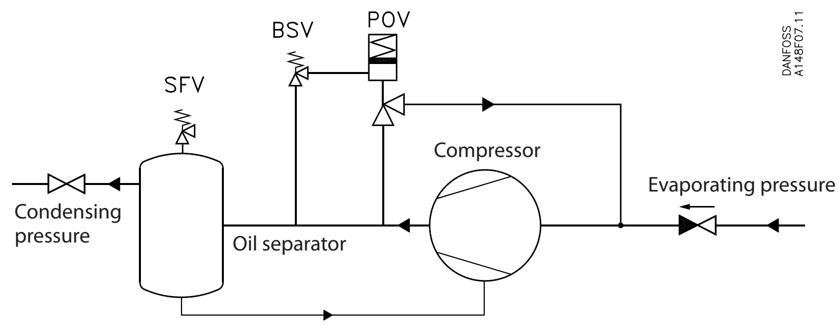


Fig. 5

Safety valves

Capacity

The values in the table are based on saturated gas and with 50K superheat.

If other operating conditions have to be taken into consideration, the formulas or the Danfoss computation program (DIRcalc™) can be used.

Table 1

Version	Nominal size		Flow diameter	Flow area	De-rated, certified coefficient of discharge
	Inlet	Outlet	d_0	A_0	K_{dr}
POV 600	40 mm	40 mm	32.6 mm	835 mm^2	0.74
	1½ in.	1½ in.	1.28 in.	1.28 in^2	
POV 1050	65 mm	65 mm	39.8 mm	1244 mm^2	0.86
	2½ in.	2½ in.	1.56 in.	1.93 in^2	
POV 2150	80 mm	80 mm	59 mm	2734 mm^2	0.8
	3 in.	3 in.	2.32 in.	4.24 in^2	

The discharge capacity of the safety relief valves are based on (IS0 4126-1/EN 1268-1 / prEN 1313 6 (1998)).

$$q_m = 0.2883 \times C \times A_0 \times K_{dr} \times K_b \times \sqrt{\frac{p}{v}}$$

q_m Discharge capacity (kg/h)
C Discharge function depending of the actual refrigerant (κ) see table 2 (-)
A_0 Flow area of the safety relief valve (mm^2).
K_{dr} De-rated coefficient of discharge ($K_{dr} = K_d \times 0.9$), (the K_{dr} is certified by TÜV) see table 1. (-)
K_b Correction factor for sub-critical flow. (-)
$K_b = 1.0$ when the back pressure is lower than approx. 0.5 × relieving pressure ($P_b < 0.5 \times p$).
For all BSV safety valves $K_b = 1.0$
v Specific volume of the vapour. (m^3/kg)
p_{set} Set pressure, the predetermined pressure at which a pressure relief valve under operation starts to open (p_{set} is indicated on the metal plate on the safety relief valve). (bar gauge)
p_{atm} Atmospheric pressure. (1 bar)
p Relieving pressure, $p = p_{set} \times 1.1 + P_{atm}$ (bar absolute)

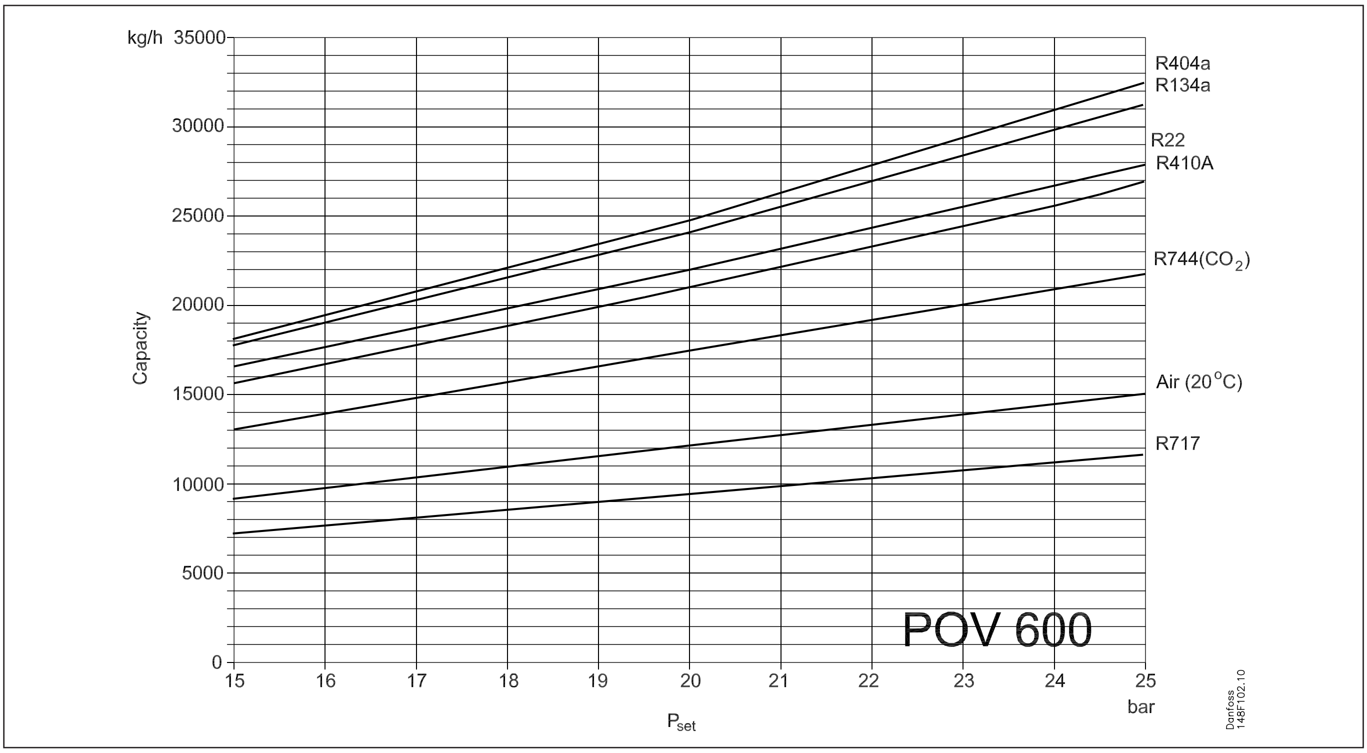
For further details see the above mentioned ISO or EN standards.

Important!
For back pressure higher than 0.5 × p, the Danfoss computer program (DIRcalc™) or the above mentioned standard must be used when calculating the capacity.

Table 2. Properties of Refrigerants

Refrigerant number	Isentropic exponent κ	Discharge function C
R 22	1.17	2.54
R 134a	1.12	2.50
R 404A	1.12	2.49
R 410A	1.17	2.54
R 717 (Ammonia)	1.31	2.64
R 744 (CO_2)	1.30	2.63
Air	1.40	2.70

Capacity - POV 600



Calculation based on the formula $q_m = 0.2883 \times C \times A_0 \times K_{dr} \times K_b \times \sqrt{\frac{p}{v}}$

P_{set}	Set pressure in bar g
P	Relieving pressure in bar a
C	Discharge function
v	Specific volume of the vapour at the relieving pressure P in m^3/kg
q_m	Discharge capacity in kg/h
K_b	Correction factor for sub-critical flow
d_o	Flow diameter seat mm^2
A_o	Flow area seat in mm^2
K_{dr}	De-rated coefficient of discharge at defined lifting height

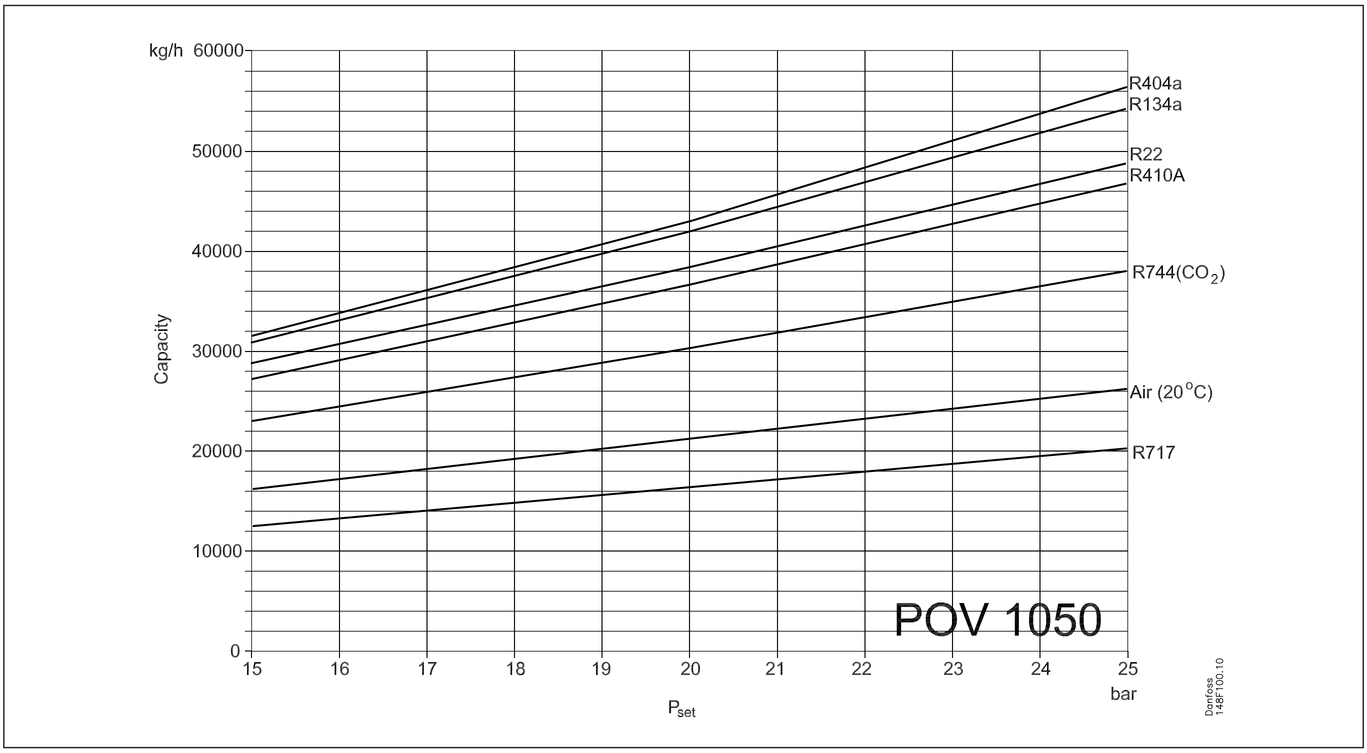
P_{set}		P		**R22**	q_m		**R134a**	q_m		**R404a**	q_m		**R717**	q_m	
bar g	psi g	bar a	psi a	v	kg/h	lb/min	v	kg/h	lb/min	v	kg/h	lb/min	v	kg/h	lb/min
10	145	12.0	174	0.01974	11077	407	0.01655	11907	437	0.01629	11953	439	0.10753	4933	181
11	160	13.1	190	0.01797	12130	446	0.01502	13059	480	0.01470	13147	483	0.09867	5380	198
12	174	14.2	206	0.01638	13228	486	0.01383	14169	521	0.01346	14305	526	0.09130	5823	214
13	189	15.3	222	0.01514	14281	525	0.01273	15330	563	0.01233	15514	570	0.08461	6279	231
14	203	16.4	238	0.01400	15376	565	0.01172	16475	605	0.01128	16793	617	0.07900	6728	247
15	218	17.5	254	0.01311	16414	603	0.01094	17685	650	0.01048	17997	661	0.07383	7189	264
16	232	18.6	270	0.01229	17477	642	0.01007	19004	698	0.00973	19256	708	0.06998	7613	280
17	247	19.7	286	0.01152	18578	683	0.00940	20243	744	0.00902	20582	756	0.06636	8045	296
18	261	20.8	302	0.01080	19716	724	0.00888	21400	786	0.00842	21889	804	0.06213	8544	314
19	276	21.9	318	0.01012	20899	768	0.00828	22741	836	0.00786	23247	854	0.05898	8998	331
20	290	23.0	334	0.00961	21978	808	0.00775	24089	885	0.00738	24586	903	0.05620	9446	347
21	305	24.1	350	0.00908	23145	850	0.00727	25459	935	0.00688	26066	958	0.05350	9910	364
22	319	25.2	365	0.00861	24305	893	0.00685	26820	985	0.00645	27528	1011	0.05121	10358	381
23	334	26.3	381	0.00810	25599	941	0.00645	28235	1037	0.00606	29013	1066	0.04900	10818	397
24	348	27.4	397	0.00768	26834	986	0.00606	29733	1092	0.00565	30670	1127	0.04687	11290	415
25	363	28.5	413	0.00738	27918	1026	0.00574	31158	1145	0.00530	32295	1187	0.04514	11733	431
26	377	29.6	429	0.00699	29235	1074	0.00541	32707	1202	0.00496	34022	1250	0.04348	12183	448
27	392	30.7	445	0.00670	30410	1117	0.00506	34442	1266	0.00463	35862	1318	0.04150	12700	467
28	406	31.8	461	0.00634	31817	1169	0.00479	36028	1324	0.00429	37918	1393	0.04010	13149	483
29	421	32.9	477	0.00607	33075	1215	0.00453	37683	1385	0.00401	39892	1466	0.03870	13615	500
30	435	34.0	493	0.00579	34426	1265	0.00422	39690	1458	0.00371	42161	1549	0.03730	14098	518
31	450	35.1	509	0.00552	35824	1316	0.00392	41842	1537	0.00339	44814	1647	0.03612	14556	535
32	464	36.2	525	0.00523	37376	1373	0.00365	44036	1618	0.00300	48378	1778	0.03482	15056	553
33	479	37.3	541	0.00499	38841	1427	0.00337	46520	1709	0.00206	59262	2178	0.03370	15535	571
34	493	38.4	557	0.00475	40393	1484	0.00306	49534	1820				0.03276	15987	587
35	508	39.5	573	0.00452	41997	1543	0.00275	52994	1947				0.03158	16514	607
36	522	40.6	589	0.00428	43755	1608	0.00221	59933	2202				0.03083	16945	623
37	537	41.7	605	0.00408	45418	1669							0.02972	17491	643
38	551	42.8	621	0.00389	47124	1731							0.02901	17935	659
39	566	43.9	637	0.00365	49269	1810							0.02815	18440	678
40	580	45.0	653	0.00345	51308	1885							0.02740	18923	695

Capacity - POV 600

(Continued)

P_{set}		P		Air(20°C)	q_m		R410a	q_m		R744 (CO_2)	q_m	
bar g	psi g	bar a	psi a	v	kg/h	lb/min	v	kg/h	lb/min	v	kg/h	lb/min
10	145	12.0	174	0.06790	6349	233	0.02213	10461	384	0.03196	9014	331
11	160	13.1	190	0.06220	6931	255	0.02022	11435	420	0.02930	9836	361
12	174	14.2	206	0.05738	7513	276	0.01848	12453	458	0.02690	10688	393
13	189	15.3	222	0.05325	8095	297	0.01690	13517	497	0.02514	11476	422
14	203	16.4	238	0.04968	8676	319	0.01569	14525	534	0.02352	12283	451
15	218	17.5	254	0.04656	9258	340	0.01457	15570	572	0.02201	13117	482
16	232	18.6	270	0.04381	9840	362	0.01353	16657	612	0.02061	13974	513
17	247	19.7	286	0.04136	10422	383	0.01275	17659	649	0.01932	14854	546
18	261	20.8	302	0.03917	11004	404	0.01201	18696	687	0.01825	15704	577
19	276	21.9	318	0.03721	11586	426	0.01132	19760	726	0.01726	16570	609
20	290	23.0	334	0.03543	12168	447	0.01060	20927	769	0.01645	17394	639
21	305	24.1	350	0.03381	12750	468	0.00995	22110	812	0.01560	18283	672
22	319	25.2	365	0.03233	13332	490	0.00944	23212	853	0.01485	19162	704
23	334	26.3	381	0.03098	13914	511	0.00887	24463	899	0.01420	20019	736
24	348	27.4	397	0.02974	14496	533	0.00847	25552	939	0.01355	20918	769
25	363	28.5	413	0.02859	15078	554	0.00795	26899	988	0.01299	21789	801
26	377	29.6	429	0.02753	15660	575	0.00758	28074	1032	0.01239	22736	835
27	392	30.7	445	0.02654	16242	597	0.00722	29295	1076	0.01185	23677	870
28	406	31.8	461	0.02562	16824	618	0.00687	30565	1123	0.01145	24515	901
29	421	32.9	477	0.02477	17406	640	0.00653	31888	1172	0.01093	25521	938
30	435	34.0	493	0.02396	17988	661	0.00621	33242	1221	0.01059	26358	968
31	450	35.1	509	0.02321	18570	682	0.00589	34681	1274	0.01015	27355	1005
32	464	36.2	525	0.02251	19152	704	0.00558	36185	1330	0.00978	28301	1040
33	479	37.3	541	0.02184	19734	725	0.00530	37688	1385	0.00948	29179	1072
34	493	38.4	557	0.02122	20316	746	0.00508	39059	1435	0.00910	30217	1110
35	508	39.5	573	0.02063	20898	768	0.00478	40839	1501	0.00875	31254	1148
36	522	40.6	589	0.02007	21479	789	0.00455	42437	1559	0.00847	32206	1183
37	537	41.7	605	0.01954	22062	811	0.00430	44241	1626	0.00820	33172	1219
38	551	42.8	621	0.01904	22643	832	0.00409	45957	1689	0.00794	34153	1255
39	566	43.9	637	0.01856	23225	853	0.00385	47973	1763	0.00768	35169	1292
40	580	45.0	653	0.01811	23808	875	0.00362	50089	1840	0.00743	36201	1330

Capacity - POV 1050



Calculation based on the formula $q_m = 0.2883 \times C \times A_0 \times K_{dr} \times K_b \times \sqrt{\frac{p}{v}}$

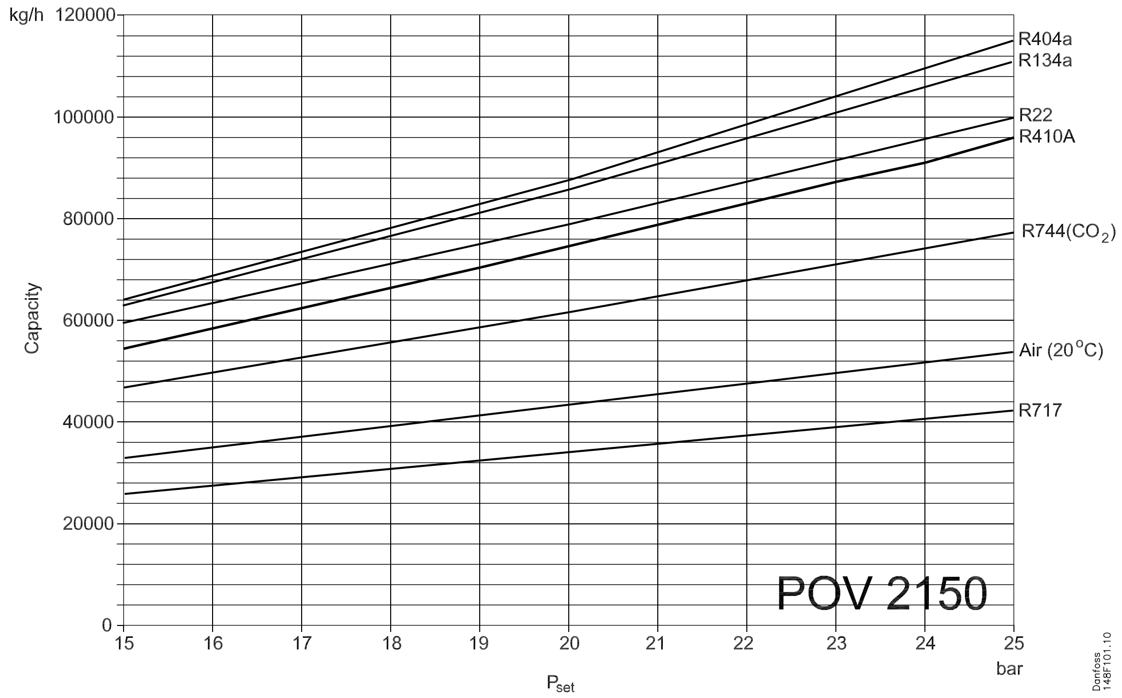
P_{set} Set pressure in bar g
P Relieving pressure in bar a
C Discharge function
v Specific volume of the vapour at the relieving pressure P in m^3/kg
q_m Discharge capacity in kg/h
K_b Correction factor for sub-critical flow
d_o Flow diameter seat mm^2
A_o Flow area seat in mm^2
K_{dr} De-rated coefficient of discharge at defined lifting height

P_{set}		P		R22	q_m		R134a	q_m		R404a	q_m		R717	q_m	
bar g	psi g	bar a	psi a	v	kg/h	lb/min	v	kg/h	lb/min	v	kg/h	lb/min	v	kg/h	lb/min
10	145	12.0	174	0.01974	19295	709	0.01655	20741	762	0.01629	20822	765	0.10753	8593	316
11	160	13.1	190	0.01797	21129	776	0.01502	22748	836	0.01470	22902	841	0.09867	9372	344
12	174	14.2	206	0.01638	23042	847	0.01383	24681	907	0.01346	24918	916	0.09130	10144	373
13	189	15.3	222	0.01514	24878	914	0.01273	26703	981	0.01233	27024	993	0.08461	10938	402
14	203	16.4	238	0.01400	26785	984	0.01172	28698	1054	0.01128	29252	1075	0.07900	11719	431
15	218	17.5	254	0.01311	28592	1051	0.01094	30807	1132	0.01048	31350	1152	0.07383	12523	460
16	232	18.6	270	0.01229	30444	1119	0.01007	33104	1216	0.00973	33542	1232	0.06998	13261	487
17	247	19.7	286	0.01152	32362	1189	0.00940	35262	1296	0.00902	35853	1317	0.06636	14015	515
18	261	20.8	302	0.01080	34344	1262	0.00888	37279	1370	0.00842	38130	1401	0.06213	14883	547
19	276	21.9	318	0.01012	36405	1338	0.00828	39613	1456	0.00786	40495	1488	0.05898	15674	576
20	290	23.0	334	0.00961	38285	1407	0.00775	41961	1542	0.00738	42828	1574	0.05620	16455	605
21	305	24.1	350	0.00908	40317	1481	0.00727	44348	1630	0.00688	45405	1668	0.05350	17264	634
22	319	25.2	365	0.00861	42338	1556	0.00685	46718	1717	0.00645	47953	1762	0.05121	18043	663
23	334	26.3	381	0.00810	44593	1638	0.00645	49185	1807	0.00606	50540	1857	0.04900	18844	692
24	348	27.4	397	0.00768	46744	1718	0.00606	51793	1903	0.00565	53425	1963	0.04687	19666	723
25	363	28.5	413	0.00738	48632	1787	0.00574	54275	1994	0.00530	56257	2067	0.04514	20438	751
26	377	29.6	429	0.00699	50925	1871	0.00541	56975	2093	0.00496	59265	2178	0.04348	21223	780
27	392	30.7	445	0.00670	52974	1946	0.00506	59997	2205	0.00463	62470	2295	0.04150	22123	813
28	406	31.8	461	0.00634	55424	2036	0.00479	62760	2306	0.00429	66051	2427	0.04010	22905	842
29	421	32.9	477	0.00607	57614	2117	0.00453	65642	2412	0.00401	69489	2553	0.03870	23716	871
30	435	34.0	493	0.00579	59969	2203	0.00422	69138	2540	0.00371	73442	2699	0.03730	24557	902
31	450	35.1	509	0.00552	62404	2293	0.00392	72886	2678	0.00339	78063	2868	0.03612	25356	932
32	464	36.2	525	0.00523	65107	2392	0.00365	76708	2819	0.00300	84273	3096	0.03482	26226	964
33	479	37.3	541	0.00499	67660	2486	0.00337	81035	2978	0.00206	103232	3793	0.03370	27061	994
34	493	38.4	557	0.00475	70363	2585	0.00306	86286	3170				0.03276	27848	1023
35	508	39.5	573	0.00452	73157	2688	0.00275	92314	3392				0.03158	28767	1057
36	522	40.6	589	0.00428	76220	2801	0.00221	104400	3836				0.03083	29517	1085
37	537	41.7	605	0.00408	79116	2907							0.02972	30468	1120
38	551	42.8	621	0.00389	82087	3016							0.02901	31243	1148
39	566	43.9	637	0.00365	85825	3154							0.02815	32121	1180
40	580	45.0	653	0.00345	89377	3284							0.02740	32963	1211

Capacity - POV 1050
(Continued)

P_{set}		P		Air(20°C)	q_m		R410a	q_m		R744 (CO_2)	q_m	
bar g	psi g	bar a	psi a	v	kg/h	lb/min	v	kg/h	lb/min	v	kg/h	lb/min
10	145	12.0	174	0.06790	11059	406	0.02213	18223	670	0.03196	15701	577
11	160	13.1	190	0.06220	12073	444	0.02022	19919	732	0.02930	17134	630
12	174	14.2	206	0.05738	13087	481	0.01848	21693	797	0.02690	18617	684
13	189	15.3	222	0.05325	14100	518	0.01690	23547	865	0.02514	19990	735
14	203	16.4	238	0.04968	15114	555	0.01569	25301	930	0.02352	21397	786
15	218	17.5	254	0.04656	16128	593	0.01457	27122	997	0.02201	22849	840
16	232	18.6	270	0.04381	17141	630	0.01353	29016	1066	0.02061	24343	894
17	247	19.7	286	0.04136	18155	667	0.01275	30761	1130	0.01932	25875	951
18	261	20.8	302	0.03917	19169	704	0.01201	32568	1197	0.01825	27356	1005
19	276	21.9	318	0.03721	20183	742	0.01132	34421	1265	0.01726	28864	1061
20	290	23.0	334	0.03543	21197	779	0.01060	36453	1339	0.01645	30299	1113
21	305	24.1	350	0.03381	22210	816	0.00995	38515	1415	0.01560	31849	1170
22	319	25.2	365	0.03233	23224	853	0.00944	40434	1486	0.01485	33380	1227
23	334	26.3	381	0.03098	24238	891	0.00887	42613	1566	0.01420	34873	1281
24	348	27.4	397	0.02974	25251	928	0.00847	44510	1635	0.01355	36438	1339
25	363	28.5	413	0.02859	26265	965	0.00795	46856	1722	0.01299	37955	1395
26	377	29.6	429	0.02753	27279	1002	0.00758	48903	1797	0.01239	39606	1455
27	392	30.7	445	0.02654	28293	1040	0.00722	51030	1875	0.01185	41244	1515
28	406	31.8	461	0.02562	29307	1077	0.00687	53243	1956	0.01145	42703	1569
29	421	32.9	477	0.02477	30321	1114	0.00653	55548	2041	0.01093	44457	1634
30	435	34.0	493	0.02396	31334	1151	0.00621	57906	2128	0.01059	45914	1687
31	450	35.1	509	0.02321	32348	1189	0.00589	60412	2220	0.01015	47651	1751
32	464	36.2	525	0.02251	33361	1226	0.00558	63033	2316	0.00978	49299	1811
33	479	37.3	541	0.02184	34375	1263	0.00530	65651	2412	0.00948	50828	1868
34	493	38.4	557	0.02122	35389	1300	0.00508	68040	2500	0.00910	52637	1934
35	508	39.5	573	0.02063	36403	1338	0.00478	71140	2614	0.00875	54443	2000
36	522	40.6	589	0.02007	37416	1375	0.00455	73924	2716	0.00847	56101	2061
37	537	41.7	605	0.01954	38430	1412	0.00430	77066	2832	0.00820	57784	2123
38	551	42.8	621	0.01904	39444	1449	0.00409	80055	2942	0.00794	59492	2186
39	566	43.9	637	0.01856	40458	1487	0.00385	83566	3071	0.00768	61263	2251
40	580	45.0	653	0.01811	41472	1524	0.00362	87253	3206	0.00743	63061	2317

Capacity - POV 2150



Calculation based on the formula $q_m = 0.2883 \times C \times A_0 \times K_{dr} \times K_b \times \sqrt{\frac{p}{v}}$

P_{set} Set pressure in bar g
P Relieving pressure in bar a
C Discharge function
v Specific volume of the vapour at the relieving pressure P in m^3/kg
q_m Discharge capacity in kg/h
K_b Correction factor for sub-critical flow
d_o Flow diameter seat mm^2
A_o Flow area seat in mm^2
K_{dr} De-rated coefficient of discharge at defined lifting height

P_{set}		P		R22	q_m		R134a	q_m		R404a	q_m		R717	q_m	
bar g	psi g	bar a	psi a	v	kg/h	lb/min	v	kg/h	lb/min	v	kg/h	lb/min	v	kg/h	lb/min
10	145	12.0	174	0.01974	39440	1449	0.01655	42395	1558	0.01629	42561	1564	0.10753	17564	645
11	160	13.1	190	0.01797	43190	1587	0.01502	46497	1708	0.01470	46812	1720	0.09867	19157	704
12	174	14.2	206	0.01638	47098	1731	0.01383	50450	1854	0.01346	50934	1871	0.09130	20735	762
13	189	15.3	222	0.01514	50851	1868	0.01273	54583	2006	0.01233	55239	2030	0.08461	22358	821
14	203	16.4	238	0.01400	54749	2012	0.01172	58660	2155	0.01128	59793	2197	0.07900	23955	880
15	218	17.5	254	0.01311	58444	2147	0.01094	62970	2314	0.01048	64080	2355	0.07383	25597	941
16	232	18.6	270	0.01229	62230	2287	0.01007	67665	2486	0.00973	68562	2519	0.06998	27106	996
17	247	19.7	286	0.01152	66149	2431	0.00940	72077	2648	0.00902	73285	2693	0.06636	28646	1053
18	261	20.8	302	0.01080	70200	2579	0.00888	76199	2800	0.00842	77940	2864	0.06213	30421	1118
19	276	21.9	318	0.01012	74413	2734	0.00828	80972	2975	0.00786	82774	3041	0.05898	32038	1177
20	290	23.0	334	0.00961	78257	2875	0.00775	85771	3152	0.00738	87543	3217	0.05620	33635	1236
21	305	24.1	350	0.00908	82411	3028	0.00727	90650	3331	0.00688	92811	3410	0.05350	35287	1297
22	319	25.2	365	0.00861	86540	3180	0.00685	95495	3509	0.00645	98018	3602	0.05121	36882	1355
23	334	26.3	381	0.00810	91150	3349	0.00645	100536	3694	0.00606	103306	3796	0.04900	38518	1415
24	348	27.4	397	0.00768	95546	3511	0.00606	105868	3890	0.00565	109203	4013	0.04687	40199	1477
25	363	28.5	413	0.00738	99406	3653	0.00574	110941	4076	0.00530	114992	4225	0.04514	41776	1535
26	377	29.6	429	0.00699	104094	3825	0.00541	116459	4279	0.00496	121141	4451	0.04348	43380	1594
27	392	30.7	445	0.00670	108281	3979	0.00506	122636	4506	0.00463	127692	4692	0.04150	45220	1662
28	406	31.8	461	0.00634	113289	4163	0.00479	128284	4714	0.00429	135011	4961	0.04010	46820	1720
29	421	32.9	477	0.00607	117767	4327	0.00453	134176	4930	0.00401	142040	5219	0.03870	48477	1781
30	435	34.0	493	0.00579	122580	4504	0.00422	141322	5193	0.00371	150120	5516	0.03730	50197	1844
31	450	35.1	509	0.00552	127557	4687	0.00392	148983	5474	0.00339	159565	5863	0.03612	51829	1904
32	464	36.2	525	0.00523	133083	4890	0.00365	156795	5761	0.00300	172258	6329	0.03482	53608	1970
33	479	37.3	541	0.00499	138300	5082	0.00337	165640	6086	0.00206	211011	7753	0.03370	55313	2032
34	493	38.4	557	0.00475	143826	5285	0.00306	176372	6481				0.03276	56922	2092
35	508	39.5	573	0.00452	149537	5495	0.00275	188694	6933				0.03158	58801	2161
36	522	40.6	589	0.00428	155797	5725	0.00221	213399	7841				0.03083	60334	2217
37	537	41.7	605	0.00408	161717	5942							0.02972	62278	2288
38	551	42.8	621	0.00389	167790	6165							0.02901	63861	2346
39	566	43.9	637	0.00365	175430	6446							0.02815	65657	2412
40	580	45.0	653	0.00345	182690	6713							0.02740	67378	2476

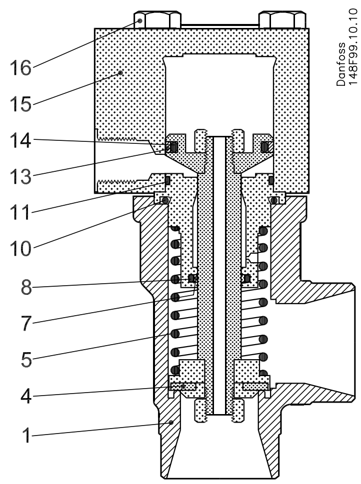
Safety valves

Capacity - POV 2150

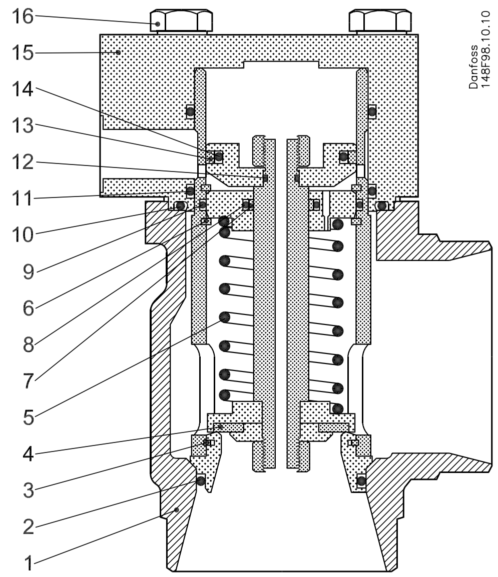
(Continued)

P_{set}		P		Air(20°C)	q_m		R410a	q_m		R744 (CO_2)	q_m	
bar g	psi g	bar a	psi a	v	kg/h	lb/min	v	kg/h	lb/min	v	kg/h	lb/min
10	145	12.0	174	0.06790	22605	831	0.02213	37249	1369	0.03196	32094	1179
11	160	13.1	190	0.06220	24677	907	0.02022	40716	1496	0.02930	35022	1287
12	174	14.2	206	0.05738	26750	983	0.01848	44342	1629	0.02690	38055	1398
13	189	15.3	222	0.05325	28822	1059	0.01690	48131	1768	0.02514	40861	1501
14	203	16.4	238	0.04968	30894	1135	0.01569	51717	1900	0.02352	43737	1607
15	218	17.5	254	0.04656	32966	1211	0.01457	55438	2037	0.02201	46704	1716
16	232	18.6	270	0.04381	35038	1287	0.01353	59310	2179	0.02061	49757	1828
17	247	19.7	286	0.04136	37110	1364	0.01275	62878	2310	0.01932	52890	1943
18	261	20.8	302	0.03917	39183	1440	0.01201	66570	2446	0.01825	55917	2055
19	276	21.9	318	0.03721	41254	1516	0.01132	70359	2585	0.01726	58999	2168
20	290	23.0	334	0.03543	43327	1592	0.01060	74513	2738	0.01645	61933	2276
21	305	24.1	350	0.03381	45399	1668	0.00995	78726	2893	0.01560	65101	2392
22	319	25.2	365	0.03233	47471	1744	0.00944	82648	3037	0.01485	68230	2507
23	334	26.3	381	0.03098	49543	1820	0.00887	87103	3201	0.01420	71281	2619
24	348	27.4	397	0.02974	51615	1897	0.00847	90981	3343	0.01355	74481	2737
25	363	28.5	413	0.02859	53687	1973	0.00795	95776	3519	0.01299	77582	2851
26	377	29.6	429	0.02753	55760	2049	0.00758	99961	3673	0.01239	80956	2975
27	392	30.7	445	0.02654	57832	2125	0.00722	104308	3833	0.01185	84305	3098
28	406	31.8	461	0.02562	59904	2201	0.00687	108831	3999	0.01145	87287	3207
29	421	32.9	477	0.02477	61977	2277	0.00653	113543	4172	0.01093	90872	3339
30	435	34.0	493	0.02396	64048	2353	0.00621	118362	4349	0.01059	93850	3448
31	450	35.1	509	0.02321	66121	2430	0.00589	123485	4537	0.01015	97401	3579
32	464	36.2	525	0.02251	68192	2506	0.00558	128842	4734	0.00978	100769	3703
33	479	37.3	541	0.02184	70265	2582	0.00530	134195	4931	0.00948	103894	3817
34	493	38.4	557	0.02122	72337	2658	0.00508	139076	5110	0.00910	107593	3953
35	508	39.5	573	0.02063	74410	2734	0.00478	145413	5343	0.00875	111285	4089
36	522	40.6	589	0.02007	76480	2810	0.00455	151104	5552	0.00847	114673	4214
37	537	41.7	605	0.01954	78554	2886	0.00430	157526	5788	0.00820	118114	4340
38	551	42.8	621	0.01904	80625	2962	0.00409	163636	6013	0.00794	121605	4468
39	566	43.9	637	0.01856	82697	3039	0.00385	170813	6276	0.00768	125225	4601
40	580	45.0	653	0.01811	84770	3115	0.00362	178349	6553	0.00743	128900	4736

Material specification



POV 600



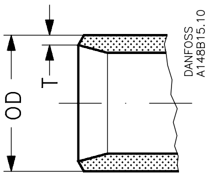
POV 1050, POV 2150

No	Part	Material	EN	ISO	ASTM
1	Housing	Steel	P285QH EN 10222-4		LF2, A350
2	O-ring	Cloropren (Neopren)			
3	Spring ring	Steel			
4	Telfon washer	PTFE(Teflon)			
5	Spring	Steel			
6	Seeger	Steel			
7	Glide ring	PTFE(Teflon)			
8-12	O-ring	Cloropren (Neopren)			
13	Glide ring	PTFE(Teflon)			
14	O-ring	Cloropren (Neopren)			
15	Top cover	Steel	P275NL1 EN 10028-3		Grade A, A662
16	Bolt	Stainless steel	A2-70 1515-1	A2-70 3506	Grade B8 A320

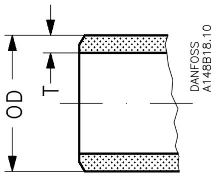
Connections

Version	Size mm	Size in.	OD mm	T mm	OD in.	T in.	
Welding DIN (2448)							
POV 600	40	1½	48.3	2.6	1.902	0.103	
POV 1050	65	2½	76.1	2.9	3	0.11	
POV 2150	80	3	88.9	3.2	3.5	0.13	
Welding ANSI (B 36.10)							
POV 600	40	1½	48.3	5.1	1.902	0.201	Schedule 80
POV 1050	65	2½	73	5.2	2.87	0.2	Schedule 40
POV 2150	80	3	88.9	5.5	3.5	0.22	Schedule 40

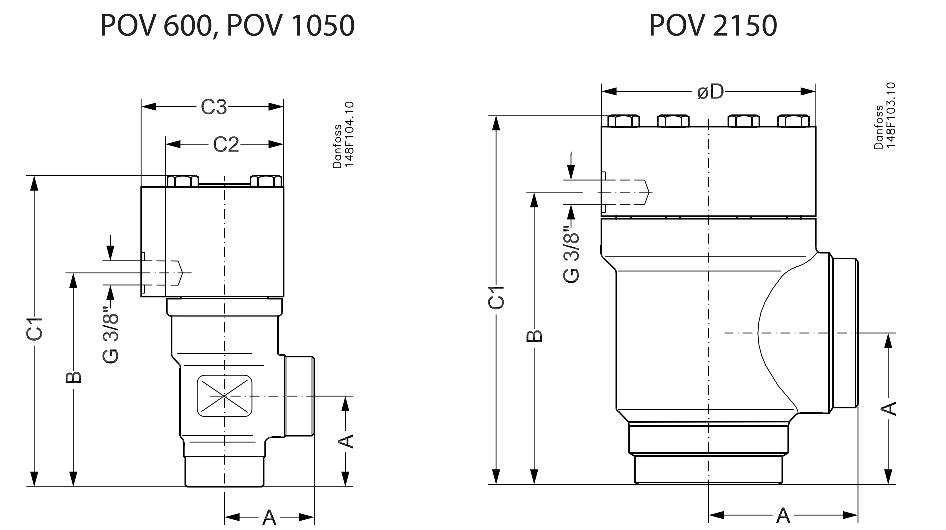
DIN



ANSI



Dimensions and weights



Valve size		A	B	C1	C2	C3	ØD	Weight
POV 600 1½ in	mm	55	130	188	73	88		5 kg
	in	2.2	5.1	7.4	2.8	3.5		
POV 1050 2½ in.	mm	70	137	184	90	105		6 kg
	in	2.8	5.4	7.2	3.5	4.1		
POV 2150 3 in.	mm	90	174	219			130	11 kg
	in	3.5	6.9	8.6			5.1	

Specified weights are approximate values only.

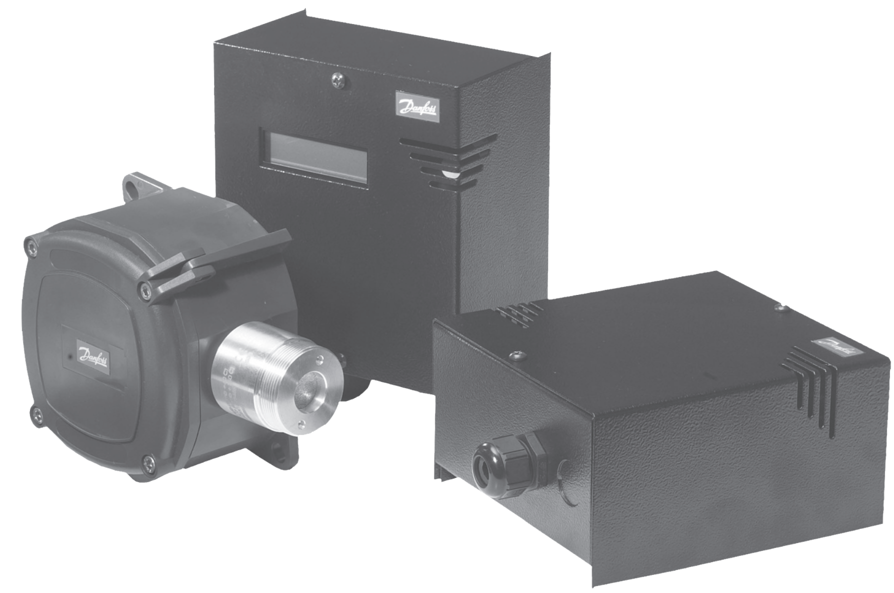
Ordering

Type	Code no.
POV 600 BUTT WELD DIN DN 40	**2417+232**
POV 600 BUTT WELD ANSI DN 40	**2417+047**
POV 1050 BUTT WELD DIN DN 65	**148F3026**
POV 1050 BUTT WELD ANSI DN 65	**148F3027**
POV 2150 BUTT WELD DIN DN 80	**148F3033**
POV 2150 BUTT WELD ANSI DN 80	**148F3034**

Size		Type	**Code no.**
mm	in.	For system POV + BSV	
15	½	Set of fittings	**2469 + 069**

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

Introduction



Danfoss Gas Detection program, type GD is a range of products designed to meet all industrial refrigeration and air conditioning applications.

GD detects a wide range of commonly used refrigerants including Ammonia, Carbon Dioxide, Halocarbons and Hydrocarbons.

GD sensors incorporate an interchangeable precalibrated sensor board, which makes it very easy to replace the sensor when service or calibration is required.

The GD products feature reliable, real time continuous monitoring. No blocked filters, tubes or technical / maintenance problems experienced by air sampling/ aspirated systems.

Features

- GD is specifically developed for refrigeration applications.
- Interchangeable precalibrated sensor board means reduced costs of recalibration and maintenance
- Optional models: LCD display, IP 56 enclosure, IP 56 Low temperature, EExd (Explosion Protected), EExd Low temperature, Models with remote sensor, Models with remote EExd sensor, Models with remote display
- Can operate as stand alone product.
- Linear analog outputs, current (mA) / volt (V) proportional to the gas concentration.
- Two digital outputs. Low Level and High Level Alarm
- Optional NO or NC and different delay setting for both Low and High Alarm Level.
- Manual or Auto reset optional.
- Low and High Alarm levels and delays setting, can be changed by the user.
- GD can be connected directly to a Danfoss m2, Micromon or AK-SM 350 monitoring unit.
- Available with a range of different sensor technologies to monitor industrial refrigeration gases:
  - Electro-Chemical (EC)
  - Semi-Conductor (SC)
  - Catalytic (CT)
  - Infra-Red (IR)
- Calibration Certificates available

Gas detectors

Technical data

Refrigerants - [ppm] range:

Ammonia (R 717)
Type GDA:
- 0-100 ppm
- 0-300 ppm
- 0-1,000 ppm
- 0-10,000 ppm
- 0-30,000 ppm

Carbon Dioxide (R 744)
Type GDC
0-10,000 ppm
0-20000 ppm
0-40000 ppm

Halo-Carbon - HCFC (R 22, R 123)
Type GDHC
- 0-1,000 ppm

HFC (R 404A, R 507)
Type GDHF
- 0-1,000 ppm

HFC (R134A)
Type GDHF-R3
- 0-1,000 ppm

Hydro-carbon (R 290, R 600, R 600A, R 1270)
Type GDH
- 0-5,000 ppm

The complete technical leaflet (DKRCI.PD.S00.A) can be downloaded from the Danfoss web site.

Technical data
(Continued)

Models / Sensor	Standard Basic	Standard Basic with LCD display	IP 65 for High RH and Fast response	IP 56 enclosure	IP 56 enclosure Low Temperature	EExd model	EExd model Low Temperature	IP 66 enclosure 5 m remote IP 65 sensor	IP 66 enclosure 5 m remote IP 65 EExd sensor	Remote LCD display IP 41 5 m cable ³)
Temperature range										
EC	–20°C/+40°C (–4°F/104°F)	0°C/+40°C (32°F/104°F)	–20°C/+40°C (–4°F/104°F)	–20°C/+40°C (–4°F/104°F)	–40°C/+40°C (–40°F/104°F)	–20°C/+40°C (–4°F/104°F)	–40°C/+40°C (–40°F/104°F)	–20°C/+40°C (–4°F/104°F)	–20°C/+40°C (–4°F/104°F)	0°C/+40°C (32°F/104°F)
SC, CT	–20°C/+50°C (–4°F/122°F)	0°C/+50°C (32°F/122°F)	–20°C/+50°C (–4°F/122°F)	–20°C/+50°C (–4°F/122°F)	–40°C/+50°C (–40°F/122°F)	–20°C/+50°C (–4°F/122°F)	–40°C/+50°C (–40°F/122°F)	–20°C/+50°C (–4°F/122°F)	–20°C/+50°C (–4°F/122°F)	0°C/+50°C (32°F/122°F)
IR	0°C/+50°C (32°F/122°F)	0°C/+50°C (32°F/122°F)	–20°C/+50°C (–4°F/122°F)	0°C/+50°C (32°F/122°F)	1) –50°C/+50°C (–58°F/122°F)	–20°C/+50°C (–4°F/122°F)	not available	not available	not available	0°C/+50°C (32°F/122°F)
Weight (excluding packing)										
EC	912 g (2.01 lb)	947 g (2.09 lb)	903 g (1.99 lb)	562 g (1.24 lb)	562 g (1.24 lb)	4408 g (9.72 lb)	4408 g (9.72 lb)	1199 g (2.64 lb)	1199 g (2.64 lb)	421 g (0.93 lb)
SC, CT										
IR					661 g (1.46 lb)	3600 g (7.94 lb)	not available	not available	not available	
Electrical data										
EC, SC, CT	12-24 V d.c., 0.23A 12-24 V a.c. 4 W				12-24 V d.c., 0.23A 12-24 V a.c. 4 W	12-24 V d.c., 0.23A 12-24 V a.c. 4 W	12-24 V d.c., 0.23A 12-24 V a.c. 4 W	12-24 V d.c., 0.23A 12-24 V a.c. 4 W		Supplied from connector on GD motherboard
IR	12- 24 V d.c 0.3 A				24V d.c., +/- 2 V. 1.4A	12- 24 V d.c 0.24 A	not available	not available	not available	
Enclosure										
EC	IP 30 (~NEMA 1)	IP 30 (~NEMA 1)	IP 65 (~NEMA 4)	IP 56 (~NEMA 4x)	IP 56 (~NEMA 4x)	IP 65 (~NEMA 4)	IP 65 (~NEMA 4)	²) IP 66 (~NEMA 4x)	²) IP 66 (~NEMA 4x)	IP 41 (~NEMA 1)
SC, CT										
IR							not available	not available	not available	

¹) With built-in heater.

²) Remote sensor: IP 65.

³) For all models except EExd and EExd Low Temp.

Sensor head

Models / Sensor	Standard Basic	Standard Basic with LCD display	IP 65 for High RH and Fast response	IP 56 enclosure	IP 56 enclosure Low Temperature	EExd model	EExd model Low Temperature	IP 66 enclosure 5 m remote IP 65 sensor	IP 66 enclosure 5 m remote IP 65 EExd sensor
Thread on external sensor									
EC	–	–	M 42	–	–	M 42	M 42	M 42	M 42
SC			M 42			1" 5/16 x 20 UNF	1" 5/16 x 20 UNF	M 42	1" 5/16 x 20 UNF
CT			M 35			M 35	M 35	M 35	M 35
IR			M 46			M 46	not available	not available	not available
Material for external sensor									
EC	–	–	Stainless Steel	–	–	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
SC, CT			Stainless Steel			Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
IR			Stainless Steel			Stainless Steel	not available	not available	not available

Cable connection

1 gland for 6-13 mm cable (0.2"-0.5")
1 Ø 20 mm (0.8") hole with blanking plug.
1 extra gland can be fitted (only Standard, LCD display, IP 65 and EExd).

Approvals

CE:
EN55011: 1998,
EN61326: 1996
Following the provisions of 89/336/EEC, EMC Directives and, Cenelec
EN61010-2 : 2001
Following the provisions of 73/23/EEC, Low

Voltage directive (LVD)

ATEX for EExd model:
Directive 94/9/EC Group 2, Category2, G and D, Zones 1 and 2.

Electrical connection

All terminals will accept 0.5-1.5 mm² (20-15 AWG)

Analog output
4-20 mA Max. 400Ω
0-10 V Min. 10 kΩ
0-5 V Min. 10 kΩ

RS 485 Communication
To Danfoss Monitoring System:
Danfoss m2
Danfoss Micromon
Danfoss AK SM 350

Digital output – volt free contacts
Load: 1 A, 24 V a.c/d.c

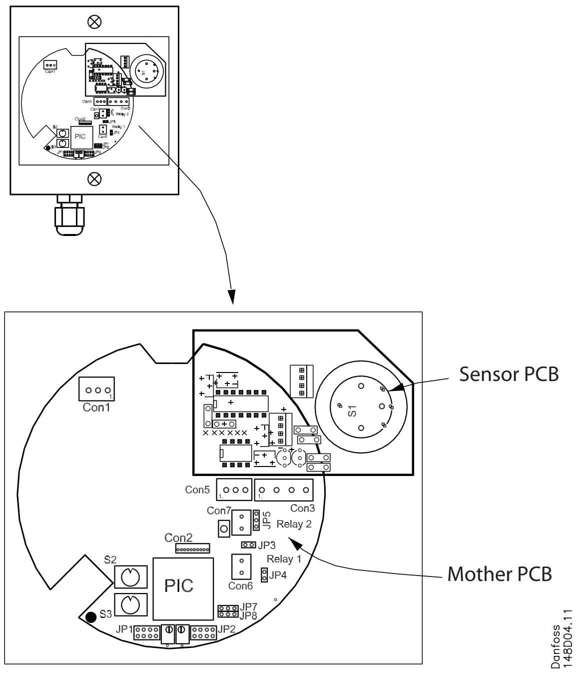
Design

The GD product range is designed in a very flexible way with a mother PCB (Print Circuit Board) and an interchangeable precalibrated sensor PCB.

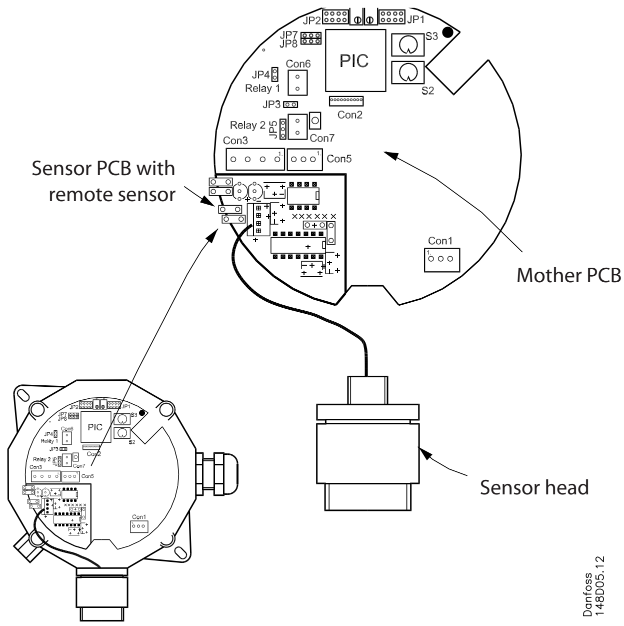
The mother PCB is the same for all GD models independent of the refrigerant or sensor technology. On the mother PCB individual settings (Alarm levels, delays e.t.c) can be set to meet local legislation or application requirements.

The sensor PCB is always precalibrated and dedicated to the actual refrigerant and ppm range. Danfoss has in advance selected the most appropriate sensor making it easy to optain safe detection and avoid false alarms from other gases present.
Because of the interchangeable precalibrated sensor PCB, it is very easy to replace the sensor when service or a calibration procedure is required (see the below drawings).

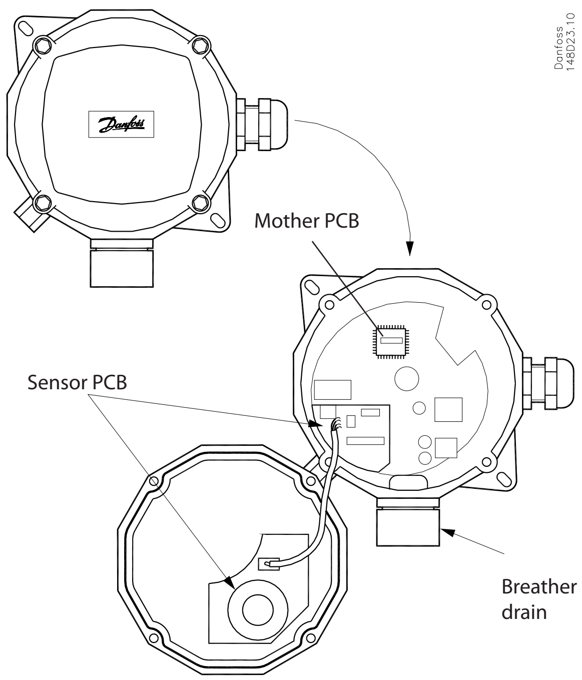
- Standard
- LCD display



- IP 65
- EExd
- EExd Low Temp



- IP 56
- IP 56 low temperature



Gas detectors

Sensor technology

Danfoss has, depending on actual ppm range and refrigerant, selected the most appropriate sensor for the target refrigerant gas. When the refrigerant and actual ppm range has been decided, the Danfoss GD product range makes it easy to pick out the right product.
Below is a brief introduction to the GD sensor types. For further information - please contact Danfoss.

Electrochemical Sensors - EC
EC sensors are used mainly for toxic gases and are suitable for ammonia but not for the other refrigerants. They are very accurate and tend to be used principally for toxic gases which cannot be otherwise detected or where high levels of accuracy are needed. They are often considered to be relatively expensive with a short life span.

However sensors are now available to cover the key range of 0-5,000 ppm and with a longer lifetime of about 3 years in clean air . Exposure to large ammonia leaks or constant background ammonia will shorten the sensor life. They are subject only to rare cross interference. EC may react to sudden large humidity changes but quickly settle.

Semi-conductor – SC
SC sensors can be used for a wide range of gases including combustible, toxic and refrigerant gases. It is claimed that they perform better than the CT type in the detection of combustible gases at low concentrations, up to 2,000 ppm. The SC sensors are low-cost, long life, sensitive, stable, resistant to poisoning and can be used to detect a large range of gases including all the CFC, HCFC, HFC refrigerants, ammonia and hydrocarbons.
However, they are not selective and are not suited to detecting a single gas in a mixture or for use where high concentrations of interfering gases are likely to be present. Cross interference problems are minimized by using a special sensor version with a filter, calibrating for the specific gas and incorporating a delayed response.

Catalytic - CT
CT sensors have been mainly used for combustible gases including ammonia. CT are relatively low-cost, well established and understood and they have a good life span, up to 5 years. The response time is about 20-30 seconds. They can be subject to poisoning in certain applications but not generally in refrigeration and are more effective at gas levels of above 2,000 ppm.

Infrared - IR
IR sensors when first introduced were specific to a single gas and therefore not suitable for applications involving monitoring more than one gas. They were very selective and accurate – reading down to one part per million. IR was typically used where a high level of accuracy and specificity is required. This precision in performance means that they are relatively expensive.

However the specificity became a disadvantage in machinery rooms, as phase out resulted in mixed gas installations needing a different model for each gas, which was a very expensive solution.

New models were developed based on broad infrared wavelength monitoring that could detect a mixture of gases. This, however, reduced the specificity and accuracy.

If preferred, refrigerant specific units may be used if a possibility of cross interference exists.

Calibration / test methods

The calibration procedure consist of:

- Annual checks by qualified bump test
- Calibration by replacement of the sensor PCB with a Danfoss pre-calibrated certified sensor PCB

Method I
Calibration / test by means of replacing Sensor PCB

This method requires that Danfoss offers factory calibrated PCB sensor boards with calibration certificate and traceability codes. Additionally an electrically simulation is required to verify the output signals and alarm settings.

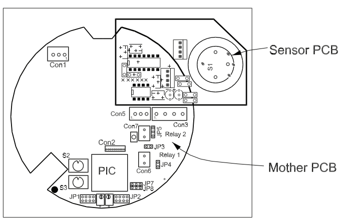
The PCB sensor board, which is the essential measuring element of the gas detector, is produced, calibrated, tested and certified by Danfoss.

After the main PCB of the gas detector has been tested with the GD tester, the new calibrated Sensor PCB can be installed.

Danfoss recommends that the calibration / test procedure is done by means of replacing the Sensor PCB, because:

- No need to purchase calibration gases in several different concentrations
- Simpler and quicker than gas calibration
- Danfoss guarantees the correct calibration and functioning of the new sensor PCB, which is supplied with a calibration certificate.
- No problems with sensor deterioration or end-of-life
- Price competitive, compared to the gas calibration carried out on site.

Test and calibration of GD Main Board by the use of GD tester



Certificate:
Gas / calibration levels etc.
Traceability

Exchange of PCB sensor board + Electrical test of alarm → Gas sensor tested

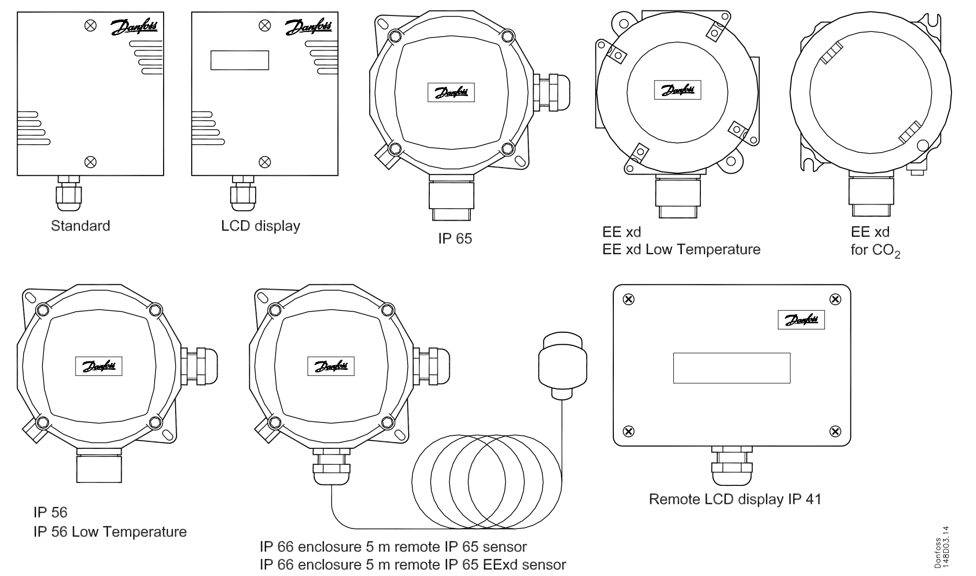
Bump test

A Bump Test consists of exposing the sensor to a gas. The objective is to establish if the sensor is reacting to the gas and all the sensor outputs are working correctly. A qualified bump test is a test carried out using ampoules or similar of known concentration.

Bump test of gas sensors (this test is a function test - it is not a calibration)

Method	Refrigerant	**SC** Semi-conductor	**EC** Electro-chemical	**CT** Catalytic	**IR** Infrared
Ampoules	Ammonia	✔	✔		
Lighter gas	HCFC, HCF	✔			
Lighter gas	HC - Hydro Carbon	✔		✔	
Ampoules or (Breath on sensor)	CO_2				✔
Ammonia water	Ammonia			✔	

Product range



- *Standard*
  Basic standard model for machine/engine rooms and cold rooms
- *Standard with LCD display*
  Basic standard model for machine/engine rooms with the actual reading of present ppm level in the room and Alarm messages.
- *IP 65*
  Like Standard but used in applications where water jets from any direction is possible.
  To be used in rooms with a high RH (RH>90%) and fast response(less than a minute) is needed.

  The sensor is mounted in an external Stainless Steel head.
- *EExd*
  Like Standard but applicable in explosive areas Zone 1 and 2 and higher IP(NEMA).

  The sensor is mounted in an external Stainless Steel head.
- *Low temperature*
  Low tempearture models can be used in applications down to -40°C(-40°F)
- *Remote LCD (accessory)*
  Remote LCD display with 5 m cable
- *Remote sensor*
  Models with 5 m cable. Can be used in connection with safety valves/vent pipe applications.
  Also available with remote EExd sensor
- *IP 56*
  High IP enclosure. Easy to replace Sensor PCB

All the models listed have exactly the same function.

Gas detectors

Functions - all models

All GD models shown on the previous page have the same basic functions. All settings are done by means of jumper settings on the mother PCB.
See the section "Mother PCB" for more details.
For detailed information on how to adjust Alarm setting - please see the instruction PI.S00.A.

Alarm
All GD models can detect 2 alarm levels and give alarm via 2 volt free contacts. When an alarm has been detected a yellow LED (Low Level Alarm) or a red LED (High Level Alarm) will go ON. All GD sensors have been preset by the factory, to realistic Low/High values related to the actual ppm range of the GD model. The actual Low and High Alarm ppm values can be read on the external GD label.

The 2 volt free contacts can be set individually to either Normally Open (NO) or Normally Closed (NC).
All GD models are factory set to NO

Both Low and High Level Alarm can be delayed individually before the 2 volt free contacts are activated. This is useful when cross interference from other gasses may occur. The delayed response time can be set to 0, 1, 5 or 10 minutes.
All GD models are factory set to 0 minutes.
When the GD sensors have detected a Low or High Level Alarm an option for having these alarms with Manual reset or Auto Reset is possible. With the option Manual reset selected, a push button on the mother PCB must be activated to release the Low or High Level Alarm.

With the option Auto reset selected, the release of the Low or High Level Alarm is done automatically.
All GD models are factory set to Auto Reset.

The factory preset values can be adjusted, with a voltmeter measuring a 0-5 V d.c output.
0 V corresponds to the min. ppm range (e.g. 0 ppm)
5 V corresponds to the max. ppm range (e.g. 1000)

Example:
If a setting of 350 ppm is required the voltage shall be set to 1.75 V (35 % of 5 V)

Analog Output
All GD will continuously generate a linear analog output, proportional to the gas concentration. The signal is available as 4-20 mA, 0-10 V and 0-5 V.
All are available at the same time (see next page).

LCD display
The model with the LCD display will continuously display the actual present ppm level in the room and the Alarm messages.

Upper Line:
Actual present ppm level (e.g: "580 ppm").

Lower Line:
Alarm status.
4 text messages are possible - only one at a time:

"No Alarm"	Neither Low Level Alarm nor High Level Alarm active.
"Lo Alarm on"	Low Level Alarm active.
"Lo,Hi Alarm on"	Both Low Level Alarm and High Level Alarm active.
"Hi Alarm on"	High Level Alarm active.

Normalization Period

Once the GD is powered up it takes some time to normalize. When GD is powered up it will give a higher analog output (4-20 mA/0-10 V/0-5 V [1])) in the beginning and after some time it goes back to the actual concentration (in clean air and no leaks, the analog output will go back to:
~ 0 V/4 mA / (~ 0 ppm)) [2])

Times below are only intended as a guide.
They may vary due to temperature, humidity, cleanliness of the air, storage time [3]) etc.

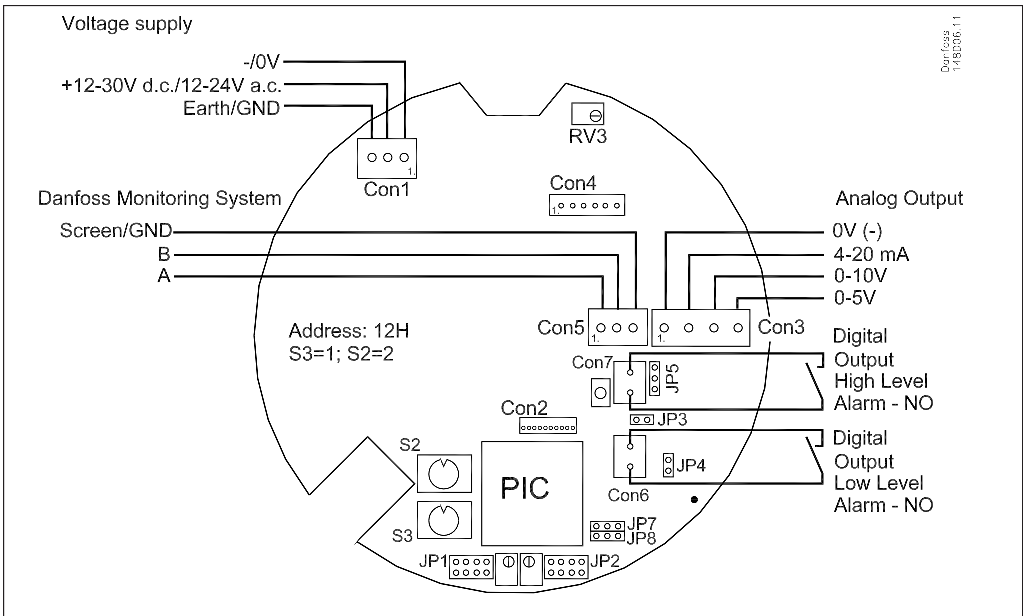
Model	
GDA with EC sensor:	20-30 Sec
GDA with SC sensor:	15 min.
GDA with CT sensor:	15 min.
GDA with CT sensor, EExd model:	7 min.
GDHC/GDHF/GDHF-R3 with SC sensor:	1 min.
GDC with IR sensor:	10 sec.
GDC with IR sensor, EExd model:	20 sec.
GDH with SC sensor:	3 min.

