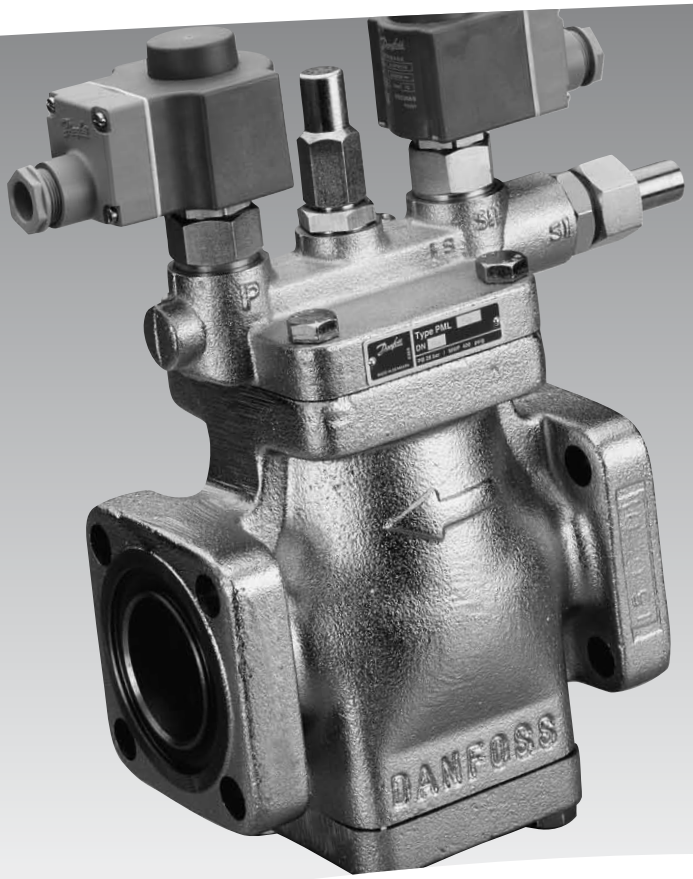

Solenoid valve, type PML

REFRIGERATION AND
AIR CONDITIONING

Technical leaflet

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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.

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

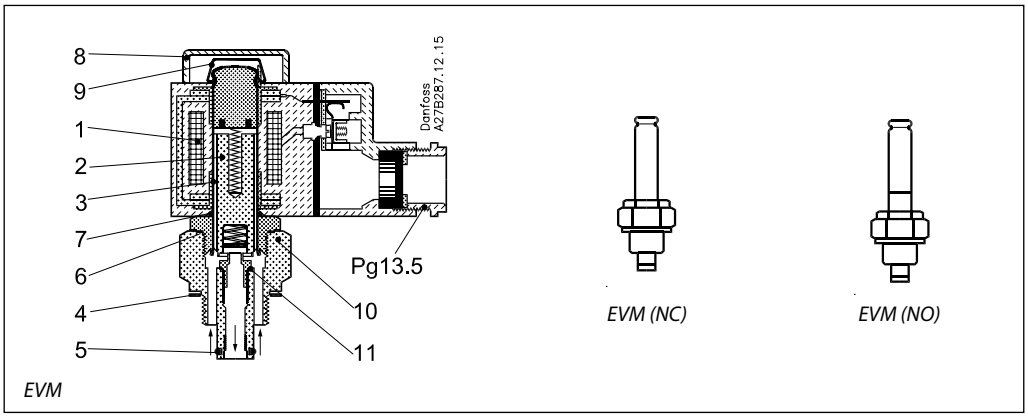
PML valves			
Nominal bore	DN≤ 25 (1 in.)	DN32-125 mm (1 1/4 - 5 in.)	DN 150 mm (6 in.)
Classified for	Fluid group I		
Category	Article 3, paragraph 3	II	III

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)

