

Application guidelines

Danfoss scrolls, **H-Series** Residential and light commercial

50 - 60 Hz - R22 - R407C - R410A





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GENERAL INFORMATION
PRODUCT INFORMATION
SYSTEM DESIGN
INTEGRATION INTO SYSTEM
ORDERING INFORMATION

Danfoss scroll compressors are designed and manufactured according to the state of the art and to valid European and US regulations. Particular emphasis has been placed on safety and reliability. Related instructions are highlighted with the following icons:

 This icon indicates instructions to avoid safety risk.

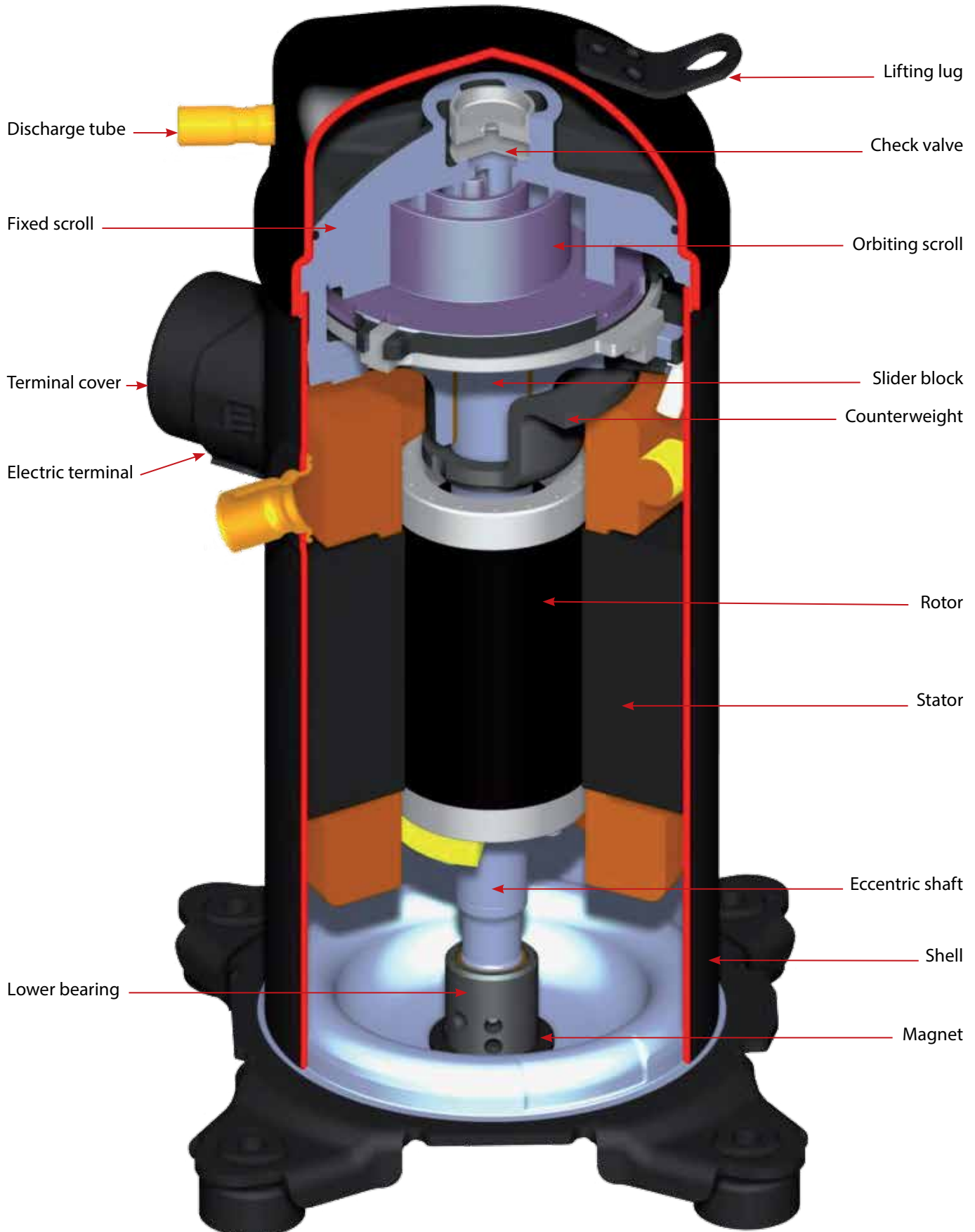
 This icon indicates instructions to avoid reliability risk.

You are strongly advise to follow these instructions. For any deviation from the guidelines, please contact Danfoss Technical Support.

Features

Danfoss H-series scroll compressors are manufactured using the most advanced machining, assembly, and process control techniques. In design of both the compressor and the factory, very high standards of reliability

and process control were first priority. The result is a highly efficient product with the highest reliability obtainable, and a low sound level. The H-series compressors can be black or blue depending on the production site.



GENERAL INFORMATION

PRODUCT INFORMATION

SYSTEM DESIGN

INTEGRATION INTO SYSTEM

ORDERING INFORMATION

Compressor model designation

Danfoss H-series scroll compressor for R22/R407C/R410A is available as single compressor and can be assembled in tandem combinations. The example below presents the compressor

nomenclature which equals the technical reference as shown on the compressor nameplate. Code numbers for ordering are listed section "Ordering information and packaging".

Nomenclature

Type	Size	Motor	Features
HRH	036	U1L	P6

Application: _____
H: high temperature / air conditioning

Family: _____
C: commercial scroll
R: residential scroll
L: light commercial scroll

Refrigerant & lubricant: _____
M: R22, alkylbenzene lubricant
P: R407C, PVE lubricant
H: R410A, PVE lubricant
J: R410A, PVE lubricant

Nominal capacity: _____
In thousand Btu/h at 60 Hz, ARI conditions

Model variation _____
T: design optimized for 7.2/54.4°C
U: design optimized for 7.2/37.8°C

Other features

	Oil sight glass	Oil equalization	Oil drain	LP gauge port	Gas equalization port
6	None	None	None	None	None
7	Threaded	None	None	None	None
8	None	Brazed	None	None	Brazed
T	None	Screw	Schrader	None	None

Tubing and electrical connections
P: brazed connections, spade terminals
C: brazed connections, screw terminals

Motor protection
L: internal motor protection

Motor voltage code
1: 208-230V/1~/60 Hz
2: 200-220V/3~/50Hz & 208-230V/3~/60 Hz
4: 380-415V/3~/50 Hz & 460V/3~/60 Hz
5: 220-240V/1~/50 Hz
7: 575V/ 3~/60 Hz
9: 380V/3~/60 Hz

Feature Version T compressors are built with a threaded oil equalization port to be used with Danfoss variable speed compressors range VZH series.

Technical specifications

50-60 Hz data

Model	Nominal tons 60 Hz		Nominal cooling capacity		Power input	COP	E.E.R	Swept volume	Displacement	Oil charge	Net weight
	TR		W	Btu/h	kW	W/W	Btu/h/W	cm ³ /rev	m ³ /h	dm ³	kg
50Hz	HRM025T4	2	5 950	20 300	1.86	3.2	10.9	34.1	5.9	1.06	32
	HRM034U4	2.8	8 350	28 490	2.66	3.14	10.7	46.2	8.03	1.06	32
	HRM034T4	2.8	8 200	28 000	2.66	3.29	11.2	46.2	8.03	1.06	32
	HRM038U4	3.2	9 240	31 520	2.94	3.14	10.7	51.6	8.98	1.06	32
	HRM040U4	3.3	9 710	33 120	2.98	3.26	11.1	54.4	9.47	1.06	32
	HRM042U4	3.5	10 190	34 770	3.13	3.26	11.1	57.2	9.95	1.06	32
	HRM042T4	3.5	10 110	34 500	3.08	3.28	11.2	57.2	9.95	1.06	32
	HRM045U4	3.8	10 940	37 310	3.45	3.17	10.8	61.5	10.69	1.33	32
	HRM047U4	3.9	11 500	39 250	3.57	3.23	11	64.1	11.15	1.33	32
	HRM048U4	4	11 510	39 270	3.57	3.23	11	64.4	11.21	1.57	39
	HRM051T4	4.3	12 390	42 280	3.67	3.37	11.5	68.8	11.98	1.57	39
	HRM051U4	4.3	12 800	43 690	3.83	3.34	11.4	68.8	11.98	1.57	39
	HRM054U4	4.5	13 390	45 680	3.97	3.37	11.5	72.9	12.69	1.57	41
	HRM054T4	4.5	13 300	45 400	3.84	3.46	11.8	72.9	12.69	1.57	41
	HRM058U4	4.8	14 340	48 930	4.25	3.37	11.5	78.2	13.6	1.57	41
	HRM060T4	5	14 570	49 720	4.28	3.4	11.6	81	14.09	1.57	41
	HRM060U4	5	14 820	50 580	4.4	3.37	11.5	81	14.09	1.57	41
	HLM068T4	5.7	16 880	57 580	5	3.37	11.5	93.1	16.2	1.57	41
	HLM072T4	6	17 840	60 870	5.29	3.37	11.5	98.7	17.2	1.57	41
	HLM075T4	6.3	18 430	62 880	5.37	3.43	11.7	102.8	17.88	1.57	41
	HLM081T4	6.8	19 890	67 880	5.8	3.43	11.7	110.9	19.3	1.57	41
60Hz	HCM094T4	7.8	23 060	78 670	6.8	3.39	11.6	126	21.93	2.66	47
	HCM109T4	9.1	26 690	91 070	7.77	3.43	11.7	148.8	25.89	2.66	47
	HCM120T4	10	29 130	99 390	8.51	3.42	11.7	162.4	28.26	2.66	47
	HRM025T4	2	7 090	24 200	2.22	3.2	10.9	34.1	7.12	1.06	32
	HRM034U4	2.8	9 810	33 480	3.07	3.2	10.9	46.2	9.69	1.06	32
	HRM034T4	2.8	9 960	34 010	2.98	3.34	11.4	46.2	9.69	1.06	32
	HRM038U4	3.2	11 130	37 980	3.39	3.28	11.2	51.6	10.84	1.06	32
	HRM040U4	3.3	11 720	39 980	3.57	3.28	11.2	54.4	11.43	1.06	32
	HRM042U4	3.5	12 300	41 980	3.75	3.28	11.2	57.2	12.0	1.06	32
	HRM042T4	3.5	12 160	41 510	3.64	3.34	11.4	57.2	12.0	1.06	32
	HRM045U4	3.8	13 180	44 980	4.01	3.28	11.2	61.5	12.9	1.33	32
	HRM047U4	3.9	13 920	47 490	4.22	3.3	11.3	64.1	13.46	1.33	32
	HRM048U4	4	13 830	47 180	4.25	3.25	11.1	64.4	13.53	1.57	39
	HRM051T4	4.3	15 030	51 270	4.46	3.37	11.5	68.8	14.46	1.57	39
	HRM051U4	4.3	15 030	51 280	4.46	3.37	11.5	68.8	14.46	1.57	39
	HRM054U4	4.5	15 730	53 680	4.62	3.4	11.6	72.9	15.32	1.57	41
	HRM054T4	4.5	15 820	54 000	4.53	3.49	11.9	72.9	15.32	1.57	41
	HRM058U4	4.8	16 930	57 780	5.02	3.37	11.5	78.2	16.41	1.57	41
	HRM060T4	5	17 490	59 670	5.14	3.4	11.6	81	17.0	1.57	41
	HRM060U4	5	17 490	59 680	5.19	3.37	11.5	81	17.0	1.57	41
	HLM068T4	5.7	20 190	68 880	5.94	3.4	11.6	93.1	19.55	1.57	41
	HLM072T4	6	21 330	72 770	6.27	3.4	11.6	98.7	20.76	1.57	41
	HLM075T4	6.3	22 120	75 480	6.45	3.43	11.7	102.8	21.58	1.57	41
	HLM081T4	6.8	23 880	81 470	6.96	3.43	11.7	110.9	23.29	1.57	41
	HCM094T4	7.8	27 690	94 470	8.07	3.43	11.7	126	26.47	2.66	47
	HCM109T4	9.1	32 020	109 270	9.33	3.43	11.7	148.8	31.25	2.66	47
	HCM120T4	10	34 950	119 260	10.22	3.42	11.7	162.4	34.11	2.66	47

① Displacement at nominal speed: 2900 rpm at 50 Hz, 3500 rpm at 60 Hz

② Net weight with oil charge

TR = Ton of Refrigeration
COP = Coefficient Of Performance
EER = Energy Efficiency Ratio

Standard rating conditions: ARI standard
Refrigerant: R22
Superheat: 11.1 K

Evaporating temperature: 7.2 °C
Condensing temperature: 54.4 °C
Sub-cooling: 8.3 K

All performance test data after run-in 72hr

Subject to modification without prior notification

Data given for motor code 4 compressor, for full data details and capacity tables refer to Online Datasheet Generator: www.danfoss.com/odsg

Technical specifications

50-60 Hz data

Model		Nominal tons 60 Hz	Nominal cooling capacity		Power input	COP	E.E.R	Swept volume	Displacement	Oil charge	Net weight
		TR	W	Btu/h	kW	W/W	Btu/h/W	cm³/rev	m³/h	dm³	kg
50Hz	HRP025T4	2.0	5730	19 570	1.86	3.08	10.5	34.1	5.90	1.06	32
	HRP034T4	2.8	7 940	27 080	2.68	2.96	10.1	46.2	8.03	1.06	32
	HRP038T4	3.2	8 840	30 150	2.82	3.14	10.7	51.6	8.98	1.06	32
	HRP040T4	3.3	9 110	31 080	3.14	2.90	9.9	54.4	9.47	1.06	32
	HRP042T4	3.5	9 580	32 680	3.30	2.90	9.9	57.2	9.95	1.06	32
	HRP045T4	3.8	10 810	36 890	3.58	3.02	10.3	61.5	10.69	1.33	32
	HRP047T4	3.9	11 130	37 980	3.69	3.02	10.3	64.1	11.15	1.33	32
	HRP048T4	4.0	11 100	37 880	3.35	3.31	11.3	64.4	11.21	1.57	39
	HRP051T4	4.3	12 120	41 370	3.83	3.17	10.8	68.8	11.98	1.57	39
	HRP054T4	4.5	12 570	42 880	3.97	3.17	10.8	72.8	12.66	1.57	41
	HRP058T4	4.8	13 470	45 970	4.25	3.17	10.8	78.2	13.60	1.57	41
	HRP060T4	5.0	13 860	47 280	4.26	3.25	11.1	81.0	14.09	1.57	41
	HLP068T4	5.7	15 700	53 560	5.10	3.08	10.5	93.1	16.20	1.57	41
	HLP072T4	6.0	16 620	56 740	5.30	3.14	10.7	98.7	17.17	1.57	41
	HLP075T4	6.3	18 040	61 550	5.54	3.26	11.1	102.8	17.88	1.57	41
	HLP081T4	6.8	19 480	66 510	5.99	3.25	11.1	110.9	19.30	1.57	41
	HCP094T4	7.8	21 590	73 660	6.63	3.26	11.1	126.0	21.93	2.66	47
	HCP109T4	9.1	26 060	88 950	7.93	3.28	11.2	148.8	25.89	2.66	47
	HCP120T4	10.0	28 150	96 080	8.88	3.17	10.8	162.4	28.26	2.66	47
60Hz	HRP025T4	2.0	6880	23 490	2.22	3.11	10.6	34.1	7.12	1.06	32
	HRP034T4	2.8	9580	32 700	3.20	3.00	10.2	46.2	9.69	1.06	32
	HRP038T4	3.2	10 670	36 410	3.36	3.18	10.8	46.2	10.84	1.06	32
	HRP040T4	3.3	10 990	37 510	3.70	2.97	10.1	54.4	11.43	1.06	32
	HRP042T4	3.5	11 560	39 460	3.93	2.94	10.0	57.2	12.01	1.06	32
	HRP045T4	3.8	13 050	44 540	4.27	3.06	10.4	61.5	12.9	1.33	32
	HRP047T4	3.9	12 690	43 300	4.24	3.00	10.2	64.1	13.46	1.33	32
	HRP048T4	4.0	13 400	45 740	3.99	3.36	11.5	64.4	13.53	1.57	39
	HRP051T4	4.3	14 380	49080	4.46	3.23	11.0	68.8	14.46	1.57	39
	HRP054T4	4.5	15 120	51 770	4.73	3.21	11.0	72.8	15.28	1.57	41
	HRP058T4	4.8	16 260	55 510	5.07	3.17	10.8	78.2	16.41	1.57	41
	HRP060T4	5.0	16 720	57 010	5.07	3.30	11.3	81.0	17.01	1.57	41
	HLP068T4	5.7	18 950	64 660	6.08	3.12	10.6	93.1	19.55	1.57	41
	HLP072T4	6.0	20 060	68 480	6.32	3.17	10.8	98.7	20.72	1.57	41
	HLP075T4	6.3	21 770	74 330	6.60	3.30	11.3	102.8	21.58	1.57	41
	HLP081T4	6.8	23 380	79 810	7.14	3.27	11.2	110.9	23.29	1.57	41
	HCP094T4	7.8	26 060	88 950	7.90	3.30	11.3	126.0	26.47	2.66	47
	HCP109T4	9.1	31 450	107 350	9.46	3.32	11.3	148.8	31.25	2.66	47
	HCP120T4	10.0	33 970	115 960	10.59	3.21	11.0	162.4	34.11	2.66	47