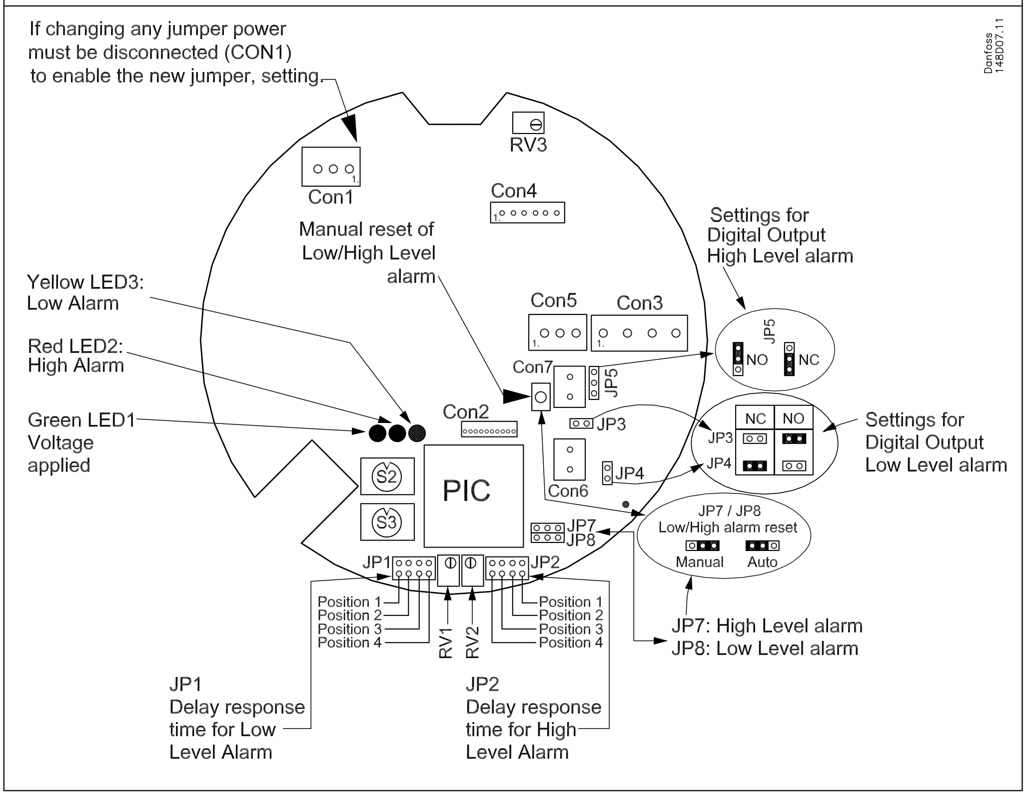
1)
Always use the voltage 0-10 V to check the output for normalization check

2)
GDC IR goes back to about 400 ppm as this is the normal level in air. (~4.6 mA/~0.4 V/ 0.2 V)

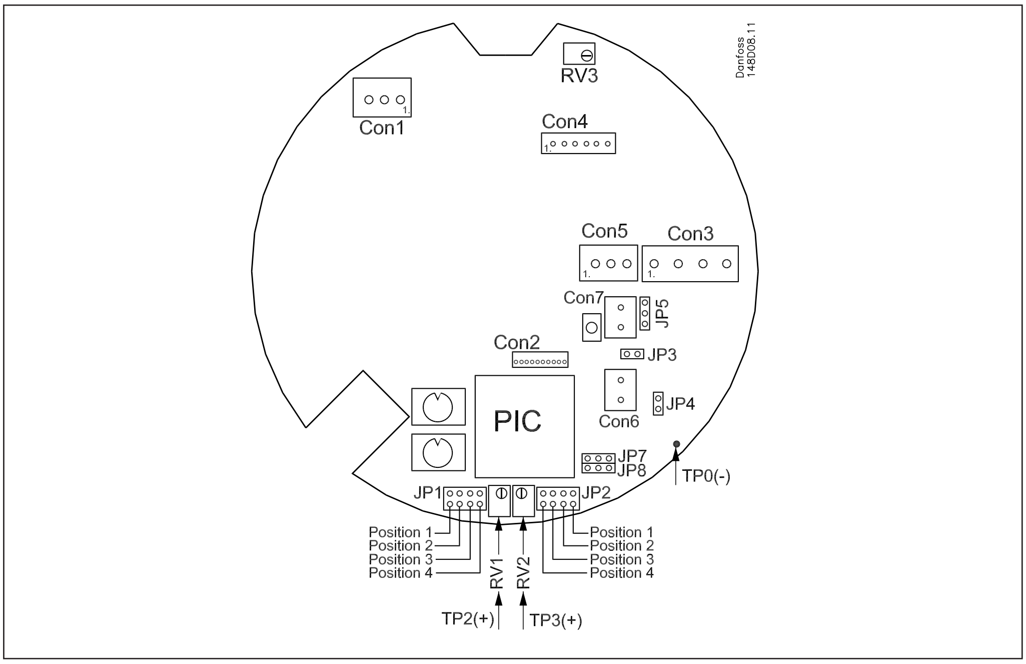
3)
If the GD has been in long-term storage or has been turned off for a long period, normalisation would be much slower. However within 1-2 hours the GD should have dropped below the low alarm level and be operational. The progress can be monitored exactly on the 0-10V output. When the output settles around zero (400 ppm in the case of IR CO_2 sensors) the GD is normalised. In exceptional circumstances particularly with CT sensors the process can take up to 30 hours.

Mother PCB


Voltage supply
-/0V
+12-30V d.c./12-24V a.c.
Earth/GND
Danfoss 148D06.11
RV3
Con1
Con4
Danfoss Monitoring System
Screen/GND
B
A
Analog Output
0V (-)
4-20 mA
0-10V
0-5V
Address: 12H
S3=1; S2=2
Con5
Con3
Con7
JP5
Digital Output High Level Alarm - NO
Con2
JP3
S2
PIC
JP4
Digital Output Low Level Alarm - NO
Con6
S3
JP7
JP8
JP1
JP2


If changing any jumper power must be disconnected (CON1) to enable the new jumper, setting.
Danfoss 148D07.11
RV3
Con1
Con4
Manual reset of Low/High Level alarm
Settings for Digital Output High Level alarm
Yellow LED3: Low Alarm
Red LED2: High Alarm
Green LED1 Voltage applied
Con5
Con3
JP5
NO
NC
Con7
Con2
JP3
NC
NO
JP3
JP4
Settings for Digital Output Low Level alarm
S2
PIC
JP4
Con6
S3
JP7 / JP8
Low/High alarm reset
Manual
Auto
JP7
JP8
JP1
JP2
Position 1
Position 2
Position 3
Position 4
RV1
RV2
Position 1
Position 2
Position 3
Position 4
JP7: High Level alarm
JP8: Low Level alarm
JP1 Delay response time for Low Level Alarm
JP2 Delay response time for High Level Alarm

Mother PCB
(Continued)

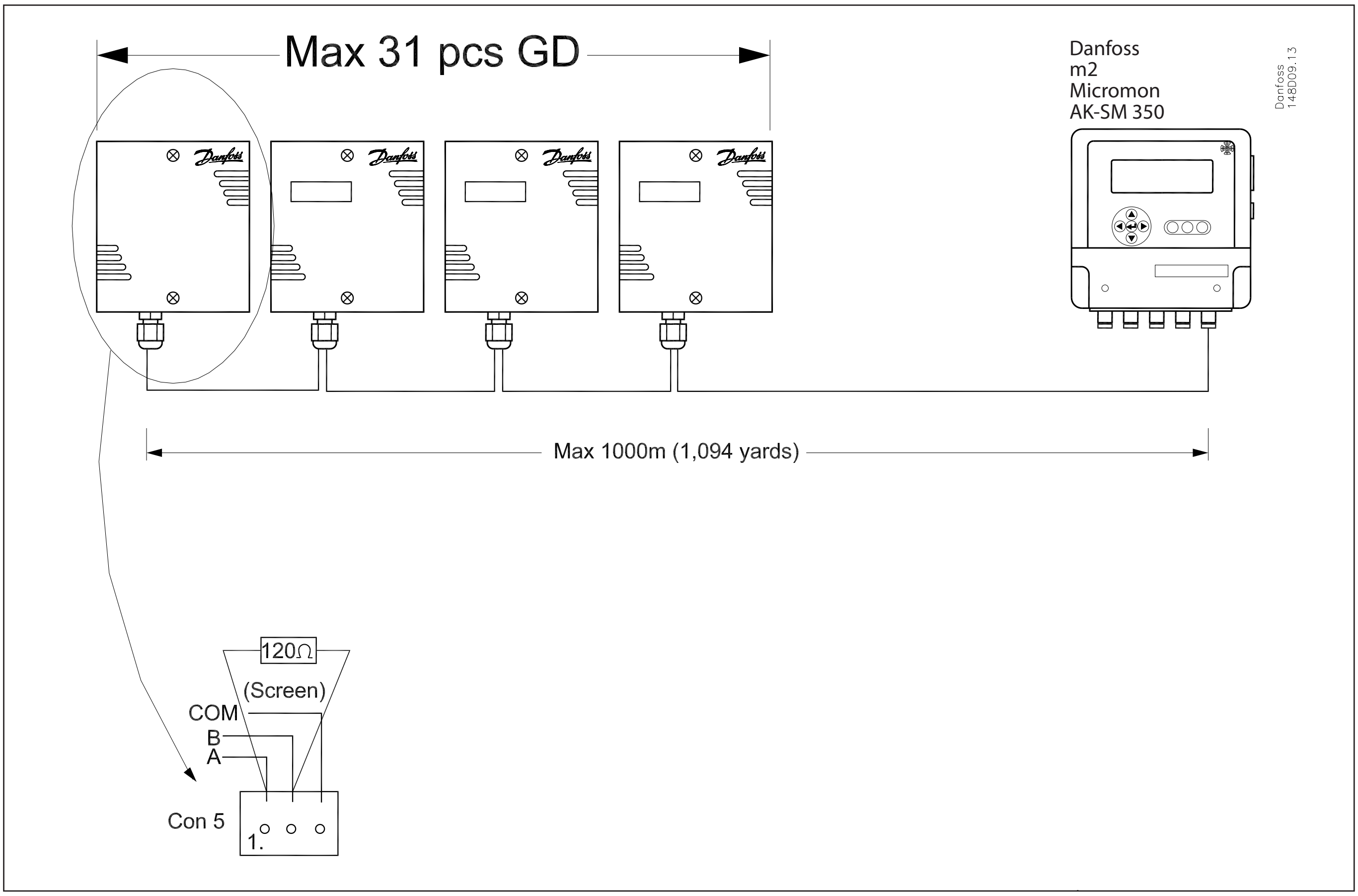


GD connected to Danfoss monitoring

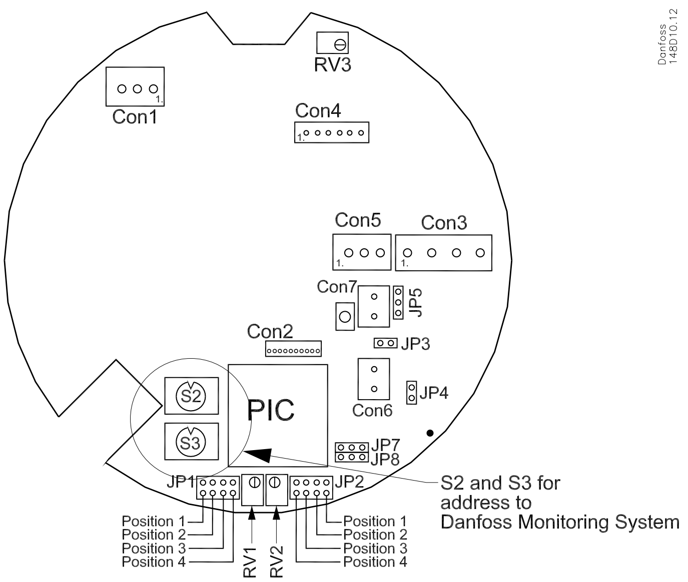
Danfoss offers the possibility of connecting every GD, independent of model, via the built-in RS 485 Bus communication, directly to the Danfoss monitoring unit.

Up to 31 GD sensors can be connected via a two-core screened communication cable (see the below drawing).
Every GD sensor needs a unique address number which must be selected. The address of GD is set by S2 and S3. By setting S2 and S3 between 0 and F, the GD will be assigned an address. See next page.
A conversion chart between channel number of the Danfoss monitoring system and the hexadecimal address of the GD is attached. Power must be removed when setting the addresses on the GD sensor.
If more than 31 units are needed, a GD Repeater (amplifier) must be installed (see Accessories).

Contact Danfoss for further information.



GD connected to Danfoss monitoring
(Continued)



Channel on Danfoss Monitoring System	S3	S2	Channel on Danfoss Monitoring System	S3	S2	Channel on Danfoss Monitoring System	S3	S2
1	0	1	34	2	2	67	4	3
2	0	2	35	2	3	68	4	4
3	0	3	36	2	4	69	4	5
4	0	4	37	2	5	70	4	6
5	0	5	38	2	6	71	4	7
6	0	6	39	2	7	72	4	8
7	0	7	40	2	8	73	4	9
8	0	8	41	2	9	74	4	A
9	0	9	42	2	A	75	4	B
10	0	A	43	2	B	76	4	C
11	0	B	44	2	C	77	4	D
12	0	C	45	2	D	78	4	E
13	0	D	46	2	E	79	4	F
14	0	E	47	2	F	80	5	0
15	0	F	48	3	0	81	5	1
16	1	0	49	3	1	82	5	2
17	1	1	50	3	2	83	5	3
18	1	2	51	3	3	84	5	4
19	1	3	52	3	4	85	5	5
20	1	4	53	3	5	86	5	6
21	1	5	54	3	6	87	5	7
22	1	6	55	3	7	88	5	8
23	1	7	56	3	8	89	5	9
24	1	8	57	3	9	90	5	A
25	1	9	58	3	A	91	5	B
26	1	A	59	3	B	92	5	C
27	1	B	60	3	C	93	5	D
28	1	C	61	3	D	94	5	E
29	1	D	62	3	E	95	5	F
30	1	E	63	3	F	96	6	0
31	1	F	64	4	0	97	6	1
32	2	0	65	4	1	98	6	2
33	2	1	66	4	2	99	6	3

Reference material

Danfoss m2 literature:
Technical Leaflet RB8BA
Manual RS8AN
Instruction RI8BM

Danfoss AK-SM 350 literature:
Manual RS8EF
Instruction RI8LC

Micromon:
Technical leaflet RC8AU
Instruction RI8HV (Micromon Expanable)
Instruction RI8GA (Micromon)

Danfoss GD apllication guide:
PA.000.B

Ordering

Standard GD models

Type of gas	Danfoss Type	Range [ppm]	Alarm limits Low/High [ppm]	Response Delay [s]"	Sensor type	Standard Basic Complete	Standard Basic Sensor PCB	Standard Basic with LCD display Complete	Standard Basic with LCD display Sensor PCB	IP 65 for High RH and Fast response Complete	IP 65 for High RH and Fast response Sensor PCB	IP 56 enclosure Complete	IP 56 enclosure Sensor PCB	IP 56 enclosure Low Temperature Complete	IP 56 enclosure Low Temperature Sensor PCB	EExd model Complete	EExd model Sensor PCB	EExd model Low Temperature Complete	EExd model Low Temperature Sensor PCB	IP 66 enclosure 5 m remote IP 65 sensor Complete	IP 66 enclosure 5 m remote IP 65 sensor Sensor PCB	IP 66 enclosure 5 m remote IP 65 EExd sensor Complete	IP 66 enclosure 5 m remote IP 65 EExd sensor Sensor PCB
Ammonia NH3						**Code number**																	
R 717	GDA EC 100	0-100	25/35	0	Electro-chemical	**148H5000**	**148H5200**	**148H5001**	**148H5200**	**148H5002**	**148H5208**	**148H5009**	**148H5251**	**148H5005**	**148H5271**	**148H5003**	**148H5208**	**148H5006**	**148H5268**	**1)**	-	**1)**	-
	GDA EC 300	0-300	100/200	0	Electro-chemical	**1)**	-	**1)**	-	**1)**	-	**1)**	-	**1)**	-	**148H5063**	**148H5240**	**1)**	-	**1)**	-	**1)**	-
	GDA EC 1000	0-1000	500/1000	0	Electro-chemical	**148H5010**	**148H5201**	**148H5011**	**148H5201**	**148H5012**	**148H5209**	**148H5019**	**148H5252**	**148H5015**	**148H5272**	**148H5013**	**148H5209**	**148H5016**	**148H5269**	**1)**	-	**1)**	-
	GDA EC 1000	0-1000	25/500	0	Electro-chemical	**148H5050**	**148H5201**	**148H5051**	**148H5201**	**148H5052**	**148H5209**	**148H5059**	**148H5252**	**148H5055**	**148H5272**	**148H5053**	**148H5209**	**1)**	-	-	-		-
	GDA SC 1000	0-1000	80/250	0	Semi-Conductor	**148H5040**	**148H5249**	**1)**	-	**148H5042**	**148H5254**	**148H5049**	**148H5253**	**1)**	-	**1)**	-	**1)**	-	**1)**	-	**1)**	-
	GDA SC 10000	0-10000	5000/9000	0	Semi-Conductor	**148H5020**	**148H5202**	**148H5021**	**148H5202**	**148H5022**	**148H5210**	**148H5029**	**148H5255**	**148H5025**	**148H5255**	**148H5023**	**148H5241**	**148H5026**	**148H5241**	**148H5027**	**148H5261**	**148H5028**	**148H5265**
	GDA CT 30000	0-30000	3000/28000	0	Catalytic	**148H5030**	**148H5203**	**148H5031**	**148H5203**	**148H5032**	**148H5211**	**148H5039**	**148H5256**	**148H5035**	**148H5256**	**148H5033**	**148H5211**	**1)**	-	**1)**	-	**1)**	-
Carbon Dioxide - CO_2																							
R 744	GDC IR 10000	0-10000	5000/9000	0	Infrared	**148H5070**	**148H5204**	**148H5071**	**148H5204**	-	-	**148H5072**	**148H5204**	**148H5075**	**148H5204**	**148H5073**	**148H5250**	**1)**	-	**1)**	-	**1)**	-
	GDC IR 20000	0-20000	10000/18000	0	Infrared	**1)**	**148H5244**	**1)**	**148H5244**	-	-	**148H5082**	**148H5244**	**148H5085**	**148H5244**	**1)**	-	**1)**	-	**1)**	-	**1)**	-
	GDC IR 40000	0-40000	20000/36000	0	Infrared	**1)**	**148H5245**	**1)**	**148H5245**	-	-	**148H5092**	**148H5245**	**1)**	**148H5245**	**1)**	-	**1)**	-	**1)**	-	**1)**	-
Halo-Carbon																							
HCFC R 22, R 123	GDHC SC 1000	0-1000	500/900	0	Semi-Conductor	**148H5100**	**148H5205**	**148H5101**	**148H5205**	**148H5102**	**148H5212**	**148H5109**	**148H5257**	**148H5105**	**148H5257**	**1)**	**148H5242**	**1)**	-	**148H5107**	**148H5262**	**1)**	-
HFC R 404A, R 507	GDHF SC 1000	0-1000	500/900	0	Semi-Conductor	**148H5110**	**148H5206**	**148H5111**	**148H5206**	**148H5112**	**148H5213**	**148H5119**	**148H5258**	**148H5115**	**148H5258**	**1)**	**148H5243**	**1)**	-	**148H5117**	**148H5263**	**1)**	-
HFC R 134A	GDHF-R3 SC 1000	0-1000	500/900	0	Semi-Conductor	**148H5120**	**148H5246**	**148H5121**	**148H5246**	-	**148H5247**	**148H5129**	**148H5259**	**148H5125**	**148H5259**	**1)**		**1)**	-	**148H5127**	**148H5264**	**1)**	-
Hydro-Carbon																							
R 290, R 600, R 600A, R 1270	GDH SC 5000	0-5000	800/2500		Semi-Conductor	**148H5190**	**148H5267**	**148H5191**	**148H5267**	-	-	-	-	-	-	**148H5193**	**148H5260**	-	-	-	-	-	-

[1]) Contact Danfoss

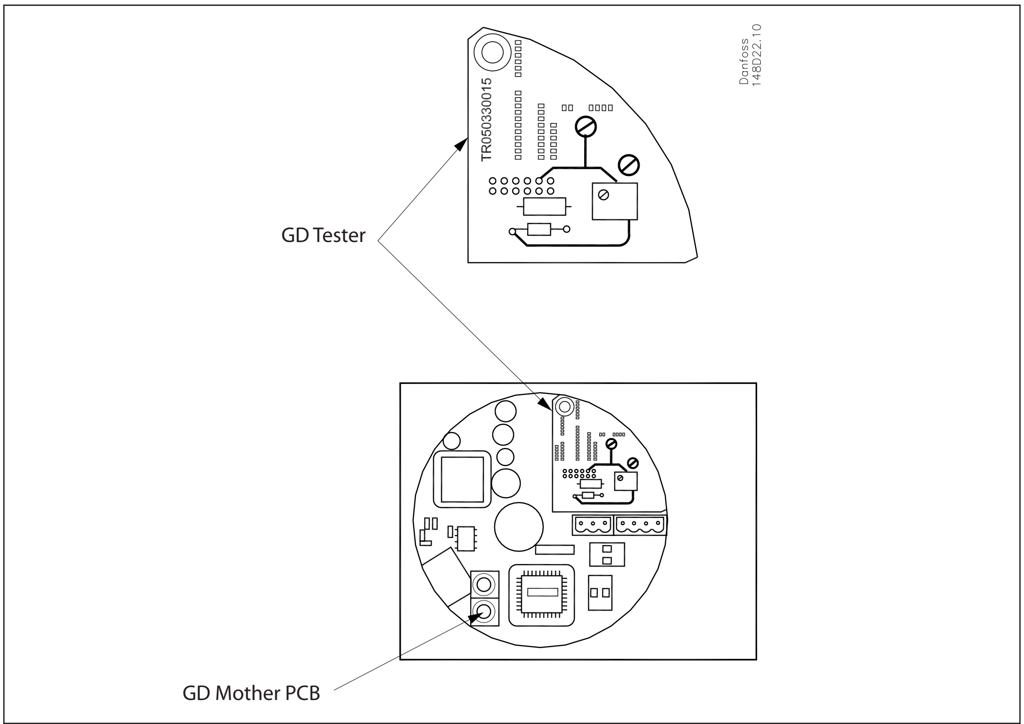
Ordering - *GD sensor PCB*

Description	Code No.
GDA EC 100 sensor PCB	**148H5200**
GDA EC 1000 sensor PCB	**148H5201**
GDA SC 10000 sensor PCB	**148H5202**
GDA CT 30000 sensor PCB	**148H5203**
GDC IR 10000 sensor PCB all models except EExd	**148H5204**
GDHC SC 1000 sensor PCB	**148H5205**
GDHF SC 1000 sensor PCB	**148H5206**
GDH CT 5000 sensor PCB	**148H5207**
GDA EC 100 sensor PCB Ext for IP 65/EExd enclosure	**148H5208**
GDA EC 1000 sensor PCB Ext for IP 65/EExd enclosure	**148H5209**
GDA SC 10000 sensor PCB Ext for IP 65 enclosure	**148H5210**
GDA CT 30000 sensor PCB Ext for IP 65/EExd enclosure	**148H5211**
GDHC SC 1000 sensor PCB Ext for IP 65 enclosure	**148H5212**
GDHF SC 1000 sensor PCB Ext for IP 65 enclosure	**148H5213**
GDH CT 5000 sensor PCB Ext for EExd enclosure	**148H5214**
GDA EC 300 sensor PCB Ext for IP 65/EExd enclosure	**148H5240**
GDA SC 10000 sensor PCB Ext for EExd enclosure/EExd Low Temp. enclosure	**148H5241**
GDHC SC 1000 sensor PCB Ext for EExd enclosure	**148H5242**
GDHF SC 1000 sensor PCB Ext for EExd enclosure	**148H5243**
GDC IR 20000 sensor PCB all models except EExd	**148H5244**
GDC IR 40000 sensor PCB all models except EExd	**148H5245**
GDHF-R3 SC 1000 sensor PCB	**148H5246**
GDHF-R3 SC 1000 sensor PCB Ext for IP 65 enclosure	**148H5247**
GDE EC 500 sensor PCB Ext for IP 65	**148H5248**
GDA SC 1000 sensor PCB	**148H5249**
GDC IR 10000 sensor PCB Ext for EExd enclosure	**148H5250**
GDA EC 100 sensor PCB for IP 56 enclosure	**148H5251**
GDA EC 1000 sensor PCB for IP 56 enclosure	**148H5252**
GDA SC 1000 sensor PCB for IP 56 enclosure/IP 56 Low Temp	**148H5253**
GDA SC 1000 sensor PCB Ext for IP 65 enclosure	**148H5254**
GDA SC 10000 sensor PCB for IP 56 enclosure/IP 56 Low Temp	**148H5255**
GDA CT 30000 sensor PCB for IP 56 enclosure/IP 56 Low Temp	**148H5256**
GDHC SC 1000 sensor PCB for IP 56 enclosure/IP 56 Low Temp	**148H5257**
GDHF SC 1000 sensor PCB for IP 56 enclosure/IP 56 Low Temp	**148H5258**
GDHF-R3 SC 1000 sensor PCB for IP 56 enclosure/IP 56 Low Temp	**148H5259**
GDH SC 5000 sensor PCB Ext for EExd enclosure	**148H5260**
GDA SC 10000 sensor PCB with 5 m remote IP 65 sensor. For IP 66 enclosure	**148H5261**
GDHC SC 1000 sensor PCB with 5 m remote IP 65 sensor. For IP 66 enclosure	**148H5262**
GDHF SC 1000 sensor PCB with 5 m remote IP 65 sensor. For IP 66 enclosure	**148H5263**
GDHF-R3 SC 1000 sensor PCB with 5 m remote IP 65 sensor. For IP 66 enclosure	**148H5264**
GDA SC 10000 sensor PCB with 5 m remote IP 65 EExd sensor. For IP 66 enclosure	**148H5265**
GDH SC 5000 sensor PCB	**148H5267**
GDA EC 100 sensor PCB Ext for EExd Low Temp. enclosure	**148H5268**
GDA EC 1000 sensor PCB Ext for EExd Low Temp. enclosure	**148H5269**
GDA EC 100 sensor PCB for IP 56 Low Temp. enclosure	**148H5271**
GDA EC 1000 sensor PCB for IP 56 Low Temp. enclosure	**148H5272**

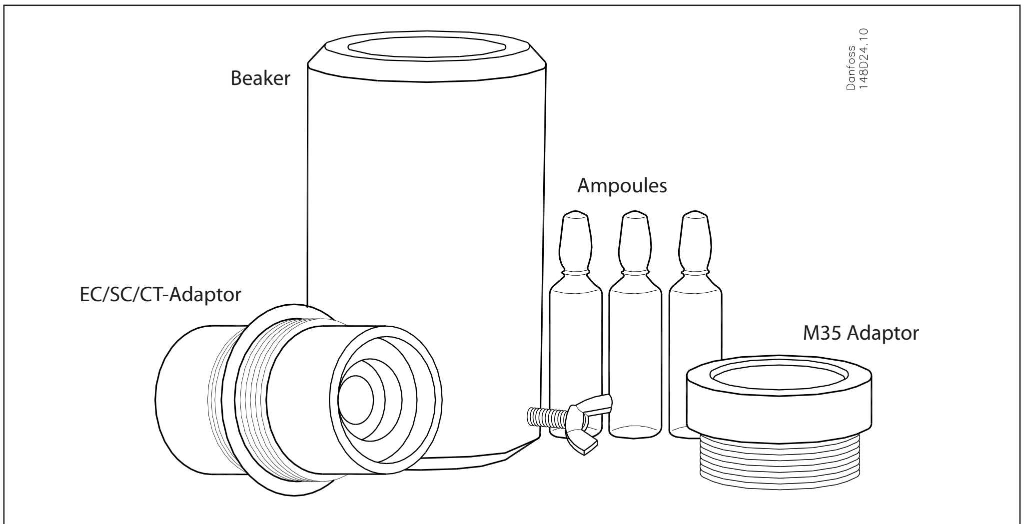
Ordering - *Accessories*

Description	Code No.
GD Test Kit - GD Tester all models. To test mother PCB at Sensor PCB replacement - Beaker M42 - EC/SC/CT-Adapter. Fit Beaker M42 - M35 Adapter. Fit Beaker M42	**148H5230**
GD Repeater all models. Between GD and Danfoss Monitoring System	**148H5231**
GD mother PCB all models	**148H5232**
GD Ampoules 10 pcs. 100 ppm ammonia.	**148H5234**
GD Ampoules 10 pcs. 1000 ppm ammonia.	**148H5235**
GD Ampoules 10 pcs 2000 ppm CO_2	**148H5236**
Remote LCD display IP 41	**148H5238**

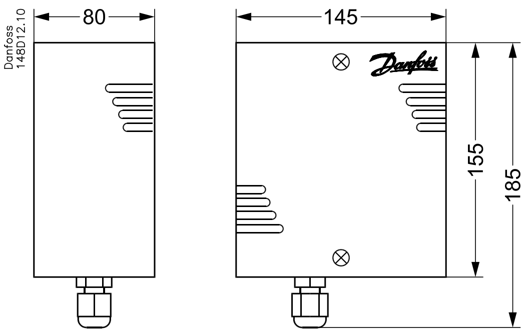
GD Tester and GD Mother PCB



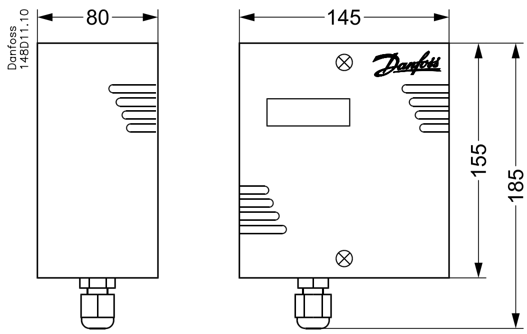
Bump test equipment



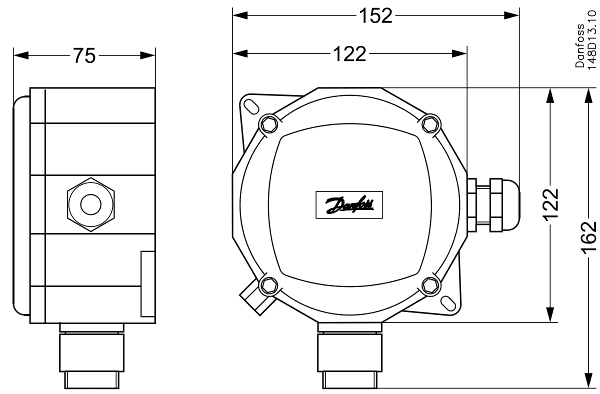
Dimensions



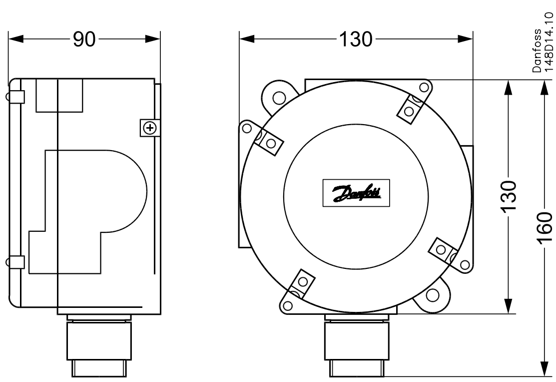
Standard



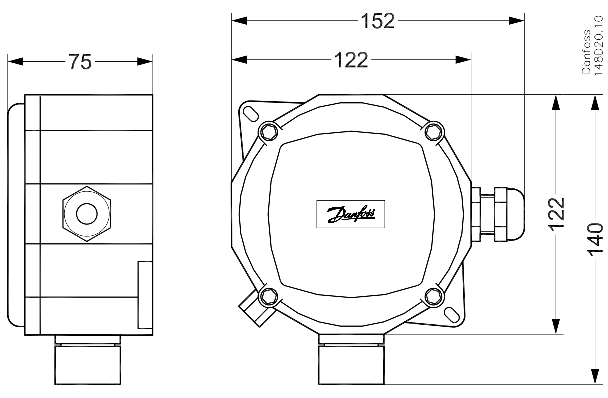
LCD display



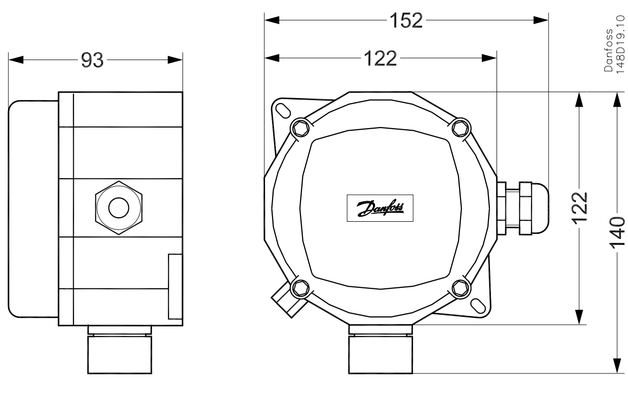
IP 65



EExd
EExd Low Temperature



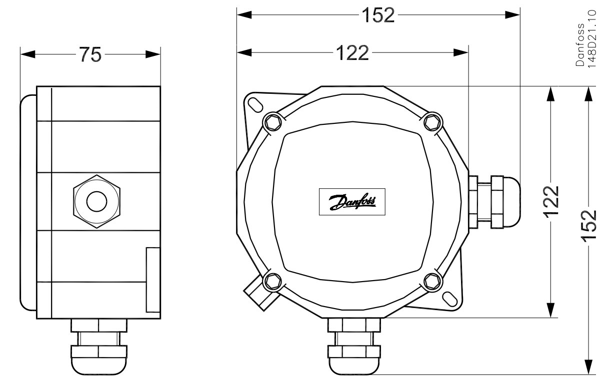
IP 56
IP 56 Low Temp
except GDC IR Low Temp for CO_2



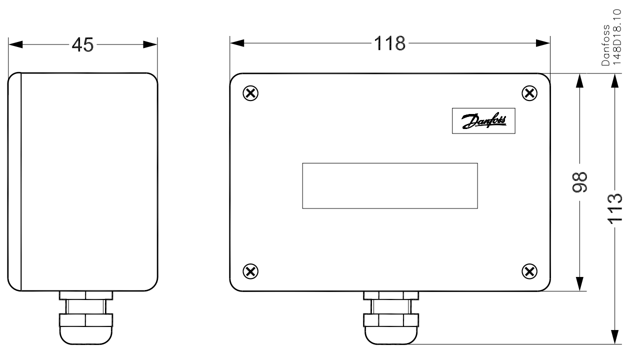
IP 56
GDC IR Low Temp for CO_2

Gas detectors

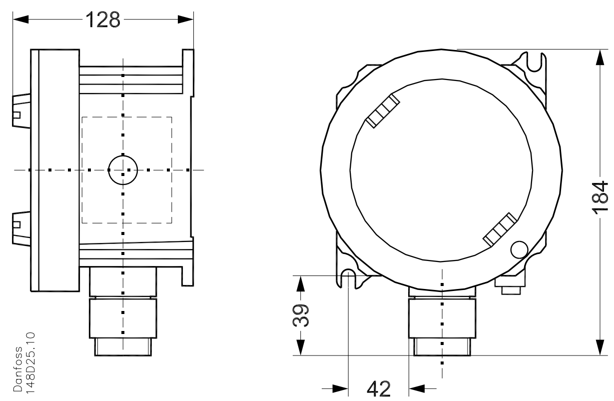
Dimensions *(Continued)*



IP 66 enclosure 5 m remote IP 65 sensor
IP 66 enclosure 5 m remote IP 65 EExd sensor



Remote LCD display IP 41



EExd for CO_2

Introduction

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 to +30°C*
  Can be used in both freezing and refrigeration systems.
- *Interchangeable orifice assemblies*
- *Interchangeable thermostatic element*
- *Rated capacities from 3.5 to 295 kW, 1 to 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.

Materials

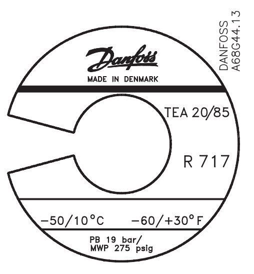
Valve housing made of GGG40.3

Gaskets are non asbestos

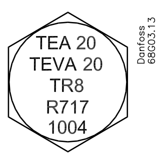
Technical data

- *Refrigerant*
  R 717 (NH_3)
- *Evaporating temperature range*
  D: –50 to 0°C
  P: –20 to +30°C
- *Capillary tube length*
  5 m
- *Connection for external pressure equalization*
  ¼ in. or ∅ 6.5 / ∅ 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

Identification



Element label



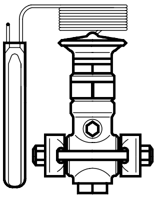
Orifice assembly marking

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 (NH_3).

The orifice assembly
is marked with
- valve type (TEA 20)
- rated capacity (8 TR = 28 kW)
- refrigerant R 717 (NH_3)
- date stamp

The complete technical leaflet (RD1EA) can be downloaded from the Danfoss web site.

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	1/2	1/2	**068G6000**		**068G2050**	
TEA 20-2	7	1/2	1/2	**068G6001**		**068G2051**	
TEA 20-3	10.5	1/2	1/2	**068G6002**		**068G2052**	
TEA 20-5	17.5	1/2	1/2	**068G6003**	**006-0042**	**068G2053**	**068G3250**
TEA 20-8	28	1/2	1/2	**068G6004**		**068G2054**	
TEA 20-12	42	1/2	1/2	**068G6005**		**068G2055**	
TEA 20-20	70	1/2	1/2	**068G6006**		**068G2056**	
TEA 20, range : –20 to +30°C							
TEA 20-1	3.5	1/2	1/2	**068G6137**		**068G2050**	
TEA 20-2	7	1/2	1/2	**068G6133**		**068G2051**	
TEA 20-3	10.5	1/2	1/2	**068G6134**		**068G2052**	
TEA 20-5	17.5	1/2	1/2	**068G6138**	**006-0042**	**068G2053**	**068G3252**
TEA 20-8	28	1/2	1/2	**068G6139**		**068G2054**	
TEA 20-12	42	1/2	1/2	**068G6140**		**068G2055**	
TEA 20-20	70	1/2	1/2	**068G6135**		**068G2056**	
TEA 85, range: –50 to 0°C							
TEA85-33	115	3/4	3/4	**068G6007**		**068G2057**	
TEA 85-55	190	3/4	3/4	**068G6008**	**006-0048**	**068G2058**	**068G3250**
TEA 85-85	295	3/4	3/4	**068G6009**		**068G2059**	
TEA 85, range: –20 to +30°C							
TEA85-33	115	3/4	3/4	**068G6141**		**068G2057**	
TEA 85-55	190	3/4	3/4	**068G6142**	**006-0048**	**068G2058**	**068G3252**
TEA 85-85	295	3/4	3/4	**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.

R 717 (NH_3)

Capacity in kW, range –50 to 0°C

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 (NH_3)
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 Δp_1 across pipelines, etc. is calculated, for example, as 0.5 bar, the effective pressure drop across the thermostatic valve becomes
$\Delta p = p_c - p_e - p_1$
$\Delta p = 12.4 - 1.9 - 0.5 = 10$ 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.

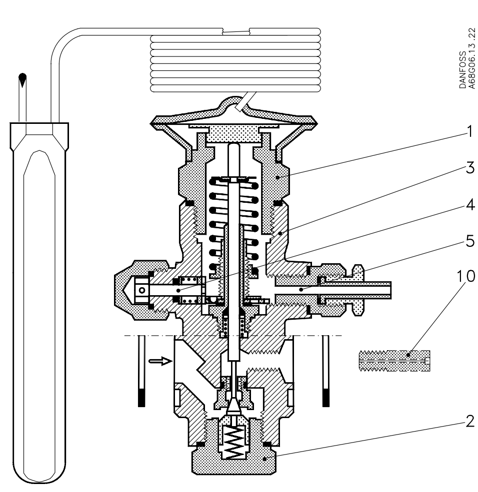
R 717 (NH_3)

Capacity in kW, range −20 to +30°C

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.

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

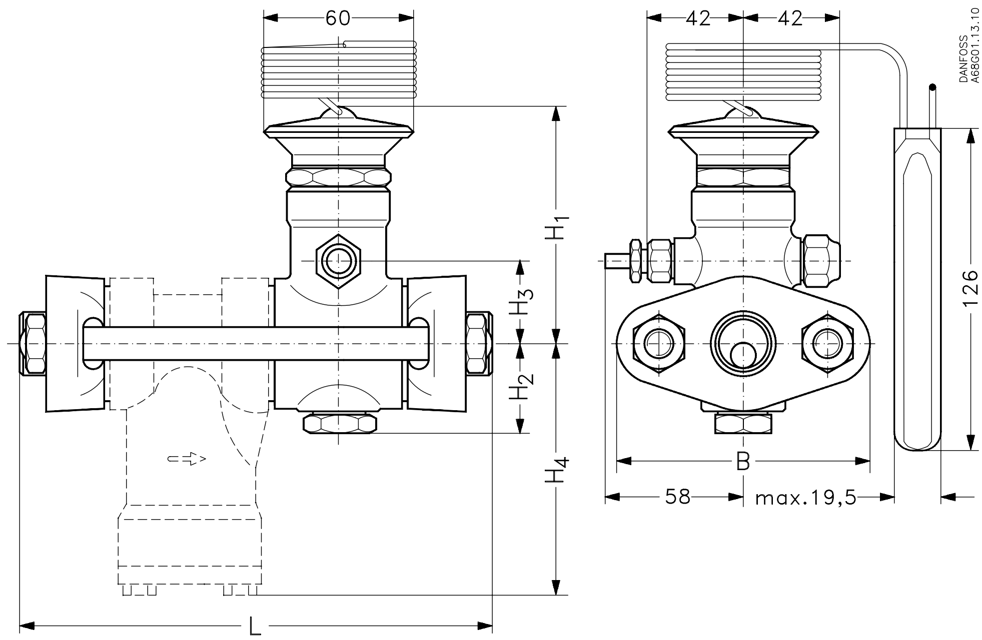
The valve has external equalization.
A separate outlet orifice assembly (10) is for use with TEA 20-1 (3.5 kW) only.

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.

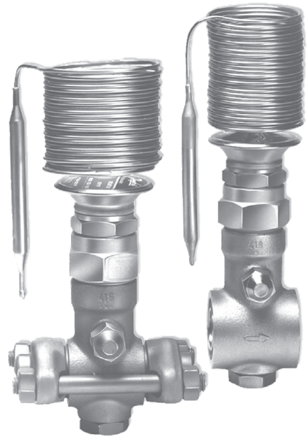
Note:
The TEA is not able to close completely tight. Consequently a solenoid valve is needed to shut off liquid supply when systems stops.

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

Introduction



1. 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.

2. 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.

3. 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
R717 (NH_3), R22, R134a, R404A and other fluorinated refrigerants

Regulation ranges
See ordering table

P band
20°C

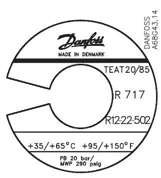
Capillary tube length
5 m

Max. bulb temperature
150°C

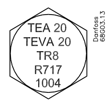
Max. working pressure
PS = 20 bar

Max. test pressure
p' = 30 bar

Identification



Element label



Orifice assembly marking

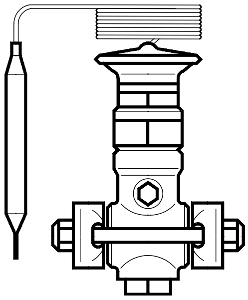
The thermostatic element
has a label giving valve type, temperature range and max. test pressure.

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.

The complete technical leaflet (RD1FA) can be downloaded from the Danfoss web site.

Ordering TEAT



Type and rated capacity (TR)	Regulating range °C	Flange connection	Code no. Assembled valve	Code no. Separate orifice assembly	Code no. 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.

Extended capacities in kW

R717 1)

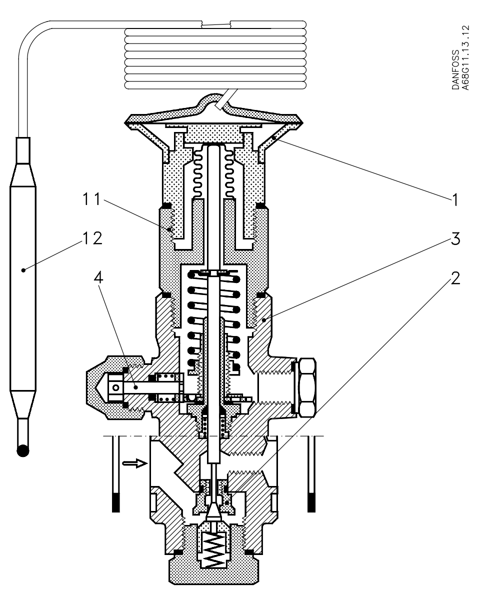
Valve size	Pressure drop across valve Δp bar				
	4	6	8	11	15
20 - 1	2.3	2.8	3.3	3.6	4.7
20 - 2	4.8	5.7	6.4	7.2	7.9
20 - 3	7.2	8.5	9.7	10.8	11.7
20 - 5	12.1	14.2	16.0	18.0	19.8
20 - 8	18.6	22.1	25.6	28.5	31.4
20 - 12	29.1	33.7	38.4	43.0	47.1
20 - 20	47.7	57.0	64.0	72.1	79.1
85 - 33	80.2	94.2	106.4	118.6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

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.

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

Design/ Function



TEAT

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.

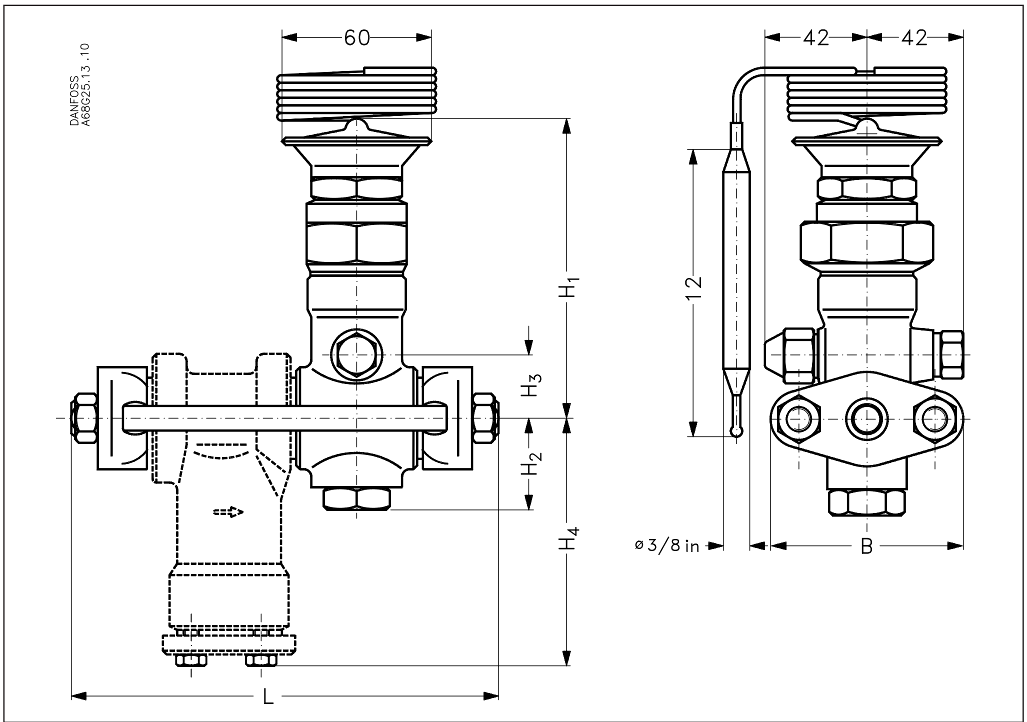
The thermostatic element is screwed to the intermediate section (11) of the valve. A bellow on the intermediate section means that the suction pressure cannot influence the valve setting.

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.

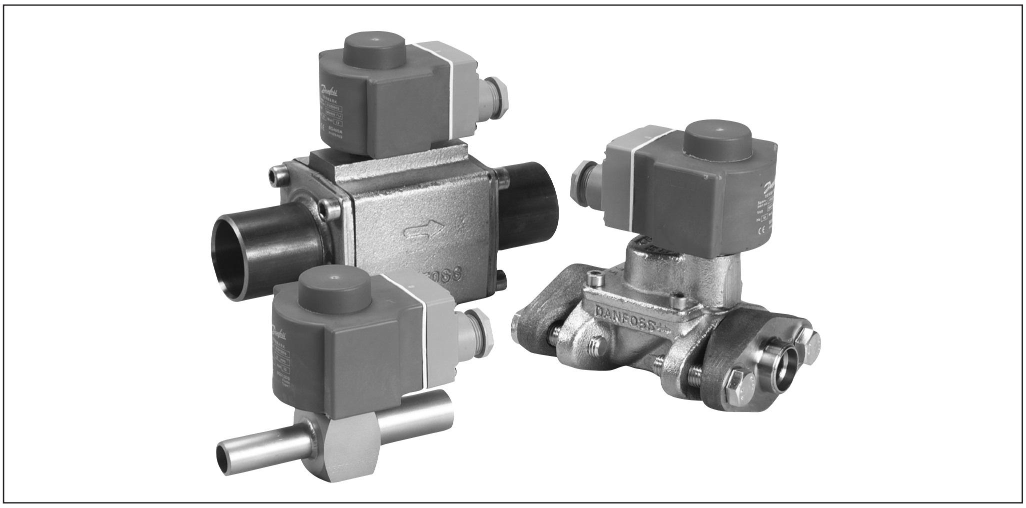
Note: The TEAT is not able to close completely tight, so a solenoid valve is needed to shut off liquid supply, when the system stops.

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

Introduction



AKVA are electrically operated 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.

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, R744, HCFC and HFC.

Features

- For ammonia (R717), R744, HCFC, HFC
- The valve requires no adjustment
- Wide regulation range
- Replaceable orifice assembly
- Wide range of coils for d.c. and a.c.
- Quick reaction in whole range of stated capacity.
- In some applications AKVA can be used both as expansion valve and solenoid valve

Approvals

DEMKO, Denmark
SETI, Finland
SEV, Switzerland

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

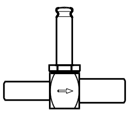
c UL us LISTED UL listed to U8.S. og Canadian standards (separate code. nos.)

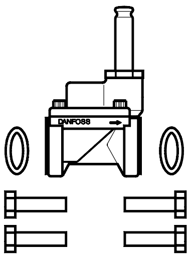
The complete technical leaflet (DKRCC.PD.VA1.B) can be downloaded from the Danfoss web site.

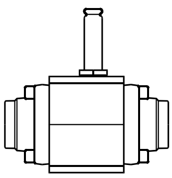
Technical data

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 to 60°C	– 40 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	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

Rated capacity and ordering

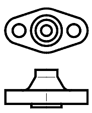






Valve type	Rated capacity[1]		k_v-value	Connections Inlet x outlet	Code no.	Connections Inlet x outlet	Code no.
	kW	tons	m^3/h	in.		in.	
AKVA 10-1	4	1.1	0.010	$^3/_8 \times ^1/_2$	**068F3261**	$^1/_2 \times ^3/_4$	**068F3281**
AKVA 10-2	6.3	1.8	0.015	$^3/_8 \times ^1/_2$	**068F3262**	$^1/_2 \times ^3/_4$	**068F3282**
AKVA 10-3	10	2.8	0.022	$^3/_8 \times ^1/_2$	**068F3263**	$^1/_2 \times ^3/_4$	**068F3283**
AKVA 10-4	16	4.5	0.038	$^3/_8 \times ^1/_2$	**068F3264**	$^1/_2 \times ^3/_4$	**068F3284**
AKVA 10-5	25	7.1	0.055	$^3/_8 \times ^1/_2$	**068F3265**	$^1/_2 \times ^3/_4$	**068F3285**
AKVA 10-6	40	11.4	0.103	$^3/_8 \times ^1/_2$	**068F3266**	$^1/_2 \times ^3/_4$	**068F3286**
AKVA 10-7	63	17.9	0.162			$^1/_2 \times ^3/_4$	**068F3267**
AKVA 10-8	100	28.4	0.251			$^1/_2 \times ^3/_4$	**068F3268**
AKVA 15-1	125	35	0.25	Flange	**068F5020**[2])		
AKVA 15-2	200	60	0.40	Flange	**068F5023**[2])		
AKVA 15-3	300	90	0.63	Flange	**068F5026**[2])		
AKVA 15-4	500	140	1.0	Flange	**068F5029**[2])		
AKVA 20-1	500	140	1.0	$1\,^1/_4 \times 1\,^1/_4$	**042H2101**		
AKVA 20-2	800	240	1.6	$1\,^1/_4 \times 1\,^1/_4$	**042H2102**		
AKVA 20-3	1250	350	2.5	$1\,^1/_4 \times 1\,^1/_4$	**042H2103**		
AKVA 20-4	2000	600	4.0	$1\,^1/_2 \times 1\,^1/_2$	**042H2104**		
AKVA 20-5	3150	900	6.3	2×2	**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**

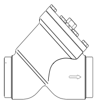
Ordering *(continued)*
Accessories

Filter

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

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

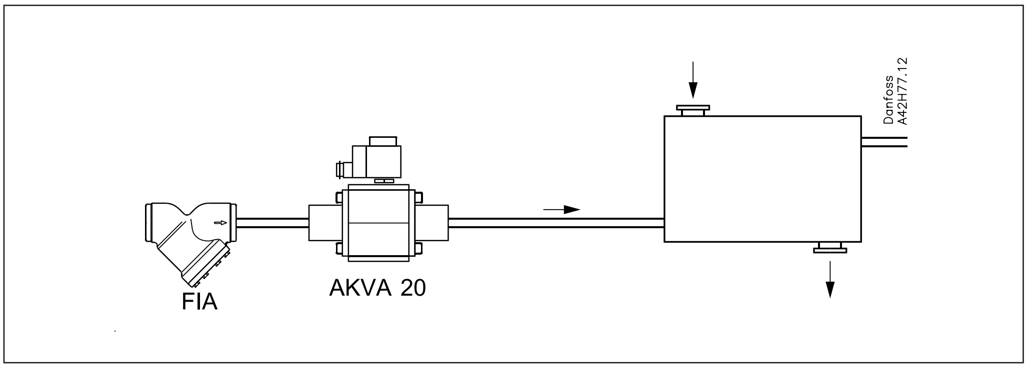
Recommended filter for AKVA 15 / 20



Filter type	Code no.	
	House	**Filter insert 100 μm**
FIA 20 D STR	**148H3086**	**148H3122**
FIA 25 D STR	**148H3087**	**148H3123**
FIA 32 D STR	**148H3088**	
FIA 40 D STR	**148H3089**	
FIA 50 D STR	**148H3090**	**148H3157**

For further information: see Danfoss catalogue RD6CD

Examples of combinations

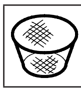


Ordering *(continued)*
Spare parts

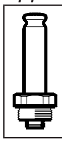
AKVA 10

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

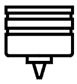
	**068F5045**	1 pcs. armature 1 pcs. armature tube 1 pcs. Al. gasket

Gasket for upper part

	**068F0548**	25 pcs. Al gaskets

AKVA 15

Piston

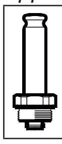


Type	Code no.	Contents
AKVA 15-1	**068F5265**	1 pcs. piston assembly 1 pcs. gasket 1 pcs. O-ring 2 pcs. labels
AKVA 15-2	**068F5266**	
AKVA 15-3	**068F5267**	
AKVA 15-4	**068F5268**	

Gasket set	**068F5264**	Complete gasket set

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

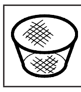
Upper part

	**068F5045**	1 pcs. armature 1 pcs. armature tube 1 pcs. Al. gasket

Gasket for upper part

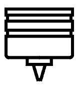
	**068F0548**	25 pcs. Al gaskets

Filter

	**068F0540**	10 pcs. filters 10 pcs. Al. gaskets

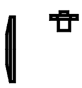
AKVA 20

Piston



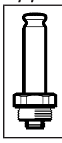
Type	Code no.	Contents
AKVA 20-0.6	**042H2039**	1 pcs. piston assembly 3 pcs. O-rings
AKVA 20-1	**042H2040**	
AKVA 20-2	**042H2041**	
AKVA 20-3	**042H2042**	
AKVA 20-4	**042H2043**	
AKVA 20-5	**042H2044**	

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

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

Gasket for upper part

	**068F0548**	25 pcs. Al. gaskets

Ordering *(continued)*
Coils for AKVA valves

D.C. coils	Code no.	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
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.	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
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**	+	+	+	+	+	–
220 V a.c. 10 W, 50 Hz with terminal box with DIN plugs	**018F6701** **018F6176**	+	+	–	+	–	–
220 V a.c. 10 W, 60 Hz with terminal box with DIN plugs	**018F6714** **018F6189**	+	+	–	+	–	–
220 V a.c. 12 W, 50 Hz with terminal box	**018F6801**	+	+	–	+	+	–
220 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**	+	+	+	+	+	+
24 V a.c. 20 W, 60 Hz with terminal box	**018F6902**	+	+	+	+	+	+

Expansion valves

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:

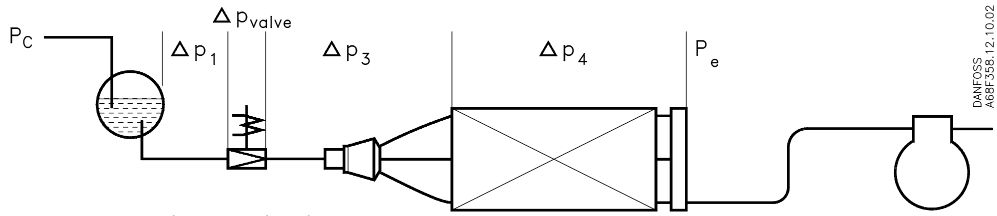
1. Evaporator capacity
2. Pressure drop across the valve
3. Correction for subcooling
4. Correction for evaporating temperature
5. Determination of valve size
6. Correctly dimensioned liquid line

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



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: R 717
Condensing temperature: 35°C (p_c = 13.5 bar)
Evaporating temperature: –20°C (p_e = 1.9 bar)
Δp_1 = 0.2 bar
Δp_3 = 0.8 bar
Δp_4 = 0.1 bar

This will give you the following equation:

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

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	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 = 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.

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:
Δp_{valve} = 10.5 bar
$Q_{e\ corrected}$ = 294 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 x 294 kW = 353 kW.

Now select a valve size from tabel "Capacity".

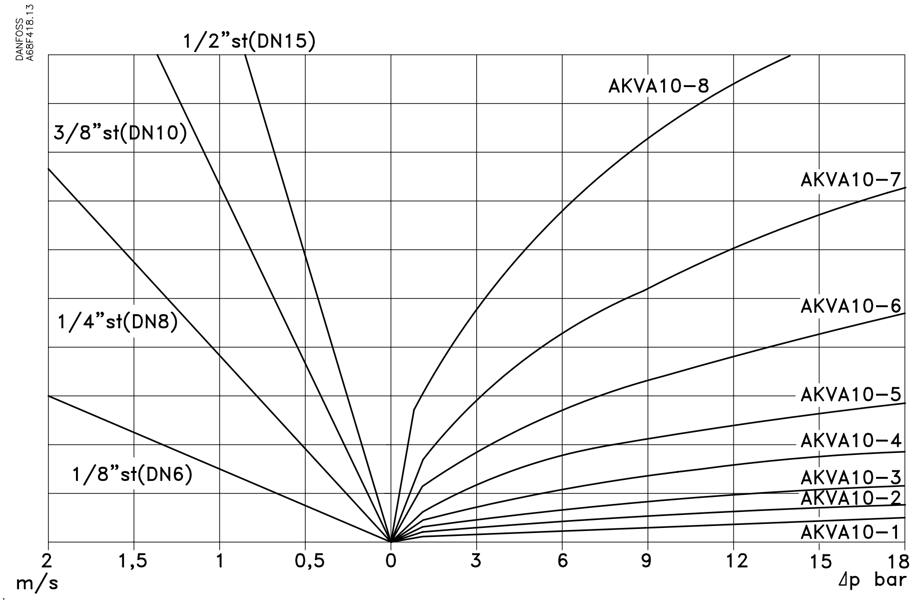
With the given values Δp_{valve} = 10.5 bar and a capacity of 353 kW, AKVA 15 - 4 is selected.

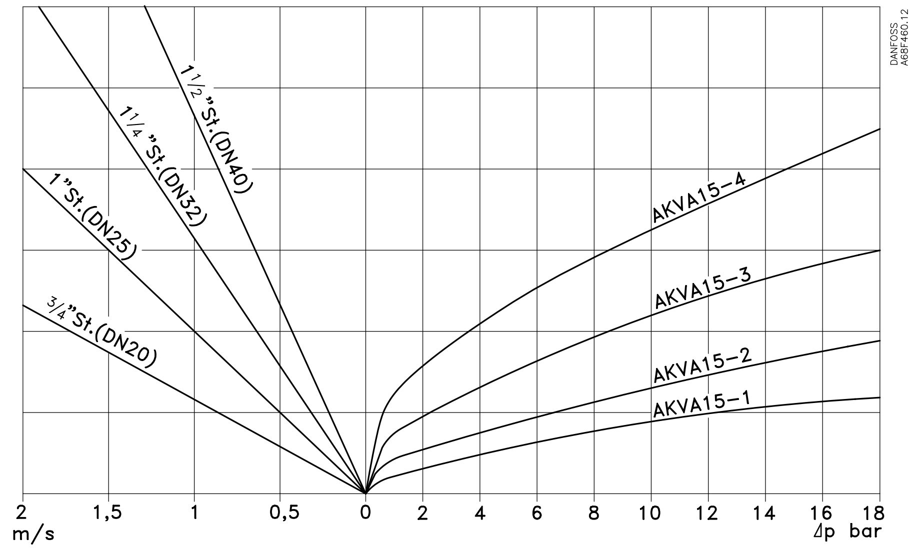
This valve will have a capacity of approx. 555 kW.

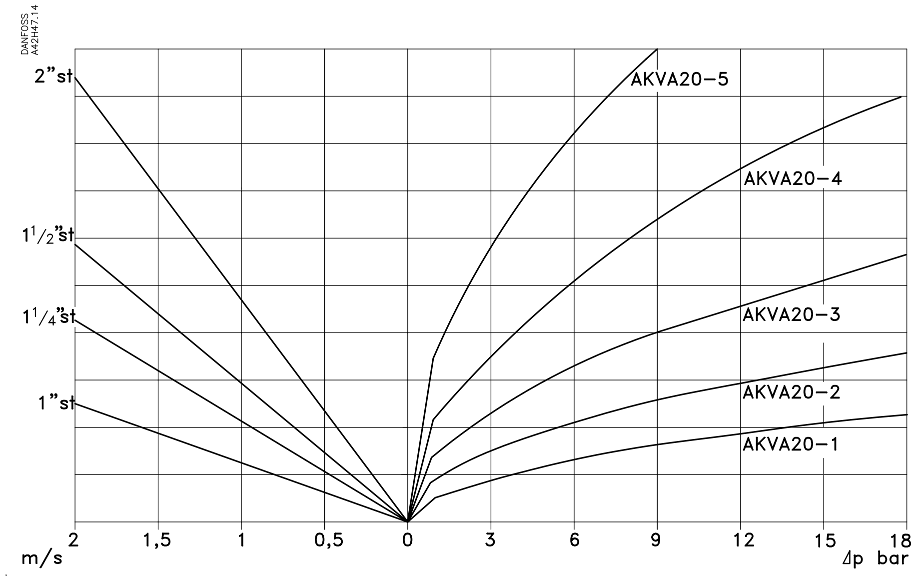
6. Correctly dimensioned liquid line
To obtain a correct supply of liquid to the AKVA valve, the liquid line to the individual AKVA valve must be correctly dimensioned.
The liquid flow rate must not exceed 1 m/sec at a fully open valve.
This must be observed on account of the pressure drop in the liquid 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

Dimensioning
(continued)

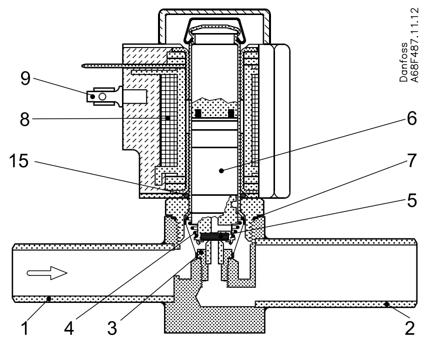




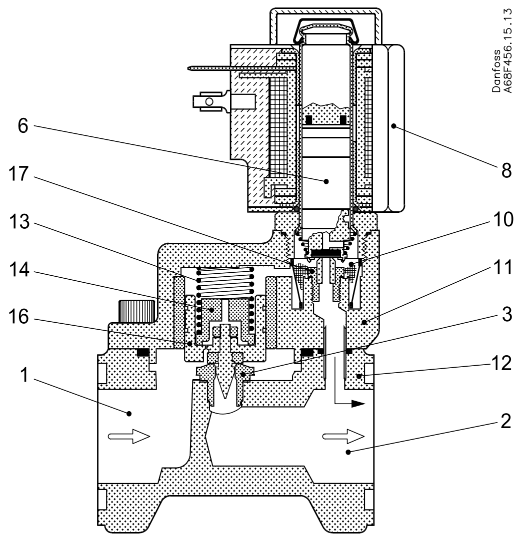


Expansion valves

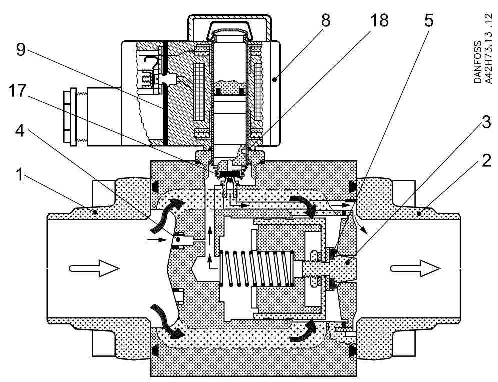
Design



AKVA 10



AKVA 15

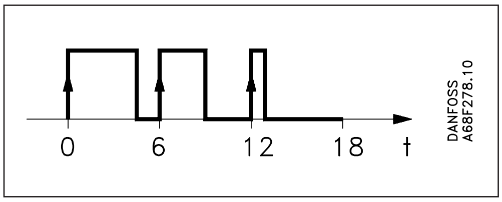


AKVA 20

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

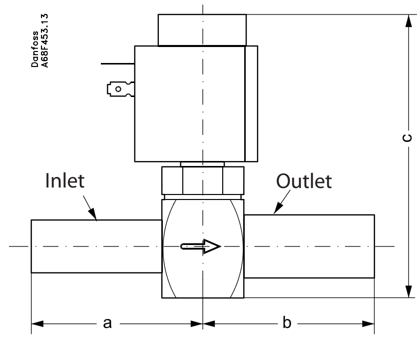
Function

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.



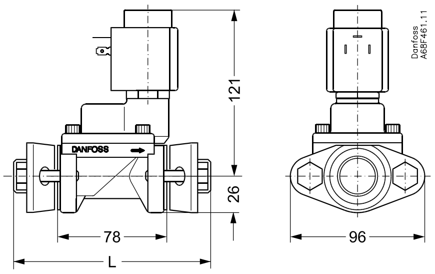
The relation between this opening and closing time indicates the actual capacity. If there is an intense need for refrigeration, the valve will remain open for almost all six seconds of the period. If the required amount of refrigeration is modest, the valve will only stay open during a fraction of the 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 advantage-ously be used both as expansion valve and solenoid valve. See appendix.

Dimension and weight



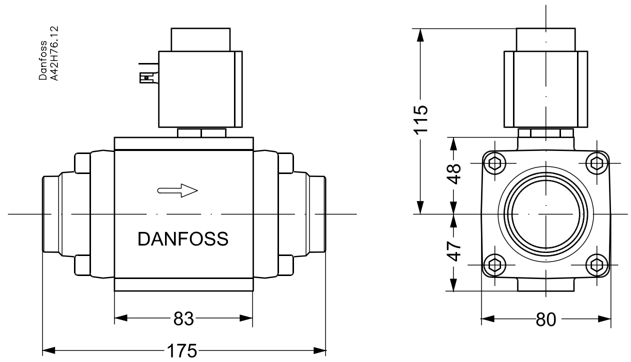
AKVA 10

Valve type		A	B	C	Connection		Weight without coil
					Inlet	Outlet	
		mm	mm	mm	in.	in.	kg
AKVA 10	$1 \rightarrow 6$	60	60	113	$^3/_8$	$^1/_2$	0.35
AKVA 10	$7 \rightarrow 8$	60	60	113	$^1/_2$	$^3/_4$	0.35



AKVA 15

L = 148 mm
Weight without coil = 2.0 kg



AKVA 20

Weight without coil = 4.1 kg

Expansion valves

Appendix

Recommandations

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 recommandations/ 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 hole 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 influende 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 vale).
- Where the demand for safety level is extremely high, (e.g. Liquid Level Control in a pump seperator) 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.

