

Catalogue

Liquid level regulating valves for Industrial Refrigeration

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Float valve

Type HFI

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Float valve

Type HFI



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.

The HFI is available with two external connections on the housing for drainage and pressure equalizations.

Features

- Designed for direct flange mounting on to plate heat exchanger type condensers
- Can be mounted directly on vessels
- Temperature range: $-50/+80^{\circ}\text{C}$ ($-58/+176^{\circ}\text{F}$)
- Equipped with purge valve for purging non condensable gasses
- Available with external connections for drainage and pressure equalizations
- Maximum operating pressure is 25 bar g (363 psi g)
- Suitable for R717 (ammonia), HCFC and HFC 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: DNV, CRN, BV, EAC etc. To get an updated list of certification on the products please contact your local Danfoss Sales Company.

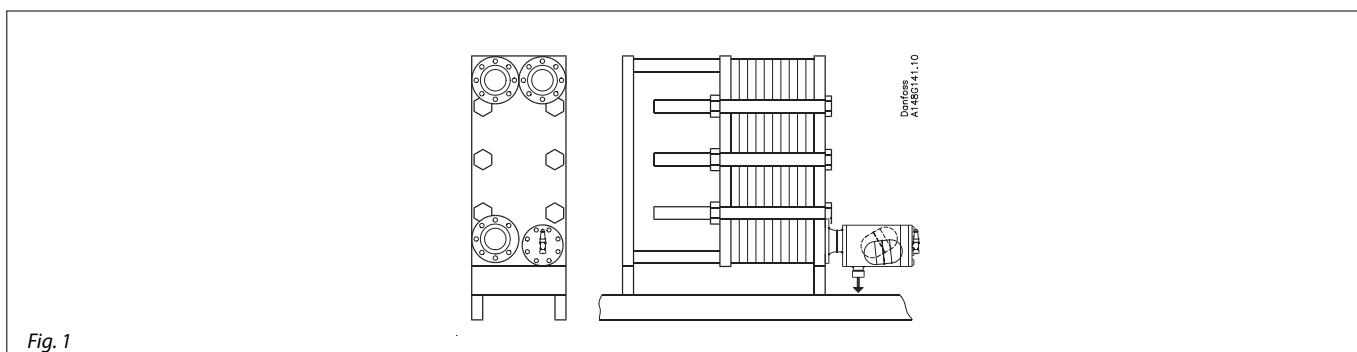


Fig. 1

Float valve, type HFI

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
Suitable for R717 (ammonia), HCFC and HFC with a density of 500 through 700 kg/m³ (31.21 - 43.70 lb/ft³). For densities 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:
Housing PED 28 bar g (407 psi g)
Ball (float) 25 bar g (363 psi g)
If test pressure exceeds 25 bar g (363 psi g) the ball should be removed during test.
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.

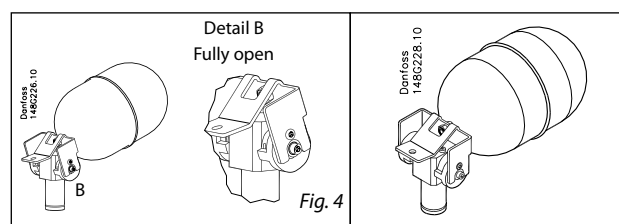
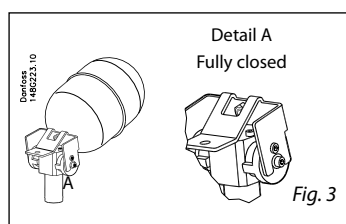
When capacity demands increase, the liquid level in the float valve will rise, which will cause the valve to open and the refrigerant to expand into the separator at the low pressure side.

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.

Float valve, type HFI

Insert for the high pressure float valve



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/m³.

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

$$\text{Mass flow } G = K \sqrt{\Delta p \times \rho} \text{ [kg / h]}$$

Δp = differential pressure [bar]

ρ = density of liquid [kg/m³]

K = valve constant (from the above table)

Float valve, type HFI

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							

Float valve, type HFI

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								

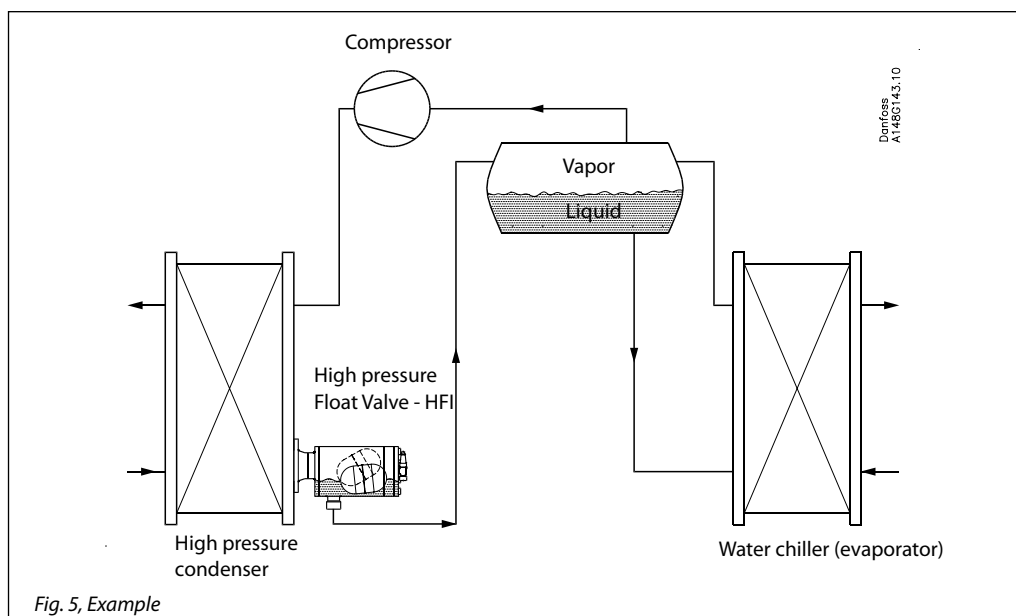
HFI 070 - R717, evaporating capacity [TR]

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								

Float valve, type HFI

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.



Float valve, type HFI

Material specification

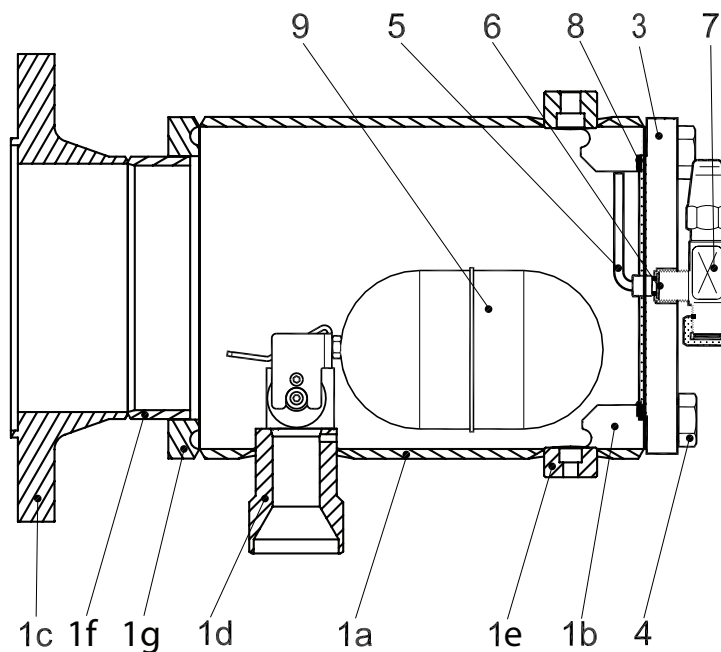


Fig. 6

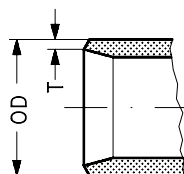
No	Part	Material	DIN/EN	ASTM
1	Housing: a. Shell b. Flange (shell) c. Flange (inlet) d. Branch (discharge) e. External connection f. Flange (shell) g. Connecting tube	Steel Steel Steel Steel Steel Steel Steel	P215NL, EN 10216-4 P275 NL1, EN10028-3 P285QH EN 10222-4 P275 NL1, EN10028-3 P285QH EN 10222-4 P215NL, EN 10216-4 P275 NL1, EN10028-3	Grade 1, A333, A334 Grade A , A662 LF2A350 Grade A , A662 LF2A350 Grade 1, A333, A334 Grade A , A662
3	End cover with cylinder	Steel	P275 NL1, EN 10 028-3	
4	Set screw	Stainless steel	A2-70	
5	Tube	Steel		
6	Gasket	Aluminium		
7	Purge valve, SNV-ST ¹⁾			
8	Gasket	Non asbestos		
9	Float Ball	Steel		

¹⁾ SNV-ST G½-G½ (148B3745).

Float valve, type HFI

Connections

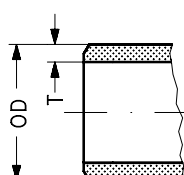
DIN - Outlet



Butt-weld DIN (EN 10220)

HFI size mm	HFI size in.	Outlet				For use with valve type
		OD mm	T mm	OD in.	T in.	
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

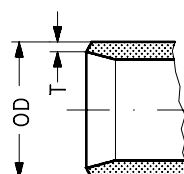
ANSI - Outlet



Butt-weld ANSI (B 36.10 Schedule 40)

HFI size mm	HFI size in.	Outlet				For use with valve type
		OD mm	T mm	OD in.	T in.	
100	4	60.3	3.9	2.37	0.15	HFI 040 HFI 050 HFI 060 HFI 070
150	6	60.3	3.9	2.37	0.15	HFI 050 HFI 060 HFI 070

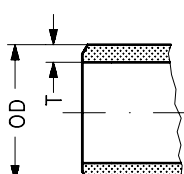
DIN - Inlet



Butt-weld DIN (EN 10220)

HFI size mm	HFI size in.	Inlet				For use with valve type
		OD mm	T mm	OD in.	T in.	
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

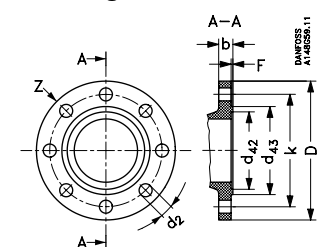
ANSI - Inlet



Butt-weld ANSI (B 36.10 Schedule 40)

HFI size mm	HFI size in.	Inlet				For use with valve type
		OD mm	T mm	OD in.	T in.	
100	4	114.3	6.3	4.50	0.25	HFI 040 HFI 050 HFI 060 HFI 070
150	6	168.3	7.1	6.63	0.28	HFI 050 HFI 060 HFI 070

Inlet flange



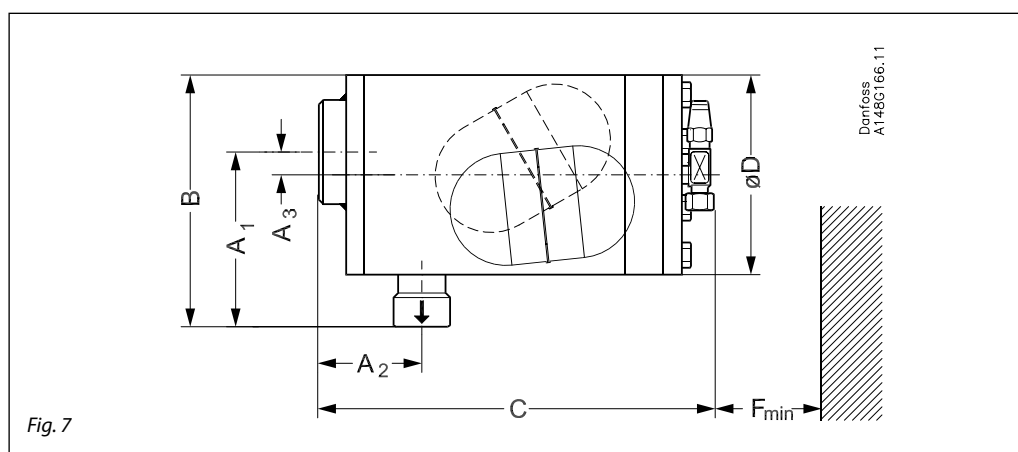
40 bar / DIN 2635 / DIN 2512-F*

		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

Float valve, type HFI

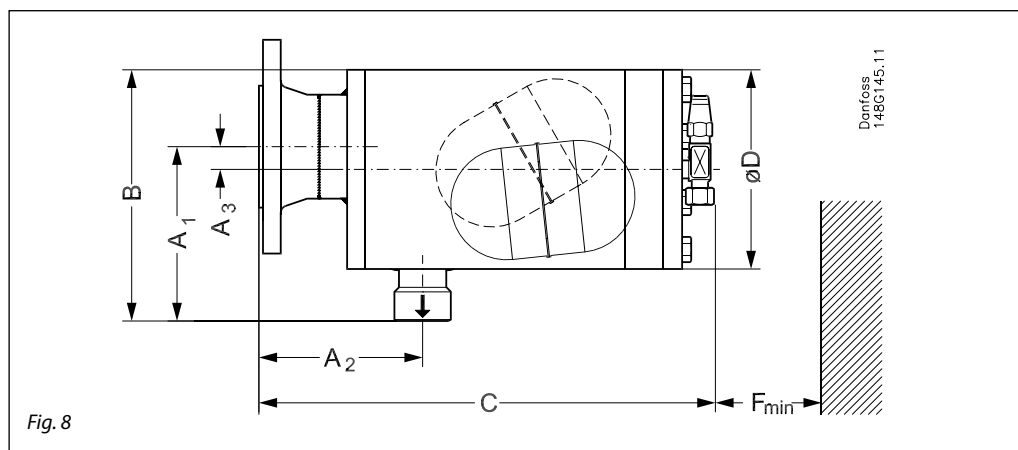
Dimensions and weights



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.