① Displacement at nominal speed: 2900 rpm at 50 Hz, 3500 rpm at 60 Hz

② Net weight with oil charge

TR = Ton of Refrigeration

COP = Coefficient Of Performance

EER = Energy Efficiency Ratio

Standard rating conditions: ARI standard

Refrigerant: R407C

Superheat: 11.1 K

Evaporating temperature: 7.2 °C

Condensing temperature: 54.4 °C

Sub-cooling: 8.3 K

All performance test data after run-in 72hr

Subject to modification without prior notification

Data given for motor code 4 compressor, for full data details and capacity tables refer to Online Datasheet Generator: www.danfoss.com/odsg

Technical specifications

50-60 Hz data

Model		Nominal tons 60 Hz	Nominal cooling capacity		Power input	COP	E.E.R	Swept volume	Displacement	Oil charge	Net weight
		TR	W	Btu/h	kW	W/W	Btu/h/W	cm³/rev	m³/h	dm³	kg
50Hz	HRH029U4	2.4	7 120	24 310	2.43	2.93	10	27.8	4.84	1.06	32
	HRH031U4	2.6	7 530	25 710	2.67	2.82	9.62	29.8	5.19	1.06	32
	HRH032U4	2.7	7 670	26 170	2.75	2.79	9.51	30.6	5.33	1.06	32
	HRH034U4	2.8	8 500	29 000	2.9	2.93	10	33.3	5.75	1.06	32
	HRH036U4	3	8 820	30 110	3.13	2.82	9.62	34.7	6.04	1.06	32
	HRH038U4	3.2	9 250	31 560	3.35	2.76	9.41	36.5	6.36	1.06	39
	HRH040U4	3.3	10 200	34 810	3.58	2.85	9.72	39.6	6.9	1.33	39
	HRH041U4	3.3	10 050	34 300	3.43	2.93	10	39.3	6.8	1.57	39
	HRH044U4	3.7	10 830	36 940	3.92	2.76	9.41	42.6	7.41	1.57	39
	HRH047U4	3.9	11 340	38 700	3.87	2.93	10.01	44.4	7.73	1.57	39
	HRH049U4	4.1	12 110	41 320	4.04	2.99	10.22	47.4	8.24	1.57	39
	HRH051U4	4.3	12 860	43 890	4.21	3.05	10.42	49.3	8.58	1.57	41
	HRH054U4	4.5	13 340	45 510	4.41	3.02	10.32	52.1	9.07	1.57	41
	HRH056U4	4.7	13 830	47 200	4.58	3.02	10.31	54.1	9.42	1.57	41
	HLH061T4	5.1	15 210	51 880	4.89	3.11	10.61	57.8	10.1	1.57	41
	HLH068T4	5.7	16 880	57 610	5.26	3.21	10.96	64.4	11.21	1.57	41
	HLJ072T4	6	17 840	60 900	5.56	3.21	11	68	11.82	1.57	41
	HLJ075T4	6.3	18 600	63 490	5.77	3.22	11	70.8	12.32	1.57	41
	HLJ083T4	6.9	20 420	69 690	6.28	3.25	11.1	78.1	13.59	1.57	41
	H CJ090T4	7.5	22 320	76 190	7.19	3.11	10.6	86.9	15.11	2.66	44
	H CJ091T4	7.5	22 380	76 360	7.03	3.18	10.87	86.9	15.11	2.46	49
	H CJ105T4	8.8	26 100	89 090	8.25	3.16	10.8	101.6	17.68	2.66	44
	H CJ106T4	8.8	26 050	88 880	8.07	3.23	11.01	101.6	17.68	2.46	49
	H CJ120T4	10	29 610	101080	9.53	3.11	10.6	116.4	20.24	2.66	44
	H CJ121T4	10	29 720	101400	9.22	3.22	11	116.4	20.24	2.46	49
60Hz	HRH029U4	2.4	8 500	29 000	2.84	2.99	10.2	27.8	5.84	1.06	32
	HRH031U4	2.6	9 080	30 990	3.04	2.99	10.2	29.8	6.26	1.06	32
	HRH032U4	2.7	9 380	31 990	3.1	3.02	10.3	30.6	6.43	1.06	32
	HRH034U4	2.8	10 110	34 510	3.38	2.99	10.2	33.3	6.94	1.06	32
	HRH036U4	3	10 370	35 390	3.47	2.99	10.2	34.7	7.3	1.06	32
	HRH038U4	3.2	11 100	37 890	3.79	2.93	10	36.5	7.67	1.06	39
	HRH040U4	3.3	12 160	41 490	4.03	3.02	10.3	39.6	8.3	1.33	39
	HRH041U4	3.3	12 100	41 300	4.05	2.99	10.2	39.3	8.3	1.57	39
	HRH044U4	3.7	13 010	44 390	4.31	3.02	10.3	42.6	8.95	1.57	39
	HRH047U4	3.9	13 630	46 510	4.56	2.99	10.2	44.4	9.33	1.57	39
	HRH049U4	4.1	14 360	48 990	4.66	3.08	10.5	47.4	9.95	1.57	39
	HRH051U4	4.3	15 180	51 780	4.84	3.14	10.7	49.3	10.36	1.57	41
	HRH054U4	4.5	15 970	54 480	5.14	3.11	10.6	52.1	10.94	1.57	41
	HRH056U4	4.7	16 670	56 880	5.36	3.11	10.6	54.1	11.36	1.57	41
	HLH061T4	5.1	18 050	61 580	5.7	3.17	10.8	57.8	12.13	1.57	41
	HLH068T4	5.7	20 130	68 670	6.3	3.2	10.9	64.4	13.52	1.57	41
	HLJ072T4	6	21 240	72 500	6.65	3.19	10.9	68	14.27	1.57	41
	HLJ075T4	6.3	22 320	76 190	6.86	3.25	11.1	70.8	14.87	1.57	41
	HLJ083T4	6.9	24 340	83 090	7.55	3.22	11	78.1	16.4	1.57	41
	H CJ090T4	7.5	26 810	91 500	8.47	3.16	10.8	86.9	18.24	2.66	44
	H CJ091T4	7.5	27 140	92 600	8.37	3.24	11.07	86.9	18.24	2.46	49
	H CJ105T4	8.8	31 170	106 390	9.75	3.2	10.9	101.6	21.34	2.66	44
	H CJ106T4	8.8	31 670	108 050	9.67	3.28	11.18	101.6	21.34	2.46	49
	H CJ120T4	10	35 620	121 600	11.15	3.2	10.9	116.4	24.43	2.66	44
	H CJ121T4	10	35 940	122 620	11.07	3.25	11.08	116.4	24.43	2.46	49

① Displacement at nominal speed: 2900 rpm at 50 Hz, 3500 rpm at 60 Hz

② Net weight with oil charge

TR = Ton of Refrigeration

COP = Coefficient Of Performance

EER = Energy Efficiency Ratio

Standard rating conditions: ARI standard

Refrigerant: R410A

Superheat: 11.1 K

Evaporating temperature: 7.2 °C

Condensing temperature: 54.4 °C

Sub-cooling: 8.3 K

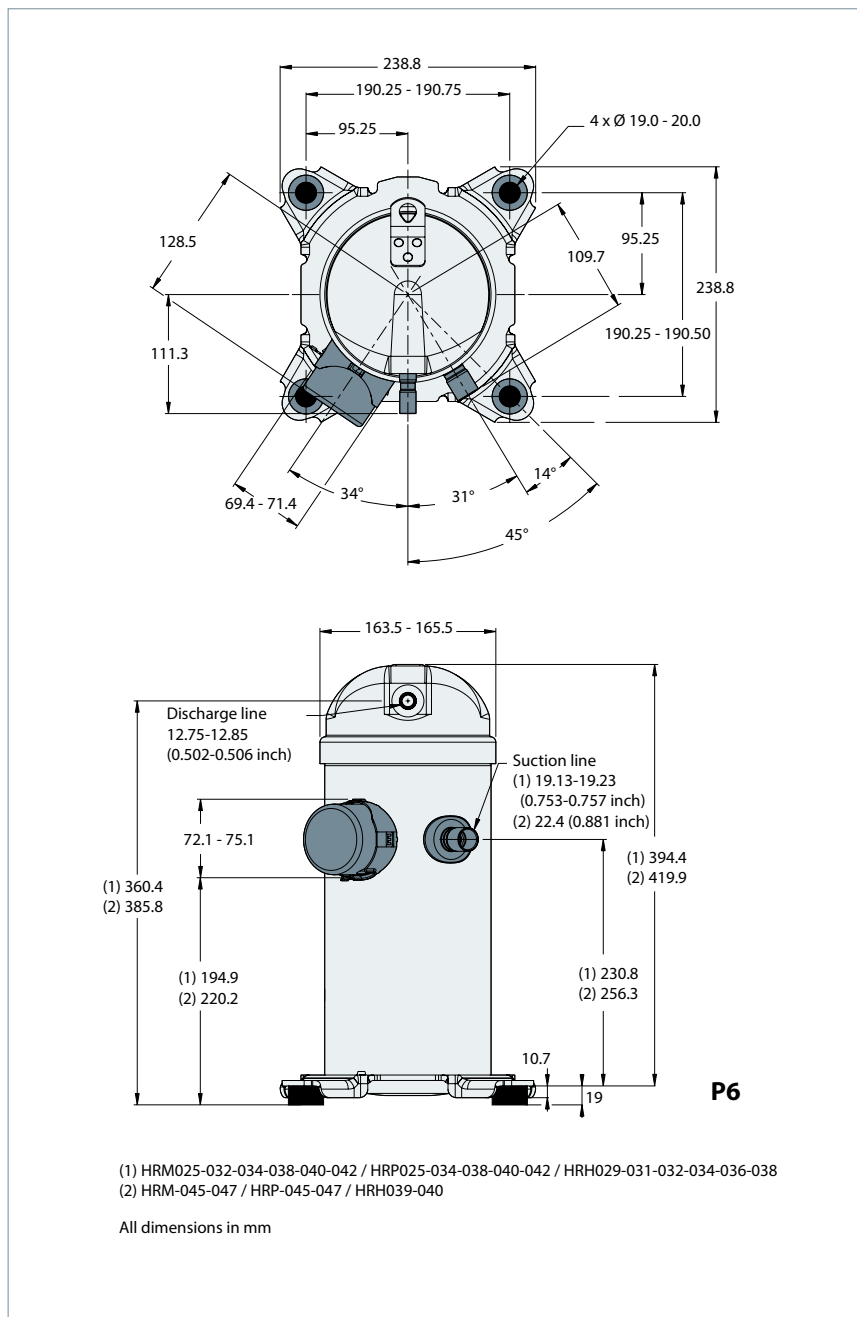
All performance test data after run-in 72hr

Subject to modification without prior notification

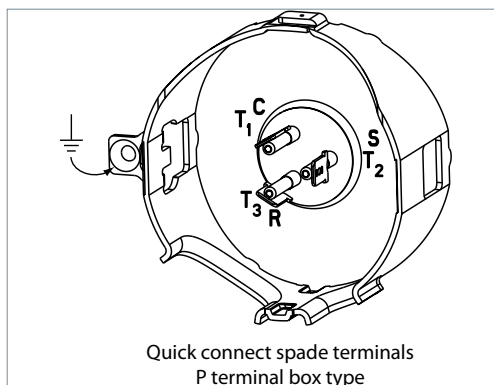
Data given for motor code 4 compressor, for full data details and capacity tables refer to Online Datasheet Generator: www.danfoss.com/odsg

Dimensions

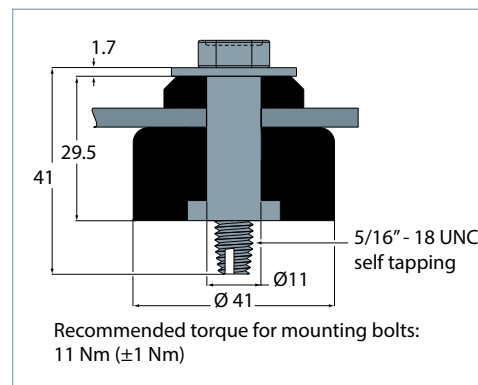
HRM025-032-034-038-040-042 / HRP025-034-038-040-042 / HRH029-031-032-034-036-038 /
HRM-045-047 / HRP-045-047 / HRH039-040



Terminal box



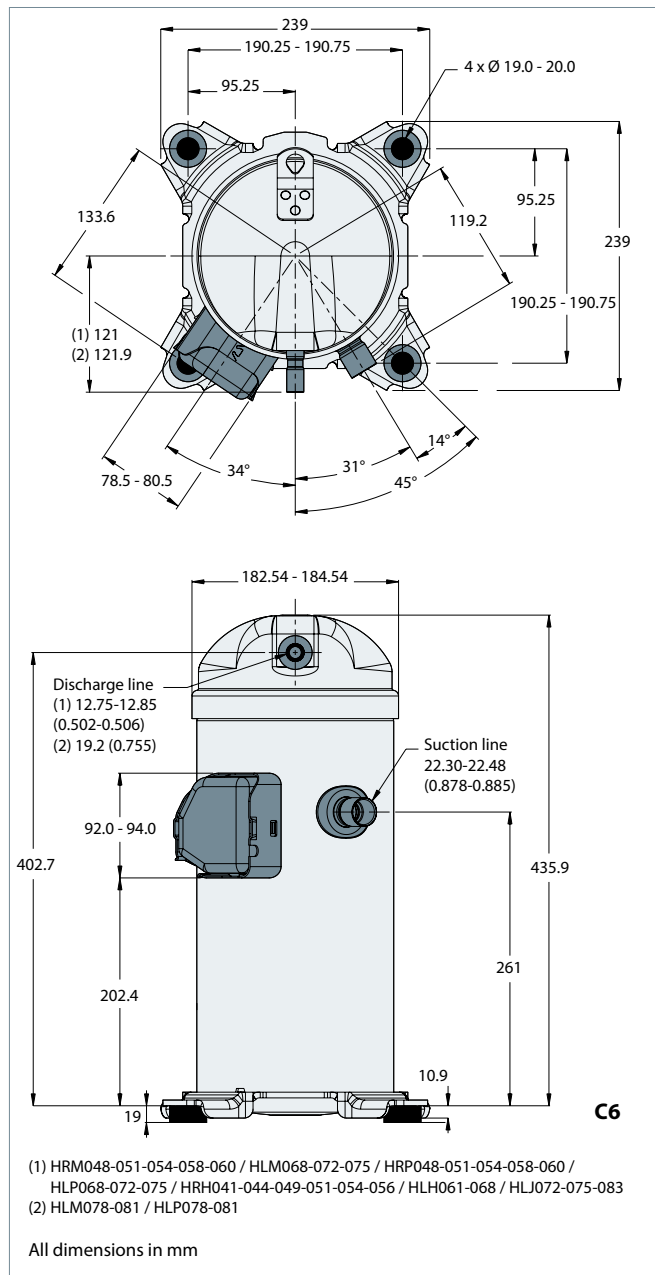
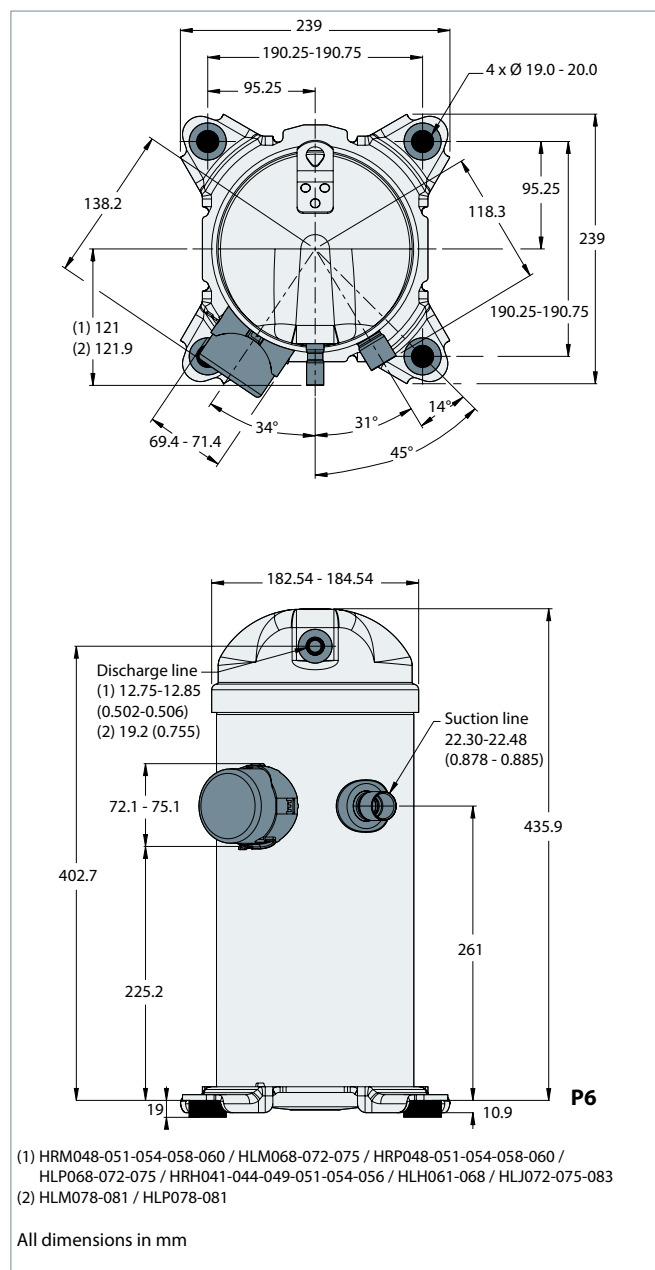
Mounting grommet