Introduction

TEVA valves are designed for use as liquid level regulators for flooded evaporators, intermediate receivers, and liquid separators.

Materials

Valve housing made of GGG40.3

Gaskets are non asbestos

Technical data

Refrigerant
R717 (NH_3). Can also be used for R22.

Temperature of medium
–50 → +10°C

Capillary tube length
5 m

Connection for external pressure equalization
¼ in. (∅6.5 / ∅ 10 mm) weld nipple or 8 mm cutting ring connection.

Approvals
DSRK

Max. working pressure
PS= 19 bar

Max. test pressure
p' = 28.5 bar

Voltage and consumption
24 V a.c. 10 W

Length of electric cable
1.5 m

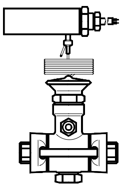
The complete technical leaflet (RD2AA) can be downloaded from the Danfoss web site.

Ordering

Separate thermostatic element with electric heater for TEVA 20 and 85, code no. **068G3255**.

Separate electric heater for TEVA 20 and 85, code no. **068G0037**.

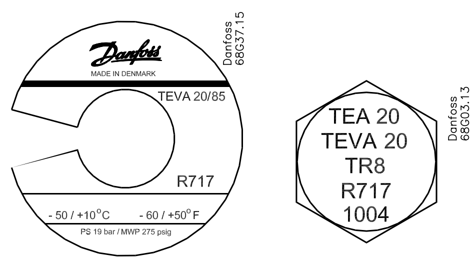
Extra weld bush for bulb, including coupling nut, sealing plug and gasket, code no. **068G0026**.



Type and rated capacity in tons (TR)	Rated capacity R717 [1] (NH_3) kW	Connection weld flanges Inlet in.	Connection weld flanges Outlet in.	Code no. Ass. regulator with strainer [2]	Code no. Ass. regulator without strainer [2])	Code no. Separate orifice assembly
TEVA 20						
TEVA 20-1	3.5	½	½	**068G6040 + 006-0042**	**068G6040**	**068G2050**
TEVA 20-2	7.0	½	½	**068G6041 + 006-0042**	**068G6041**	**068G2051**
TEVA 20-3	10.5	½	½	**068G6042 + 006-0042**	**068G6042**	**068G2052**
TEVA 20-5	17.5	½	½	**068G6043 + 006-0042**	**068G6043**	**068G2053**
TEVA 20-8	30.0	½	½	**068G6044 + 066-0042**	**068G6044**	**068G2054**
TEVA 20-12	42.0	½	½	**068G6045 + 006-0042**	**068G6045**	**068G2055**
TEVA 20-20	70.0	½	½	**068G6046 + 006-0042**	**068G6046**	**068G2056**
TEVA 85						
TEVA 85-33	115	¾	¾	**068G6047 + 006-0048**	**068G6047**	**068G2057**
TEVA 85-55	195	¾	¾	**068G6048 + 006-0048**	**068G6048**	**068G2058**
TEVA 85-85	295	¾	¾	**068G6049 + 006-0048**	**068G6049**	**068G2059**

[1]) The rated capacity is the regulator capacity at -15°C evaporating temperature and +32°C condensing temperature. The capacities are based on 4°C subcooling ahead of the regulator.
[2]) The strainer 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 increase wear on orifice

Identification

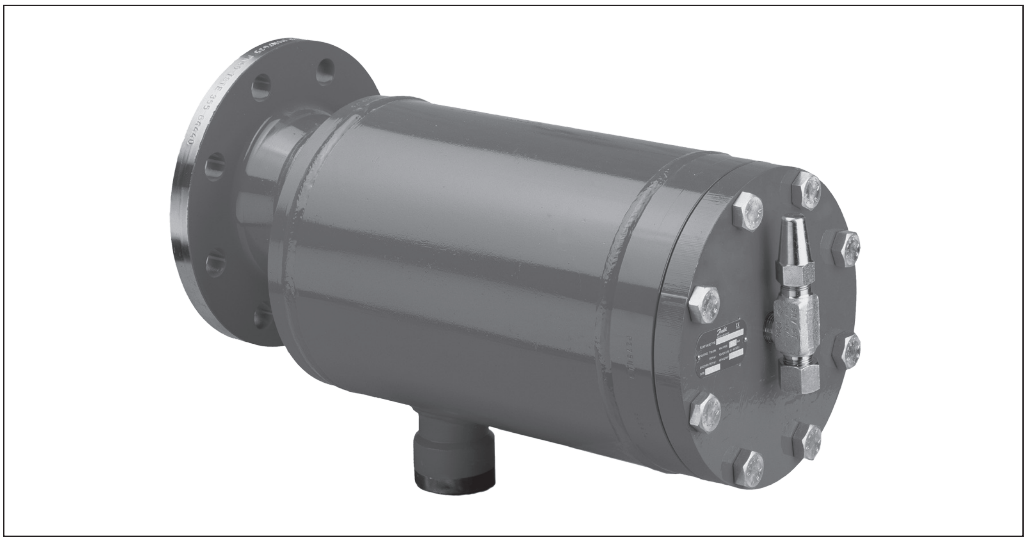


Element label *Stamping on orifice assembly*

The thermostatic element
has a white label on the top. The colour refers to the refrigerant for which the valve is designed: R717 (NH_3).

The orifice assembly
is market with the valve type (TEVA 20) rated capacity (8 TR = 28 kW), refrigerant (R717 = NH_3), and date marking (1004 = week 10, 2004).

Introduction



HFI is a high pressure float valve with internal liquid measuring device. The float valve is designed for direct flange mounting or welding on to plate heat exchanger type condensers, as illustrated in fig 1.

HFI is direct acting, therefore no differential pressure is required to activate the valve.

HFI is sturdy and reliable owing to its simple design. The float valve is equipped with a purge valve for purging non condensable gases e.g. air from the top of the valve housing. This facility is also useful if the valve has to be serviced.

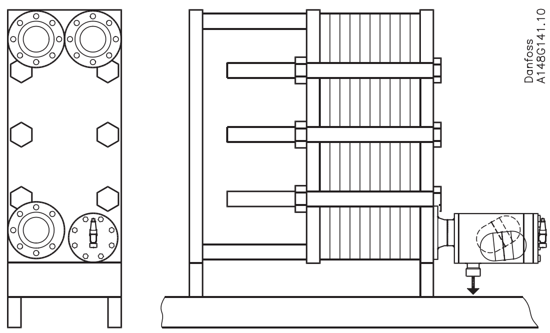


Fig. 1

Features

- Designed for direct flange mounting on to plate heat exchanger type condensers
- Can be mounted directly on vessels
- Temperature range: –50/+80°C (–58/+176°F)
- Equipped with purge valve for purging non condensable gasses
- Maximum operating pressure is 25 bar g (363 psi g)
- Suitable for ammonia and other refrigerants with a density of 500 through 700 kg/m^3 (31.21 - 43.70 lb/ft^3). For densities outside this range please contact your local Danfoss sales company.
- Housing i.e. shell and flange are made of special steel approved for low temperature application
- Classification: To get an updated list of certification on the products please contact your local Danfoss Sales Company.

The complete technical leaflet (DKRCI.PD.GB0.A) can be downloaded from the Danfoss web site.

Design

Available connections
Flange:
Inlet: Flange DN 100 or DN 150 (DIN-2635/DIN 2512-F)
Outlet: Welding connection DN 50 (EN 10220)

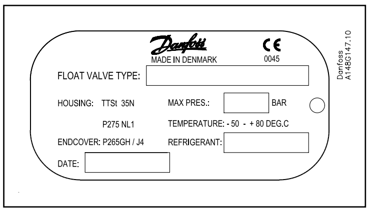
Butt-weld, DIN:
Inlet: DN 100 or DN 150 (EN 10220)
Outlet: Welding connection DN 50 (EN 10220)

Butt-weld, ANSI:
Inlet: DN 100 (4 in.) or DN 150 (6 in.) (ANSI B 36.10)
Outlet: Welding connection DN 50 (2 in.) (ANSI 36.10)

Housing
Housing i.e. shell and flange is made of special steel approved for low temperature operation.

Installation
Refer to installation instruction for HFI.

Identification:



Pressure Equipment Directive (PED)
The HFI-valves are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction

HFI valves	
Nominal bore	DN 100 and 150 mm (4 in. and 6 in.)
Classified for	Fluid group I
Catagory	III

Technical data

- Refrigerants
  HFI as standard can be used for R 717 (ammonia) and other refrigerants with a density of 500 through 700 kg/m^3 (31.21 - 43.70 lb/ft^3). If the density of the refrigerant in question is outside this range, please contact your local Danfoss Sales Company.
  Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.
- Temperature range
  –50/+80°C (–58/+176 °F)
- Pressure
  The float valve is designed for:
  Maximum operating pressure:
  25 bar g (363 psi g).
  Strength test without float ball:
  50 bar g (725 psi g).
  Leakage test:
  25 bar g (363 psi g).
  Valves for higher pressure are available on request.

The principle of high pressure control

Introduction
In installations with one application high pressure control is an effective and cost saving way of expanding liquid from the condenser to the low pressure side.

High pressure refrigerant entering the condenser will start to condense, consequently condensate will accumulate at the bottom of the condenser and in the float valve.

When capacity demands increase, the liquid level in the float valve will rise, which will cause the valve to open and the refrigerant to expand into the separator at the low pressure side.

When the valve is closed, there will still be a small by-pass over the seat, so any remaining liquid will equalize slowly to the low pressure side, for instance during an off cycle. Therefore the system will equalize automatically and the compressor can start up without excessive back pressure. The size of the bypass is predetermined and defined by geometry of the elements.

It follows from the above, that almost all the refrigerant will be accumulated on the low pressure side under normal conditions. Therefore under normal conditions no high pressure receiver is necessary when using the HFI for high pressure control.

Insert for the high pressure float valve

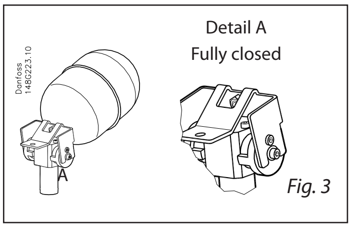


Fig. 3

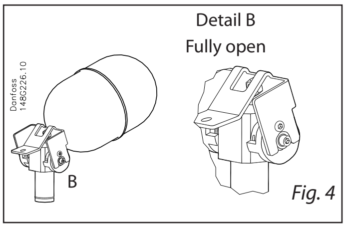
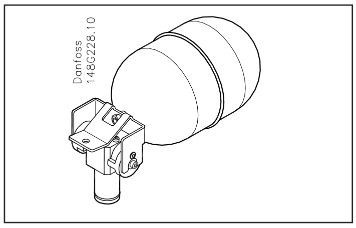


Fig. 4



Computation and selection

In R 717 plants (ammonia)

On the following pages you will find tables with capacities of the float valve at various operating conditions.

Select a valve using the specific operating conditions. The chosen valve must have a capacity higher than the required capacity during nominal operation, as well as during plant start up.

In plants using other refrigerants than ammonia

The capacity of the float valve can be calculated by using the values and the equation to the right. However, the density of the refrigerant must be in the range: 500 to 700 kg/m^3.

For densities outside this range please contact your local Danfoss Sales Company.

Valve type	Nominal capacity [kW] (R 717, –10/+35°C)	Valve constant [K]
HFI 040 FD	400	16.79
HFI 050 FD	800	33.58
HFI 060 FD	1200	50.36
HFI 070 FD	2400	100

Mass flow G = $K\sqrt{\Delta p \times \rho}\;[\mathrm{kg/h}]$

Δp = differential pressure [bar]
ρ = density of liquid [kg/m^3]
K = valve constant (from the above table)

Level controls

Computation and selection capacity tables - SI units

HFI 040 - R 717, evaporating capacity [kW]

Condensing temp. (°C)	Evaporating temperature (°C)												
	–40	–35	–30	–25	–20	–15	–10	–5	0	5	10	15	20
50	475	480	480	475	475	475	470	460	455	445	430	415	395
45	460	460	460	460	455	455	445	440	430	420	405	385	360
40	440	440	440	440	435	430	425	415	405	390	375	350	325
35	420	420	420	415	415	405	**400**	390	375	360	340	315	280
30	400	400	400	395	390	385	375	360	345	325	300	270	230
25	380	380	375	370	365	360	345	330	315	290	260	220	160
20	360	355	355	350	340	330	315	300	280	250	210	155	
15	340	335	330	325	315	300	285	265	240	200	150		
10	315	310	305	295	285	270	250	225	195	140			
5	290	285	280	270	255	240	215	185	135				
0	270	260	255	240	225	205	175	125					
–5	245	235	225	210	190	165	120						
–10	220	210	200	180	155	115							

HFI 050 - R 717, evaporating capacity [kW]

Condensing temp. (°C)	Evaporating temperature (°C)												
	–40	–35	–30	–25	–20	–15	–10	–5	0	5	10	15	20
50	955	955	955	955	950	945	935	925	910	890	865	830	790
45	920	920	920	915	910	905	895	880	860	835	805	770	725
40	880	880	880	875	870	860	850	830	810	780	745	700	645
35	845	845	840	835	825	815	**800**	780	755	720	680	625	560
30	805	800	800	790	780	765	750	725	695	655	605	540	455
25	765	760	755	745	730	715	695	665	630	580	520	440	320
20	720	715	705	695	680	660	635	600	555	500	420	310	
15	675	670	660	645	630	605	570	530	480	405	295		
10	630	625	610	595	570	545	505	455	385	285			
5	585	575	560	540	515	480	430	365	270				
0	540	525	505	485	450	405	345	255					
–5	490	475	455	425	385	325	240						
–10	440	420	395	360	305	230							

HFI 060 - R 717, evaporating capacity [kW]

Condensing temp. (°C)	Evaporating temperature (°C)												
	–40	–35	–30	–25	–20	–15	–10	–5	0	5	10	15	20
50	1430	1435	1435	1430	1425	1420	1405	1385	1365	1335	1295	1245	1190
45	1380	1380	1380	1375	1370	1360	1340	1320	1290	1255	1210	1155	1085
40	1325	1325	1320	1315	1305	1290	1270	1245	1215	1170	1120	1055	970
35	1265	1265	1260	1250	1240	1220	**1200**	1170	1130	1080	1020	940	840
30	1205	1205	1195	1185	1170	1150	1120	1085	1040	980	905	810	685
25	1145	1140	1130	1115	1100	1075	1040	995	940	870	780	660	485
20	1080	1070	1060	1045	1020	990	950	900	835	750	635	465	
15	1015	1005	990	970	940	905	860	795	715	605	445		
10	945	935	915	890	860	815	755	680	580	425			
5	875	860	840	810	770	720	645	550	405				
0	805	785	760	725	675	610	520	380					
–5	735	710	680	635	575	490	360						
–10	660	635	595	540	460	340							

HFI 070 - R717, evaporating capacity [kW]

Condensing temp. (°C)	Evaporating temperature (°C)												
	–40	–35	–30	–25	–20	–15	–10	–5	0	5	10	15	20
50								2775	2725	2665	2590	2495	2375
45							2680	2640	2580	2510	2420	2310	2170
40							2545	2490	2425	2340	2235	2105	1940
35						2445	**2400**	2335	2260	2160	2035	1880	1680
30					2340	2300	2245	2170	2080	1960	1815	1625	1370
25					2195	2145	2080	1995	1885	1745	1565	1320	965
20				2090	2040	1980	1900	1800	1670	1500	1265	930	
15				1940	1885	1810	1715	1595	1435	1210	890		
10			1835	1785	1715	1630	1515	1365	1160	850			
5		1725	1680	1620	1540	1435	1295	1100	810				
0		1575	1520	1450	1350	1220	1040	765					
–5	1470	1425	1360	1270	1150	980	725						
–10	1325	1265	1190	1080	920	685							

Computation and selection capacity tables - US units

HFI 040 - R 717, evaporating capacity [TR]

Condensing temp. (°F)	Evaporating temperature (°F)												
	–40	–30	–20	–10	0	10	20	30	40	50	60	70	80
120	134	135	135	134	134	132	131	128	125	121	116	109	101
110	129	129	129	128	127	126	123	121	117	112	106	98	87
100	123	123	122	122	120	118	116	112	108	102	94	84	71
90	117	117	116	115	113	111	107	103	98	91	81	69	50
80	110	110	109	107	105	102	99	94	87	78	66	49	
70	103	103	102	100	97	94	89	83	75	63	47		
60	97	96	94	92	89	84	79	71	60	44			
50	90	88	86	83	80	74	67	57	42				
40	82	81	78	75	70	63	54	40					
30	75	73	70	65	59	51	38						
20	67	65	61	55	47	35							
10	59	56	51	44	33								

HFI 050 - R 717, evaporating capacity [TR]

Condensing temp. (°F)	Evaporating temperature (°F)												
	–40	–30	–20	–10	0	10	20	30	40	50	60	70	80
120	268	269	269	269	267	265	261	256	250	242	231	218	201
110	258	258	257	256	254	251	247	241	233	224	211	195	175
100	246	246	245	243	241	237	232	224	215	204	189	169	143
90	234	233	232	229	226	221	215	207	196	181	163	138	101
80	221	220	218	215	211	205	197	187	174	156	132	97	
70	207	206	203	200	194	187	178	166	149	127	93		
60	193	191	188	184	177	169	157	142	121	89			
50	179	176	172	167	159	149	134	114	84				
40	165	161	156	149	140	127	108	80					
30	150	145	139	130	118	102	75						
20	135	129	121	110	95	70							
10	119	112	102	88	65								

HFI 060 - R 717, evaporating capacity [TR]

Condensing temp. (°F)	Evaporating temperature (°F)												
	–40	–30	–20	–10	0	10	20	30	40	50	60	70	80
120	403	404	404	403	401	397	392	385	375	363	347	327	302
110	386	387	386	384	381	377	370	362	350	335	317	293	262
100	369	368	367	365	361	355	347	337	323	305	283	253	214
90	350	350	348	344	339	332	322	310	293	272	244	207	151
80	331	329	327	322	316	307	296	281	261	234	199	146	
70	310	309	305	299	292	281	267	249	224	190	140		
60	290	287	282	275	266	253	236	213	181	133			
50	269	265	259	250	239	223	202	172	126				
40	247	242	234	224	209	190	162	120					
30	225	218	209	196	178	152	113						
20	202	194	182	165	142	106							
10	178	168	153	132	98								

HFI 070 - R717, evaporating capacity [TR]

Condensing temp. (°F)	Evaporating temperature (°F)												
	–40	–30	–20	–10	0	10	20	30	40	50	60	70	80
120							784	769	750	725	694	654	603
110							741	723	700	671	633	586	524
100						710	695	673	646	611	566	507	428
90					678	664	645	620	587	544	489	413	302
80					632	615	592	561	521	469	397	292	
70				599	583	562	534	497	447	380	279		
60				551	532	506	472	426	362	267			
50			517	500	477	446	403	343	253				
40		483	469	448	419	380	325	240					
30		436	418	391	355	305	226						
20	404	387	364	331	284	211							
10	357	336	307	263	195								

High pressure control in refrigeration system with condenser/evaporator

Fig. 5 shows a water chiller with plate heat exchanger as both condenser and evaporator. HFI is flanged directly on to the condenser.

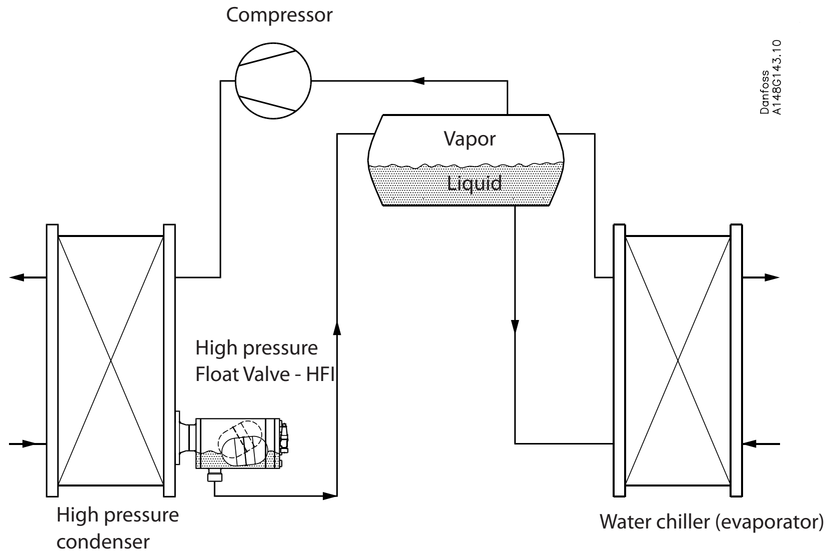


Fig. 5, Example

Material specification

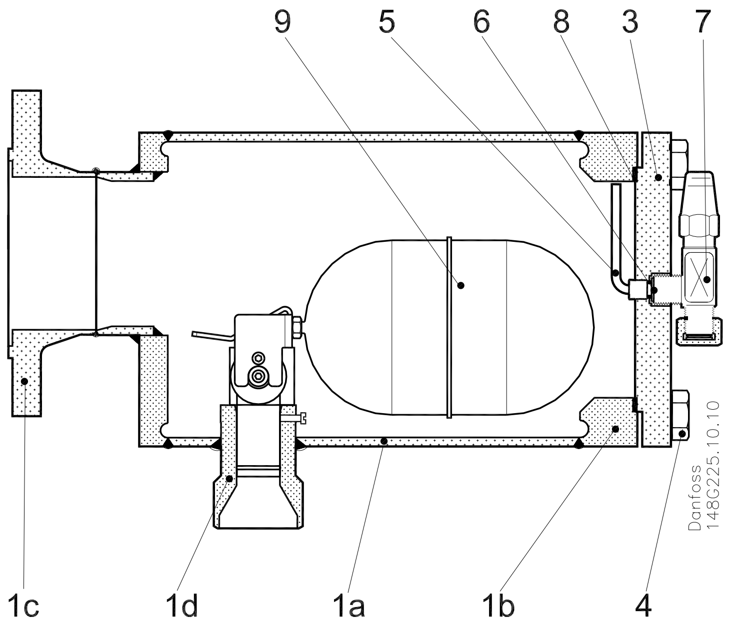


Fig. 6

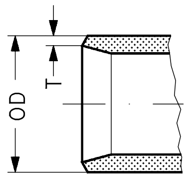
No	Part	Material	DIN/EN	ISO	ASTM
1	Housing: a. Shell b. Flange (shell) c. Flange (inlet) d. Branch (discharge)	 Steel Steel Steel Steel	 TTSt 35 N, 17173 P275 NL1, EN 10 028-3 P275 NL1, EN 10 028-3 TTSt 35 N/V, 17173	 TW6, 2604/3 TW6, 2604/3	 Grade 1, A333, A334 Grade 1, A333, A334
3	End cover with cylinder	Steel	P275 NL1, EN 10 028-3		
4	Set screw	Stainless steel	A2-70	A2-70	
5	Tube	Steel			
6	Gasket	Aluminium			
7	Purge valve, SNV-ST [1])				
8	Gasket	Non asbestos			
9	Float Ball	Steel			

[1]) for further information please see the datasheet for SNV-ST valves.

Level controls

Connections

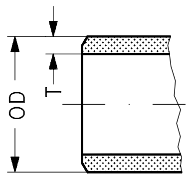
DIN - Outlet



Butt welding EN10220

Size mm	Size in.	Outlet OD mm	Outlet T mm	Outlet OD in.	Outlet T in.	For use with valve type
100	4	60.3	2.9	2.37	0.11	HFI 040 HFI 050 HFI 060 HFI 070
150	6	60.3	2.9	2.37	0.11	HFI 050 HFI 060 HFI 070

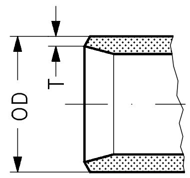
ANSI - Outlet



Butt welding ANSI B 36.10

Size mm	Size in.	Outlet OD mm	Outlet T mm	Outlet OD in.	Outlet T in.	For use with valve type
100	4	60.3	2.9	2.37	0.11	HFI 040 HFI 050 HFI 060 HFI 070
150	6	60.3	2.9	2.37	0.11	HFI 050 HFI 060 HFI 070

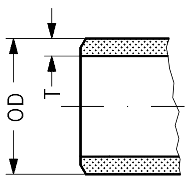
DIN - Inlet



Butt welding EN 10220

Size mm	Size in.	Inlet OD mm	Inlet T mm	Inlet OD in.	Inlet T in.	For use with valve type
100	4	114.3	3.6	4.50	0.14	HFI 040 HFI 050 HFI 060 HFI 070
150	6	168.3	4.5	6.63	0.18	HFI 050 HFI 060 HFI 070

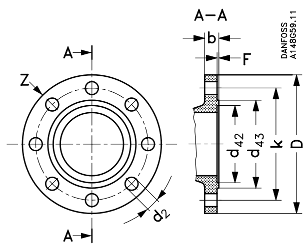
ANSI - Inlet



Butt welding ANSI B 36.10

Size mm	Size in.	Inlet OD mm	Inlet T mm	Inlet OD in.	Inlet T in.	For use with valve type
100	4	114.3	3.6	4.50	0.14	HFI 040 HFI 050 HFI 060 HFI 070
150	6	168.3	4.5	6.63	0.18	HFI 050 HFI 060 HFI 070

Inlet flange



*40 bar / DIN 2635 / DIN 2512-F**

		D	b	k	d_{42}	d_{43}	F	d_2	Z
Size 100 (4 in.)	mm	235	24	190	129	149	4.5	22	8 pcs.
	in.	9.3	0.94	7.48	5.08	5.87	0.18	0.97	
Size 150 (6 in.)	mm	300	28	250	183	203	4.5	26	8 pcs.
	in.	11.8	1.10	9.84	7.20	7.99	0.18	1.02	

*Inlet flange and DIN outlet

Dimensions and weights

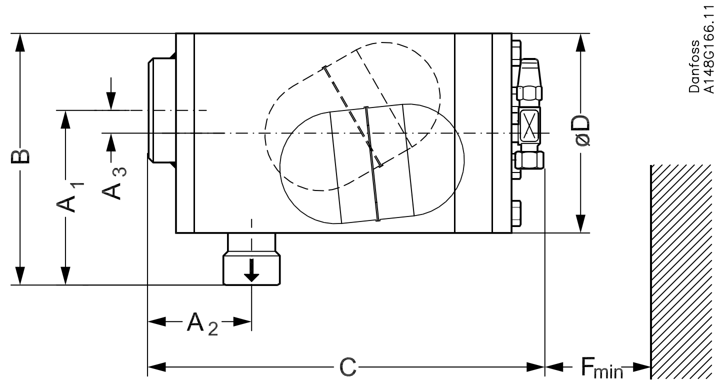


Fig. 7

High pressure float valve without flange (Fig. 7)

Valve size		A_1	A_2	A_3	B	C	ØD	$F_{min.}$	Weight
HFI 100	mm	192	113	25	276	435	219	200	37 kg
	in.	7.56	4.45	0.98	10.87	17.13	8.62	7.87	81.5 lb
HFI 150	mm	167	113		276	435	219	200	37 kg
	in.	6.57	4.45		10.87	17.13	8.62	7.87	81.5 lb

Specified weights are approximate values only.

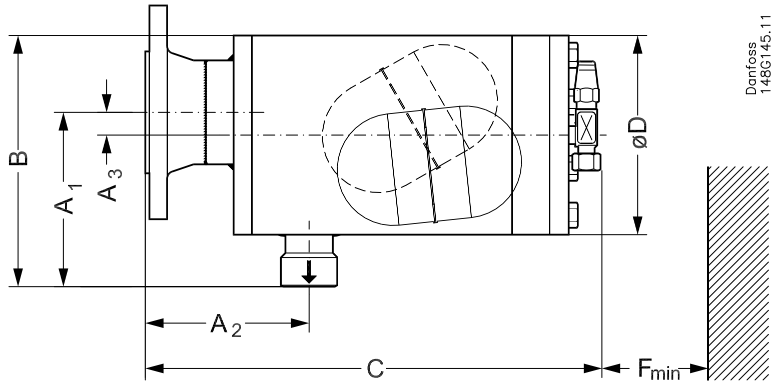


Fig. 8

High pressure float valve with flange (Fig. 8)

Valve size		A_1	A_2	A_3	B	C	ØD	$F_{min.}$	Weight
HFI 100	mm	192	180	25	309	502	219	200	41 kg
	in.	7.56	7.09	0.98	12.17	19.76	8.62	7.87	90.4 lb
HFI 150	mm	167	189		317	511	219	200	41 kg
	in.	6.57	7.44		12.48	20.12	8.62	7.87	90.4 lb

Specified weights are approximate values only.

Volumes

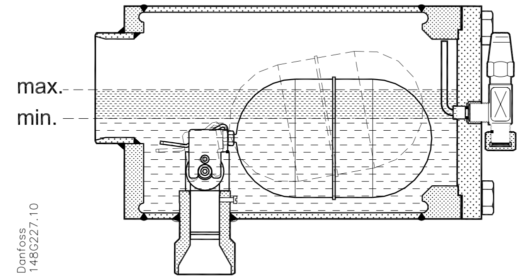


Fig. 9

Internal volume (gross): *8.2×10^{-3} m^3 (2.17 USgal)*
Internal volume with float ball: *6.4×10^{-3} m^3 (1.69 USgal)*
Liquid volume at max. level: *4.6×10^{-3} m^3 (1.22 USgal)*
Liquid volume at min. level: *1.6×10^{-3} m^3 (0.42 USgal)*

Ordering

The table below is used to identify the valve required.
Example: HFI 040 D 100 = 148G3092

Type	Inlet connection size	Nozzle size	**Code numbers**
HFI 040 FD 100	100 (4 in.) DIN Flange	40	**148G3102**
HFI 050 FD 100		50	**148G3103**
HFI 060 FD 100		60	**148G3104**
HFI 070 FD 100		70	**148G3422**
HFI 050 FD 150	150 (6 in.) DIN Flange	50	**148G3105**
HFI 060 FD 150		60	**148G3106**
HFI 070 FD 150		70	**148G3423**
HFI 040 D 100	100 (4 in.) DIN BW	40	**148G3092**
HFI 050 D 100		50	**148G3093**
HFI 060 D 100		60	**148G3094**
HFI 070 D 100		70	**148G3418**
HFI 050 D 150	150 (6 in.) DIN BW	50	**148G3095**
HFI 060 D 150		60	**148G3096**
HFI 070 D 150		70	**148G3419**
HFI 040 A 100	100 (4 in.) ANSI BW	40	**148G3097**
HFI 050 A 100		50	**148G3098**
HFI 060 A 100		60	**148G3099**
HFI 070 A 100		70	**148G3420**
HFI 050 A 150	150 (6 in.) ANSI BW	50	**148G3100**
HFI 060 A 150		60	**148G3101**
HFI 070 A 150		70	**148G3421**

FD = inlet flange DIN
D = Butt welding DIN
A = Butt welding ANSI

Insert for HFI 070 (complete insert with float ball - without float housing)	**148G3584**
Insert for HFI 60 (complete insert with float ball - without float housing)	**148G3663**
Insert for HFI 50 (complete insert with float ball - without float housing)	**148G3662**
Insert for HFI 40 (complete insert with float ball - without float housing)	**148G3661**

Specials

Special HFI valves with extra connections for drainage and pressure equalization are available on request.
Please contact your local Danfoss sales office.

Introduction

The SV 1 and 3 can be used separately as a modulating liquid level regulator in refrigerating, freezing and air conditioning systems for ammonia or fluorinated refrigerants.

However, in most cases, the SV is used as a float pilot valve for the main expansion valve type PMFL or PMFH.

Technical data

Refrigerant
R717, R22, R134a, R404A and other fluorinated refrigerants

P band
35 mm

Temperature of medium
$-50 \rightarrow +65°C$

Max. working pressure
PS = 28 bar

Max. test pressure
p' = 36 bar

k_v value for float orifice
SV 1 = 0.06 m^3/h
SV 3 = 0.14 m^3/h

The highest k_v value for the built-in throttle valve is 0.18 m^3/h. The throttle valve can be used both in parallel and in series with the float orifice.

Approvals

Pressure Equipment Directive (PED)
SV1 and 3 are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.

For further details / restrictions - see Installation Instruction

	SV1 and 3
Classified for	Fluid group I
Category	I

Identification

Dimensioning example for SV (L)

Refrigerant
R717 (NH_3)

Evaporating capacity
$Q_e = 27$ kW

Evaporating temperature
$t_e = -10°C$ (~ $p_e = 2.9$ bar abs.)

Condensing temperature
$t_c = +30°C$ (~ $p_c = 11.7$ bar abs.)

Liquid temperature for SV
$t_l = +20°C$

Subcooling
$\Delta t_{sub} = t_c - t_l = 30°C - 20°C = 10$ K

Pressure drop in SV
$\Delta p = p_c - p_e = 11.7 - 2.9 = 8.8$ bar

Correction factor k for 10 K subcooling
0.98

Corrected capacity
$27 \times 0.98 = 26.4$ kW

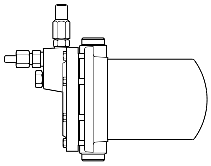
At $t_e = -10°C$ and $\Delta p = 8$ bar SV 1 yields 27 kW and can therefore be used.

If SV 3 is used for this capacity, it will mean a small offset.

The complete technical leaflet (DKRCI.PD.GE0.B) can be downloaded from the Danfoss web site.

Ordering

Regulator



The code nos. stated apply to liquid level regulators type SV 1 and SV 3 incl. ∅ 6.5 / ∅ 10 mm weld connection [1]) for the pilot line. Balance tube connection (liquid/vapour): 1 in. weld / $1^1/_8$ in. solder.							
The rated capacity refers to the valve capacity at evaporating temperature t_e = +5°C, condensing temp. t_c = +32°C and liquid temperature t_l = +28°C.							
Valve type	**Code no.**	Rated capacity in kW					
		R717	R22	R134a	R404A	R12	R502
SV 1	**027B2021**	25	4.7	3.9	3.7	3.1	3.4
SV 3	**027B2023**	64	13	10.0	9.7	7.9	8.8

[1]) ⅜ in. flare connection can be supplied under code no. **027B2033.**

Spare parts and accessories
See spare parts catalogue.

Pipe dimensions

Liquid line
The following suggested dimensions for the liquid line, which is connected to the nipple pos. C, see "Design / Function", are based on a maximum velocity in a line with subcooled ammonia of *approx. 1 m/s* and a *maximum* velocity in a line with subcooled fluorinated refrigerant of *approx. 0.5 m/s.*

1. R717 (ammonia)

Type	Dimensions	
	0.8 bar < Δp_{sv} < 4 bar	4 bar < Δp_{sv} < 16 bar
	Steel tube	Steel tube
SV 1	$^3/_8$ in.	$^3/_8$ in.
SV 3	$^3/_8$ in.	$^1/_2$ in.

2. R22, R134a, R404A

Type	Dimensions			
	0.8 bar < Δp_{sv} < 4 bar		4 bar < Δp_{sv} < 16 bar	
	Steel tube	Copper tube	Steel tube	Copper tube
SV 1	$^3/_8$ in.	$^3/_8$ in.	$^3/_8$ in.	$^1/_2$ in.
SV 3	$^3/_8$ in.	$^5/_8$ in.	$^1/_2$ in.	$^3/_4$ in.

Upper balance pipe (connect to pos. D on SV (L)

Type	Dimensions
SV (L) 1	1 in.
SV (L) 3	$1^1/_2$ in.

Capacity

The values in the capacity tables are based on a subcooling of 4 K just ahead of the SV valve.

If the subcooling is more or less than 4 K, refer to the following correction factors.

R717 (NH_3)

Type	Evaporating temperature t_e °C	Capacity in kW at pressure drop across valve Δp bar							
		0.8	1.2	1.6	2	4	8	12	16
SV 1	+10	9.5	11	13	15	20	27	30	
	0	9.9	12	14	15	20	27	31	33
	–10	10	12	14	15	21	27	31	33
	–20	11	12	14	15	21	27	30	33
	–30	11	12	14	15	20	26	30	33
	–40	11	13	14	15	20	26	29	32
	–50	11	12	13	15	20	26	29	32
SV 3	+10	25	31	35	39	52	71	77	
	0	26	32	36	40	52	69	78	83
	–10	26	32	36	40	52	68	77	83
	–20	26	31	35	39	52	67	76	82
	–30	25	30	34	38	50	66	75	82
	–40	24	29	33	36	49	65	73	80
	–50	23	27	31	35	47	64	71	79

R22

Type	Evaporating temperature t_e °C	Capacity in kW at pressure drop across valve Δp bar							
		0.8	1.2	1.6	2	4	8	12	16
SV 1	+10	2.2	2.6	3.0	3.2	4.2	4.8	5.7	5.7
	0	2.3	2.7	3.1	3.4	4.4	4.9	5.8	5.8
	–10	2.4	2.8	3.2	3.5	4.5	5.0	5.8	5.9
	–20	2.4	2.9	3.3	3.6	4.6	5.0	5.8	5.8
	–30	2.5	2.9	3.3	3.6	4.5	5.0	5.7	5.7
	–40	2.5	2.9	3.3	3.6	4.4	4.9	5.6	5.6
	–50	2.6	2.9	3.3	3.5	4.3	4.8	5.4	5.4
SV 3	+10	5.6	6.8	7.7	8.5	11	13	15	15
	0	5.8	7.0	8.0	8.8	11	13	15	15
	–10	6.0	7.3	8.2	9.0	12	13	15	15
	–20	6.1	7.3	8.3	8.9	11	13	14	15
	–30	6.2	7.3	8.1	8.8	11	12	14	14
	–40	6.1	7.1	7.9	8.5	11	12	14	14
	–50	5.9	6.9	7.6	8.2	11	12	13	14

Correction factors

When dimensioning, multiply the evaporator capacity by a correction factor k dependent on the subcooling Δt_{sub} just ahead of the valve. The corrected capacity can then be found in the capacity table.

R717 (NH3)

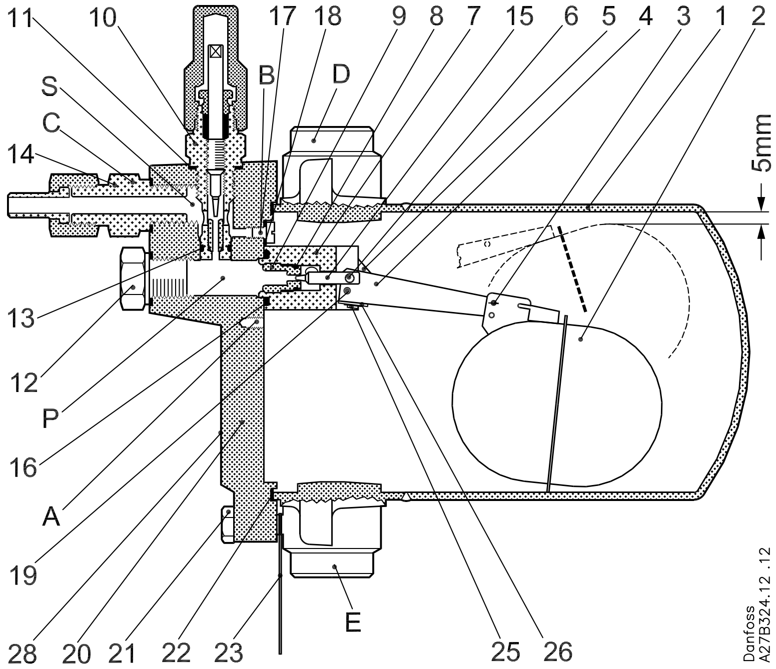
Δt K	2	4	10	15	20	25	30	35	40	45	50
k	1.01	1.00	0.98	0.96	0.94	0.92	0.91	0.89	0.87	0.86	0.85

R22

Δt K	2	4	10	15	20	25	30	35	40	45	50
k	1.01	1.00	0.96	0.93	0.90	0.87	0.85	0.83	0.80	0.78	0.77

Design
Function

SV with low-pressure function



C. Nipple
D. Connection for balance pipe
P. Parallel connection of pos. C (screw 25 in pos. A)
S. Series connection of pos. C (screw 25 in pos. B)

No.	Part	Material	DIN / EN
1	Float housing	Stainless steel Low temperature, steel	X5CrNi18-10, DIN 17440 P285QH, EN 10222-4
2	Float	Stainless steel	
3	Split pin	Steel	
4	Float arm	Stainless steel	
5	Link	Steel	
6	Pin	Stainless steel	
7	Valve housing	Steel	
8	O-ring	Cloroprene (Neoprene)	
9	Float orifice	Plastic	
10	Manual regulation unit. Throttle valve	Steel	
11	Gasket	Non asbestos	
12	Plug	Steel	
13	O-ring	Cloroprene (Neoprene)	
14	Pilot connection (spare part)	Steel	
15	Orifice needle	Plastic	
16	O-ring	Cloroprene (Neoprene)	
17	Screw	Steel	
18	Gasket	Non asbestos	
19	Pin	Steel	
20	Cover	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563
21	Screw	Stainless steel	A2-70
22	Gasket	Non asbestos	
23	Label	Cardboard	
25	Screw	Steel	
26	Spring washer	Steel	
28	Sign	Aluminium	

Design
Function
(continued)

SV (L), low-pressure function
SV (L) is used for small, flooded evaporators, where only slight variations in the liquid level can be accepted.
When the liquid level falls, the float pos. (2) moves downwards. This draws the needle pos. (15) away from the orifice and the amount of liquid injected is increased.

The liquid inlet line, which is mounted on the nipple pos. (C), should be dimensioned in such a way *that acceptable liquid velocities* and *pressure drops are obtained*.
This is particularly important when the liquid is only slightly subcooled, since valve capacity is reduced considerably if flashgas occurs in the liquid ahead of the orifice and wear is strongly increased.
See the suggested dimensions for the liquid line in "Pipe dimensions".

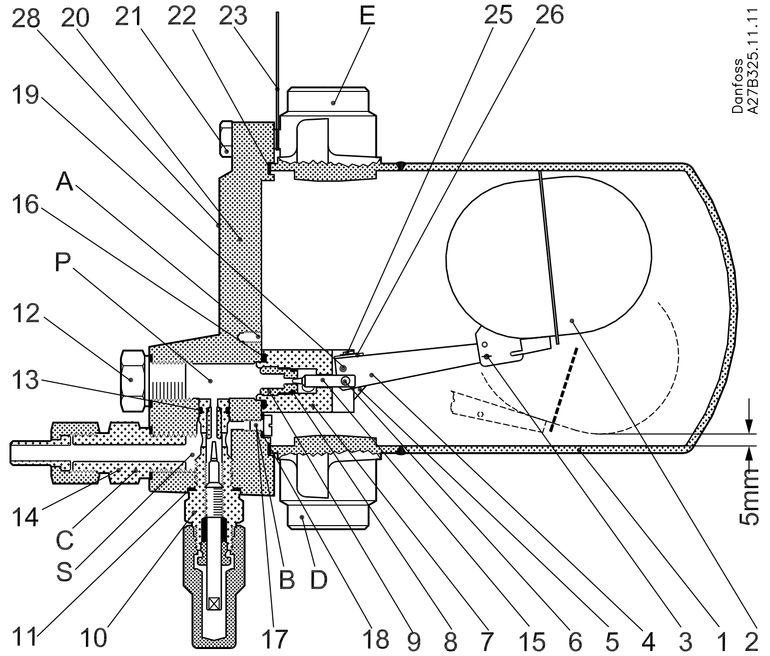
The flashgas quantity which occurs on expansion is removed through the balance pipe from pos. (D). On refrigeration plant using fluorinated refrigerants, slight subcooling and a large pressure drop can give a flashgas quantity of approx. 50% of the injected liquid quantity.
Therefore the pressure drop in this balance pipe must be kept at a minimum, since there will otherwise be a risk that

- the liquid level in the evaporator will vary to an unacceptable degree as a function of evaporator load
- the absolute difference between the liquid level of the evaporator and the SV valve will be too large.

See the suggested dimensions for the balance pipe in "Pipe dimensions".

Design
Function
(continued)

SV with high-pressure function



C. Nipple
D. Connection for balance pipe
P. Parallel connection of pos. C (screw 25 in pos. A)
S. Series connection of pos. C (screw 25 in pos. B)

No.	Part	Material	DIN / EN
1	Float housing	Stainless steel Low temperature, steel	X5CrNi18-10, DIN 17440 P285QH, EN 10222-4
2	Float	Stainless steel	
3	Split pin	Steel	
4	Float arm	Stainless steel	
5	Link	Steel	
6	Pin	Stainless steel	
7	Valve housing	Steel	
8	O-ring	Cloroprene (Neoprene)	
9	Float orifice	Plastic	
10	Manual regulation unit. Throttle valve	Steel	
11	Gasket	Non asbestos	
12	Plug	Steel	
13	O-ring	Cloroprene (Neoprene)	
14	Pilot connection (spare part)	Steel	
15	Orifice needle	Plastic	
16	O-ring	Cloroprene (Neoprene)	
17	Screw	Steel	
18	Gasket	Non asbestos	
19	Pin	Steel	
20	Cover	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN 1563
21	Screw	Stainless steel	A2-70
22	Gasket	Non asbestos	
23	Label	cardboard	
25	Screw	Steel	
26	Spring washer	Steel	
28	Sign	Aluminium	

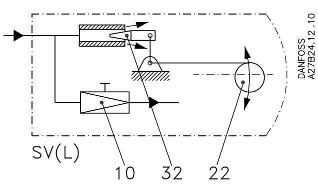
Design
Function
(continued)

SV (H), high-pressure function
SV (H) is used as a liquid level regulator for small condensers or receivers.
When the liquid level rises, the float pos. (2) moves upwards. This draws the needle pos. (15) away from the orifice and the excess liquid is drawn away.
On refrigeration plant using fluorinated refrigerants slight subcooling and a large pressure drop can, as already mentioned, cause the formation of a large amount of flashgas.

This mixture of liquid and vapour has to pass through the nipple pos. (C) and out into the liquidline.
If the dimensions of the line are too small, a pressure drop will occur which can reduce the capacity of the SV (H) valve considerably. This will mean a risk of inadvertent liquid accumulation in the condenser or receiver.

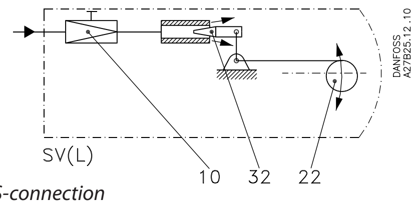
See the suggested dimensions for the liquid line in "Pipe dimensions".

The connection nipple (C) can be mounted either in P or in S.



P-connection

P-connection (= parallel)
With P-connection an SV with closed float orifice will have a capacity which corresponds to the degree of opening of the adjustable throttle valve 10.



S-connection

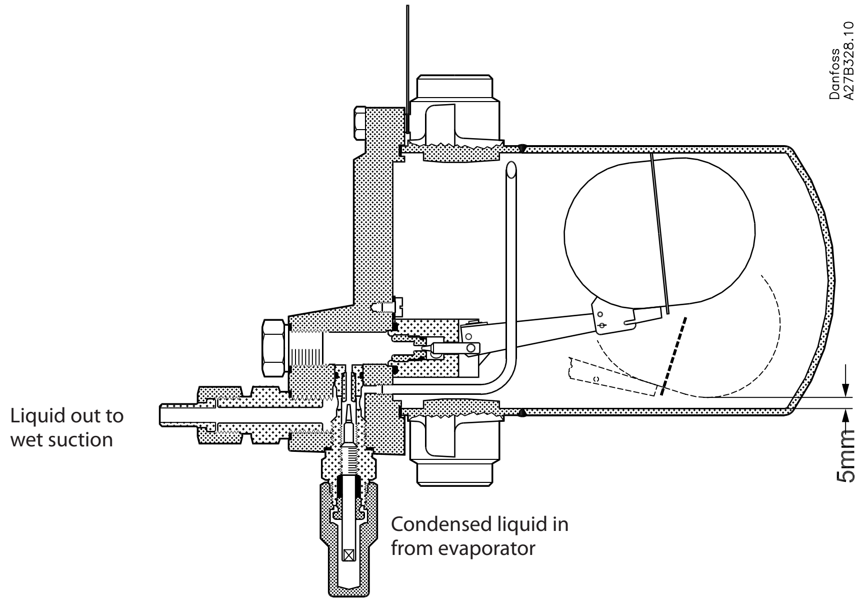
S-connection (= series)
With S-connection the throttle valve 10 will function as a pre-orifice on SV (L) and as a post orifice on SV (H).

Level controls

SV 1 - 3 used as a high pressure defrost drain float valve

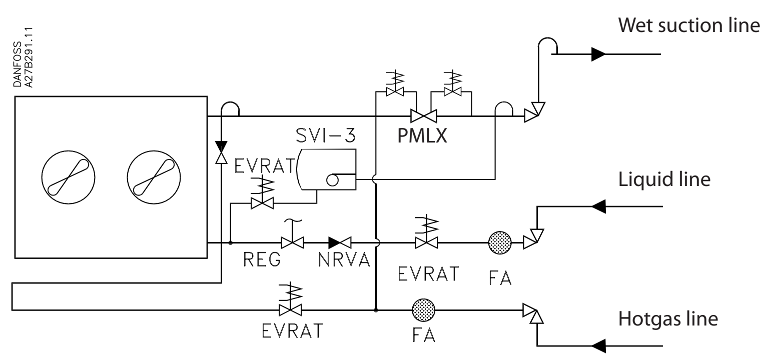
SV 1 - 3 can be used as a defrost drain float valve, when one balance pipe is sealed off and the liquid level regulator is mounted with a special kit (code no. 027B2054) consisting of:

- Special orifice and orifice needle with a larger k_v-value of 0.28 m^3/h.
- Gas drain pipe



SV 1 - 3 fitted with the special kit

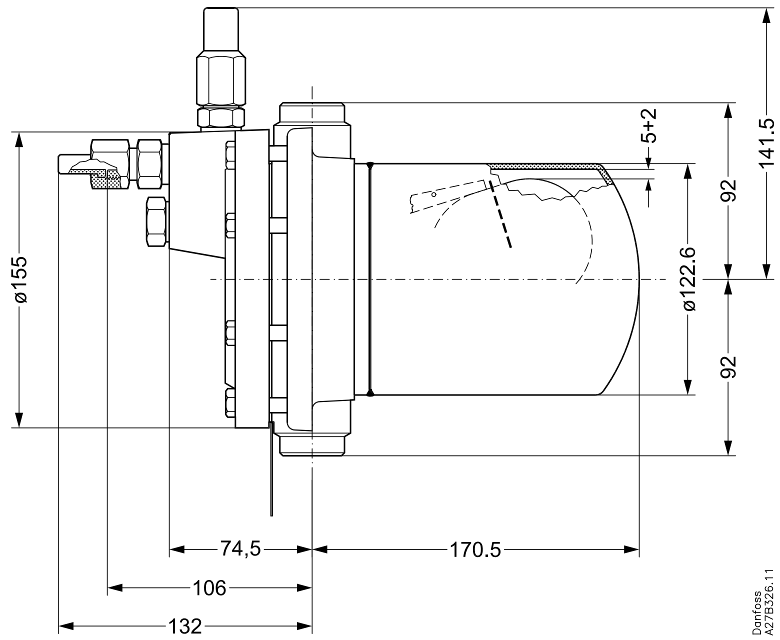
Application example



SV 1 - 3 with special kit mounted as defrost drain float valve on a flooded evaporator with hotgas defrost.

Dimensions and weight

SV 1 and SV 3



Weight
5.7 kg

Introduction

SV 4-6 are for use on the low pressure side as modulating liquid level regulators in refrigeration, freezing and air conditioning systems with ammonia and other common types of refrigerants.

Features

- Reliable function
- Stable regulation, even during momentary load change
- Liquid injection into the float housing or directly into the evaporator through external pipe connection
- Orifice assembly and filter can be replaced without evacuating the float housing
- Can be supplied without float housing for direct installation in the system (special order only)
- Can be used as pilot float for PMLF if mounted with special orifice (diameter Ø2.5 mm)

Technical data

Refrigerants
Can be used for all normal, non-flammable refrigerants, including R717, and non-corrosive gases/liquids - assuming seals of the correct material are used.
Use with flammable hydrocarbons cannot be recommended; please contact Danfoss.

P band
Approx. 35 mm

Max. working pressure
MWP = 28 bar

Max. Δp
SV 4 = 23 bar
SV 5 = 21 bar
SV 6 = 19 bar

Media temperature
–50°C to 120°C

Max. test pressure
MTP = 42 bar

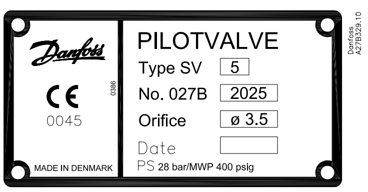
k_v value and diameter for orifice
SV 4: k_v = 0.23 m^3/hD = 3.0 mm
SV 5: k_v = 0.31 m^3/hD = 3.5 mm
SV 6: k_v = 0.43 m^3/hD = 4.0 mm

Approvals

Pressure Equipment Directive (PED)
SV 4, 5 and 6 are approved in accordance with the European standard specified in the Pressure Equipment Directive and are CE marked.
For further details / restrictions - see Installation Instruction

	SV 4, 5 and 6
Classified for	Fluid group I
Category	II

Identification



The complete technical leaflet (RD2BC) can be downloaded from the Danfoss web site.

Materials

- Gaskets are non asbestos
- Valve housing made of lowtemperature cast iron, spherical (EN-GJS-400-18-LT)
- Float housing: ST 35.8 DIN 17175 W. no. 1.0305

Dimensioning example for SV

Refrigerant
R717 (NH_3)

Evaporating capacity
Q_e = 145 kW

Evaporating temperature
t_e = −10°C (~ p_e = 2.9 bar abs.)

Condensing temperature
t_c = +30°C (~ p_c = 11.7 bar abs.)

Liquid temperature ahead of SV
t_l = +20°C

Subcooling
$\Delta t_{sub} = t_c - t_l$ = 30°C − 20°C = 10 K

Pressure drop in SV
$\Delta p = p_c - p_e$ = 11.7 − 2.9 = 8.8 bar

Correction factor k for 10 K subcooling
= 0.98

Corrected capacity
145 × 0.98 = 142 kW

At t_e = −10°C and Δp = 8 bar SV 5 yields 147 kW and can therefore be used.

Capacity

The values in the capacity tables are based on a subcooling of 4 K just ahead of the SV valve. If the subcooling is more or less than 4 K, refer to the following correction factors.

R717 (NH_3)

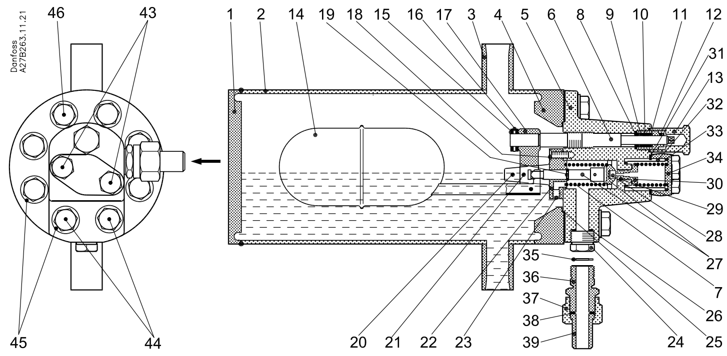
Type	Evaporating temperature t_e °C	Capacity in kW at pressure drop across valve Δp bar							
		0.8	1.2	1.6	2	4	8	12	16
SV 4	+10	37	45	52	58	79	105	122	134
	0	39	47	54	59	81	107	124	136
	−10	40	48	55	61	82	108	125	137
	−20	41	49	56	62	83	109	125	137
	−30	42	50	57	63	84	109	125	136
	−40	42	51	58	63	84	108	124	135
	−50	43	51	58	63	83	107	122	133
SV 5	+10	51	62	71	78	107	143	166	183
	0	53	64	73	81	110	145	168	185
	−10	54	66	75	83	112	147	170	186
	−20	56	67	76	84	113	148	170	186
	−30	57	68	78	85	114	148	170	185
	−40	58	69	78	86	114	147	168	184
	−50	58	69	78	86	113	146	167	182
SV 6	+10	68	83	95	105	144	191	222	245
	0	71	86	98	108	147	195	226	248
	−10	73	88	101	111	150	197	227	250
	−20	75	90	103	113	152	198	228	250
	−30	76	92	104	115	153	198	227	248
	−40	77	93	105	115	153	197	226	246
	−50	78	93	105	115	152	196	223	243

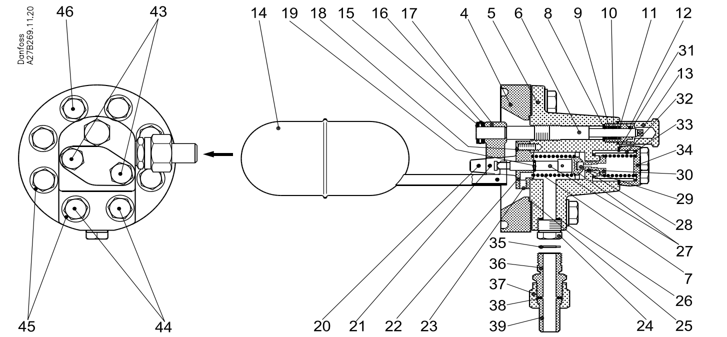
Correction factors
When dimensioning, multiply the evaporating capacity by the correction factor k, dependent on the subcooling Δt_{sub} just ahead of the valve. The corrected capacity can then be found in the capacity table.

R717 (NH_3)

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

Construction
Function

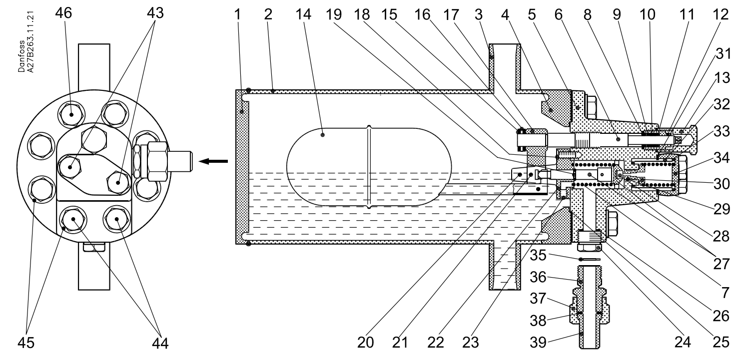


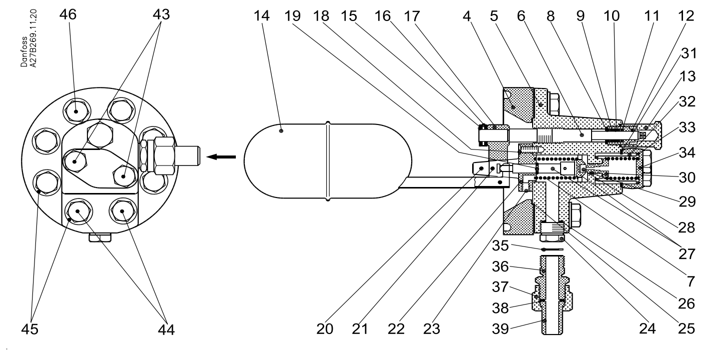


No.	Part	Material	DIN / EN
1	Bottom flange for float valve	Steel	P275NL1 EN10028-3
2	Tube for valve body	Steel	TTST35N DIN17173
3	Connection for float house	Steel	P275NL1 EN10028-3
4	Top cover for float valve	Steel	P275NL1 EN10028-3
5	Valve housing	Low temperature, cast iron (spherical)	EN-GJS-400-18-LT EN1563
6	Spindle	Stainless steel	
7	Spring	Steel	
8	Sealing ring	Nylon (PA 6)	
9	O-ring	Cloroprene (Neoprene)	
10	Distance ring	Nylon (PA 6)	
11	Packing ring	Nylon (PA 6)	
12	Packing box	Steel	
13	Cap	Steel	
14	Float	Stainless steel	
15	Adjusting ring	Steel	
16	Pin	Steel	
17	Fork for spindle	Steel	
18	Screw	Steel	
19	Locking ring	Steel	
20	Pin	Steel	

Level controls

Construction
Function
(cont.)





No.	Part	Material	DIN / EN
21	Pin	Steel	
22	Cover with guide	Steel	
23	Screw	Steel	
24	Plug	Steel	
25	Gasket	Non asbestos	
26	Gasket	Aluminium	
27	Valve cone (guide) with pin	Steel / Nylon (PA6)	
28	Valve cone	Teflon (PTFE)	
29	O-ring	Cloroprene (Neoprene)	
30	Nozzle	Teflon (PTFE)	
31	Gasket	Non asbestos	
32	Filter	Steel / Stainless steel	
33	Spring	Steel	
34	Cover for filter	Steel	
35	Gasket	Aluminium	
36	Nipple	Steel	
37	Union nut	Steel	
38	Gasket	Aluminium	
39	Welding nipple	Steel	
40	Locking ring	Steel	
41	Ring	Nylon (PA6)	
42	Pin	Steel	
43	Screw	Stainless steel	A2-70
44	Screw	Stainless steel	A2-70
45	Washer	Steel	
46	Screw	Stainless steel	A2-70

Construction
Function
(cont.)

SV 4-6 float valves are for low pressure operation only. They are used for flooded evaporators, where only slight variations in the liquid level can be accepted.
When the liquid level decreases, the float moves downwards. This opens the orifice (pos. 7) and the amount of liquid injected is increased.

The liquid inlet line should be dimensioned in *such a way that acceptable liquid velocities and pressure drops are obtained.*
This is particularly important when the liquid is only slightly subcooled, since valve capacity is reduced considerably if flashgas occurs in the liquid ahead of the orifice.

The flashgas quantity which occurs on expansion is removed through the balance pipe. On refrigeration plant using fluorinated refrigerants, slight subcooling and a large pressure drop can result in a flashgas quantity of approx. 50% of the injected liquid quantity.

Therefore the pressure drop in this balance pipe must be kept at a minimum, otherwise there is a risk that:
- the liquid level in the evaporator will vary to an unacceptable degree as a function of evaporator load
- the absolute difference between the liquid level of the evaporator and the SV valve

If too large amounts of flash gas are created it is recommended to use the external injection connection or let the liquid expand directly into the surge drum. See application drawings 3 and 4.

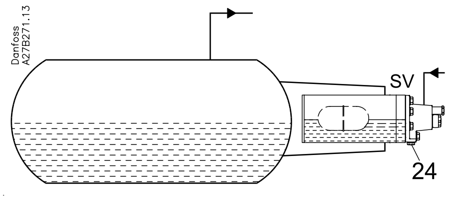
See instruction for SV 4 - 6 for:
- Cleaning of strainer
- Change of orifice
- Change of valve plate

Level controls

Application

The liquid expands into the float housing

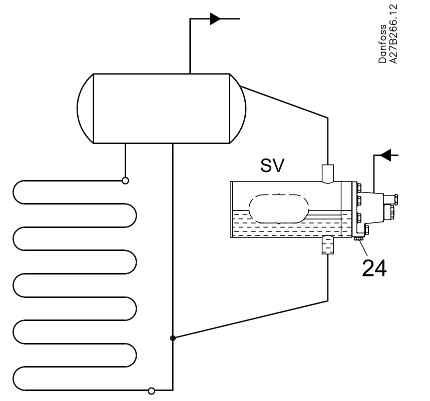
1)



Direct liquid injection into the float housing 4 pcs. M6 screws (pos. 23) are removed, and pos. 24 remains blanked off. This leaves four holes through which liquid expands directly.
Note: *If the capacity is too high, only remove two or three screws.*
Pos. 23 and 24, see Construction & Function.

The liquid expands into the float housing

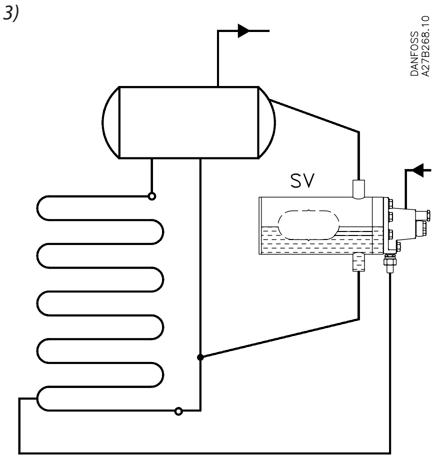
2)



4 pcs. M6 screws (pos. 23) are removed, and pos. 24 remains blanked off. This leaves four holes through which liquid expands directly.
Note: *If the capacity is too high, only remove two or three screws.*
Pos. 23 and 24, see Construction & Function.

The liquid expands into the evaporator

3)

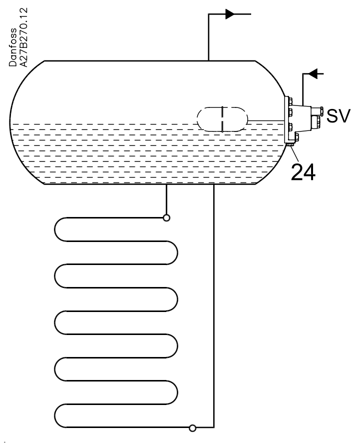


Used in large evaporators with long pipe lines.
- *pos. 24 is removed and weld connection is mounted*
- *pos. 23 remains screwed*

Pos. 23 and 24, see Construction & Function.

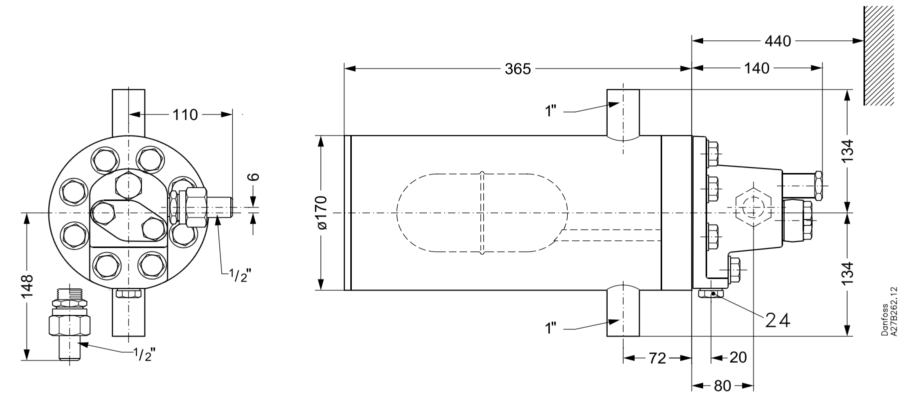
The liquid expands directly into the surge drum

4)

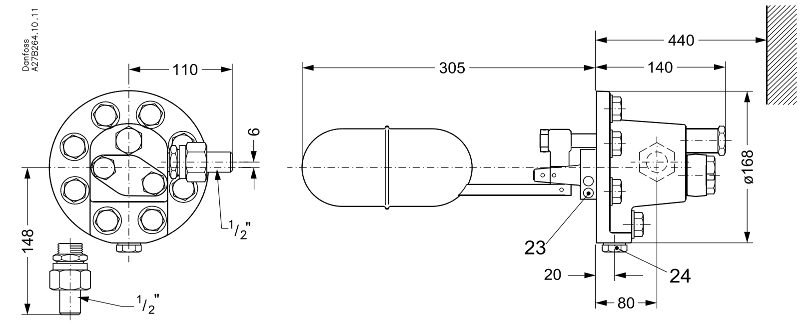


4 pcs. M6 screws (pos. 23) are removed, and pos. 24 remains blanked off. This leaves four holes through which liquid expands directly.
Note: *If the capacity is too high, only remove two or three screws.*
Pos. 23 and 24, see Construction & Function.