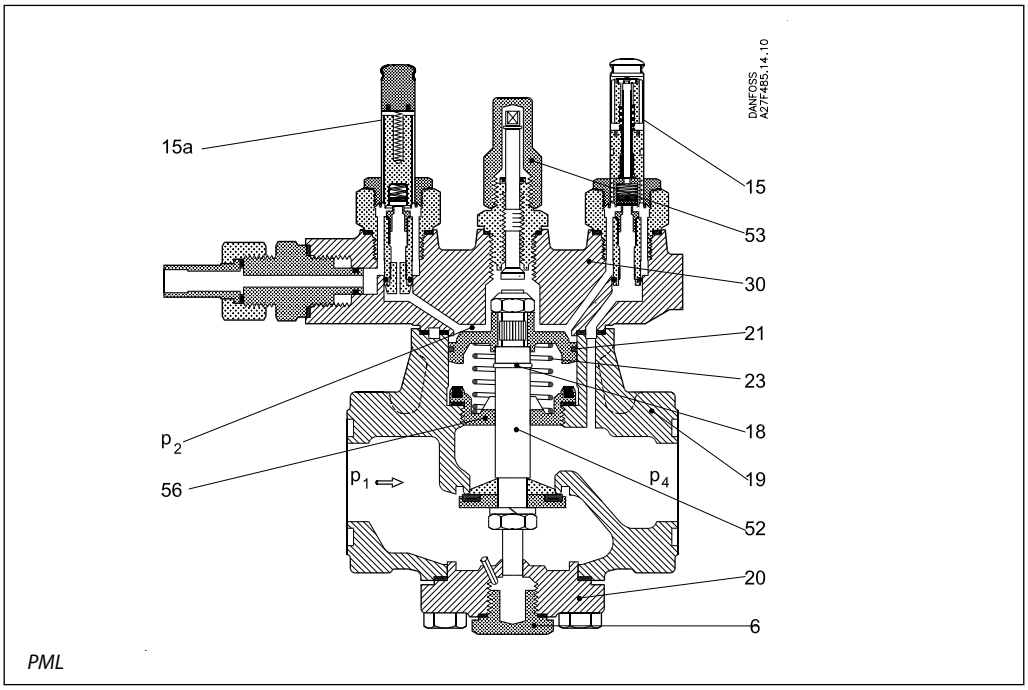
  Opening differential pressure:
  0 bar g (0 psi g) as valve is kept open by external pilot pressure.
  Max. (MOPD), solenoid valves only (10 W a.c. [NC] /12 W a.c. [NO] or 20 W d.c.): 21 bar g (305 psig).

Design
Function



EVM

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



PML

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

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.

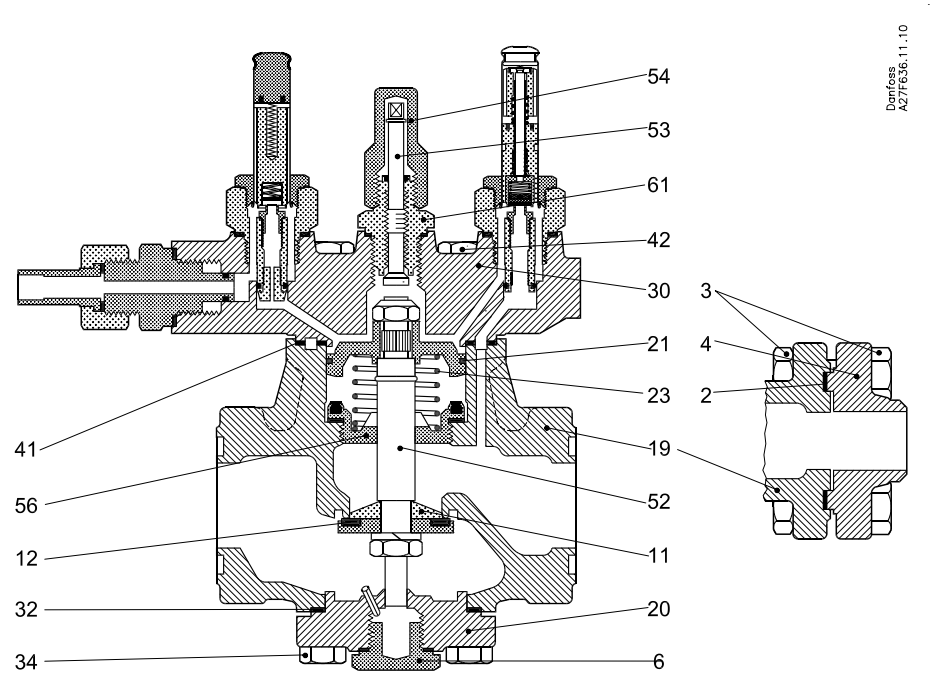
When, for example, the condensing pressure is used as pilot pressure, the system side will not be loaded with undesired hot gas injection.