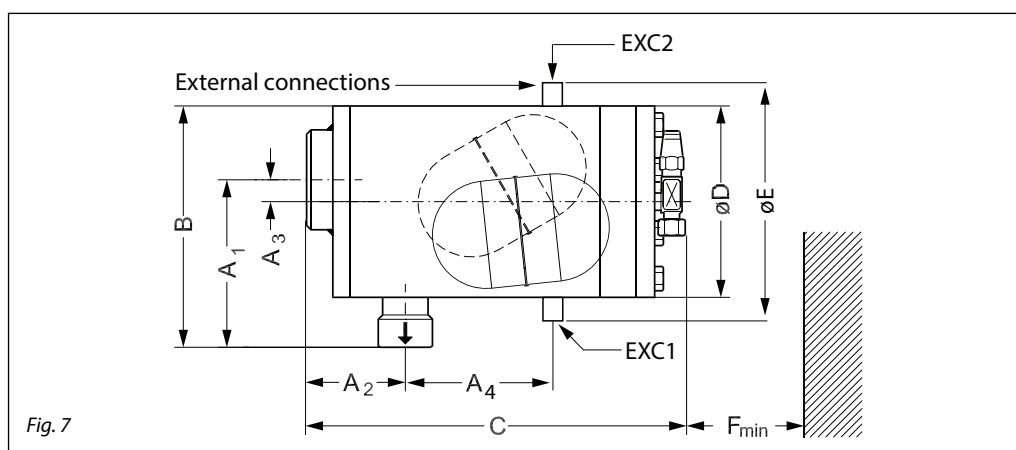
High pressure float valve with flange (Fig. 8)

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.

Float valve, type HFI

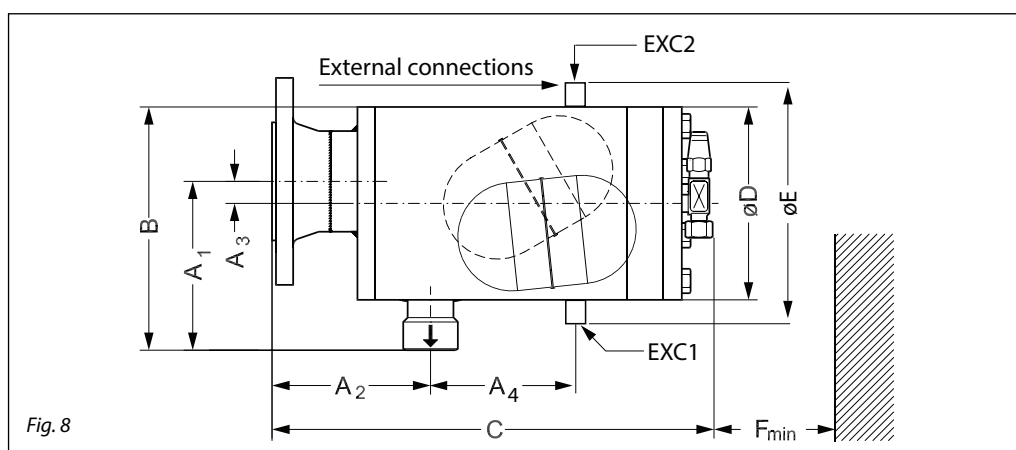
Dimensions and weights (HFI with external connections)



High pressure float valve without flange (Fig. 7)

Valve size		A ₁	A ₂	A ₃	A ₄	B	C	ØD	ØE	F _{min.}	Weight
HFI 100	[mm]	192	113	25	176	276	435	219	247	200	37 kg
	[in]	7.56	4.45	0.98	6.93	10.87	17.13	8.62	9.72	7.87	81.5 lb
HFI 150	[mm]	167	113		176	276	435	219	247	200	37 kg
	[in]	6.57	4.45		6.93	10.87	17.13	8.62	9.72	7.87	81.5 lb

Specified weights are approximate values only.



High pressure float valve with flange (Fig. 8)

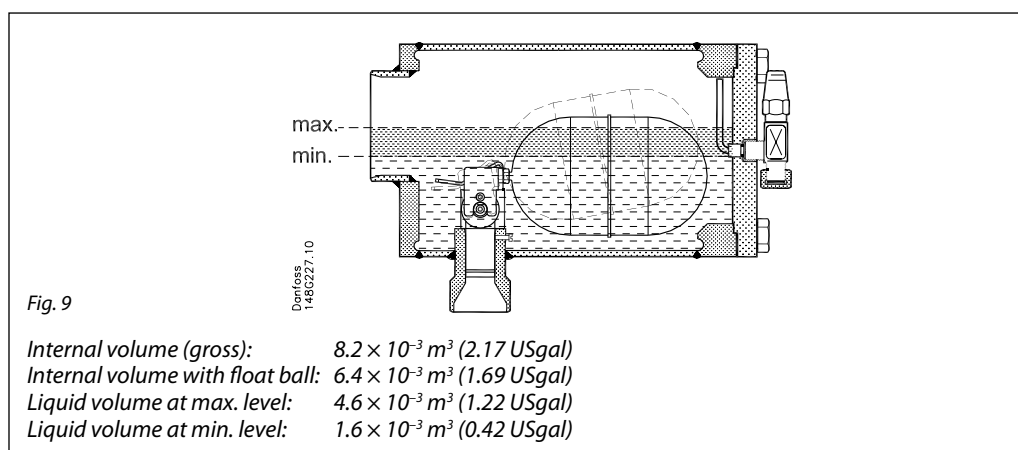
Valve size		A ₁	A ₂	A ₃	A ₄	B	C	ØD	ØE	F _{min.}	Weight
HFI 100	[mm]	192	180	25	176	309	502	219	247	200	41 kg
	[in]	7.56	7.09	0.98	6.93	12.17	19.76	8.62	9.72	7.87	90.4 lb
HFI 150	[mm]	167	189		176	317	511	219	247	200	41 kg
	[in]	6.57	7.44		6.93	12.48	20.12	8.62	9.72	7.87	90.4 lb

Specified weights are approximate values only.

EXC1	3/8 - 18 NPT
EXC2	1/2 - 14 NPT

Float valve, type HFI

Volumes



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

HFI with 2 external connections

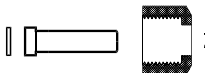
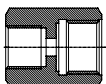
Type	Inlet connection size	Nozzle size	Code numbers
HFI 040 FD 100 w. 2 ext. con	100 (4 in) DIN Flange	40	148G3196
HFI 050 FD 100 w. 2 ext. con		50	148G3727
HFI 060 FD 100 w. 2 ext. con		60	148G3670
HFI 070 FD 100 w. 2 ext. con		70	148G3671
HFI 050 FD 150 w. 2 ext. con	150 (6 in) DIN Flange	50	148G3762
HFI 060 FD 150 w. 2 ext. con		60	148G3763
HFI 070 FD 150 w. 2 ext. con		70	148G3764
HFI 040 D 100 w. 2 ext. con	100 (4 in) DIN BW	40	148G3765
HFI 050 D 100 w. 2 ext. con		50	148G3704
HFI 060 D 100 w. 2 ext. con		60	148G3766
HFI 070 D 100 w. 2 ext. con		70	148G3720
HFI 050 D 150 w. 2 ext. con	150 (6 in) DIN BW	50	148G3767
HFI 060 D 150 w. 2 ext. con		60	148G3768
HFI 070 D 150 w. 2 ext. con		70	148G3769

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 060 (complete insert with float ball - without float housing)	148G3663
Insert for HFI 050 (complete insert with float ball - without float housing)	148G3662
Insert for HFI 040 (complete insert with float ball - without float housing)	148G3661

Float valve, type HFI

Accessories

Type		Connection type	Quantity	Code no.
	Welding nipple incl. aluminium gasket	G½-ND6	2 pcs.	148B4184
	Al gaskets included	¼" FPT – ½" G	1 pc.	148B3860
	Al gaskets included	¾" G - ½" G	1 pc.	148B3861

Float valves

Types SV 1 and SV 3

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Float valves

Types SV 1 and SV 3



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 PMFH.

Technical data

- *Refrigerant*
Applicable to HCFC, HFC and R717 (Ammonia).
- *P band*
35 mm
- *Temperature of medium*
-50 – 65°C
- *Max. working pressure*
PS = 28 bar
- *Max. test pressure*
p' = 36 bar
- *k_v value for float orifice*
SV 1 = 0.06 m³/h
SV 3 = 0.14 m³/h
- The highest k_v value for the built-in throttle valve is 0.18 m³/h. The throttle valve can be used both in parallel and in series with the float orifice.
- Classification: DNV, CRN, BV, EAC etc.
To get an updated list of certification on the products please contact your local Danfoss Sales Company.

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

Float valves, types SV 1 and 3

Identification



Dimensioning example for SV (L)

Refrigerant
R717 (NH₃)

Evaporating capacity
 $Q_e = 27 \text{ kW}$

Evaporating temperature
 $t_e = -10 \text{ °C}$ ($\sim p_e = 2.9 \text{ bar abs.}$)

Condensing temperature
 $t_c = 30 \text{ °C}$ ($\sim p_c = 11.7 \text{ bar abs.}$)

Liquid temperature for SV
 $t_l = 20 \text{ °C}$

Subcooling
 $\Delta t_{\text{sub}} = t_c - t_l = 30 \text{ °C} - 20 \text{ °C} = 10 \text{ K}$

Pressure drop in SV

$$\Delta p = p_c - p_e = 11.7 - 2.9 = 8.8 \text{ bar}$$

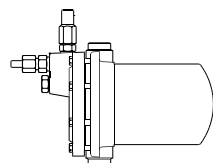
Correction factor k for 10 K subcooling
0.98

Corrected capacity
 $27 \times 0.98 = 26.4 \text{ kW}$

At $t_e = -10 \text{ °C}$ and $\Delta p = 8 \text{ bar}$ SV 1 yields 27 kW and can therefore be used.

If SV 3 is used for this capacity, it will mean a small offset.

Ordering



Regulator

The code nos. stated apply to float valves, types SV 1 and SV 3 incl. $\varnothing 6.5 / \varnothing 10 \text{ mm}$ 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 $t_e = 5 \text{ °C}$, condensing temp. $t_c = 32 \text{ °C}$ and liquid temperature $t_l = 28 \text{ °C}$.

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⁾ 3/8 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

Float valves, types SV 1 and 3

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.

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

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

R717 (NH₃)

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

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

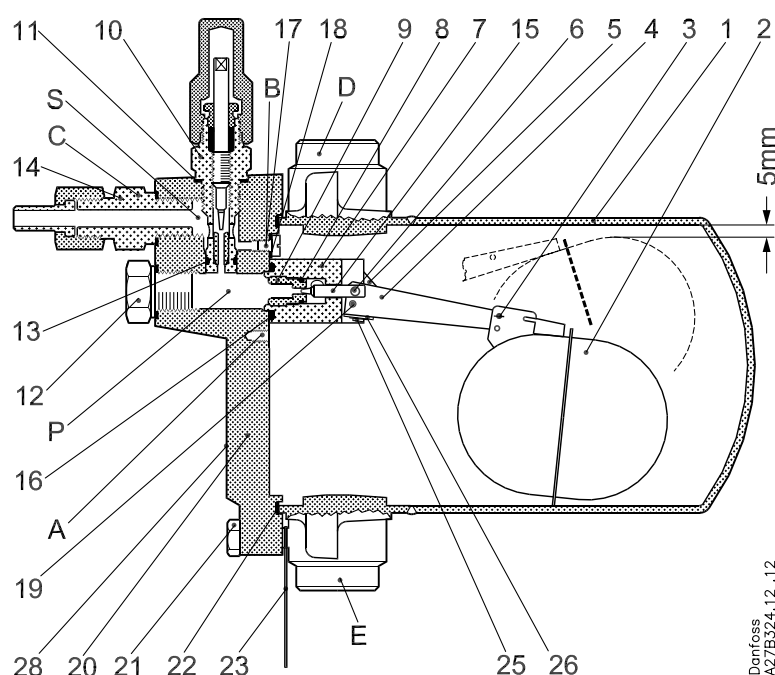
R22

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

Float valves, types SV 1 and 3

Design / function

SV with low-pressure function



- C. Nipple
- D. Connection for balance pipe
- P. Parallel connection of pos. C (screw 17 in pos. A)
- S. Series connection of pos. C (screw 17 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	

Float valves, types SV 1 and 3

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".

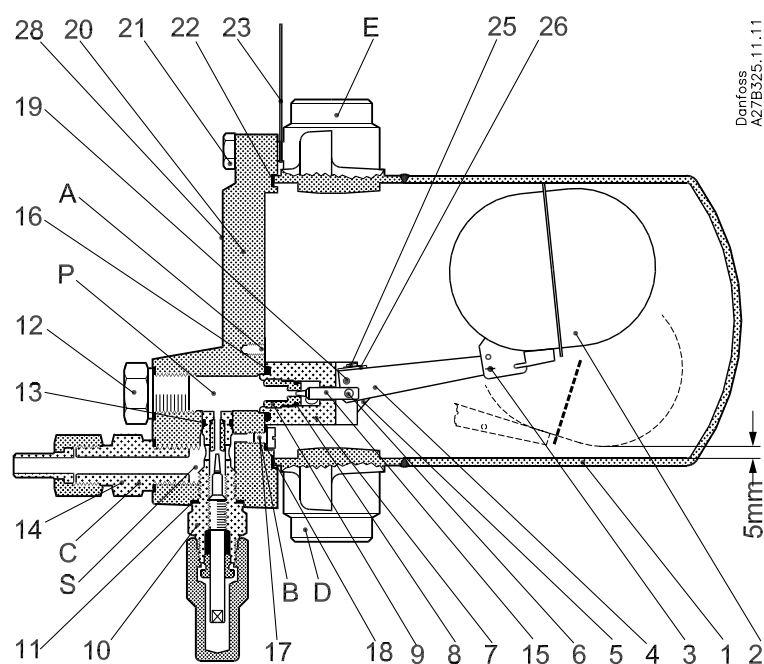
The flashgas quantity which occurs on expansion is removed through the balance pipe from pos. (D). On refrigeration plant using fluorinated refrigerants, slight subcooling and a large pressure drop can give a flashgas quantity of approx. 50% of the injected liquid quantity. *Therefore the pressure drop 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".