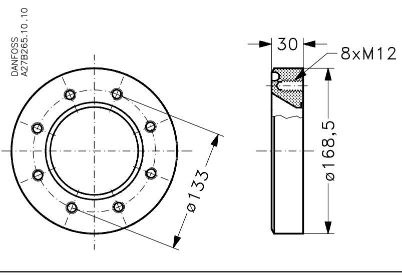
Dimensions and weight



Weight:
19.6 kg

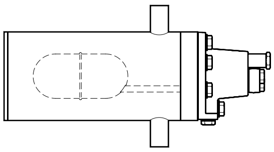


Weight:
9.7 kg



Weight:
3.1 kg

Ordering



Regulator

The code nos. stated apply to liquid level regulators type SV 4, 5 and 6 with two 1" weld connections for balance tubes and two ½" weld joints for liquid and evaporator connections respectively.							
Valve type	Orifice diameter	**Code no.**	**Code no.** without housing [2]	Rated capacity in kW[1]			
				R717	R22	R134a	R404A
SV 4	∅ 3.0 mm	**027B2024**	**027B2014**	102	21.0	16.4	15.4
SV 5	∅ 3.5 mm	**027B2025**	**027B2015**	138	28.6	22.3	21.0
SV 6	∅ 4.0 mm	**027B2026**	**027B2016**	186	38.3	29.9	28.1

[1] The rated capacity refers to the valve capacity at evaporating temperature $t_c = +5°C$, condensing temp. $t_c = +32°C$ and liquid temperature $t_l = +28°C$.
[2] Flange for mounting without housing Code no. **027B2027**.

Spare parts and accessories
Smaller orifices for the SV 4 - 6 are available as spare parts and can be mounted in the SV 4 - 6 if smaller capacities are required.

- Seal kit: **027B2070**
- Other spare parts: See spare parts catalogue RK0XG.

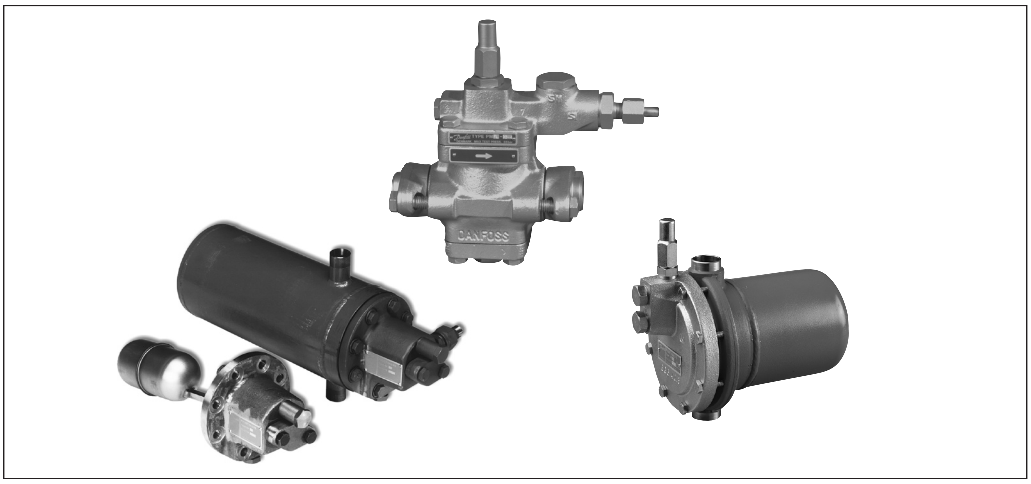
Special orifice code no. and rated capacities for SV 4 - 6

Orifice diameter	k_v	Capacities at –10°C evaporating temperature at pressure drop across valve ΔP bar						**Code no.** [1]
		R717			R22			
		4	7	10	4	7	10	
∅ 1.0 mm	0.026	9	12	13.5	1.6	2.2	2.4	**027B2080**
∅ 1.5 mm	0.06	21	27	29	3.8	4.9	5.2	**027B2081**
∅ 2.0 mm	0.10	35	46	50	6.3	8.3	9	**027B2082**
∅ 2.5 mm	0.16	56	70	81	10	13	15	**027B2083**
∅ 2.8 mm	0.20	70	87.5	101	12	16	18	**027B2084**

[1] The code no. includes orifice and all necessary gaskets

Note: The SV 4 - 6 mounted with special orifice diameter ∅2.5 mm is recommended as pilot float valve for the servo-operated level regulators type PMFL for higher capacities.

Introduction



For modulating liquid level control in refrigeration, freezing and air conditioning plant, a system comprising a modulating servo-controlled main expansion valve type PMFL or PMFH, controlled by a pilot float valve type SV, is used.

PMFL and SV systems are used on the evaporator side. PMFH and SV systems are used on the condenser side.
The system is suitable for use with ammonia or fluorinated refrigerants. The PMFL and PMFH can be used in liquid lines to or from

- evaporators
- separators
- intermediate coolers
- condensers
- receivers

Modulating liquid level regulation provides liquid injection that is proportional to the actual capacity. This gives a constant amount of flashgas, thus ensuring stable regulation and economic operation because variations in pressure and temperature are held to a minimum.

Features

- Applicable to all common, non-flammable refrigerants, including R 717, and non-corrosive gases/liquids - dependent on sealing material compatability
- PMFL/PMFH are based on PM valve family housings
- Same flange programme as for PM valve series
- Valve housing in low temperature cast iron (spherical) - EN GJS 400-18-LT
- Manual operation possible
- Position indicator available
- Pressure gauge connection to monitor inlet pressure
- Simple installation
- Main valve top cover can be located in any position without affecting the function

Pressure Equipment Directive (PED)
The PMFL / PMFH valves are approved and CE marked in accordance with Pressure Equipment Directive - 97/23/EC.
For further details / restrictions - see Installation Instruction.

PMFL/PMFH-valves*			
Nominal bore	DN≤ 25 (1 in.)	DN 32-125 mm ($1^1/_4$ - 5 in.)	DN 150 mm (6 in.)
Classified for	Fluid group I		
Catagory	Article 3, paragraph 3	II	III

* CE is only applicable to the EN GJS 400-18-LT

Technical data

The complete technical leaflet (DKRCI.PD.GE0.A) can be downloaded from the Danfoss web site.

Refrigerants
R 717, R 22, R 134a, R 404A and other fluorinated refrigerants.

Max. working pressure
PMFL / H: MWP = 28 bar
SV: MWP = 28 bar

Max. test pressure
PMFL / H: Max. test pressure = 42 bar
SV: Max. test pressure = 42 bar

Temperature of media:
–60°C to +120°C.

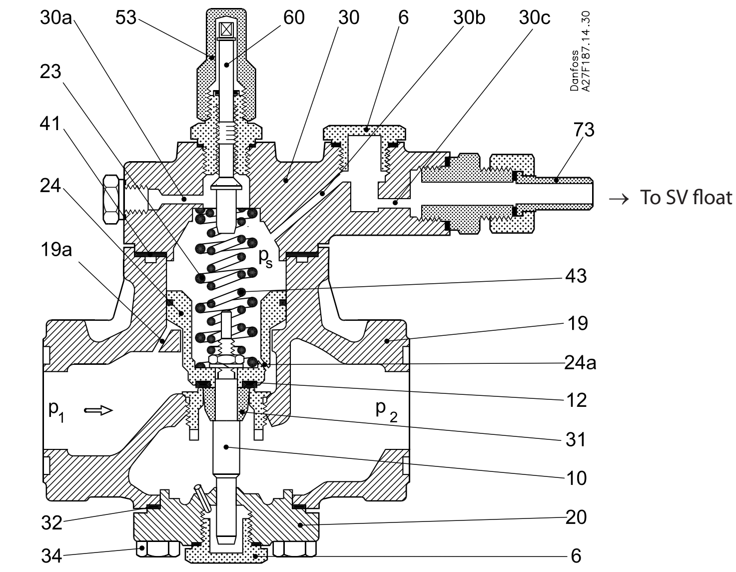
Note:
Max. working pressure is limited to
MWP = 21 bar when media temperatures are:
below –20°C for valves made of GGG-40.3 and below –10°C for valves made of GG-25.

Level controls

Design/Function

PMFL

6. Seal plug
10. Valve spindle
12. Valve seat
19. Valve body
19a. Channel in valve body
20. Bottom cover
23. Main spring
24. Servo piston
24a. Channel in servo piston
30. Top cover
30a.b.c. Channels in top cover
31. Valve cone
43. Supplementary spring
44. Manometer connection
53. Spindle cap
60. Setting spindle
73. Pilot connection



PMFL

When the liquid level inside the float drops, the float orifice opens. This relieves the higher pressure, ps, acting on the servo piston to the low pressure side causing the PMFL to open. Variations in liquid level will result in variations in pressure over the piston and variation in the amount of liquid injected. It is important to choose the correct spring set when designing the plant. The spring set should be selected from the table below:

Subcooling		Pressure difference over main valve			
		bar	psi	bar	psi
K	F	4 - 15	58 - 218	1.2 - 4.0	17 - 58
0 - 8	0 - 14	Normal spring set		Weak spring set	
8 - 40	14 - 72	Strong spring set			

The setting spindle, pos. 60, has not been set from factory. It is imperative that the setting spindle is adjusted before the valve is put into operation. The outer spring, pos. 23, is preset and the inner spring, pos. 43, is adjusted when turning the spindle. The following tables shows the adjustment of the inner spring in number of turns of the spindle as a function of valve size, spring type and pressure difference:

PMFL	C/w normal (factory mounted) spring set, subcooling 0-8 K ~ 0-14 F				
	Pressure difference (Δp) over PMFL in bar or psi				
	< 5 bar	5 - 8 bar	8 - 10 bar	10 - 12 bar	> 12 bar
	< 72 psi	72 - 116 psi	116 - 145 psi	145 - 174 psi	> 174 psi
80	No tension	2 - 3	3 - 4.5	4.5 - 6	ca. 7
125	No tension	3 - 5	5 - 7	7 - 9	ca. 10
200	No tension	3 - 5	5 - 7	7 - 9	ca. 10
300	No tension	4 - 6	6 - 9	9 - 12	ca. 14

PMFL	C/w strong spring set, subcooling 8-40 K ~ 14-72 F	
	Pressure difference (Δp) over PMFL in bar or psi	
	6 - 9 bar	> 9 bar
	87 - 131 psi	> 131 psi
80	4	Max. tension
125	6	Max. tension

PMFL	C/w stong spring set, subcooling 8-40 K ~ 14-72 F
	Pressure difference (Δp) over PMFL in bar or psi
	6 - 16 bar
	87 - 232 psi
200	Spring must always be set to max. tension
300	

PMFL	C/w weak spring set, low pressure plants			
	Pressure difference (Δp) over PMFL in bar or psi			
	1.2 - 1.8 bar	1.8 - 2.5 bar	2.5 - 3 bar	3 - 4 bar
	17 - 26 psi	26 - 36 psi	36 - 43 psi	43 - 58 psi
80	No tension	3 - 4	4 - 6	Max. tension
125	No tension	4 - 6	6 - 8	Max. tension
200	No tension	4 - 6	6 - 8	Max. tension
300	No tension	5 - 7	5 - 7	Max. tension

Design/Function
(*continued*)

The values for spindle turns are an indication for an initial setting only. If a position indicator is used, a more precise modulation can be achieved when fine tuning the valve setting. If the PMFL is not opening fully, the spring tension must be reduced. If the PMFL is operating in a ON/OFF function, the spring tension should be increased. The condenser pressure will have an effect on the fine tuning and large variations in condensing pressure might call for readjustment.
The subcooling is measured just before the PMFL and the pressure difference is for the valve only excluding piping and armatures.

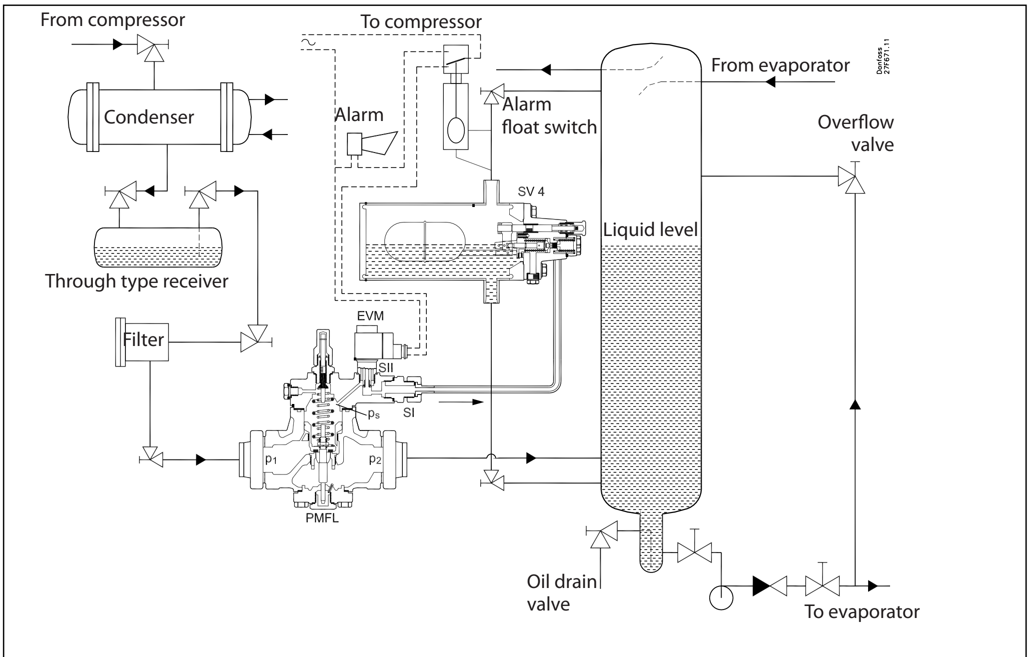
The PMFL can be used together with either SV 1-3 or SV 4-6 as the pilot valve.

The orifices determines the k_v (C_v) value of the pilot and the following table can be used as an initial selection guide:

PMFL	SV 1-3		SV 4-6	
	SV 1	SV 3	Ø 2.5	Ø 3 (SV 4)
80	X		X	
125	X		X	
200	X		X	
300		X		X

The final choice of orifice may vary depending on refrigerant and pressure levels. Smaller pressure levels needs a bigger orifice. Pressure difference levels below 3 bar (43 psi) need SV 3 or SV 4-6 with Ø3 mm orifice.

PMFL function example



Low pressure float system
(for explanatory purposes only)

SV floats for PMFL

Both the SV 1-3 and SV 4-6 can be used for PMFL low pressure control system. If SV 4-6 is used as shown above, the float must be connected as shown.

If SV 1-3 float is used, this has 2 different pilot connections: S-port (series connection with the PMFL) or P-port (parallel connection with the PMFL).

P-port:
When using the P-port, it is possible to force open the PMFL valve to a fully open position. This is practical for service purposes or to confirm if the float has sufficient capacity for the PMFL and the operating conditions. However, when P-port connection is used it is possible to overfill a system due to constant bleeding or unauthorised tampering. In this case, its advisable to introduce a shut off when the liquid level reaches a preset point. Shut off can be done via an electrical switch if an EVM valve is mounted in the SII port in the top of the PMFL. It is only advisable to use the P-port connection at low subcooling, < 8 K (< 14 F).

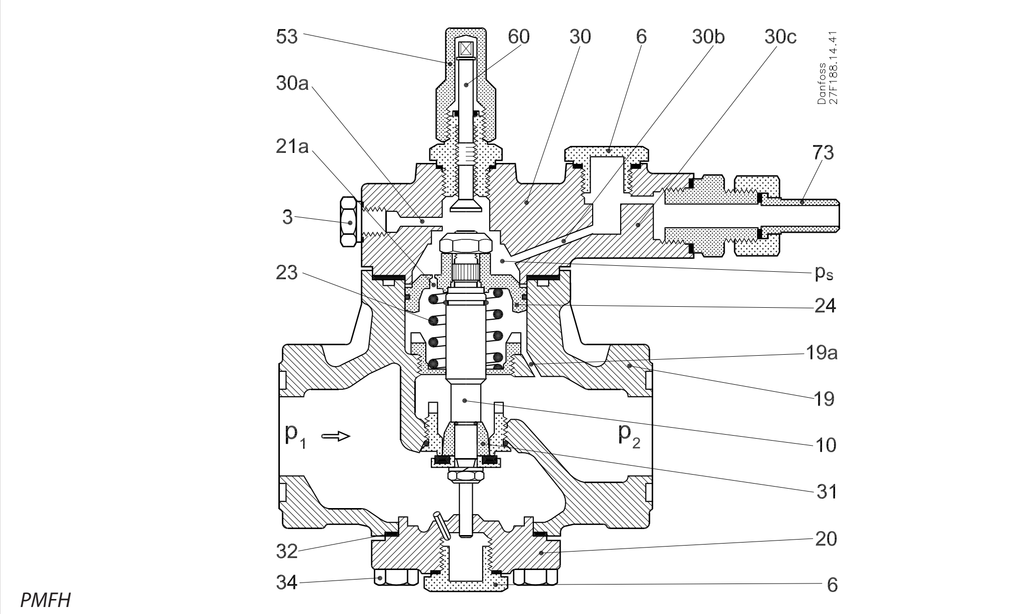
In general:
- If the float system is unstable, set a larger bleed.
- If the PMFL stays open when the float is closed, set a smaller bleed.

S-port:
The S-port offers the advantage of a preorifice which divides the pressure drop and any wear possibility due to cavitation. S-port connection must be used if the subcooling is higher than 8 K (14 F). The spindle should be opened 4 turns initially before adjustment. Adjustment should be done in steps of ¼ turn until the PMFL has a modulating function. The k_v (C_v) value of the SV is higher using S-port than using

Level controls

Design/Function
(Continued)

PMFH



PMFH

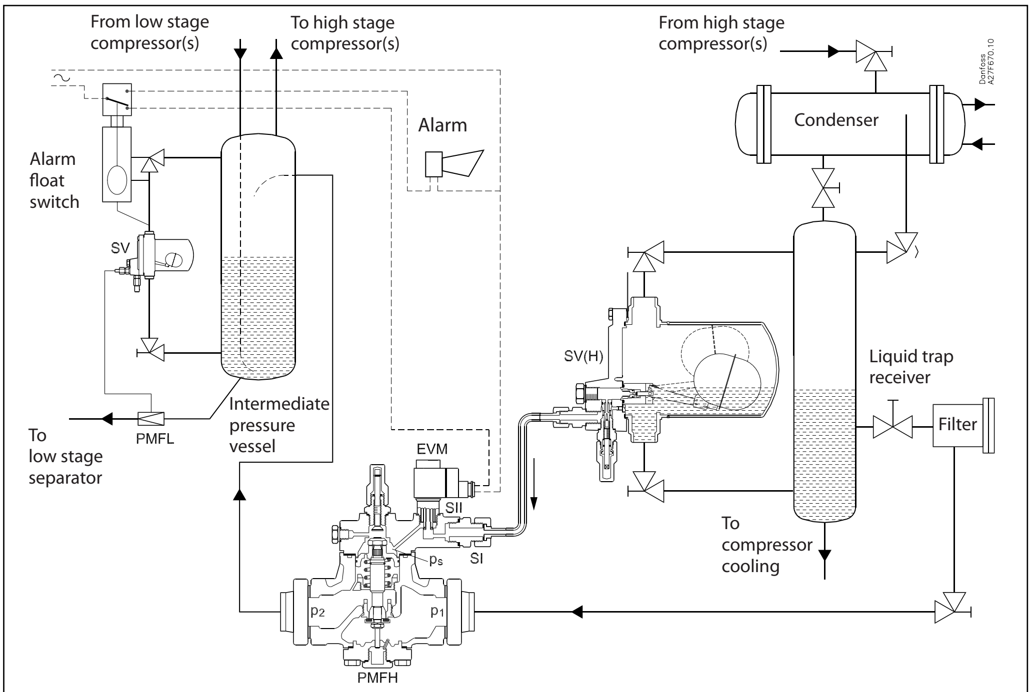
3.	Manometer connection
6.	Seal plug
10.	Valve spindle
19.	Valve body
19a.	Channel in valve body
20.	Bottom cover
21a.	Channel in servo piston
23.	Main spring
24.	Servo piston
30.	Top cover
30a.b.c.	Channels in top cover
31.	Valve cone
53.	Spindle cap
60.	Manual opening
73.	Pilot connection

If the liquid level inside the SV float rises, the float orifice opens and leads the pressure through the pilot line to the top of the PMFH, so that the pressure, ps, moves the pushrod downwards and opens the PMFH main valve. The pilot line is connected in the topcover at SI. Override of the pilot signal can be made by using an EVM valve at SII. It is important to choose the correct spring set when designing the plant. The spring set should be selected from the table below:

The PMFH can be used together with either SV 1 or 3 whith the SV mounted with the bleed valve downwards, refer to the drawing below. This reverses the opening so that rising float opens the orifice.

Pressure difference over main valve			
bar	psi	bar	psi
0 - 4.5	0 - 65	> 4.5	> 65
Weak spring set		Normal spring set	

PMFH function example



High pressure float system
(for explanatory purposes only)

Design/Function
(Continued)

SV 1-3

SV 1-3 float has 2 different pilot connections: S-port (series connection with PMFH) or P-port (parallel connection with the PMFH).

P-port:
When using the P-port, it is possible to force open the PMFH valve to a fully open position. This is practical for service purposes or to confirm if the float has sufficient capacity for the PMFH and the operating conditions. However, when P-port connection is used it is possible to overfill a system due to constant bleeding or unautorised tampering. In this case, it is advisable to introduce a shut off when the liquid level reaches a preset point. Shut off can be done via an electrical switch if an EVM valve is mounted in the SII port in the top of the PMFH. It is only advisable to use the P-port at low pressure difference.

S-port:
The S-port offers the advantage of a preorifice which divides the pressure drop and any wear possibility due to cavitation. S-port connection must be used at high pressure differences, dp > 10 bar (145 psi). The k_v (C_v) value of the SV is higher using S-port than using P-port. A higher P-band can thus be obtained.

Sizing

Sizing example for PMFL

Refrigerant
R 717 (NH_3)

Evaporator capacity
Q_e = 600 kW

Evaporating temperature
t_e = –10°C (~ p_e = 2.9 bar abs.)

Condensing temperature
t_c = +30°C (~ p_c = 11.9 bar abs.)

Liquid temperature ahead of valve
t_l = +20°C at max. capacity

Subcooling
$\Delta t_{sub} = t_c - t_l$ = 30°C – 20°C = 10 K
Calculations do not take into account pressure loss in pipelines.

Pressure drop across valve
$\Delta p = p_c - p_e$ = 11.9 bar – 2.9 bar = 9 bar

Correction factor for 10 K subcooling
0.98

Corrected capacity
600 kW × 0.98 = 588 kW

The corrected capacity can be found in the capacity table. It will be seen from the table that valve type PMFL 80-4 should be chosen.
Refering to "ordering table", code number **027F0053** can be found.
For details of flanges, accessories and pilot valve, see the ordering table.

Since Δp = 9 bar and Δt_{sub} = 10 K, it will be seen from the "C/w strong spring set" for PMFL that a "STRONG" spring set must be used. The pilot line is connected to SV at connection S.
In the ordering table the code number for the spring set can be found: **027F0118**.

Sizing example for PMFH

Refrigerant
R 717 (NH_3)

Evaporator capacity
Q_e = 2200 kW

Evaporating temperature
t_e = –10°C (~ p_e = 2.9 bar abs.)

Condensing temperature
t_c = +30°C (~ 11.9 bar abs.)

Liquid temperature ahead of valve
t_l = +20°C

Subcooling
$\Delta t_{sub} = t_c - t_l$ = 30°C – 20°C = 10 K
Calculations do not take into account pressure loss in pipelines.

Pressure drop across valve
$\Delta p = p_c - p_e$ = 11.9 bar – 2.9 bar = 9 bar

Correction factor for 10 K subcooling
0.98

Corrected capacity
2200 kW × 0.98 = 2156 kW

The corrected capacity can be found in the capacity table. It will be seen from the table that valve type PMFH 80-7 should be chosen.
In the ordering table the code number for the valve can be found: **027F3060** for CE-approved valve.

For details of flanges, accessories and pilot valve, see the ordering table.

Correction factors
When dimensioning, multiply the evaporator capacity by a correction factor k dependent on the subcooling Δt_{sub} just ahead of the valve.
The corrected capacity can then be found in the capacity table.

R 717 (NH_3)

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

Capacity in kW

Type	Evaporating temperature t_e	Rated capacity in kW at pressure drop across valve Δp bar			
	°C	0.8	1.2	1.6	2.0

R 717 (NH_3)

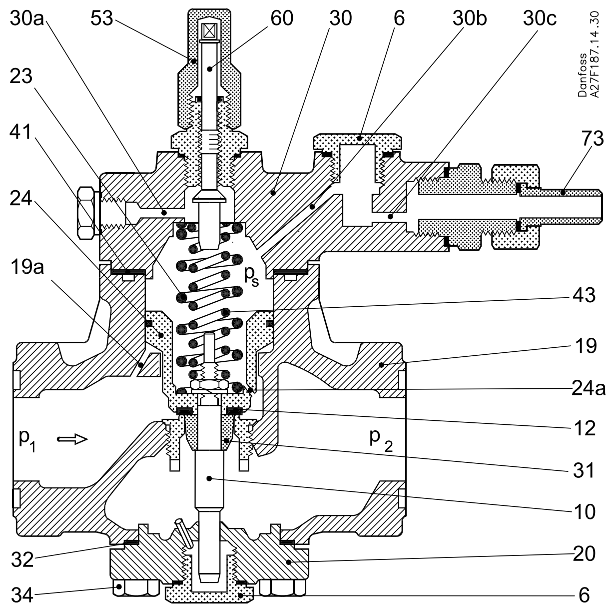
PMFL 80-1	+10	50	60	69	76
	0	51	62	71	79
	–10	53	64	73	81
	–20	54	65	74	82
	–30	55	66	75	83
	–40	56	67	79	86
	–50	56	67	75	82
PMFL 80-2	+10	80	97	111	123
	0	83	101	115	127
	–10	85	103	118	130
	–20	86	105	119	132
	–30	88	106	120	133
	–40	89	107	120	132
	–50	90	106	119	131
PMFL 80-3	+10	127	154	176	194
	0	131	159	182	201
	–10	134	163	186	205
	–20	137	164	188	207
	–30	139	167	188	207
	–40	140	166	187	205
	–50	139	164	184	201
PMFL 80-4	+10	206	250	286	316
	0	214	259	295	327
	–10	219	264	301	333
	-20	222	267	303	334
	–30	224	267	301	330
	–40	223	263	295	323
	–50	219	257	288	315
PMFL 80-5	+10	325	394	449	496
	0	336	406	463	511
	–10	344	413	470	518
	–20	347	414	468	514
	–30	345	407	458	502
	–40	338	396	444	486
	–50	327	383	429	470
PMFL 80-6	+10	565	682	773	851
	0	584	700	792	869
	–10	591	705	795	871
	–20	587	692	777	850
	–30	571	666	746	816
	–40	546	636	712	781
	–50	520	608	684	751
PMFL 80-7	+10	881	1060	1190	1300
	0	909	1080	1210	1310
	–10	910	1070	1190	1300
	–20	887	1030	1150	1250
	–30	844	975	1090	1190
	–40	794	921	1030	1130
	–50	750	875	984	1080
PMFL 125	+10	1400	1690	1910	2100
	0	1450	1730	1950	2140
	–10	1460	1740	1950	2140
	–20	1450	1700	1930	2080
	–30	1400	1630	1820	1990
	–40	1330	1550	1730	1900
	–50	1260	1480	1660	1830
PMFL 200	+10	2250	2710	3060	3360
	0	2320	2770	3120	3420
	–10	2340	2780	3120	3410
	–20	2310	2710	3030	3310
	–30	2220	2590	2890	3160
	–40	2110	2480	2750	3020
	–50	2000	2340	2630	2900
PMFL 300	+10	3420	4110	4650	4990
	0	3530	4210	4740	5180
	–10	3560	4210	4730	5170
	–20	3500	4100	4590	5010
	–30	3370	3910	4370	4780
	–40	3190	3710	4160	4560
	–50	3030	3540	3980	4380

Type	Evaporating temperature t_e	Rated capacity in kW at pressure drop across valve Δp bar			
	°C	4.0	8.0	12.0	16.0

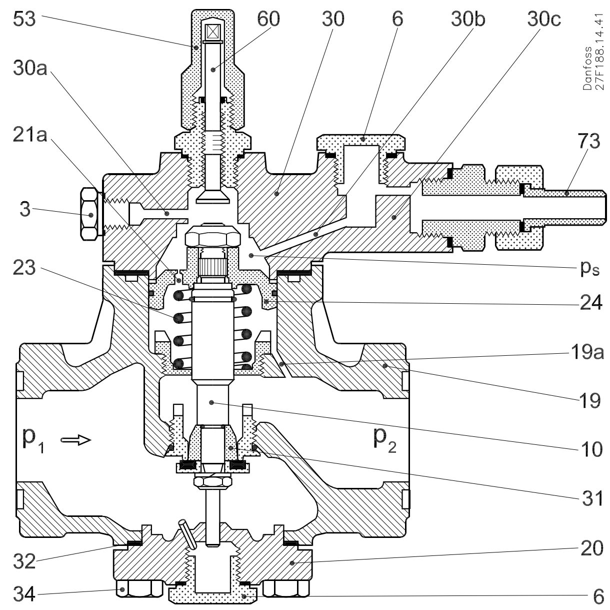
R 717 (NH_3)

PMFL 80-1	+10	104	140	161	
	0	107	142	165	176
	–10	110	143	166	178
	–20	111	143	166	179
	–30	111	143	165	179
	–40	111	142	162	177
	–50	109	140	160	175
PMFL 80-2 PMFH 80-2	+10	167	224	257	
	0	172	227	264	281
	–10	176	228	265	284
	–20	177	238	264	285
	–30	177	227	262	284
	–40	175	225	258	281
	–50	173	222	253	277
PMFL 80-3 PMFH 80-3	+10	264	353	404	
	0	271	356	414	440
	–10	276	357	416	444
	–20	278	356	413	445
	–30	276	353	407	443
	–40	272	349	400	438
	–50	267	343	393	431
PMFL 80-4 PMFH 80-4	+10	427	571	651	
	0	438	573	664	704
	–10	444	572	665	709
	-20	445	568	657	709
	–30	439	561	647	704
	–40	429	552	635	696
	–50	420	543	624	685
PMFL 80-5 PMFH 80-5	+10	667	887	1010	
	0	679	883	1020	1080
	–10	685	874	1020	1080
	–20	680	864	1000	1080
	–30	666	852	984	1070
	–40	649	837	966	1060
	–50	632	823	948	1040
P MFL 80-6 PMFH 80-6	+10	1130	1490	1670	
	0	1130	1460	1690	1780
	–10	1130	1430	1670	1780
	–20	1110	1410	1640	1770
	–30	1080	1380	1610	1760
	–40	1050	1360	1570	1730
	–50	1020	1340	1540	1710
PMFL 80-7 PMFH 80-7	+10	1690	2220	2480	
	0	1670	2150	2500	2610
	–10	1660	2090	2470	2610
	–20	1630	2050	2410	2610
	–30	1580	2010	2350	2590
	–40	1530	1970	2300	2550
	–50	1490	1940	2250	2510
PMFL 125 PMFH 125	+10	2770	3650	4100	
	0	2770	3570	4140	4350
	–10	2770	3500	4090	4350
	–20	2720	3430	4010	4340
	–30	2650	3370	3920	4300
	–40	2570	3320	3840	4240
	–50	2490	3260	3770	4180
PMFL 200 PMFH 200	+10	4410	5810	6530	
	0	4420	5680	6590	6920
	–10	4400	5550	6510	6920
	–20	4330	5450	6370	6900
	–30	4210	5360	6240	6830
	–40	4080	5260	6110	6740
	–50	3960	5170	5990	6640
PMFL 300 PMFH 300	+10	6690	8810	9880	
	0	6690	8600	9980	10500
	–10	6660	8400	9850	10500
	–20	6550	8240	9650	10400
	–30	6360	8100	9430	10300
	–40	6170	7960	9240	10200
	–50	5990	7820	9050	10000
PMFH 500	+10	10700	14100	15800	
	0	10700	13700	15900	16700
	–10	10600	13400	15700	16700
	–20	10400	13100	15400	16700
	–30	10100	12900	15000	16500
	–40	9830	12700	14700	16300
	–50	9540	12400	14400	16000

Material specification



PMFL



PMFH

Material specification for PMFL/PMFH valves

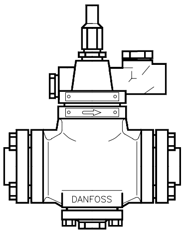
No.	Part	Material	DIN/EN	ISO	ASTM
2	Gasket between body and flange	Non-metal Non-asbestos			
3	Bolts for flange	Stainless steel	A2-70	A2-70	Type 308
4	Flange PM 5 - 65	Steel	RSt. 37-2, 10025	Fe360 B, 630	Grade C, A 283
6	Plug	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
10	Valve spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
12	Valve seat	Teflon [PTFE]			
19	Valve body	Low temperature cast iron (spherical)	EN-GJS-400-18-LT EN-1693		
20	Bottom cover	Low temperature cast iron (spherical)	EN-GJS-400-18-LT EN-1693		
23	Spring	Steel			
24	Servo piston	Cast iron	GG-25	Grade 250	Class 40B
30	Cover	Low temperature cast iron (spherical)	EN-GJS-400-18-LT EN-1693		
31	Trottle cone	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
32	Gasket between body and bottom cover	Non-metal Non-asbestos			
34	Bolts for top and bottom cover	Stainless steel	A2-70	A2-70	Type 308
41	Gasket	Non-metal Non-asbestos			
43	Spring	Steel			
53	Spindle cap	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
60	Setting / manual operating spindle	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403
73	Pilot connection	Steel	9SMn28 1651	Type 2 R683/9	1213 SAE J 403

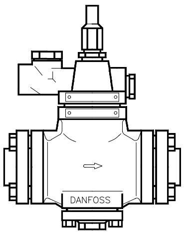
Ordering

Rated capacity in kW (1 kW = 0.284 TR)

Valve type	R 717	R 22	R 134a	R 404A	R 12	R 502
PMFL/H 80-1	139	27.8	22.1	33	17.4	30
PMFL/H 80-2	209	41.8	35.3	49.7	27.8	45.2
PMFL/H 80-3	348	70	53.1	82.7	41.8	75.2
PMFL/H 80-4	558	105	88.9	124	70	113
PMFL/H 80-5	835	174	133	207	105	188
PMFL/H 80-6	1395	278	221	330	174	300
PMFL/H 80-7	2080	435	353	569	278	470
PMFL/H 125	3480	700	552	831	435	755
PMFL/H 200	5580	1050	889	1243	700	1130
PMFL/H 300	8350	1740	1333	2068	1050	1880
PMFL/H 500	13900	2780	2210	3300	1740	3000

The rated capacity is given at
evaporating temperature t_e = +5°C,
condensing temperature t_c = +32°C and
liquid temperature t_l = +28°C.





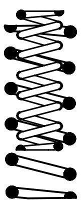
Main valve

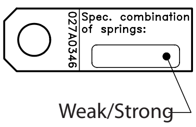
Valve type	Code no.	
	GG 25	EN GJS 400-18-LT
PMFL 80-1	**027F0050**	**027F3054**
PMFL 80-2	**027F0051**	**027F3055**
PMFL 80-3	**027F0052**	**027F3056**
PMFL 80-4	**027F0053**	**027F3057**
PMFL 80-5	**027F0054**	**027F3058**
PMFL 80-6	**027F0055**	**027F3059**
PMFL 80-7	**027F0056**	**027F3060**
PMFL 125	**027F0057**	**027F3061**
PMFL 200	**027F0058**	**027F3062**
PMFL 300	**027F0059**	**027F3063**

Valve type	Code no.	
	GG 25	EN GJS 400-18-LT
PMFH 80-2	**027F0061**	**027F3065**
PMFH 80-3	**027F0062**	**027F3066**
PMFH 80-4	**027F0063**	**027F3067**
PMFH 80-5	**027F0064**	**027F3068**
PMFH 80-6	**027F0065**	**027F3069**
PMFH 80-7	**027F0066**	**027F3070**
PMFH 125	**027F0067**	**027F3071**
PMFH 200	**027F0068**	**027F3072**
PMFH 300	**027F0069**	**027F3073**
PMFH 500	**027F0070**	**027F3074**

The code nos. stated apply to main valves type PMFL or PMFH incl. flange gaskets, flange bolts, blanking plug and pilot connection with Ø6.5 / Ø10 mm weld nipple ($^3/_8$ in. flare connection can be supplied, code no. **027F0115**).

Spring set





Special spring set for PMFL

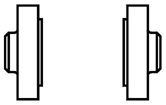
Subcooling Δt_u K	Pressure drop Δp in PMFL		Pilot connection on SV	Pos.	Type PMFL	"WEAK"	"STRONG"
	4 → 15 bar	1.2 → 4 bar				Code no.	
	Spring set						
0-8	"STANDARD"	"WEAK"	P	23 + 43	80-1 → 80-7	**027F0123**	**027F0118**
8-40	"STRONG"		S		125	**027F0124**	**027F0119**
					200	**027F0125**	**027F0120**
					300	**027F0126**	**027F0121**

Special spring set for PMFH

Pressure drop in PMFH Δp bar	Type	"WEAK"
		Code no.
1 → 4	PMFH 80.1 → 7	**027F2190**
	PMFH 125	**027F2191**
	PMFH 200	**027F2192**
	PMFH 300	**027F2193**
	PMFH 500	**027F2194**

Level controls

Ordering
(continued)

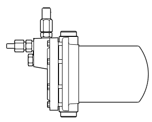


Flanges [2])

Valve type	Flange type	Weld flanges		Solder flanges			
		in.	**Code no. [1])**	in.	**Code no. [1])**	mm	**Code no. [1])**
PMFL 80 / PMFH 80	12	$^{3}/_{4}$ 1 $1^{1}/_{4}$	**027N1220** **027N1225** **027N1230**	$^{7}/_{8}$ $1^{1}/_{8}$	**027L1223** **027L1229**	22 28	**027L1222** **027L1228**
PMFL 125 / PMFH 125	23	$1^{1}/_{4}$ $1^{1}/_{2}$	**027N2332** **027N2340**	$1^{3}/_{8}$	**027L2335**	35	**027L2335**
PMFL 200 / PMFH 200	24	$1^{1}/_{2}$ 2	**027N2440** **027N2450**	$1^{5}/_{8}$	**027L2441**	42	**027L2442**
PMFL 300 / PMFH 300	25	2 $2^{1}/_{2}$	**027N2550** **027N2565**	$2^{1}/_{8}$	**027L2554**	54	**027L2554**
PMFH 500	26	$2^{1}/_{2}$ 3	**027N2665** **027N2680**	$2^{5}/_{8}$	**027L2666**	76	**027L2676**

[1]) Code no. applies to one flange set consisting of one inlet and one outlet flange.
[2]) Dimension sketch see spare part catalogue.

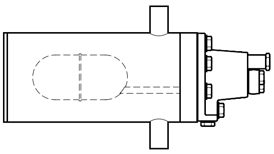
Stainless steel: flanges, bolts for flanges and top and bottom covers, see spare parts catalogue.



Pilot valves SV 1-3

Type	Connection		**Code no.**	
Float pilot valve type SV	Balance tube liquid / vapour	Pilot line	SV 1: **027B2021** **027B2021CE** [2])	SV 3: **027B2023** **027B2023CE** [2])
	1 in. weld	Ø 6.5 / Ø 10 mm weld [1])		

[1]) $^{3}/_{8}$ in. flare connection can be supplied under code no. **027B2033**.
[2]) Approved and CE-marked in accordance with Pressure Equipment Directive - 97/23/EC.



Pilot valves SV 4

Valve type	Orifice diameter	**Code no.**	**Code no.** without housing[1])
SV 4	Ø 3.0 mm	**027B2024** [2])	**027B2014** [2])

[1]) Flange for mounting without housing Code no. 027B2027.
[2]) Approved and CE-marked in accordance with Pressure Equipment Directive - 97/23/EC.

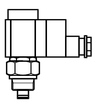
The code nos. stated apply to liquid level regulators type SV 4, 5 and 6 with two 1" weld connections for balance tubes and two ½" weld joints for liquid and evaporator connections respectively.

Spare parts and accessories
Smaller orifices for the SV 4 are available as spare parts.
*– Seal kit: **027B2070***

Special orifice code no. for SV 4

Orifice diameter	k_v	Code no.[1])
Ø 1.0 mm	0,026	**027B2080**
Ø 1.5 mm	0,06	**027B2081**
Ø 2.0 mm	0.10	**027B2082**
Ø 2.5 mm	0,16	**027B2083**
Ø 2.8 mm	0.20	**027B2084**

[1]) The code no. includes orifice and all necessary gaskets

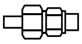
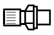
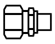
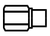


Pilot valve kits (EVM and coil)
Can be screwed on to the PMFL or PMFH instead of the blanking plug.

Coils, 10 W a.c.	a.c.: 027B1122xx where xx can be	d.c.: 027B1124yy where yy can be
24 V, 50 Hz	16	02 (24 V)
110 V, 60 Hz	21	09 (220 V)
115 V, 50 Hz	22	
220 V, 50 Hz	31	
220 V, 50/60 Hz	32	
240 V, 50 Hz	33	

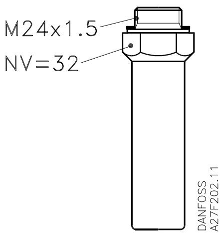
Ordering
(continued)

Optional accessories

Description		Code no.
Pressure gauge connection Ø 6.5 / Ø 10 mm weld / solder		**027B2035**
Pressure gauge connection $^{1}/_{4}$ in. flare (self-closing) (Must not be used in ammonia plant)		**027B2041**
Pressure gauge connection Cutting ring connection	6 mm 10 mm	**027B2063** **027B2064**
Pressure gauge connection	$^{1}/_{4}$ NPT	**027B2062**
Damping cylinder for PMFH 80 → 500		**027F2195**

Fundtion indicator



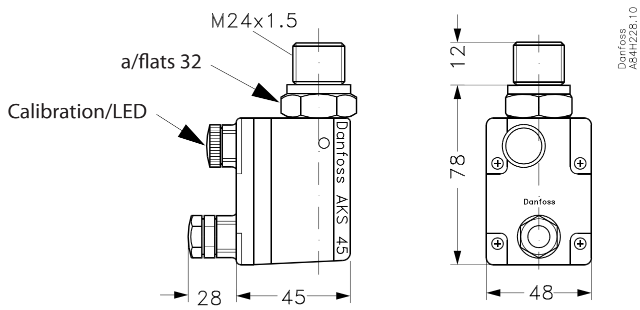
Description	Code no.
Function indicator Can be fitted in place of the main valve bottom plug. When the protective cap of the indicator is removed, the degree of opening of the PMFL-regulator can be observed in relation to the degree of opening of the SV pilot valve. Note: The function indicator must be considered as a very important tool for the accurate adjustment of the spring pressure.	**027F0085**
Manual operating unit for PMFL. Can be fitted in place of the regulator bottom plug	**027F0128**
$^{3}/_{8}$ in. flare pilot connection for PMFL and PMFH	**027F0115**
$^{3}/_{8}$ in. flare pilot connection for SV	**027B2033**

Electronic position indicator, type AKS 45

Electronic position indicator	Code no.
Type AKS 45 - 26	**084H4045**

AKS 45 is an electronic transmitter that provides a standard 4 - 20 mA output signal in accordance with the opening degree of a PMFL/PMFH valve, and digital signals for fully open/closed valve.

AKS 45 is designed on the induction/eddy current principle. This means that the measuring circuit is not in physical contact with mineral oils and diverse refrigerants.

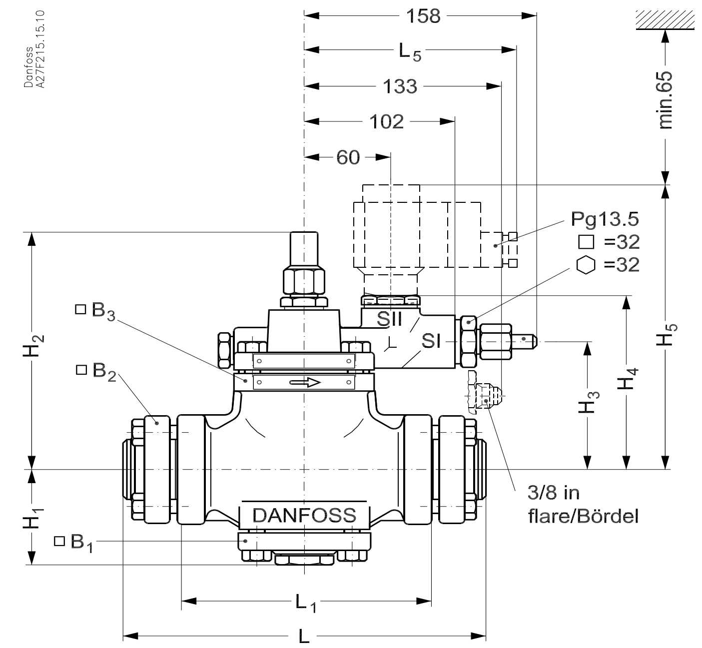


AKS 45-26

Accessories		L	L_1	L_2	H	H_1		B	B_1
Electronic position indicator, type AKS 45									
AKS 45 - 26	mm	28	45	48	12	78		NV 32	M 24 × 1.5
	in.	1.10	1.77	1.89	0.47	3.07			

Level controls

Dimensions and weights



PMFL/PMFH

Type		H_1 mm	H_2 mm	H_3 mm	H_4 mm	H_5 mm	L mm	L_1 mm	L_5 max. 10 W mm	L_5 max. 20 W mm	B_1 mm	B_2 mm	B_3 mm	Weight excl. solenoid valve kg
PMFL PMFH	80	66	162	79	113	176	177	106	130	140	75		87	7.0
	125	72	178	96	128	193	240	170	130	140	84	82	94	11.3
	200	79	187	105	138	202	254	170	130	140	94	89	102	14.2
	300	95	205	123	155	220	288	200	130	140	104	106	113	19.8
PMFH	500	109	227	146	176	242	342	250	130	140	127	113	135	28.3

Introduction

RT 280A and 281A are primarily used as liquid level alarms and safety switches to prevent too high a liquid level in liquid separators.

Secondarily, RT 280A and 281A can be used as liquid level regulators where a liquid level differential of up to ±40 mm can be permitted.

RT 280A and 281A used as safety switches ensure that the max. permissible refrigerant level in flooded evaporators, pump tanks or liquid separators is not exceeded.

As liquid level regulators, RT 280A and 281A maintain a constant average refrigerant level in flooded evaporators, pump tanks or liquid separators.

Materials

Gaskets are non-asbestos.

Technical data

1. General
Refrigerants
R 717 (NH3), R 22 and R 502
Other refrigerants
Ask Danfoss

Operating ranges for RT 280A
R 12: -50 → +10°C
R 22 and R 717 (NH3): -50 → 0°C
R 502: -65 → -5°C

Operating ranges for RT 281A
R 22 and R 717 (NH3): -30 → +20°C

Liquid level differential
With a steady liquid level and a liquid level variation rate of max. 15 mm/min, the differential will be approx. 10 mm on a rise in level and approx. 20 mm on a fall in level.
In unfavourable operating conditions, differentials of approx. 20 mm on a rise in level and approx. 60 mm on a fall in level must be expected.

Ambient temperature
-50 → +70°C

Switch
Single pole changeover switch (SPDT),
code no. **017-4030**

Approvals
CE-approved according to EN 60947-4, -1
EN 60947-5, -1
Meet the requirements of VDE 0660
(VDE: Verband Deutscher Elektrotechniker)

Contact load
Alternating current
AC1: 10 A, 400 V
AC3: 4 A, 400 V
AC15: 3 A, 400 V
Max. short-time AC 3 current: 28 A

Direct current
DC13: 12 W, 220 V

Weight
2.0 kg

Enclosure
IP 66 to IEC 529.

2. Pressure element
Pressure connection
G 3/8 A with Æ 6.5 / Æ 10 mm weld nipple

Max. working pressure
PB = 22 bar

Max. test pressure
p' = 25 bar

3. Thermostatic element
Adsorption charge
3 m capillary tube
Max. permissible bulb temperature: +80°C

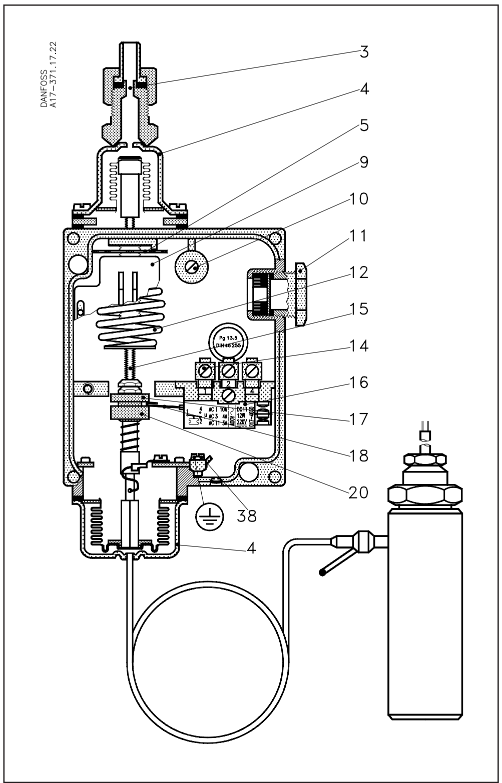
4. Bulb with electric heater
10 W heater for 24 V d.c. or a.c. The heater must be constantly energized whilst the system is in operation. 1.5 m connection cable.

The complete technical leaflet (RD2DA) can be downloaded from the Danfoss web site.

Ordering

RT 280A code no. **017D004066**
RT 281A code no. **017D004666**

Design/ function

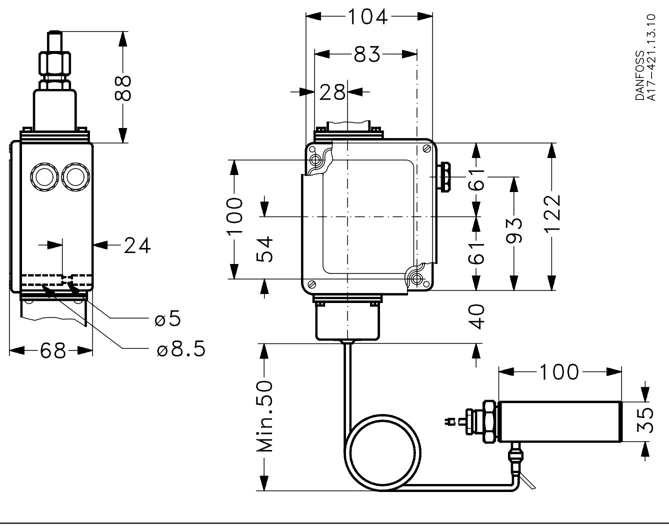


3. Pressure connection
4. Bellows element
5. Setting disc
9. Scale
10. Loop terminal
11. Pg 13.5 screwed cable entry
12. Spring
14. Terminals
15. Spindle
16. Switch (17-4030)
17. Upper guide bush
18. Contact arm
20. Lower guide bush
38. Earth terminal

RT 280A / 281A units are based on RT 260A. The lower element is thermal and has an electrically heated bulb.
As stated, the units are primarily for use as liquid level alarms and safety switches. In designing the units, emphasis was placed on failsafe function. In the event of a defect in the thermal element, the compressor is stopped and liquid injection cut off. Restart is only possible after the defect has been rectified.
This also applies in the case of loss of charge, for example if the capillary tube or heating element in the bulb is damaged, or if current to the heating element falls.
The element heating or cooling signal is compared with the reference pressure and then converted to an electric on/off impulse.
The regulating principle is based on the heat conduction difference between the liquid and vapour phases of the refrigerant.

Note:
If the evaporating temperature, and with it the reference pressure, is higher than the max. regulation range temperature, the unit will react as though the liquid level in the liquid container was too high.

Dimensions and weight



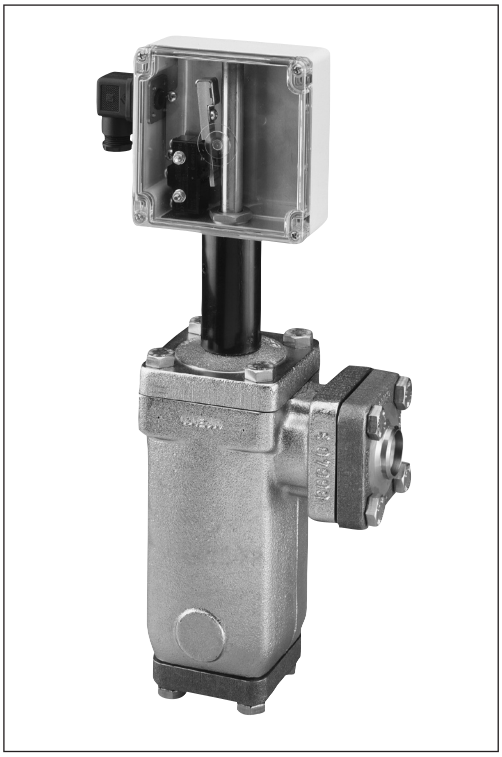
Weight
2.0 kg

Introduction

AKS 38 is an electro-mechanical float switch designed to provide a reliable, electro-mechanical response to liquid level changes.

The simple and basic design ensures long lifetime performance and reliable operation for many applications.

AKS 38 can control liquid level in vessels and accumulators or can be used as a low/high level safety alarm.



Features

- Based on Danfoss float type 38E
- DIN, ANSI and FPT/NPT flanges
- The switch box can be placed in any position on top of float housing for ease of installation.
- Adjustable liquid level differential switch point.
- Electric magnetic microswitch, mechanically activated.
- The complete switch box can easily be replaced without any interference with the refrigeration system.
- Switch box supplied with a DIN plug for easy installation and service.
- Flanges included.

Technical data

- *Refrigerants*
  Can be used for all common non-flammable refrigerants, including R717 and non-corrosive gases/liquids dependent on sealing material compatibility. Flammable hydrocarbons are not recommended.
- *Temperature range*
  –50°C/+65°C (–58°F/+149°F)
- *Pressure range*
  AKS 38 is designed for a max. working pressure of 28 bar g (406 psi g)

IMPORTANT
Should pressure testing in excess of 28 bar g (406 psig) be necessary then the internal float assembly must be removed, thus allowing a maximum test pressure of 42 bar g (609 psig).

- *Material*
  Float housing:
  Cast Iron, zinc chromated, EN-GJS-400-18-LT

  Floats housing bolts:
  Stainless steel
  A2-70 (DIN 267-11) / ASTM A-276

  Flanges:
  P285QH
  EN 10222-4 / ASTM A350

  Flange gasket:
  Fiber, non asbestos

  Pressure tube:
  Stainless steel
  X5CrNi18-10, EN 10088 / AISI 304, A276

  O-ring:
  Neoprene (Cloroprene)

  Gasket between pressure tube and housing
  Aluminium

  Electrical switch box:
  Shock resistant polycarbonate
  CT-661-T

The complete technical leaflet (RD5MA) can be downloaded from the Danfoss web site.

Level controls

Technical data

- *Electrical data*
  - **Change over Micro (SPDT) switch**
    250 V a.c / 10 A
    30 V d.c / 5 A
    Normally Open (NO) and Normally Closed (NC) function
  - **DIN Plug**
    DIN 43650 connection
    PG 11, 8-10 mm (0.31”-0.39”)
    Screw terminal 1.5 mm2 (16 AWG)
    3+PE
- *Liquid level differential*
  Variable between 12.5 mm to 50 mm (½" to 2") in 12.5 mm (½") increments.
  Required diffferential setting should be made prior to installation.
  Factory set at 50 mm (2").
- *Enclosure*
  IP 65
- *Weight (including flanges)*
  9.75 kg (21.5 lb)
- *Approvals*
  CE – for further details please see instruction.

Design

AKS 38 is an electro-mechanical float switch.

The design is based on a mechanical float, which will operate in the refrigerant. When the set level is reached an electrical volt free micro (SPDT) switch will be activated.

The microswitch is located in the switch box which has a clear front cover and allows viewing of the switch position. The micro- switch is fully isolated from the refrigeration system and operates by means of a magnet.

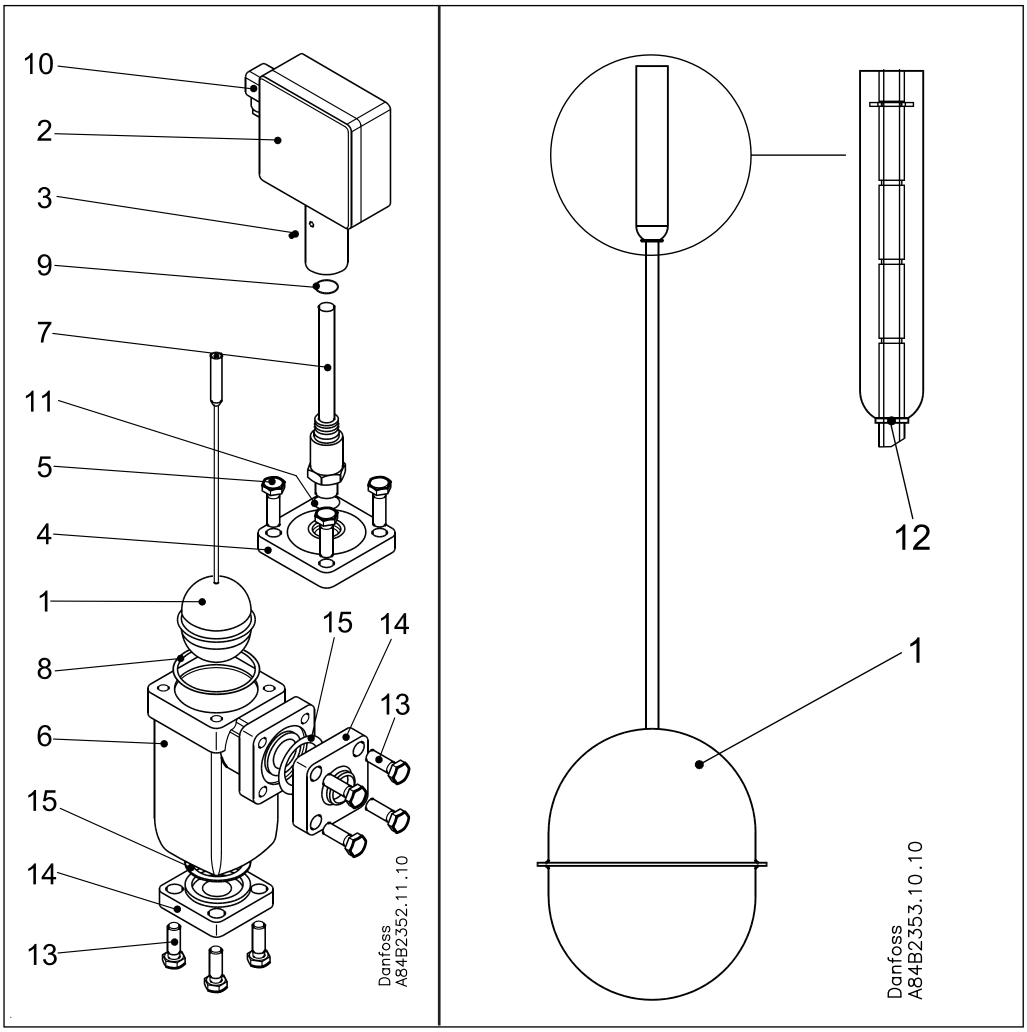
AKS 38 is supplied with a DIN plug for the electrical connections. The microswitch provides volt free contacts to open/close solenoid valves or energise/de-energise contactors for the starting/stopping refrigerant pumps/ compressors.

Can be used as a safety device for acoustic alarms/switches for visual indication when there is a danger of high or low liquid level.

The switch box can be placed in any position on top of the float housing for easy installation and can be replaced without any interference with the refrigeration system.
Flanges are included.

Function

1 Internal float assembly
2 Switch box
3 M4x8 pinol tailstock screw
4 Top cover
5 4 pcs M12x35 stainless steel bolts
6 AKS 38 housing
7 Pressure tube
8 Top cover gasket
9 O-ring for pressure tube
10 DIN-plug for electrical connection
11 Aluminium gasket
12 Locking ring for internal float
13 Stainless steel bolts
14 Flanges
15 Flange gaskets



AKS 38 incorporates an internal float assembly (1), which will operate directly in accordance with the refrigerant level.

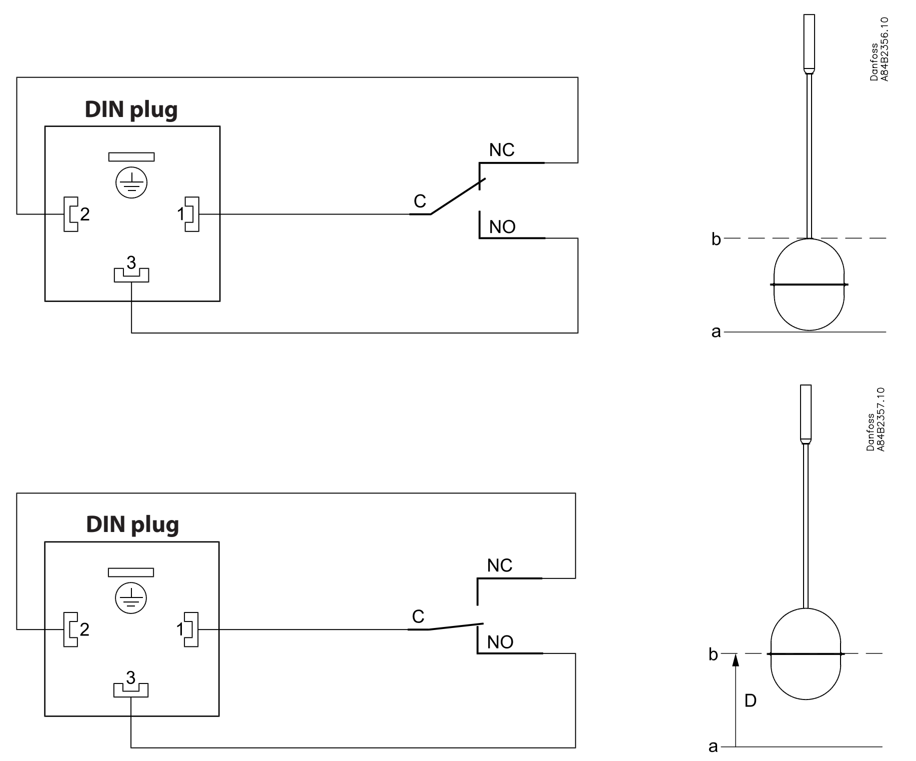
The internal float will follow the liquid level vertically up and down.

The upper part of the internal float assembly moves within the pressure tube (7).

At a specific switch point the upper part of the internal float assembly will via a magnet activate the electrical microswitch in the switch box (2).

A volt free signal can be detected by wiring to terminals at the DIN-plug (10). The actual switch point can be adjusted by means of a locking ring (12) before installation.

Function



Differential (D) = Variable between 12.5 mm (½") to 50 mm (2") in 12. 5 mm (½") increments.

Application

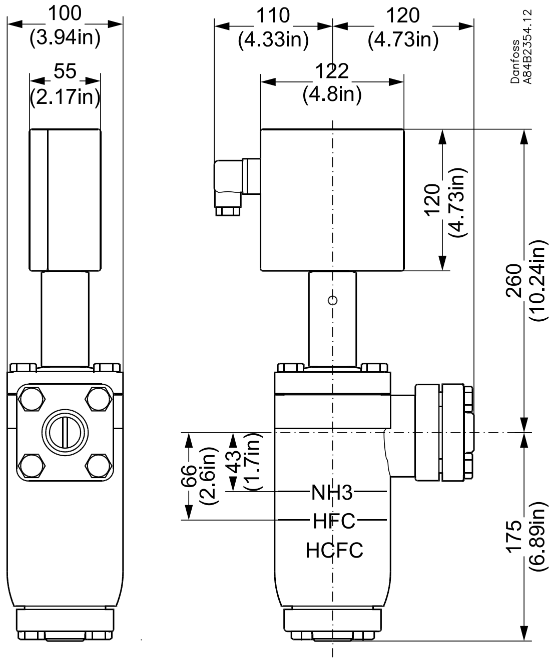
For the control and detection of liquid levels in: -

- Liquid over-feed accumulators.
- Flooded surge drums.
- Flooded shell & tube chillers.
- High and low pressure receivers.
- Inter coolers.
- Use as low/high level safety switch to protect circulating pumps/compressors.

Ordering

Type	Code No.
AKS 38 Butt Weld, DIN DN 25 (1 in.)	**148H3194**
AKS 38 Butt Weld, ANSI DN 25 (1 in.)	**148H3204**
AKS 38 Socket Weld, ANSI DN 20 ($^3/_4$ in.)	**148H3205**
AKS 38 Socket Weld, ANSI DN 25 (1 in.)	**148H3206**
AKS 38 FPT, NPT DN 20 ($^3/_4$ in.)	**148H3207**
AKS 38 FPT, NPT DN 25 (1 in.)	**148H3208**

Dimensions



Spare parts

Type	Code no.
Repair kit: Top cover gasket O-ring for pressure tube Alu. gasket Flange gasket Locking ring for internal float	**148H3200**
Internal float assembly	**148H3203**
Electrical switch box	**148H3202**
Flanges: AKS 38 Butt Weld, DIN DN 25 (1 in.) AKS 38 Butt Weld, ANSI DN 25 (1 in.) AKS 38 Socket Weld, ANSI DN 20 (3/4 in.) AKS 38 Socket Weld, ANSI DN 25 (1 in.) AKS 38 FPT, NPT DN 20 (3/4 in.) AKS 38 FPT, NPT DN 25 (1 in.) **Please observe:** Same flanges as for NRVA 25 and NRVA 32	 **027N1026** **027N2023** **027N2012** **027N2013** **027G1007** **027G1008**

Introduction

AKS 41 / 41U liquid level transmitters are used to measure the liquid level in refrigerant vessels.

The AKS 41 / 41U transmits an active 4-20 mA signal which is proportional to the refrigerant liquid level.

The 4-20 mA signal from AKS 41 / 41U can be used in conjunction with a controller to control the refrigerant liquid level.

The Danfoss EKC 347 liquid level controller, is a dedicated controller for use with the AKS 41 / 41U.

Special features

- *"Plug and Play":* no calibration required.
- *Service friendly:* electronic head and sensor tube can be separated without emptying the standpipe.
- *Damping of output signal available.*
- *Improved calibration:* AKS 41 / 41U range/signal output can be adapted to suit the actual application.
- AKS 41 / 41U can be supplied with a LED Bargraph indication of Liquid Level, as option

Technical data

- Supply voltage and load:
  24 V a.c, –15% / +25%, 50/60 Hz
  24 V d.c, ±10%
  1.5 W
- *Signal output:*
  4-20 mA
- *Refrigerants:*
  *AKS 41 / 41U supports the following refrigerants:*R717 (factory setting)
  R22
  R404A
  R134a
  R744
  R718 (H_2O) - R717 and R718 will give the same AKS 41 output
- *Temperature range:*
  –60/+100°C (–76/+212°F)

  When used in refrigerant above +60°C (140°F), a Min. Calibration must be carried out after 1 week of operation. Subsequently only a Min. Calibration once a year is needed.
- *Pressure range:*
  The AKS 41 / 41U is designed for:
  Max. working pressure: 100 bar g (1450 psig)
- *Connection:*
  Pipe thread ISO 228/1 - G 1A or 3/4 " NPT
- *Max. load resistance:*
  500 ohm
- *Ambient temperature:*
  During operation: –25 to +55°C (–13/+131°F).
  During transport: –40 to +70°C (–40/+158°F).
- *Enclosure:*
  IP65
- *Connection:*
  4-pole plug (DIN 43650)
- *Approvals:*
  EMC directive 89/336/EEC
  EMD directive 92/31/EEC
  EN 50081-1
  EN 50082-1
- *Material:*

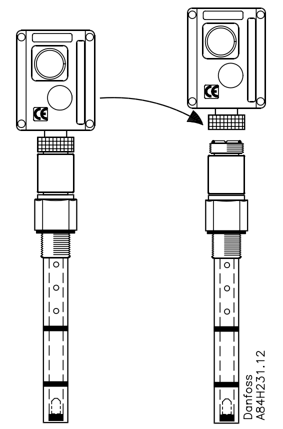
Thread:	Stainless steel. AISI 303
Reference pipe:	Stainless steel. AISI 304
Inner electrode:	PTFE
Electronic top part:	Cast Aluminium

The complete technical leaflet (DKRCI.PD.SC0.A) can be downloaded from the Danfoss web site.