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 not 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

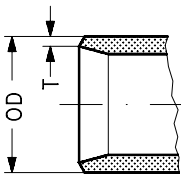
No.	Part	Material	DIN / EN	ISO	ASTM
2	Gasket between body and bottom cover	Non-metal Non-asbestos			
3	Bolts for flange (to be ordered separately)	Stainless steel	A2 / A4-70	A2 / A4-70	
4	Flange PML 32 - 65	Steel	RSt. 37-2, 10025	Fe360 B, 630	Grade C, A 283
4	Flange PML 80 - 125	Steel	TSTE 355, 2635 / 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.

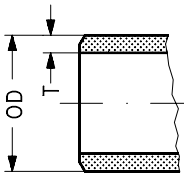
DIN



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**

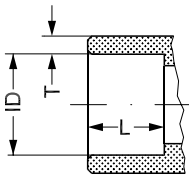
ANSI



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



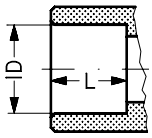
Socket welding ANSI (B 16.11)

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

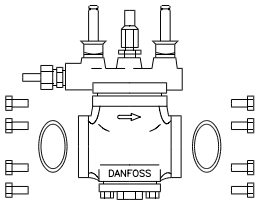
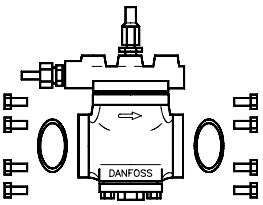
Complete valves

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.

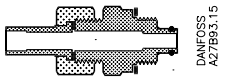
Coils are ordered separately according to coil voltage and frequency.
For EVM (NC), code no. **027B1120**, 10 / 12 watt a.c. coils or 20 watt d.c. coils are used.
For EVM (NO), code no. **027B1130**, 12 watt a.c. coils or 20 watt d.c. coils, type I, are used.