Float valves, types SV 1 and 3

Design / function (continued)

SV with high-pressure function



- C. Nipple
- D. Connection for balance pipe
- P. Parallel connection of pos. C (screw 17 in pos. A)
- S. Series connection of pos. C (screw 17 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	

Float valves, types SV 1 and 3

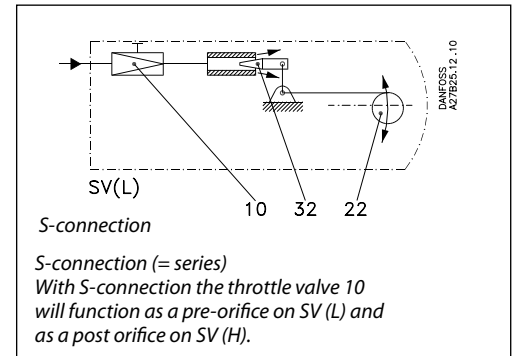
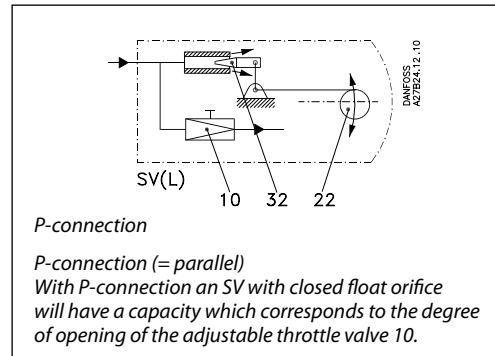
Design / function (continued)

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".

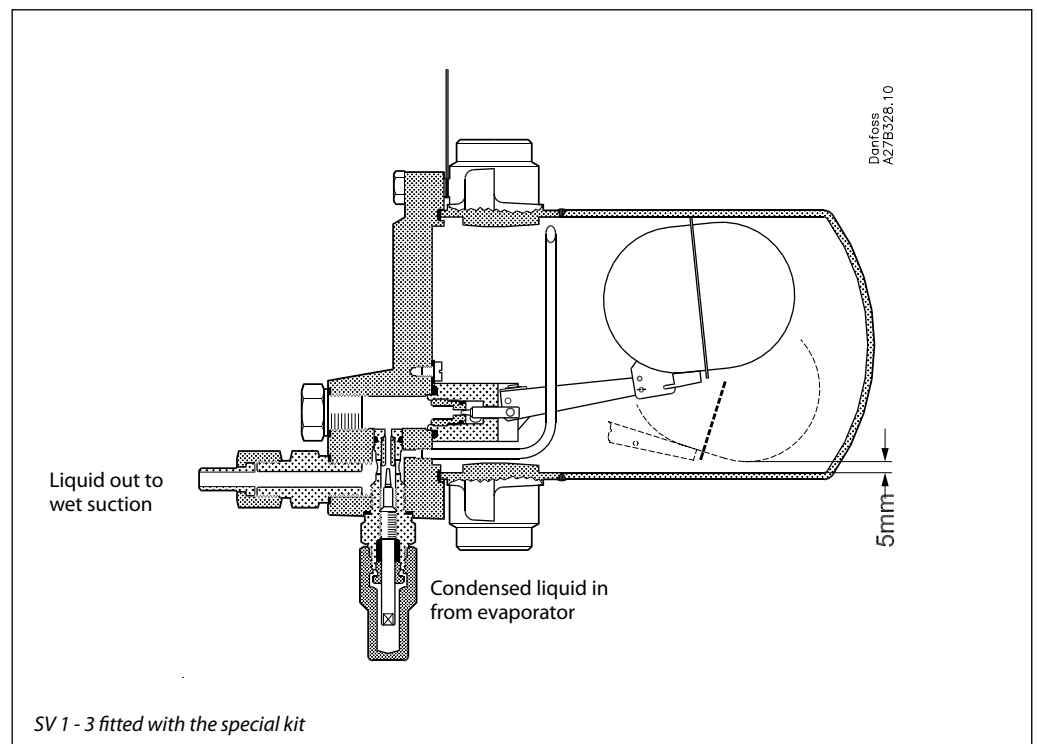
The connection nipple (C) can be mounted either in P or in S.



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:

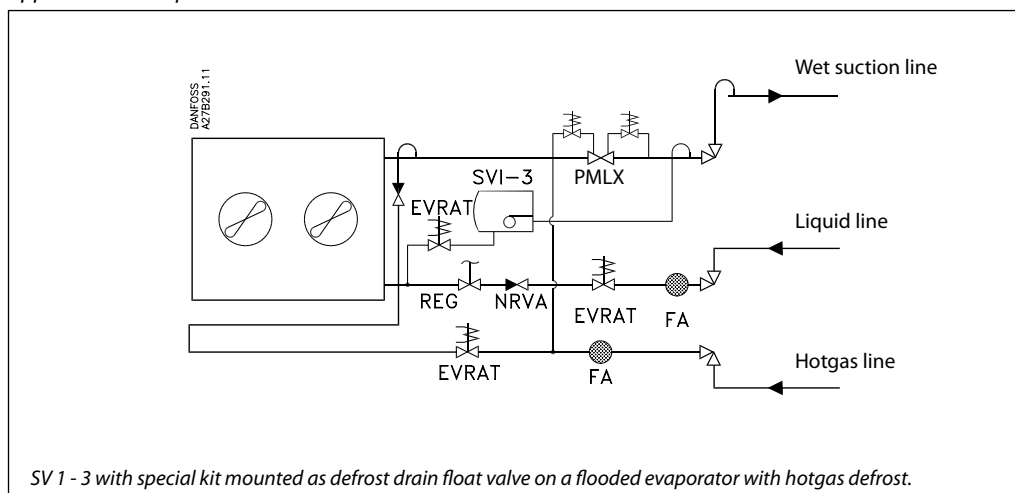
- Special orifice and orifice needle with a larger k_v -value of 0.28 m³/h.
- Gas drain pipe



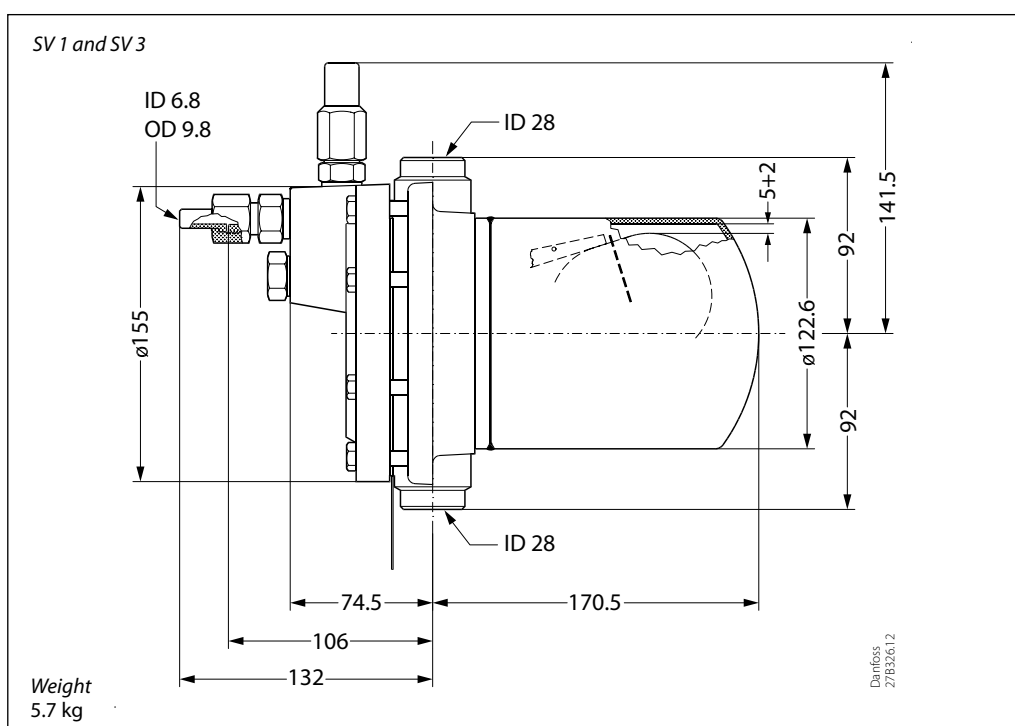
Float valves, types SV 1 and 3

SV 1 - 3 used as a high pressure defrost drain float valve (continued)

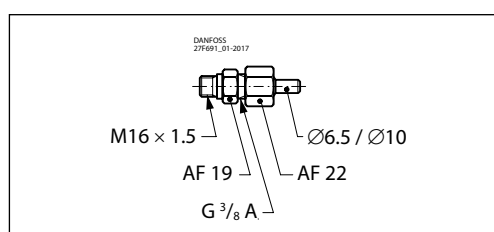
Application example



Dimensions and weight



Pilot connection (weld / solder)



Float valves

Types SV 4, SV 5 and SV 6

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Float valves

Types SV 4, SV 5 and SV 6



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)
- Classification: DNV, CRN, BV, EAC etc.
To get an updated list of certification on the products please contact your local Danfoss Sales Company

Technical data

Refrigerants
Applicable to HCFC, HFC and R717 (Ammonia).
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 – 120 °C

Max. test pressure
MTP = 32 bar

k_v value and diameter for orifice
SV 4: $k_v = 0.23 \text{ m}^3/\text{hD} = 3.0 \text{ mm}$
SV 5: $k_v = 0.31 \text{ m}^3/\text{hD} = 3.5 \text{ mm}$
SV 6: $k_v = 0.43 \text{ m}^3/\text{hD} = 4.0 \text{ mm}$

Float valves, types SV 4, SV 5 and SV 6

Approvals

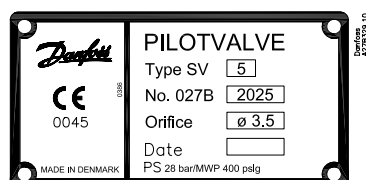


Pressure Equipment Directive (PED)

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



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 (NH₃)

Evaporating capacity
 $Q_e = 145 \text{ kW}$

Evaporating temperature
 $t_e = -10 \text{ °C}$ ($\sim p_e = 2.9 \text{ bar abs.}$)

Condensing temperature
 $t_c = 30 \text{ °C}$ ($\sim p_c = 11.7 \text{ bar abs.}$)

Liquid temperature ahead of SV
 $t_l = 20 \text{ °C}$

Subcooling

$$\Delta t_{\text{sub}} = t_c - t_l = 30 \text{ °C} - 20 \text{ °C} = 10 \text{ K}$$

Pressure drop in SV

$$\Delta p = p_c - p_e = 11.7 - 2.9 = 8.8 \text{ bar}$$

Correction factor k for 10 K subcooling
 $= 0.98$

Corrected capacity
 $145 \times 0.98 = 142 \text{ kW}$

At $t_e = -10 \text{ °C}$ and $\Delta p = 8 \text{ bar}$ SV 5 yields 147 kW and can therefore be used.

Float valves, types SV 4, SV 5 and SV 6

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.

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

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

R717 (NH₃)

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
SV 5	-50	43	51	58	63	83	107	122	133
	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
SV 6	-40	58	69	78	86	114	147	168	184
	-50	58	69	78	86	113	146	167	182
	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
SV 6	-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

R22

SV 4	10	8.5	10.3	11.7	12.9	17.2	21.8	24.1	25.1
	0	8.9	10.7	12.2	13.5	17.8	22.4	24.6	25.7
	-10	9.3	11.2	12.7	14.0	18.3	22.8	25.0	25.9
	-20	9.7	11.6	13.1	14.4	18.7	23.1	25.1	25.9
	-30	9.9	11.8	13.4	14.6	18.9	23.1	25.0	25.7
	-40	10.1	12.1	13.6	14.8	18.9	22.9	24.7	25.3
SV 5	-50	10.3	12.1	13.6	14.8	18.8	22.6	24.2	24.8
	10	11.6	14.0	15.9	17.6	23.4	29.6	32.7	34.2
	0	12.1	14.6	16.7	18.4	24.3	30.5	33.5	34.9
	-10	12.7	15.2	17.3	19.0	24.9	31.1	34.0	35.3
	-20	13.1	15.7	17.8	19.6	25.4	31.4	34.1	35.3
	-30	13.5	16.1	18.2	19.9	25.7	31.4	34.0	35.0
SV 6	-40	13.8	16.4	18.4	20.1	25.7	31.2	33.6	34.5
	-50	14.0	16.5	18.5	20.2	25.6	30.7	33.0	33.7
	10	15.5	18.7	21.3	23.6	31.4	39.7	43.9	45.8
	0	16.3	19.6	22.3	24.6	32.6	40.9	45.0	46.8
	-10	17.0	20.4	23.2	25.5	33.5	41.7	45.6	47.3
	-20	17.6	21.1	23.9	26.2	34.1	42.1	45.8	47.3
SV 6	-30	18.1	21.6	24.4	26.7	34.5	42.1	45.6	47.0
	-40	18.5	22.0	24.7	27.0	34.5	41.8	45.0	46.2
	-50	18.7	22.2	24.8	27.0	34.3	41.2	44.2	45.2

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 (NH₃)