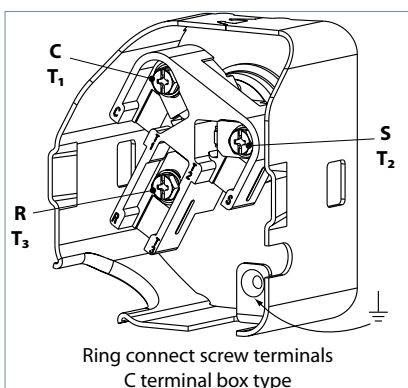
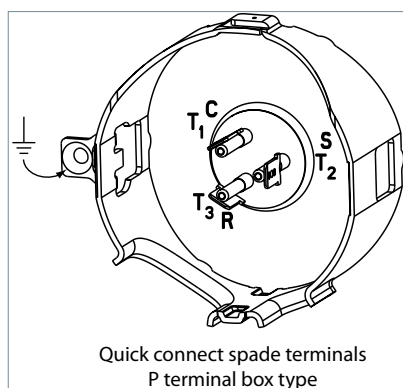
Refer to section 44 for overview of shipped mounting accessories

Dimensions

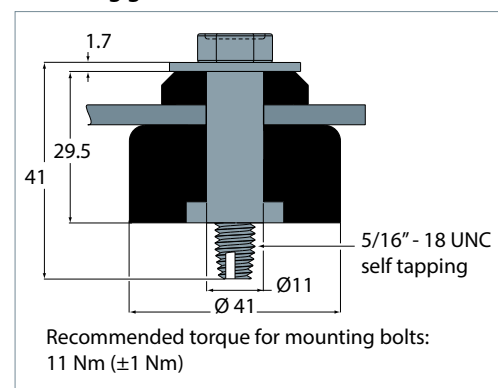
HRM048-051-054-058-060 / HLM068-072-075-078-081 / HRP048-051-054-058-060 /
HLP068-072-075-078-081 / HRH041-044-049-051-054-056 / HLH061-068 / HLJ072-075-083



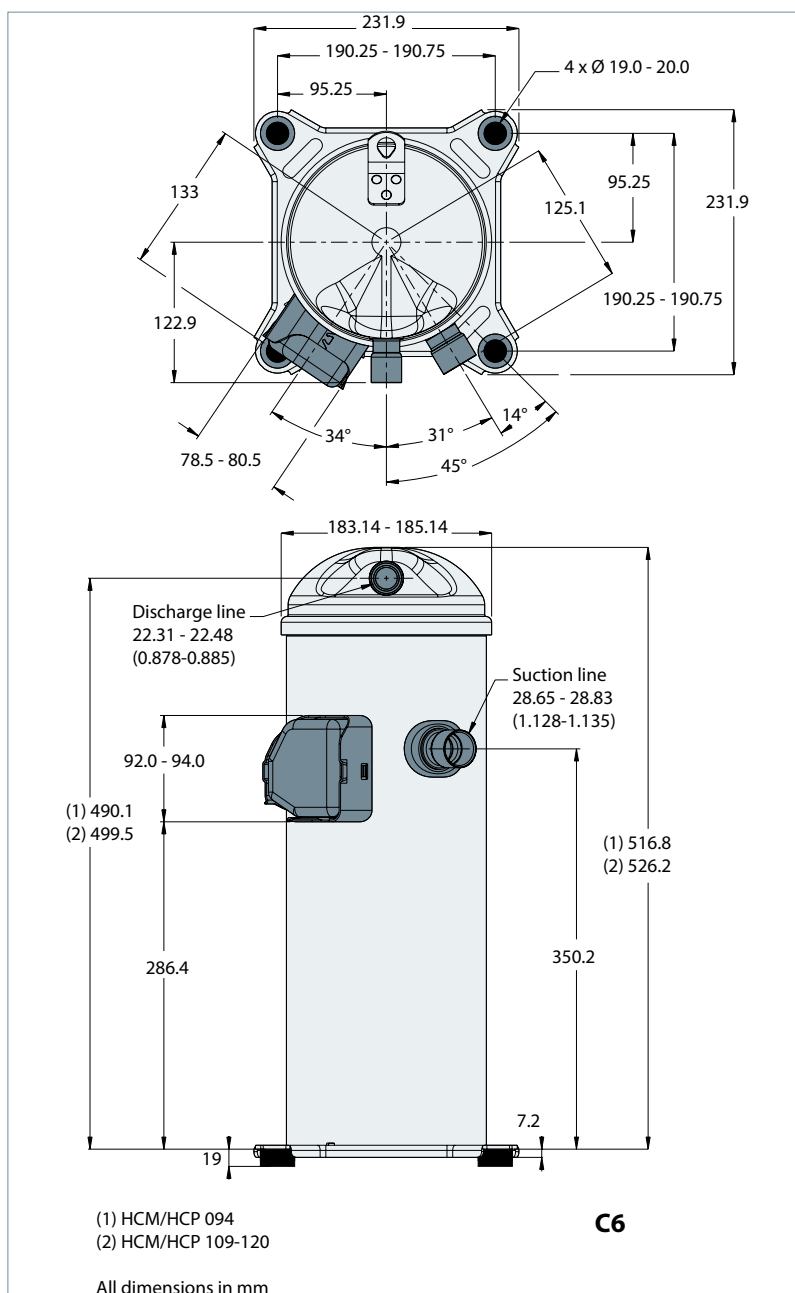
Terminal boxes



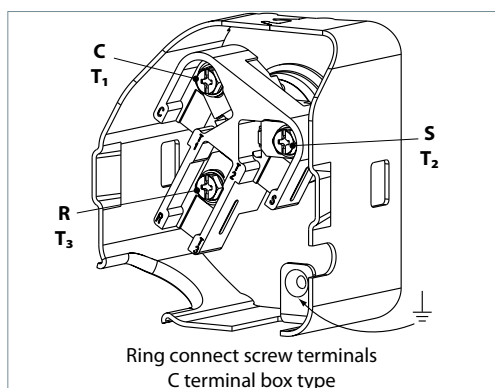
Mounting grommet



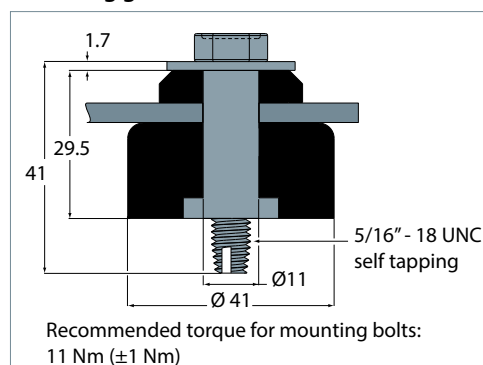
Refer to section 44 for overview of shipped mounting accessories



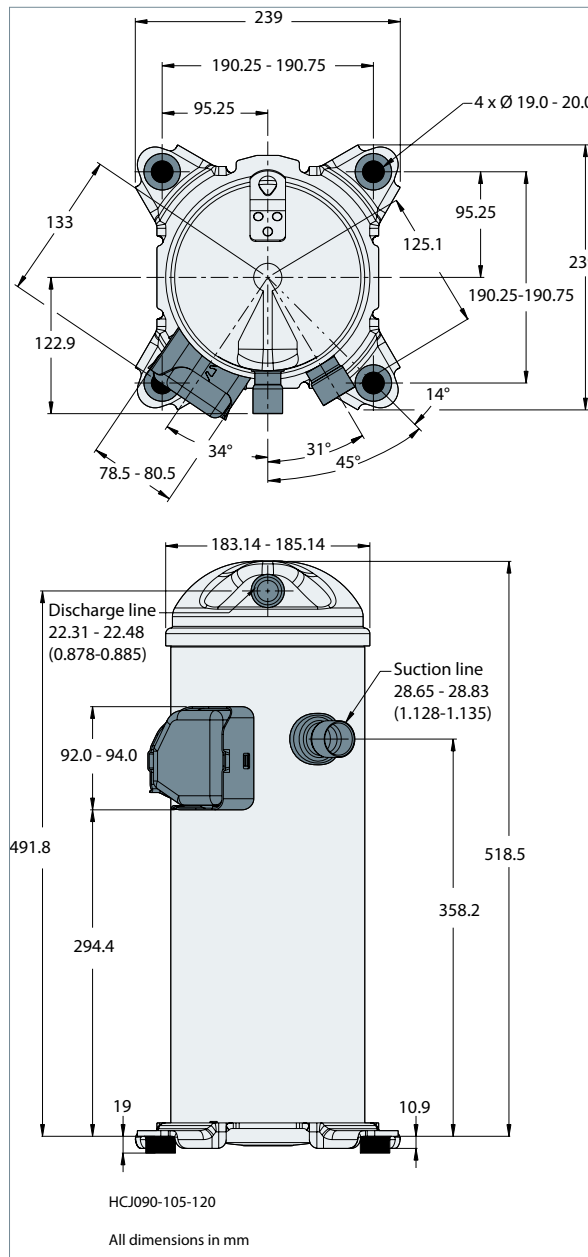
Terminal box



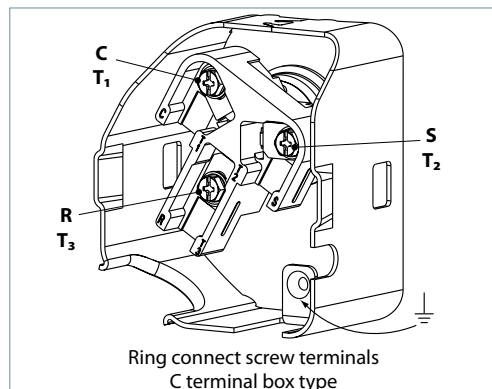
Mounting grommet



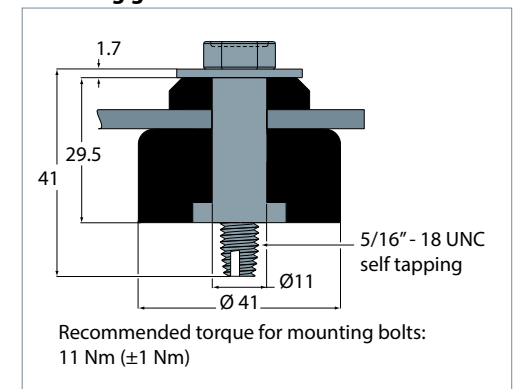
Refer to section 44 for overview of shipped mounting accessories



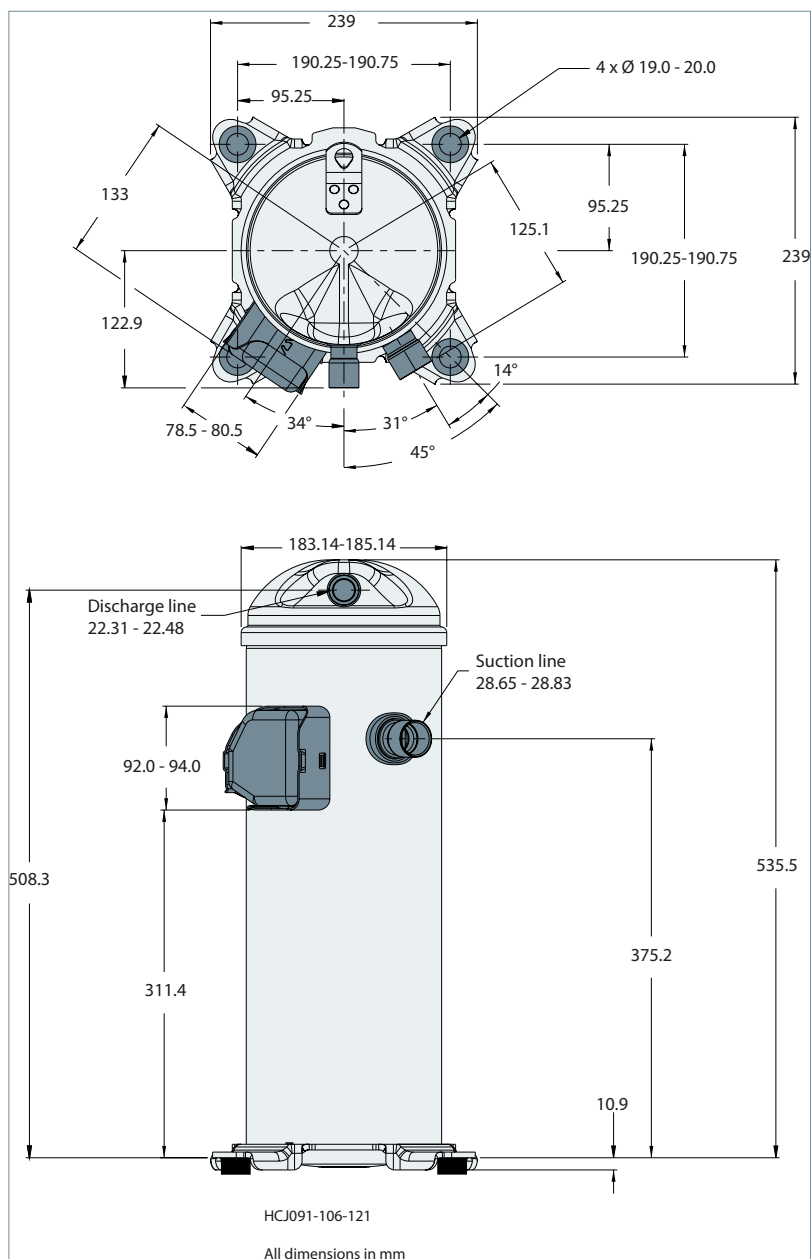
Terminal box



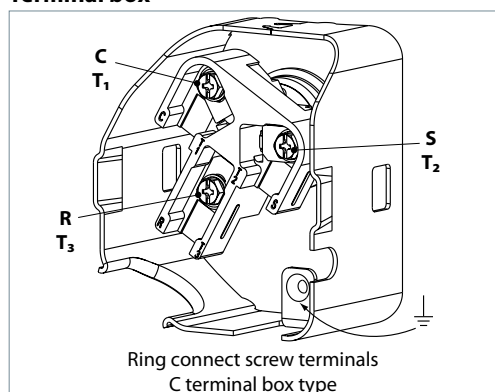
Mounting grommet



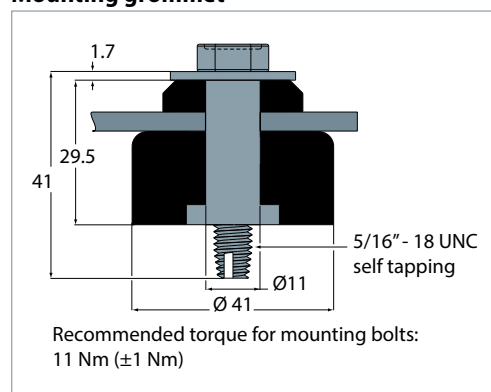
Refer to section 44 for overview of shipped mounting accessories



Terminal box



Mounting grommet



Refer to section 44 for overview of shipped mounting accessories



Diagram illustrating the Ring Connect Screw Terminals (C terminal box type) with terminals labeled C, T₁, T₂, S, R, and T₃.