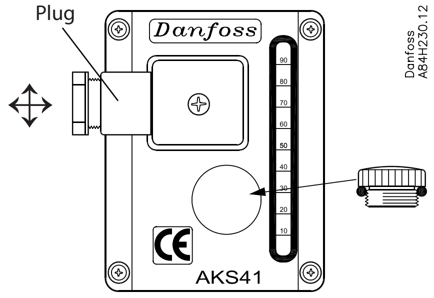
Level controls

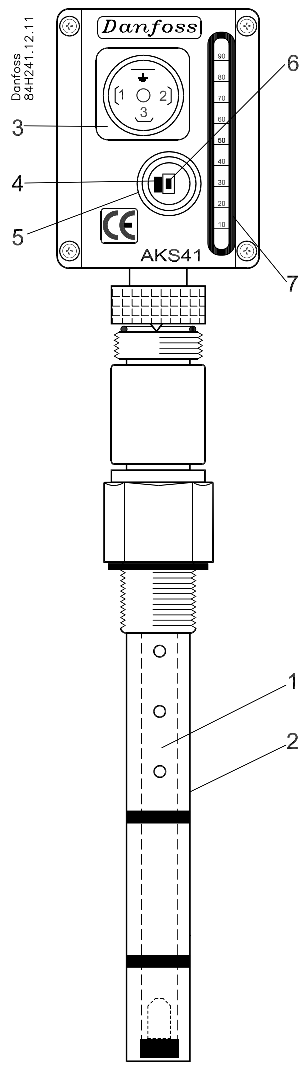
Design

- Electronic head and sensor tube can be separated without emptying the standpipe.



- Plug can be mounted in 4 different positions.





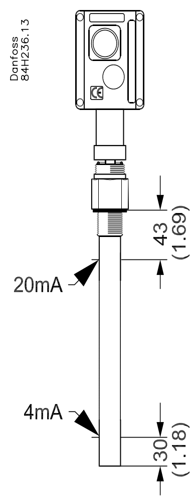
1 Inner pipe
2 Outer pipe
3 DIN connection
4 Green LED
5 Calibration cover
6 Calibration pushbutton
7 OPTION: LED Bargraph for indication of liquid level

Function and factory setting

The rod consists of two pipes - an inner pipe and an outer pipe. The liquid will flow up between the two pipes and by measuring the electrical capacitance between the pipes, the length of rod immersed in the liquid refrigerant is registered.

The signal is transmitted as a current signal from 4 to 20 mA (4 mA when the rod does not register liquid - and 20 mA when the entire rod is surrounded by liquid).

Factory setting:
The rod comes factory calibrated for R717 (NH_3), so that it will cover 4 to 20 mA throughout the rod's whole measuring range.
Any disturbances in connection with the level measurement will be damped internally.



A = 43 mm (1.69")
B = 30 mm (1.18")

R717 (NH_3) / R718 (H_2O)
It is not necessary to change the settings.
The factory setting can be used.

R22 / R404A / R134a / R744
Setting for the required refrigerant **must** be made by following the procedure described in next section.

NOTE!
If an alternative refrigerant other than the listed is used, a new Min/max calibration of the level transmitter is required.

Please observe that when used in R718, over time a lime coating on the outer reference pipe can be experienced. Danfoss recommend removing this lime coating on regular basis.

Setting of refrigerant

The setting may be carried out before the level transmitter is mounted on the plant.

1. *To give in the refrigeration mode setting push the calibration pushbutton and keep it pressed while 24 V a.c. is connected and then release the pushbutton.*

   NOTE!
   This sequence **must** be observed.
   If the supply voltage is connected before the calibration pushbutton is activated, the signal damping will be changed.

2. *Release the calibration pushbutton. Observe the present refrigerant setting and measure the 4-20 mA output signal.*

   1 flash of Green LED - output signal is ~ 5 mA = R717 (factory setting)
   2 flashes of Green LED - output signal is ~ 6 mA = R22
   3 flashes of Green LED - output signal is ~ 7 mA = R404A
   4 flashes of Green LED - output signal is ~ 8 mA = R134a
   5 flashes of Green LED - output signal is ~ 9 mA = R744

3. *Activate the calibration pushbutton to select required refrigerant.*
   Each activating will cause AKS 41 / 41U to step to next refrigerant according to below sequence:

   ~ 5 mA = R717 or R718 (factory setting)
   ~ 6 mA = R22
   ~ 7 mA = R404A
   ~ 8 mA = R134a
   ~ 9 mA = R744

4. When the current corresponds to the required refrigerant, wait 10 seconds until the green LED is constant ON (not flashing). This indicates that the required refrigerant has been selected.

5. *To leave the setting mode isolate the voltage supply to the level transmitter.*

Go through step 1, 2 and 5 if you wish to control the setting.

Signal damping

Signal damping is factory-set at 15 seconds. This setting can be altered by activating the calibration switch (see page 4).
The setting range is 1 to 120 seconds.

Settings can also be made whilst the system is operating.

Procedure:

1. *Connect the supply voltage.*
2. *Push the calibration pushbutton once for each second by which you want to increase the damping.*
   Example:
   1. push ⇒ 1 sec.
   2. pushes ⇒ 2 sec.
   etc.
   120. pushes ⇒ 120 sec.
   121. pushes ⇒ 120 sec.

10 seconds after the last push, the value will be saved in the memory and the green LED will start flashing again.

After 10 seconds, a further push will start 1-second signal damping again.
(If the damping setting is set too high, restart the procedure from step 1).

Calibration of the AKS 41 / 41U

AKS 41 / 41U will not need calibration if it is installed in refrigerant which is defined in AKS 41 / 41U and the ordered length corresponds to actual refrigerant measuring range.

Calibration of the AKS 41 / 41U may be relevant:-

- If the default setting does not fit and the max. /min. calibration points have to be adjusted.
- If the AKS 41 / 41U is used in a refrigerant, not already defined in AKS 41 / 41U.
- If the electronic head is replaced on an existing AKS 41 / 41U sensor.

Usually the min. calibration point is chosen to be 4 mA and the max. calibration point to be 20 mA, but it is also possible to calibrate the transmitter at other calibration points.

This opportunity can be useful when cali brating on a plant with no possibility of bringing the level to the limit points.

Default factory setting is:
0% (AKS 41 / 41U free of liquid) output signal: 4 mA
100% (AKS 41 / 41U fully covered by liquid) output signal: 20 mA

The max. /min. points can be set to any value.

Adjusting the min. /max. calibration points:

Min. calibration:

1. *Bring the refrigerant liquid level to desired minimum level.*
2. *Press the calibration pushbutton and keep it activated in approx. 5 seconds, until green LED stopps flashing.*
3. *Activate, within the next 10 seconds, the calibration pushbutton once* (If calibration pushbutton is not activated within 10 seconds, it will automatically leave calibration mode and return to normal operation)

Green LED is ON in a few seconds, and then flashing.

Output is now 4 mA and AKS 41 / 41U is in normal operation

Max. calibration:

1. *Bring the refrigerant liquid level to desired maximum level.*
2. *Press the calibration pushbutton and keep it activated in approx. 5 seconds, until green LED stopps flashing.*
3. *Activate, within the next 10 seconds, the calibration pushbutton twice* (If calibration pushbutton is not activated within 10 seconds, it will automatically leave calibration mode and return to normal operation)

Green LED is ON in a few seconds, and then flashing.

Output is now 20 mA and AKS 41 / 41U is in normal operation

Continued next page....

Calibration of the AKS 41 / 41U

(Continued)

Min. calibration when minimum refrigerant level must be different from 4 mA:

1. *Bring the refrigerant liquid level to desired minimum level.*
2. *Press the calibration pushbutton and keep it activated in approx. 5 seconds, until green LED stopps flashing.*
3. *Activate, within the next 10 seconds, the calibration pushbutton once and keep it activated.* (If calibration pushbutton is not activated within 10 seconds, it will automatically leave calibration mode and return to normal operation)
4. *Observe the output mA signal increasing fast starting at 4 mA.*
5. *Release the calibration pushbutton when the output signal is approx. 0.5 mA from the desired point.*
6. All the next activations will increase the output signal by approx. 0.05 mA
7. Approx. 10 seconds after the latest activation the LED starts flashing
8. Output now corresponds to the value measured at the latest activation.

Max. calibration when maximum refri-gerant level must be different from 20 mA:

1. *Bring the refrigerant liquid level to desired maximum level.*
2. *Press the calibration pushbutton and keep it activated in approx. 5 seconds, until green LED stopps flashing.*
3. *Activate, within the next 10 seconds, the calibration pushbutton twice and keep it activated.* (If calibration pushbutton is not activated within 10 seconds, it will automatically leave calibration mode and return to normal operation)
4. *Observe the output mA signal decreasing fast starting at 20 mA.*
5. *Release the calibration pushbutton when the output signal is approx. 0.5 mA from the desired point.*
6. All the next activations will decrease the output signal by approx. 0.05 mA
7. Approx. 10 seconds after the latest activation the LED starts flashing
8. Output now corresponds to the value measured at the latest activation.

Reset to factory setting

AKS 41 / 41U can always be reset to factory setting regardless of any revised calibration values.

1. *Press the calibration pushbutton and keep it activated in min. 20 seconds, until green LED starts flashing.*
2. *Release the calibration pushbutton.*
3. When LED starts flashing, reset to factory setting is completed.

AKS 41 / 41U is now operating according to the factory settings.

Green LED indication

When voltage is applied the LED will flash rapidly as many times as it has been calibrated through its lifetime.

Please note: The current mA output is activated as soon as the flashing sequence has changed from rapid to slowly flashing.

Normal operation:
At normal operation the Green LED will be flashing slowly.
Generally the Green LED is ON every time calibration pushbutton is activated.

Calibration mode
In calibration mode (*Press the calibration pushbutton and keep it activated in approx. 5 seconds*) the Green LED is OFF.

Change of refrigerant
In refrigeration mode setting (*Push the calibration pushbutton and keep it pressed while 24 V a.c. is connected and then release the pushbutton*) the green LED is OFF until the pushbutton is released.

After this the green LED will flash according to the type of refrigerant.

When the refrigerant has been selected, the green LED is constantly ON.

Ordering - AKS 41

Type	Length mm	Length in.	Measuring range mm	Measuring range in.	AKS 41 without Bargraph **Code no.**	AKS 41 with Bargraph **Code no.**
AKS 41-3	280	11.02	207	8.1	**084H4053**	**084H4153**
AKS 41-5	500	19.69	427	16.8	**084H4055**	**084H4155**
AKS 41-8	800	31.5	727	28.6	**084H4058**	**084H4158**
AKS 41-10	1000	39.37	927	36.5	**084H4060**	**084H4160**
AKS 41-12	1200	47.24	1127	44.4	**084H4062**	**084H4162**
AKS 41-15	1500	59.06	1427	56.2	**084H4065**	**084H4165**
AKS 41-17	1700	66.93	1627	64.1	**084H4067**	**084H4167**
AKS 41-22	2200	86.61	2127	83.7	**084H4072**	**084H4172**
AKS 41-30	3000	118.1	2927	115.2	**084H4080**	**084H4180**

Ordering - accessories

AKS 41 only:	**Code no.**
Alu-gasket, 10 pcs.	**084H4081**
1" connection	**027F1010**

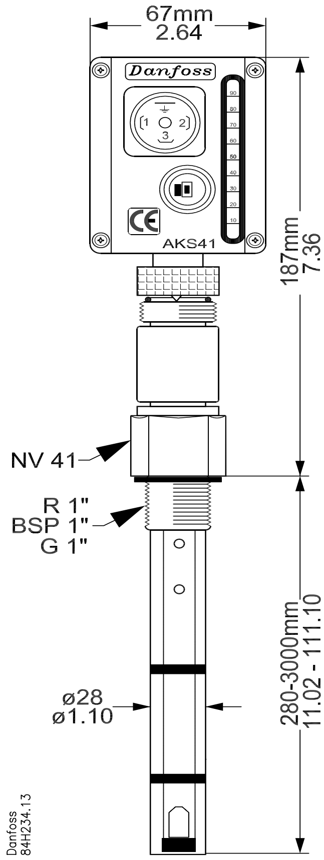
AKS 41 and AKS 41U:	Without Bargraph indication **Code no.**	With Bargraph indication **Code no.**
Electronic top part [1])	**084H4150**	**084H4151**

[1]) *Must always be calibrated when mounted on actual sensor rod*

Ordering - AKS 41U

Type	Length in.	Length mm	Measuring range in.	Measuring range mm	AKS 41U without Bargraph **Code no.**	AKS 41U with Bargraph **Code no.**
AKS 41U-6"	6	152	3.13	79	**084H4100**	**084H4101**
AKS 41U-8"	8	203	5.13	130	**084H4102**	**084H4103**
AKS 41U-12"	12	305	9.13	232	**084H4104**	**084H4105**
AKS 41U-15.3"	15.3	389	12.43	316	**084H4106**	**084H4107**
AKS 41U-19.2"	19.2	488	16.33	415	**084H4108**	**084H4109**
AKS 41U-23.1"	23.1	587	20.23	514	**084H4110**	**084H4111**
AKS 41U-30"	30	762	27.13	689	**084H4112**	**084H4113**
AKS 41U-35"	35	889	32.13	816	**084H4114**	**084H4115**
AKS 41U-45"	45	1143	42.13	1070	**084H4116**	**084H4117**
AKS 41U-55"	55	1397	52.13	1324	**084H4118**	**084H4119**
AKS 41U-65"	65	1651	62.13	1578	**084H4122**	**084H4123**
AKS 41U-85"	85	2159	82.13	2086	**084H4126**	**084H4127**
AKS 41U-105"	105	2667	102.13	2594	**084H4130**	**084H4131**
AKS 41U-120"	125	3048	119.25	3029	**084H4132**	**084H4133**

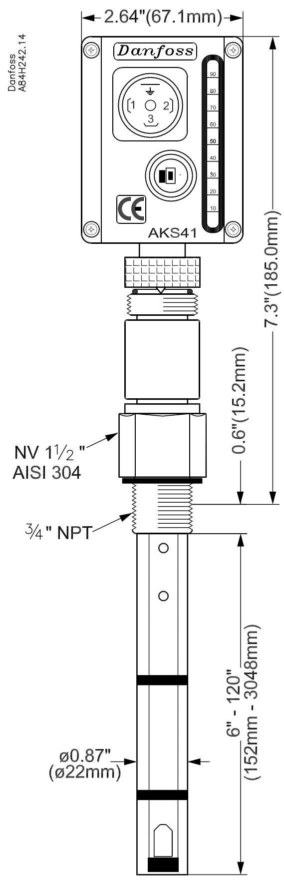
AKS 41
Dimensions and weights



AKS 41

Type	Insertion length		Weight kg / lb
AKS 41-3	280 mm	(11.02″)	1.7 / 3.7
AKS 41-5	500 mm	(19.69″)	2.0 / 4.4
AKS 41-8	800 mm	(31.50″)	2.4 / 5.3
AKS 41-10	1000 mm	(39.37″)	2.7 / 6.0
AKS 41-12	1200 mm	(47.24″)	3.1 / 6.8
AKS 41-15	1500 mm	(59.06″)	3.5 / 7.7
AKS 41-17	1700 mm	(66.93″)	3.8 / 8.4
AKS 41-22	2200 mm	(86.61″)	4.6 / 10.1
AKS 41-30	3000 mm	(118.10″)	5.8 / 12.8

AKS 41U
Dimensions and weights



AKS 41U

Type	Insertion length		Weight lb / kg
AKS 41U-6″	6″	(152 mm)	2.9 / 1.32
AKS 41U-8″	8″	(203 mm)	3.1 / 1.41
AKS 41U-12″	12″	(305 mm)	3.4 / 1.55
AKS 41U-15.3″	15.3″	(389 mm)	3.8 / 1.72
AKS 41U-19.2″	19.2″	(488 mm)	4.0 / 1.82
AKS 41U-23.1″	23.1″	(587 mm)	4.3 / 1.96
AKS 41U-30″	30″	(762 mm)	4.9 / 2.22
AKS 41U-35″	35″	(889 mm)	5.2 / 2.38
AKS 41U-45″	45″	(1143 mm)	6.0 / 2.71
AKS 41U-55″	55″	(1397 mm)	6.8 / 3.1
AKS 41U-65″	65″	(1651 mm)	7.7 / 3.5
AKS 41U-85″	85″	(2159 mm)	9.5 / 4.3
AKS 41U-105″	105″	(2667 mm)	10.9 / 4.93
AKS 41U-120″	120″	(3048 mm)	12.6 / 5.7

Introduction

LLG are liquid level glasses in ductile steel which meets the strictest requirements on industrial and marine refrigeration installations. The liquid level glasses are offered in 3 different versions:

- with welding nipples (LLG)
- with stop valves equipped with caps (LLG S)
- with stop valves and sight adapter in acrylic glass ready for insulation on site (LLG SF).

The range of liquid level glasses is based on 3 basic liquid level glasses: LLG 185, LLG 335 and LLG 740. The other standard lengths are combined by using variations of basic glass lengths.

LLG produce sufficient flow areas to secure the highest possible degree of synchronous operation, and have a specially hardened reflection glass for quick reading. The front and the base frame are mounted together from the front with countersunk allen screws. This ensures easy insulation on site as well as easy inspection and service, if any.

All liquid level glasses are equipped as standard with a built-in safety system (non return device). If a glass is damaged, the pressure of the refrigerant will activate the safety system and refrigerant loss will be limited to an absolute minimum.

Features

- Refrigerants
  Applicable to all common non flammable refrigerants including R717 and non corrosive gases/liquids dependent on sealing material compatibility
- Temperature range
  –10/+100°C (–14/+212°F) or
  –50/+30°C (–58/+86°F)
- Maximum operating pressure: 25 bar g (363 psi g)
- Equipped with boron silicate glass, hardened by an accurately controlled heat treatment process
- Classification: To get an updated list of certification on the products please contact your local Danfoss Sales Company

Design

The complete technical leaflet (DKRCI.PD.GG0.A) can be downloaded from the Danfoss web site.

Glass
LLG's are equipped with a boronsilicate glass, hardened by an accurately controlled heat treatment process. All glasses are according to DIN 7081.

Gaskets
The glasses are equipped with a special non-asbestos carbon compound gasket which provides superior mechanical characteristics and a long time guarantee against service leakage.

Connectors
LLG 590, LLG 995, LLG 1145 and LLG 1550 are joined together by 2 basic LLG’s by means of a connector. The connector holds the two basic glasses together by means of screws and guiding pins, which ensures a rigid construction.

Stop Valves/Nipples
The glasses are connected to the refrigeration system by means of welding nipples or stop valves. Which ever system is used, the nipples or stop valves are screwed into a flange, which is located in the correct position and subsequently tightened with a seal gasket and 4 screws.

Installation
Install the glasses on a bracket using the 4 screws supplied with the glass.

Use the threaded holes on the back of the frame to mount the glass on a bracket (not of Danfoss supply). Always connect the piping after mounting on the bracket. Please note the importance of a minimum of stress in the liquid level glasses from the connected pipes.
Please also make sure that there is sufficient space behind the the liquid level glasses to ensure proper insulation, service and inspection, etc.

For installations below –10°C (+14°F) it is recommended to add the sight adapter to enable reading after insulation has been applied.
For installations below –10°C (+14°F) in R717 plants it is recommended to use an oil column as described in the following pages. There will be no formation of bubbles or ice build-up in oilfilled liquid level glasses, which may be the case in the refrigerant-filled glasses.

The liquid sight glasses are designed to withstand high internal pressures. However, the piping system in general should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion.

Note:
The LLG liquid level glass can only be placed in CE approved applications with the stop valves in front.

Technical data

- Refrigerants
  The liquid level glasses are applicable to all common non flammable refrigerants including R717 and non corrosive gases/ liquids dependent on sealing material compatibility.
  For further information please see installation instruction for LLG.
  Flammable hydrocarbons are not recommended. For further information please contact your local Danfoss Sales Company.
- Temperature range
  The liquid level glasses are applicable to the above mentioned refrigerants within the temperature range of:
  –10/+100°C (+14/+212°F) for the LLG types with safety system with welding nipples and the LLG S types with safety system with stop valves.
  –50/+30°C (–58/+86°F) for the LLG SF types with safety system with stop valves and sight adapter (acrylic glass) and the LLG F types with safety system and sight adapter (acrylic glass).
- Pressure range
  All LLG types are designed for:
  Max. operating pressure 25 bar g (363 psi g)
  Strength test: 50 bar g (725 psi g)
  Leakage test: at 25 bar g (363 psi g).

Frostproof liquid level glasses

Example 1
Refrigerant: R717 (ammonia).
Temperature: Recommended for temperatures below –10°C (+14°F).

The principle shown in fig. 1 can be used in connection with low temperature liquid separators or intermediate coolers when the refrigerant is R717 (ammonia).

As the liquid level in the R717 separator varies the oil level will change simultaneously.

Oil Charging
The system is charged with synthetic oil type SHC 226 with a specific weight, differing from that of R717, and (h) must be multiplied by approximately 1.35 (the ratio of density oil to density R717) to calculate H.

Charge the oil vessel (volume approximate 10 litres) to a level just below the lower balancing pipe (A) through the oil charging valve. Close the oil charging valve.

The oil will show in the liquid level glass at a level equal to the level in the oil vessel. When R717 is filled into the separator or intermediate cooler it will enter the oil vessel and press down the oil surface.

The R717 will also rise into the upper balance pipe (B) to a level equal to the level in the separator or intermediate cooler. As the oil surface in the oil vessel is pressed down, the oil will rise into the liquid level glass.

Note:
It is important to use an oil which is not likely to mix with R717. The oil must have a high viscosity index to ensure easy flowing at low temperatures. Mobil SHC 226 of the synthetic polyalphaolefin type has proven suitable for this purpose.

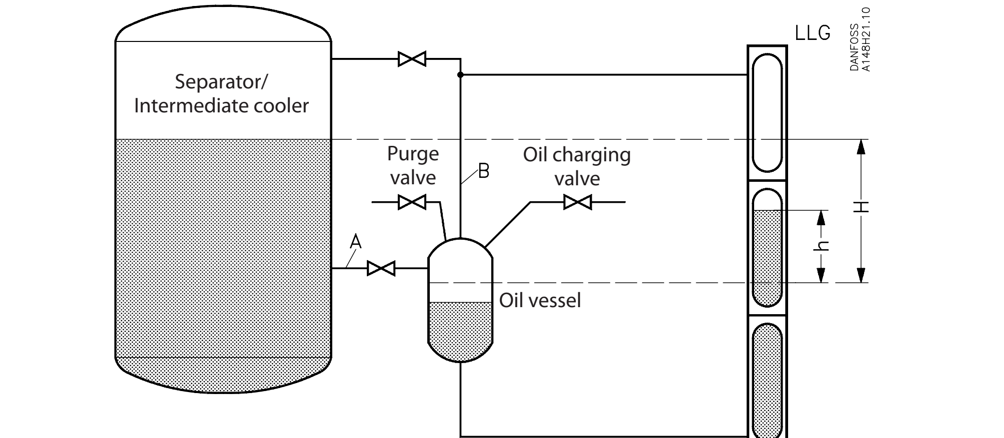


Fig. 1

Frostproof liquid level glasses

Example 2
Refrigerant: R717 (ammonia).
Temperature: Recommended for temperatures below –10°C (+14°F).

Fig. 2 shows a frostproof liquid level glass for an R717 liquid separator which is placed above ground level. The arrangement is called a Hampsonmeter.

Due to the evaporation taking place in the uninsulated balance pipe (ND 80/3 in.) the pressure in this pipe will be equal to
$P_1 = P_0 + H \times \rho \times g$.

P_0	Separator pressure	N/m^2
H	R717 liquid level (see fig. 2)	m
ρ	R717 density	kg/m^3
g	Acceleration due to gravity 9.81	m/s^2

Oil Charging
The pressure will act on the oil surface in the oil vessel and cause the oil to rise in the liquid level glasses which are installed in a length of e.g. 2 in. pipe, the top of which is connected to the top of the separator which is at pressure P_0.

The oil will rise to a level h and H can then be calculated by multiplying h by 1.35 (the ratio of density oil to density R717).

Charge the oil vessel through the oil charging valve to a level of approximately ¾ of full level. The level will show in the lower liquid level glass.

Take care that the volume of the oil vessel is sufficient to allow the oil to rise into the liquid level glasses. When the system is operating keep the bypass valve closed.

Note:
It is important to use an oil not likely to mix with R717, and having a high viscosity index to ensure easy oil movements at low temperatures. Mobil SHC 226 of the synthetic polyalphaolefin type has proven suitable for this purpose.

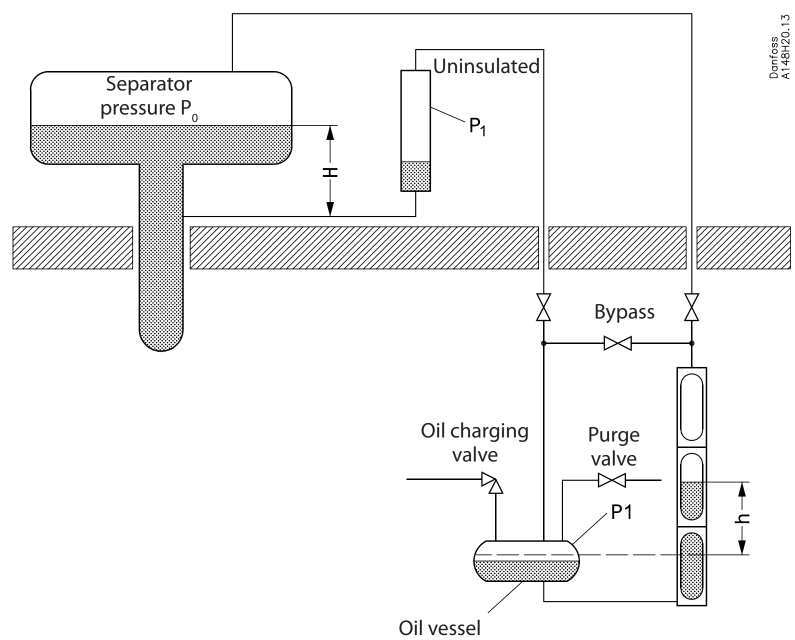
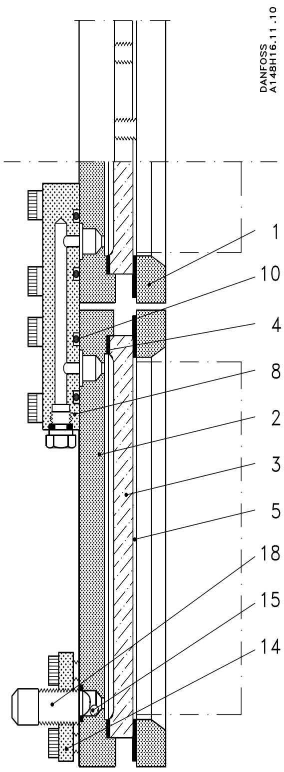


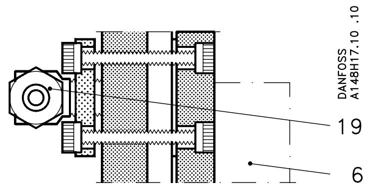
Fig. 2

Material specification

LLG



LLG S and LLG SF

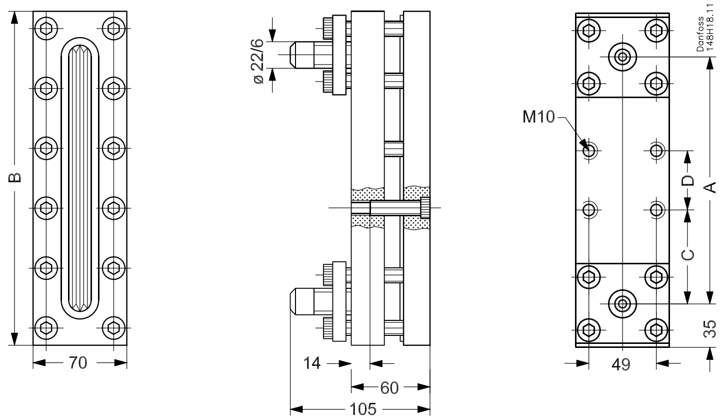


No.	Part	Material	DIN	ISO	ASTM
1	Front frame	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
2	Back frame	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
3	Sight glass	Glass			
4	Gasket	Non-asbestos			
5	Protective coating for sight glass	Non-asbestos			
6	Sight adapter	PMMA-acrylic			
8	Connecting piece	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
10	O-ring	Cloroprene (Neoprene)			
14	Flange	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
15	Balls	Stainless steel			
18	Welding nipple	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
19	Stop valve (SNV-ST*)	Steel			

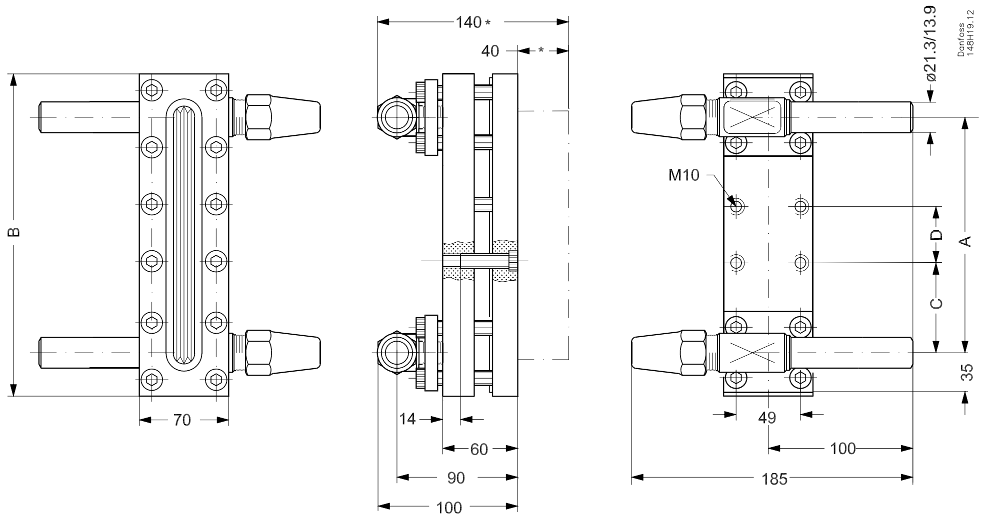
* See technical data for SNV-ST valves.

Dimensions and weights

LLG



LLG S and LLG SF



* Only for LLG SF with sight adapter.

Type		A	B	C	D	Weight
LLG 185 - 1550						
LLG 185	mm in.	185 7¼	255 10	69 2¾	48 2	4.2 kg [1] 5.8 kg [2]
LLG 335	mm in.	335 13¼	405 16	63 2½	42 1¾	7.5 kg [1] 9.2 kg [2]
LLG 590	mm in.	590 23¼	660 26	69 + 63 2¾ + 2½	48 + 42 2 + 1¾	13.2 kg [1] 15.1 kg [2]
LLG 740	mm in.	740 29¼	810 32	63 2½	42 1¾	16.5 kg [1] 18.5 kg [2]
LLG 995	mm in.	995 39¼	1065 42	69 + 63 2¾ + 2½	48 + 42 2 + 1¾	22.5 kg [1] 24.7 kg [2]
LLG 1145	mm in.	1145 45	1215 47¾	63 2½	42 + 42 1¾ + 1¾	25.7 kg [1] 28.0 kg [2]
LLG 1550	mm in.	1550 61	1620 63¾	63 2½	42 1¾	33.5 kg [1] 36.1 kg [2]

[1]) Type LLG
[2]) Type LLG S and LLG SF

Specified weights are approximate values only.

Ordering

How to order
The table below is used to identify liquid level glasses required.

Please note that the type codes only serve to identify the liquid level glasses, some of which may not form part of the standard product range.

For further information please contact your local Danfoss Sales Company.

Example for type codes

LLG 740 SF

Type codes

Valve type	**LLG**	Liquid Level Glass	
Nominal size in mm			Combined by:
	185	DN 185	
	335	DN 335	
	590	DN 590	LLG 185 + LLG 335
	740	DN 740	
	995	DN 995	LLG 185 + LLG 740
	1145	DN 1145	LLG 335 + LLG 740
	1550	DN 1550	LLG 740 + LLG 740
Equipment	**-**	Safety system and welding nipples	
	F	Safety system and sight adapter	
	S	Safety system and stop valves (SNV-ST)	
	SF	Safety system, stop valves (SNV-ST) and sight adapter	

Liquid level glasses - LLG

With safety system and welding nipples

Length		Type	Code no.
mm	in.		
185	7¼	LLG 185	**2512+049**
335	13¼	LLG 335	**2512+050**
590	23¼	LLG 590	**2512+051**
740	29¼	LLG 740	**2512+052**
995	39¼	LLG 995	**2512+053**
1145	45	LLG 1145	**2512+054**
1550	61	LLG 1550	**2512+055**

Liquid level glasses - LLG S

With safety system and stop valves (SNV-ST)

Length		Type	Code no.
mm	in.		
185	7¼	LLG 185 S	**2512+056**
335	13¼	LLG 335 S	**2512+057**
590	23¼	LLG 590 S	**2512+058**
740	29¼	LLG 740 S	**2512+059**
995	39¼	LLG 995 S	**2512+060**
1145	45	LLG 1145 S	**2512+061**
1550	61	LLG 1550 S	**2512+062**

Liquid level glasses for insulating - LLG F

With safety system and sight adapter

Length		Type	Code no.
mm	in.		
185	7¼	LLG 185 F	**2512+078**
335	13¼	LLG 335 F	**2512+079**
590	23¼	LLG 590 F	**2512+080**
740	29¼	LLG 740 F	**2512+081**
995	39¼	LLG 995 F	**2512+082**
1145	45	LLG 1145 F	**2512+083**
1550	61	LLG 1550 F	**2512+084**

Important!
Where products need to be certified according to specific certification societies or where higher pressures are required, the relevant information should be included at the time of order.

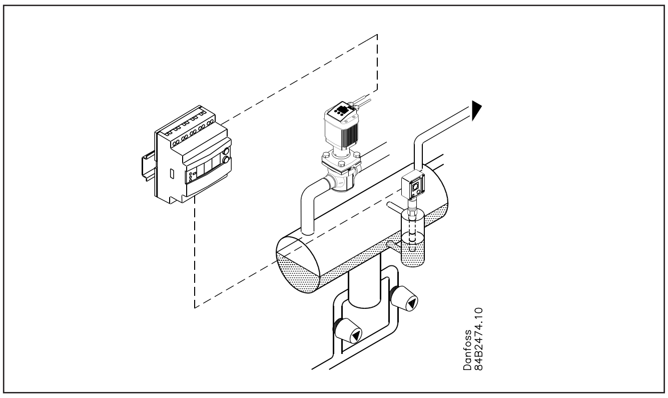
Liquid level glasses for insulating - LLG SF

With safety system, stop valves (SNV-ST) and sight adapter

Length		Type	Code no.
mm	in.		
185	7¼	LLG 185 SF	**2512+066**
335	13¼	LLG 335 SF	**2512+067**
590	23¼	LLG 590 SF	**2512+068**
740	29¼	LLG 740 SF	**2512+069**
995	39¼	LLG 995 SF	**2512+070**
1145	45	LLG 1145 SF	**2512+071**
1550	61	LLG 1550 SF	**2512+072**

Introduction

Application
The controller is used for regulation of the refrigerant level in:
• Pump reservoirs
• Separators
• Intermediate coolers
• Economisers
• Condensers
• Receivers

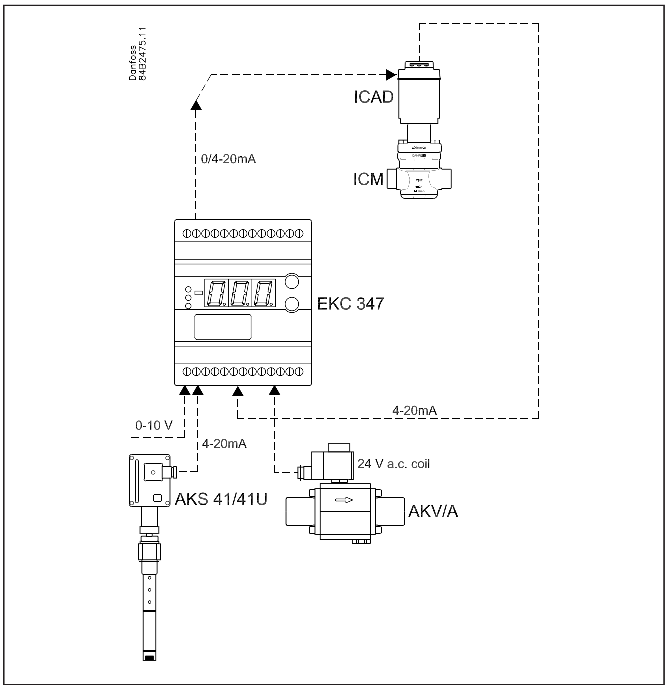


System
A signal transmitter will constantly measure the refrigerant liquid level in the reservoir - the controller will receive the signal and subsequently control the valve, in order to control the refrigerant liquid level according to liquid level setpoint.

Signaltransmitter
With the capacitive rod it is possible to set the refrigerant level within a wide range.

EKC 347
The controller receive a signal and are then able to contol low or high side applications. A analog input signal (voltage/ current) can displace the setpoint and then remote change of setpoint is thus possible.
EKC 347 does support 2 types of Danfoss expansion valves. (see below)
One analog input is available as feed back from ICM in order to indicate Opening degreee of the ICM.

Expansions valve
Two types of Danfoss expansion valves can be used
ICM - ICM are direct operated motorized valves driven by digital stepper motor type ICAD
AKV/A - AKVA or AKV are pulse-width modulating expansion valves.

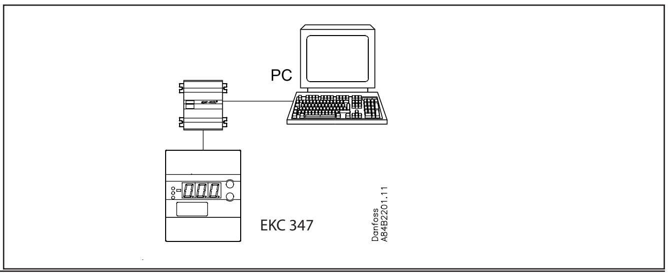


Functions
• Liquid level control
• Alarm if the set alarm limits are exceeded
• Relay outputs for upper and lower level limits and for alarm level
• Analog input signal which can displace the reference
• PI control
• Low or High side control
• When AKV/A is selected, a MASTER/SLAVE system can run up to 3 AKV/A with distributed Opening Degree
• Manual control of output
• Limitation of Opening degree possible
• ON/OFF operation with hysteresis

LED's on front panel

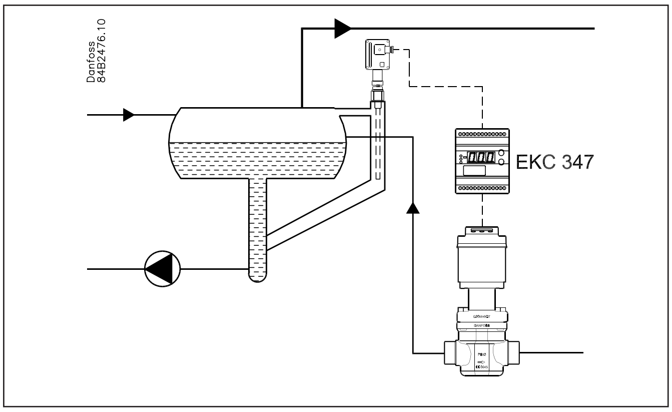
	Opening signal to valve
▲	Indication of upper level limit
▼	Indication of lower level limit
All	Indication of alarm level

Extra options
• PC operation
The controller can be provided with data communication, so that it may be hooked up with other products in the ADAP-KOOL® range of refrigeration controls. Operation, monitoring and data collection can then be performed from a PC - either in situ or at a service company.

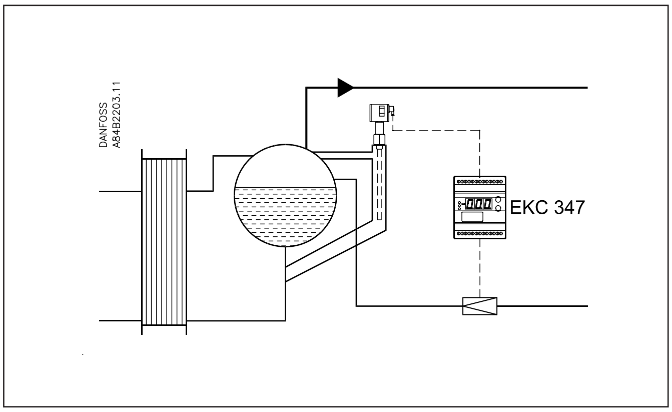


Application examples

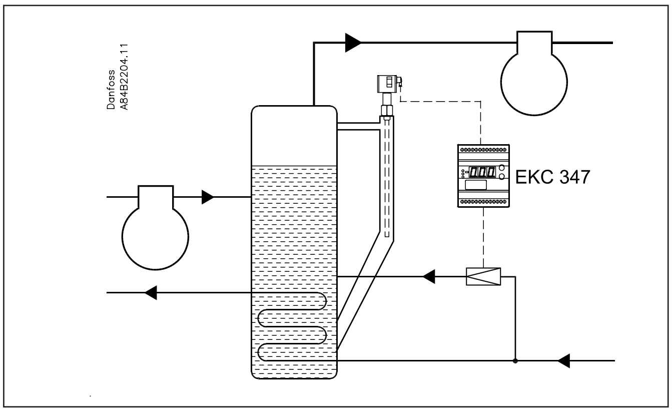
Pump reservoir
Modulating control of injection makes for a more stable liquid level and suction pressure.



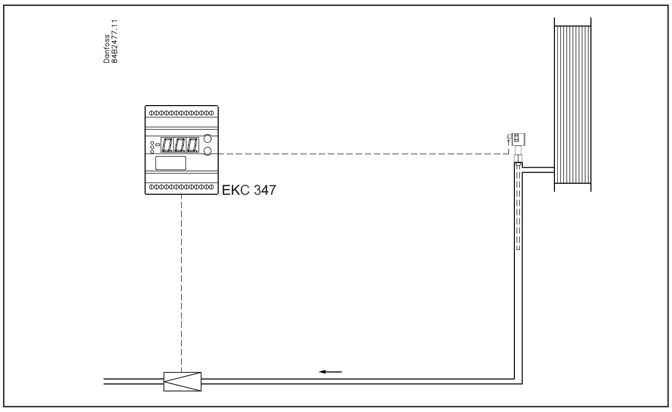
Separator on flooded evaporator
Modulating control and the valve's large capacity range ensure a stable level - even under conditions of quickly changing loads.



Intermediate cooler
The level transmitter's wide measuring range enables it to monitor the liquid at all levels of the reservoir - and hence to use the signal for safety functions in connection with the max. permissible level



Receiver / condenser
The control system's short reaction time makes it very suited for high-pressure float systems with small refrigerant charges.



Survey of functions

Function	Para-meter	Parameter by operation via data communication
Normal display		**Level control**
The liquid level is indicated in % The % value is calculated on the basis of the input signal and the definition in "o31".	-	Liquid level
The valve's actual opening degree can be displayed by giving the lower button a brief push (1s). Cf. also o17.	-	OD %
Reference		
Set point Regulation is based on the set value provided that there is no external contribution (o10). (Push both buttons simultaneously to set the setpoint).	-	SP Liquid Level
External contribution to the reference This setting determines how large a contribution is to be added to the set reference when the input signal is max (20 mA or 10 V. Cf. also o10). The value is set in %-points.	r06	r06 Ext. Ref.offset
Start/stop of regulation With this setting the level regulation can be started and stopped. Start/stop of level regulation can also be performed with the external contact function. Regulation is stopped if just one of them is OFF.	r12	r12 Main Switch
Alarm		**Level Alarms**
The controller can give alarm in different situations. When there is an alarm the three lowest LED's at the front of the controller will flash, and the alarm relay is cut in		
Limit for upper level Here you set the limit value for the upper level indication. The value is set in %. The relay for the upper level will become activated when the level exceeds the set value.	A01	A01 Upper Dev.
Limit for lower level Here you set the limit value for the lower level indication. The value is set in %. The relay for the lower level will become activated when the level drops below the set level.	A02	A02 Lower Dev.
Time delay for upper level limit When the limit value is exceeded a timer function will start. The relay will not become activated until the set time delay has been passed.The time delay is set in seconds.	A03	A03 Upper Delay
Delay for lower limit level When the limit value is exceeded a timer function will start.The relay will not become activated until the set time delay has been passed. The time delay is set in seconds.	A15	A15 Lower Delay
Limit for alarm level An alarm level can be set which when passed will activate the alarm relay- The value is set in %. Cf. also the definition in A18. If the limit alarm (A3) is not required, it can be avoided by means of the following setting in A16: 100 : If the rising level definition has been chosen. (A18=0 or 2) 0: If the falling level definition has been chosen. (A18=1 or 3)	A16	A16 Limit Alarm
Time delay for alarm level When the alarm level is exceeded a timer function will start. The relay will not become activated until the set time delay has been passed. The time delay is set in seconds.	A17	A17 Limit Delay

Configuration of limit alarm (A3) level and lower limit alarm(A2) for pump cut-out. To define whether the limit alarm (A3) is linked to rising (A18=0) or falling level (A18=1). It is also possible to configurate the Relay for lower level limit when lower limit alarm (A2) is detected. Dedicated to switch off pumps at low level alarm. 0: Rising level. When liquid level is higher than A16, and time in A17 has expired, A3 alarm is generated. 1: Falling level . When liquid level is lower than A16, and time in A17 has expired, A3 alarm is generated. 2: Same function as if A18=0, but in addition (to that: - When liquid level is higher than A02. No A2 alarm and Relay for lower level limit, gives ON signal (cut in) on terminal 8 and 10. - When liquid level is lower than A02 and time in A15 has expired. A2 alarm is generated and Relay for lower level limit, gives OFF signal (cut out) on terminal 8 and 10. 3: Same function as if A18=1, but in addition (to that: - When liquid level is higher than A02. No A2 alarm and Relay for lower level limit, gives ON signal (cut in) on terminal 8 and 10. - When liquid level is lower than A02 and time in A15 has expired. A2 alarm is generated and Relay for lower level limit, gives OFF signal (cut out) on terminal 8 and 10.	A18	A18 Lim. LowMode
Function Alarm relay when A1, A2 or A3 alarms are detected. 0: Alarm relay to be activated when A1 or A2 or A3 are detected. 1: Alarm relay only to be activated when A3 is detected.	A19	A19 Alarm type (With setting = 0 the alarm is also transmitted via the data communication)
Alarm relay The alarm relay will become activated if one of the set limits is exceeded or if the controller loses the input signal from the level-measuring unit.		With data communication the importance of the individual alarms can be defined. Setting is carried out in the “Alarm destinations” menu. See also page 11.
Control parameters		**Injection Settings**
Definition of regulating principle Here you set whether the controller is to open or close the valve when the liquid level is rising. Low (0): Regulation on the low-pressure side. The valve closes when liquid level is rising. High (1): Regulation on the high-pressre side. The valve opens when liquid level is rising.	n35	n35 Low/High Pr.
Period time An AKV/A valve is operated with pulses of a given length. The length depends on the opening degree required. If a large opening degree is required, the pulse will last for an entire period time. A period time will thus comprise both open and closed valve.	n13	n13 AKV per.time
P - band If the value is reduced the regulating range will be reduced. (The P-band will be near the reference).	n04	n04 P-band
I: Integration time Tn The I-link can be made passive by setting the value at max. (600s) (If the Tn value is increased the regulation becomes slower).	n05	n05 Tn sec.
Neutralzone The function is only active if the selected expansion valve is of type ICM	n34	n34 Neutralzone
Min. opening degree Here you can make a setting if you require a limitation of the valve’s working range.	n33	n33 OD Min.
Max. opening degree Here you can make a setting if you require a limitation of the valve’s working range.	n32	n32 OD Max.

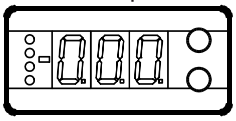
Miscellaneous		Miscellaneous
Valve and output signal The controller can control three types of expansion valves - ICM or AKV/A. With AKV/A up to three EKC 347 controllers can be linked up to a MASTER/SLAVE function (this function is only used if there is a need for several parallel AKV/A expansion valves). The application is selected with one of the following settings: 1: ICM. AO: 4-20 mA 2: ICM. AO: 0-20 mA 3: AKV/A, AO: 4-20 mA 4: AKV/A, AO: 0-20 mA or, if the master/slave function is used:: 5: AKV/A, MASTER 6: AKV/A, SLAVE 1/1. AO:4-20 mA 7: AKV/A, SLAVE 1/1. AO:0-20 mA 8: AKV/A, SLAVE 1/2. AO:4-20 mA 9: AKV/A, SLAVE 1/2. AO:0-20 mA 10: AKV/A, SLAVE 2/2. AO:4-20 mA 11: AKV/A, SLAVE 2/2. AO:0-20 mA 12: AKV/A, SLAVE 1/1. AO:4-20 mA - AO always updated 13: AKV/A, SLAVE 1/1. AO:0-20 mA- AO always updated 14: AKV/A, SLAVE 1/2. AO:4-20 mA- AO always updated 15: AKV/A, SLAVE 1/2. AO:0-20 mA- AO always updated 16: AKV/A, SLAVE 2/2. AO:4-20 mA- AO always updated 17: AKV/A, SLAVE 2/2. AO:0-20 mA- AO always updated With settings 1 and 2 the AO [mA] signal is dedicated for the motor valve ICM. With settings 3, 4, AO [mA] will be send out a signal for process indications. With settings 6, 7, 8, 9, 10 or 11, AO [mA] on EKC 347 SLAVE, will be send out a signal for process indications. With settings 12, 13, 14, 15, 16 or 17, AO will also be updated (active) when DI is OFF	o09	o09 AO type
Reference displacement If you wish to connect a signal that is to displace the controller's control reference, the signal must be defined in this menu. The signal is connected to terminals 19-21 or 20-21 0: No signal 1: 4 - 20 mA 2: 0 - 20 mA 3: 2 - 10 V 4: 0 - 10 V (The min. value will give no displacement. The max. value will displace the reference with the value set in menu r06).	o10	o10 AI type
Input signal from the level-measuring unit The input signal for terminals 14-16 or 15-16 must be defined: 0: No signal 1: Current signal of 4-20 mA 2: Voltage signal. The voltage range must be set in the next two menus. (If the connections are a master/slave system and the signal to the master is 4 to 20 mA, the setting in the slave modules must also be selected to 1 – this must be done, even if the signal is connected to the voltage input).	o31	o31 Levelsign.
Voltage signal's lower value (only if the setting in 031 = 2).	o32	o32 Lev. V. Low
Voltage signal's upper value (only if the setting in o31 = 2)	o33	o33 Lev. V. High
Position signal If a ICM valve is selected it is possible to have ICM valve position as a [mA] feed back signal 0: Not used 1: ICM mA feedback signal from connected ICAD. 2: Not used	o34	o34 Valve feedb.
Frequency Set the net frequency.	o12	o12 50 / 60 Hz (50=0, 60=1)
Address If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be madewhen a data communication modulehas been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC8AC"..		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60	o03	-
The address is sent to the gateway when the menu is set in pos. ON (The setting will automatically change back to Off after a few seconds.)	o04	-

Language This setting is only required when data communication is connected to the controller. Settings: 0=English, 1=German, 2=French, 3=Danish, 4=Spanish, 5=Italian, and 6= Swedish When the controller is operated via data communication, the texts in the right-hand column will be shown in the selected language. When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	o11	o11 Language
Selection of parameter for displays and AO The selection depends on the setting made in menu "o34". The selected value to display is also send to AO, except when ICM or AKV/A as MASTER, has been selected as valve type (o09=1 or 2 or 5) If o34 has been set at 0, the subsequent setting of o17 will mean: 0: The liquid level will be shown in the "normal display" 1: The valve's opening degree OD will be shown in the "normal display" If o34 has been set at 1, the subsequent setting of o17 will mean: 0: The liquid level will be shown in the "normal display" 1: The ICM valve position feed back signal [%] will be shown in the "normal display" The normal display has now been selected. If the other is requested, activate the con-trollers lowest button This will give a display showing of liquid level/opening degree - or vice versa. After five seconds the display will revert to the original mode.	o17	o17 Display / AO
Manual control of outputs In connection wit service the individual relay outputs and the AKV/A output can be put in pos. ON. But not until regulation has been stopped. OFF: No override 1: Relay for upper level is ON 2: Relay for lower level is ON 3: AKV/A output is ON 4: Alarm relay is activated (terminals 12 and 13 will be connected)	o18	-
Service		**Service**
A number of controller values can be printed for use in a service situation		
Read liquid level	u01	u01 Liquid level
Read the control reference (Set reference + any contribution from external signal)	u02	u02 Liq. Lev Ref
Read valve's opening degree	u24	u24 OD %
Read value of the external current signal (reference displacement) which is received on terminals 19-21	u06	u06 Ext. Ref. mA
Read value of the external voltage signal (reference displacement) which is received on terminals 20-21	u07	u07 Ext. Ref. V
Read value of the current signal (level signal) received on terminals 15-16	u30	u30 Levelsign. mA
Read value of the voltage signal (level signal) received on terminals 14-16	u31	u31 Levelsign. V
Read value of the current signal (position signal from the valve) received on terminals 17-18	u32	u32 Valve fb mA
Read position signal from the valve. The value is converted into % of the total open-ing degree	u33	u33 Valve fb %
Read value of the delivered current signal (terminals 2-5)	u08	u08 AO mA
Read status of input DI (start/stop input)	u10	u10 DI
	--	DO1 Limit alarm Read status of alarm relay ON is operating status with alarm
	--	DO2 Upper alarm Read status of the relay for the upper level limit
	--	DO3 Lower alarm Read status of the relay for the lower level limit
Operating status		
Operating status of the controller can be called forth in the display. Push briefly (1s) the upper button. If there is a status code, it will be shown on the dis-play. (Status codes have lower priority than alarm codes. In other words, you cannot see a status code, if there is an active alarm). The individual status codes have the following meanings:		EKC State (0 = regulation)
S10: Level regulation stopped by the internal or external start/ stop		10
S12: Liquid level had exceeded A01 limit or Liquid level is lower than A02 limit		12

Operation

Display

The values will be shown with three digits, and after an operation the controller will return to its standard mode and show the measured liquid level.



Light-emitting diodes (LED) on front panel

There are LED's on the front panel which will light up when the corresponding relay is activated.
The upper LED will indicate the valve's opening degree. A short pulse indicates a slow liquid flow and a long pulse a fast liquid flow.
The three lowest LED's will flash, if there is an error in the regulation.
In this situation you can upload the error code on the display and cancel the alarm by giving the uppermost button a brief push.

The buttons

When you want to change a setting, the two buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously.

Gives access to the menu (or cutout an alarm)

Gives access to changes

Saves a change

Examples of operations

Set reference

1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Set one of the other menus

1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Literature survey:
- Manual for EKC 347...RS8AX---
- Instruction for EKC 347..RI8BY---
- Installation guide, "Data communication link for ADAP-KOOL® "..RC8AC---

Menu survey

SW = 1.1x

Function	Parameter	Min.	Max.	Fac. setting
Normal display				
Read the measured liquid level	-		%	50.0
If you wish to see the actual opening degree, give the lower button a brief push	-		%	0
If you wish to set the required setpoint you obtain access by pushing both buttons simultaneously	-	0%	100%	100
Level control				
External contribution to the reference. Cf. also o10. Value is set in %-points.	r06	-100	100	0.0
Start / stop of level control	r12	OFF/0	ON/1	1
Alarm				
Upper level limit	A01	0 %	100%	85
Lower level limit	A02	0%	100%	15
Time delay for upper level limit	A03	0 s	999 s	50
Time delay for lower level limit	A15	0 s	999 s	10
Level alarm limit	A16	0 s	999 S	20
Delay for level alarm	A17	0 s	999 s	0
The level alarm is linked to: 0: Rising level (higher level than A16) 1: Falling level (lower level than A16) 2: Same function as if A18=0. When A2 alarm is generated and Relay for lower level limit, gives OFF signal (cut out). 3: Same function as if A18=1 When A2 alarm is generated and Relay for lower level limit, gives OFF signal (cut out).	A18	0	3	0
Function for Alarm relay when A1, A2 or A3 alarms are detected. 0: Alarm relay to be activated when A1 or A2 or A3 are detected. 1: Alarm relay only to be activated when A3 is detected.	A19	0	1	0
Regulating parameters				
P - band	n04	0%/Off	200%	30
I: Integration time Tn	n05	60	600/ Off	400
Period time (only if AKV/A valve is used)	n13	3 s	10 s	6
Max. opening degree	n32	0%	100%	100
Min. opening degree	n33	0%	100%	0
Neutral zone (only for ICM valve)	n34	2%	25%	2
Definition of regulating principle Low: On the low-pressure side (valve closes when liquid level is rising) High: On the high-pressure side (valve opens when liquid level is rising)	n35	Low/0	Hig/1	0
Miscellaneous				
Controller's address	o03*	0	60	0
ON/OFF switch (service-pin message)	o04*	OFF	ON	
Define valve and output signal: 1: ICM. AO: 4-20 mA 2: ICM. AO: 0-20 mA 3: AKV/A, AO: 4-20 mA 4: AKV/A, AO: 0-20 mA Or if a master/slave function is used: 5: AKV/A, MASTER 6: AKV/A, SLAVE 1/1. AO:4-20 mA 7: AKV/A, SLAVE 1/1. AO:0-20 mA 8: AKV/A, SLAVE 1/2. AO:4-20 mA 9: AKV/A, SLAVE 1/2. AO:0-20 mA 10: AKV/A, SLAVE 2/2. AO:4-20 mA 11: AKV/A, SLAVE 2/2. AO:0-20 mA 12: AKV/A, SLAVE 1/1. AO:4-20 mA - AO always updated 13: AKV/A, SLAVE 1/1. AO:0-20 mA- AO always updated 14: AKV/A, SLAVE 1/2. AO:4-20 mA- AO always updated 15: AKV/A, SLAVE 1/2. AO:0-20 mA- AO always updated 16: AKV/A, SLAVE 2/2. AO:4-20 mA- AO always updated 17: AKV/A, SLAVE 2/2. AO:0-20 mA- AO always updated	o09	1	17	1

Continued from previous page

Define the input signal on terminals 10, 20, 21 (external reference displacement) 0: OFF 1: 4-20 mA 2: 0-20 mA 3: 2-10 V 4: 0-10 V	o10	0	4	0
Language 0=English, 1=German, 2=Frensh, 3=Danish, 4=Spanish, 5=Italian, 6=Swedish. When you change the setting you must also activate o04.	o11*	0	6	0
Set supply voltage frequency	o12	0/50 Hz	1/60 Hz	0
Selection of parameter for display and AO (except from when o09=1,2 or 5) If o34 = 0: 0: Liquid level is show 1: Valve's opening degree OD will be shown If o34 = 1: 0: Liquid level is show 1: The ICM valve position feed back signal [%] will be shown	o17	0	1	0
Manual control of outputs: OFF: No manual control 1: Upper level relay put in pos. ON 2: Lower level relay put in pos. ON 3: AKV/A output put in pos. ON 4: Alarm relay activated (cut out)	o18	OFF	4	0
Define input signal (level signal) on terminals 14, 15, 16 0: OFF 1: 4-20 mA 2: 0-10 V (also set the voltage values in the next two menus) Read functional description if the connection used is a master/slave function.	o31	0	2	1
Define input signal's lower value for terminal 14, if required	o32	0.0 V	4.9 V	4.0
Define input signal's upper value for terminal 14, if required	o33	5.0 V	10 V	6.0
Define input signal on terminals 17-18 0: Not used 1: ICM mA feedback signal from ICAD connected 2: Not used	o34	0	2	0
Service				
Read liquid level	u01			%
Read liquid level reference	u02			%
Read external contribution to the reference	u06			mA
Read external contribution to the reference	u07			V
Read current signal on the analog output	u08			mA
Read status of input DI	u10			
Read valve's opening degree	u24			%
Read level signal	u30			mA
Read level signal	u31			V
Read signal from ICM/ICAD	u32			mA
Read signal from ICM/ICAD converted into %	u33			%

*) This setting will only be possible if a data communication module has been installed in the controller.

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Error messages

The controller can give the following messages:		
E1	**Error message**	Errors in the controller
E12		The external reference contribution is outside the range
E21		Level signal outside the range 1)
E22		Signal from ICM/ICAD outside the range
A1	**Alarm message**	Upper level limit reached
A2		Lower level limit reached
A3		Alarm level limit reached

1)
If E21 is detected. EKC 347 will force the valve to close or open the valve depending af n35

If Low presure has been selected. (n35=0)
The valve is forced to fully closed, however if Min. Opening Degree (n33) is higher than 0 the valve will open to the value of n33

If High presure has been selected. (n35=1)
The valve is forced to fully open, however if Max. Opening Degree (n32) is lower than 100 the valve will open to the value of n32

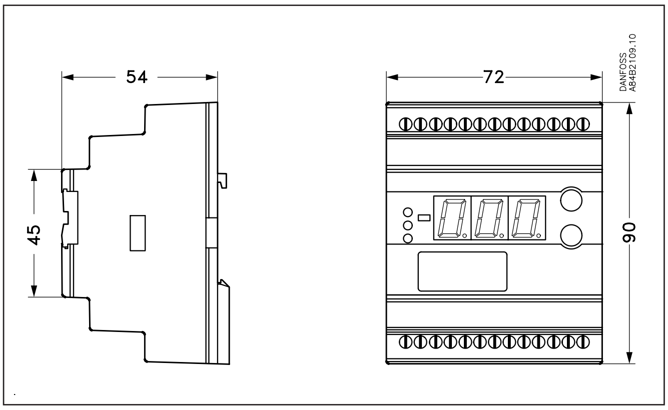
Ordering

Type	Function	Code No.
EKC 347	Liquid level controller	**084B7067**
EKA 173	Data communication module (accessories), (FTT 10 module)	**084B7092**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

Level transmitter/controller: ....Kindly refer to catalogue RK0YG
AKV / AKVA Valves: ....Kindly refer to catalogue RK0YG
ICM and ICAD..Kindly refer to catalogue RD4YB

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 60 VA (the supply voltage is galvanically separated from the input and output signals. Input/output are not individual galvanic isolated)	
Power consumption	Controller 20 W coil for AKV	5 VA 55 VA
Input signal	Level signal	4-20 mA or 0-10 V
	Reference displacement	4-20 mA, 0-20 mA, 2-10 V or 0-10 V
	ICM valve feedback signal	From ICAD 0/4-20 mA
	Contact function start/stop of regulation	
Relay output	2 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarm relay	1 pcs. SPST	
Current output	0-20 mA or 4-20 mA Max. load: 500 ohm	
Valve connection	ICM - via current output AKV/A- via 24 a.c. Pulse-Width Modulating output	
Data communication	Possible to connect a data communication module	
Environments	-10 - 55°C, during operation -40 - 70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence / vibrations	
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3-digits	
Terminals	max. 2.5 mm² multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN50081-1 and EN 50082-2	



Connections

Necessary connections

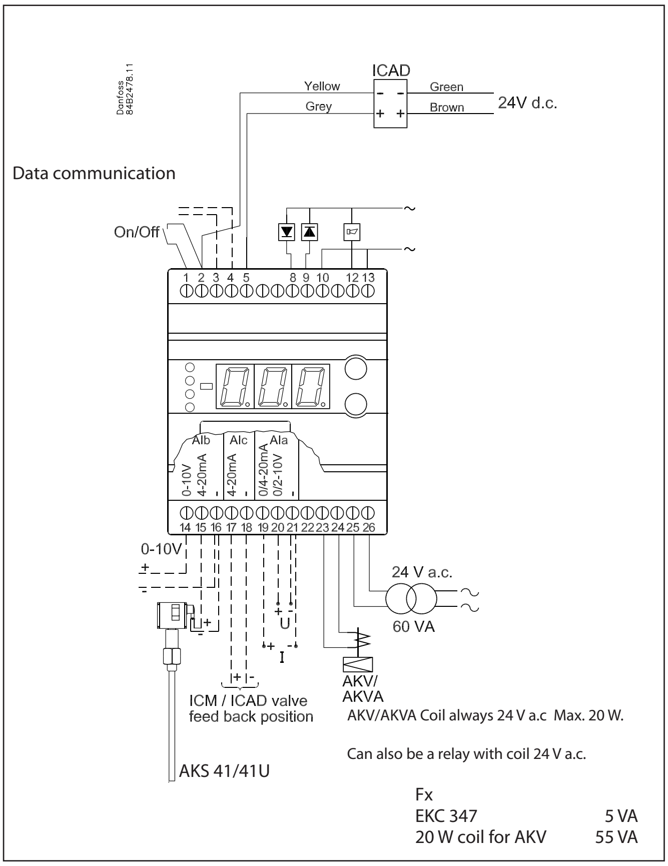
Terminals:

25-26 Supply voltage 24 V a.c.
15-16 Signal from level transmitter type AKS 41 **or**
14-16 Signal from transmitter 0-10 V
23-24 Expansion valve type AKV or AKVA **or**
2-5 Expansion valve type: ICM with ICAD
1-2 Switch function for start/stop of regulation. If a switch is not connected, terminals 1 and 2 must be shortcircuited.

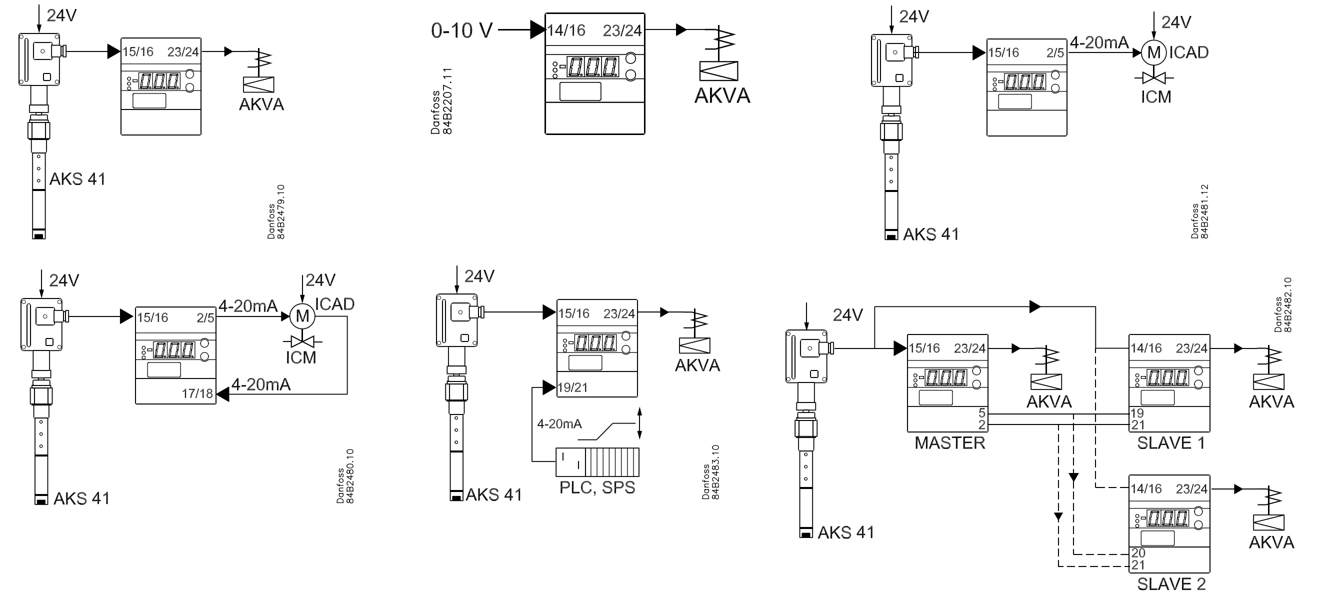
Application dependent connections

Terminal:

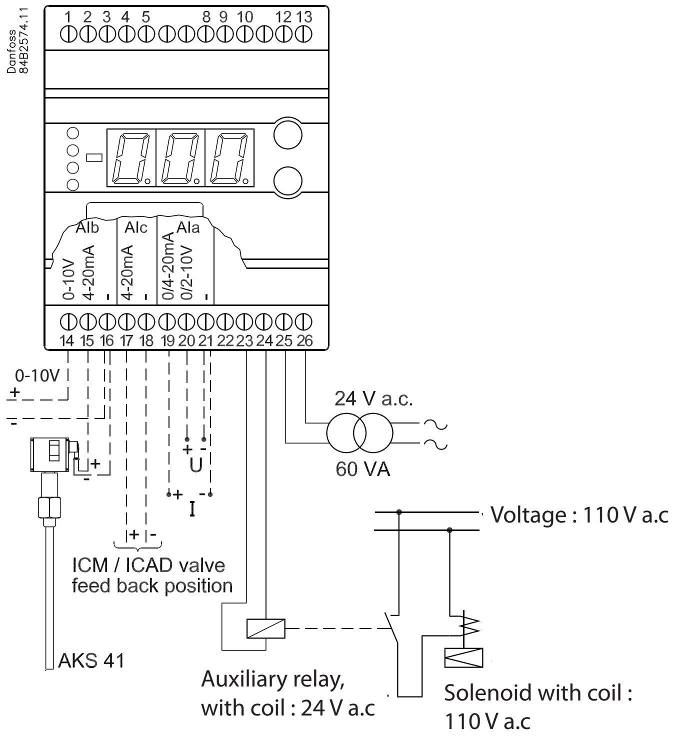
12-13 Alarm relay. See A19 and A18
8-10 Relay for lower level limit. See A18 for setting of ON (cut in) or OFF(cut out) function
9-10 Relay for upper level limit. There is connection between 9 and 10 when the set value is passed
17-18 ICM valve feedback signal from ICAD 0/4-20 mA
19-21 Current signal **or**
20-21 Voltage signal from other regulation (for external reference displacement)
3-4 Data communication
Mount only, if a data communication module has been mounted.
It is important that the installation of the data communication cable be done correctly. Cf. separate literature No. RC8AC...