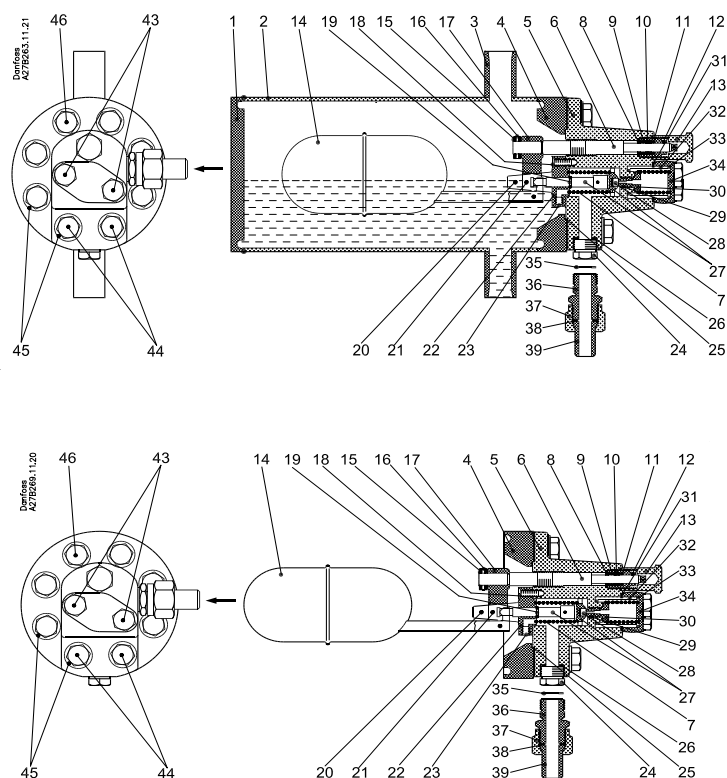
Δt K	2	4	10	15	20	25	30	35	40	45	50
k	1.01	1.00	0.98	0.96	0.94	0.92	0.91	0.89	0.87	0.86	0.85

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

Float valves, types SV 4, SV 5 and SV 6

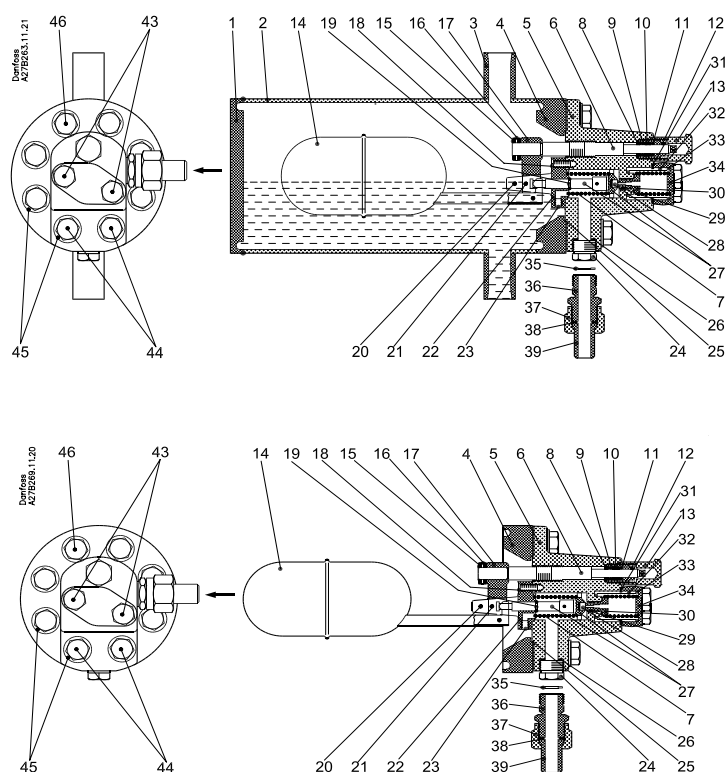
Construction / function



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	TTST35N DIN17173
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	

Float valves, types SV 4, SV 5 and SV 6

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

Float valves, types SV 4, SV 5 and SV 6

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.

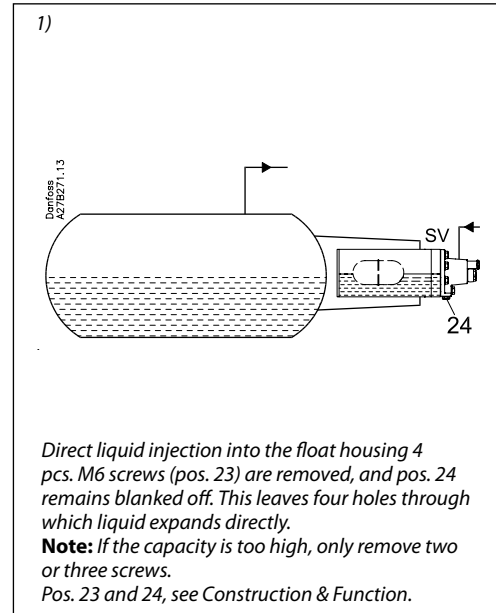
See instruction for SV 4 - 6 for:

- Cleaning of strainer
- Change of orifice
- Change of valve plate

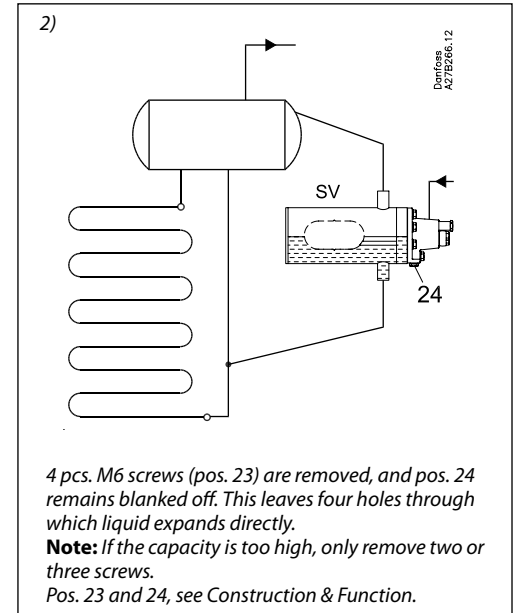
Float valves, types SV 4, SV 5 and SV 6

Application

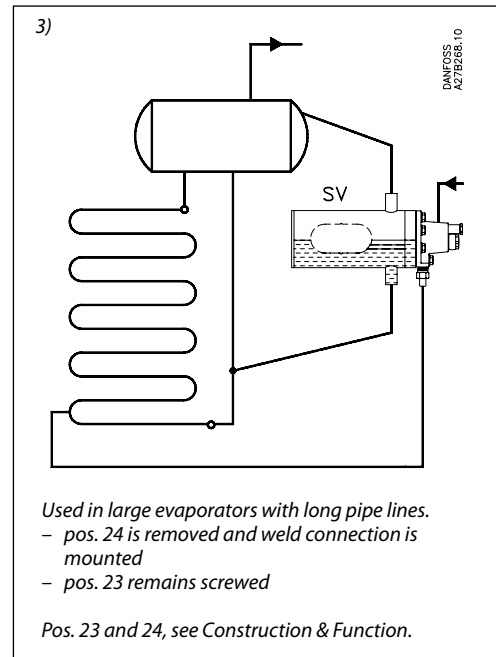
The liquid expands into the float housing



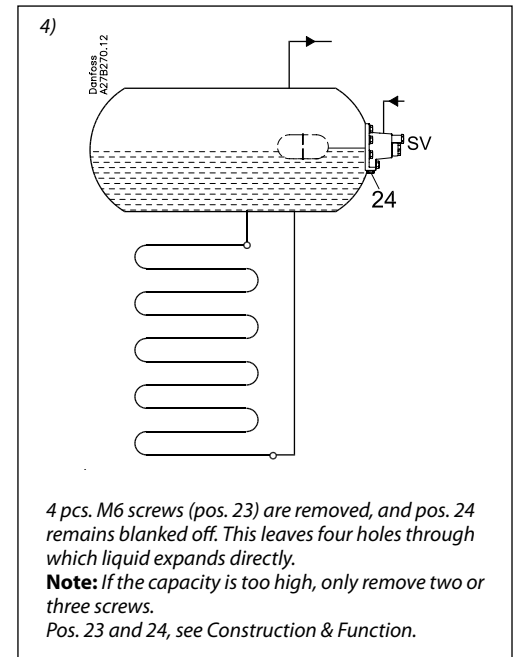
The liquid expands into the float housing



The liquid expands into the evaporator

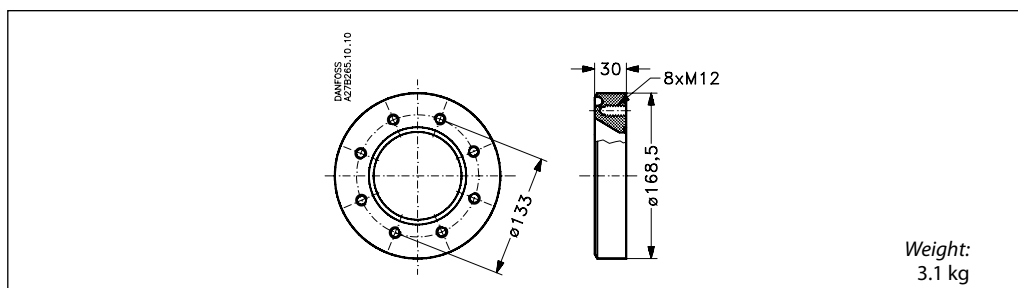
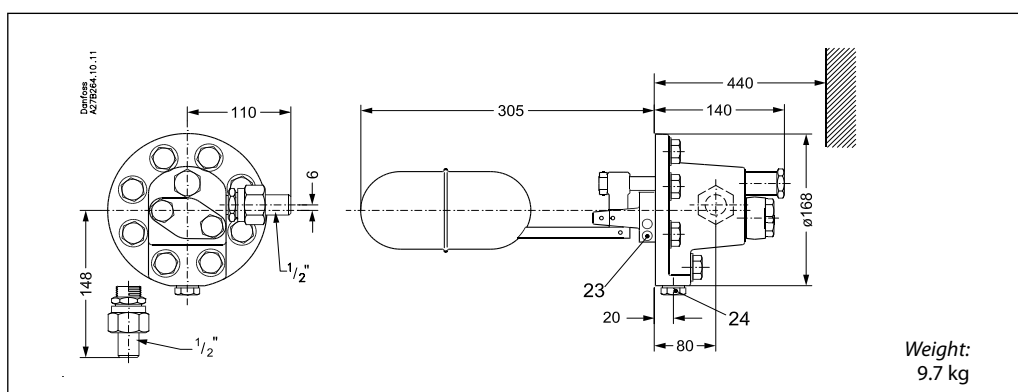
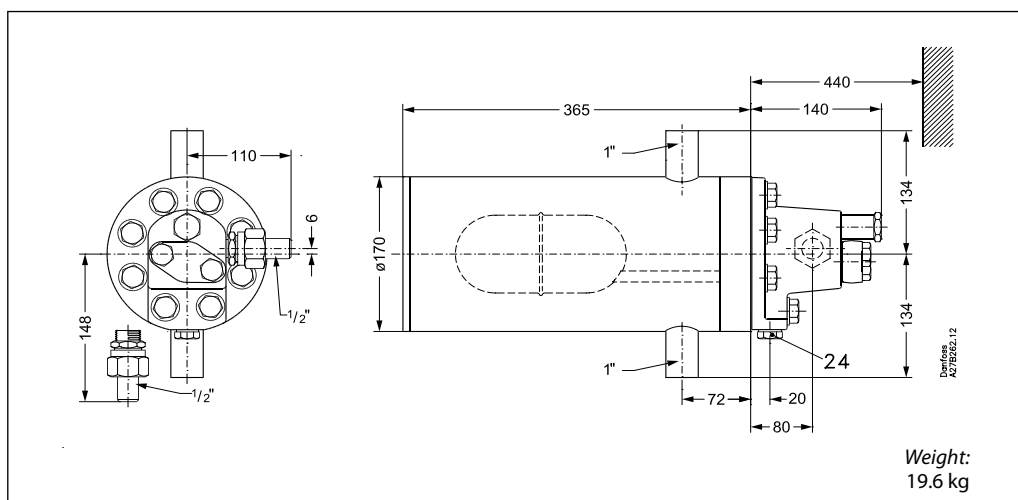


The liquid expands directly into the surge drum



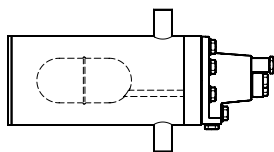
Float valves, types SV 4, SV 5 and SV 6

Dimensions and weight



Float valves, types SV 4, SV 5 and SV 6

Ordering



Regulator

The code nos. stated apply to float valves types 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	Ø 3.0 mm	027B2024	027B2014	102	21.0	16.4	15.4
SV 5	Ø 3.5 mm	027B2025	027B2015	138	28.6	22.3	21.0
SV 6	Ø 4.0 mm	027B2026	027B2016	186	38.3	29.9	28.1

¹⁾ The rated capacity refers to the valve capacity at evaporating temperature $t_e = 5^\circ\text{C}$, condensing temp. $t_c = 32^\circ\text{C}$ and liquid temperature $t_l = 28^\circ\text{C}$.

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

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	
Ø 1.0 mm	0.026	9	12	13.5	1.6	2.2	2.4	027B2080
Ø 1.5 mm	0.06	21	27	29	3.8	4.9	5.2	027B2081
Ø 2.0 mm	0.10	35	46	50	6.3	8.3	9	027B2082
Ø 2.5 mm	0.16	56	70	81	10	13	15	027B2083
Ø 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 Ø2.5 mm is recommended as pilot float valve for the servo-operated level regulators type PMFL for higher capacities.

Liquid level regulating valves

Types PMFL / PMFH and SV

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Liquid level regulating valves

Types PMFL / PMFH and SV



For modulating liquid level control in refrigeration, freezing and air conditioning plant, a system comprising a liquid level regulating 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 HCFC, HFC and R717 (Ammonia)
- 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
- Classification: DNV, CRN, BV, EAC etc. To get an updated list of certification on the products please contact your local Danfoss Sales Company

Approvals

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

Liquid level regulating valves, types PMFL / PMFH and SV

Technical data

Refrigerants

Applicable to HCFC, HFC and R717 (Ammonia).