	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

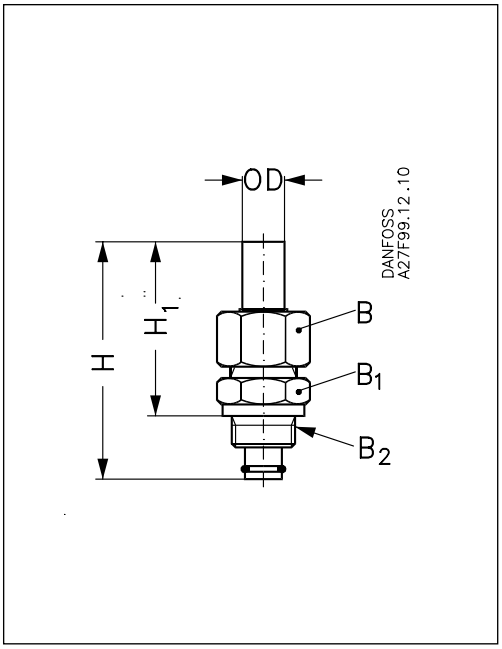
External pilot connection



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**

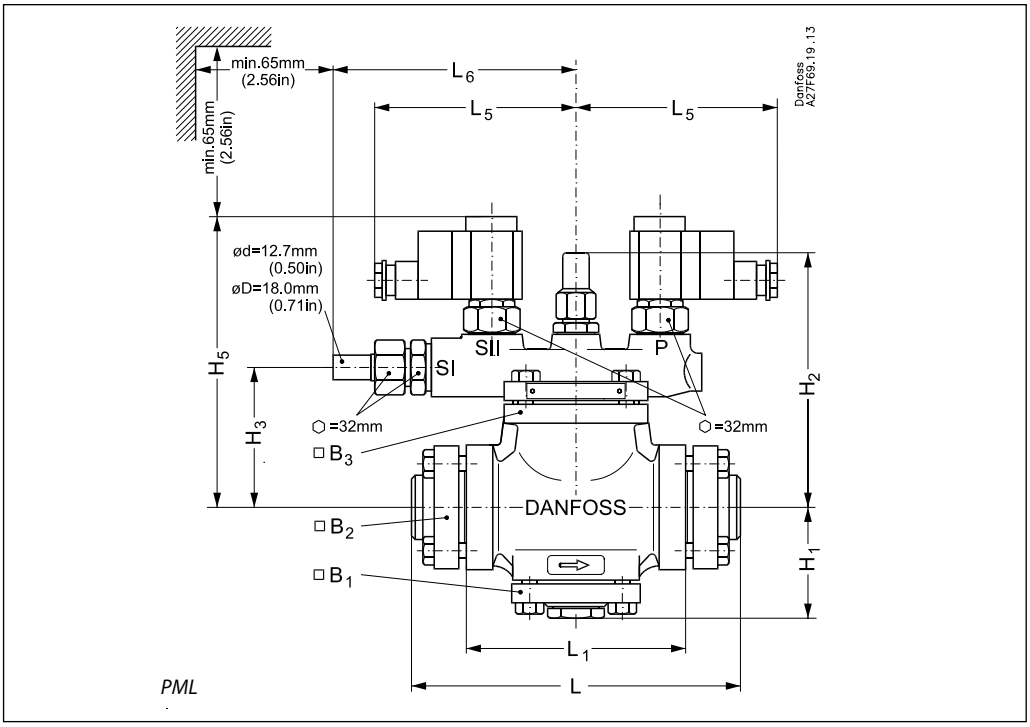
PML	Description	Code no.
32 - 65	Damping orifice for EVM. 10 off, (D: 1.0 mm)	**027F0664**
80 - 125	Damping orifice for EVM. 10 off, (D: 1.8 mm)	**027F0176**

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



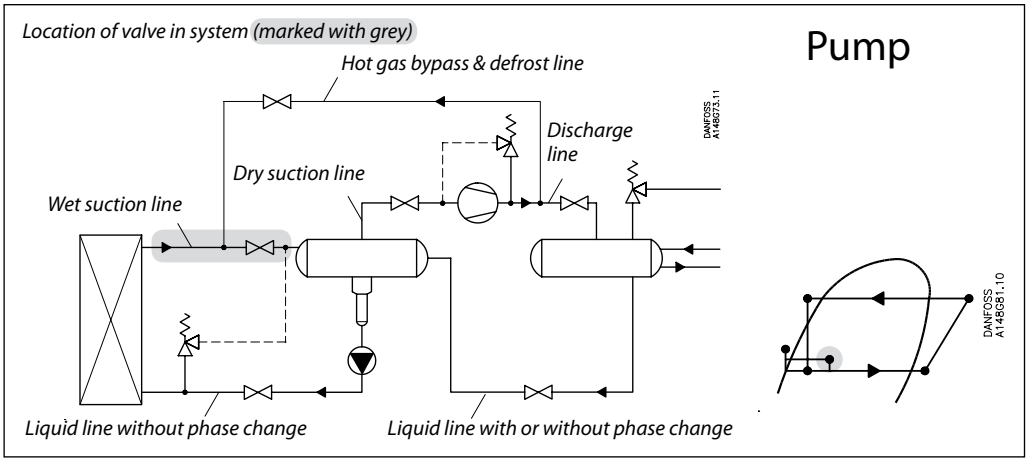
Flange set for valve type	Weight kg. / lb
PML 32	1.5 kg.
(DN 20 - 32)	3.3 lb
PML 40	1.9 kg.
(DN 40 - 50)	4.2 lb
PML 50	2.8 kg.
(DN 50 - 65)	6.2 lb
PML 65	3.0 kg.
(DN 65 - 80)	6.6 lb