Connections examples

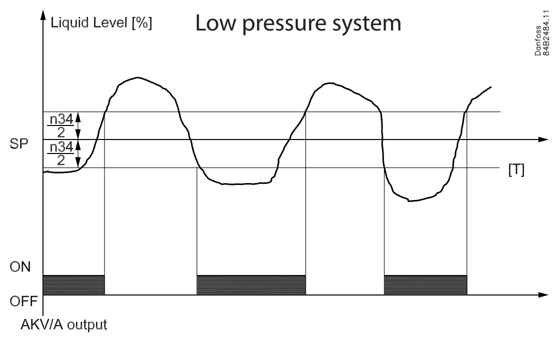


EKC 347 – ON/OFF Application. Open/Close solenoid valve with coil 110 V



ON/OFF application
Beside of modulating PI control EKC 347 does also support ON/OFF operation with hysteresis.

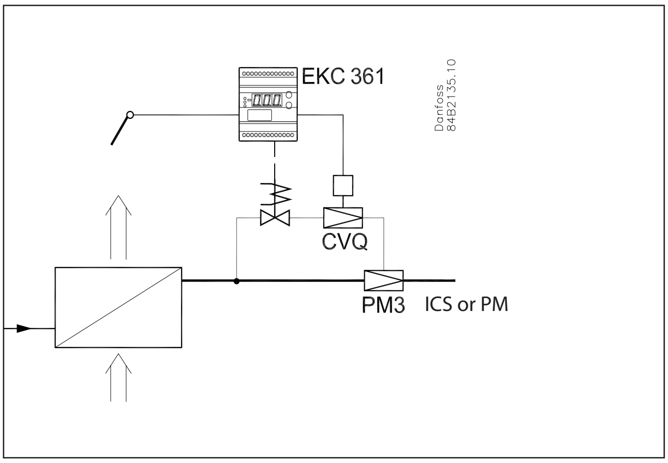
To ensure this operation:
P.Band must be (n04)=0%//OFF
Hysteresis is given by (n34)
Setpoint as normal procedure. (pushing the upper/lower buttons simultaneously)
Low or High side system. (n35)



Introduction

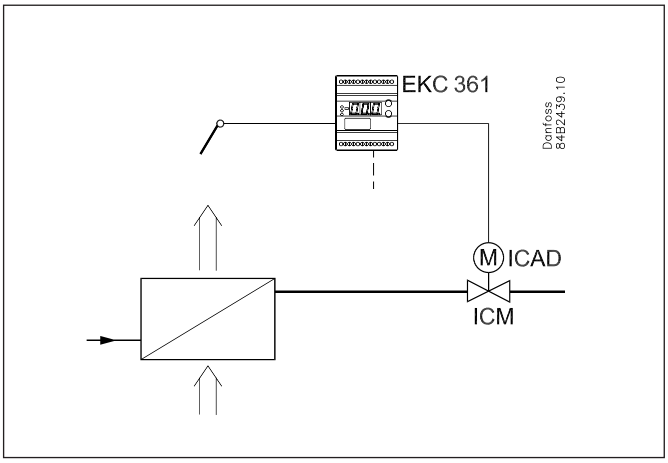
Application

The controller and valve can be used where there are stringent requirements to accurate temperature control in connection with refrigeration.
E.g.:
• Cold room for fruits and food products
• Refrigerating systems
• Work premises in the food industry
• Process cooling of liquids



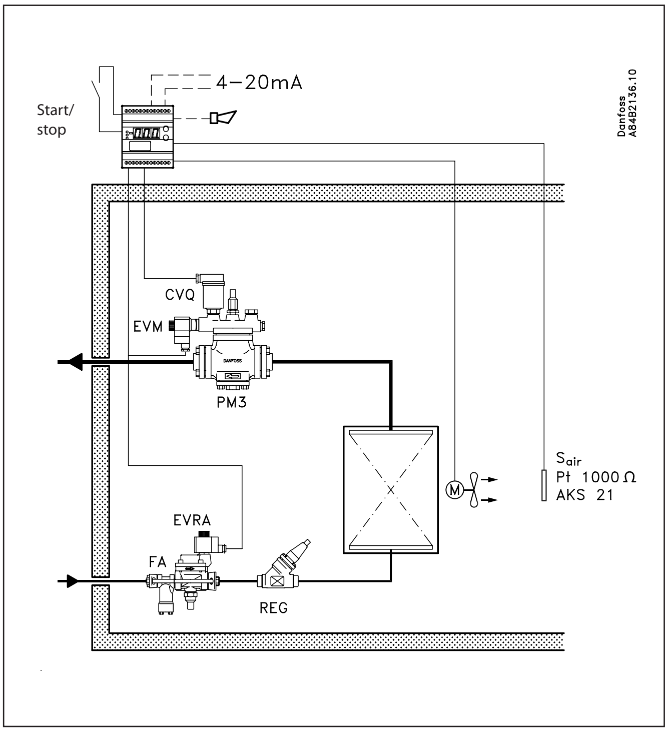
Advantages

• The temperature is kept within an accuracy of ±0.25°C or better after a transient phenomenon
• The evaporator's temperature is kept as high as possible, so that the air humidity is kept high and waste is limited
• A transient phenomenon can be controlled with the adaptive function. Select either:
  - Fast build-up where underswings are allowed
  - Not quite so fast build-up where underswings are less pronounced
  - Build-up without underswings
• PID regulation
• p_0 limitation



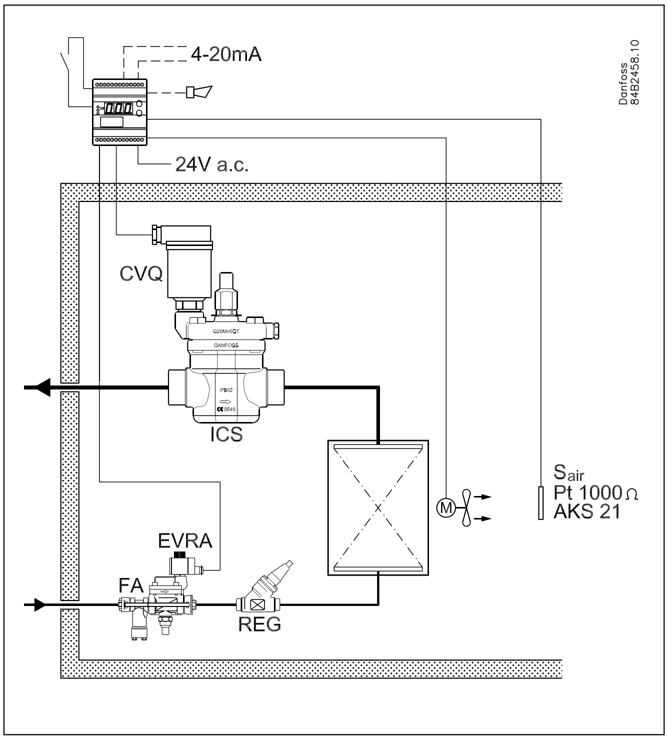
Functions

• Modulating temperature control
• Digital ON/OFF input for start/stop of regulation ICS/PM or forced closing of ICM
• Alarm if the set alarm limits are exceeded
• Relay output for fan
• Relay output for solenoid valves
• Analog input signal that can displace the temperature reference
• Analog Output signal corresponding to selecting temperature as running display value. Please observe : Not possible if ICM is selected as valve

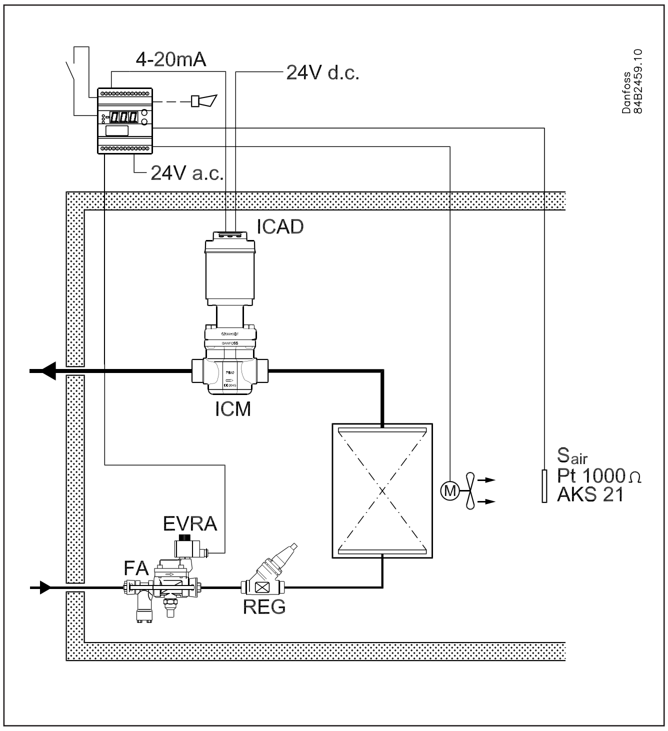


Application examples

ICS/PM
ISC/PM with CVQ is a pilot-operated and pressure-dependent valve for for controlling media temperature.
The ICS or PM must be equipped with a CVQ pilot valve in order to position ICS or PM. The CVQ valve is operated by the EKC 361 controller.
Please notice that a power failure will cause the CVQ pilot valve to fully open ICS/PM. If it is required that ICS/PM must close at power failure, the pilot valve type EVM-NC can be installed.
If the Digital Input is ON, it releases the ICS/PM for controlling temperature. If the Digital Input is OFF, if stops controlling PM/ICS, but EKC 361 will maintain a CVQ mimimum temperature. (Parameter n02)
Please see seperate literature for ICS/PM
ICS : RD4YA
PM : RD4XA



ICM
ICM is a direct activating and pressure independent valve for controlling media temperature.
When ICM is selected, the ICM is positioned directly via the analog output 0/4-20mA output from the EKC 361.
If the Digital Input is ON, it releases the ICM for controlling temperature. If the Digital Input is OFF, the ICM is forced to close.
The opening degree OD 0-100 % can be limited by parameter n32 and n33.
Please see seperate literature for ICM
ICM : RD4YB



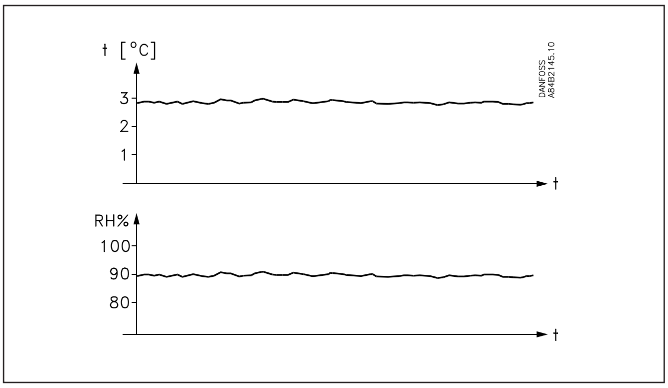
General for ICS/PM and ICM
The EKC 361 can also operate a solenoid valve in the liquid line (Digital output on terminal 9 and 10). It will follow the status of Digital Input, however if a low temperature alarm is detected (A2 alarm) the solenoid valve in the liquid line will be closed.
The EKC 361 can also operate a fan (Digital output on terminal 8 and 10). It will follow the status of Digital Input.
The Parameter (r12) must be ON in order to ensure general operation. If Parameter (r12) is OFF, EKC 361 will operate corresponding to if Digital Input is OFF
As media temperature sensor is S_{air} is used. Please observe that S_{air} can also be used to control liquid.
As option an auxiliary temperature sensor Saux can be installed but only for monitoring.
S_{air}/S_{aux} can both be shown as running display value selected by parameter o17. The selected sensor (S_{air} or S_{aux}) will be sent out on the Analog Output as 0/4-20 mA.
Temperature scaling with parameter o27 and o28. Please observe by ICM the Analog Output is not available for sending temperature signals (S_{air} or S_{aux}).
It is normally recommended, on a aircooler, to install S_{air}, at the evaporator air outlet side.

Extra options

• PC operation
The controller can be provided with data communication, so that it may be hooked up with other products in the ADAP-KOOL® range of refrigeration controls. Operation, monitoring and data collection can then be performed from a PC - either in situ or at a service company.

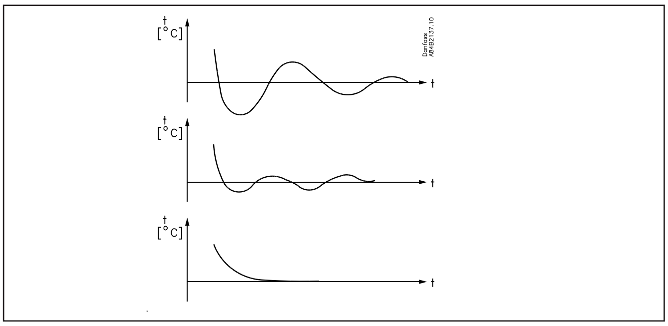
Function

Very accurate temperature control
With this system where controller, pilot valve and main valve have been adapted for optimum use in the refrigerating plant, the refrigerated products may be stored with temperature fluctuations of less than ±0.25°C.

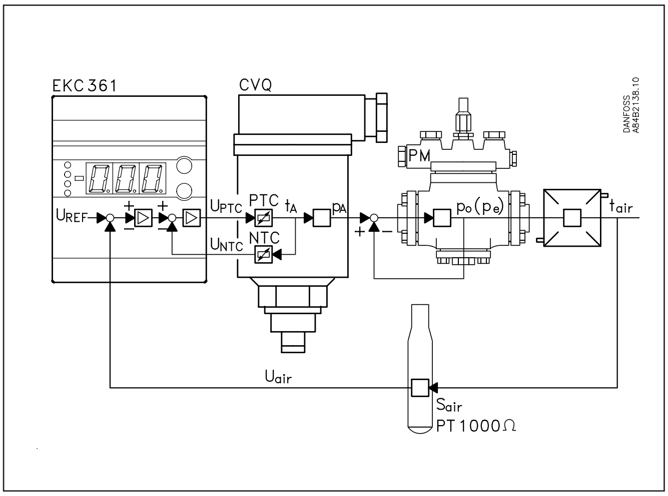


High air humidity
As the evaporating temperature is constantly adapted to the refrigeration needs and will always be as high as possible with a very small temperature fluctuation, the relative air humidity in the room will be kept at a maximum.
Drying-out of the products will in this way be reduced to a minimum.

Temperature is quickly attained
With the built-in PID control and the possibility of choosing between three transient phenomena, the controller can be adapted to a kind of temperature performance that is optimum for this particular refrigerating plant. See parameter (n07).
- **Fastest** possible cooling
- Cooling with **less** underswing
- Cooling where underswing is **unwanted.**



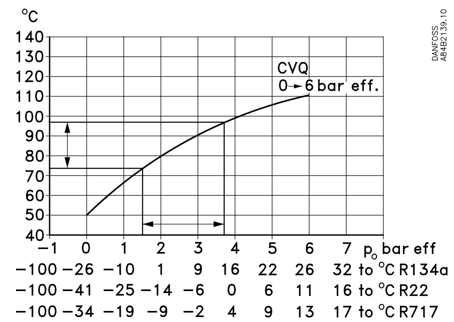
Regulation ICS/PM with CVQ
The controller receives signals from room sensor S_{air}. This room sensor must be placed at the air outlet from the evaporator to obtain the best possible regulation. The controller sees to it that the required room temperature is maintained.
Built-in between the controller and the actuator is a so-called inner control loop which constantly checks the temperature (pressure) in the actuator's pressure vessel. In this way a very stable control system is obtained.
If there is a deviation between the required and the registered temperature the controller will immediately send more or fewer pulses to the actuator to counteract the error. A change of the number of pulses will act on the temperature and hence the pressure in the pressure vessel. As the charging pressure and the evaporating pressure p_0 follow each other, a changed charging pressure will produce the effect that the valve's opening degree is also changed. The ICS/PM with CVQ system maintains the pressure in the evaporator whatever pressure changes there may be on the suction side (on the ICS/PM valve's outlet).



Evaporating pressure limitation (p_0 limitation)
The inner control loop mentioned above also causes the evaporating pressure to stay within a fixed limit. In this way the system is safeguarded against a too low supply air temperature.
It offers the following advantages:
- High-temperature systems can be connected to low-temperature compressor units
- Protection against icing on evaporator
- Frost protection of liquid coolers

The allowed temperature in the actuator determines the evaporating pressure

Actuator temperature



Regulation with ICM
When using ICM as selected valve the system will still control ICM in order to maintain S_{air} according to entered setpoint.
This system does not inlude any inner control loop.
It is a direct operating and pressure independent valve for controlling media temperatur. (S_{air}).

Survey of functions

Function	Para-meter	Parameter by operation via data communication
Normal display		

Normally S_{air} (017=Air) will be shown as running display value. If lower button is activated S_{aux} will be displayed for 5 sec, and then return to S_{air}
 	
If (017=Au) Saux will be shown as running display value. If lower button is activated Sair will be displayed for 5 sec, and then return to Saux
 	
If ICM has been selected (n03=6)
If (017=Air) S_{air} (017=Air) will be shown as running display value. If lower button is activated OD (u24) will be displayed for 5 sec, and then return to S_{air}.
If (017=Au) OD (u24) will be shown as running display value. If lower button is activated S_{air} will be displayed for 5 sec, and then return to OD (u24)
		Air temp.

Reference		
Setpoint Regulation is performed based on the set value provided that there is no external contribution (o10). (Push both buttons simultaneously to set the setpoint).	-	SP Temp.
Temperature unit Here you select whether the controller is to indicate the temperature values in °C or in °F. If indication in °F is selected, other temperature settings will also change over to Fahrenheit, either as absolute values or as delta values.	r05	Temp unit °C=0, °F=1 (In AKM only °C is displayed whatever the setting)
External contribution to the setpoint This setting determines how large a contribution (in °C/°F) is to be added to the set setpoint when the input signal is max. (20 mA).	r06	Ext. Ref.off set (°C/°F)
Correction of signal from S_{air} (Compensation possibility through long sensor cable).	r09	Adjust S_{Air} (°C/°F)
Correction of signal from S_{aux} (Compensation possibility through long sensor cable).	r10	Adjust S_{Aux} (°C/°F)
Start/stop of refrigeration With this setting refrigeration can be started and stopped. Start/stop of refrigeration can also be accomplished with the external switch function. See also appendix 1.	r12	Main Switch
Alarm		
The controller can give alarm in different situations. When there is an alarm all the light-emitting diodes (LED) will flash on the controller front panel, and the alarm relay will cut in.		
Alarm for upper deviation The alarm for too high S_{air} temperature is set here. The value is set in Kelvin. The alarm becomes active when the S_{air} temperature exceeds the actual reference plus A01. (The actual reference (SP + r06) can be seen in u02).	A01	Upper deviation
Alarm for lower deviation The alarm for too low S_{air} temperature is set here. The value is set in Kelvin. The alarm becomes active when the S_{air} temperature drops below the actual reference minus A02. If a low temperature alarm is detected (A2 alarm) the solenoid valve in the liquid line (Digital output on terminal 9 and 10) will be closed	A02	Lower deviation
Alarm delay If one of the two limit values is exceeded, a timer function will commence. The alarm will not become active until the set time delay has been passed. The time delay is set in minutes.	A03	Temp alarm delay
		With data communication the importance of the individual alarms can be defined. Setting is carried out in the "Alarm destinations" menu. See also page 10.
Control parameters		
Actuator's max. temperature Set the temperature (°C) the actuator is to have at the limit of the regulating range. The setting ensures that the actuator will not become superheated and work itself away from the regulating range. Due to tolerances in the actuator the value must be set 10K higher than indicated in the curves on page 11.	n01	Q-max. temp.
Actuator's min. temperature Set the temperature (°C) the actuator will have at the limit of the regulating range. The setting ensures that the actuator will not become too cold and work itself away from the regulating range. Due to tolerances in the actuator the value must be set 10K lower than indicated in the curves on page 11.	n02	Q-min. temp.

Actuator type Here you define the actuator mounted in the system: 1: CVQ -1-5 bar 2: CVQ 0-6 bar 3: CVQ 1.7-8 bar 4: CVMQ 5: KVQ 6: ICM	n03	Valve type
P: Amplification factor Kp If the Kp value is reduced the regulation becomes slower.	n04	Kp factor
I: Integration time Tn The I-setting can be cancelled by setting the value to max. (600s). If it is set to 600s, parameter n07 must be set to "0". (If the Tn value is increased the regulation becomes slower).	n05	Tn sec.
D: Differentiation time Td The D-setting can be cancelled by setting the value to min. (0).	n06	Td sec.
Transient phenomenon If the refrigeration requires a very fast transient phenomenon or must not have an underswing or temperature shift, this function can be used. (see page 4) 0: Ordinary regulating technique 1: Fast building-up where a minor underswing is allowed 2: Not quite so fast building-up, but without underswing	n07	Q-ctrl. mode
OD - Opening degree Max. Limitation - ICM only When ICM has been selected (n03=6) the Maximum OD can be entered. ICM will never go above this value. (If n32=n33, ICM is forced to this value)	n32	ICM OD Max.
OD - Opening degree Min. Limitation - ICM only When ICM has been selected (n03=6) the Minimum OD can be entered. ICM will never go below this value. (If n32=n33, ICM is forced to this value)	n33	ICM OD Min.
Miscellaneous		

Output signal
The controller can transmit a current signal via the analog output (terminal 2 and 5). Range of current signal can be selected below:
If (017=Air) Sair will send out to the analog output.
If (017=Au) Saux will send out to the analog output
S_{air}/S_{aux} min. value (0 or 4 mA) will correspond to the setting in "o27"
S_{air}/S_{aux} max. value (20 mA) will correspond to the setting in "o28"
If ICM has been selected (n03=6)
OD (u24) to control ICM, is send out to the analog output
(o27) and (o28) is not active
Range for current signal:
0: No output signal
1: 4-20 mA
2: 0-20 mA
	o09	AO type

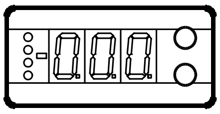
Input signal If you wish to connect a signal that is to displace the controller's control reference, the signal must be defined in this menu. 0: No signal 1: 4-20 mA 2: 0-20 mA (4 or 0 mA will not give a displacement. 20 mA will displace the reference by the value set in menu r06).	o10	AI type
Data communication If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be made when a data communication module has been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC8AC".		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60	o03	-
The address is sent to the gateway when the menu is set in pos. ON (The setting will automatically change back to Off after a few seconds.)	o04	-
Language This setting is only required if data communication is connected to the controller. Settings: 0=English, 1=German, 2=French, 3=Danish, 4=Spanish and 6=Swedish When the controller is operated via data communication, the texts in the right-hand column will be shown in the selected language. When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	o11	Language
Frequency Set the net frequency.	o12	50 / 60 Hz (50=0, 60=1)

Selection of running display value
If S_{air} (017=Air) will be shown as running display value. If lower button is activated S_{aux} will be displayed for 5 sec, and then return to S_{air}
S_{air} will send out to the analog output. See also (o09),(o27),(o28)
 	
If (017=Au) S_{aux} will be shown as running display value. If lower button is activated S_{air} will be displayed for 5 sec, and then return to S_{aux}
S_{aux} will send out to the analog output. See also (o09),(o27),(o28)
 	
If ICM has been selected (n03=6)
If (017=Air) S_{air} (017=Air) will be shown as running display value. If lower button is activated OD (u24) will be displayed for 5 sec, and then return to S_{air}
 	
If (017=Au) OD (u24) will be shown as running display value. If lower button is activated S_{air} will be displayed for 5 sec, and then return to OD (u24)
	o17	Display Aux/Air
		Aux =0
		Air = 1

(Setting for the function o09) Set the temperature value where the output signal must be minimum (0 or 4 mA)	o27	Temp. at AO min.
(Setting for the function o09) Set the temperature value where the output signal must be maximum (20 mA). (With a temperature range of 50°C (differential between the settings in o27 and o28) the dissolution will be better than 0.1 °C. With 100°C the dissolution wil be better than 0.2°C.)	o28	Temp. at AO max.
Service		
A number of controller values can be printed for use in a service situation		
Read the temperature at the S_{air} sensor (calibrated value)	u01	Air temp.
Read the control reference (Setpoint + any contribution from external signal)	u02	Air reference
Read temperature at the S_{aux} sensor (calibrated value) (This showing can also be uploaded from the normal display, if you push the lowermost button for almost a second)	u03	Aux. temp.
Read valve's actuator temperature	u04	Actuator temp.
Read reference for valve's actuator temperature	u05	Actuator Ref.
Read value of external current signal	u06	AI mA
Read value of transmitted current signal	u08	AO mA
Read status of input DI (start/stop input)	u10	DI
ICM opening degree. Only active if (n03)=6	u24	OD%
	--	DO1 Alarm Read status of alarm relay
	--	DO2 Cooling Read status of relay for solenoid valve
	--	DO3 Fan Read status of relay for fan
Operating status		
Operating status of the controller can be called forth in the display. Push briefly (1s) the upper button. If there is a status code, it will be shown on the display. (Status codes have lower priority than alarm codes. In other words, you cannot see a status code, if there is an active alarm). The individual status codes have the following meanings:		EKC State (0 = regulation)
S10: Refrigeration stopped by the internal or external start/ stop		10
S12: Refrigeration stopped due to low S_{air}		12

Operation

Display
The values will be shown with three digits, and with a setting you can determine whether the temperature is to be shown in °C or in °F.

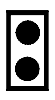


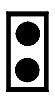
Light-emitting diodes (LED) on front panel
There are LED's on the front panel which will light up when the corresponding relay is activated.
The three lowest LED's will flash, if there is an error in the regulation.
In this situation you can upload the error code on the display and cancel the alarm by giving the uppermost button a brief push.

The controller can give the following messages:		
E1	Error message	Errors in the controller
E7		Cut-out S_{air}
E8		Shortcircuited S_{air}
E11		Valve's actuator temperature outside its range
E12		Analog input signal is outside the range
A1	Alarm message	High-temperature alarm
A2		Low-temperature alarm

The buttons
When you want to change a setting, the two buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously.

 Gives access to the menu (or cutout an alarm)

 Gives access to changes

 Saves a change

Examples of operations

Set set-point
1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Set one of the other menus
1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Menu survey

SW =1.5x

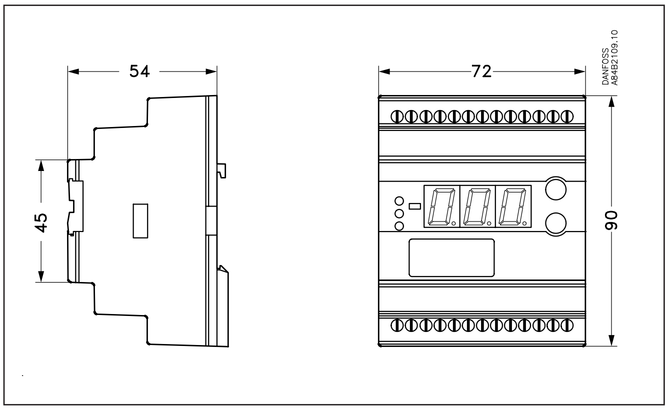
Function	Parameter	Min.	Max.	Fac. setting
Normal display				
Shows the temperature at the selected sensor At ICM valve OD also can be selected	-		°C	
Reference				
Set the required room temperature	-	-70°C	160°C	10°C
Temperature unit	r05	°C	°F	°C
Input signal's temperature influence	r06	-50°C	50°C	0.0
Correction of the signal from S_{air}	r09	-10,0°C	10,0°C	0.0
Correction of the signal from S_{aux}	r10	-10,0°C	10,0°C	0.0
Start/stop of refrigeration	r12	OFF/0	On/1	On/1
Alarm				
Upper deviation (above the temperature setting)	A01	0	50 K	5.0
Lower deviation (below the temperature setting)	A02	0	50 K	5.0
Alarm's time delay	A03	0	180 min	30
Regulating parameters				
Actuator max. temperature	n01	41°C	140°C	140
Actuator min. temperature	n02	40°C	139°C	40
Actuator type (1=CVQ-1 to 5 bar, 2=CVQ 0 to 6 bar, 3=CVQ 1.7 to 8 bar, 4= CVMQ, 5=KVQ, 6= ICM)	n03	1	6	2
P: Amplification factor Kp	n04	0,5	50	3
I: Integration time Tn (600 = off)	n05	60 s	600 s	240
D: Differentiation time Td (0 = off)	n06	0 s	60 s	10
Transient phenomenon 0: Ordinary control 1: Underswing minimised 2: No underswing	n07	0	2	2
OD - Opening degree - max. limit - ICM only	n32	0%	100%	100
OD - Opening degree min limit - ICM only	n33	0%	100%	0
Miscellaneous				
Controller's address (0-120)	o03*	0	990	0
ON/OFF switch (service-pin message)	o04*	-	-	
Define output signal of analog output: 0: no signal, 1: 4 - 20 mA, 2: 0 - 20 mA	o09	0	2	0
Define input signal of analog input 0: no signal, 1: 4 - 20 mA, 2: 0 - 20 mA	o10	0	2	0
Language (0=english, 1=German, 2=French, 3=Danish, 4=Spanish and 6=Swedish.)When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	011*	0	6	0
Set supply voltage frequency	o12	50 Hz/0	60 Hz/1	0
Select of running display value	o17	Au/0	Air/1	Air/1
(Setting for the function o09) Set the temperature value where the output signal must be minimum (0 or 4 mA)	o27	-70°C	160°C	-35
(Setting for the function o09) Set the temperature value where the output signal must be maximum (20 mA)	o28	-70°C	160°C	15
Service				
Read temperature at the S_{air} sensor	u01		°C	
Read regulation reference	u02		°C	
Read temperature at the S_{aux} sensor	u03		°C	
Read valve's actuator temperature	u04		°C	
Read reference of the valve's actuator temperature	u05		°C	
Read value of external current signal	u06		mA	
Read value of transmitted current signal	u08		mA	
Read status of input DI	u10		on/off	
ICM opening degree. (only at ICM)	u24		%	

*) This setting will only be possible if a data communication module has been installed in the controller.

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 80 VA (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller Actuator	5 VA 75 VA
Input signal	Current signal	4-20 mA or 0-20 mA
	Digital input from external contact function	
Sensor input	2 pcs. Pt 1000 ohm	
Output signal	Current signal	4-20 mA or 0-20 mA Max. load: 200 ohm
Relay output	2 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarm relay	1 pcs. SPST	
Actuator	Input	Temperature signal from sensor in the actuator
	Output	Pulsating 24 V a.c. to actuator
Data communication	Possible to connect a data communication module	
Ambient temperature	During operation During transport	-10 - 55°C -40 - 70°C
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2.5 mm^2 multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN50081-1 and EN 50082-2	



Ordering

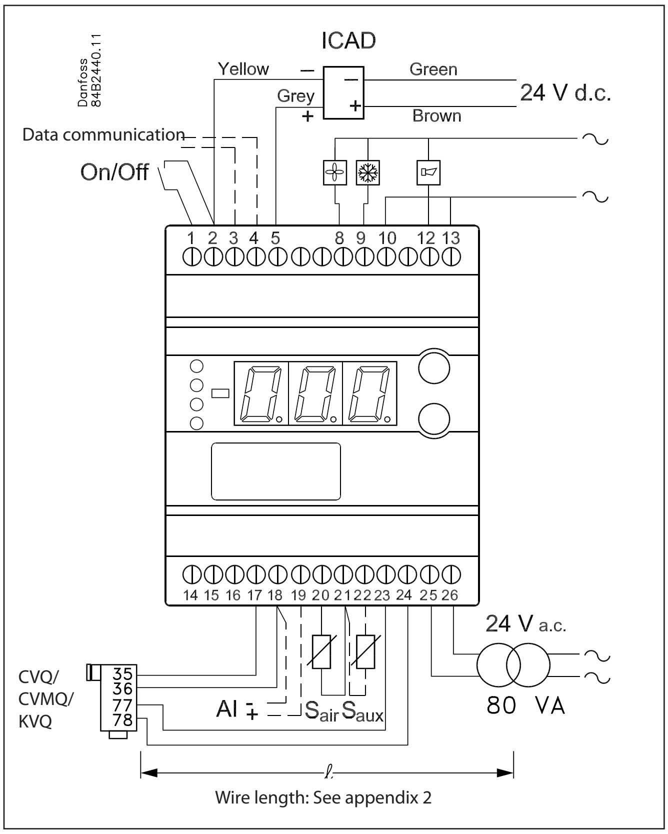
Type	Function	Code No.
EKC 361	Evaporating pressure controller	**084B7060**
EKA 173	Data communication module (accessories), (FTT 10 module)	**084B7092**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

Temperature sensor Pt 1000 ohm:..........Kindly refer to catalogue RK0YG...
Valves: ....Kindly refer to catalogue RK0YG...

Connections

Necessary connections
Terminals:
25-26 Supply voltage 24 V a.c.
17-18 Signal from actuator (from NTC)
23-24 Supply to actuator (to PTC)
20-21 Pt 1000 sensor at evaporator outlet
1-2 Switch function for start/stop of regulation. If a switch is not connected, terminals 1 and 2 must be shortcircuited.

Application dependent connections
Terminal:
12-13 Alarm relay
There is connection between 12 and 13 in alarm situations and when the controller is dead
8-10 Relay switch for start/stop of fan
9-10 Relay switch for start/stop of solenoid valves
18-19 Current signal from other regulation (Ext.Ref.)
21-22 Pt 1000 sensor for monitoring
2-5 Current output for Sair/Saux temperature or ICAD actuator for ICM valve
3-4 Data communication
Mount only, if a data communication module has been mounted.
It is <u>important</u> that the installation of the data communication cable be done correctly. Cf. separate literature No. RC8AC..

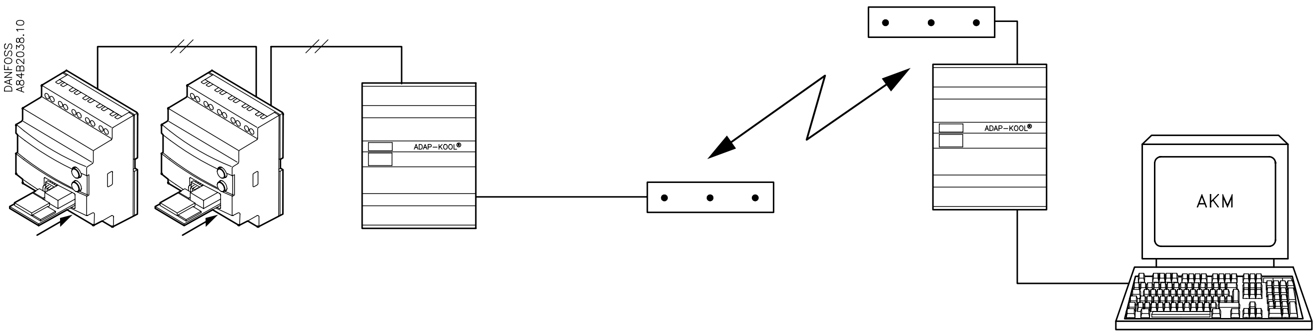


Data communication

This page contains a description of a few of the possibilities you will have when the controller is provided with data communication.

If you want to know more about operation of controllers via PC, you may order additional literature.

Examples



Each controller is provided with a plug-in module.

The controllers are then connected to a two-core cable.

The cable can be connected to a gateway type AKA 245.

This gateway will now control the communication to and from the controllers.

It will collect temperature values and it will receive alarms. When there is an alarm the alarm relay will be activated for two minutes

The gateway can now be connected to a modem.

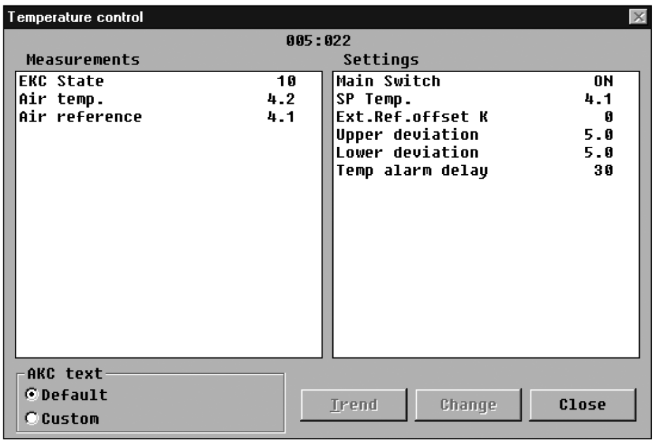
When an alarm occurs from one of the controllers, the gateway will - via the modem - make a phone call to the service company.

At the service company a modem, gateway and PC with system software type AKM have been installed.

All the controllers' functions can now be operated from the various menu displays.

The programme will for example upload all the collected temperature values once a day.

Example of menu display



- Measurements are shown at one side and settings at the other.
- You will also be able to see the parameter names of the functions on page 5-7.
- With a simple change-over the values can also be shown in a trend diagram.
- If you wish to check earlier temperature measurements, you can see them in the log collection.

Alarms

If the controller is extended with data communication, it will be possible to define the importance of the transmitted alarms.
The importance is defined with the setting: 1, 2, 3 or 0. When the alarm then arises at some time, it will result in one of the following activities:

1 = Alarm
The alarm message is sent off with alarm status 1. This means that the gateway that is the master in the system will have its alarm relay output activated for two minutes. Later, when the alarm ceases, the alarm text will be retransmitted, but now with status value 0.

2 = Message
The alarm text is transmitted with status value 2. Later, when the "message" lapses, the alarm text is retransmitted, but now with status value 0.

3 = Alarm
As "1", but the master gateway's relay output is not activated.

0 = Suppressed information
The alarm text is stopped at the controller. It is transmitted nowhere.

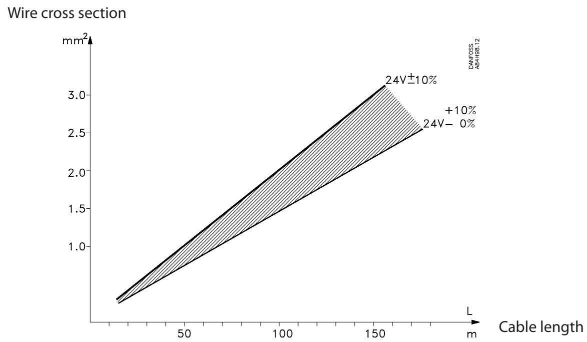
Appendix 1

Interaction between internal and external start/stop functions and active functions.

Internal Start/stop	Off	Off	On	On
External Start/stop	Off	On	Off	On
Refrigeration	Off			On
Actuator	Stand-by			Regulating
Actuator temperature	"n02"			"n02" to "n01"
Fan relay	Off			On
Expansion valve relay	Off			On
Temperature monitoring	No			Yes
Sensor monitoring	Yes			Yes

Appendix 2

Cable length for the CVQ actuator
The actuator must be supplied with 24 V a.c. ± 10%.
To avoid excessive voltage loss in the cable to the actuator, use a thicker cable for large distances.



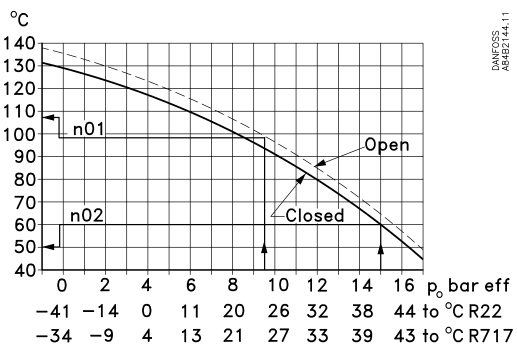
Appendix 3

Connection between the evaporating temperature and the actuator's temperature (the values are approximate).

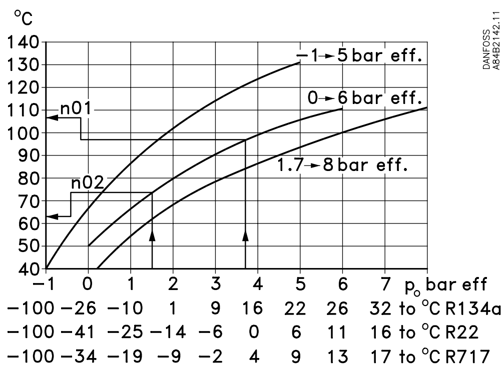
n01: The highest regulated room temperature will have a belonging t_o value which in turn indicates the value of the n01 setting. Due to tolerances in the actuator, the setting value must be 10 K **higher** than shown in the curve.

n02: The lowest occurring suction pressure will have a belonging t_o value which in turn indicates the value of the n02 setting. Due to tolerances in the actuator, the setting value must be 10 K **lower** than shown in the curve.

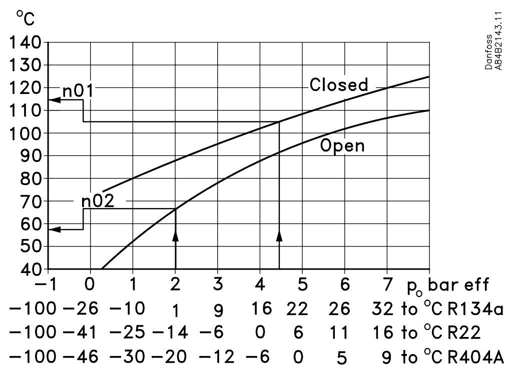
CVMQ



CVQ



KVQ



Start of controller

When the electric wires have been connected to the controller, the following points have to be attended to before the regulation starts:

1. Switch off the external ON/OFF switch that starts and stops the regulation.
2. Follow the menu survey on page 7, and set the various parameters to the required values.
3. Switch on the external ON/OFF switch, and regulation will start.
4. If the system has been fitted with a thermostatic expansion valve, it must be set to minimum stable superheating. (If a specific T0 is required for the adjustment of the expansion valve, the two setting values for the actuator temperature (n01 and n02) can be set to the belonging value while the adjustment of the expansion valve is carried out. Remember to reset the values).
5. Follow the actual room temperature on the display. (On terminals 2 and 5 a current signal can be transmitted which represents the room temperature. Connect a data collection unit, if applicable, so that the temperature performance can be followed).

If the temperature fluctuates

When the refrigerating system has been made to work steadily, the controller's factory-set control parameters should in most cases provide a stable and relatively fast regulating system.
If the system on the other hand oscillates, you must register the periods of oscillation and compare them with the set integration time T_n, and then make a couple of adjustments in the indicated parameters.

If the time of oscillation is longer than the integration time:
($T_p > T_n$, (T_n is, say, 4 minutes))
1. Increase T_n to 1.2 times T_p
2. Wait until the system is in balance again
3. If there is still oscillation, reduce K_p by, say, 20%
4. Wait until the system is in balance
5. If it continues to oscillate, repeat 3 and 4

If the time of oscillation is shorter than the integration time:
($T_p < T_n$, (T_n is, say, 4 minutes))
1. Reduce K_p by, say, 20% of the scale reading
2. Wait until the system is in balance
3. If it continues to oscillate, repeat 1 and 2

Trouble shooting - ICS/PM with CVQ

In addition to the error messages transmitted by the controller, the table below may help identifying errors and defects.

Symptom	Defect	Confirmation of defect
Media temperature too low. Actuator feels cold.	Short-circuited NTC resistor in actuator.	If less than 100 ohm is measured across terminals 17 and 18 (disassemble the lead), the NTC or the leads are short-circuited. Check the leads.
	Defective PTC resistor (heating element) in actuator.	If more than 30 ohm or 0 ohm is measured across terminal 23 and 24 (disassemble the lead), either the PTC or the leads are defective. Check the leads.
Media temperature too low. Actuator fells warm.	Undersized cable to CVQ.	Measure voltage across terminanls 77 and 78 (min. 18 V a.c.). Measure resistance in power cables to CVQ (max. 2 ohm)
	Undersized 24 V transformer.	Measue voltage across transformer output terminals (24 V a.c. +10/ -15%) under all working conditions. If voltage drops under some working conditions the transformer is undersized.
	Loss of charge in actuator.	Replace actuator.
Media temperature too high. Actuator feels cold.	Fault in refrigerant plant.	Examine platn for ther defects.
Media temperature too high. Actuator feels warm.	Cut out NTC resistor in actuator.	If more than 200 kohm is measured across terminals 17 and 18 (disassemble the lead), either the NTC or leads are disconnected. Check the leads.

Fine adjustments

When the system has been operating for a while, it may be required for some systems to optimise some of the adjustments. Below we have a look at settings having an influence on the speed and accuracy of the regulation.

Adjustment of the actuator's min. and max. temperatures
At the first setting these values were set to 10 K outside of the expected temperature in order to eliminate the tolerances in the actuator. By adjusting the two values to the values where the valve is exactly in mesh, the valve will all the time remain active in its regulation.
If the actuator is replaced at a later date, this procedure must be repeated for the new actuator.

Min.
By adjusting the actuator's min. temperature you obtain a limit for how low a pressure can occur in the evaporator (the point is where the valve starts a limitation of the refrigerant flow).
The system must be put in an operating situation where max. capacity is called for (large refrigeration need).
The min. temperature must now be changed upwards step by step, at the same time as the evaporating pressure is read on the system's manometer.
When a change of the evaporating pressure is registered, this is the point where the valve is exactly in mesh. (If frost protection is required for the system, the value can be raised to the belonging value).

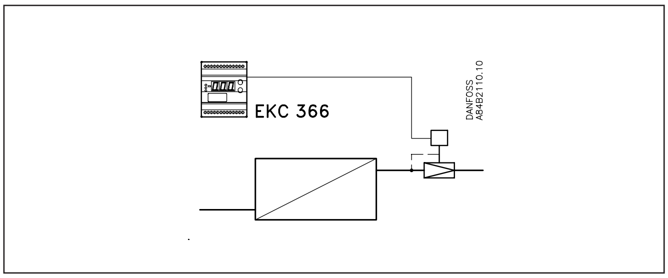
Max.
By adjusting the actuator's max. temperatur you obtain a limit for how high a pressure can occur in the evaporator (the refrigerant flow is blocked completely).
The system is put in an operating situation where there is no call for refrigeration capacity (no refrigerant flow).
The max. temperature is now changed downwards step by step, at the same time as the evaporating pressure is read on the system's manometer.
When a change of the evaporating pressure is registered, this is the point where the valve opens. Adjust the setting a little upwards, so that the valve will again close completely for the refrigerant flow. (If the actual application has a requirement regarding max. evaporating pressure, a lower setting may of course be selected, so that the pressure is limited).

Method for fixing Kp, Tn and Td
Described below is a method (Ziegler-Nichols) for fixing Kp, Tn and Td.

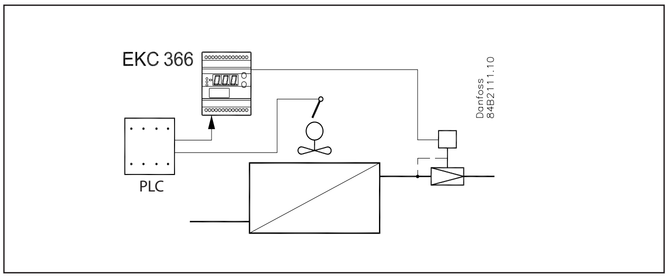
1. The system is made to regulate the temperature at the required reference with a typical load. It is important that the valve regulates, and that it is not fully open.
2. Parameter u05 is read. The actuator's min. and max. setting is adjusted, so that the average of the min. and max. values is equal to the read u05.
3. The controller is set, so that it will regulate as a P-controller. (Td is set to 0, Tn in pos. OFF (600), and Q-Ctrl.mode is set at 0).
4. The stability of the system is examined by stopping the system for, say, one minute (using the start/stop setting or the switch). Now check how the building-up of the temperature proceeds. If the building-up peters out, raise Kp a little and repeat the start/stop operation. Continue with this until you obtain a building-up which does **not** peter out.
5. Kp is in this case the critical amplification ($Kp_{critical}$) and the building-up time for the continued oscillation is the critical building-up time ($T_{critical}$).
6. Based on these values, the regulating parameters can now be calculated and subsequently set:
   - If PID regulation is required:
     $Kp < 0.6x\ Kp_{critical}$
     $Tn > 0.5x\ T_{critical}$
     $Td < 0.12x\ T_{critical}$
   - If PI regulation is required:
     $Kp < 0.45x\ Kp_{critical}$
     $Tn > 0.85x\ T_{critical}$
7. Reset the values for the controller's min. and max. temperatures and Q-Ctrl.mode.

Introduction

Application
The controller is used for regulating a valve in a refrigerating system - for example in connection with:
• Long-term storage of fruits and vegetables
• Refrigerating plant
• Brewery systems
• Processing plant



Here the controller has been specially designed for the following functions:
• *Maintenance of a constant evaporating pressure*
A temperature sensor in the valve's actuator will regulate its temperature. This temperature is an indication of the pressure in the valve, and the interface module will keep this temperature constant.
• *The media temperature is regulated by a PLC or similar device.*
Here the interface module receives a variable signal from the PLC and will subsequently regulate the valve, so that the refrigeration will be as accurate as possible.



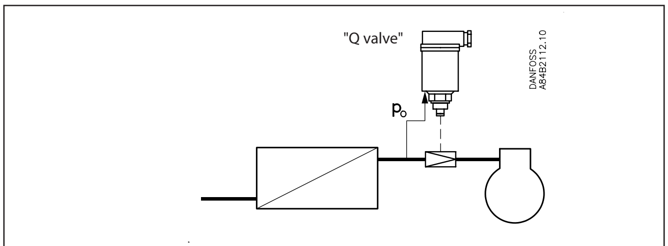
System

The controller must always be used in conjunction with a pilot valve of the types shown here.
The most commonly used one is pilot valve CVQ in conjunction with main valve PM3 (sketched out above).

Valve types:
- CVQ + PM
- KVQ
- TQ
- PHTQ
- TEAQ
- CVMQ

Function

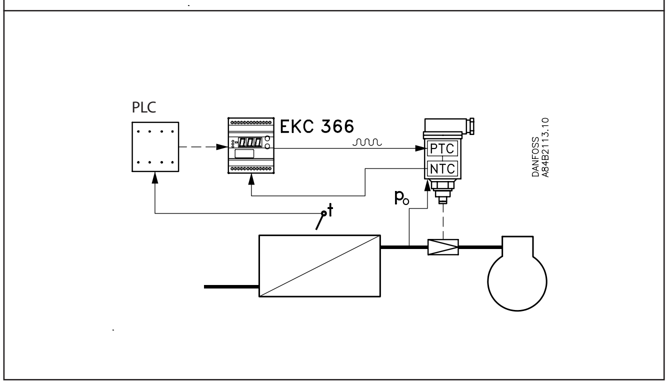
The valve constantly receives feedback of the pressure in the evaporator. Whatever the variations in the suction pressure from the compressor, this feedback will produce the result that the evaporating pressure is kept constant.



In conjunction with the controller, an electronic constant-pressure valve is thus obtained.

Inserted between the controller and the actuator is a so-called inner regulating loop. This loop will - via an NTC resistance - constantly control the temperature in the actuator.

In an application where a PLC or similar device is used for regulating a media temperature, the regulating system will in this way be supplied with an outer regulating loop - which will result in great regulating accuracy.



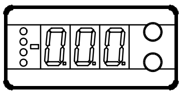
Electronic controls and transmitters

Survey of functions

Function	Para-meter	Parameter by operation via data communication
Temperatur**e regulation**		**Actuator temperature**
Display of valve temperature The display constantly shows the valve's temperature. The display is filtered over a period of approx. 10 seconds	-	Actuator temp.
Valve's basic temperature reference This temperature setting is the valve's basic setting. At this value no signal must be received from an external regulation. The setting value is taken from one of the curves shown and may be fine-adjusted later when the valve has reached the temperature (read the manometer in the system). (Push both buttons simultaneously to set the menu)	-	SP Temp.
Temperature **uni**t Set here whether the controller is to show the temperature values in °C or in °F. If indication in °F is selected, other temperature settings will also change over to Fahrenheit, either as absolute values or as delta values.	r05	Temp. unit (°C=0, °F=1) (In AKM only °C is displayed, whatever the setting).
Input signal's temperature influence This setting determines how much the input signal has to raise the temperature in the valve. You should aim at selecting the value, so that the valve can close at the highest occurring evaporating pressure when the input signal is maximum (value to be set in Kelvin)	r06	Ext.Ref.offset K
Reference The valve's temperature is regulated on the basis of the basic setting plus the signal from the external regulation. (Reference = SP Temp + percentage of "r06".) The reference can be seen when you push the lower of the two buttons	-	Actuator Ref.
Sundry configurations		**Miscellaneous**
External signal Here you set the signal that is to be connected to the controller. 0: no signal 1: 4-20 mA 2: 0-20 mA 3: 0-10 V 4: 2-10 V	o10	AI Type
Frequency Set network frequency	o12	50 / 60 Hz (50=0, 60=1)
Data communication If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be madewhen a data communication modulehas been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC.8A.C".		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60	o03	
The address is sent to the gateway when the menu is set in pos. ON	o04	
Language This setting is only required when data communication is connected to the controller. Settings: 0=English, 1=German, 2=French, 3=Danish, 4=Spanish, and 6= Swedish When the controller is operated via data communication, the texts in the right-hand column will be shown in the selected language. When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	o11	Language
Service		
The signal will be constantly updated. If you wish to follow the signal beyond the 20 seconds, the time-out period, push one of the two buttons before the time-out period expires		
External current signal Here you can read the value of the current signal received by the controller at its input	u06	AI mA
External voltage signal Here you can read the value of the voltage signal received by the controller at its input	u07	AI Volt

Operation

Display
The values will be shown with three digits, and with a setting you can determine whether they are to be shown in °C or in °F.



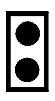
LED's on the front panel
There is one LED on the front panel which will light up when power is sent to the pilot valve.
There are furthermore three LED's which will flash if there is an error in the regulation. In this situation you can show the error code on the display and cut out the alarm by giving the upper button a brief push.

The controller can give the following messages:	
E1	Errors in the controller
E11	Valve's actuator temperature outside its range
E12	Input signal outside its range

The buttons
When you want to change a setting, the two buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously.

 Gives access to the menu

 Gives access to changes

 Saves a change

Examples of operations

Set the valve's basic temperature reference
1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Read the valve's regulating reference
1. Push the lower button
   (After approx. 20 seconds the controller automatically returns to its setting, and it again shows the valve's actual temperature)

Set one of the other menus
1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Menu survey

SW =1.2x

Function	Parameter	Min.	Max.
Read valve's actual temperature (standard display)	-		°C
Set valve's basic temperature reference	-	40.0°C	140°C
Read valve's regulation reference	-		°C
Select temperature unit (°C/°F)	r05	°C	°F
Input signal's temperature influence	r06	-99.9 K	99.9 K
Controller's address	o03*	1	60
ON/OFF switch (service-pin message)	o04*	-	-
Define input signal 0: no signal 1: 4 - 20 mA 2: 0 - 20 mA 3: 0 - 10 V 4: 2 - 10 V	o10	0	4
Language (0=English, 1=German, 2=french, 3=Danish, 4=Spanish, 6=Swedish). When you change this setting you must also activate o04.	011*	0	6
Set supply voltage frequency	o12	50 Hz	60 Hz
Service information			
Read value of external current signal	u06		mA
Read value of external voltage signal	u07		V

*) This setting will only be possible if a data communication module has been installed in the controller.

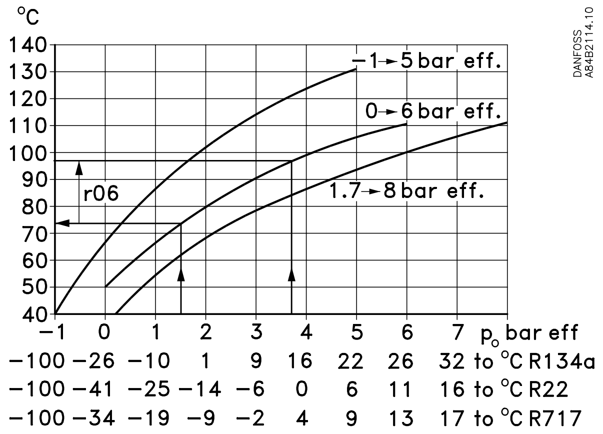
Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Valve's working temperature

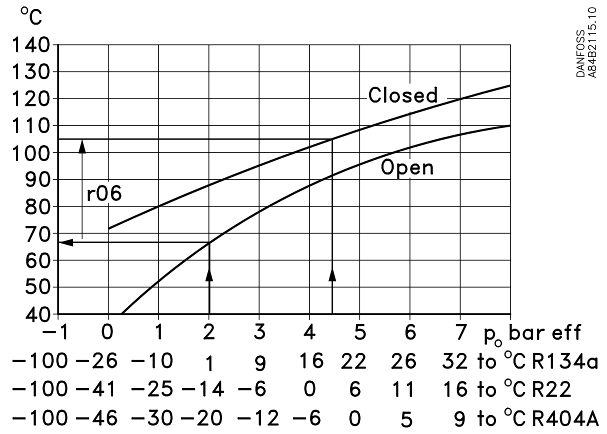
Without external signal
The working temperature must be set on the basis of one of the following curves. Find the actuator temperature corresponding to the required evaporating temperature (push). Set the value in the controller as mentioned under "Set the valve's basic temperature reference".

With external signal
If the valve is to be operated with an external signal, two settings have to be made. One is as mentioned to the left, and the other determines how much the signal must be able to raise the temperature in the valve. This value is also read on one of the following curves.
Set the value in the r06 menu.
If the set value is too low, the valve will not be able to close/open fully.

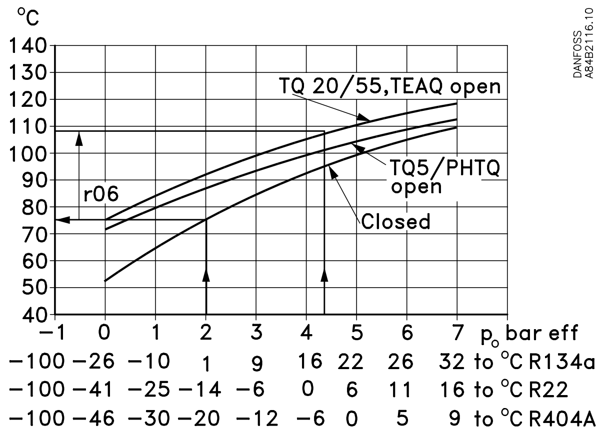
CVQ



KVQ

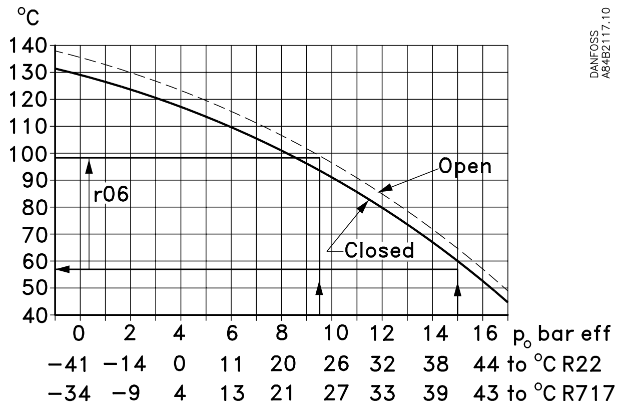


TQ



All the curves shown are approximate.

CVMQ



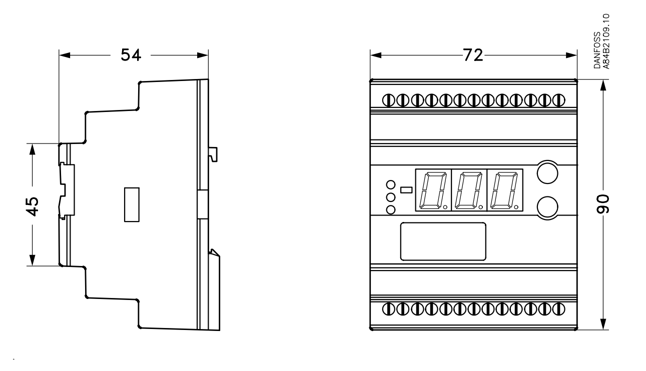
The two curves are shown with the valve's spring setting equal-ling the factory setting. If the spring setting is changed to a higher pressure, the curve will be displaced correspondingly to a higher temperature.

Example
CVQ type = 0-6 bar
Refrigerant = R_{717}
A constant evaporating temperature or input pressure to the valve of -9°C (2 bar) is required.
According to the CVQ curve this will require a temperature in the actuator of 80°C.
Set the valve's basic temperature reference at 80°C.

When the valve has reached its working temperature, it may be necessary to fine-adjust the setting from the system's manometer.

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 80 VA (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller Valve	5 VA 75 VA
Input signal	4-20 mA, 0-20 mA, 0-10V d.c. or 2-10 V d.c.	
Actuator	Input	Temperature signal from sensor in actuator
	Output	Pulsating 24 V a.c. to actuator
Data communication	Possible to connect a data communication module	
Ambient temperature	During operation During transport	-10 - 55°C -40 - 70°C
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2.5 mm^2 multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN 50081-1 and EN 50082-2	



Ordering

Type	Function	Code No.
EKC 366	Interface module	**084B7076**
EKA 173	Data communication module (accessories), (FTT 10 module)	**084B7092**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

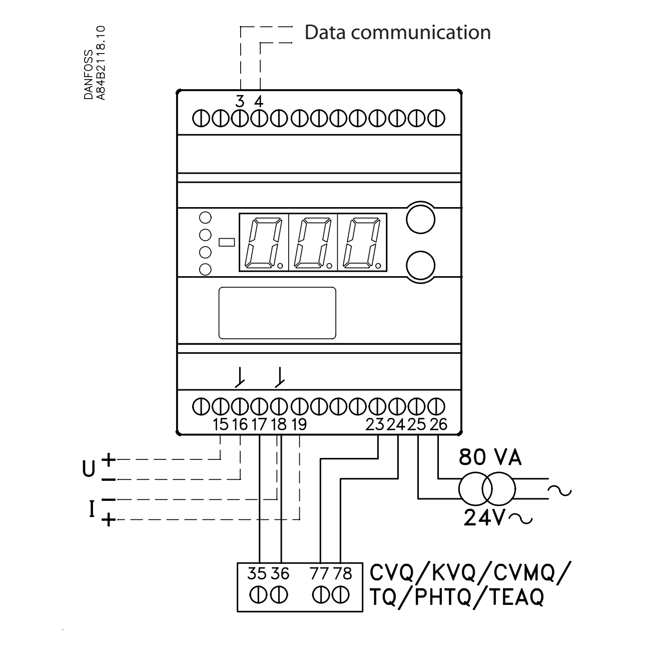
Valves: Kindly refer to catalogue RK0YG

Connections

Necessary connections
Terminals:
25-26 Supply voltage 24 V a.c. 80 VA
17-18 Signal from NTC sensor in valve
23-24 Supply to valve's PTC resistance

Control signal, if applicable (see also o10)
Either terminals:
15-16 Voltage signal
or
18-19 Current signal

Data communication, if applicable
Terminals:
3-4 Mount only, if a data communication module has been mounted.
It is <u>important</u> that the installation of the data communication cable be done correctly. Cf. separate literature No. RC.8A.C...

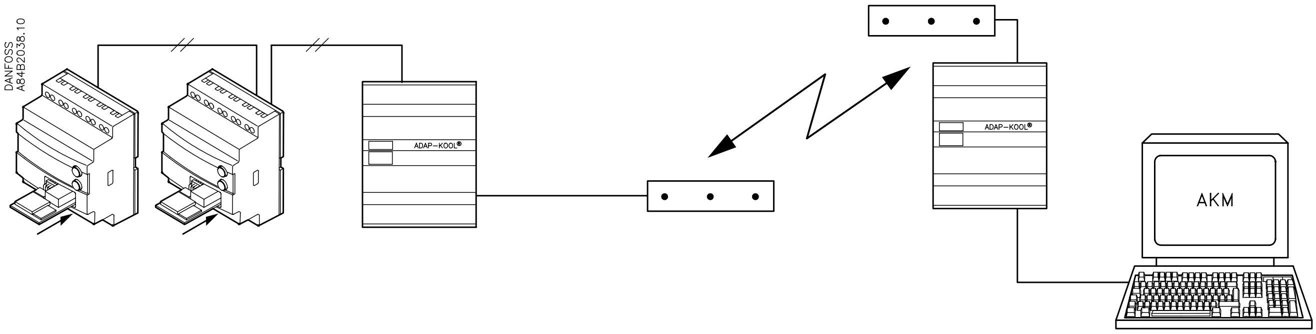


Data communication

This page contains a description of a few of the possibilities you will have when the controller is provided with data communication.

If you want to know more about operation of controllers via PC, you may order additional literature.

Examples



Each controller is provided with a plug-in module.

The controllers are then connected to a two-core cable.

Up to 60 controllers may be connected to one cable.

This cable is also connected to a gateway type AKA 243.

This gateway will now control the communication to and from the controllers.

It will collect temperature values and it will receive alarms. When there is an alarm the alarm relay will be activated for two minutes

The gateway can now be connected to a modem.

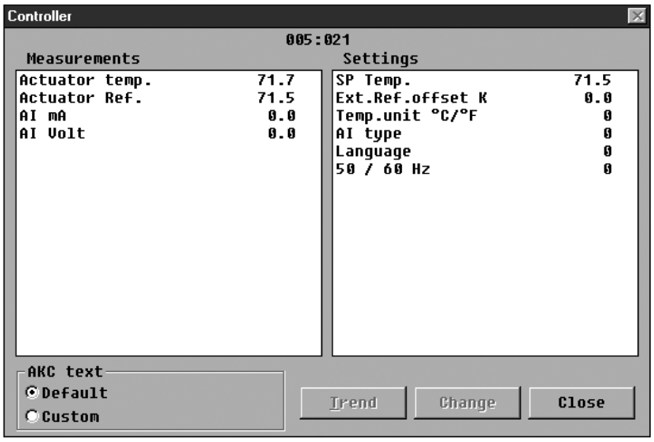
When an alarm occurs from one of the controllers, the gateway will - via the modem - make a phone call to the service company.

At the service company a modem, gateway and PC with system software type AKM have been installed.

All the controllers' functions can now be operated from the various menu displays.

The programme will for example upload all the collected temperature values once a day.

Example of menu display



Measurements are shown at one side and settings at the other.

You will also be able to see the parameter names of the functions on page 3.