Temperature of media:

-60 – 120 °C.

Max. working pressure

PMFL / H: MWP = 28 bar

SV: MWP = 28 bar

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.

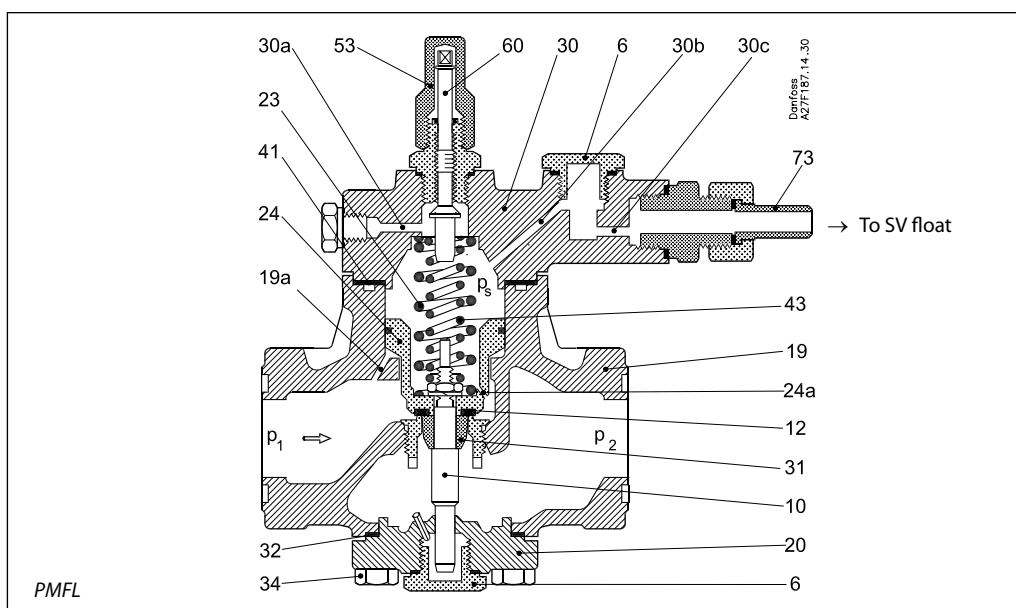
Max. test pressure

PMFL / H: Max. test pressure = 42 bar

SV: Max. test pressure = 42 bar

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



When the liquid level inside the float drops, the float orifice opens. This relieves the higher pressure, p_s , 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 strong spring set, subcooling 8-40 K ~ 14-72 F	
	Pressure difference (Δp) over PMFL in bar or psi	
	6 – 16 bar	
	87 – 232 psi	
300	Spring must always be set to max. tension	

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

Liquid level regulating valves, types PMFL / PMFH and SV

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.

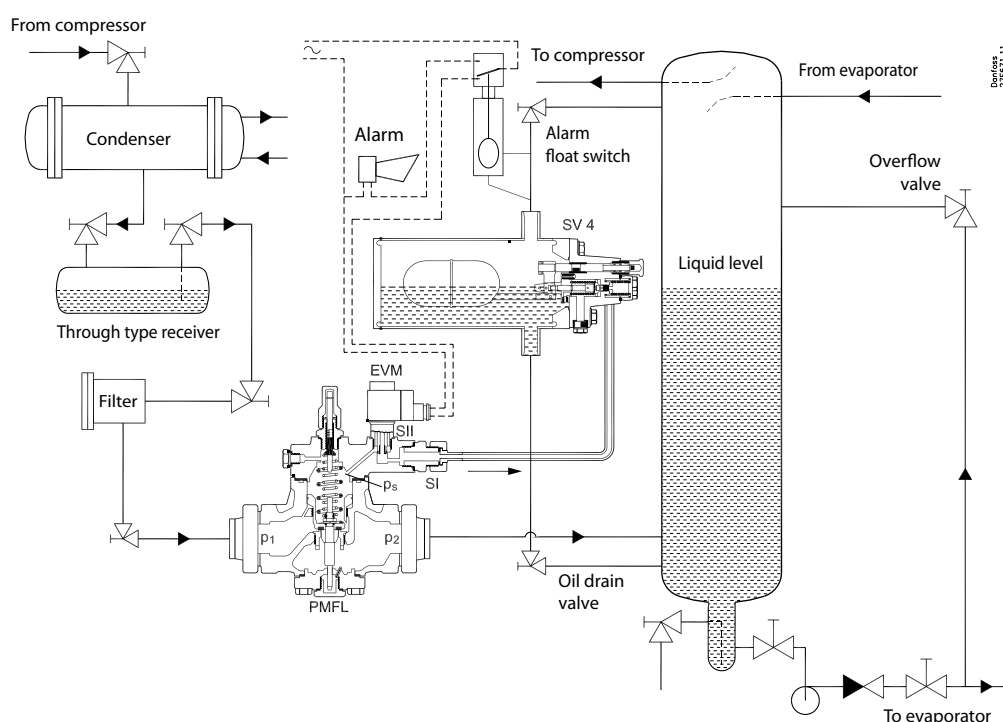
The PMFL can be used together with SV 4 as a pilot valve.

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 4-6	
	Ø 2.5	Ø 3 (SV 4)
80	X	
125	X	
200	X	
300		X

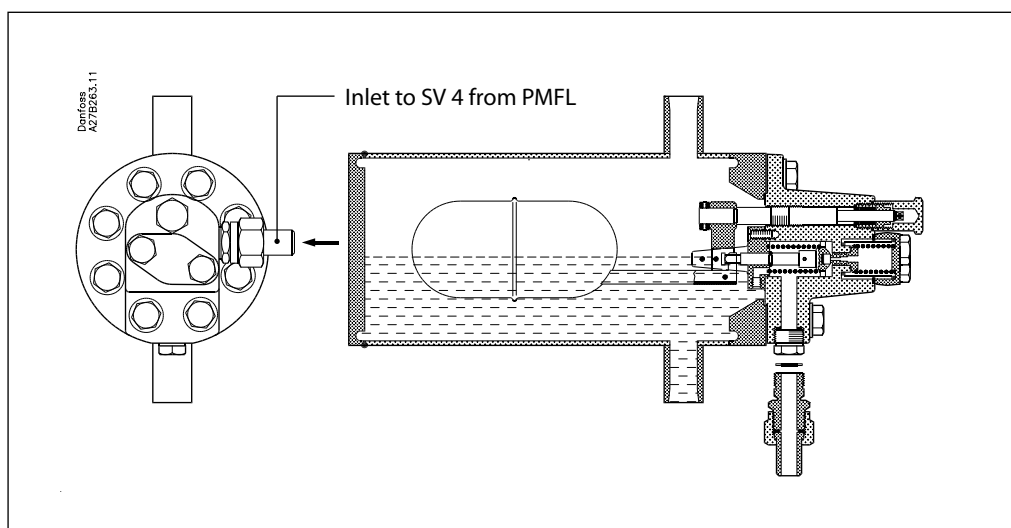
The final choice of orifice may vary depending on refrigerant and pressure levels. Smaller pressure levels needs a bigger orifice. Pressure difference levels below 3 bar (43 psi) need SV 4-6 with Ø3 mm orifice.

PMFL function example



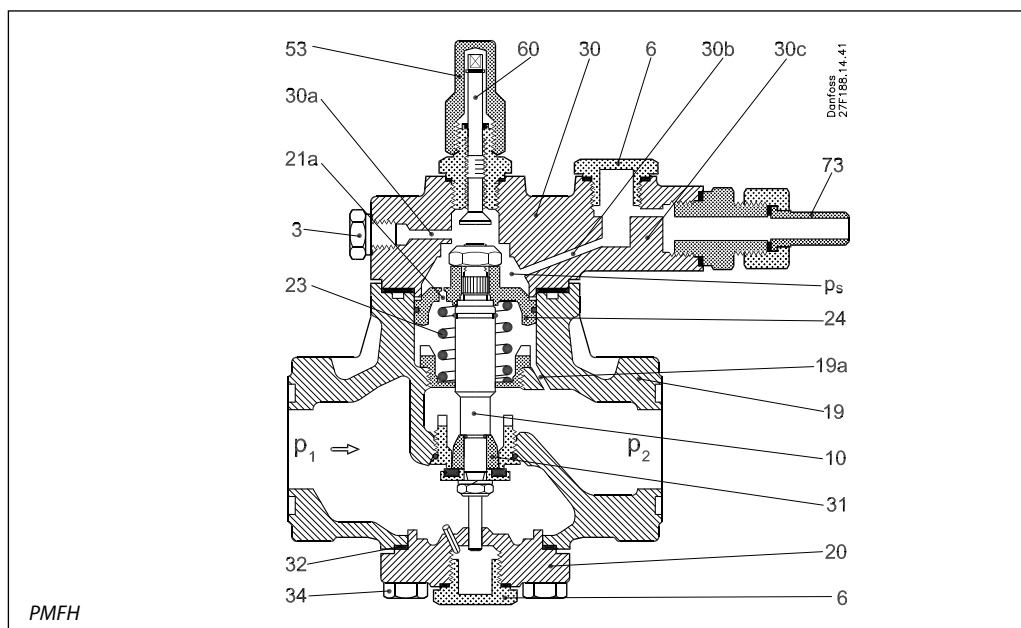
SV floats for PMFL

SV 4 can be used for PMFL low pressure control system. The float must be connected as shown.
Note: Only one inlet connection possible for SV 4.



Design/Function 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

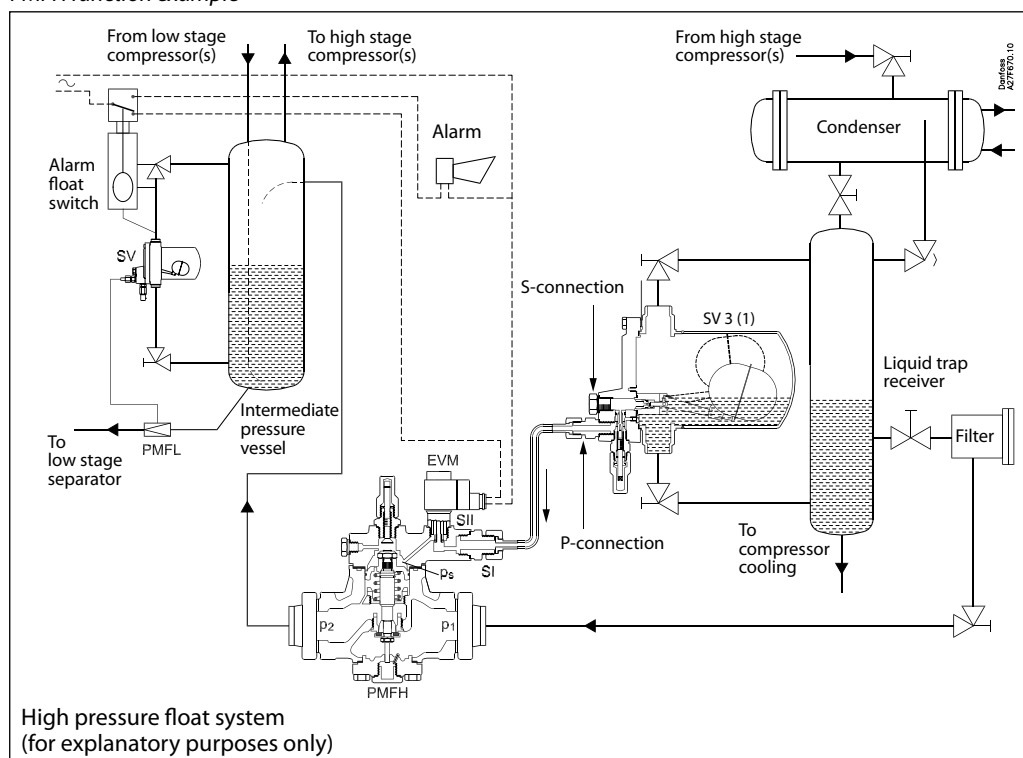


If the liquid level inside the SV float rises, the float orifice opens and relieves pressure through the pilot line to the top of the PMFH, increasing the pressure, p_s , moving the pushrod downwards and opening the PMFH. The pilot line is connected in the topcover at SI. Override of the pilot signal 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 with 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



Liquid level regulating valves, types PMFL / PMFH and SV

Design / Function 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 unauthorised 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 P-port than using S-port. A higher P-band can thus be obtained.

Sizing

Sizing example for PMFL

Refrigerant
R 717 (NH₃)

Evaporator capacity
 $Q_e = 600$ kW

Evaporating temperature
 $t_e = -10^\circ\text{C}$ ($\sim p_e = 2.9$ bar abs.)

Condensing temperature
 $t_c = 30^\circ\text{C}$ ($\sim p_c = 11.9$ bar abs.)

Liquid temperature ahead of valve
 $t_l = 20^\circ\text{C}$ at max. capacity

Subcooling
 $\Delta t_{\text{sub}} = t_c - t_l = 30^\circ\text{C} - 20^\circ\text{C} = 10$ 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 $\times$ $0.98 = 588$ 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. Referring to "ordering table", code number **027F0053** can be found.

For details of flanges, accessories and pilot valve, see the ordering table.

Since $\Delta p = 9$ bar and $\Delta t_{\text{sub}} = 10$ 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 (NH₃)

Evaporator capacity
 $Q_e = 2200$ kW

Evaporating temperature
 $t_e = -10^\circ\text{C}$ ($\sim p_e = 2.9$ bar abs.)

Condensing temperature
 $t_c = 30^\circ\text{C}$ (~ 11.9 bar abs.)