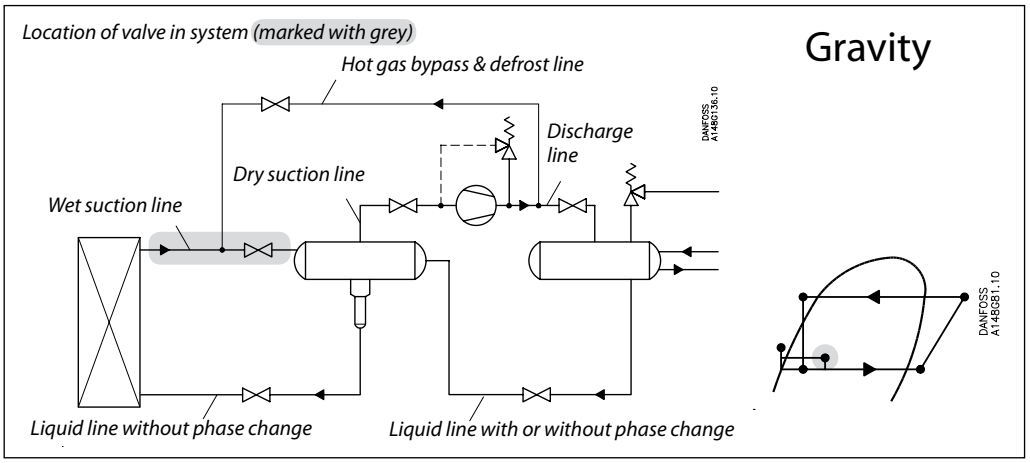
Type		H_1	H_2	H_3	H_5	L	L_1	L_5 max. 10 W	L_5 max. 20 W	L_6	B_1	B_2	B_3	Weight
PML 32	mm	72	178	96	208	240	170	122	132	160	84	82	94	12.6 kg.
(DN 20 - 32)	in.	2.8	7	3.8	8.2	9.4	6.7	4.8	5.2	6.3	3.3	3.2	3.7	27.8 lb
PML 40	mm	79	187	105	215	254	170	125	135	163	94	89	102	15.3 kg.
(DN 40 - 50)	in.	3.1	7.4	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.

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

Wet suction line

SI units

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

R 22

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
PML 32	25.5	11.4	14	17	20	23	26	29	32
PML 40	34	15	18	22	26	30	34	38	41
PML 50	50	22	27	33	38	44	50	56	62
PML 65	81	36	44	53	62	72	81	91	100
PML 80	188	84	103	123	144	167	189	211	233
PML 100	269	120	147	176	207	238	270	302	333
PML 125	427	190	233	279	328	378	429	480	528

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 22

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	30	3.2	4	4.9	5.8	6.8	7.7	8.8	9.7
PML 40	39	4.2	5.3	6.4	7.7	8.9	10.2	11.5	12.7
PML 50	58	6.3	7.9	9.6	11.4	13.3	15.2	17.2	19
PML 65	94	10.2	12.8	15.6	18.5	22	25	28	31
PML 80	218	24	30	36	43	50	57	65	71
PML 100	312	34	42	52	62	72	82	93	102
PML 125	495	54	67	82	98	114	130	147	162

* 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

Wet suction line

SI units

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

R 404A

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
PML 32	25.5	11.8	14	17	20	22	25	28	30
PML 40	33.5	15	19	22	26	29	33	36	39
PML 50	50	23	28	33	38	44	49	54	59
PML 65	81	37	45	53	62	71	80	88	95
PML 80	188	87	105	123	144	165	185	204	221
PML 100	269	124	150	177	206	236	264	292	317
PML 125	427	197	239	280	327	374	420	464	503

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 404A

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	3.3	4.1	4.9	5.8	6.7	7.6	8.4	9.1
PML 40	39	4.4	5.4	6.5	7.6	8.8	9.9	11.1	11.9
PML 50	58	6.5	8.1	9.7	11.4	13.1	14.8	16.5	17.8
PML 65	94	10.6	13.1	15.7	18.4	21	24	27	29
PML 80	218	25	30	36	43	49	56	62	67
PML 100	312	35	43	52	61	71	80	89	96
PML 125	495	56	69	83	97	112	126	141	152