Technical drawing of the mounting bracket showing dimensions and specifications:

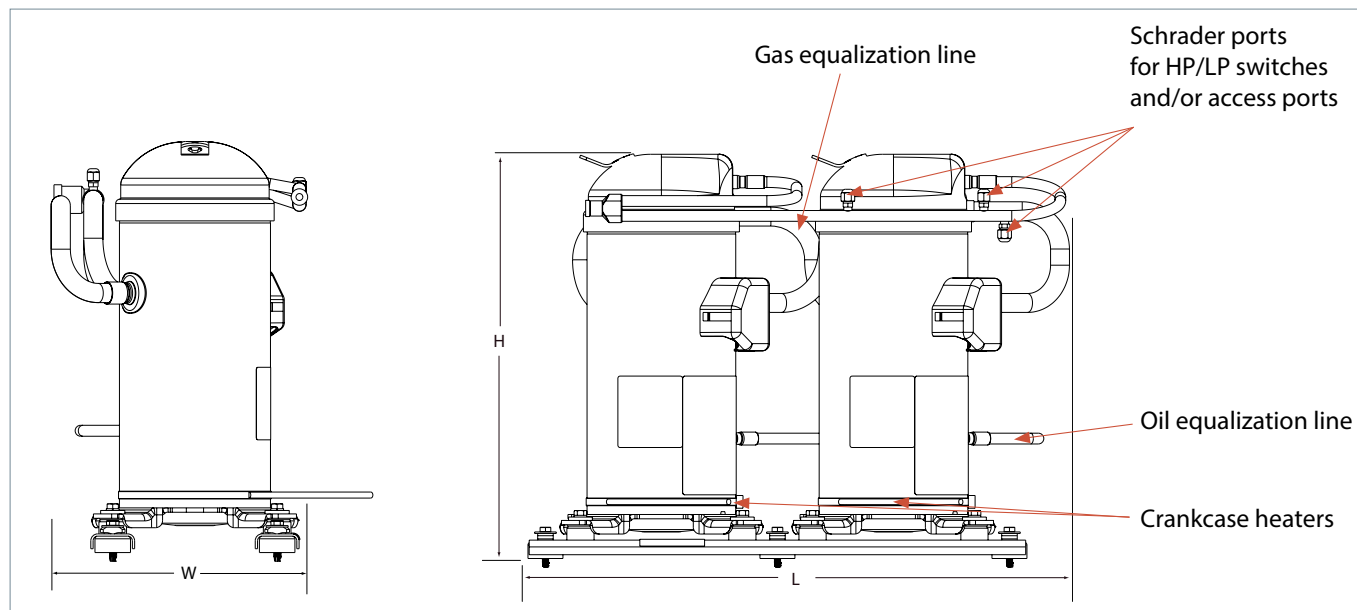
- Top flange thickness: 1.7
- Distance from top flange to center of mounting hole: 29.5
- Overall height: 41
- Mounting hole diameter: $\varnothing 11$
- Thread specification: 5/16" - 18 UNC self tapping
- Overall width: $\varnothing 41$

Recommended torque for mounting bolts:
11 Nm (± 1 Nm)

Refer to section 44 for overview of shipped mounting accessories

Version T compressors are built with a threaded oil equalization port to be used with our variable speed compressors range VZH.

Dimensions



By default, H series tandems are not factory-built, just provide tandem version compressors (feature 8).

Tandems to be achieved by assembly of individual compressors, if they are the feature 8 compressor.

Tandem model	Composition	L (mm)	H(mm)	Wmm)	Outline drawing number
TLJ082	HRH041 + HRH041	636	476	297	8556080
TLJ098	HRH049 + HRH049	636	476	297	8556080
TLJ122	HLH061 + HLH061	636	476	297	8556080
TLJ136	HLH068 + HLH068	636	476	297	8556080
TLJ144	HLJ072 + HLJ072	636	476	297	8556080
TLJ166	HLJ083 + HLJ083	636	476	297	8556080
TCJ180	HCJ090 + HCJ090	676	558	312	8556081
TCJ181	HCJ091 + HCJ091	676	575	312	8556153
TCJ210	HCJ105 + HCJ105	676	558	312	8556081
TCJ211	HCJ106 + HCJ106	676	575	312	8556153
TCJ240	HCJ120 + HCJ120	676	558	312	8556081
TCJ241	HCJ121 + HCJ121	676	575	312	8556153

Motor voltage

Danfoss scroll compressors H Series are available in four different motor voltages as listed below.

Motor voltage code	Code 1	Code 2	Code 4	Code 5	Code 7	Code 9
Nominal voltage 50 Hz	-	200-220 V - 3 ph	380-415V - 3 ph	220-240 V -1 ph	-	-
Voltage range 50 Hz	-	180 - 242 V	342 - 457 V	198 - 264 V	-	-
Nominal voltage 60 Hz	208-230 V - 1ph	208-230 V - 3 ph	460 V - 3 ph	-	575 V - 3 ph	380 V - 3 ph
Voltage range 60 Hz	187 - 253 V	187 - 253 V	414 - 506 V	-	517 - 632 V	342 - 418 V

The maximum allowable voltage imbalance is 2%. Voltage imbalance causes high amperage over one or several phases, which in turn leads

to overheating and possible motor damage. Voltage imbalance is given by the formula:

$$\% \text{ voltage unbalance} = \frac{|V_{avg} - V_{1-2}| + |V_{avg} - V_{1-3}| + |V_{avg} - V_{2-3}|}{2 \times V_{avg}} \times 100$$

V_{avg} = Mean voltage of phases 1, 2 and 3
 V_{1-2} = Voltage between phases 1 and 2

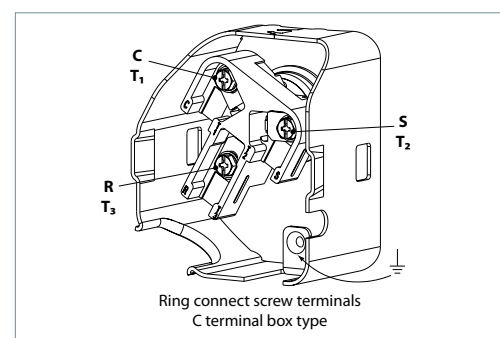
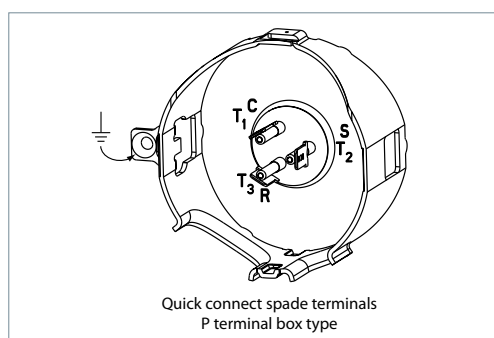
V_{1-3} = Voltage between phases 1 and 3
 V_{2-3} = Voltage between phases 2 and 3.

Wiring connections

Danfoss Scroll Compressors H-series will only compress gas while rotating counter-clockwise (when viewed from the compressor top). Since single-phase motors will start and run in only one direction, reverse rotation is not a major consideration. Three-phase motors, however, will start and run in either direction, depending on the phase angles of the supplied power. Care must be taken during installation to ensure that the compressor operates in the correct direction (see "Phase sequence and reverse rotation protection").

Electrical box cover must be fitted and cable gland or similar protection component must be used on electrical box's knockouts before energizing the compressor to against accidental contact with electrical parts inside.

The drawings below show electrical terminal labelling and should be used as a reference when wiring the compressor. For three phase applications, the terminals are labelled T1, T2, and T3. For single-phase applications the terminals are labelled C (common), S (start), and R (run).

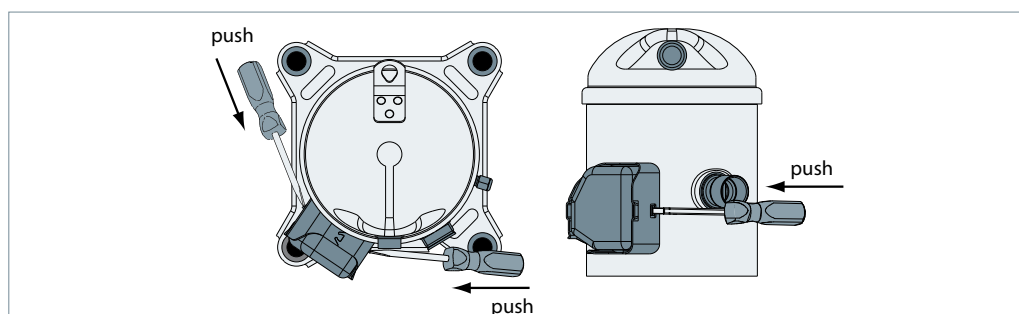


Terminal cover mounting

The terminal cover and gasket should be installed prior to operation of the compressor. The terminal cover has two outside tabs, 180 degrees apart, that engage the terminal fence.

When installing the cover, check that it is not pinching the lead wires. Both the inside of the terminal cover and the gasket have labels for the terminal pins: C (common), R (run), and S (start).

Terminal cover removal



Three phase electrical characteristics

Compressor model	LRA	MCC	Max. operating current	Winding resistance (Ohm)		
				L2-L3	L1-L3	L2-L1
Motor voltage code 2 200-220 V / 3 ph / 50 Hz 208-230 V / 3 ph / 60 Hz	HRM034U2	95	17.5	13.6	1.18	0.87
	HRM038U2	95	19	14.8	1.18	0.87
	HRM040U2	95	20	15.5	1.18	0.87
	HRM042U2	95	22	16.6	1.18	0.87
	HRM045U2	115	25	18.9	0.98	0.73
	HRM047U2	115	25	20.1	0.98	0.73
	HRM054U2	123	27	21.7	0.59	0.59
	HRM058U2	123	27	22.7	0.59	0.59
	HRM060U2	123	28	23.5	0.59	0.59
	HLM068T2	170	30	26.6	0.48	0.48
	HLM072T2	170	30	28.2	0.48	0.48
	HLM075T2	190	35	31.6	0.42	0.42
	HLM081T2	190	39	35.2	0.42	0.42
	HCM094T2	190	40	36.1	0.37	0.37
Motor voltage code 4 380-415 V / 3ph / 50 Hz 460 V / 3 ph / 60 Hz	HCM109T2	235	46	40.7	0.33	0.32
	HCM120T2	250	55	47.6	0.30	0.29
	HRM025T4	30	7	4.9	6.72	4.95
	HRM034T4	45	9.5	6.8	4.66	3.42
	HRM034U4	45	9.5	6.8	4.66	3.42
	HRM038T4	45	9.5	7.6	4.66	3.42
	HRM038U4	45	10	7.2	4.66	3.42
	HRM040U4	45	10	7.5	4.66	3.42
	HRM042T4	45	11	8.3	4.66	3.42
	HRM042U4	45	11	8.3	4.66	3.42
	HRM045U4	50	12	8.9	3.87	2.85
	HRM047T4	50	12	9.3	3.87	2.85
	HRM047U4	50	12	9.3	3.87	2.85
	HRM048U4	60	12.5	9.4	2.65	2.61
	HRM051T4	60	13	9.8	2.65	2.62
	HRM054T4	70	12.5	10.5	2.37	2.35
	HRM054U4	70	13.1	11.0	2.37	2.35
	HRM058U4	70	15	11.3	2.37	2.35
	HRM060T4	70	15	11.7	2.37	2.36
	HRM060U4	70	15	11.7	2.37	2.35
	HLM068T4	82	15	12.4	1.80	1.88
	HLM072T4	82	15	14.1	1.82	1.86
	HLM075T4	100	16	15.0	1.70	1.68
	HLM078T4	87	16	15.6	1.67	1.69
	HLM081T4	87	17	16.6	1.82	1.82
	HCM094T4	95	21	18.1	1.48	1.48
	HCM109T4	110	24	20.3	1.30	1.28
	HCM120T4	140	25	23.9	1.13	1.11
Motor voltage code 7 575 V / 3ph / 60 Hz	HRM038U7	38	8.5	6.2	7.34	5.38
	HRM042U7	38	9	6.6	7.34	5.38
	HRM045U7	40	9.5	7.1	6.09	4.47
	HRM047U7	40	10	7.4	6.09	4.47
	HRM054U7	53	11	8.4	4.12	4.06
	HRM058U7	53	11.5	8.8	4.12	4.06
	HRM060U7	53	11.5	9.1	4.04	3.97
	HLM072T7	63.6	11.5	11.3	2.98	2.83
	HLM075T7	72	13.5	11.8	2.51	2.48
Motor voltage code 9 380 V / 3ph / 60 Hz	HCM094T7	75	16	14.4	2.30	2.31
	HRM034T9	52	12	8.3	3.01	2.20
	HRM038T9	52	12	9.3	3.01	2.20
	HRM042T9	52	12.5	10.1	3.01	2.20
	HRM047T9	59.6	8.3	11.3	2.51	1.84
	HRM054T9	81	16.5	12.7	1.49	1.46
	HRM060T9	81	17	14.2	1.03	1.02
	HLM072T9	96	20	17.0	1.27	1.25
	HLM081T9	110	19	20.4	1.13	1.08
Motor voltage code 2 200-220 V / 3 ph / 50 Hz 208-230 V / 3 ph / 60 Hz	HCM094T9	135	25	21.9	0.93	0.91
	HCM120T9	135	27	23.9	0.87	0.88
	HRP025T2		14.5	9.6	1.67	1.23
	HRP038T2	95	19	14.8	1.18	0.87
	HRP040T2	95	20	15.5	1.18	0.87
	HRP047T2	115	25	20.1	0.98	0.73
	HRP051T2	120	26	20.1	0.68	0.67
	HRP058T2	123	27	22.7	0.59	0.59
	HRP060T2	123	28	23.5	0.59	0.59
	HLP068T2	170	32	27.3	0.48	0.48
	HLP072T2	170	33	28.2	0.48	0.48
	HLP075T2	190	35	31.6	0.41	0.40
	HLP078T2	190	37	33.4	0.43	0.43
	HLP081T2	190	39	35.2	0.43	0.43
	HCP094T2	190	40	36.1	0.37	0.37
	HCP109T2	235	46	40.7	0.33	0.32
	HCP120T2	250	55	47.6	0.30	0.29

Three phase electrical characteristics

Compressor model	LRA	MCC	Max. operating current	Winding resistance (Ohm)		
				L2-L3	L1-L3	L2-L1
Motor voltage code 4 380-415 V / 3ph / 50 Hz 460 V / 3 ph / 60 Hz	HRP025T4	30	7	4.9	6.72	4.95
	HRP034T4	45	9.5	6.8	4.66	3.42
	HRP038T4	45	11	7.9	4.66	3.42
	HRP040T4	45	12	8.6	4.66	3.42
	HRP042T4	45	11	8.3	4.66	3.42
	HRP045T4	50	12	8.9	3.87	2.85
	HRP047T4	50	12	9.3	3.87	2.85
	HRP048T4	60	12	9.0	2.65	2.61
	HRP051T4	60	13	9.8	2.65	2.62
	HRP054T4	70	12.5	10.5	2.37	2.37
	HRP058T4	70	14	11.3	2.36	2.33
	HRP060T4	70	14	11.7	2.37	2.36
	HLP068T4	82	15	12.4	1.80	1.88
	HLP072T4	87	15	14.1	1.91	1.93
	HLP075T4	100	17	15.0	1.62	1.60
	HLP078T4	87	16	15.6	1.67	1.69
	HLP081T4	87	17	16.6	1.90	1.88
	HCP094T4	95	21	18.1	1.48	1.48
	HCP109T4	110	24	20.3	1.30	1.28
	HCP120T4	140	25	23.9	1.13	1.11
Motor voltage code 2 200-220 V / 3 ph / 50 Hz 208-230 V / 3 ph / 60 Hz	HRH029U2	95	20	14.8	1.18	0.87
	HRH031U2	95	20	15.8	1.18	0.87
	HRH032U2	95	20	16.3	1.18	0.87
	HRH034U2	95	22	17.4	1.18	0.87
	HRH036U2	95	22	18.4	1.18	0.87
	HRH038U2	115	23	18.8	0.98	0.73
	HRH040U2	115	25	19.8	0.98	0.73
	HRH041U2	120	25	16.8	0.68	0.67
	HRH044U2	120	26	17.5	0.68	0.67
	HRH047U2	115	27	22.4	0.83	0.61
	HRH048U2	115	27	23.0	0.83	0.61
	HRH049U2	120	26	18.1	0.68	0.67
	HRH050U2	115	30	23.3	0.83	0.61
	HRH051U2	121.5	27.5	20.5	0.59	0.59
	HRH054U2	123	27.5	20.5	0.59	0.59
	HRH056U2	120	27.5	21.1	0.61	0.60
	HLH061T2	170	30	24.9	0.48	0.48
	HLH068T2	160	35.6	25.7	0.45	0.45
	HLJ072T2	180	35	30.0	0.42	0.42
	HLJ075T2	190	35	31.2	0.41	0.40
Motor voltage code 4 380-415 V / 3ph / 50 Hz 460 V / 3 ph / 60 Hz	HLJ083T2	190	39	34.0	0.36	0.36
	HCJ090T2	235	45	37.4	0.33	0.32
	HCJ105T2	235	45	42.1	0.33	0.32
	HCJ120T2	250	55	48.9	0.33	0.33
	HRH029U4	45	10	6.8	4.66	3.42
	HRH031U4	45	10	7.3	4.66	3.42
	HRH032U4	45	10	7.5	4.66	3.42
	HRH034U4	45	10	8.0	4.66	3.42
	HRH036U4	45	10	8.4	4.66	3.42
	HRH038U4	50	12	9.4	3.87	2.85
	HRH040U4	50	12	10.0	3.87	2.85
	HRH041U4	60	13	8.8	2.65	2.61
	HRH044U4	60	13.5	9.1	2.65	2.61
	HRH047U4	53	13	10.0	3.29	2.41
	HRH048U4	53	14	10.5	3.29	2.41
	HRH049U4	60	13.5	7.5	2.65	2.61
	HRH051U4	70	13	8.3	2.37	2.35
	HRH054U4	70	15	10.2	2.37	2.36
	HRH056U4	70	15	10.6	2.37	2.35
	HLH061T4	82	15	12.8	1.83	1.85
Motor voltage code 4 380-415 V / 3ph / 50 Hz 460 V / 3 ph / 60 Hz	HLH068T4	87	19	12.8	1.93	1.92
	HLJ072T4	87	19	13.4	1.93	1.92
	HLJ075T4	100	18	15.7	1.62	1.60
	HLJ083T4	100	19	15.7	1.48	1.44
	HCJ090T4	110	19	21.0	1.29	1.28
	HCJ091T4	125	25	19.0	0.98	0.97
	HCJ105T4	110	25	21.5	1.31	1.29
	HCJ106T4	125	26	21.5	0.98	0.97
Motor voltage code 4 380-415 V / 3ph / 50 Hz 460 V / 3 ph / 60 Hz	HCJ120T4	140	27	26.9	1.13	1.11
	HCJ121T4	125	27	24.0	0.98	0.97