Liquid temperature ahead of valve
 $t_l = 20^\circ\text{C}$

Subcooling
 $\Delta t_{\text{sub}} = t_c - t_l = 30^\circ\text{C} - 20^\circ\text{C} = 10$ 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 $\times$ $0.98 = 2156$ 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 (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

R 22

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

Capacity in kW

Type	Evaporating temperature t _e [°C]	Rated capacity in kW at pressure drop across valve Δp bar			
		0.8	1.2	1.6	2.0

R 717 (NH₃)

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 [°C]	Rated capacity in kW at pressure drop across valve Δp bar			
		4.0	8.0	12.0	16.0

R 717 (NH₃)

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

Liquid level regulating valves, types PMFL / PMFH and SV

Capacity in kW (continued)

Type	Evaporating temperature t _e [°C]	Rated capacity in kW at pressure drop across valve Δp bar			
		0.8	1.2	1.6	2.0

R 22

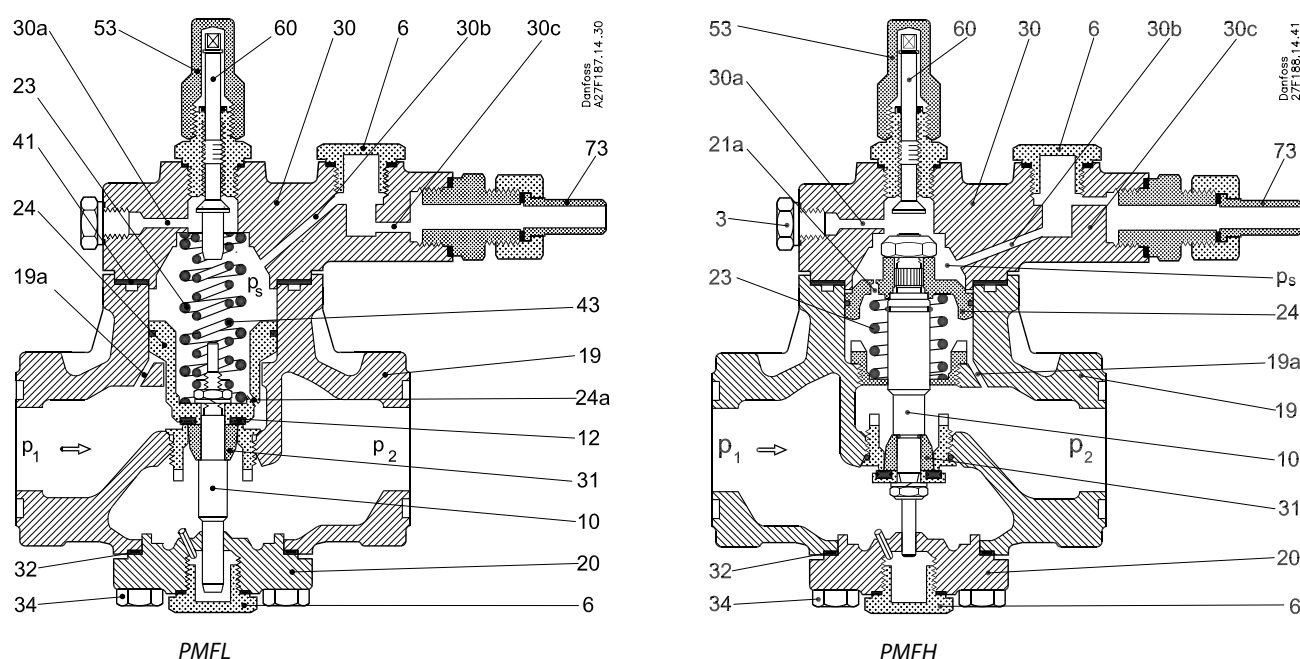
PMFL 80-1	10	11	13	15	17
	0	12	14	16	18
	-10	12	15	17	18
	-20	12	15	17	19
	-30	13	15	17	19
	-40	13	16	18	19
	-50	13	16	18	19
PMFL 80-2	10	18	22	25	27
	0	19	23	26	29
	-10	20	24	27	30
	-20	20	24	28	30
	-30	21	25	28	31
	-40	21	25	28	31
	-50	21	25	28	31
PMFL 80-3	10	29	35	39	43
	0	30	36	41	46
	-10	31	37	43	47
	-20	32	39	44	48
	-30	33	39	44	48
	-40	34	40	45	49
	-50	34	40	44	48
PMFL 80-4	10	47	57	64	71
	0	49	59	67	74
	-10	51	61	70	77
	-20	52	63	71	78
	-30	54	64	72	78
	-40	54	64	72	78
	-50	55	64	71	77
PMFL 80-5	10	74	89	102	112
	0	78	94	107	117
	-10	80	96	110	121
	-20	83	99	112	122
	-30	84	99	112	122
	-40	84	99	110	120
	-50	84	97	108	117
PMFL 80-6	10	129	156	177	194
	0	135	162	184	202
	-10	140	167	188	206
	-20	142	168	189	205
	-30	143	167	186	202
	-40	141	163	181	196
	-50	137	158	175	189
PMFL 80-7	10	202	242	273	299
	0	211	251	283	308
	-10	216	256	286	311
	-20	218	255	283	307
	-30	215	249	275	298
	-40	209	240	265	286
	-50	200	230	254	275
PMFL 125	10	321	386	437	479
	0	336	402	455	498
	-10	346	412	464	507
	-20	352	415	464	505
	-30	352	410	455	494
	-40	346	399	442	478
	-50	335	386	426	461
PMFL 200	10	515	618	700	767
	0	538	645	728	796
	-10	555	660	742	810
	-20	563	663	740	805
	-30	561	653	725	786
	-40	550	635	702	760
	-50	532	612	677	732
PMFL 300	10	782	940	1060	1170
	0	819	980	1110	1210
	-10	843	1000	1130	1230
	-20	855	1010	1120	1220
	-30	851	990	1100	1190
	-40	833	961	1060	1150
	-50	804	925	1020	1110

Type	Evaporating temperature t _e [°C]	Rated capacity in kW at pressure drop across valve Δp bar			
		4.0	8.0	12.0	16.0

R 22

PMFL 80-1	10	22	28	31	32
	0	23	29	32	33
	-10	24	30	32	34
	-20	25	30	32	34
	-30	25	30	32	33
	-40	25	30	32	32
	-50	24	29	31	32
PMFL 80-2 PMFH 80-2	10	36	46	51	52
	0	38	47	52	53
	-10	39	48	52	54
	-20	40	48	52	54
	-30	40	48	52	53
	-40	40	48	51	52
	-50	39	47	49	51
PMFL 80-3 PMFH 80-3	10	57	72	80	82
	0	60	74	82	84
	-10	62	76	82	85
	-20	63	76	82	85
	-30	63	76	81	83
	-40	62	75	79	81
	-50	61	73	77	79
PMFL 80-4 PMFH 80-4	10	94	118	130	133
	0	98	121	133	136
	-10	101	123	133	138
	-20	102	123	132	137
	-30	101	122	130	134
	-40	99	120	127	131
	-50	97	117	124	127
PMFL 80-5 PMFH 80-5	10	147	184	202	206
	0	153	188	205	211
	-10	157	190	205	212
	-20	157	189	203	210
	-30	156	187	199	206
	-40	152	184	195	200
	-50	148	179	189	194
PMFL 80-6 PMFH 80-6	10	251	310	341	345
	0	260	314	343	352
	-10	263	315	341	353
	-20	262	313	335	348
	-30	257	308	328	340
	-40	249	302	320	331
	-50	241	294	312	321
PMFL 80-7 PMFH 80-7	10	381	466	510	515
	0	390	467	510	524
	-10	393	465	504	523
	-20	389	461	495	516
	-30	378	454	483	503
	-40	366	444	471	489
	-50	353	433	458	473
PMFL 125 PMFH 125	10	620	763	837	847
	0	639	770	842	864
	-10	647	771	835	865
	-20	643	767	821	853
	-30	628	755	804	834
	-40	609	739	784	810
	-50	589	720	762	785
PMFL 200 PMFH 200	10	990	1220	1330	1350
	0	1020	1230	1340	1380
	-10	1030	1230	1330	1380
	-20	1020	1220	1310	1360
	-30	1000	1200	1280	1330
	-40	969	1170	1250	1290
	-50	937	1150	1210	1250
PMFL 300 PMFH 300	10	1500	1850	2020	2050
	0	1550	1860	2030	2080
	-10	1560	1860	2010	2090
	-20	1550	1850	1980	2060
	-30	1510	1820	1930	2010
	-40	1470	1780	1890	1950
	-50	1420	1730	1830	1890
PMFH 500	10	2410	2950	3240	3270
	0	2480	2970	3250	3330
	-10	2500	2970	3210	3330
	-20	2480	2950	3160	3290
	-30	2420	2900	3090	3210
	-40	2340	2840	3010	3120
	-50	2260	2770	2930	3020

Material specification



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

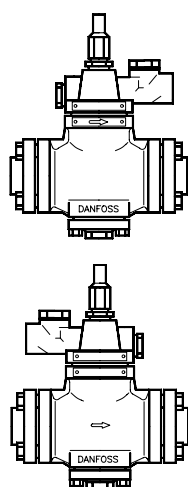
Liquid level regulating valves, types PMFL / PMFH and SV

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 $t_e = 5^\circ\text{C}$, condensing temperature $t_c = 32^\circ\text{C}$ and liquid temperature $t_l = 28^\circ\text{C}$.



Main valve

Valve type	Code no.
	EN GJS 400-18-LT
PMFL 80-1	027F3054
PMFL 80-2	027F3055
PMFL 80-3	027F3056
PMFL 80-4	027F3057
PMFL 80-5	027F3058
PMFL 80-6	027F3059
PMFL 80-7	027F3060
PMFL 125	027F3061
PMFL 200	027F3062
PMFL 300	027F3063

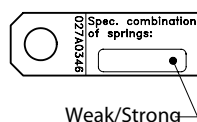
Valve type	Code no.
	EN GJS 400-18-LT
PMFH 80-2	027F3065
PMFH 80-3	027F3066
PMFH 80-4	027F3067
PMFH 80-5	027F3068
PMFH 80-6	027F3069
PMFH 80-7	027F3070
PMFH 125	027F3071
PMFH 200	027F3072
PMFH 300	027F3073
PMFH 500	027F3074

The code nos. stated apply to main valves type PMFL or PMFH incl. flange gaskets, flange bolts, blanking plug and pilot connection with $\varnothing 6.5 / \varnothing 10$ mm weld nipple.

Spring set



DANFOSS
A27F205.10



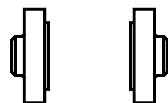
Special spring set for PMFL

Subcooling Δt _s K	Pressure drop Δp in PMFL		Pilot connection on SV 1-3 only	Pos.	Type PMFL	"WEAK"	"STRONG"
	4 – 15 bar	1.2 – 4 bar				Code no.	Code no.
	Spring set						
0-8	"STANDARD"	"WEAK"	P	23 + 43	80-1 → 80-7	027F0123	027F0118
8-40	"STRONG"		S		125 200 300	027F0124 027F0125 027F0126	027F0119 027F0121

Special spring set for PMFH

Pressure drop in PMFH Δp bar	Type	"WEAK"
		Code no.
1 → 4	PMFH 80.1 → 7 PMFH 125 PMFH 200 PMFH 300	027F2190 027F2191 027F2192 027F2193

Ordering (continued)



Flanges ²⁾

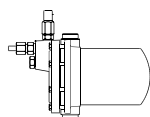
Valve type	Flange type	Weld flanges		Solder flanges			
		[in]	Code no. ¹⁾	[in]	Code no. ¹⁾	[mm]	Code no. ¹⁾
PMFL 80 / PMFH 80	12	$\frac{3}{4}$ 1 $1\frac{1}{4}$	027N1220 027N1225 027N1230	$\frac{7}{8}$ $1\frac{1}{8}$	027L1223 027L1229	22 28	027L1222 027L1228
PMFL 125 / PMFH 125	23	$1\frac{1}{4}$ $1\frac{1}{2}$	027N2332 027N2340	$1\frac{3}{8}$	027L2335	35	027L2335
PMFL 200 / PMFH 200	24	$1\frac{1}{2}$ 2	027N2440 027N2450	$1\frac{5}{8}$	027L2441	42	027L2442
PMFL 300 / PMFH 300	25	2 $2\frac{1}{2}$	027N2550 027N2565	$2\frac{1}{8}$	027L2554	54	027L2554
PMFH 500	26	$2\frac{1}{2}$ 3	027N2665 027N2680	$2\frac{5}{8}$	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

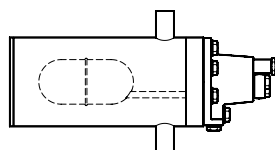


Type	Connection		Code no.	
Float pilot valve type SV	Balance tube liquid / vapour	Pilot line	SV 1: 027B2021 027B2021CE ²⁾	SV 3: 027B2023 027B2023CE ²⁾
	1 in weld	$\varnothing 6.5 / \varnothing 10$ mm weld ¹⁾		

¹⁾ $\frac{3}{8}$ 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	$\varnothing 3.0$ 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 $\frac{1}{2}$ " 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⁾
$\varnothing 1.0$ mm	0,026	027B2080
$\varnothing 1.5$ mm	0,06	027B2081
$\varnothing 2.0$ mm	0,10	027B2082
$\varnothing 2.5$ mm	0,16	027B2083
$\varnothing 2.8$ 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.