* 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

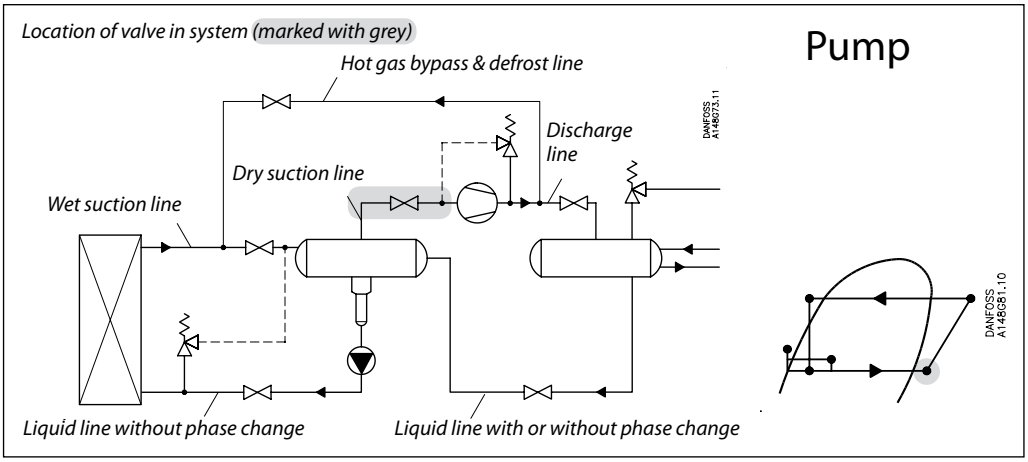
Correction factor for circulation ratio (f_{circ})

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

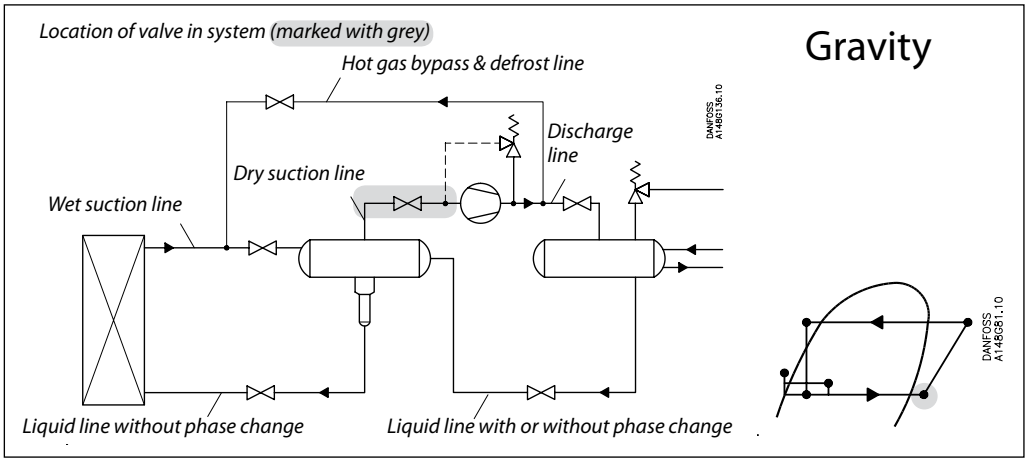
Nominal capacities

Dry suction line

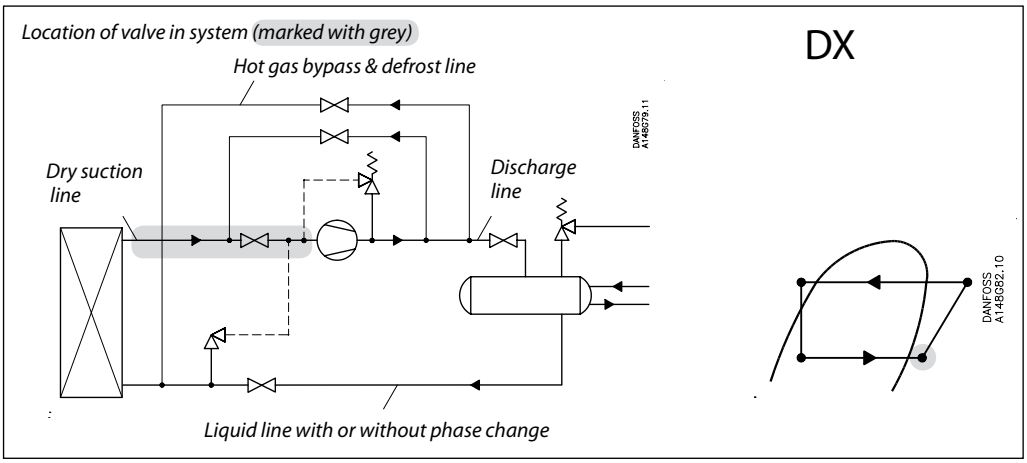
Pump



Gravity



DX



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. ΔP = 0.1 bar

The capacity table is based on nominal conditions (pressure drop ΔP = 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 ΔP = 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. ΔP = 1.25 psi