GENERAL INFORMATION

PRODUCT INFORMATION

SYSTEM DESIGN

INTEGRATION INTO SYSTEM

ORDERING INFORMATION

Three phase electrical characteristics

Compressor model		LRA	MCC	Max. operating current	Winding resistance (Ohm)		
		A	A	A	L2-L3	L1-L3	L2-L1
Motor voltage code 7 575 V / 3ph / 60 Hz	HRH032U7	38	8.5	6.2	7.34	5.38	7.34
	HRH034U7	38	8.5	6.6	7.34	5.38	7.34
	HRH036U7	38	8.5	7.0	7.34	5.38	7.34
	HRH038U7	40	9.5	6.7	6.09	4.47	6.09
	HRH040U7	40	10	6.7	6.09	4.47	6.09
	HRH041U7	42	10	6.6	4.47	4.40	4.39
	HRH049U7	42	10.5	7.4	4.47	4.40	4.39
	HRH051U7	53	11.5	7.8	4.12	4.06	4.03
	HRH054U7	53	11.7	8.2	4.12	4.06	4.03
	HRH056U7	53	12.5	8.5	4.12	4.06	4.03
	HLH061T7	63.6	12	10.8	2.89	2.83	2.87
	HLH068T7	62	13.5	10.4	3.26	3.29	3.33
	HLJ072T7	62	15	11.0	3.26	3.29	3.33
	HLJ083T7	72	14.5	12.5	2.51	2.48	2.53
	HCJ090T7	95	17	16.3	0.98	0.97	1.01
	HCJ105T7	95	18.5	18.5	2.05	1.96	1.99
	HCJ120T7	100	20	21.4	1.75	1.66	1.73
Motor voltage code 9 380 V / 3ph / 60 Hz	HRH031U9	52	12.5	8.3	3.01	2.20	3.01
	HRH034U9	52	10	9.1	3.01	2.20	3.01
	HRH038U9	59.6	13.5	9.8	2.51	1.84	2.51
	HRH054U9	81	16	13.1	1.49	1.46	1.48
	HLH061T9	96	20	15.8	1.27	1.25	1.28
	HLH068T9	95	19	13.1	0.58	0.58	0.58
	HLJ072T9	95	19	17.5	0.58	0.58	0.58
	HLJ083T9	110	22.4	20.8	1.13	1.08	1.10
	HCJ090T9	135	29	18.8	0.87	0.88	0.89
	HCJ105T9	135	30	26.7	0.87	0.88	0.89
	HCJ120T9	135	33	30.2	0.87	0.88	0.89

Single phase electrical characteristics

Compressor model		LRA	MCC	Max. operating current	Winding resistance (Ohm)	
		A	A	A	Start	Run
Motor voltage code 5 200-220 V / 1 ph / 50 Hz	HRM032T5	97	23	17.9	1.51	0.69
	HRM034T5	97	25	19.5	1.51	0.69
	HRM038U5	97	25	21.2	1.51	0.69
	HRM042T5	97	27	24.2	1.51	0.69
	HRM042U5	97	26	24.2	1.51	0.69
	HRM047T5	102.5	31.2	29.0	1.61	0.66
	HRM047U5	102.5	31.2	29.0	1.61	0.66
	HRM060U5	130	45	33.9	1.02	0.39
Motor voltage code 1 208-230 V / 1 ph / 60 Hz	HRM025T1	69	19	13.8	1.74	0.85
	HRM032U1	96.7	26	20.1	1.57	0.67
	HRM034U1	96.7	26	21.4	1.57	0.67
	HRM038U1	105	30	24.7	1.44	0.54
	HRM040U1	115	32.9	25.5	1.43	0.54
	HRM042U1	115	32.9	26.8	1.45	0.54
	HRM045U1	115	35	28.5	0.82	0.32
	HRM047U1	120	38	29.8	1.32	0.52
	HRM048U1	150	41.5	32.5	0.86	0.33
	HRM051U1	150	40	31.9	0.86	0.33
	HRM054U1	150	39	33.9	0.86	0.33
	HRM058T1	160	45	36.0	1.72	0.27
	HRM058U1	145	45	36.4	0.84	0.29
	HRM060T1	160	45	37.2	1.76	0.28
	HRM060U1	145	45	37.7	0.84	0.29
	HLM068T1	145	45	38.2	0.84	0.29
	HLM072T1	145	45	40.5	0.84	0.29
	HLM081T1	145	45	41.2	0.84	0.29

Single phase electrical characteristics

Compressor model		LRA	MCC	Max. operating current	Winding resistance (Ohm)	
		A	A	A	Start	Run
Motor voltage code 5 200-220 V / 1 ph / 50 Hz	HRP032T5	97	23	18.3	1.51	0.69
	HRP034T5	97	25	19.5	1.51	0.69
	HRP038T5	97	25	21.2	1.51	0.69
	HRP040T5	97	25	22.3	1.51	0.69
	HRP042T5	97	27	24.2	1.51	0.69
	HRP045T5	102.5	30	27.9	1.61	0.66
	HRP047T5	102.5	31.2	29.0	1.61	0.66
	HRP054T5	130	40	30.8	1.02	0.39
	HRP058T5	130	42	32.8	1.02	0.39
	HRP060T5	130	40	33.9	1.02	0.39
	HLP068T5	130	40	38.4	1.02	0.39
	HLP072T5	130	40	38.9	1.02	0.39
Motor voltage code 1 208-230 V / 1 ph / 60 Hz	HRP025T1	69	19	13.8	1.74	0.85
	HRP034T1	96.7	24.5	21.4	1.57	0.67
	HRP042T1	115	32.9	26.8	1.47	0.55
	HRP051T1	150	40	31.9	0.86	0.33
	HRP060T1	160	45	37.2	1.76	0.28
	HLP068T1	145	45	38.2	0.84	0.29
	HLP072T1	145	45	40.5	0.84	0.29
	HLP081T1	145	45	41.2	0.84	0.29
Motor voltage code 5 200-220 V / 1 ph / 50 Hz	HRH029U5	97	24	17.9	1.51	0.69
	HRH031U5	97	25	19.2	1.51	0.69
	HRH032U5	97	25	19.8	1.51	0.69
	HRH034U5	97	25.5	21.0	1.51	0.69
	HRH036U5	97	25.5	22.3	1.51	0.69
	HRH038U5	102.5	28	23.8	1.61	0.66
	HRH040U5	102.5	33	26.6	1.61	0.66
	HRH051U5	130	38	31.7	1.02	0.39
	HRH054U5	130	40	38.2	1.02	0.39
	HRH056U5	130	40	38.9	1.02	0.39
	HLH061T5	130	42	44.1	1.02	0.39
	HLH068T5	130	45	41.7	1.02	0.39
	HLJ072T5	130	45	48.9	1.02	0.39
	HLJ083T5	130	50	55.7	1.02	0.39
Motor voltage code 1 208-230 V / 1 ph / 60 Hz	HRH029U1	96.7	27	19.5	1.45	0.72
	HRH031U1	96.7	26.5	20.8	1.57	0.67
	HRH032U1	87.5	26	17.9	1.66	0.67
	HRH034U1	115	31	20.9	1.40	0.53
	HRH036U1	105	34	23.3	1.22	0.54
	HRH038U1	115	33	23.6	1.21	0.54
	HRH039U1	115	31	22.8	1.19	0.53
	HRH040U1	115	32	27.7	1.31	0.53
	HRH041U1	150	36.9	28.2	0.86	0.33
	HRH044U1	150	38	29.9	0.86	0.33
	HRH047U1	135	43	35.3	1.06	0.43
	HRH048U1	135	42	35.6	1.06	0.43
	HRH049U1	150	45	32.4	0.84	0.32
	HRH050U1	135	43	39.3	1.06	0.43
	HRH051U1	150	41	33.6	0.84	0.32
	HRH054U1	145	45	34.1	0.84	0.29
	HRH056U1	145	47	35.9	0.84	0.29
	HLH061T1	145	42	41.8	0.84	0.29
	HLH068T1	145	42	46.1	0.84	0.29
	HLJ072T1	145	42	48.6	0.84	0.29
	HLJ083T1	145	42	57.6	0.84	0.29

GENERAL INFORMATION

PRODUCT INFORMATION

SYSTEM DESIGN

INTEGRATION INTO SYSTEM

ORDERING INFORMATION

Electrical data, connections and wiring

IP rating

The compressor terminal box IP rating according to IEC 529 is **IP22** for all models. IP ratings is only valid when correctly sized cable glands of the IP rating is applied.

- First numeral, level of protection against contact and foreign objects
2 protection against object size over 12.5 mm (fingers of similar)
- Second numeral, level of protection against water
2 protection against dripping water when tilted up to 15°

LRA (Locked Rotor Amp)

Locked Rotor Amp value is the higher average current as measured on mechanically blocked compressors tested under nominal voltage. The LRA value can be used as a rough estimation for

the starting current. However, in most cases, the real starting current will be lower. A soft starter can be applied to reduce starting current.

MCC (Maximum Continuous Current)

The MCC is the current at which the motor protection trips under maximum load and low voltage conditions. This MCC value is the maximum at which the compressor can be

operated in transient conditions and out of the application envelope. Above this value, the external electronic module will cut-out the compressor to protect the motor.

Max. Operating Current

The max. operating current is the current when the compressors operate at maximum load conditions and 10% below nominal voltage. Max Oper. A can be used to select cables and

contactors. In normal operation, the compressor current consumption is always less than the Max Oper. A. value.

Winding resistance

Winding resistance is the resistance between indicated terminal pins at 25°C (resistance value +/- 7%).

Winding resistance is generally low and it requires adapted tools for precise measurement. Use a digital ohm-meter, a '4 wires' method and measure under stabilised ambient temperature. Winding resistance varies strongly with winding temperature ; If the compressor is stabilised at a different value than 25°C, the measured resistance must be corrected with following formula:

$$R_{t_{amb}} = R_{25^{\circ}\text{C}} \frac{a + t_{amb}}{a + t_{25^{\circ}\text{C}}}$$

$t_{25^{\circ}\text{C}}$: reference temperature = 25°C

t_{amb} : temperature during measurement (°C)

$R_{25^{\circ}\text{C}}$: winding resistance at 25°C

R_{amb} : winding resistance at t_{amb}

coefficient $a = 234.5$

Motor protection

Danfoss Scroll Compressors H-Series are equipped with an internal line break protector mounted on the motor windings. The protector is an automatic reset device, containing a snap action bimetal switch.

Internal protectors respond to over-current and overheating. They are designed to interrupt

motor current under a variety of fault conditions, such as lose phase, running overload, and locked rotor.

If the internal overload protector trips out, it must cool down to about 60°C to reset. Depending on ambient temperature, this may take up to several hours.

Phase sequence and reverse rotation protection

The compressor will only operate properly in a single direction. Use a phase meter to establish the phase orders and connect line phases L1, L2 and L3 to terminals T1, T2 and T3, respectively. For three-phase compressors, the motor will run equally well in both directions. Reverse rotation results in excessive noise; no pressure differential between suction and discharge; and suction line warming rather than immediate cooling. A service technician should be present at initial start-up to verify that supply power is properly phased and that compressor and auxiliaries are rotating in the correct direction.

Danfoss HR* and HL* series scroll compressor are designed to operate for a maximum of 150 hours in reverse, but as a reverse rotation situation can go unnoticed for longer periods, phase monitors are recommended.

For HC* series compressors, phase monitors are required. The selected phase monitor should lock out the compressor from operation in reverse.

Electrical connections

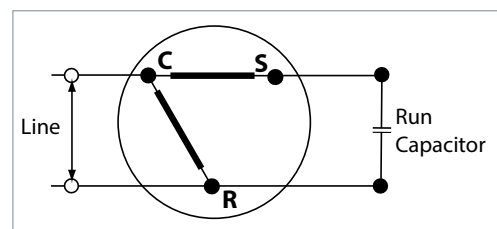
Danfoss scroll compressors are designed to operate without any assistance if running within

the defined nominal voltage. PSC wiring is sufficient (see below).

PSC wiring

The start winding (C-S) of the motor remains in circuit through a permanent (run) capacitor.

This permanent (run) capacitor is connected between the start winding (C-S) and the run winding (C-R).

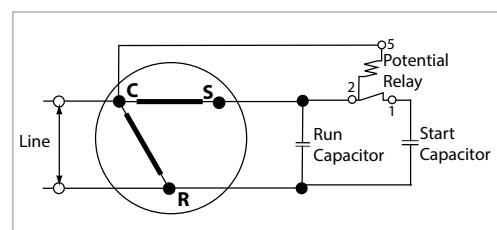


CSR wiring

If start assist is required, in case of operating below the nominal voltage, a CSR starting device is required.

During start-up, the start winding (C-S) is energised through an electromagnetic potential relay and a start capacitor.

A permanent (run) capacitor is wired between the start winding (C-S) and the run winding (C-R).



Nominal capacitor value and relays

Models		PSC wiring Run capacitor	CSR wiring Start capacitor	Relay	
50 Hz, motor voltage code 5	R22	HRM025-032-034-038-040-042	70 μ F	145-175 μ F	3ARR3*3AL* RVA 9CKL
		HRM045-047	60 μ F	145-175 μ F	3ARR3*3AL* RVA 9CKL
		HRM054	55 μ F	161-193 μ F	3ARR3*24AP* RVA 3EKL
		HRM058-060	55 μ F	88-108 μ F	3ARR3*25AS* RVA 4GKL
		HLM068-072-075-081	55 μ F	88-108 μ F	3ARR3*25AS* RVA 4GKL
	R407C	HRP025-034-038-040-042	70 μ F	145-175 μ F	3ARR3*3AL* RVA 9CKL
		HRP045-047	60 μ F	145-175 μ F	3ARR3*3AL* RVA 9CKL
		HRP054	55 μ F	161-193 μ F	3ARR3*24AP* RVA 3EKL
		HRP058-060	55 μ F	88-108 μ F	3ARR3*25AS* RVA 4GKL
		HLP068-072-075-081	55 μ F	88-108 μ F	3ARR3*25AS* RVA 4GKL
	R410A	HRH029-031-032-034-036	70 μ F	145-175 μ F	3ARR3*3AL* RVA 9CKL
		HRH038-040	60 μ F	145-175 μ F	3ARR3*3AL* RVA 9CKL
		HRH051-054-056	55 μ F	88-108 μ F	3ARR3*25AS* RVA 4GKL
		HLH061-068, HLJ072-083	55 μ F	88-108 μ F	3ARR3*25AS* RVA 4GKL
60 Hz, motor voltage code 1	R22	HRM025-032-034	45 μ F	145-175 μ F	3ARR3*3M* RVA 2ACKL
		HRM038	55 μ F	88-108 μ F	3ARR3*3L* RVA 2ABKL
		HRM040-042-045-047	60 μ F	88-108 μ F	3ARR3*3L* RVA 2ABKL
		HRM048	60 μ F	161-193 μ F	3ARR3*3L* RVA 2ABKL
		HRM051-054	70 μ F	161-193 μ F	3ARR3*3L* RVA 2ABKL
		HRM058T1-060T1	55 μ F	88-108 μ F	3ARR3*25S* RVA A4IKL
		HRM058U1-060U1, HLM068-072-075-081	80 μ F	189-227 μ F	3ARR3*3L* RVA 2ABKL
	R407C	HRP051	70 μ F	161-193 μ F	3ARR3*3L* RVA 2ABKL
		HLP068-072-075-081	80 μ F	189-227 μ F	3ARR3*3L* RVA 2ABKL
	R410A	HRH031	45 μ F	145-175 μ F	3ARR3*3M* RVA 2ACKL
		HRH032-034	50 μ F	88-108 μ F	3ARR3*3L* RVA 2ABKL
		HRH036	55 μ F	88-108 μ F	3ARR3*3AL* RVA 9CKL
		HRH038-039-040	60 μ F	88-108 μ F	3ARR3*3L* RVA 2ABKL
		HRH041-044-048-049-050-051	70 μ F	161-193 μ F	3ARR3*3L* RVA 2ABKL
		HRH054-056, HLH061-068, HLJ072-083	80 μ F	189-227 μ F	3ARR3*3L* RVA 2ABKL

Approvals and certificates

Danfoss scroll H-series compressors comply with the following approvals and certificates.