AC: 027B1122xx where xx can be	
Coils, 10 W AC	
110 V, 60 Hz	21
220 V, 50 Hz	31
220 V, 50/60 Hz	32
240 V, 50 Hz	33

Liquid level regulating valves, types PMFL / PMFH and SV

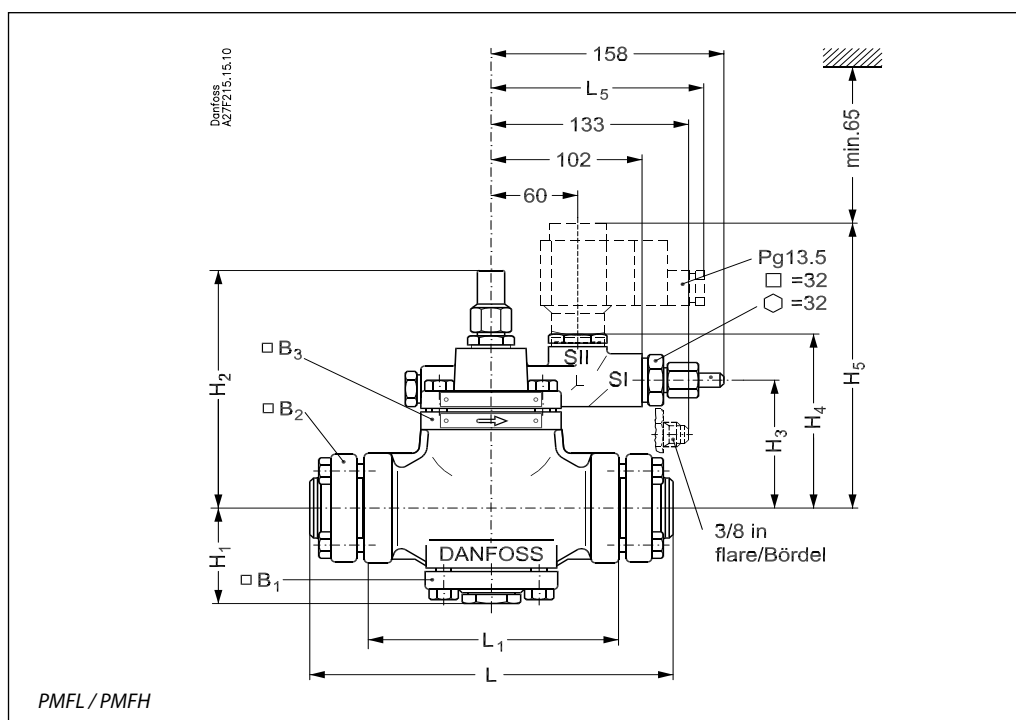
Ordering (continued)



Optional accessories

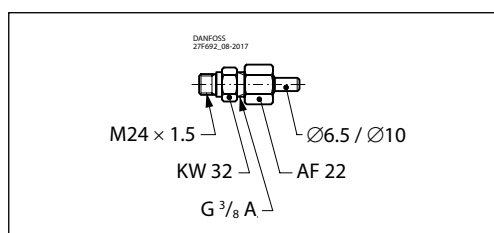
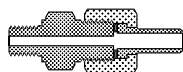
Description		Code no.
Pressure gauge connection Ø 6.5 / Ø 10 mm weld / solder		027B2035
Pressure gauge connection 1/4 in flare (self-closing) (Must not be used in ammonia plant)		027B2041
Pressure gauge connection	6 mm	027B2063
Cutting ring connection	10 mm	027B2064
Pressure gauge connection	1/4 NPT	027B2062
Manual operating unit for PMFL. Can be fitted in place of the regulator bottom plug		027F0128
3/8 in flare pilot connection for SV		027B2033

Dimensions and weights



Type			H ₁	H ₂	H ₃	H ₄	H ₅	L	L ₁	L _s max.		B ₁	B ₂	B ₃	Weight excl. solenoid valve [kg]
			[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	10 W	20 W	[mm]	[mm]	[mm]	
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	

Pilot connection (weld / solder)



Liquid Level Alarms

Types RT 280A, RT 281A

Contents

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Liquid Level Alarms

Types RT 280A, RT 281A



RT 280A and RT 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 RT 281A can be used as liquid level regulators where a liquid level differential of up to ± 40 mm can be permitted.

When used as safety switches, RT 280A and RT 281A 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 RT 281A maintain a constant average refrigerant level in flooded evaporators, pump tanks or liquid separators.

Features

- Waterproof versions, enclosure IP66
- Single pole changeover switch (SPDT) suitable for AC / DC loads
- Interchangeable contact system

Approvals

CE-approved according to
EN 60947-4, -1 EN 60947-5, -1

Meets the requirements of VDE 0660 (VDE:
Verband Deutscher Elektrotechniker)

Liquid Level Alarms, types RT280A, RT281A

Technical data

Refrigerants	R717 (NH ₃), R22 and R502 "For other refrigerants, please contact Danfoss."	
Operating ranges for RT 280A	R12	-50 – 10 °C
	R22 and R717 (NH ₃)	-50 – 0 °C
	R502	-65 – -5 °C
Operating ranges for RT 281A	R22 and R717 (NH ₃)	-30 – 20 °C
Ambient temperature	-50 – 70 °C	
Switch	Single pole changeover switch (SPDT), code no. 017-403066	
Contact load	Alternating current	AC1: 10 A, 400 V
		AC3: 4 A, 400 V ¹⁾
		AC15: 3 A, 400 V
	Direct current	DC13: 12 W, 220 V
Weight	2.0 kg	
Enclosure	IP66 to IEC 529.	
Pressure connection	G 3/8 A with ø 6.5 / ø 10 mm weld nipple	
Max. working pressure	PB = 22 bar	
Max. test pressure	Pe = 25 bar	
Thermostatic element	Adsorption charge	
	3 m capillary tube	
	Max. permissible bulb temperature: 80 °C	
Bulb with electric heater	10 W heater for 24 V DC or AC. The heater must be constantly energised whilst the system is in operation. 1.5 m connection cable.	

¹⁾ Max. short-time AC3 current: 28 A

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.

Materials

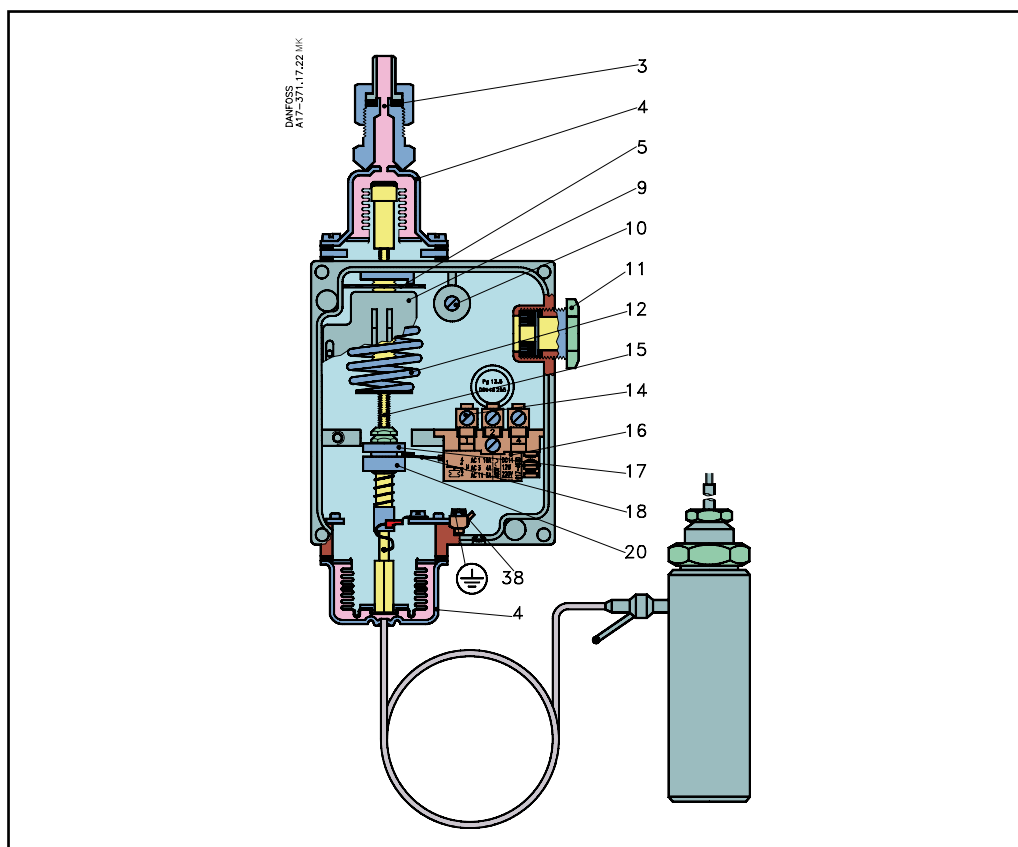
Gaskets are non-asbestos.

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 and RT 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 the 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.

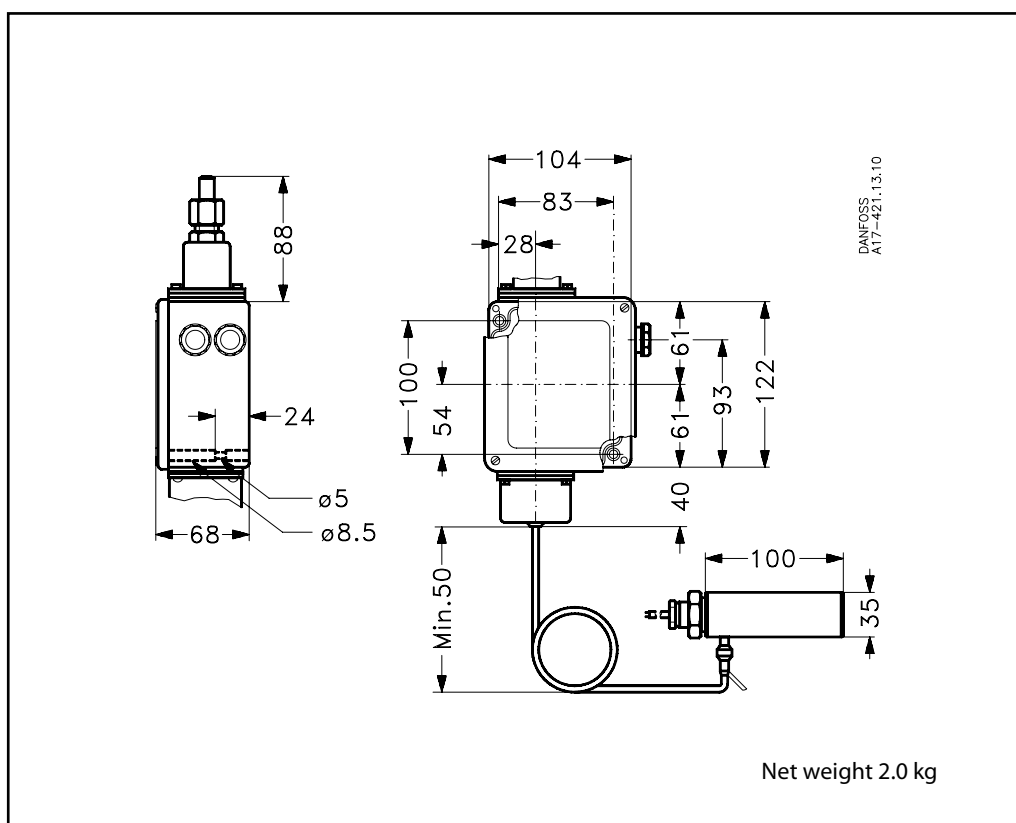
The element heating or cooling signal is compared to the reference pressure and then converted to an electric on / off impulse. The regulating principle is based on the heat conduction difference between the liquid and vapour phases of the refrigerant.

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.

Liquid Level Alarms, types RT280A, RT281A

**Dimensions [mm] and
weights [kg]**



Sight glass

Type LLG 185 - 1550

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Sight glass

Type LLG 185 - 1550



LLG are sight glasses in ductile steel which meets the strictest requirements on industrial and marine refrigeration installations. The sight 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 sight glasses is based on 3 basic sight 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 sight 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 HCFC, HFC and R717 (Ammonia).
- 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: CRN, EAC etc.
To get an updated list of certification on the products please contact your local Danfoss Sales Company.

Technical data

- *Refrigerants*
Applicable to HCFC, HFC and R717 (Ammonia). 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 sight 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.

Design

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 sight glasses from the connected pipes.

Please also make sure that there is sufficient space behind the the sight 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 sight glasses, which may be the case in the refrigerant-filled glasses.

The 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 sight glass can only be placed in CE approved applications with the stop valves in front.

Sight glasses, type LLG 185 - 1550

Frostproof sight 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.

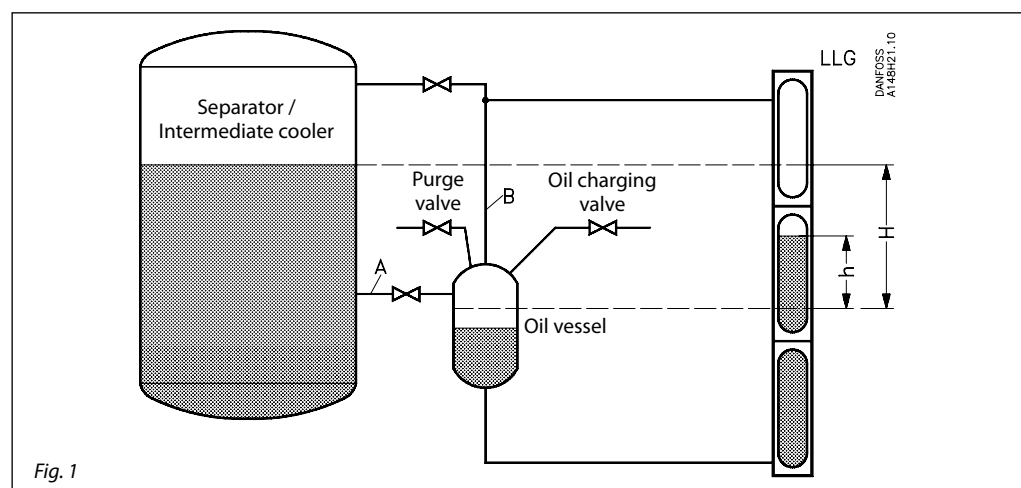
Charge the oil vessel (volume approximate 10 litres) to a level just below the lower balancing pipe (A) through the oil charging valve. Close the oil charging valve.