With a simple change-over the values can also be shown in a trend diagram.

If you prefer to see the earlier temperature measurements, you may upload a log collection.

Alarms

If the controller is extended with data communication, it will be possible to define the importance of the transmitted alarms.

The importance is defined with the setting: 1, 2, 3 or 0. When the alarm then arises at some time, it will result in one of the following activities:

1 = Alarm
The alarm message is sent off with alarm status 1. This means that the gateway that is the master in the system will have its alarm relay output activated for two minutes. Later, when the alarm ceases, the alarm text will be retransmitted, but now with status value 0.

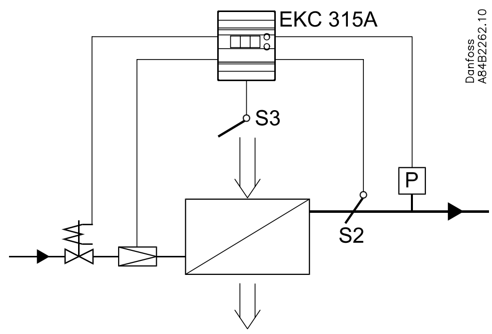
2 = Message
The alarm text is transmitted with status value 2. Later, when the "message" lapses, the alarm text is retransmitted, but now with status value 0.

3 = Alarm
As "1", but the master gateway's relay output is not activated.

0 = Suppressed information
The alarm text is stopped at the controller. It is transmitted nowhere.

Introduction

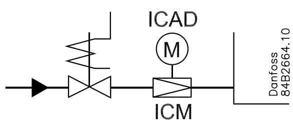
Application
The controller and valve can be used where there are requirements to accurate control of superheat and temperature in connection with refrigeration.
E.g.:
• Cold store (air coolers)
• Processing plant (water chillers)
• A/C plant



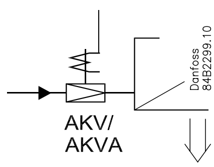
Advantages
• The evaporator is charged optimally – even when there are great variations of load and suction pressure
• Energy savings – the adaptive regulation of the refrigerant injection ensures optimum utilisation of the evaporator and hence a high suction pressure
• Exact temperature control – the combination of adaptive evaporator and temperature control ensures great temperature accuracy for the media
• The superheating is regulated to the lowest possible value at the same time as the media temperature is controlled by the thermostat function

Functions
• Regulation of superheat
• Temperature control
• MOP function
• ON/OFF input for start/stop of regulation
• Input signal that can displace the superheat reference or the temperature reference
• Alarm if the set alarm limits are exceeded
• Relay output for solenoid valve
• PID regulation
• Output signal following the temperature showing in the display

System
The superheat in the evaporator is controlled by one pressure transmitter P and one temperature sensor S2.
The valve can be one of the following types:
• ICM
• AKV (AKVA)
ICM is an electronically, directly run engine valve, controlled by an ICAD type actuator. It is used with a solenoid valve in the liquid line.
TQ valve
The controller can also control a TQ type valve. This valve has been discontinued from the product range, but the settings are still described in this manual.
AKV is a pulsating valve.
Where the AKV valve is used it also functions as solenoid valve.
Temperature control is performed based on a signal from temperature sensor S3 which is placed in the air current before the evaporator. Temperature control is in the shape of an ON/OFF thermostat that shuts off the liquid flow in the liquid line.



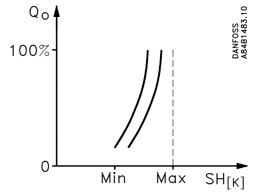
Water chiller application

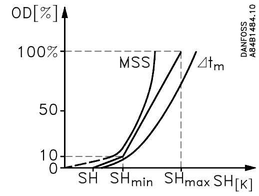


Air cooler application

Operation

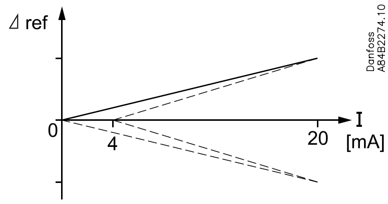
Superheat function
You may choose between two kinds of superheat, either:
• Adaptive superheat or
• Load-defined superheat



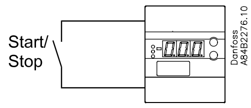


MOP
The MOP function limits the valve's opening degree as long as the evaporating pressure is higher than the set MOP value.

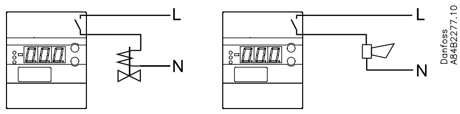
Override function
Via the analog input a displacement can be made of the temperature reference or of the superheat reference. The signal can either be a 0-20 mA signal or a 4-20 mA signal. The reference can be dsplaced in positive or negative direction.



External start/stop of regulation
The controller can be started and stopped externally via a contact function connected to input terminals 1 and 2. Regulation is stopped when the connection is interrupted. The function must be used when the compressor is stopped. The controller then closes the solenoid valve so that the evaporator is not charged with refrigerant.

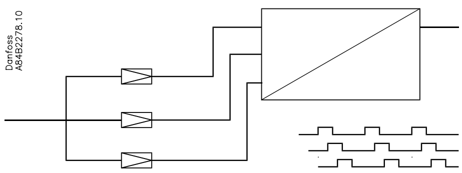


Relays
The relay for the solenoid valve will operate when refrigeration is required. The relay for the alarm function works in such a way thatr the contact is cut in in alarm situations and when the controller is de-energised.

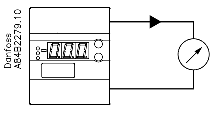


Modulating/pulsating expansion valve
In 1:1 systems (one evaporator, one compressor and one condenser) with small refrigerant charge ICM is recommended.

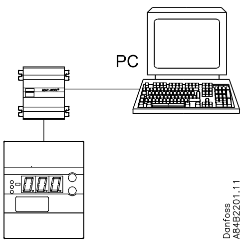
In a system with an AKV valve the capacity can be distributed by up to three valves if slave modules are mounted. The controller will displace the opening time of the AKV valves, so that they will not pulsate at the same time.
Used as slave module is a controller of the type EKC 347.



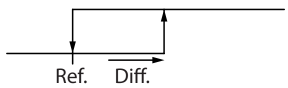
Analog output
The controller is provided with an analog current output which can be set to either 0-20 mA or 4-20 mA. The signal will either follow the superheat, opening degree of the valve or the air temperature.
When an ICM valve is in use, the signal is used for control of the valve via the ICAD actuator.



PC operation
The controller can be provided with data communication so that it can be connected to other products in the range of ADAP-KOOL® refrigeration controls. In this way operation, monitoring and data collection can be performed from one PC – either on the spot or in a service company.



Survey of functions

Function	Para-meter	Parameter by operation via data communication
Normal display		
Normally the superheat is shown (but the valve's opening degree or air temperature may also be selected. See o17).		SH / OD% / S3 temp
Reference		
Se point Regulation is performed based on the set value provided that there is no external contribution (o10). (Push both buttons simultaneously to set the setpoint).	-	TempSetpoint.
Differential When the temperature is higher than the reference plus the set differential, the solenoid valve's relay will be activated. It will become deactivated when the temperature drops below the set reference. 	r01	Differential
Unit Here you select whether the controller is to indicate the temperature values in °C or in °F. If indication in °F is selected, other temperature settings will also change over to Fahrenheit, either as absolute values or as delta values The combination of temperature unit and pressure unit is depicted to the right.	r05	Units 0: °C + bar 1: °F + psig (in AKM only °C + bar – is displayed – whatever the setting).
External contribution to the reference This setting determines how large a contribution is to be added to the set setpoint when the input signal is max. (20 mA). See o10.	r06	ExtRefOffset
Correction of signal from S2 (Compensation possibility through long sensor cable).	r09	Adjust S2
Correction of signal from S3 (Compensation possibility through long sensor cable).	r10	Adjust S3
Start/stop of refrigeration With this setting refrigeration can be started and stopped. Start/stop of refrigeration can also be accomplished with the external switch function. See also appendix 1.	r12	Main Switch
Define thermostat function 0: No thermostat function. Only the superheat is regulated 1: Thermostat function as well as regulation of superheat.	r14	Therm. Mode
Alarm		
The controller can give alarm in different situations. When there is an alarm all the light-emitting diodes (LED) will flash on the controller front panel, and the alarm relay will cut in.		
Alarm for upper deviation The alarm for too high S3 temperature is set here. The value is set in Kelvin. The alarm becomes active when the S3 temperature exceeds the actual reference plus A01. (The actual reference can be seen in u28).	A01	Hgh.TempAlrm
Alarm for lower deviation The alarm for too low S3 temperature is set here. The value is set in Kelvin. The alarm becomes active when the S3 temperature drops below the actual reference minus A02.	A02	Low.TempAlrm
Alarm delay If one of the two limit values is exceeded, a timer function will commence. The alarm will not become active until the set time delay has been passed. The time delay is set in minutes.	A03	TempAlrmDel
		With data communication the importance of the individual alarms can be defined. Setting is carried out in the "Alarm destinations" menu.

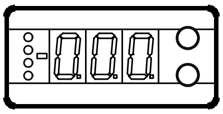
Control parameters		
P: Amplification factor Kp If the Kp value is reduced the regulation becomes slower.	n04	Kp factor
I: Integration time Tn If the Tn value is increased the regulation becomes slowe	n05	Tn sec.
D: Differentiation time Td The D-setting can be cancelled by setting the value to min. (0).)	n06	Td sec.
Max. value for the superheat reference	n09	Max SH
Min. value for the superheat reference Warning! Due to the risk of liquid flow the setting should not be lower than approx. 2-4 K.	n10	Min SH
MOP If no MOP function is required, select pos. Off.	n11	MOP (Bar) (A value of 60 bar corresponds to Off)
AKV valve's time period in seconds Should only be set to a lower value if it is a decentralised plant and the suction pressure fluctuates a lot and in line with the opening of the AKV valve.	n13	AKV per. time
Stability factor for regulation of superheat With a higher value the control function will allow a greater fluctuation of the superheat before the reference is changed. The value should only be changed by specially trained staff.	n18	Stability
Damping of amplification near reference value This setting damps the normal amplification Kp, but only just around the reference value. A setting of 0.5 will reduce the KP value by half. The value should only be changed by specially trained staff.	n19	Kp Min
Amplification factor for the superheat (only in 1:1 plant) This setting determines the ICM or AKV valve's opening degree as a function of the change in evaporating pressure. An increase of the evaporating pressure will result in a reduced opening degree. When there is a drop-out on the low-pressure thermostat during start-up the value must be raised a bit. If there is pendling during start-up the value must be reduced a little. The value should only be changed by specially trained staff.	n20	Kp T0
Definition of superheat regulation (Ref. appendix 6) 1: Lowest permissible superheat (MSS). Adaptive regulation. 2: Load-defined superheat. The reference is established based on the line formed by the three points: n09, n10 and n22.	n21	SH mode
Value of min. superheat reference for loads under 10% (The value must be smaller than "n10").	n22	SH Close
Standby temperature when valve closed (TQ only) The TQ actuator is kept warm when the valve reaches its closing point. As the closing point cannot be defined completely accurately due to tolerances and pressure variations, the setting can be changed, as required (how "tightly"/securely the valve is to close). See also appendices 1 and 5.	n26	TQ Kmin
Standby temerature when valve open (TQ only) The TQ actuator's temperature is kept low when the valve reaches its fully open position. Here you set how many degrees the temperature is to be above the expected open temperature in completely open position. The greater the value, the surer it is that the valve will be open, but it will also react more slowly when it has to close again.	n27	TQ Kmax
Max. opening degree The ICM or AKV valve's opening degree can be limited. The value is set in %. The value should only be changed by specially trained staff.	n32	OD Max
Min. opening degree The ICM or AKV valve's opening degree can be set to a specified min. value, disabling full closure. The value should only be changed by specially trained staff.	n33	OD Min

Miscellaneous		
Address If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be madewhen a data communication modulehas been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC8AC"		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 0 and 119	o03	-
The address is sent to the gateway when the menu is set in pos. ON (The setting will automatically change back to Off after a few seconds.)	o04	-
Valve and output signal Define here the valve that is to regulate and the current signal to be transmitted to the analog output "AO". The current signal will show the superheat if o17=1. Or opening degree of the valve, if O17=2. Or the S3 temperature if o17=3 0:Off 1: TQ valve and 0-20 mA 2: TQ valve and 4-20 mA 3: AKV valve and 0-20 mA 4: AKV valve and 4-20 mA 5: AKV valve and signal for an other controller. See appendix 3. 6: ICM and ICM OD% /0-20 mA 7: ICM and ICM OD% /4-20 mA	o09	AO type
Input signal for reference displacement Definition of function and signal range. 0: No signal 1: Displacement of temperature reference with 0-20 mA 2: Displacement of temperature reference with 4-20 mA 3: Displacement of superheat reference with 0-20 mA 4: Displacement of superheat reference with 4-20 mA (4 or 0 mA will not give a displacement. 20 mA will displace the reference by the value set in menu r06)	o10	AI A type
Frequency Set the net frequency.	o12	50 / 60 Hz (50=0, 60=1)
Select signal for showing display Here you can select the signal to be shown in the normal display. The signal is also transmitted to the analog output. See O09. 1: Superheat 2: Valve's opening degree 3: Air temperature (If you during operation give the lower button a brief push, you can see the following: The S3 temperature, if 1 has been selected. The superhea, if 2 has been selected. Temperature reference if 3 has been selected).	o17	Display mode
Manual control of outputs For service purposes the individual relay outputs and the AKV/A output can be forced into position ON. However only when regulation has been stopped. OFF: No override 1: Relay to the solenoid valve is ON. 2: AKV/A output is ON. 3: Alarm relay is activated (connection established between terminals 12 and 13).	o18	-
Working range for pressure transmitter Depending on the application a pressure transmitter with a given working range is used. This working range (say, -1 to 12 bar) must be set in the controller. The min. value is set.	o20	MinTrans Pres.
The max. value is set	o21	Max TransPres.
(Setting for the function o09 and only if the valve is TQ or AKV) Set the temperature value or opening degree of the valve where the output signal must be minimum (0 or 4 mA)	o27	AO min. value
(Setting for the function o09 and only if the valve is TQ or AKV) Set the temperature value or opening degree of the valve where the output signal must be maximum (20 mA). (With a temperature range of 50 K (differential between the settings in o27 and o28) the dissolution will be better than 0.1 K. With 100 K the dissolution wil be better than 0.2 K.)	o28	AO max. value

Refrigerant setting Before refrigeration can be started, the refrigerant must be defined. You can select the following refrigerants: 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270. (Warning: Wrong selection of refrigerant may cause damage to the compressor).	o30	Refrigerant
Service		
A number of controller values can be printed for use in a service situation		
Read valve's actuator temperature (TQ)	u04	Actuator temp.
Read reference for valve's actuator temperaturer (TQ)	u05	Actuator Ref.
Read value of external current signal (AIA)	u06	AI A mA
Read value of transmitted current signal	u08	AO mA
Read status of input DI (start/stop input)	u10	DI
Read the ongoing cutin time for the thermostat or the duration of the last completed cutin	u18	Ther. RunTime
Read the temperature at the S2 sensor	u20	S2 temp.
Read superheat	u21	SH
Read the control's actual superheat reference	u22	SH ref.
Read the valve's opening degree	u24	OD%
Read evaporating pressure	u25	Evap. pres. Pe
Read evaporating temperature	u26	Evap. temp Te
Read the temperature at the S3 sensor	u27	S3 temp.
Read control reference (Set setpoint + any contribution from external signal)	u28	Temp. ref
Read value of current signal from pressure transmitter (AIB)	u29	AI B mA
	--	DO1 Alarm Read status of alarm relay
	--	DO2 Liq. Valv Read status of relay for solenoid valve
Operating status		
The controller's operating status can be called forth by a brief (1s) activation of the upper button. If a status code exists it will be shown. (Status codes have lower priority than alarm codes. This means that status codes cannot be seen if there is an active alarm code. The individual status codes have the following meanings:		EKC State (0 = regulation)
S10: Refrigeration stopped by the internal or external start/ stop.		10
S11: Thermostat is cutout		11

Operation

Display
The values will be shown with three digits, and with a setting you can determine whether the temperature are to be shown in °C or in °F.



Light-emitting diodes (LED) on front panel
There are LED's on the front panel which will light up when the belonging relay is activated.
The upper LED will indicate the valve's opening degree. A short pulse indicates a small liquid flow and a long pulse a heavy liquid flow. The other LED will indicate when the controller calls for refrigeration.
The three lowermost LED's will flash, if there is an error in the regulation.
In this situation you can upload the error code on the display and cancel the alarm by giving the uppermost button a brief push.

The buttons
When you want to change a setting, the two buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously.

Gives access to the menu (or cutout an alarm)

Gives access to changes

Saves a change

Examples of operations

Set set-point
1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Set one of the other menus
1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Menu survey

SW =1.3x

Function	Parameter	Min.	Max.	Factory setting
Normal display				
Shows the actual superheat/ valve's opening degree/ temperature Define view in o17	-		K	
Temperature, superheating, or the temp. reference is displayed if the bottom button is pressed briefly. Define view in o17	-		%	
Reference				
Set the requirede set point	-	-60°C	50°C	10
Differential	r01	0.1 K	20 K	2.0
Units (0=°C+bar /1=°F+psig)	r05	0	1	0
External contribution to the reference	r06	-50 K	50 K	0
Correction of signal from S2	r09	-10.0 K	10.0 K	0.0
Correction of signal from S3	r10	-10.0 K	10.0 K	0.0
Start / stop of refrigeration	r12	OFF	On	1
Define thermostat function (0= no thermostat function, 1=On/off thermostat)	r14	0	1	0
Alarm				
Upper deviation (above the temperature setting)	A01	3.0 K	20 K	5.0
Lower deviation (below the temperature setting)	A02	1 K	10 K	3.0
Alarm's time delay	A03	0 min.	90 min.	30
Regulating parameters				
P: Amplification factor Kp	n04	0.5	20	3.0
I: Integration time T	n05	30 s	600 s	120
D: Differentiation time Td (0 = off)	n06	0 s	90 s	0
Max. value of superheat reference	n09	2 K	50 K	6
Min. value of superheat reference	n10	1 K	12 K	4
MOP (max = off)	n11	0.0 bar	60 bar	60
Period time (only when AKV/A valve is used)	n13	3 s	10 s	6
Stability factor for superheat control. Changes should only be made by trained staff	n18	0	10	5
Damping of amplification around reference value Changes should only be made by trained staff	n19	0.2	1.0	0.3
Amplification factor for superheat Changes should only be made by trained staff	n20	0.0	10.0	0.4
Definition of superheat control 1=MSS, 2=LOADAP	n21	1	2	1
Value of min. superheat reference for loads under 10%	n22	1	15	2
Standby temperature when valve closed (TQ valve only) Changes should only be made by trained staff	n26	0 K	20 K	0
Standby temperature when valve open (TQ valve only) Changes should only be made by trained staff	n27	-15 K	70 K	20
Max. opening degree Changes should only be made by trained staff	n32	0	100	100
Min. opening degree Changes should only be made by trained staff	n33	0	100	0
Miscellaneous				
Controller's address	o03*	0	119	-
ON/OFF switch (service-pin message)	o04*	-	-	-
Define valve and output signal: 0: Off 1: TQ. AO: 0-20 mA 2: TQ. AO: 4-20 mA 3: AKV, AO: 0-20 m 4: AKV, AO: 4-20 mA 5: AKV, AO: EKC 347-SLAVE 6: ICM, AO: 0-20 mA / ICM OD% 7: ICM, AO: 4-20 mA / ICM OD%	o09	0	7	0

Define input signal on the analoge input AIA: 0: no signal, 1: Temperature setpoint. 0-20 mA 2: Temperature setpoint. 4-20 mA 3: Displacement of superheat reference. 0-20 mA 4: Displacement of superheat reference. 4-20 mA	o10	0	4	0
Set supply voltage frequency	o12	50 Hz	60 Hz	0
Select display for "normal picture" (Display the item indicated in parenthesis by briefly pressing the bottom button) 1: Superheat (Temperature) 2: Valve's opening degree (Superheat) 3: Air temperature (Temperature reference)	o17	1	3	1
Manual control of outputs: OFF: no manual control 1: Relay for solenoid valve: select ON 2: AKV/A output: select ON 3: Alarm relay activated (cut out)	o18	off	3	Off
Working range for pressure transmitter – min. value	o20	-1 bar	60 bar	-1.0
Working range for pressure transmitter – max. value	o21	-1 bar	60 bar	12
(Setting for the function o09, only AKV and TQ) Set the temperature value or opening degree where the output signal must be minimum (0 or 4 mA)	o27	-70°C	160°C	-35
(Setting for the function o09, only AKV and TQ) Set the temperature value or opening degree where the output signal must be maximum (20 mA)	o28	-70°C	160°C	15
Refrigerant setting 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270.	o30	0	29	0
Service				
TQ valve's actuator temperature	u04	°C		
Reference of the valve's actuator temperature	u05	°C		
Analog input AIA (18-19)	u06	mA		
Analog output AO (2-5)	u08	mA		
Read status of input DI	u10	on/off		
Thermostat cut-in time	u18	min.		
Temperature at S2 sensor	u20	°C		
Superheat	u21	K		
Superheat reference	u22	K		
Read AKV valve's opening degree	u24	%		
Read evaporating pressure	u25	bar		
Read evaporating temperature	u26	°C		
Temperature at S3 sensor	u27	°C		
Temperature reference	u28	°C		
Read signal at pressure transmitter input	u29	mA		

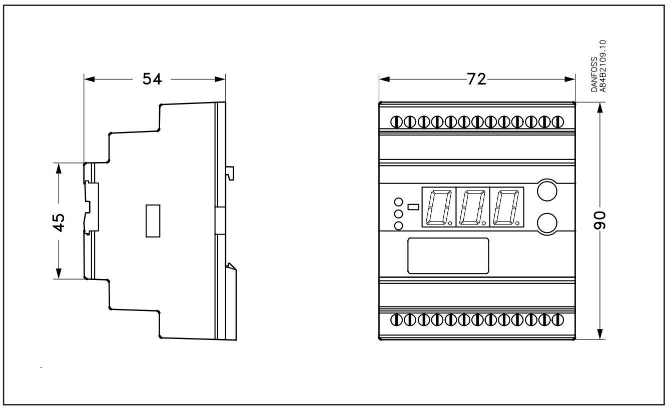
*) This setting will only be possible if a data communication module has been installed in the controller.

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

The controller can give the following messages:		
E1	Error message	Fault in controller
E11		Valve's actuator temperature outside its range
E15		Cut-out S2 sensor
E16		Shortcircuited S2 sensor
E17		Cut-out S3 sensor
E18		Shortcircuited S3 sensor
E19		The input signal on terminals 18-19 is outside the range.
E20		The input signal on terminals 14-15 is outside the range (P0 signal)
A1	Alarm message	High-temperature alarm
A2		Low-temperature alarm
A11		No refrigerant has been selected

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, (80 VA) (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller TQ actuator AKV coil	5 VA 75 VA 55 VA
Input signal	Current signal	4-20 mA or 0-20 mA
	Pressure transmitter	4-20 mA from AKS 33
	Digital input from external contact function	
Sensor input	2 pcs. Pt 1000 ohm	
Output signal	Current signal	4-20 mA or 0-20 mA
	Load	Max. 200 ohm
Relay output	1 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarm relay	1 pcs. SPST	
Actuator	Input (from TQ)	Temperature signal from sensor in the TQ actuator
	Output (AKV, TQ)	Pulsating 24 V a.c. to actuator
	Output ICAD mounted on ICM	Current signal 4-20 mA or 0-20 mA
Data communication	Possible to connect a data communication module	
Environments	0 to +55°C, during operations -40 to +70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence / vibrations	
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2.5 mm² multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN50081-1 and EN 50082-2	



Ordering

Type	Function	Code no.
EKC 315A	Superheat controller	**084B7086**
EKA 173	Data communication module (accessories), (FTT 10 module)	**084B7092**
EKA 175	Data communication module (accessories), (RS 485 modul)	**084B7093**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

Temperature sensor Pt 1000 ohm / Pressure transmitter type AKS 33 / TQ Valves / AKV valves: .... Kindly refer to catalogue RK0YG...

Connections

Necessary connections

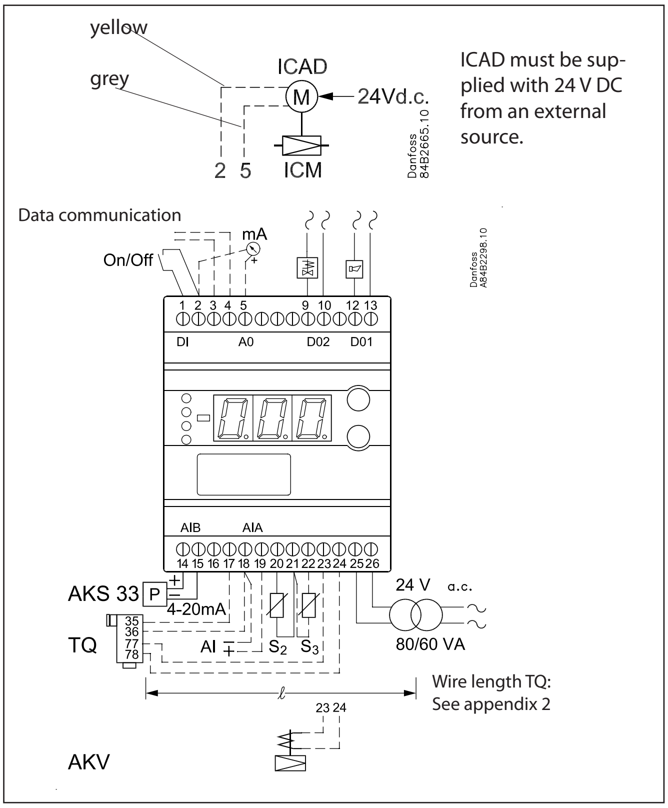
Terminals:

25-26 Supply voltage 24 V a.c.
17-18 Only at TQ actuator: Signal from actuator
20-21 Pt 1000 sensor at evaporator outlet (S2)
14-15 Pressure transmitter type AKS 33
9-10 Relay switch for start/stop of solenoid valve
1-2 Switch function for start/stop of regulation. If a switch is not connected, terminals 1 and 2 must be shortcircuited.

Application dependent connections

Terminals:

21-22 Pt 1000 sensor for measuring air temperature (S3)
12-13 Alarm relay
There is connection between 12 and 13 in alarm situations and when the controller is dead
18-19 Current signal from other regulation (Ext.Ref.)
23-24 Supply to actuator AKV / TQ
2-5 Current output for showing superheat or air temperature. Or for signal to a slave module. Or control from ICM valve.
3-4 Data communication
Mount only, if a data communication module has been mounted.
It is <u>important</u> that the installation of the data communication cable be done correctly. Cf. separate literature No. RC8AC...



Installation considerations

Accidental damage, poor installation, or site conditions, can give rise to malfunctions of the control system, and ultimately lead to a plant breakdown.
Every possible safeguard is incorporated into our products to prevent this. However, a wrong installation, for example, could still present problems. Electronic controls are no substitute for normal, good engineering practice.

Danfoss wil not be responsible for any goods, or plant components, damaged as a result of the above defects. It is the installer's responsibility to check the installation thoroughly, and to fit the necessary safety devices.
Particular attention is drawn to the need for a "force closing" signal to controllers in the event of compressor stoppage, and to the requirement for suction line accumulators.

Your local Danfoss agent will be pleased to assist with further advice, etc.

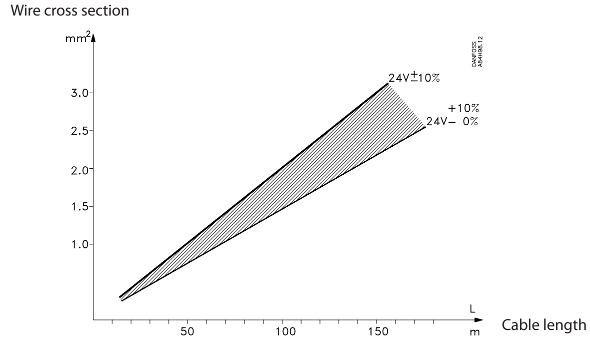
Appendix 1

Interaction between internal and external start/stop functions and active functions.

Internal Start/stop	Off	Off	On	On
External Start/stop (DI)	Off	On	Off	On
Refrigeration (DO2)	Off			On
TQ actuator	Standby temperature			Regulating
Expansion valve relay	Off			On
Temperature monitoring	No			Yes
Sensor monitoring	Yes			Yes
ICM	Closed			Regulating

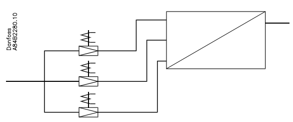
Appendix 2

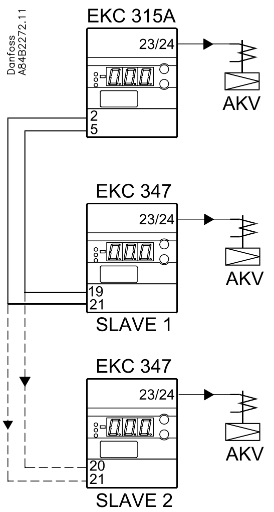
Cable length for the TQ actuator
The actuator must be supplied with 24 V a.c. ± 10%.
To avoid excessive voltage loss in the cable to the actuator, use a thicker cable for large distances.



Appendix 3

If the flow of refrigerant is to be distributed to several expansion valves, this can be accomplished by using AKV valves and EKC controllers as slave modules.

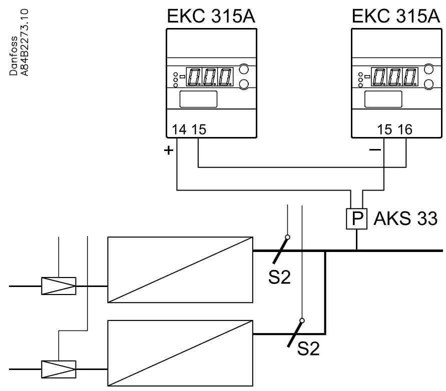




Remember to open the functions in:
- EKC 315A's menu o09
- EKC 347's menu o09

Appendix 4

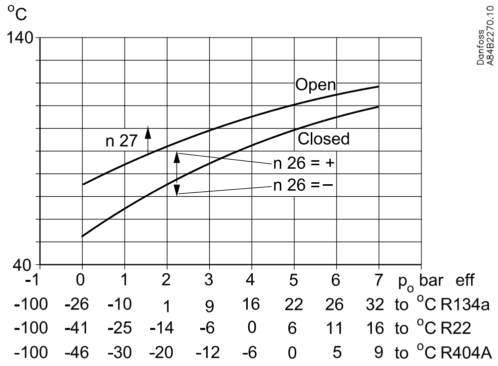
If there are two evaporators sharing the same suction line, the signal from the pressure transmitter can be used by two controllers.



Appendix 5

Standby temperatures for TQ valves.

TQ valve
The valve's actuator temperature is limited, both when regulation is stopped and when the valve is right out at the opening point and closing point.
(The opening and closing points may fluctuate a couple of degrees up or down, depending on pressures and tolerances).



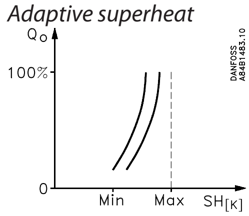
n26
The setting is based on the TQ valve's closing curve. With a plus value the valve can be kept slightly open. With a minus value the valve can be closed completely. If the minus value is high you can be sure that the valve will close, but then it will also react slowly when it has to open again.

n27
This setting defines the number of degrees the actuator has to be warmer when the valve is completely open. If the value is high you can be sure that the valve is completely open, but then it will also react slowly when it has to close again.

Appendix 6

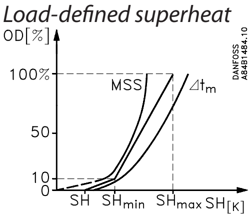
The two types of regulation for superheat are, as follows:

Adaptive superheat



Regulation is here based on the evaporator's load by means of MSS search (MSS = lowest permissible superheat).
(The superheat reference is lowered to the exact point where instability sets in).
The superheat is limited by the settings for min.and max.superheat.

Load-defined superheat



The reference follows a defined curve.This curve is defined by three values: the closing value, the min. value and the max. value. These three values must be selected in such a way that the curve is situated between the MSS curve and the curve for average temperature difference ΔTm (temperature difference between media temperature and evaporating temperature. Setting example = 4, 6 and 10 K).

Start of controller

When the electric wires have been connected to the controller, the following points have to be attended to before the regulation starts:

1. Switch off the external ON/OFF switch that starts and stops the regulation.
2. Follow the menu survey on page 8, and set the various parameters to the required values.
3. Switch on the external switch, and regulation will start.
4. Follow the actual room temperature or superheat on the display.
   (On terminals 2 and 5 a current signal can be transmitted which represents the display view. Connect a data collection unit, if applicable, so that the temperature performance can be followed).

If the superheating fluctuates

When the refrigerating system has been made to work steadily, the controller's factory-set control parameters should in most cases provide a stable and relatively fast regulating system.
If the system however fluctuates this may be due to the fact that too low superheat parameters have been selected:

If adaptive superheat has been selected:
Adjust: n09, n10 and n18.

If load-defined superheat has been selected:
Adjust: n09, n10 and n22.

Alternatively it may be due to the fact that the set regulation parameters are not optimal.

If the time of oscillation is longer than the integration time:
($T_p > T_n$, (T_n is, say, 240 seconds))
1. Increase T_n to 1.2 times T_p
2. Wait until the system is in balance again
3. If there is still oscillation, reduce K_p by, say, 20%
4. Wait until the system is in balance
5. If it continues to oscillate, repeat 3 and 4

If the time of oscillation is shorter than the integration time:
($T_p < T_n$, (T_n is, say, 240 seconds))
1. Reduce K_p by, say, 20% of the scale reading
2. Wait until the system is in balance
3. If it continues to oscillate, repeat 1 and 2.

If the superheat has excessive underswing during start-up

If you regulate with valve type ICM or AKV:
Adjust n22 a little bit up and/or n04 a little bit down.

If you regulate with valve type TQ:
Adjust n26 a littlle bit down

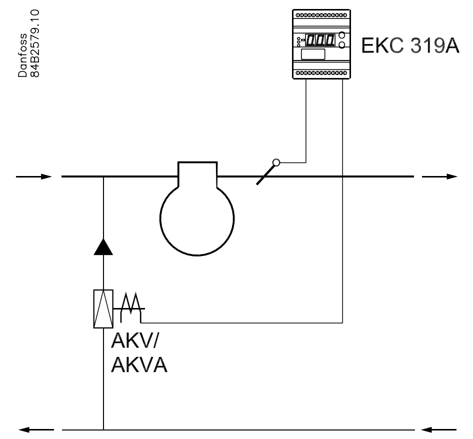
List of literature

Instructions RI8GT (extract from this manual).
Here you can see how controllers are mounted and programmed.

Installation guide for extended operation RC8AC
Here you can see how a data communication connection to ADAP-KOOL® Refrigeration control systems can be established.

Introduction

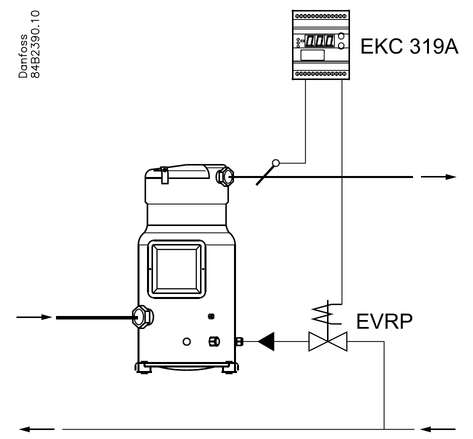
Application
The controller limits the pressure gas temperature in compressors by opening up for liquid injection in the suction line.



System
A temperature sensor will register the pressure gas temperature. If the temperature reaches the set temperature value, opening of the valve will be commenced.
A PI regulation will adapt the opening degree of the valve so that the temperature will be limited.

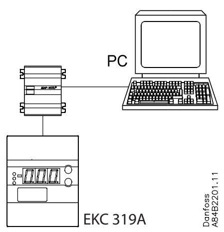
Temperature sensor
Type AKS 21 can be used. It can stand the high temperature.

Valve
If the liquid injection is carried out directly in the suction line an expansion valve type AKV, or a type AKVA (for NH_3), is used. The capacity requirement is determined by the size of the valve. If the compressor is provided with a connection for liquid injection a pulse solenoid valve type EVRP is used in the liquid supply.



Alarm function
The controller will sound an alarm if the set alarm limit is exceeded.
The alarm will activate the alarm relay.

Extra options
PC operation
The controller can be provided with data communication, so that it may be hooked up with other products in the ADAP-KOOL® range of refrigeration controls. Operation, monitoring and data collection can then be performed from a PC - either in situ or at a service company.



Literature survey:
Manual for EKC 319A...........RS8EB..
Instructions for EKC 319A...........RI8HY..
Installation guide, "Data communication link for ADAP-KOOL® "...........RC8AC..

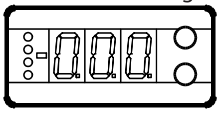
Survey of functions

Function	Para-meter	Parameter by operation via data communication
Normal display		
The temperature sensor registers the discharge gas temperature. The value is shown in the display.	-	Temperature
The valve's actual opening degree can be displayed by giving the lower button a brief push (1s). Cf. also o17.	-	OD %
Reference		**Temperature control**
Reference The liquid injection starts when the set value is passed. Push both buttons simultaneously to set the setpoint.	-	Temperature Ref
Start/stop of regulation With this setting the regulation can be started and stopped. Start/stop can also be performed with the external contact function. Regulation is stopped if just one of them is OFF.	r12	Main Switch
Alarm		
The controller can give alarm in different situations. When there is an alarm the three lowest LED's at the front of the controller will flash, and the alarm relay is cut in. See also A19.		
Alarm limit A temperature limit can be set where the alarm is to be activated.	A16	Limit Alarm
Time delay for alarm When the temperature value is exceeded a timer function will start. The alarm will not become activated until the set time delay has been passed. The time delay is set in seconds.	A17	Limit Alm. delay
Activation of the alarm relay Set here whether the alarm relay is to be activated when the time delay has been passed: 0: Alarm relay active 1: Alarm relay not active	A19	Alarm type (With setting = 0 the alarm is also transmitted via the data communication)
		With data communication the importance of the individual alarms can be defined. Setting is carried out in the "Alarm destinations" menu.
Control parameters		**Control Settings**
P - band If the value is reduced the regulating range will be reduced. (The P-band will be over the reference).	n04	Kp factor
I: Integration time Tn The I-link can be made passive by setting the value at max. (600s) (If the Tn value is increased the regulation becomes slower).	n05	Tn sec.
Periode time The valve is operated with pulses of a given length. The length depends on the opening degree required. If a large opening degree is required, the pulse will last for an entire period time. A period time will thus comprise both open and closed valve.	n13	Period time
Miscellaneous		**Miscellaneous**
Address If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be madewhen a data communication modulehas been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC8AC"..		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60 (119)	o03	-
The address is sent to the gateway when the menu is set in pos. ON (The setting will automatically change back to Off after a few seconds.)	o04	-
Frequency Set the net frequency.	o12	50 / 60 Hz (50=0, 60=1)

Selection of display The normal display can be defined to show either: 0: Discharge gas temperature 1: Opening degree of valve Later during the regulation: If the second display is to be read, the controller's lowermost button must be activated briefly. After five seconds the normal display will reappear.	o17	Display
Manual control of outputs In connection wit service the alarm relay and the valve output can be put in pos. ON. But not until regulation has been stopped. OFF: No override 1: Valve output is ON 2. Alarm relay is activated (terminals 12 and 13 will be cutin)	o18	-
Service		**Service**
A number of controller values can be printed for use in a service situation		
Read discharge gas temperature	u01	Temperature
Read the temperature reference	u02	Temperature ref
Read status of input DI (start/stop input)	u10	DI
Read valve's opening degree	u24	OD %
	--	DO1 limit alarm Read status of alarm relay ON is operating status with alarm
Operating status		
Operating status of the controller can be called forth in the display. Push briefly (1s) the upper button. If there is a status code, it will be shown on the display. (Status codes have lower priority than alarm codes. In other words, you cannot see a status code, if there is an active alarm). The individual status codes have the following meanings:		EKC Status (0 = regulation)
S10: The regulation stopped by the internal or external start/ stop		10

Operation

Display
The values will be shown with three digits, and after an operation the controller will return to its standard mode and show the measured discharge temperature.

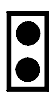


Light-emitting diodes (LED) on front panel
There are LED's on the front panel which will light up when the corresponding relay is activated.
The upper LED will indicate the valve's opening degree. A short pulse indicates a slow liquid flow and a long pulse a fast liquid flow.
The three lowest LED's will flash, if there is an error in the regulation.
In this situation you can upload the error code on the display and cancel the alarm by giving the uppermost button a brief push.

The buttons
When you want to change a setting, the two buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously.

 Gives access to the menu (or cutout an alarm)

 Gives access to changes

 Saves a change

Examples of operations

Set reference
1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Set one of the other menus
1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Error messages

The controller can give the following messages:		
E1	Error message	Errors in the controller
E17		The temperature sensor is disconnected
E18		The temperature sensor is shortcircuited
A3	**Alarm message**	Alarm temperature limit is reached

Menu survey

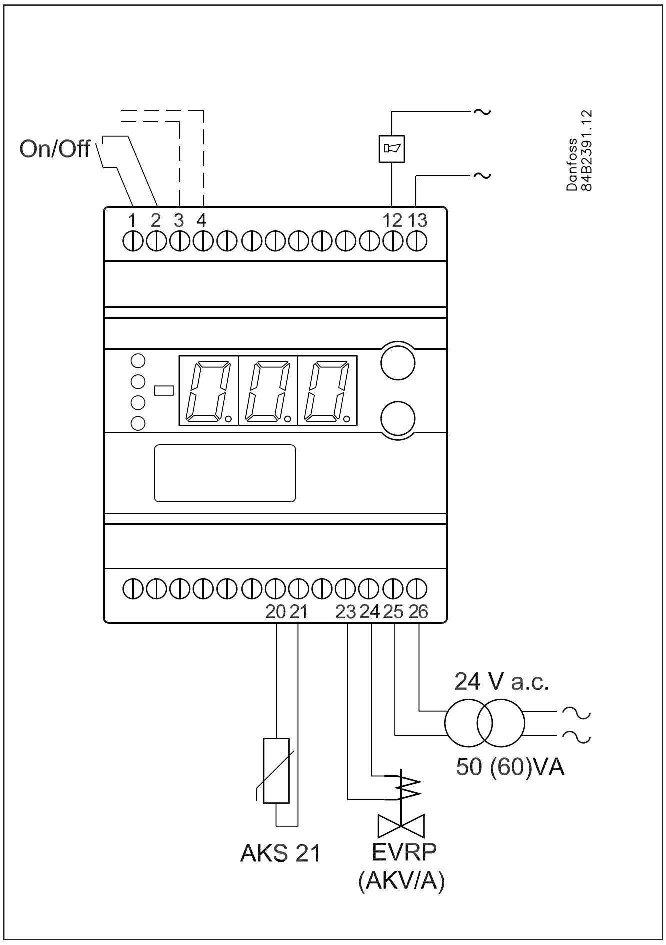
SW = 1.1x

Function	Parameter	Min.	Max.	Fac. setting
Normal display				
Read the measured discharge gas temperature	-		°C	
If you wish to see the actual opening degree, give the lower button a brief push	-		%	
If you wish to set the temperature reference you obtain access by pushing both buttons simultaneously	-	-70°C	160°C	125
Display / Control				
Select unit (0=°C, 1=°F)	r05	0	1	0
Start / stop of regulation	r12	OFF	ON/on	on
Alarm				
Alarm limit	A16	-50°C	150°C	135
Time delay for alarm	A17	0 s	999 s	0
Function of the alarm relay when the temperature exceed the alarm limit 0: Alarm relay active 1: Alarm relay not active	A19	0	1	1
Regulating parameters				
Proportionale factor Kp	n04	0,5	30	15
I: Integration time Tn	n05	60 s	600 s / Off	120
Periode time	n13	3 s	10 s	3
Miscellaneous				
Controller's address	o03*	0	119	-
ON/OFF switch (service-pin message)	o04*	OFF	ON	-
Set supply voltage frequency	o12	0/50 Hz	1/60 Hz	50
Select the showing of the "normal display": 0: Discharge gas temperature is shown 1: Valve's opening degree is shown	o17	0	1	0
Manual control of outputs: OFF: No manual control 1: Valve output put in pos. ON 2: Alarm relay activated (cut out)	o18	OFF	2	off
Service				
Read discharge gas temperature	u01		°C	
Read temperature reference	u02		°C	
Read status of input DI	u10			
Read valve's opening degree	u24		%	

*) This setting will only be possible if a data communication module has been installed in the controller.

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Connnections

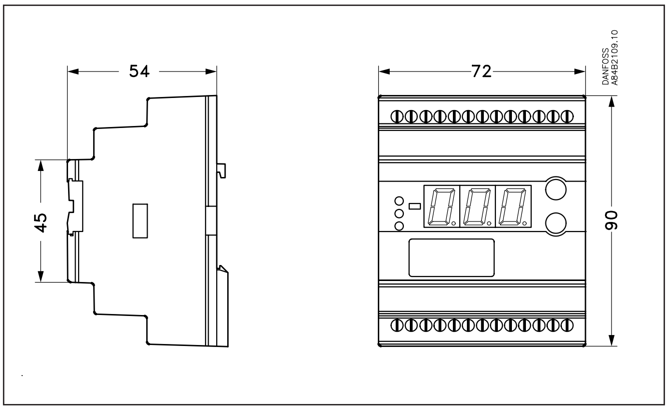


Necessary connections
Terminals:
25-26 Supply voltage 24 V a.c.
20-21 Signal from temperature sensor
23-24 Solenoid valve type EVRP / expansion valve type AKV or AKVA
1-2 Switch function for start/stop of regulation. If a switch is not connected, terminals 1 and 2 must be shortcircuited.

Application dependent connections
Terminal:
12-13 Alarm relay.
There is connection between 12 and 13 in alarm situations and when the supply voltage to the controller is interrupted
3-4 Data communication
Mount only, if a data communication module has been mounted.
It is important that the installation of the data communication cable be done correctly. Cf. separate literature No. RC8AC...

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 60 VA (the supply voltage is galvanically separated from the input and output signals. Input/output are not individual galvanic isolated)	
Power consumption	Controller 20 W coil for AKV / A Coil for EVRP	5 VA 55 VA 40 VA
Input signal	Temperature sensor	Pt 1000 ohm / 0°C
	Contact function start/stop of regulation	
Alarm relay	SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Valve connection	AKV, AKVA or EVRP via 24 a.c. Pulse-Width Modulating output	
Data communication	Possible to connect a data communication module	
Environments	0 - 55°C, during operation -40 - 70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence / vibrations	
Enclosure	IP 20	
Weight	300 g	
Montage	DIN Rail	
Display	LED, 3-digits	
Terminals	max. 2.5 mm^2 multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN50081-1 and EN 50082-2	



Ordering

Type	Function	Code no.
EKC 319A	Temperature controller	**084B7251**
EKA 173	Data communication module (accessories), (FTT 10 module)	**084B7092**
EKA 175	Data communication module (accessories), (RS 485 modul)	**084B7093**

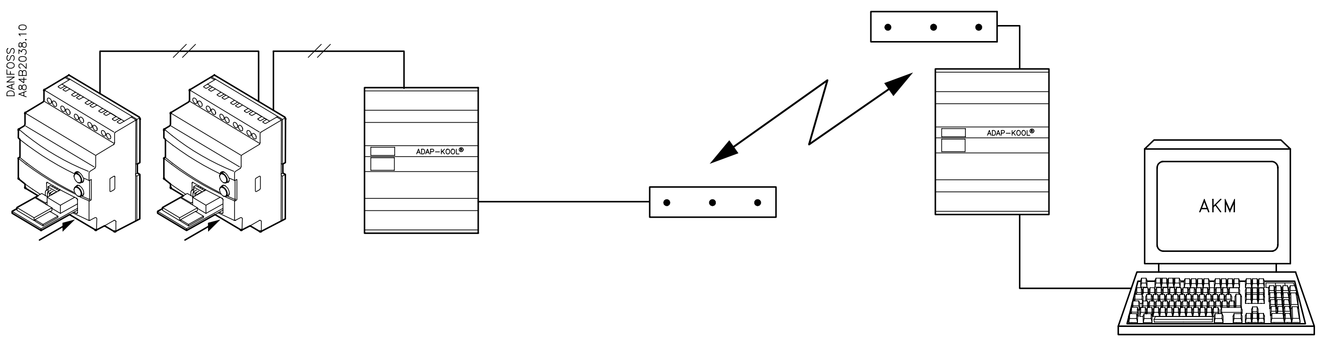
Temperature sensor..Kindly refer to catalogue RK0YG
AKV / AKVA Valves...Kindly refer to catalogue RK0YG
EVRP valves..Kindly refer to data sheet RD3KB

Data communication

This page contains a description of a few of the possibilities you will have when the controller is provided with data communication.

If you want to know more about operation of controllers via PC, you may order additional literature.

Examples



Each controller is provided with a plug-in module.

The controllers are then connected to a two-core cable.

The cable can be connected to a gateway type AKA 245.

This gateway will now control the communication to and from the controllers.

It will collect temperature values and it will receive alarms. When there is an alarm the alarm relay will be activated for two minutes.

The gateway can now be connected to a modem.

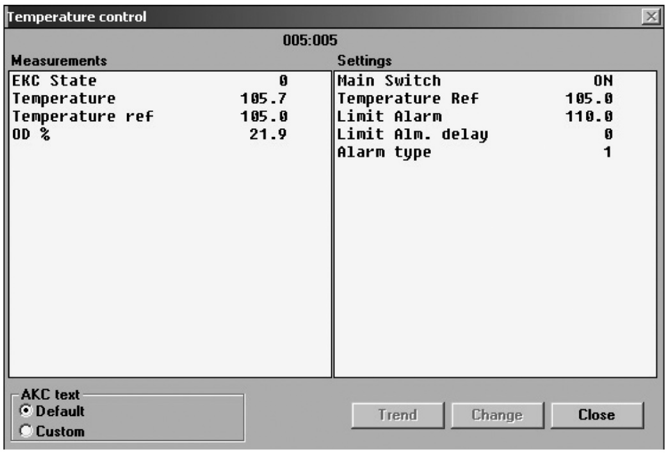
When an alarm occurs from one of the controllers, the gateway will - via the modem - make a phone call to the service company.

At the service company a modem, gateway and PC with system software type AKM have been installed.

All the controllers' functions can now be operated from the various menu displays.

The programme will for example upload all the collected temperature values once a day.

Example of menu display



- Measurements are shown at one side and settings at the other.
- You will also be able to see the parameter names of the functions on page 3-4.
- With a simple change-over the values can also be shown in a trend diagram.
- If you wish to check earlier temperature measurements, you can see them in the log collection.

Alarms

If the controller is extended with data communication, it will be possible to define the importance of the transmitted alarms.
The importance is defined with the setting: 1, 2, 3 or 0. When the alarm then arises at some time, it will result in one of the following activities:

1 = Alarm
The alarm message is sent off with alarm status 1. This means that the gateway that is the master in the system will have its alarm relay output activated for two minutes. Later, when the alarm ceases, the alarm text will be retransmitted, but now with status value 0.

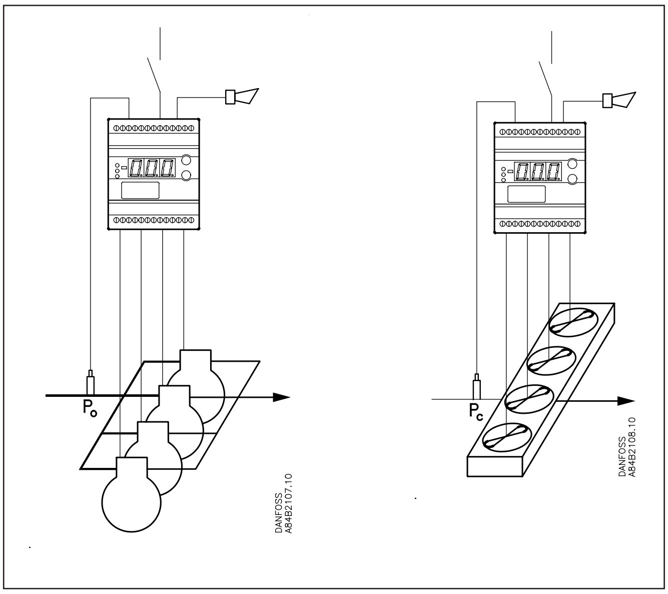
2 = Message
The alarm text is transmitted with status value 2. Later, when the "message" lapses, the alarm text is retransmitted, but now with status value 0.

3 = Alarm
As "1", but the master gateway's relay output is not activated.

0 = Suppressed information
The alarm text is stopped at the controller. It is transmitted nowhere.

The Product contains electrical components
And may not be disposed together with domestic waste.
Equipment must be separate collected with Electrical and Electronic waste. According to Local and currently valid legislation.

Introduction

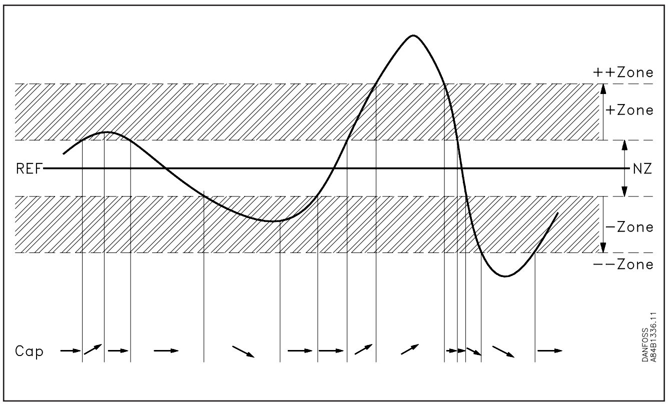


Application
The controller is used for capacity regulation of compressors or condensers in small refrigerating systems.

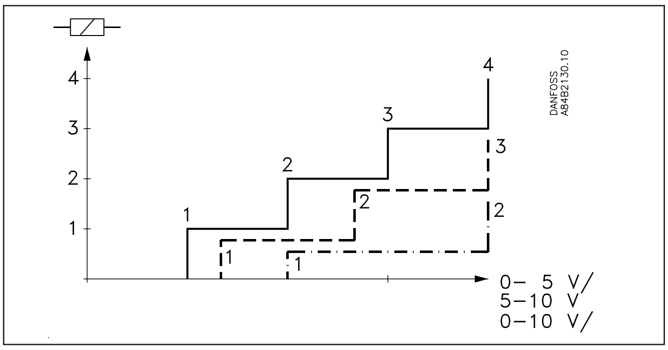
Advantages
- Patented neutral zone regulation
- Sequential or cyclic operation

Functions
- Regulation
  Regulation with up to four relay outputs can be carried out. Regulation takes place with a set reference which is compared to a signal from a pressure transmitter.
- Relay module
  It is possible to use the controller as relay module, so that the relays are cut in or out by means of an external voltage signal.
- Alarmfunction
  A relay becomes activated when the set alarm limits are exceeded.
- Digital input
  The digital input can be used for:
  - night operation where the suction pressure is raised
  - heat recovery where the condensing pressure is raised
  - external start/stop of the regulation.

Function



Capacity regulation
The cut-in capacity is controlled by signals from the connected pressure transmitter and the set reference.
Outside the reference a neutral zone is set where the capacity will neither be cut in nor out.
Outside the neutral zone (in the hatched areas named +zone and -zone) the capacity will be cut in or out if the regulation registers a change of pressure "away" from the neutral zone. Cutin and cutout will take place with the set time delays.
If the pressure however "approaches" the neutral zone, the controller will make no changes of the cut-in capacity.
The size of the +zone and -zone is identical and defined to be constantly 0.7 times the set value of the neutral zone.
If regulation takes place outside the hatched area (named ++zone and --zone), changes of the cut-in capacity will occur somewhat faster than if it were in the hatched area. The set time delays will here be reduced by factor 0.3.
Cutin of steps can be defined for either sequential or cyclic operation.



Relay module
The controller can also be used as a relay module where the relays in the module will then be controlled by the received voltage signal.
Depending on the definition of the signal and the number of relays used, the relays will be "distributed" over the signal.
A hysteresis around the individual cutin and cutout points will ensure that the relay will not cut in or out when it is not called for.

Electronic controls and transmitters

Survey of functions

Function	Para-meter	Parameter by operation via data communication
Normal display		
Normally the signal from the pressure transmitter is shown. If the controller is used as relay module, U_{in} will appear on the display.		Pressure
Pressure regulation		**Reference**
Regulation reference Regulation is based on the set value. (Push both buttons simultaneously to set the menu.)	-	Press. set point
Neutral zone There is a neutral zone around the reference. See also page 2.	r01	Neutral zone
Displacement of reference The set reference may be displaced with a fixed value when a signal is received at the DI input. Regulation will then be based on the set reference plus the value set here. The total reference can be seen when you push the lower of the two buttons. (Cf. also Definition of DI input).	r13	Pressure offset
Reference limitation The controller's setting range for the reference can be narrowed down, so that you cannot accidentally set a too high or too low value - that may result in damage to the system. With these settings the reference can only be set between the two values.		
Max. permissible reference value.	r02	Max. set point
Min. permissible reference value.	r03	Min. set point
Pressure unit Here you can select whether the controller is to indicate the pressure in bar or psig. (When psig is selected, the settings must also be in psig).	r05	Unit bar=0 psig=1 (In AKM only bar is used, whatever the setting).
Alarm		**Alarm settings**
The controller can give alarm in different situations. When there is an alarm all the light-emitting diodes (LED) will flash on the controller front panel, and the alarm relay will cut in.		
Upper deviation Here you set when the alarm at high pressure is to enter into effect. The value is set as an absolute value. See also emergency procedure page 5.	A10	Max. pressure
Lower deviation Here you set when the alarm at low pressure is to enter into effect. The value is set as an absolute value. See also emergency procedure page 5.	A11	Min. pressure
Alarm delay If one of the two limit values is exceeded, a timer function will commence. The alarm will not become active until the set time delay has been passed. The time delay is set in seconds.	A03	Alarm delay
Give the top button a brief push to zeroset the alarm and to have the message shown on the display.		Reset alarm The function zerosets all alarms when set in pos. ON.
		Alarm relay Here you can read the status of the alarm relay. (ON indicates operation with alarm).
		With data communication the importance of the individual alarms can be defined. Setting is carried out in the "Alarm destinations" menu. See also page 8.

Capacity		Capacity
Running time To prevent irregular operation, values have to be set for how the relays are to cut in and out.		
Min. ON time for relays.	c01	Min.ON time
Time delay for cutin of relays.	c05	Step delay inc.
Time delay for cutout of relays.	c06	Step delay dec.
Min. time period between cutin of same relay.	c07	Min recycle time
Coupling Cutin and cutout can take place in three ways: 1. Sequential: First relay 1 cuts in, then relay 2, etc. Cutout takes place in the opposite sequence. 2. Cyclic: An automatic operating time equalisation is arranged here, so that all steps will have the same operating time. (The relay with the fewest number of operating hours cuts in or out before the others). 3. Cyclic with unloader: The function can only be used when there are two compressors with one unloader each. The cyclic operation is performed on relays 1 and 3. The unloaders are mounted on relays 2 and 4 (relays 1 and 2 belong to the first compressor, relays 3 and 4 to the other). The above mentioned “Min. ON time for relays” is not used by the two unloaders. In connection with cutout, the two unloaders are cut out before the compressors are cut out.	c08	Step mode
Unloaders’ cutin and cutout mode (Only in connection with cutin/cutout mode 3. See above). The relays for the two unloaders can be set to switch on when more capacity is required (setting = 0), or they can switch off when more capacity is called for (setting = 1).	c09	Unloader (switch on = 0) (switch off = 1)
Miscellaneous		**Miscellaneous**
External signal Here you set the signal to be connected to the controller. 0: No signal/regulation stopped (display will then show OFF) 1: 4-20 mA from pressure transmitter for compressor regulation 2: 4-20 mA from pressure transmitter for condenser regulation 3: Pressure transmitter type AKS 32R for compressor regulation 4: Pressure transmitter type AKS 32R for condenser regulation 5: 0-10 V from other regulation 6: 0-5 V from other regulation 7: 5-10 V from other regulation	o10	Application mode
Number of relays Depending on the application, up to four relays may be used. This number must be set in the controller. (The relays are always used in numerical sequence).	o19	Number of steps
Pressure transmitter’s working range Depending on the pressure, a pressure transmitter with a given working range is used. This working range must be set in the controller (e.g.: -1 to 12 bar).		
Min. value	o20	Min. trans. press
Max. value	o21	Max trans. press
Use of DI input The digital input can be connected to a contact function, and the contact can now be used for one of the following functions: Setting / function: 0: DI input not used 1: Regulation reference displaced when contact is cut in 2: Regulation is started and stopped when the contact is cut in and out, respectively.	o22	Di input control
Operating hours The operating hours for the four relays can be read in the following menus. The read value is multiplied by 10 to obtain the number of hours. On reaching 999 hours the counter stops and must now be reset to, say, 0. There will be no alarm or error message for counter overflow.		(In the AKM display the hour number has not been multiplied)
Value for relay number 1	o23	DO 1 run hour
Value for relay number 2	o24	DO 2 run hour
Value for relay number 3	o25	DO 3 run hour
Value for relay number 4	o26	DO 4 run hour

Manual control From this menu the relays can be cut in and out manually. OFF gives no override, but a number between 1 and 4 will cut in a corresponding number of relays. Cutins and cutouts always take place from relay number 1. When there is manual operation, the display will show "- - x". Where x is 0 - 4.	o18	Manual control Only when "Manual control" has been put in pos. ON will it be possible to operate the individual relays. DO relay 1 DO relay 2 DO relay 3 DO relay 4 Alarm relay set When this function is used, the buttons on the controller cannot be used.
Language This setting is only required when data communication has been connected to the controller. Settings: 0=English, 3=Danish. When the controller is operated via data communication, the texts in the right-hand column will be shown in the selected language. When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	o11	Language
Frequency Set the net frequency.	o12	Main freq (50=0, 60=1)
Address If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be madewhen a data communication modulehas been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC.8A.C".		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60	o03	
The address is sent to the gateway when the menu is set in pos. ON (The setting will automatically change back to Off after a few seconds.)	o04	
Access code If the settings in the controller are to be protected by a numerical code, you can set a numerical value between 0 and 100. If not, you can cancel the function with setting OFF.	o05	
Operating status		
The controller goes through some regulating situations where it is just waiting for the next point of the regulation. To make these "why is nothing happening" situations visible, you can see an operating status on the display. Push briefly (1s) the upper button. If there is a status code, it will be shown on the display. The individual status codes have the following meanings:		EKC state (0 = regulation)
S2: When the relay is operated, it must be activated for min. x minutes		2
S5: Renewed cutin of the same relay must not take place more often than every x minutes		5
S8: The next relay must not cut in until x minutes have elapsed		8
S9: The next relay must not cut out until x minutes have elapsed		9

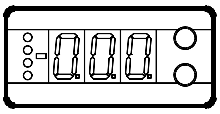
Emergency procedure
If the controller registers irregularities in the registered signals, it will start an emergency procedure:

For compressor regulation:
- If the signal from the pressure transmitter becomes smaller than expected, the controller will continue operating with the average capacity that has been cut in during the past 60 minutes. This cut-in capacity will gradually decline as time passes.
- If the signal for the suction pressure becomes smaller than the set value of A11, the capacity will instantly be cut out.

For condenser regulation:
- If the signal from the pressure transmitter becomes smaller than expected, or if the condensing pressure becomes bigger than the set value of A10, the entire capacity will instantly be cut in.

Operation

Display
The values will be shown with three digits, and with a setting you can determine whether the pressure are to be shown in bar or in psig.



Light-emitting diodes (LED) on front panel
There are four LED's on the front panel which will light up when the relays are operated.
All LED's will flash if there is an error in the regulation. In this situation you can upload the error code on the display and cancel the alarm by pushing the top button briefly.

The controller can give the following messages:		
E1	**Error message**	Errors in the controller
E2		Regulation out of range or control signal is defect.
A1	**Alarm message**	High pressure alarm
A2		Low pressure alarm

The buttons
When you want to change a setting, the two buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously.

Gives access to the menu (or cutout an alarm)

Gives access to changes

Saves a change

Examples of operations

Set the regulation's reference
1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Set one of the other menus
1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Menu survey

Function	Parameter	Min.	Max.
Normal display			
Shows the signal from the pressure transmitter	-		bar
Reference			
Set the regulation's pressure reference	-	-1 bar	40 bar
Neutral zone	r01	0,1 bar	5 bar
Max. limitation of pressure setting	r02	-1 bar	40 bar
Min. limitation of pressure setting	r03	-1 bar	40 bar
Select unit (0=bar / 1=psig)	r05	0	1
Reference displacement by signal at DI input	r13	-5 bar	5 bar
Alarm			
Upper alarm limit (absolute value)	A10	-1 bar	40 bar
Lower alarm limit (absolute value)	A11	-1 bar	40 bar
Alarm's time delay	A03	1 s	300 s
Capacity			
Min. ON time for relays	c01	0 s	900 s
Time delay for cutin of relays	c05	5 s	900 s
Time delay for cutout of relays	c06	5 s	900 s
Min. time period between cutins of same relay	c07	0 s	900 s
Definition of regulation mode 1: Sequential 2: Cyclic 3: Cyclic with unloaders	c08	1	3
If the regulation mode 3 has been selected, the relays for the unloaders can be defined to: 0: Cut in when more capacity is required 1: Cut out when more capacity is required	c09	0	1
Miscellaneous			
Controllers address	o03*	1	60
On/off switch (service-pin message)	o04*	-	-
Access code	o05	off(-1)	100
Define input signal and application: 0: no signal / regulation stopped 1: 4-20 mA pressure transmitter - compressor reg. 2: 4-20 mA pressure transmitter - condenser reg. 3: AKS 32R pressure transmitter - compressor reg. 4: AKS 32R pressure transmitter - condenser reg. 5: 0 - 10 V relay module 6: 0 - 5 V relay module 7: 5 - 10 V relay module	o10	0	7
Language (0=english, 3=danish). When you change this setting you must also activate O04.	011*	0	3
Set supply voltage frequency	o12	50 Hz	60 Hz
Manual operation with "x" relays	o18	0	4
Define number of relay outputs	o19	1	4
Pressure transmitter's working range - min. value	o20	-1 bar	0 bar
Pressure transmitter's working range - max. value	o21	1 bar	40 bar
Define DI input: 0: not used 1: Contact displaces reference 2: Contact starts and stops regulation	o22	0	2
Operating hours of relay 1 (value times 10)	o23	0 h	999 h
Operating hours of relay 2 (value times 10)	o24	0 h	999 h
Operating hours of relay 3 (value times 10)	o25	0 h	999 h
Operating hours of relay 4 (value times 10)	o26	0 h	999 h

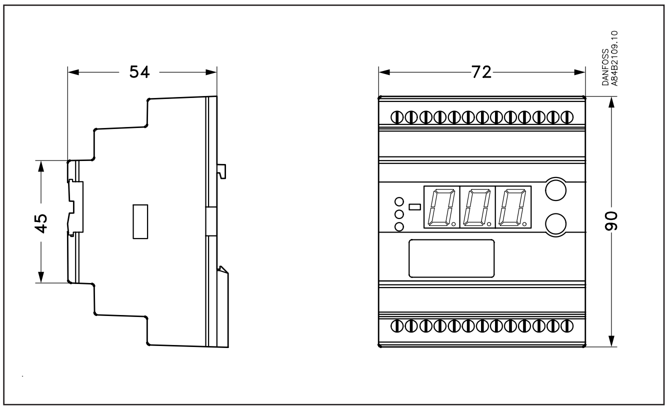
*) This setting will only be possible if a data communication moduel has been installed in the controller.