Certificates are listed on the product datasheets: <http://www.danfoss.com/odsg>

CE (European Directive)		All models
UL (Underwriters Laboratories)		All models
Other approvals / certificates		Contact Danfoss

Pressure equipment directive 2014/68/EU

Products	All models
Refrigerating fluids	Group 2
Category PED	I
Evaluation module	no scope

Low voltage directive 2014/35/EU

Products	All models
Declaration of conformity ref. Low voltage Directive 2014/35/EU	Contact Danfoss

Machines directive 2006/42/EC

Products	All models
Manufacturer's declaration of incorporation ref. Machines Directives 2006/42/EC	Contact Danfoss

Internal free volume

Products	Internal free volume at LP side without oil (litre)	Internal free volume at HP side without oil (litre)
HRM/P032-034-038-040-042 HRH029-031-032-034-036-038	2.93	0.49
HRM/P045-047 HRH040	3.20	0.70
HRM/P048-051-054-058-060, HLM/P068-072-075-081 HRH044-049-051-054-056, HLH/J061-068-072-075-083	3.44	0.71
HCM/P094-109-120 HCJ090-105-120	5.92	0.51
HCJ091-106-121	5.75	0.51

Refrigerant and lubricants

General information

When choosing a refrigerant, different aspects must be taken into consideration:

- Legislation (now and in the future)
- Safety
- Application envelope in relation to expected running conditions
- Compressor capacity and efficiency
- Compressor manufacturer recommendations & guidelines

Additional points could influence the final choice:

- Environmental considerations
- Standardisation of refrigerants and lubricants
- Refrigerant cost
- Refrigerant availability

PVE

Polyvinyl ether (PVE) is an innovative refrigeration lubricant for HFC refrigerant systems. PVE is as hygroscopic as existing polyolester lubricants (POE), but PVE doesn't chemically react with water; no acids are formed and compressor evacuation is easier.

The compressor technology applied in Danfoss H-series scroll compressors in combination with PVE lubricant provides the best possible result in terms of reliability and compressor lifetime. The PVE lubricant is compatible with R22 which makes the Danfoss H-series scroll compressors a very versatile multi- refrigerant solution.

Alkylbenzene oil

Alkylbenzene oil can be applied in systems using HCFC refrigerants (R22). Compared to a mineral oil it provides distinct advantages: excellent miscibility, excellent thermal stability, compatibility with mineral oils and constant quality.

Danfoss Scroll H_M series compressors are charged with Alkylbenzene oil and herewith offer an economically interesting alternative to the Danfoss H series in regions where R22 is still the predominant refrigerant. Note however that Danfoss H-series scroll compressors can not be used with HFC refrigerants.

Oil type

Danfoss scroll compressors are charged with oil at the factory with the oils indicated, in the following table.

Compressor range	Oil type
HRM / HLM / HCM	Alkylbenzene
HRP / HLP / HCP	PVE
HRH / HLH	PVE
HLJ/HCL	PVE

Effective week 31 of 2009, the HRP/HLP/ HCP & HRH/HLH series of compressors were changed from POE oil to PVE oil. Compressors produced prior to this week still had POE, and may be in stock in the warehouses until supply is exhausted. This change was made to standardize to the better oil for reliability. Replacement PVE 320HV is available for topping up or replacing oil in the field (see accessory section). As it is fully miscible with POE, Danfoss recommends the 320HV regardless of original oil charge in the compressor.

Residual moisture

Prior to shipment from the factory, every compressor is dehydrated, evacuated, and charged with dry nitrogen. Maximum residual

moisture levels are 0.0082 oz. for models capacities up to HRM/HRP047 and HRH040 and 0.0120 oz. for larger compressors.

Run-in process

Our H product ranges feature a compliance technology which allows

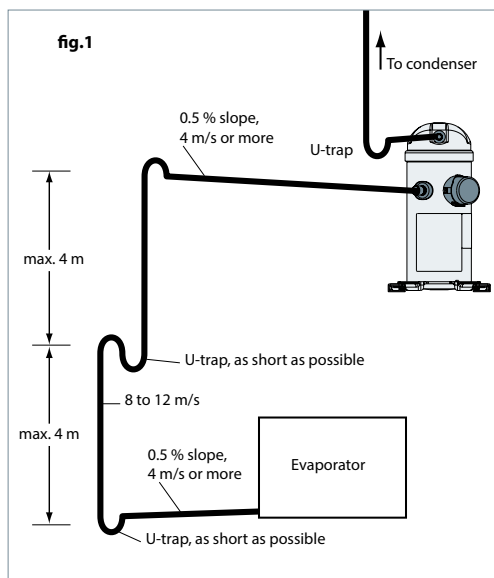
- an exceptional slugging capability (radial compliance)
- a very low starting torque (axial compliance)

When a compressor with compliance technology is new, the performance is not immediately at peak. A run-in period is needed to polish all surfaces as well as to reduce friction and leakage. The run-in period eliminates extra power input

General requirements

Proper piping practices should be employed to:

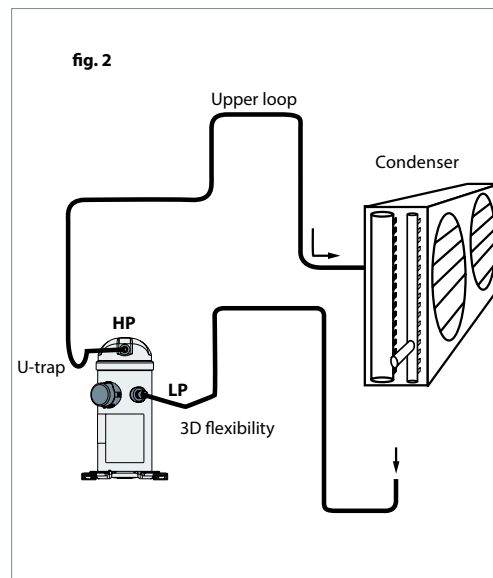
1. Ensure adequate oil return, even under minimum load conditions (refrigerant speed, piping slope). For validation tests see section "Manage oil in the circuit".



3. Piping should be designed with adequate three-dimensional flexibility to avoid excess vibration. It should not be in contact with the surrounding structure, unless a proper tubing

2. Avoid condensed liquid refrigerant from draining back to the compressor when stopped (discharge piping upper loop). For validation tests see section "Manage off cycle migration".

General recommendations are described in the figures below:

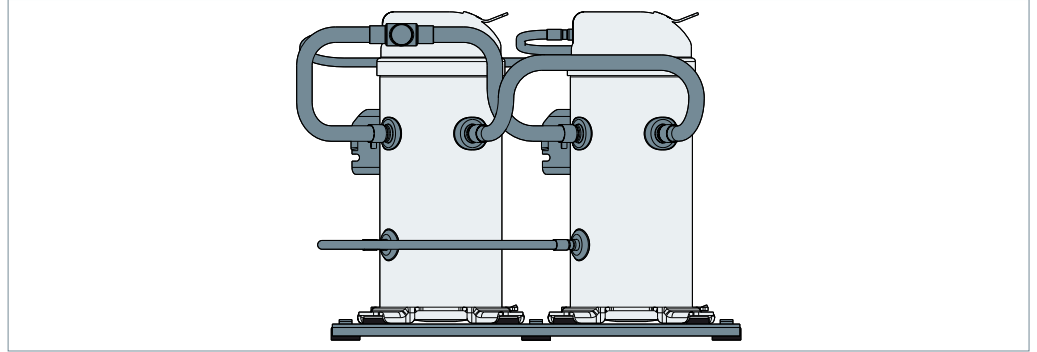


mount has been installed. For more information on noise and vibration, see section on: "Manage sound and vibration".

Tandem requirements

Danfoss scroll compressor H series tandem use static oil balancing principle to equalize oil level between the compressors by gravity. This is ensured by a precise suction and oil equalization piping designs.

The discharge line as no impact on oil balancing and is shown with tees, to indicate that both left and right side discharge header are possible



Danfoss scroll H series compressors in C8 version can be mounted in tandem assemblies.

Such manifolding applications require special design considerations that go beyond the scope of this document. Please contact Danfoss for further information.

By default, H series tandems are not factory-built, just provide tandem version compressors (feature 8).

For each tandem configuration, specific outline drawings are available as indicated in following tables.

R Suction and oil & gas equalization piping drawing must be respected (diameters, minimum straight lengths)

Tandem model	Comp.1	Comp.2	Connection Sizes		Oil equalization (in)	Gas equalization (in)	Kit tandem Code No	Outline drawing number
			Suction (in)	Discharge (in)				
TLJ082	HRH041	HRH041	1-1/8"	3/4"	1/2"	7/8"	120Z0636	8556080
TLJ098	HRH049	HRH049	1-1/8"	3/4"	1/2"	7/8"	120Z0636	8556080
TLJ122	HLH061	HLH061	1-1/8"	3/4"	1/2"	7/8"	120Z0636	8556080
TLJ136	HLH068	HLH068	1-1/8"	3/4"	1/2"	7/8"	120Z0636	8556080
TLJ144	HLJ072	HLJ072	1-1/8"	3/4"	1/2"	7/8"	120Z0636	8556080
TLJ166	HLJ083	HLJ083	1-1/8"	3/4"	1/2"	7/8"	120Z0636	8556080
TCJ180	HCJ090	HCJ090	1-5/8"	1-1/8"	1/2"	1-1/8"	120Z0636	8556081
TCJ181	HCJ091	HCJ091	1-5/8"	1-1/8"	1/2"	1-1/8"	120Z0636	8556153
TCJ210	HCJ105	HCJ105	1-5/8"	1-1/8"	1/2"	1-1/8"	120Z0636	8556081
TCJ211	HCJ106	HCJ106	1-5/8"	1-1/8"	1/2"	1-1/8"	120Z0636	8556153
TCJ240	HCJ120	HCJ120	1-5/8"	1-1/8"	1/2"	1-1/8"	120Z0636	8556081
TCJ241	HCJ121	HCJ121	1-5/8"	1-1/8"	1/2"	1-1/8"	120Z0636	8556153

R Depending on manifold configuration, it is essential to equalize the pressure of compressor sumps.

General requirements

Compressors used in single applications must be mounted with flexible grommets.

and the manifold assembly must be mounted with flexible grommets onto frame.

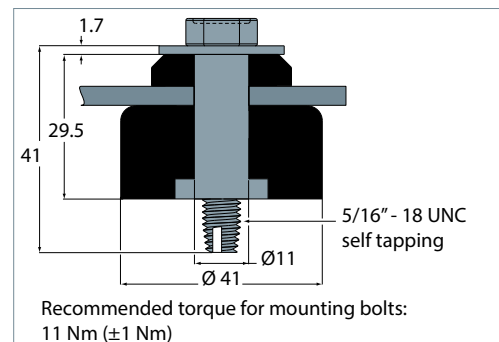
Compressors used in parallel application must be mounted with rigid mounting spacers onto rails

During operation, the maximum inclination from the vertical plane must not exceed 3 degrees.

Single requirements

H-series compressors come delivered with flexible grommets, accessory Mounting kit 120Z5064.

The grommets must be compressed until contact between the flat washer and the steel mounting sleeve is established. The required bolt size for the H-series compressors is M8*40mm. This bolt must be tightened to a torque of 11 Nm.

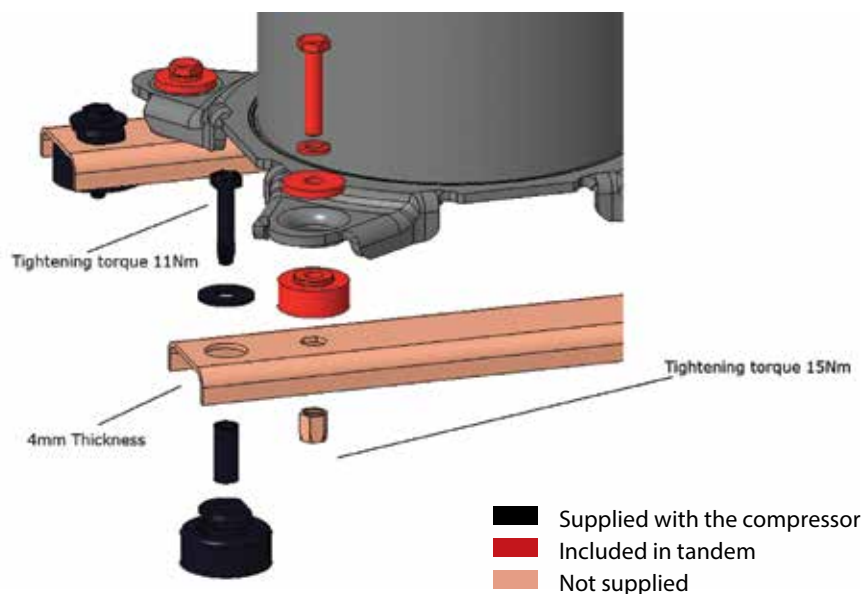


Tandem requirements

Parallel mounting feet

For parallel mounting, the compressor must be mounted with rigid mounting spacers (included in the tandem kit 120Z0636) on the rails.

Rubber grommets and sleeves (delivered with the compressor) must be installed below the rails.



Compressor sound radiation

Typical sounds and vibrations in systems can be broken down into the following three categories:

- Sound radiation (through air)
- Mechanical vibrations (through parts and structure)
- Gas pulsation (through refrigerant)

The following sections focus on the causes and methods of mitigation for each of the above sources.

For sound radiating from the compressors, the emission path is air and the sound waves are travelling directly from the machine in all directions.

Sound levels are as follows:

- For compressors running alone:

Compressor model	50 Hz		60 Hz		Acoustic hood code number
	Sound power dB(A)	Attenuation dBA ①	Sound power dB(A)	Attenuation dBA ①	
HRM025-038	66	5	69	5	120Z5083
HRM040-047	67	5	70	5	120Z5083
HRM048-054	68	5	71	5	120Z5084
HRM058-060	69	5	72	5	120Z5084
HLM068-081	70	5	73	5	120Z5084
HCM094	71	5	74	5	120Z5085
HCM109-120	74	5	78	5	120Z5085
HRH029-032	65	5	68	5	120Z5083
HRH034-040	66	5	69	5	120Z5083
HRH041-054	67	5	70	5	120Z5084
HLH061	70	5	73	5	120Z5084
HLH068-HLJ083	71	5	74	5	120Z5084
HCM094	71	5	74	5	120Z5085
HCJ090-105-120	72	5	75	5	120Z5085
HCJ091-106-121	73	5	76	5	120Z5085

① Attenuation given with acoustic hood only

Acoustic hood could be applied for both single and tandem version compressors.

Materials are UL approved and RoHS compliant

Sound power and attenuation are given at ARI conditions, measured in free space

H*P series same as H*M series. Maximum sound is +5dBA

Note: During compressor shut down, a short reverse rotation sound is generated. The duration of this sound depends on the pressure difference at shut down and should be less than 3 seconds. This phenomenon has no impact on compressor reliability.

Mitigations methods:

We can consider two means to reduce compressors sound radiations:

1. Acoustic hoods are quick and easy to install and do not increase the overall size of the compressors to a great extent. Acoustic hoods are available from Danfoss as accessories. Refer to the table above for sound levels, attenuation and code numbers.
2. Use of sound-insulation materials on the inside of unit panels is also an effective means to reduce radiation.