The capacity table is based on nominal conditions (pressure drop ΔP = 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 ΔP = 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

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

R 717

SI units

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

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
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

R 717

US units

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

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

Nominal capacities

Dry suction line

R 22

SI units

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

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	13	17	21	27	32	39	46	54
PML 40	34	17	22	28	35	42	51	61	72
PML 50	50	25	33	42	52	63	76	91	107
PML 65	81	41	53	68	84	103	124	147	173
PML 80	188	95	124	157	196	238	287	341	402
PML 100	269	137	177	224	280	341	410	488	575
PML 125	427	217	281	356	445	541	652	775	912

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	0.71
–10°C	0.75
0°C	0.80
10°C	0.86
20°C	0.92
30°C	**1**
40°C	1.09
50°C	1.22

R 22

US units

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

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	3.6	4.8	6.2	7.8	9.7	11.9	14.5	17.3
PML 40	39	4.7	6.3	8.1	10.3	12.8	15.6	19.1	23
PML 50	58	7	9.3	12.1	15.4	19.1	23	28	34
PML 65	94	11.4	15.1	20	25	31	38	46	55
PML 80	218	26.4	35	46	58	72	88	107	127
PML 100	312	37.7	50	65	83	103	125	153	182
PML 125	495	60	80	103	131	163	199	243	289

* 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	0.73
10°F	0.77
30°F	0.82
50°F	0.87
70°F	0.93
90°F	**1**
110°F	1.09
130°F	1.20

Nominal capacities

Dry suction line

R 134a

SI units

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

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
PML 32	25.5	-	11	15	19	24	30	36	44
PML 40	34	-	14	19	25	31	39	48	58
PML 50	50	-	22	29	37	47	58	72	87
PML 65	81	-	35	46	60	76	94	116	140
PML 80	188	-	81	107	139	176	219	269	326
PML 100	269	-	116	154	200	252	314	385	466
PML 125	427	-	184	244	317	399	498	611	740

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	0.66
–10°C	0.70
0°C	0.76
10°C	0.82
20°C	0.90
30°C	**1**
40°C	1.13
50°C	1.29

R 134a

US units

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

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	-	3.1	4.2	5.6	7.2	9.2	11.6	14.3
PML 40	39	-	4.1	5.6	7.3	9.5	12	15.3	18.7
PML 50	58	-	6.1	8.3	11	14.2	18	22.8	28
PML 65	94	-	9.9	13.4	17.8	23	29	37	45
PML 80	218	-	23	31	41	53	68	86	105
PML 100	312	-	33	45	59	76	97	123	150
PML 125	495	-	52	71	94	121	154	195	239

* 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	0.64
10°F	0.68
30°F	0.74
50°F	0.81
70°F	0.89
90°F	**1**
110°F	1.15
130°F	1.35

Nominal capacities

Dry suction line

R 404A

SI units

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

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
PML 32	25.5	10	13	17	22	27	34	41	49
PML 40	33.5	13	17	22	29	36	44	54	65
PML 50	50	19	26	33	43	53	66	80	97
PML 65	81	31	41	54	69	87	107	130	157
PML 80	188	72	96	125	161	201	248	303	365
PML 100	269	103	137	179	230	288	355	433	522
PML 125	427	163	218	285	366	457	564	687	828

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	0.55
–10°C	0.60
0°C	0.66
10°C	0.74
20°C	0.85
30°C	**1**
40°C	1.23
50°C	1.68

R 404A

US units

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

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	2.6	3.6	4.9	6.4	8.2	10.3	12.9	15.8
PML 40	39	3.4	4.8	6.4	8.4	10.7	13.5	17	21
PML 50	58	5.1	7.1	9.6	12.5	16	20	25	31
PML 65	94	8.3	11.5	15.5	20	26	33	41	50
PML 80	218	19.4	27	36	47	60	76	95	116
PML 100	312	28	38	51	67	86	108	136	166
PML 125	495	44	61	82	107	137	172	216	264

* 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	0.52
10°F	0.57
30°F	0.63
50°F	0.72
70°F	0.83
90°F	**1**
110°F	1.29
130°F	1.92