The oil will show in the sight 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 sight 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.



Frostproof sight glasses

Example 2

Refrigerant: R717 (ammonia).
 Temperature: Recommended for temperatures below -10°C / 14 °F

Fig. 2 shows a frostproof sight 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 sight 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

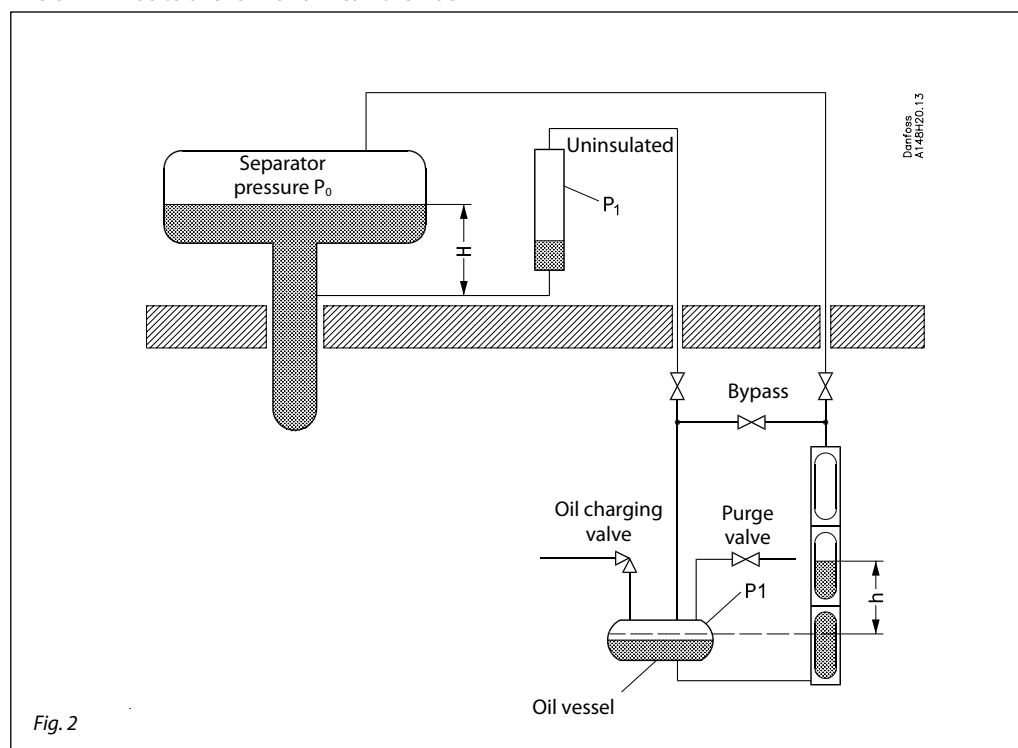
calculated by multiplying h by 1.35 (the ratio of density oil to density R717).

Charge the oil vessel through the oil charging valve to a level of approximately $\frac{3}{4}$ of full level. The level will show in the lower sight glass.

Take care that the volume of the oil vessel is sufficient to allow the oil to rise into the sight glasses. When the system is operating keep the bypass valve closed.

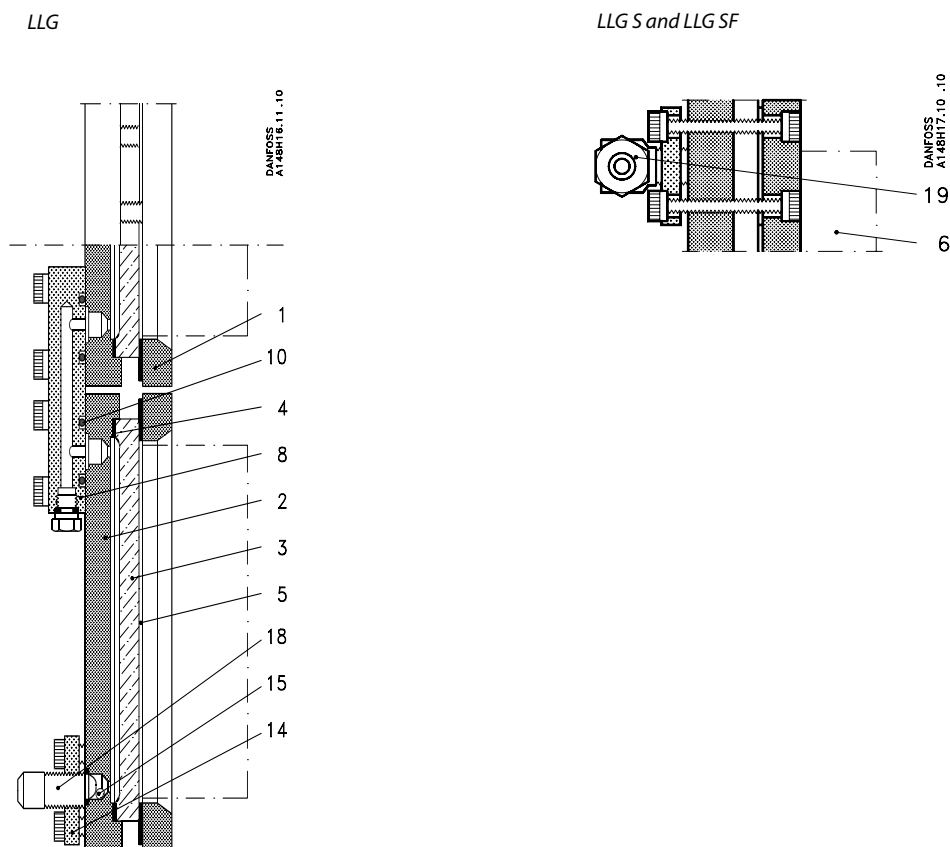
Note:

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.



Sight glasses, type LLG 185 - 1550

Material specification

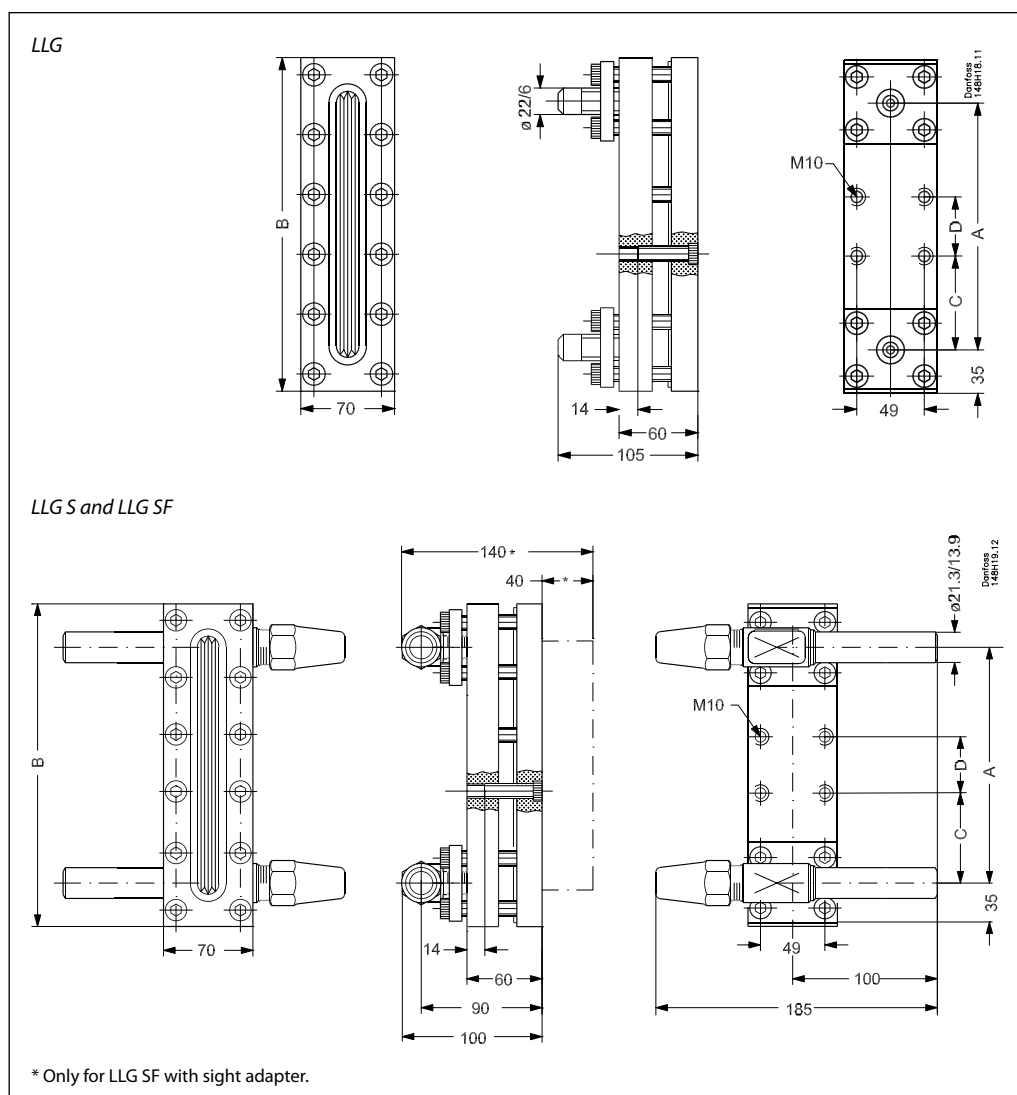


No.	Part	Material	DIN	ISO	ASTM
1	Front frame	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
2	Back frame	Steel	RSt. 37.2, 17 100	Fe 360 B, 630	Grade C, A 283
3	Sight glass	Glass			
4	Gasket	Non-asbestos			
5	Protective coating for sight glass	Non-asbestos			
6	Sight adapter	PMMA-acrylic			
8	Connecting 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.

Sight glasses, type LLG 185 - 1550

Dimensions and weights



Type		A	B	C	D	Weight
LLG 185 - 1550						
LLG 185	[mm] [in]	185 7 1/4	255 10	69 2 3/4	48 2	4.2 kg ¹⁾ 5.8 kg ²⁾
LLG 335	[mm] [in]	335 13 1/4	405 16	63 2 1/2	42 1 3/4	7.5 kg ¹⁾ 9.2 kg ²⁾
LLG 590	[mm] [in]	590 23 1/4	660 26	69 + 63 2 3/4 + 2 1/2	48 + 42 2 + 1 3/4	13.2 kg ¹⁾ 15.1 kg ²⁾
LLG 740	[mm] [in]	740 29 1/4	810 32	63 2 1/2	42 1 3/4	16.5 kg ¹⁾ 18.5 kg ²⁾
LLG 995	[mm] [in]	995 39 1/4	1065 42	69 + 63 2 3/4 + 2 1/2	48 + 42 2 + 1 3/4	22.5 kg ¹⁾ 24.7 kg ²⁾
LLG 1145	[mm] [in]	1145 45	1215 47 3/4	63 2 1/2	42 + 42 1 3/4 + 1 3/4	25.7 kg ¹⁾ 28.0 kg ²⁾
LLG 1550	[mm] [in]	1550 61	1620 63 3/4	63 2 1/2	42 1 3/4	33.5 kg ¹⁾ 36.1 kg ²⁾

¹⁾ Type LLG

²⁾ Type LLG S and LLG SF

Specified weights are approximate values only.

* please note that LLG 740 consist of one back piece and 2 front sight glasses.

Sight glasses, type LLG 185 - 1550

Ordering

How to order

The table below is used to identify sight glasses required.

Please note that the type codes only serve to identify the sight 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	Sight glass
Nominal size in mm		Combined by:
	185	DN 185
	335	DN 335
	590	DN 590
	740	DN 740
	995	DN 995
	1145	DN 1145
	1550	DN 1550
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

Sight glasses - LLG

With safety system and welding nipples

Length		Type	Code no.
[mm]	[in]		
185	7 ¼	LLG 185	2512+049
335	13 ¼	LLG 335	2512+050
590	23 ¼	LLG 590	2512+051
740	29 ¼	LLG 740	2512+052
995	39 ¼	LLG 995	2512+053
1145	45	LLG 1145	2512+054
1550	61	LLG 1550	2512+055

Sight glasses - LLG S

With safety system and stop valves (SNV-ST)

Length		Type	Code no.
[mm]	[in]		
185	7 ¼	LLG 185 S	2512+056
335	13 ¼	LLG 335 S	2512+057
590	23 ¼	LLG 590 S	2512+058
740	29 ¼	LLG 740 S	2512+059
995	39 ¼	LLG 995 S	2512+060
1145	45	LLG 1145 S	2512+061
1550	61	LLG 1550 S	2512+062

Sight glasses for insulating - LLG F

With safety system and sight adapter

Length		Type	Code no.
[mm]	[in]		
185	7 ¼	LLG 185 F	2512+078
335	13 ¼	LLG 335 F	2512+079
590	23 ¼	LLG 590 F	2512+080
740	29 ¼	LLG 740 F	2512+081
995	39 ¼	LLG 995 F	2512+082
1145	45	LLG 1145 F	2512+083
1550	61	LLG 1550 F	2512+084

Sight glasses for insulating - LLG SF

With safety system, stop valves (SNV-ST) and sight adapter

Length		Type	Code no.
[mm]	[in]		
185	7 ¼	LLG 185 SF	2512+066
335	13 ¼	LLG 335 SF	2512+067
590	23 ¼	LLG 590 SF	2512+068
740	29 ¼	LLG 740 SF	2512+069
995	39 ¼	LLG 995 SF	2512+070
1145	45	LLG 1145 SF	2512+071
1550	61	LLG 1550 SF	2512+072

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.

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