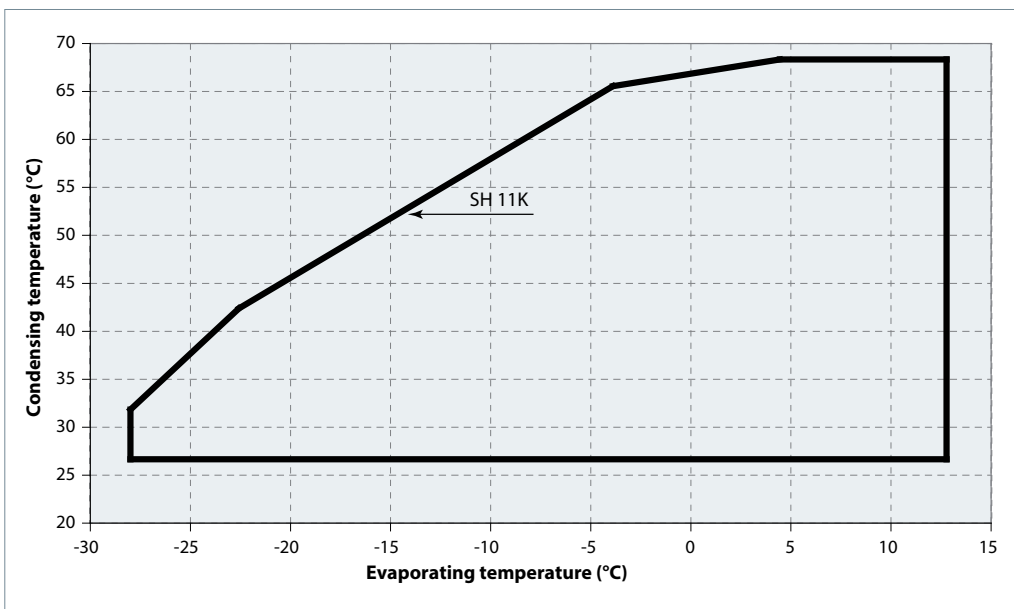
GENERAL INFORMATION	Mechanical vibrations	
	<p>Vibration isolation constitutes the primary method for controlling structural vibration. H-series scroll compressors are designed to produce minimal vibration during operations. The use of rubber isolators on the compressor base plate or on the frame of a manifolded unit is very effective in reducing vibration being transmitted from the compressor(s) to the unit. Rubber grommets are supplied with all H-series scroll compressors.</p> <p>Once the supplied rubber grommets have been properly mounted, vibration transmitted from the compressor base plate to the unit</p>	<p>are held to a strict minimum. In addition, it is extremely important that the frame supporting the mounted compressor be of sufficient mass and stiffness to help dampen any residual vibration potentially transmitted to the frame. The tubing should be designed so as to both reduce the transmission of vibrations to other structures and withstand vibration without incurring any damage. Tubing should also be designed for three-dimensional flexibility. For more information on piping design, please see the section entitled "Essential piping design considerations".</p>
PRODUCT INFORMATION	Gas pulsation	
SYSTEM DESIGN	<p>The Danfoss Scroll Compressors H-series has been designed and tested to ensure that gas pulsation has been optimised for the most commonly encountered air conditioning pressure ratio. Manifolded compressors are equivalents to lagged sources of gas pulsation. Therefore pulse level can vary during time.</p>	<p>Mitigations methods: If an unacceptable level is identified, a discharge muffler with the appropriate resonant volume and mass can be installed.</p>
INTEGRATION INTO SYSTEM		
ORDERING INFORMATION		

Requirement

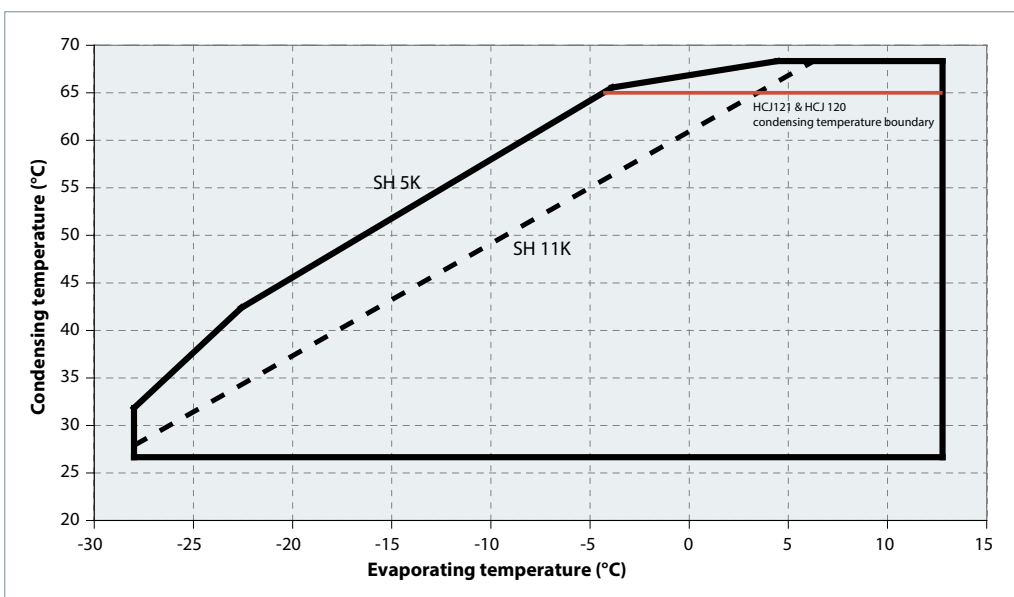
R The operating envelope for H-series scroll compressors is given in the figures below and guarantees reliable operations of the compressor for steady-state and transient operation.

Steady-state operation envelope is valid for a suction superheat within 5K to 30K range.

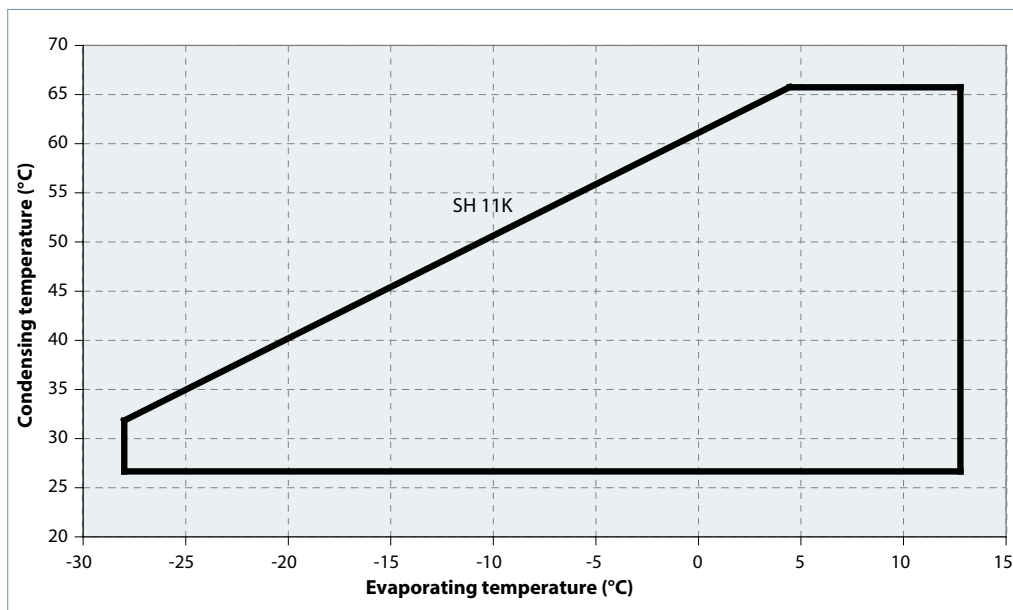
R22, R407C Model variation T



R410A Model variation T



R22, R410A Model variation U



		R22	R407C	R410A
Working pressure range high side	bar (g)	10.9 - 27.7	10.5 - 29.1	15.8 - 44.5
Working pressure range low side	bar (g)	1.4 - 6.9	1.1 - 6.4	1.9 - 10.8
Maximum high pressure safety switch setting*	bar (g)	29	30	45
Minimum low pressure safety switch setting	bar (g)	0.5	0.5	1.5
Recommended pump-down switch settings	bar (g)	1.5 bar below nominal evap. pressure with minimum limitation as below		
Minimum low pressure pump-down switch setting	bar (g)	1.5	1.3	2.3

* Maximum allowable pressure on high pressure side according to PED regulation.

⚠ LP and HP safety switches must never be bypassed nor delayed and must stop all the compressors.

When caused low by LP safety switch, limit the number of auto-restart to maximum 5 times within 12 hours.

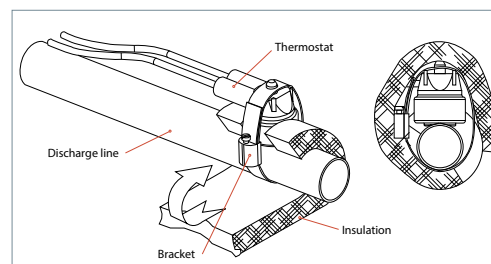
⚠ HP safety switch must be manual reset

Depending on application operating envelope, you must define HP and LP limits within operating envelope and pressure setting table above.

For H-series compressors, the external Discharge Gas Temperature protection (DGT) is required if the high and low pressure switch settings do not protect the compressor against operations beyond its specific application envelope.

The discharge gas thermostat accessory kit (code 7750009) includes all components required for installation as shown on the right. DGT installation must respect below requirements:

- The thermostat must be attached to the discharge line within 150 mm from the compressor discharge port and must be thermally insulated and tightly fixed on the pipe.
- The DGT should be set to open at a discharge gas temperature of 135°C.



Evaluate the risk

We consider two types of operating envelope management:

<p>Basic:</p> <ul style="list-style-type: none"> • HP and LP switch • MOP (Max Operating Pressure) ensured by expansion device • Condensing pressure control • DGT 	<p>Advanced:</p> <ul style="list-style-type: none"> • HP and LP sensor • Operating envelope limits (permanent and transient) integrated into control logic • DGT
<p>See "Test, criteria and solutions"</p>	<p>No additional test are required</p>

Test, criteria and solutions

Test N°	Purpose	Test condition	Pass criteria	Solutions
1	Check the compressor operation in the "continuous running area".	Start test at minimum foreseeable evaporating temperature (minimum ambient temperature)	Confirmed compressor stable working in the continuous running area.	Work on compressor staging, fan staging, water flow etc.
2		Perform a defrost test if reversible unit		Improve MOP function. Work on compressor staging, fan staging, water flow etc.
3		Perform a start-up test at maximum foreseeable evaporating temperature (max ambient temperature, or start up with hot water)		

During normal operation, refrigerant enters the compressor as a superheated vapor. Liquid flood back occurs when a part of the refrigerant entering the compressor is still in liquid state.

Liquid flood back can cause oil dilution and, in extreme situations lead to liquid slugging that can damage compression parts.

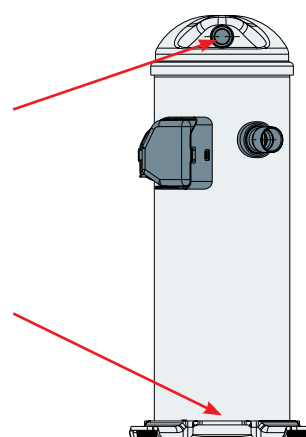
Requirement

In steady state conditions,
• Suction superheat must remain within 5K to 30K
• According to the floodback chart

In transient conditions,
• According to the floodback chart

Discharge temperature sensor must be placed onto the discharge fitting and be insulated.

Oil temperature sensor must be placed on the mid shell, closed to the lower shell, and be insulated.



Evaluate the risk

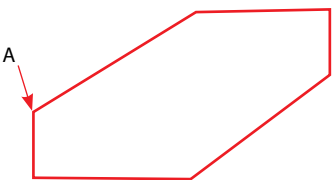
Use the tables below in relation with the system charge and the application to quickly evaluate the risk and potential tests to perform.

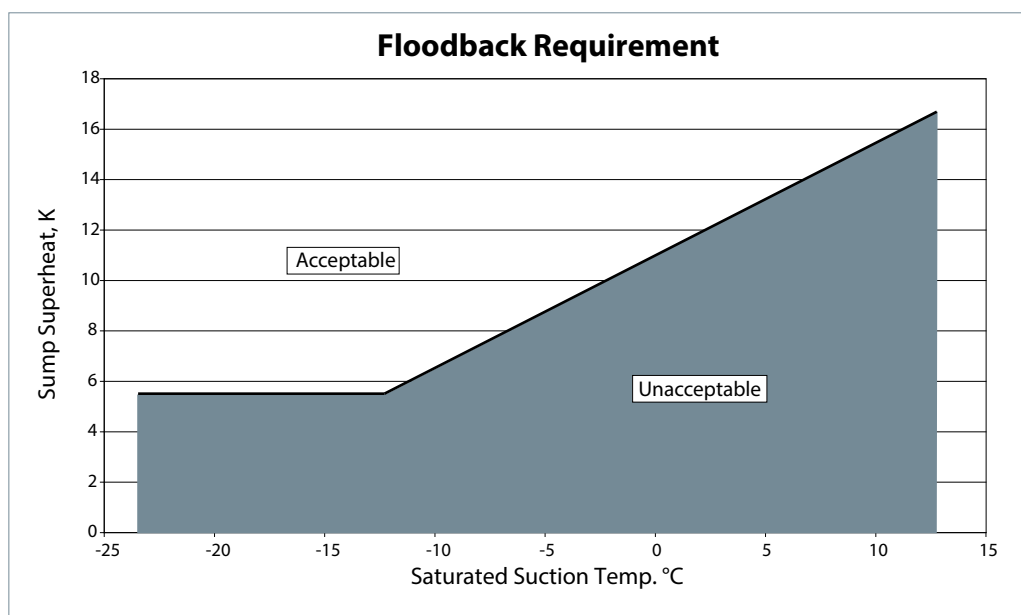
	BELOW CHARGE LIMIT	ABOVE CHARGE LIMIT
Non reversible	No test or additional safeties required	Liquid flood back test
Reversible	Defrost test	Liquid flood back test Defrost test

Charge limit is defined in table below:

	Models	Refrigerant charge limit (kg)
Single	HRM032-034-038-040-042-045-047 HRP034-038-040-042-045-047 HRH029-031-032-034-036-038-039-040-047-048	3.6
	HRM048-051-054-058-060/HLM068-072-075-078-081 HRP048-051-054-058-060/HLP068-072-075-078-081 HRH041-044-049-051-054-056/ HLH061-068-HLJ072-075-083	5.4
	HCM094-109-120 HCP094-109-120 HCJ090 - 091-105-106-120 -121	7.2
Tandem	TLJ082-098-122-136-144-166	6
	TCJ180-181-210-211-240-241	8

Test, criteria and solutions

Test N°	Purpose	Test condition	Pass criteria	Solutions
Liquid flood back test	Steady-state	<p>Liquid flood back testing must be carried out under expansion valve threshold operating conditions: a high pressure ratio and minimum evaporator load (A).</p> 	Refer to flood back chart criteria	<ol style="list-style-type: none"> 1. Check expansion valve selection and setting. 2. Add a suction accumulator*.
	Transient	<p>Tests must be carried out with most unfavorable conditions :</p> <ul style="list-style-type: none"> • fan staging, • compressor staging • ... 	Refer to flood back chart criteria	<ol style="list-style-type: none"> 1. Check expansion valve selection and setting. -For Thermostatic expansion valve (TXV) check bulb position... -For Electronic expansion valve (EXV) check measurement chain and PID.... 2. Add a suction accumulator*.
Defrost test	Check liquid floodback during defrost cycle	Defrost test must be carried out in the most unfavorable condition (at 0°C evaporating temperature).	Refer to flood back chart criteria	In reversible systems, the defrost logic can be worked out to limit liquid floodback effect. (for more details see "Control Logic").



*Suction accumulator offers protection by trapping the liquid refrigerant upstream from the compressor. The accumulator should be sized at least 50 % of the total system charge. Suction accumulator dimensions can impact oil return (gas velocity, oil return hole size...), therefore oil return has to be checked according to section "Manage oil in the circuit".

- R** Off -cycle refrigerant migration happens:
- when the compressor is located at the coldest part of the installation, refrigerant vapor condenses in the compressor.
 - or directly in liquid-phase by gravity or pressure difference.

When the compressor restarts, the refrigerant diluted in the oil, or stored in evaporator, generates poor lubrication conditions and may reduce bearings life time. In extreme situations, this leads to liquid slugging that can damage compression scrollset.

Requirement

- Compressor can tolerate occasional flooded start, but it should remain exceptional situation and unit design must prevent that this situation happen at each start
- Right after start, liquid refrigerant must not flow massively to compressor
- The charge limit is a threshold beyond some protective measures must be taken to limit risk of liquid slugging and extreme dilution at start. (refer to charge limit table in section "Manage superheat").

Evaluate the risk

Use the table below in relation with the system charge (refer to charge limit table in section "Manage superheat") and the application to

quickly define necessary safeties to implement and test to perform:

	BELOW CHARGE LIMIT	ABOVE CHARGE LIMIT
Non split	No test or additional safeties required	<ul style="list-style-type: none"> • Crankcase Heater* • Migration test • External Non Return Valve
Split	Since each installation is unique, no test can fully evaluate off-cycle migration, therefore the following safeties are required: <ul style="list-style-type: none"> • Crankcase Heater * • Liquid Line Solenoid Valve**+ pump-down cycle*** • (Internal Non-Return Valve integrated) 	

Test, criteria and solutions

Test N°	Purpose	Test condition	Pass criteria	Solutions
Migration test	Check that there is no migration of refrigerant into the compressor (either liquid or vapour condensating)	Energize CCH*. Stabilize the non-running system at a pressure equivalent to 5°C. Raise the system pressure equivalent to 20°C. When saturated condensing temperature reaches 20°C then start the unit.	When all compressors are idle: • Check in liquid line sight glass that there is no liquid refrigerant transfer • Refer to flood back chart criteria After compressors has started: • Oil superheat must remain the criteria refer to flood back chart.	1. Check bulb position, tightness of expansion device, 2. add LLSV** 3. add pump down cycle*** 4. Check Crank Case Heater efficiency

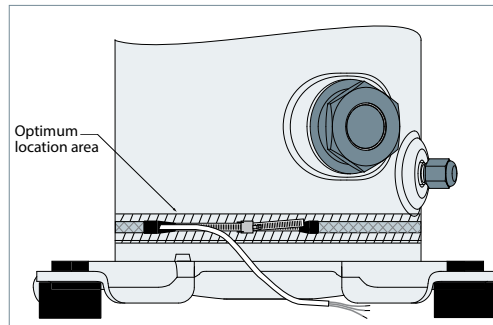
Oil temperature sensor must be placed between oil sight glass and compressor baseplate and be insulated.

* Crank case heater (CCH)

The Crank case heaters are designed to protect the compressor against off-cycle migration of refrigerant.

Additional heater power or thermal insulation might be needed in case of ambient temperature below -5°C and a wind speed above 5m/second. The heater must be energized whenever all the compressors are off.

Crank case heater accessories are available from Danfoss (see section "Accessories").



⚠ Provide separate electrical supply for the heaters so that they remain energized even when the machine is out of service (e.g. seasonal shutdown).

It's recommended that the heater be turned on for a minimum of 8 hours prior to starting the compressor.

**Liquid line solenoid valve (LLSV)

A LLSV is used to isolate the liquid charge on the condenser side, thereby preventing against charge transfer to the compressor during off -cycles. The quantity of refrigerant on the low-pressure side of the system can be further reduced by using a pump-down cycle in association with the LLSV.