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Data

Supply voltage	230 V a.c. +/-15% 50/60 Hz, 5 VA	
Input signal	Pressure transmitter*) with 4-20 mA or voltage signal (0 - 5 V, 0 - 10 V or 5 - 10 V)	
	Digital input to external contact function	
Relay output	4 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarmrelay	1 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 1 A (inductive)
Data communication	Possible to connect a data communication module	
Ambient temperature	During operation -10 - 55°C During transport -40 - 70°C	
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2,5 mm² multicore	
Approvals	EU Low voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN50081-1 and EN 50082-2	

***) Pressure transmitter**
As pressure transmitter can be used AKS 3000 or AKS 33 (AKS 33 has a higher accuracy than AKS 3000).
It is also possible to use an AKS 32R. This pressure transmitter is only supplied in large quantities as per arrangement with Danfoss. Please refer to catalogue RK.0Y.G...



Ordering

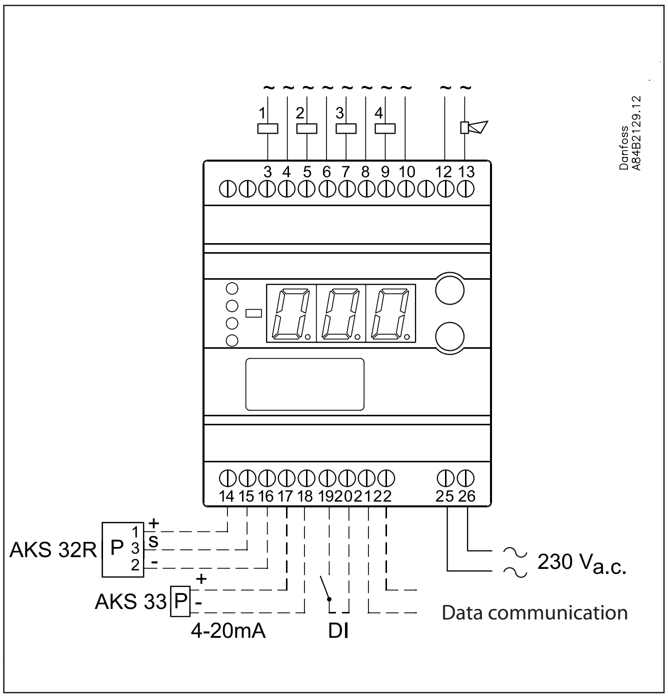
Type	Function	Code No.
EKC 331	Capacity controller	**084B7104**
EKA 173	Data communication module (accessories), (FTT 10 module)	**084B7092**
EKA 175	Data communication module (accessories), (RS 485 module)	**084B7093**

Connections

Necessary connections
Terminals:
25-26 Supply voltage 230 V a.c.
3- 10 Relay connections no. 1, 2, 3 and 4
12-13 Alarm relay
There is connection between 12 and 13 in alarm situations and when the controller is dead
Control signal (see also o10)
Either terminals:
14-16 Voltage signal from AKS 32R
or
17-18 Current signal from AKS 3000 or AKS 33
or
15-16 Voltage signal from an other regulation.

External contact function, if applicable
19-20 Contact function for displacement of reference or start/stop of the regulation.

Data communication, if applicable
21-22 Mount only, if a data communication module has been mounted.
It is important that the installation of the data communication cable be done correctly. Cf. separate literature No. RC.8A.C...

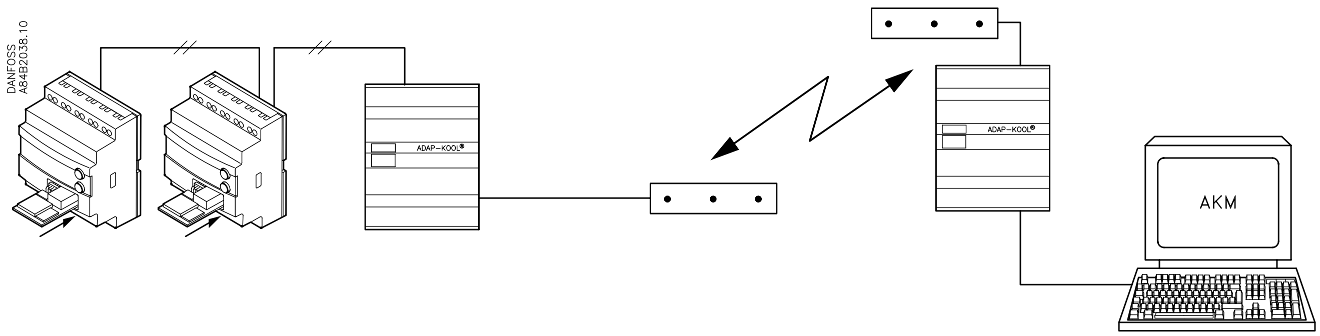


Data communication

This page contains a description of a few of the possibilities you will have when the controller is provided with data communication.

If you want to know more about operation of controllers via PC, you may order additional literature.

Example



Each controller is provided with a plug-in module type EKA 173.

The controllers are then connected to a two-core cable.

Up to 60 controllers may be connected to one cable.

This cable is also connected to a gateway type AKA 243.

This gateway will now control the communication to and from the controllers.

It will collect pressure values and it will receive alarms. When there is an alarm the alarm relay will be activated for two minutes

The gateway can now be connected to a modem.

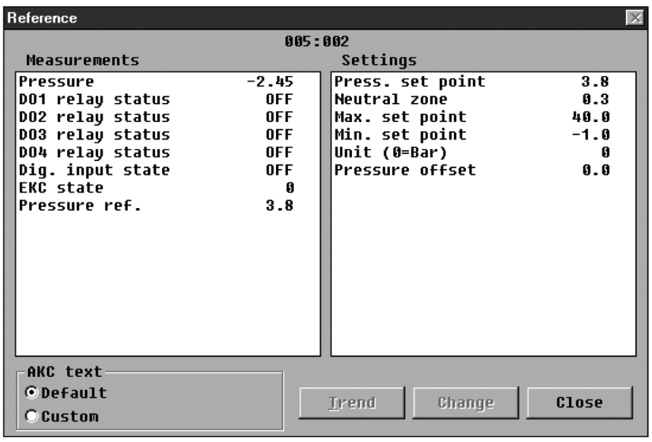
When an alarm occurs from one of the controllers, the gateway will - via the modem - make a phone call to the service company.

At the service company a modem, gateway and PC with system software type AKM have been installed.

All the controllers' functions can now be operated from the various menu displays.

The programme will for example upload all the collected temperature values once a day.

Example of menu display



Measurements are shown at one side and settings at the other.

You will also be able to see the parameter names of the functions on page 3 - 5.

With a simple change-over the values can also be shown in a trend diagram.

If you wish to check earlier pressure measurements, you can see them in the log collection.

Alarms

If the controller is extended with data communication, it will be possible to define the importance of the transmitted alarms.
The importance is defined with the setting: 1, 2, 3 or 0. When the alarm then arises at some time, it will result in one of the following activities:

1 = Alarm
The alarm message is sent off with alarm status 1. This means that the gateway that is the master in the system will have its alarm relay output activated for two minutes. Later, when the alarm ceases, the alarm text will be retransmitted, but now with status value 0.

2 = Message
The alarm text is transmitted with status value 2. Later, when the "message" lapses, the alarm text is retransmitted, but now with status value 0.

3 = Alarm
As "1", but the master gateway's relay output is not activated.

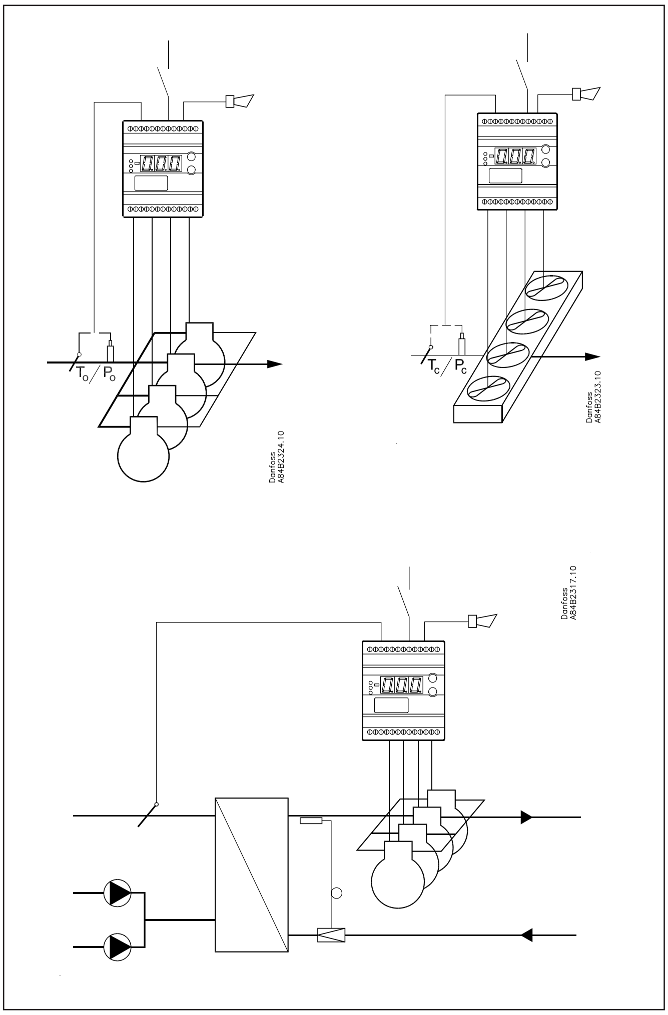
0 = Suppressed information
The alarm text is stopped at the controller. It is transmitted nowhere.

Introduction

Application
The controller is used for capacity regulation of compressors or condensers in small refrigerating systems.
Regulation can be carried out with up to four identical capacity steps.

Advantages
- Patented neutral zone regulation
- Sequential or cyclic operation

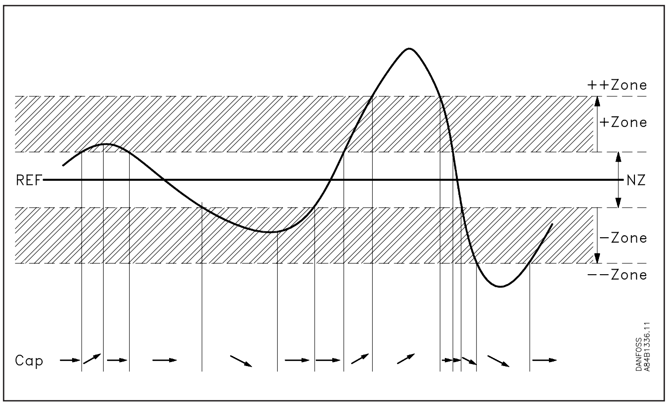
Functions
- Regulation
  Regulation with up to four relay outputs can be carried out. Regulation takes place with a set reference which is compared to a signal from a pressure transmitter or a temperature sensor.
- Relay module
  It is possible to use the controller as relay module, so that the relays are cut in or out by means of an external voltage signal.
- Alarmfunction
  A relay becomes activated when the set alarm limits are exceeded.
- Digital input
  The digital input can be used for:
  - night operation where the suction pressure is raised
  - heat recovery where the condensing pressure is raised
  - external start/stop of the regulation.
  - Monitoring of safety circuit
- Possibility of data communication



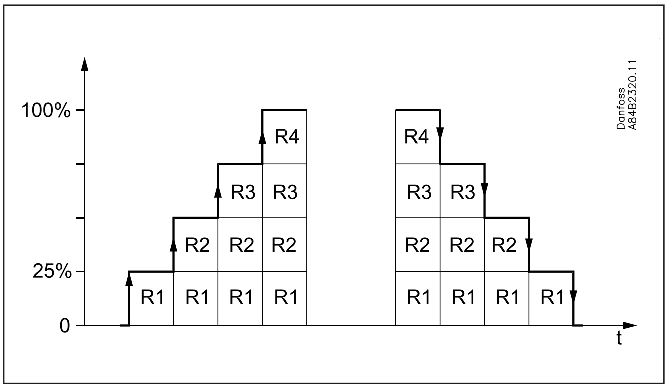
Display
A signal from a pressure transmitter will always be converted and shown as a temperature value.
Settings are made as for temperature values.

Function

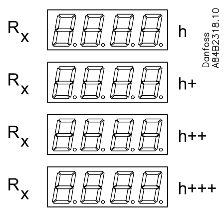
Capacity regulation
The cut-in capacity is controlled by signals from the connected pressure transmitter (temperature sensor) and the set reference.
Outside the reference a neutral zone is set where the capacity will neither be cut in nor out.
Outside the neutral zone (in the hatched areas named +zone and -zone) the capacity will be cut in or out if the regulation registers a change of pressure (the temperature) "away" from the neutral zone. Cutin and cutout will take place with the set time delays.
If the pressure (the temperature) however "approaches" the neutral zone, the controller will make no changes of the cut-in capacity.
If regulation takes place outside the hatched area (named ++zone and --zone), changes of the cut-in capacity will occur somewhat faster than if it were in the hatched area.
Cutin of steps can be defined for either sequential or cyclic operation.



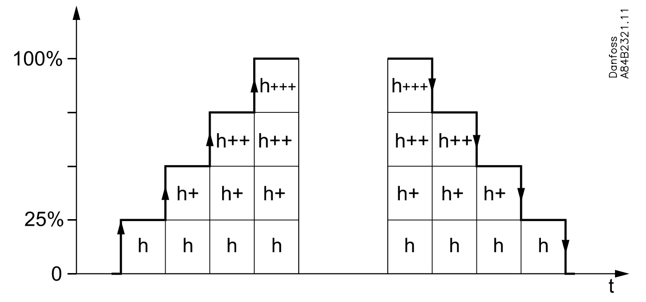
Sequential
The relays are here cut in in sequence – first relay number 1, then 2, etc.
Cutout takes place in the opposite sequence, i.e. the last cut-in relay will be cut out first.



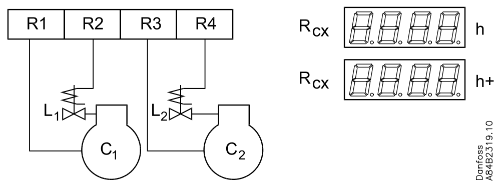
Cyclic
The relays are coupled here so that the operating time of the individual relays will become equalised.
At each cutin the regulation scans the individual relays' timer, cutting in the relay with least time on it.
At each cutout a similar thing happens. Here the relay is cut out that has most hours on the timer.

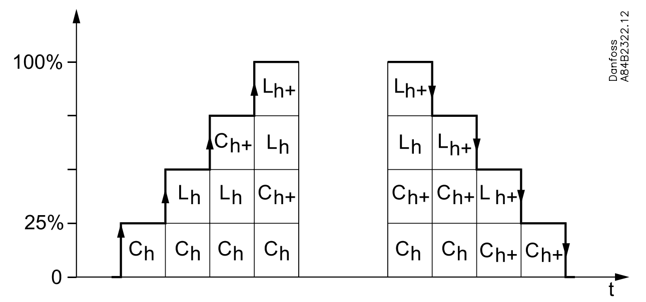


Rx = random relay
h = number of hours



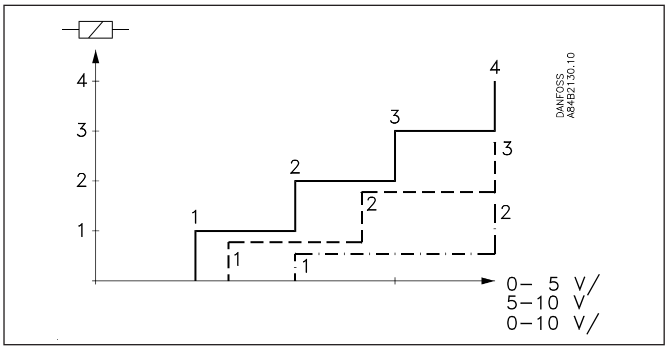
If capacity regulation is carried out on two compressors with one unloader each, the following function can be used:
Relays 1 and 3 are connected to the compressor motor.
Relays 2 and 4 are connected to the unloaders.
Relays 1 and 3 will operate in such a way that the operating time for the two relays will become equalised.





C = compressor, L = Unloader

Relay module
The controller can also be used as a relay module where the relays in the module are operated by the received voltage signal. The signal must be connected to terminal 15-16.
Depending on the definition of the signal and the number of relays used, the relays will be "distributed" over the signal.
A hysteresis at the individual coupling points will ensure that the relay will not cut in or out when not required.



Suvey of functions

Function	Para-meter	Parameter by operation via data communication
Normal display		
Normally the signal from the pressure transmitter/temperature sensor is shown If the controller is used as relay module, U_{in} will appear on the display.		Pressure / Temp°C
Pressure regulation		**Reference**
Regulation setpoint Regulation is based on the set value. A change of the set value can be limited/fixed by means of the settings in r02 and r03. (Push both buttons simultaneously to set the menu.)	-	Set point°C
Neutral zone There is a neutral zone around the reference. See also page 2.	r01	Neutral zone
Reference The set reference may be displaced with a fixed value when a signal is received at the DI input. Regulation will then be based on theset point plus the value set here. (Cf. also Definition of DI input).	r13	Offset K
The total reference can be seen when you push the lower of the two buttons	-	Reference
Set point limitation The controller's setting range for the set point can be narrowed down, so that you cannot accidentally set a too high or too low value - that may result in damage to the system. With these settings the setpoint can only be set between the two values.		
Max. permissible setpoint value.	r02	Max. set point
Min. permissible setpoint value.	r03	Min. set point
Correction of temperature measurement An offset adjustment of the registered temperature can be made. The function is used if correction for a too long sensor cable has to be made.	r04	Adjust sensor
Unit Here you can select whether thedisplay is to indicate temperatures in °C or in °F. Setting = "C-b" will give °C. Setting = "F-P" will give °F.	r05	Unit 0: °C 1: °F (In AKM only °C is used, whatever the setting)
Capacity		**Capacity**
Running time To prevent frequent start/stop, values have to be set for how the relays are to cut in and out.		
Min. ON time for relays.	c01	Min.ON time
Min. time period between cutin of same relay.	c07	Min recycle time
Coupling Cutin and cutout can take place in three ways: 1. Sequential: First relay 1 cuts in, then relay 2, etc. Cutout takes place in the opposite sequence. (”First in, last out”). 2. Cyclic: An automatic operating time equalisation is arranged here, so that all steps will have the same operating time. (The relay with the fewest number of operating hours cuts in or out before the others) (Or put differently: ”First in, last out”). 3. Cyclic with unloader: The function can only be used when there are two compressors with one unloader each. The cyclic operation is performed on relays 1 and 3. The unloaders are mounted on relays 2 and 4 (relays 1 and 2 belong to the first compressor, relays 3 and 4 to the other). The above mentioned ”Min. On-time” and "Min. recycle time" are not used for unloaders. In connection with cutout, the two unloaders are cut out efore the compressors are cut out.	c08	Step mode
Unloaders' cutin and cutout mode (Only in connection with cutin/cutout mode 3. See above). The relays for the two unloaders can be set to switch on when more capacity is required (setting = no), or they can switch off when more capacity is called for (setting = nc).	c09	Unloader (switch on = 0) (switch off = 1)

Setting for neutral zone regulation Regulation band under the neutral zonen	c10	+ Zone K
Time delay between step cut-ins in the regulation band over the neutral zone	c11	+ Zone m
Time delay between step cut-ins in the regulation band over the "+Zone band".	c12	+ + Zone s
Regulation band over the neutral zone	c13	- Zone K
Time delay between step cut-outs in the regulation band under the neutral zone	c14	- Zone m
Time delay between step cut-outs in the regulation band under the "-Zone band"	c15	- - Zone s
Alarm		**Alarm settings**
The controller can give alarm in different situations. When there is an alarm all the light-emitting diodes (LED) will flash on the controller front panel, and the alarm relay will cut in.		
Upper deviation Here you set when the alarm at high temperature/pressure is to enter into effect. The value is set as an absolute value. See also emergency procedure page 7.	A10	Max. press / Temp.
Lower deviation Here you set when the alarm at low temperature/pressure is to enter into effect. The value is set as an absolute value. See also emergency procedure page 7.	A11	Min. press / Temp.
Alarm delay If one of the two limit values is exceeded, a timer function will commence. The alarm will not become active until the set time delay has been passed. The time delay is set in minutes.	A03	Alarm delay
Give the top button a brief push to zeroset the alarm and to have the message shown on the display.		Reset alarm The function zerosets all alarms when set in pos. ON.
		Alarm relay Here you can read the status of the alarm relay. (ON indicates operation with alarm).
		With data communication the importance of the individual alarms can be defined. Setting is carried out in the "**Alarm destinations**" menu.
Miscellaneous		**Miscellaneous**
External signal Here you set the signal to be connected to the controller. 0: No signal/regulation stopped (display will then show OFF) 1: 4-20 mA from pressure transmitter for compressor regulation 2: 4-20 mA from pressure transmitter for condenser regulation 3: Pressure transmitter type AKS 32R for compressor regulation 4: Pressure transmitter type AKS 32R for condenser regulation 5: 0-10 V from other regulation 6: 0-5 V from other regulation 7: 5-10 V from other regulation 8: Pt1000 ohm temperature sensor for compressor regulation 9: Pt1000 ohm temperature sensor for condenser reguation 10: PTC1000 ohm temperature sensor for compressor regulation 11: PTC1000 ohm temperature sensor for condenser regulation	o10	Application mode
Number of relays Depending on the application, up to four relays may be used. This number must be set in the controller. (The relays are always used in numerical sequence).	o19	Number of steps
Pressure transmitter's working range Depending on the pressure, a pressure transmitter with a given working range is used. This working range must be set in the controller (e.g.: -1 to 12 bar The values must be set in bar if display in °C has been selected. And in psig, if °F has been selected.		If the two values are to be set from the AKM programme, they must be set in bar.
Min. value	o20	Min. trans. press
Max. value	o21	Max trans. press

Use of DI input The digital input can be connected to a contact function, and the contact can now be used for one of the following functions: Setting / function: 0: DI input not used 1: Regulation reference displaced when contact is cut in 2: Regulation is started and stopped when the contact is cut in and out, respectively. 3: Monitoring of the compressor's safety circuit. When the contact on the DI input cuts out, all relay outputs will immediately be cut out. At the same time the alarm will sound.	o22	Di input control
Operating hours The operating hours for the four relays can be read in the following menus. The read value is multiplied by 10 to obtain the number of hours. On reaching 999 hours the counter stops and must now be reset to, say, 0. There will be no alarm or error message for counter overflow.		(In the AKM display the hour number has not been multiplied)
Value for relay number 1	o23	DO 1 run hour
Value for relay number 2	o24	DO 2 run hour
Value for relay number 3	o25	DO 3 run hour
Value for relay number 4	o26	DO 4 run hour
Refrigerant setting Before refrigeration is started, the refrigeration must be defined. You may choose between the following refrigerants: 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270. 30=R417A Warning: Wrong selection of refrigerant may cause damage to the compressor.	o30	Refrigerant
Manual control From this menu the relays can be cut in and out manually. OFF gives no override, but a number between 1 and 4 will cut in a corresponding number of relays. Cutins and cutouts always take place from relay number 1. When there is manual operation, the display will show "- - x". Where x is 0 - 4	o18	
Frequency Set the net frequency.	o12	Main freq (50=0, 60=1)
Address If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be madewhen a data communication modulehas been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC.8A.C".		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60	o03	
The address is sent to the gateway when the menu is set in pos. ON	o04	
Access code If the settings in the controller are to be protected by a numerical code, you can set a numerical value between 0 and 100. If not, you can cancel the function with setting OFF.	o05	
		Manual control Only when "Manual control" has been put in pos. ON will it be possible to operate the individual relays: DO relay 1 DO relay 2 DO relay 3 DO relay 4 Alarm relay set When this function is used, the buttons on the controller cannot be used.

Operating status		
The controller goes through some regulating situations where it is just waiting for the next point of the regulation. To make these "why is nothing happening" situations visible, you can see an operating status on the display. Push briefly (1s) the upper button. If there is a status code, it will be shown on the display. The individual status codes have the following meanings		EKC state (0 = regulation)
S2: When the relay is operated, it must be activated for min. x minutes (cf. C01)		2
S5: Renewed cutin of the same relay must not take place more often than every x minutes (cf. C07)		5
S8: The next relay must not cut in until x minutes have elapsed (cf. C11-C12)		8
S9: The next relay must not cut out until x minutes have elapsed (cf. C14-C15)		9
S16: Regulation stopped due to manual operation via o18.		16
PS: Password required. Set password		PS
Alarm messages		**Alarms**
A1: High temperature alarm (cf. A10)		High temp. alarm
A2: Low temperature alarm (cf. A11)		Low temp. alarm
A11: No refrigerant has been selected (cf. o30)		RFG not selected
A12: Regulation stopped due to interrupted signal on the DI input		DI Alarm
E1: Error in the controller		Controller fault
E2: Control signal outside the range (short-circuited/interrupted)		Out of range

Emergency procedure
If the controller registers irregularities in the registered signals, it will start an emergency procedure:

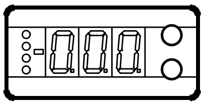
For compressor regulation:
- If the signal from the temperature sensor/pressure transmitter becomes smaller than expected, the controller will continue operating with the average capacity that has been cut in during the past 60 minutes. This cut-in capacity will gradually decline as time passes.
- If the signal becomes smaller than the set value of A11, the capacity will instantly be cut out.

For condenser regulation:
- If the signal from the temperature sensor/pressure transmitter becomes smaller than expected, or if the condensing pressure becomes bigger than the set value of A10, the entire capacity will instantly be cut in.

Operation

Display

The values will be shown with three digits, and with a setting you can determine whether the temperature are to be shown in °C or in °F.



Light-emitting diodes (LED) on front panel

There are four LED's on the front panel which will light up when the relays are operated.
All LED's will flash if there is an error in the regulation. In this situation you can upload the error code on the display and cancel the alarm by pushing the top button briefly.

The controller can give the following messages:		
E1	**Error message**	Errors in the controller
E2		Regulation out of range or control signal is defect.
A1	**Alarm message**	High pressure alarm
A2		Low pressure alarm
A11		No refrigerant selected
A12		Regulation stopped due to interrupted signal on the DI input

The buttons

When you want to change a setting, the two buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously.

Gives access to the menu (or cutout an alarm)

Gives access to changes

Saves a change

Examples of operations

Set the regulation's set point
1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Set one of the other menus
1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Menu survey

SW: 1.1x

Function	Parameter	Min.	Max.	Factory setting
Normal display				
Shows the signal from the temperature sensor / pressure transmitter	-		°C	
Reference				
Set the regulation's set point	-	-60 °C	170 °C	3
Neutral zone	r01	0.1 K	20 K	4.0
Max. limitation of set point setting	r02	-60 °C	170 °C	50
Min. limitation of set point setting	r03	-60 °C	50 °C	-60
Correction of signat from the sensor	r04	-20 K	20 K	0.0
Select unit (C-b=°C and F-P= °F)	r05	C-b	F-P	C-b
Reference displacement by signal at DI input	r13	-50 K	50 K	0
Capacity				
Min. ON time for relays	c01	0 min.	30 min	2
Min. time period between cutins of same relay	c07	0 min.	60 min.	4
Definition of regulation mode 1: Sequential (step mode / FILO) 2: Cyclic (step mode / FIFO) 3: Compressor with unloader	c08	1	3	1
If the regulation mode 3 has been selected, the relays for the unloaders can be defined to: no: Cut in when more capacity is required nc: Cut out when more capacity is required	c09	no	nc	no
Regulation parameter for + Zone	c10	0.1 K	20 K	3
Regulation parameter for + Zone min.	c11	0.1 min.	60 min.	2
Regulation parameter for ++ Zone seconds	c12	1 s	180 s	30
Regulation parameter for - Zone	c13	0 K	20 K	3
Regulation parameter for - Zone min.	c14	0.1 min.	60 min.	1
Regulation parameter for - - Zone seconds	c15	1 s	180 s	30
Alarm				
Alarm time delay	A03	1 min.	90 min.	30
Upper alarm limit (absolute value)	A10	-60 °C	170 °C	50
Lower alarm limit (absolute value)	A11	-60 °C	50 °C	-60
Miscellaneous				
Controllers address	o03*	1	60	0
On/off switch (service-pin message)	o04*	-	-	-
Access code	o05	off(-1)	100	-
Define input signal and application: 0: no signal / regulation stopped 1: 4-20 mA pressure transmitter - compressor reg. 2: 4-20 mA pressure transmitter - condenser reg. 3: AKS 32R pressure transmitter - compressor reg. 4: AKS 32R pressure transmitter - condenser reg. 5: 0 - 10 V relay module 6: 0 - 5 V relay module 7: 5 - 10 V relay module 8: Pt 1000 ohm sensor - compressor reg. 9: Pt 1000 ohm sensor - condenser reg. 10: PTC 1000 ohm sensor - compressor reg. 11: PTC 1000 ohm sensor - condenser reg.	o10	0	11	0
Set supply voltage frequency	o12	50 Hz	60 Hz	50
Manual operation with "x" relays	o18	0	4	0
Define number of relay outputs	o19	1	4	4
Pressure transmitter's working range - min. value	o20	-1 bar	0 bar	-1
Pressure transmitter's working range - max. value	o21	1 bar	40 bar	12

Continued

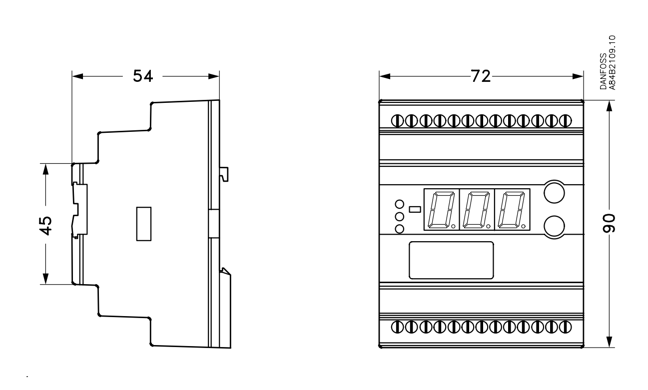
Define DI input: 0: not used 1: Contact displaces reference 2: Contact starts and stops regulation 3: Interrupted contact will cut out the capacity, and alarm will be given.	o22	0	3	0
Operating hours of relay 1 (value times 10)	o23	0 h	999 h	0
Operating hours of relay 2 (value times 10)	o24	0 h	999 h	0
Operating hours of relay 3 (value times 10)	o25	0 h	999 h	0
Operating hours of relay 4 (value times 10)	o26	0 h	999 h	0
Setting of refrigerant 1=R12. 2=R22. 3=R134a. 4=R502. 5=R717. 6=R13. 7=R13b1. 8=R23. 9=R500. 10=R503. 11=R114. 12=R142b. 13=User defined. 14=R32. 15=R227. 16=R401A. 17=R507. 18=R402A. 19=R404A. 20=R407C. 21=R407A. 22=R407B. 23=R410A. 24=R170. 25=R290. 26=R600. 27=R600a. 28=R744. 29=R1270. 30=R417A	o30	0	30	0

*) This setting will only be possible if a data communication moduel has been installed in the controller.

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Data

Supply voltage	230 V a.c. +/-15% 50/60 Hz, 5 VA	
Input signal	Pressure transmitter*) with 4-20 mA or temperature sensor Pt 1000 ohm or temperature sensor PTC 1000 ohm or voltage signal (0 - 5 V, 0 - 10 V or 5 - 10 V)	
	Digital input to external contact function	
Relay output	4 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarmrelay	1 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 1 A (inductive)
Data communication	Possible to connect a data communication module	
Environments	-10 - 55°C, during operation -40 - 70°C, during transport	
	20 - 80% Rh, not condensed	
	No shock influence / vibrations	
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2.5 mm^2 multicore	
Approvals	EU Low voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN50081-1 and EN 50082-2	



***) Pressure transmitter**
As pressure transmitter can be used AKS 3000 or AKS 33 (AKS 33 has a higher accuracy than AKS 3000).
It is also possible to use an AKS 32R. This pressure transmitter is only supplied in large quantities as per arrangement with Danfoss.
Please refer to catalogue RK0YG...

Ordering

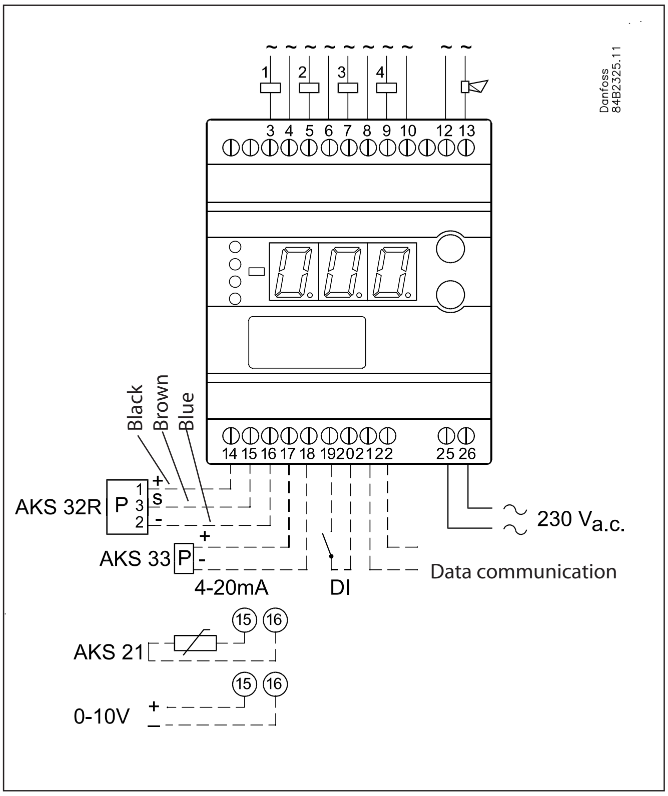
Type	Function	Code No.
EKC 331T	Capacity controller	**084B7105**
EKA 173	Data communication module (accessories), (FTT 10 module)	**084B7092**
EKA 175	Data communication module (accessories), (RS 485 module)	**084B7093**

Connections

Necessary connections
Terminals:
25-26 Supply voltage 230 V a.c.
3- 10 Relay connections no. 1, 2, 3 and 4
12-13 Alarm relay
There is connection between 12 and 13 in alarm situations and when the controller is dead
Control signal (see also o10)
Either terminals:
14-16 Voltage signal from AKS 32R
or
17-18 Current signal from AKS 3000 or AKS 33
or
15-16 Sensor signal from AKS 21, AKS 12 or EKS 111
or
15-16 Voltage signal from an other regulation.

External contact function, if applicable
19-20 Contact function for displacement of reference or start/stop of the regulation or for monitoring of safety circuit.

Data communication, if applicable
21-22 Mount only, if a data communication module has been mounted.
It is <u>important</u> that the installation of the data communication cable be done correctly. Cf. separate literature No. RC8AC...



Introduction and application

The sensor is based on a high - accuracy PT 1000 element.

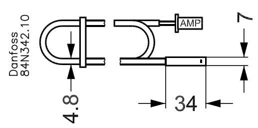
The sensor is developed for temperature monitoring and data logging in HACCP system. Further it can be used for defrost stop and for controlling air and room temperatures.

The sensor comes adjusted and complies with the requirements to tolerance in EN 60751, class B.

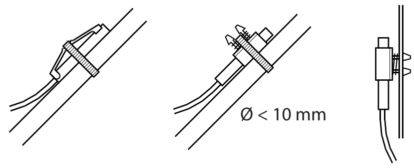
Technical data

Nominal resistance	1000 ohm at 0°C
Measuring accuracy	Class B
Temperature range	-50 to 100°C
Cable material	PVC 2 x 0.22 mm^2
Sensor housing	PBT
IP Class	IP 69K
AMP Plug	AMP ital mod 2, housing 280 358 crimp contact 280 708-2

R (Typ.) Ohm	Temp. °C	Temp. °F
1117	30	86
1078	20	68
1039	10	50
1000	0	32
961	-10	14
922	-20	-4
882	-30	-22



AKS 10

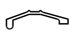


Mounting bracket with spring function

Ordering

Type	Cable length	Number	Code no.	
			Cable	Cable with AMP plug
AKS 10	1.5 m	1	**084N3109**	
		85	**084N3029**	
	2.5 m	1	**084N3110**	
		70	**084N3108**	
	3.5 m	1	**084N3101***	
		1		**084N3105**
		110	**084N3030**	**084N3040**
	5.5 m	1	**084N3102***	
		1		**084N3106**
		70	**084N3031**	**084N3041**
	8.5 m	1	**084N3103***	
		1		**084N3107**
		50	**084N3032**	**084N3042**

Other specifications on request
*) Mounting brackets included

Accessories	Symbol	Number	Mounting	Code no.
Mounting bracket with spring function		100	Pipe	**084N3140**
		100	Air / pipe	**084N3141**

Pt 1000 ohm/0°C

AKS 11, AKS 12, AKS 21

Application
The sensor is recommended for accurate temperature measurements such as e.g. superheating, food safety logs and other important temperature measurements.

Function
The sensor unit consists of a platinum element the resistance value of which changes proportionally with the temperature. Pt 1000 ohm sensor (1000 ohm at 0°C).
The sensors are adjusted and meet the tolerance requirements of EN 60751 Klasse B.

Type	Description	Temperature range °C	Sensor/ sensor body	Connection/ cable	Enclosure	Time constant in seconds	Cable length m	No.	Code no.
AKS 11 *)	Surface and duct sensor	-50 to +100	Toppart: PPO (Noryl) Bottom: Stainless Steel	PVC cable, 2 x 0.2 mm²	IP 67	3 [1] 10 [2] 35 [3]	3.5 m	1	**084N0003**
							3.5 m with AMP plug	110	**084N0050**
							5.5 m	1	**084N0005**
							5.5 m with AMP plug	70	**084N0051**
							8.5 m	1	**084N0008**
							8.5 m with AMP plug	50	**084N0052**
AKS 12	Air temperature sensor	-40 to 80	18/8 Stainless steel	PVC cable 2 x 0.22 mm²	IP 67	15 [1]	1.5 m	1	**084N0036**
								30	**084N0035**
							3.5 m	30	**084N0039**
							5.5 m	30	**084N0038**
							5.5 m with AMP plug	30	**084N0037**
							13.5 m	20	**084N0034**
AKS 21A **)	Surface sensor with clip	-70 to +180	18/8 Stainless steel	Fire-resistive silicone rubber cable 2 x 0.2 mm²	IP 67	6 [1] 14 [2] 35 [3]	2.5 m	1	**084N2007**
							5.0 m	1	**084N2008**
	Surface sensor with screened cable and clip	-70 to +180					2.0 m	1	**084N2024**
AKS 21M	Multipurpose sensor	-70 to +180					2.5 m	1	**084N2003**
AKS 21W	Immersion sensor with cable and senor pocket, Weld version	-70 to +180	Immersion sensor: 18/8 stainless steel tube Weld nipple:Free cutting steel Thread nipple:Free cutting steel	Fire-resistive silicone rubber cable 2 x 0.2 mm²	IP 56	18 [1]	2.5 m	1	**084N2017**

*) Recommended for measuring superheat
**) Recommended for hotgas systems

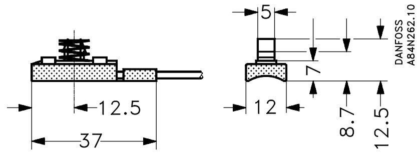
[1]) Agitated liquid.
[2]) Clamped to pipe.
[3]) Air 4 m/s.

AKS 11, AKS 12, AKS 21

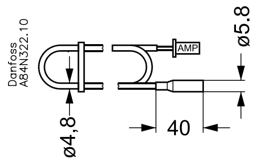
°C	ohm	°C	ohm
0	1000.0		1000.0
1	1003.9	−1	996.1
2	1007.8	−2	992.2
3	1011.7	−3	988.3
4	1015.6	−4	984.4
5	1019.5	−5	980.4
6	1023.4	−6	976.5
7	1027.3	−7	972.6
8	1031.2	−8	968.7
9	1035.1	−9	964.8
10	1039.0	−10	960.9
11	1042.9	−11	956.9
12	1046.8	−12	953.0
13	1050.7	−13	949.1
14	1054.6	−14	945.2
15	1058.5	−15	941.2
16	1062.4	−16	937.3
17	1066.3	−17	933.4
18	1070.2	−18	929.5
19	1074.0	−19	925.5
20	1077.9	−20	921.6
21	1081.8	−21	917.7
22	1085.7	−22	913.7
23	1089.6	−23	909.8
24	1093.5	−24	905.9
25	1097.3	−25	901.9
26	1101.2	−26	898.0
27	1105.1	−27	894.0
28	1109.0	−28	890.1
29	1112.8	−29	886.2
30	1167.7	−30	882.2
31	1120.6	−31	878.3
32	1124.5	−32	874.3
33	1128.3	−33	870.4
34	1132.2	−34	866.4
35	1136.1	−35	862.5
36	1139.9	−36	858.5
37	1143.8	−37	854.6
38	1147.7	−38	850.6
39	1151.5	−39	846.7
40	1155.4	−40	842.7
41	1159.3	−41	838.8
42	1163.1	−42	835.0
43	1167.0	−43	830.8
44	1170.8	−44	826.9
45	1174.7	−45	822.9
46	1178.5	−46	818.9
47	1182.4	−47	815.0
48	1186.3	−48	811.0
49	1190.1	−49	807.0
50	1194.0	−50	803.1

~ 3,9 ohm/K

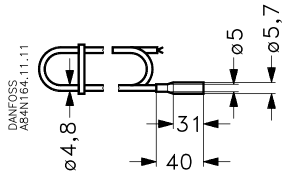
AKS 11



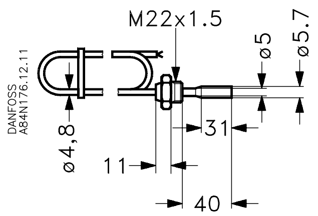
AKS 12



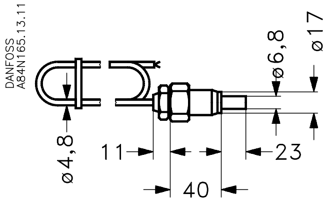
AKS 21A,
AKS 21M



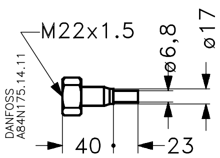
AKS 21W



AKS 21W
in welded version



Pocket in welded version
for AKS 21W



Sensors with AMP plug:
Plug is of the type: AMP ital mod 2, housing 280 358,
crimp contact 280 708-2.

Introduction

AKS 3000 is a series of absolute transmitters with high-level signal conditioned current output, developed to meet demands in A/C and refrigeration.
AKS 3000 utilizes the proved piezoresistive measuring principle, which has been used for decades in Danfoss pressure transmitters.
The pressure reference is a sealed gauge. This means that atmospheric pressure variations have no influence on regulating accuracy. A must in accurate low pressure regulation.
All materials in contact with the refrigerant and materials for the housing are AISI 316L stainless steel. No soft gaskets, all environmental sealings are made through laser weldings only.
AKS 3000 has a 4 to 20 mA output, and is available with 2 m cable or with spade terminals and EN 175301-803 plug.

Features

Designed to meet A/C and refrigeration demands without compromising control accuracy concerning

Tough environment
- Vibration
- Shock during operation and transport
- Humidity and ice formation
- Temperature variations
- Corrosive media like ammonia gases and salt mist

Convenient performance
- 4 to 20 mA signal
- 1% typical accuracy
- 0.5% typical linearity
- Prepared for high pressure refrigerants
- Bar code for tracing of calibration data

Perfect system integrity
- Compact design
- Max. working pressure ≥33 bar
- Temperature compensation for suction line
- Optimized accuracy at −10°C and +20°C for suction line installations, see page 4
- $^1/_4$-18 NPT, G $^3/_8$ A or $^1/_4$ flare ensures tight pressure connection
- All laser welded AISI 316L stainless steel enclosure
- No soft seals
- Enclosure: IP 65 with plug; IP 67 with cable

Application
- Fan speed control
- High pressure control
- Compressor capacity control
- Evaporator pressure detection
- Oil pressure control

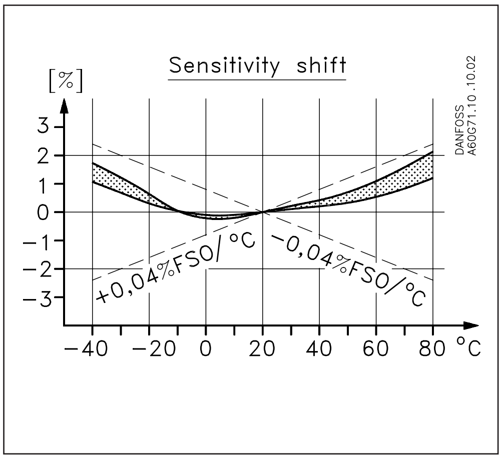
Approvals
- UL
- CE marked acc. to the EMC directive

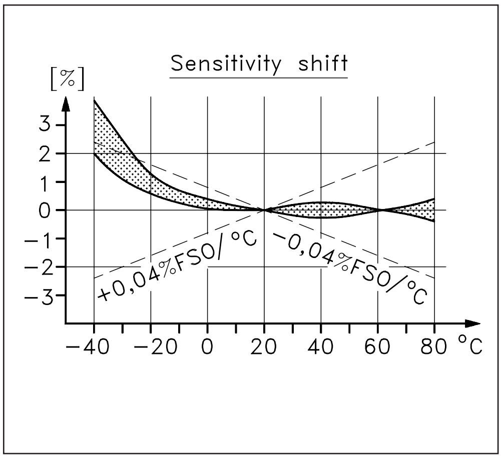
The complete technical leaflet (DKRCC.PD.SBO.A) can be downloaded from the Danfoss web site.

Thermal sensitivity

AKS 3000 is calibrated to limit ambient temperature influence on the regulating accuracy.
Pressure transmitters to be used at low temperature conditions, e.g. in suction lines, are calibrated at –10°C and +20°C.
In this way control accuracy is optimized in a temperature range of –30°C to +40°C.

Pressure transmitters for general use, e.g. at normal room temperature, are calibrated at +20°C and +60°C.
In this way control accuracy is optimized in a temperature range of 0°C to +80°C.





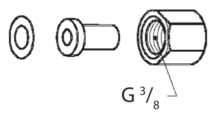
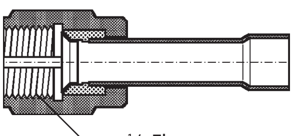
Ordering

AKS 3000

Operating range bar	Max. working pressure PB bar	Calibration at °C	Code no. EN 175301-803 plug, Pg 9: G $^3/_8$A	$^1/_4$ - 18 NPT	$^1/_4$ flare
–1 → 6	33	– 10 / +20	**060G1040**		**060G1321**
–1 → 9	33			**060G1051**	**060G1007**
–1 → 12	33		**060G1058**	**060G1052**	**060G1323**
–1 → 20	50		**060G1049**	**060G1053**	**060G1010**
0 → 18	50	+20 / +60		**060G1038**	**060G1325**
0 → 25	50		**060G1041**	**060G1080**	**060G1019**
0 → 30	60			**060G1081**	**060G1327**
0 → 40	100		**060G1066**		**060G1328**
0 → 60	100			**060G1083**	

Accessories

In case hermetic mounting is required, the following reduction nipples can be used, if the mounting is made so that no vibrations can be transferred to the nipple:

	Adaptor	Materials	Dimension	**Code no.**
 G $^3/_8$	Solder nipple	Steel	G $^3/_8$A → 8 mm	**993N3572**
 $^1/_4$ Flare	Solder nipple	Copper	$^1/_4$ flare → 6 mm	**023U8001**
	Solder nipple	Copper	$^1/_4$ flare → $^1/_4$ solder	**023U8002**

Technical data

Performance

Accuracy	±1% FS (typ.) / ±2% FS (max.)
Non-linearity	< ±0.5% FS
Hysteresis and repeatability	≤ ±0.1% FS
Thermal zero point shift	≤ ±0.2% FS/10K (typ.) ≤ ±0.4% FS/10K (max.)
Thermal sensitivity (span) shift	≤ ±0.2% FS/10K (typ.) ≤ ±0.4% FS/10K (max.)
Response time	< 4 ms
Max. operating pressure	See ordering table

Electrical specifications

Rated output signal	4 to 20 mA
Supply voltage, V_{supply} (polarity protected)	10 to 30 V d.c.
Voltage dependency	< 0.2% FS/10 V
Current limitation	28 mA (typ.)
Max. load, R_L	$R_L \le \frac{V_{supply} - 10\,V}{0.02\,A}$ [Ω]

Environmental conditions

Operating temperature range				–40 to 80°C
Compensated temperature range				LP: –30 → 40°C HP: 0 → 80°C
Transport temperature range				–50 to 85°C
EMC - Emmission				EN 61000-6-3
EMC - Immunity	Electrostatic discharge	Air	8 kV	EN 61000-6-2
		Contact	4 kV	EN 61000-6-2
	RF	field	10 V/m, 26 MHz - 1 GHz	EN 61000-6-2
		conducted	3 V_{rms}, 150 kHz - 30 MHz	EN 61000-6-2
	Transient	burst	4 kV (CM), Clamp	EN 61000-6-2
		surge	1 kV (CM,DM) at Rg = 42Ω	EN 61000-6-2
Insulation resistance				> 100 MΩ at 100 V d.c.
Mains frequency		500 V, 50 Hz		SEN 361503
Vibration stability	Sinusoidal	20 g, 25 Hz - 2 kHz		IEC 60068-2-6
	Random	7,5 g_{rms}, 5 Hz - 1 kHz		IEC 60068-2-34, IEC 60068-2-36
Shock resistance	Shock	500 g / 1 ms		IEC 60068-2-27
	Free fall			IEC 60068-2-32
Enclosure				Plug: IP 65 (IEC 60529) Cable: IP 67

Approvals

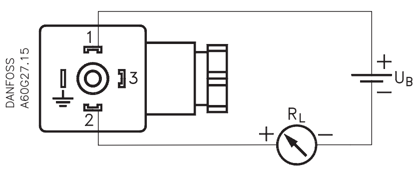
UL recognized for sale in the USA and Canada	File no. E310 24
CE marked according to the EMC directive	89/ 336/ EC

Mechanical characteristics

Electrical connection	EN 175301-803 plug/ 2 m cable
Wetted parts, material	EN10088-1-1.4404 (AISI 316L)
Housing material	EN10088-1-1.4404 (AISI 316L)
Weight	0.2 kg
Media	HFC, CFC, HCFC, ammonia

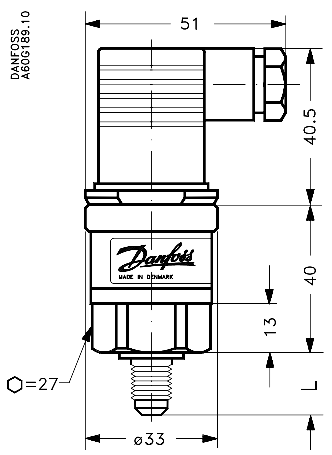
Electrical connection, Two-wire, 4 - 20 mA

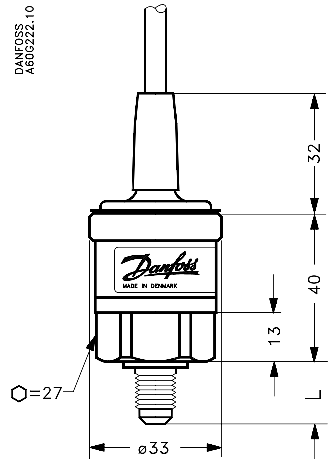
EN 175301-803 plug



1 Supply +
2 Supply –
3 Unused
⏚ Connected to transmitter housing

Dimensions and weight





All dimensions in mm

Pressure Connection	$^1/_4$-18 NPT	G $^3/_8$ A ISO 228/1	$^1/_4$ flare $^7/_{16}$ - 20 UNF	Weight kg	
				plug	cable
L [mm]	16	21	16.5	0.15	0.20

Introduction

AKS 32 and AKS 33 are pressure transmitters that measure a pressure and convert the measured value to a standard signal:

- 1 → 5 V d.c. or 0 → 10 V d.c. for AKS 32
- 4 → 20 mA for AKS 33

A robust design makes the AKS very suitable for application within a number of fields e.g.

- Air conditioning systems
- Refrigeration plant
- Process control
- Laboratories

Features

Highly developed sensor technology means high pressure regulation accuracy, a very important factor in the precise and energy-economic capacity regulation of refrigeration plant.

- Temperature compensation for LP and HP pressure transmitters, developed specially for refrigeration plant:
  LP: −30 → +40°C (≤16 bar)
  HP: 0 → +80°C (>16 bar)
- Compatibility with all refrigerants incl. ammonia means less stock and greater application flexibility.
- Built-in voltage stabiliser, i.e. the AKS pressure transmitters can be powered from an unregulated voltage supply of any output within given limits.
- Effective protection against moisture means that the sensor can be mounted in very harsh environments, e.g. in the suction line encapsulated in an ice block.
- Robust construction gives protection against mechanical influences such as shock, vibration and pressure surge. AKS sensors can be mounted direct on to the plant.
- No adjustment necessary. With the highly developed sensor technology and sealed gauge principle, the accuracy of the factory setting is maintained independent of variations in ambient temperature and atmospheric pressure. This is very important when ensuring evaporating pressure control in air conditioning and refrigeration applications.
- EMC protection according to EU EMC-directive (CE-marked)
- UL approved
- Polarity protected inputs.

The complete technical leaflet (RD5GH) can be downloaded from the Danfoss web site.

Technical data

Performance

Accuracy	±0.3% FS (typ.)/±0.8% FS (max.)
Non-linearity (Best fit straight line)	< ±0.2% FS
Hysteresis and repeatability	≤ ±0.1% FS
Thermal zero point shift	≤ ±0.1% FS/10K (typ.) ≤ ±0.2 %FS/10K (max.)
Thermal sensitivity (span) shift	≤ ±0.1% FS/10K (typ.) ≤ ±0.2 %FS/10K (max)
Response time	< 4 ms
Max. operating pressure	See ordering table
Burst pressure	min. 300 bar

Electrical specifications for AKS 33, 4 - 20 mA output signal

Rated output signal	4 to 20 mA
Supply voltage, V_{supply} (polarity protected)	10 to 30 V d.c.
Voltage dependency	< 0.05% FS/10 V
Current limitation (linear output signal up to 1.5 × rated range)	28 mA
Max. load, R_L	$R_L \le \frac{V_{supply} - 10\ V}{0.02\ A}$ [Ω]

Electrical specifications for AKS 32, 0 - 10 V d.c. output signal

Rated output signal (short-circuit protected)	0 to 10 V d.c.
Supply voltage, V_{supply} (polarity protected)	15 to 30 V d.c.
Supply current consumption	< 8 mA
Supply voltage dependency	< 0.05% FS/10 V
Output impedance	< 25 Ω
Load resistance, R_L	$R_L \ge 15$ kΩ

Electrical specifications for AKS 32, 1-5 V d.c. output signal

Rated output signal (short-circuit protected)	1 to 5 V d.c.
Supply voltage, V_{supply} (polarity protected)	9 to 30 V d.c.
Supply current consumption	< 5 mA
Supply voltage dependency	< 0.05% FS/10 V
Output impedance	< 25 Ω
Load resistance, R_L	$R_L \ge 10$ kΩ

Environmental conditions

Operating temperature range					–40 to 85°C
Compensated temperature range					LP:–30 to +40°C / HP:0 to +80°C
Transport temperature range					–50 to 85°C
EMC - Emission					EN 61000-6-3
EMC - Immunity	Electrostatic discharge		Air	8 kV	EN 61000-6-2
			Contact	4 kV	EN 61000-6-2
	RF	field	10 V/m, 26 MHz - 1 GHz		EN 61000-6-2
		conducted	3 V_{rms}, 150 kHz - 30 MHz		EN 61000-6-2
	Transient		burst	4 kV (CM)	EN 61000-6-2
			surge	1 kV (CM,DM)	EN 61000-6-2
Insulation resistance					> 100 MΩ at 100 V d.c.
Mains frequency test			500 V, 50 Hz		SEN 361503
Vibration stability	Sinusoidal		20 g, 25 Hz - 2 kHz		IEC 60068-2-6
	Random		7,5 g_{rms}, 5 Hz - 1 kHz		IEC 60068-2-34, IEC 60068-2-36
Shock resistance	Shock		500 g / 1 ms		IEC 60068-2-27
	Free fall				IEC 60068-2-32
Enclosure	Plug version				IP 65 - IEC 60529
	Cable version				IP 67 - IEC 60529

Technical data
(continued)

Approvals

UL recognized for sale in the USA and Canada	File no. E310 24
CE marked according to the EMC directive	89/ 336/ EC

Mechanical characteristics

Housing material and material in contact with medium	EN 10088-1. 1.4404 (AISI 316L)
Weight	0.3 kg

Ordering

AKS 32, version 1 → 5 V

Operating range bar		Max. working pressure PB bar	Compensated temperature range °C	Code no.					
				EN 175301-803, plug Pg 9			Cable		
				$^1/_4$ NPT 1)	G $^3/_8$ A 2)	$^1/_4$ flare 3)	$^1/_4$ NPT 1)	$^1/_4$ flare 3)	
LP	–1 → 6	33	– 30 → +40	**060G2000**	**060G2004**	**060G2068**			
	–1 → 12	33	– 30 → +40	**060G2001**	**060G2005**	**060G2069**	**060G2017**	**060G2073**	
HP	–1 → 20	40	0 → +80	**060G2002**	**060G2006**	**060G2070**			
	–1 → 34	55	0 → +80	**060G2003**	**060G2007**	**060G2071**			

AKS 32, version 0 → 10 V

Operating range bar		Max. working pressure PB bar	Compensated temperature range °C	Code no.		
				EN 175301-803, plug Pg 9		
				$^1/_4$ NPT 1)	G $^3/_8$ A 2)	$^1/_4$ flare 3)
LP	–1 → 5	33	– 30 → +40		**060G2038**	
	–1 → 9	33	– 30 → +40	**060G2013**	**060G2036**	**060G2082**
HP	–1 → 24	40	0 → +80	**060G2014**	**060G2037**	**060G2083**
	–1 → 39	60	0 → +80	**060G2080**	**060G2079**	**060G2084**

AKS 33, version 4 → 20 mA

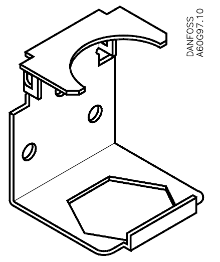
Operating range bar		Max. working pressure PB bar	Compensated temperature range °C	Code no.					
				EN 175301-803, plug Pg 9			Cable		
				$^1/_4$ NPT 1)	G $^3/_8$ A 2)	$^1/_4$ flare 3)	$^1/_4$ NPT 1)	G $^3/_8$ A 2)	$^1/_4$ flare 3)
LP	–1 → 5	33	– 30 → +40	**060G2112**	**060G2108**	**060G2047**			
	–1 → 6	33	– 30 → +40	**060G2100**	**060G2104**	**060G2048**		**060G2120**	
	–1 → 9	33	– 30 → +40	**060G2113**	**060G2111**	**060G2044**			**060G2062**
	–1 → 12	33	– 30 → +40	**060G2101**	**060G2105**	**060G2049**	**060G2117**		
	–1 → 20	40	0 → +80	**060G2102**	**060G2106**	**060G2050**	**060G2118**		
HP	–1 → 34	55	0 → +80	**060G2103**	**060G2107**	**060G2051**	**060G2119**		**060G2065**
	0 → 16	40	0 → +80	**060G2114**	**060G2109**				
	0 → 25	40	0 → +80	**060G2115**	**060G2110**			**060G2127**	**060G2067**

1) $^1/_4$-18 NPT
2) Thread ISO 228/1 - G $^3/_8$ A (BSP)
3) $^7/_{16}$-20 UNF

Is also available in US-version (1 → 6 V) and with $^1/_8$-27 NPT connection. Please contact Danfoss

Accessories

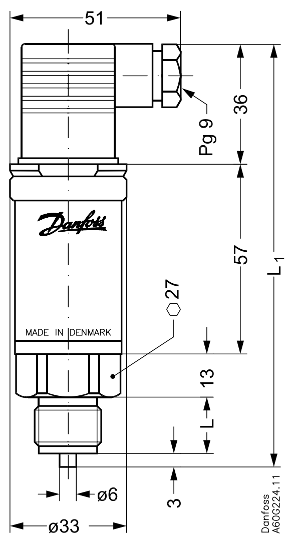
AKS 32, AKS 33



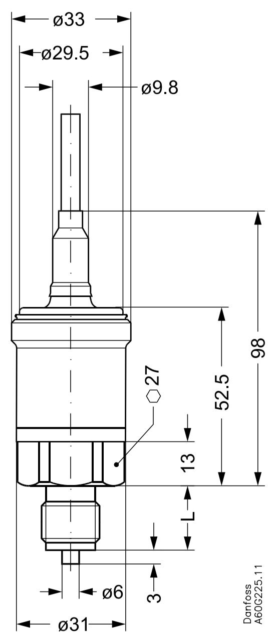
Description	**Code no.**
Mounting bracket	**060G0213**
10 pcs. aluminium gaskets for G $^3/_8$ A thread	**060B1208**

Dimensions and weights

Version with EN 175301-803 plug



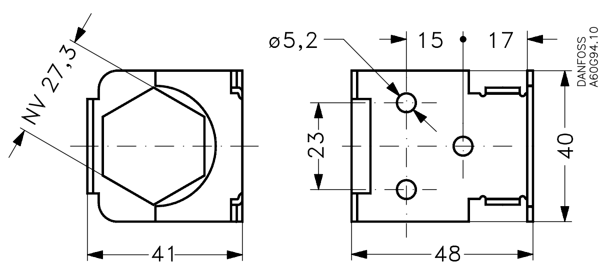
Cable version



Pressure connection	$^1/_4$-18 NPT	G $^3/_8$ A ISO 228/1	$^1/_4$ in. flare $^7/_{16}$-20 UNF
L [mm]	16	18	16.5
L_1 [mm]	122	127	122.5

Weight approx. 0.3 kg

Bracket



Introduction

AKS 32R is a ratiometric pressure transmitter that converts the measured pressure to a linear output signal. The min. value of the output signal is 10% of the actual supply voltage. The max. value is 90% of the actual supply voltage.

At a supply voltage of 5 V, a linear output signal is thus obtained, i.e.

- 0.5 V at min. pressure of the pressure transmitter
- 4.5 V at max. pressure of the pressure transmitter

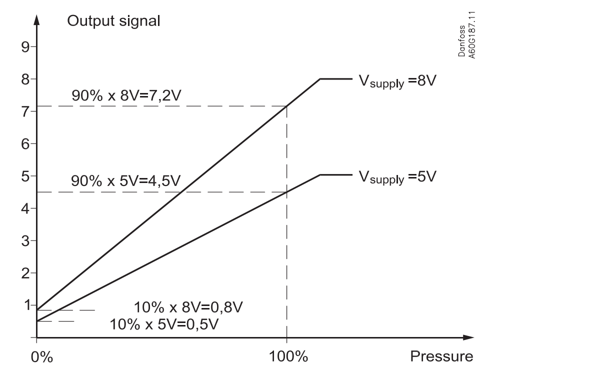
The robust design and the ratiometric output signal makes the AKS 32 R suitable for systems together with ratiometric A/D converters within a number of fields:

- A/C systems
- Refrigeration plant
- Process control
- Laboratories

Features

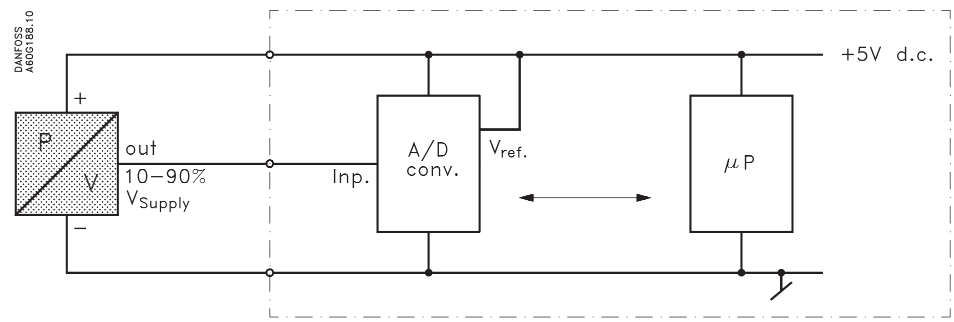
- Highly developed sensor technology means great regulation accuracy.
- Selective temperature compensation for LP and HP pressure transmitters,
- optimally adjusted to refrigeration plant
  LP: –30 → +40°C (≤16 bar)
  HP: 0 → +80°C (>16 bar).
- Compatible with all refrigerants incl. ammonia.
- Built-in voltage stabilizer
- Effective protection against moisture makes it possible to mount AKS 32R under the most rough operating conditions.
- Robust construction gives protection against mechanical influences such as shock, vibration,and pressure surge. Therefore, AKS 32R can be mounted direct on to the plant.
- EMC protected in accordance with the EU EMC-directive (CE-marked).
- Polarity protected inlets
- Output signal specially adjusted to ratiometric A/D-converters.
- Sealed gauge measuring principle (pressure reference = 1013 mbar).
- UL approved

Output signal



The diagram indicates the relationship between output signal from AKS 32 R, supply voltage and pressure.

Connection for A/D converter



The complete technical leaflet (RD5GJ) can be downloaded from the Danfoss web site.

Tecnical data

Performance

Accuracy	±0.3% FS (typ.) ±0.8% FS (max.)
Linearity deviation (Best fit straight line)	< ±0.2% FS
Hysteresis and repeatability	≤ ±0.1% FS
Thermal zero point operation	≤ ±0.1% FS/10K (typ.) ≤ ±0.2 %FS/10K (max.)
Thermal sensitivity operation	≤ ±0.1% FS/10K (typ.) ≤ ±0.2 %FS/10K (max)
Response time	< 4 ms
Max. working pressure	> 33 bar
Burst pressure	min.300 bar

Electrical specifications

Nominal output signal (short-circuit protection)	10 to 90% of V_{supply}
Supply voltage, V_{supply} (polarity protection)	4.75 to 8 V d.c.
Power consumption, supply	< 5 mA at 5 V d.c.
Voltage dependence, supply	< 0.05% FS/10 V
Output impedance	< 25 Ω
Load resistance, R_L	$R_L \geq 10$ kΩ

Operating conditions

Operating temperature					–40 to 85°C
Compensated temperature range				LP	–30 to +40°C
				HP	0 to +80°C
Transport temperature					–50 to 85°C
EMC - Emission					EN 61000-6-3
EMC - Immunity	Electrostatic discharge		Air	8 kV	EN 61000-6-2
			Contact	4 kV	EN 61000-6-2
	RF	field	10 V/m, 26 MHz - 1 GHz		EN 61000-6-2
		conducted	3 V_{rms}, 150 kHz - 30 MHz		EN 61000-6-2
	Transient		burst	4 kV (CM)	EN 61000-6-2
			surge	1 kV (CM,DM)	EN 61000-6-2
Insulation resistance					> 100 MΩ at 100 V d.c.
Operation frequency test			500 V, 50 Hz		SEN 361503
Vibration stability	Sinusoidal		20 g, 25 Hz - 2 kHz		IEC 60068-2-6
	Random		7,5 g_{rms}, 5 Hz - 1 kHz		IEC 60068-2-34, IEC 60068-2-36
Shock resistance	Shock		500 g / 1 ms		IEC 60068-2-27
	Free fall				IEC 60068-2-32
Enclosure	Plug				IP 65 - IEC 60529
	Cable				IP 67 - IEC 60529

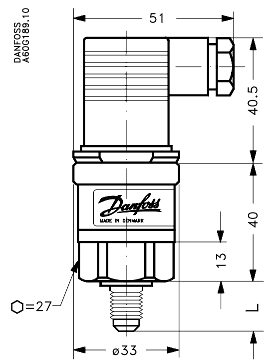
Approvals

UL recognized for sale in the USA and Canada	File no. E310 24
CE marked according to the EMC directive	89/ 336/ EC

Mechanical characteristics

Housing material and material in contact with medium	EN 10088-1. 1.4404 (AISI 316L)
Weight	0.3 kg

Dimensions and weight



Weight approx. 0.3 kg

Pressure connection	$^1/_4$-18 NPT	G $^3/_8$ A ISO 228/1	$^1/_4$ in. flare $^7/_{16}$-20 UNF
L [mm]	16	21	16.5

Notes

Notes