***Pump-down cycle

By decreasing pressure in the sump, pump down:
• evacuates refrigerant from oil
• set the sump saturating pressure much lower than ambience temperature and due to that, avoid refrigerant condensation in the compressor.

For more details on pump-down cycle see section "Control Logic".

On/off cycling (cycle rate limit)

Danfoss recommends a restart delay timer to limit compressor cycling. The timer prevents reverse compressor rotation, which may occur during brief power interruptions.

The system must be designed in a way that guarantees a minimum compressor running time of 2 minutes so as to provide for sufficient

motor cooling after start-up along with proper oil return. Note that the oil return may vary since it depends upon system design.

There must be no more than 12 starts per hour, a number higher than 12 reduces the service life of the motor-compressor unit. A three-minute (180-sec) time out is recommended.

Wiring information

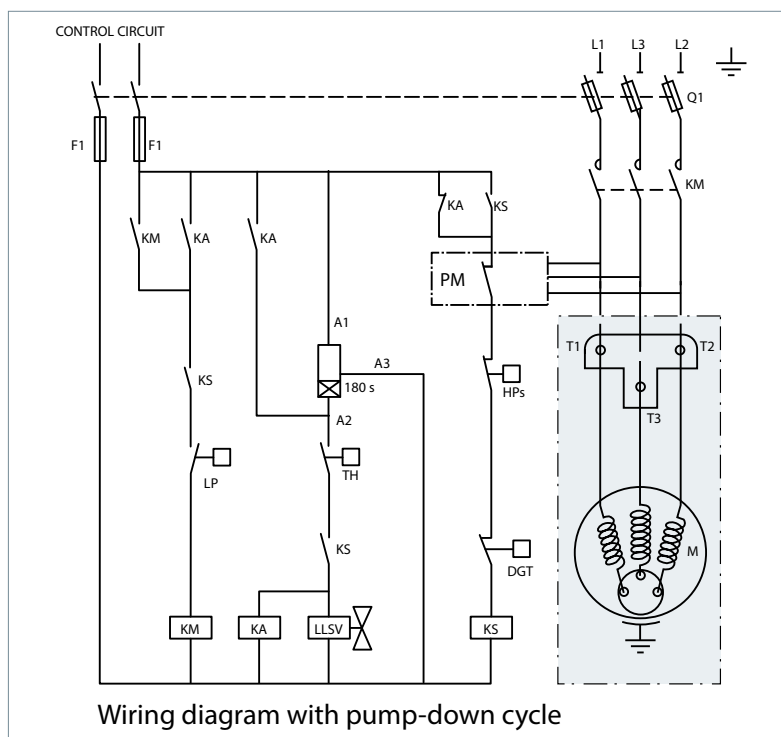
Requirements:

- An additional external overload protection is still advisable for either alarm or manual reset. For overload setting, take the max current you can face on the application and add 10%. Setting must always be lower than Max Operating Current (see table "Three phase electrical characteristics" from the section "Electrical data, connections and wiring")

- HP safety switch and DGT must be wired in the safety chain. Other safety devices such as LP can be either hardware or software managed.
- Provide separate electrical supply for the heaters so that they remain energized even when the machine is out of service (e.g. seasonal shutdown).

The wiring diagrams below are examples for a safe and reliable compressor wiring:

Control device..... TH
Optional short cycle timer (3 min) 180 s
Control relay KA
Liquid Line Solenoid valve..... LLSV
Compressor contactor..... KM
Phase monitor PM
Safety lock out relay..... KS
Pump-down control low pressure switch ..LP
High pressure safety switch..... HPs
Fused disconnect Q1
Fuses F1
Compressor motor M
Discharge gas thermostat..... DGT



Note:

For H-series compressor, phase monitors are mandatory. The selected phase monitor should lock out the compressor from operation in reverse.

Control logic

Safety control logic requirements

	Tripping conditions		Re-start conditions	
	Value	Time	Value	Time
HP switch	See Pressure settings table from section "Manage operating envelope"	Immediate, no delay. No by-pass	Conditions back to normal. Switch closed again	Manual reset
LP safety switch				Maximum 5 auto reset during a period of 12 hours, then manual reset.
Electronic module (Motor protection, DGT)	Contact M1-M2 opened			

Cycle rate limit requirements

Danfoss requires a minimum compressor running time of 2 minutes to ensure proper oil return and sufficient motor cooling. Additionally, compressor service life is based on a maximum of 12 starts per hour.

Therefore, to guarantee these 2 requirements, a three-minute (180- sec) time out is recommended.

Oil management logic recommendations

In some cases, oil management can be enhanced by control logic:

If oil return test failed, a function can be integrated in control to run all compressors simultaneously during one minute every hour in order to boost oil return. Time and delay can be fine-tuned by oil return test N°1. Manage oil in the circuit. During oil boost, pay special attention to superheat management to avoid liquid flood back and foaming.

If after running long time in full load, oil unbalance appears, then a function can be in control to stop all compressors in manifold during one minute every two hours in order to balance oil between compressors. Time and delay can be fine-tuned by Oil balancing test N°2. Manage oil in the circuit.

GENERAL INFORMATION

PRODUCT INFORMATION

SYSTEM DESIGN

INTEGRATION INTO SYSTEM

ORDERING INFORMATION

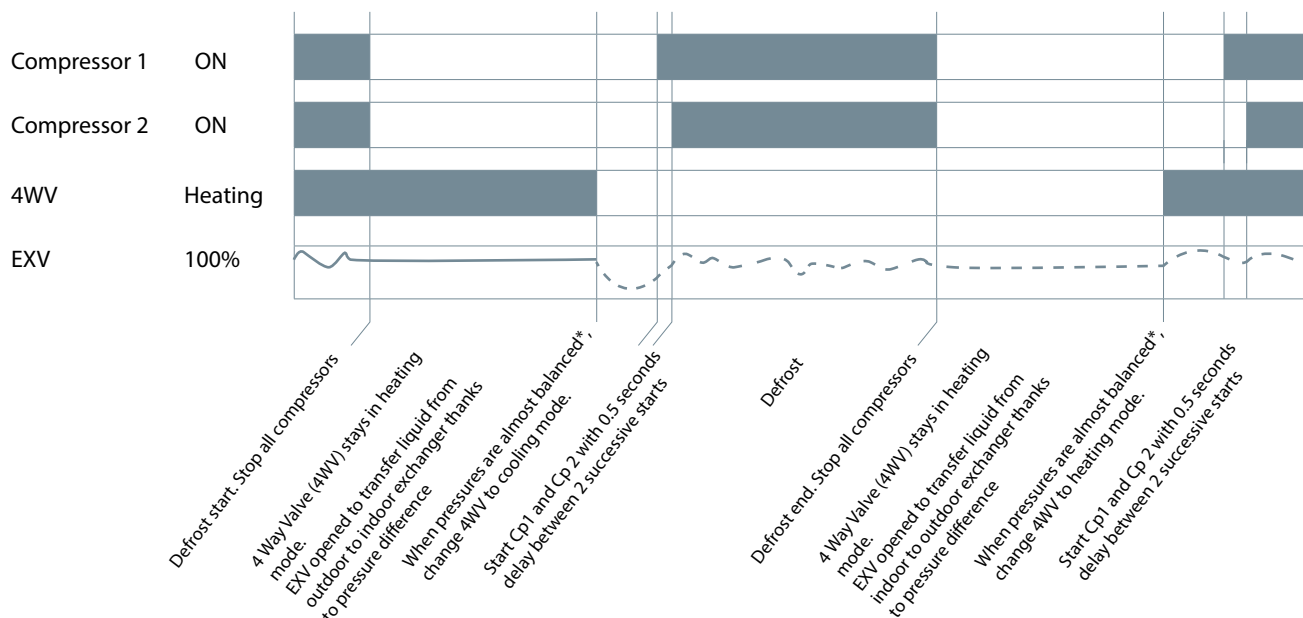
Defrost logic recommendations

In reversible systems, the defrost logic can be worked out to limit liquid flood back effect by:

1. Running full load during defrost to share liquid refrigerant between all compressors.

2. Transferring liquid refrigerant from one exchanger to the other one thanks to pressures.

The following defrost logic combines both advantages:



* EXV Opening degree and time have to be set to keep a minimum pressure for 4 way valve moving. In any case, defrost logics must respect requirements and tests described in sections "Manage superheat" and "Manage operating envelope".

Pump-down logic recommendations

Pump down is initiated prior to shutting down the last compressor on the circuit by de-energizing a liquid line solenoid valve or closing electronic expansion valve. When suction pressure reached the cut-out pressure, compressor is stopped, and liquid solenoid valve or electronic expansion valve remains closed.

Two types of pump-down exist:

- One shot pump down (preferred): when last compressor of the circuit stops, suction pressure is decreased 1.5 bar (R22, R407C), 2.5 bar (R410A) below nominal evaporating pressure. Even if suction pressure increases again, the compressor will not restart.
- Continuous pump-down: traditional pump-down, Compressor restarts automatically when suction pressure increases. A non-return valve in the discharge line is recommended.

Reduce moisture in the system

	<p>Excessive air and moisture</p> <ul style="list-style-type: none"> • can increase condensing pressure and cause excessively high discharge temperatures. • can create acid giving rise to copper plating. 	<ul style="list-style-type: none"> • can destroy the lubricating properties of the oil. <p>All these phenomena can reduce service life and cause mechanical and electrical compressor failure.</p>
Requirements	<p>H-series compressors are delivered with < 100 ppm moisture level.</p> <p>At the time of commissioning, system moisture content may be up to 100 ppm.</p>	<p>During operation, the filter drier must reduce this to a level between 20 and 50 ppm.</p>
Solutions	<p>To achieve this requirement, a properly sized and type of drier is required. Important selection criteria's include:</p> <ul style="list-style-type: none"> • driers water content capacity, • system refrigeration capacity, • system refrigerant charge. 	<p>For new installations with H-series compressors with polyolester oil, Danfoss recommends using the Danfoss DML (100% molecular sieve) solid core filter drier.</p>

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Compressor storage

Store the compressor not exposed to rain, corrosive or flammable atmosphere between -35°C and 70°C when charged with nitrogen and

between -35°C and 55°C when charged with refrigerant.

Compressor holding charge

Each compressor is shipped with a nominal dry nitrogen holding charge between 0.3 and 0.7 bar and is sealed with elastomer plugs.



Respect the following sequence:

- Remove the nitrogen holding charge via the suction Schrader valve to avoid an oil mist blow out.

- Remove the suction plug first and the discharge plug afterwards to avoid discharge check valve gets stuck in open position.

An opened compressor must not be exposed to air for more than 20 minutes to avoid moisture is captured by the PVE oil.

Handling



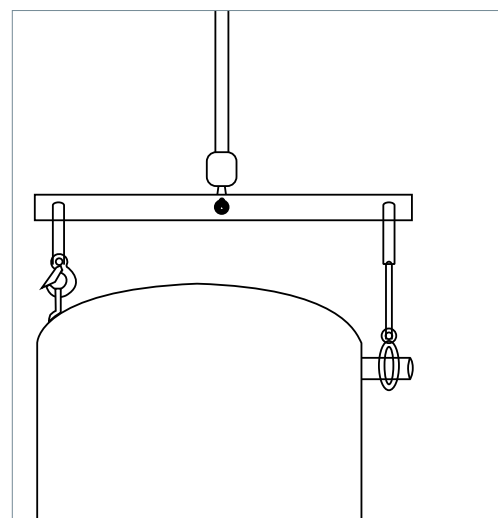
Each Danfoss H-series scroll compressor is equipped with the lift ring on the top shell and ring for the discharge port.

- Always use both these rings when lifting the compressor.
- Use lifting equipment rated and certified for the weight of the compressor or compressor assembly.
- A spreader bar rated for the weight of the compressor is highly recommended to ensure a better load distribution.
- The use of lifting hooks closed with a clasp is recommended.

- For tandem and trio assemblies, use a spreader bar and all compressor rings as shown in picture below.

- Never use the lift rings on the compressor to lift the full unit.

Maintain the compressor in an upright position during all handling manoeuvres (maximum of 15° from vertical).



Piping assembly

Good practices for piping assembly is a pre-requisite to ensure compressor service life.

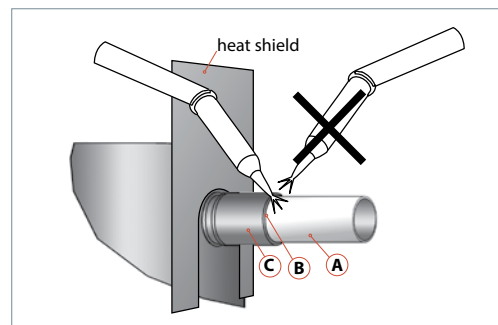
System cleanliness

Circuit contamination possible cause:	Requirement:
Brazing and welding oxides	During brazing, flow nitrogen through the system
Filings and particles from the removal of burrs in pipe-work	Remove any particles and burrs generated by tube cutting and hole drilling
Moisture and air	Use only clean and dehydrated refrigeration grade copper tubing Opened compressor must not be exposed to air more than 20 minutes to avoid moisture captured by POE oil.

Brazing procedure:

- Brazing operations must be performed by qualified personnel.
- Make sure that no electrical wiring is connected to the compressor.
- To prevent compressor shell and electrical box overheating, use a heat shield and/or a heat-absorbent compound.
- Clean up connections with degreasing agent
- Flow nitrogen through the compressor.
- Use flux in paste or flux coated brazing rod.

- Use brazing rod with a minimum of 5% silver content.
- It is recommended to use double-tipped torch using acetylene to ensure a uniform heating of connection.
- To enhance the resistance to rust, a varnish on the connection is recommended.



! Before eventual un-brazing of the compressor or any system component, the refrigerant charge must be removed.



System pressure test and leak detection

- !** The compressor has been strength tested and leak proof tested (<3g/year) at the factory. For system tests:
- Always use an inert gas such as Nitrogen or Helium.

- Pressurize the system on HP side first then LP side.
- Do not exceed the following pressures:

Maximum compressor test pressures

Maximum compressor test pressure high side (HP)	45 bar (g), Do keep the low side pressure not exceed 31.1 bar(g)
Maximum compressor test pressure low side (LP)	31.1 bar (g)

GENERAL INFORMATION	Vacuum evacuation and moisture removal	
	Requirements:	Recommendations:
	<ul style="list-style-type: none"> • Never use the compressor to evacuate the system. • Connect a vacuum pump to both the LP and HP sides. • Evacuate the system to a pressure of 500 μm Hg (0.67 mbar) absolute. 	<ul style="list-style-type: none"> • Energized heaters improve moisture removal. • Alternate vacuum phases and break vacuum with Nitrogen to improve moisture removal. <p>For more detailed information see "Vacuum pump-down and dehydration procedure" TI-026-0302.</p>
PRODUCT INFORMATION	Refrigerant charging	
	<p> Initial charge:</p> <ul style="list-style-type: none"> • For the initial charge, the compressor must not run. • Charge refrigerant as close as possible to the nominal system charge. • This initial charging operation must be done in liquid phase between the condenser outlet and the filter drier. 	<p>If needed, a complement of charge can be done:</p> <ul style="list-style-type: none"> • In liquid phase while compressor is running by slowly throttling liquid in. • On the low pressure side, as far away as possible from the compressor suction connection. • Never bypass safety low pressure switch. <p>For more detailed information see "Recommended refrigerant system charging practice" FRCC.EN.050.</p>
SYSTEM DESIGN	Dielectric strength and insulation resistance tests	
	<p>The tests are performed on each compressor at the factory between each phase and ground.</p> <ul style="list-style-type: none"> • Dielectric strength test is done with a high potential voltage (hi-pot) of 2Un +1000V AC at least, and leakage current must be less than 5 mA. Additional tests of this type are not recommended as it may reduce motor lifetime. Nevertheless, if such a test is necessary, it must be performed at a lower voltage. <p> Do not use a megohm meter nor apply power to the compressor while it is under vacuum as this may cause internal damage.</p>	<ul style="list-style-type: none"> • Insulation resistance is measured with a 500 V DC megohm tester and must be higher than 1 megohm. • The presence of refrigerant around the motor windings will result in lower resistance values to ground and higher leakage current readings. Such readings do not indicate a faulty compressor. To prevent this, the system can be first operated briefly to distribute refrigerant.
INTEGRATION INTO SYSTEM		
ORDERING INFORMATION		

Preliminary check



Check electrical power supply:

- Phase order: For H-series compressors, reverse rotation is obvious if the compressor do not build up pressure and sound level is abnormal high. For more details refer to section "Motor protection".

- Voltage and voltage unbalance within tolerance: For more details refer to section "Motor voltage".

Initial start-up

- Crankcase heaters must be energized at least 8 hours in advance to remove refrigerant.
- A quicker start-up is possible by "jogging" the compressor to evacuate refrigerant.

Start the compressor for 1 second, then wait for 1 to 2 minutes. After 3 or 4 jogs the compressor can be started. This operation must be repeated for each compressor individually.

System monitoring

The system must be monitored after initial startup for a minimum of 60 minutes to ensure proper operating characteristics such as:

- Correct superheat and subcooling.
- Current draw of individual compressors within acceptable values (max operating current).
- No abnormal vibrations and noise.
- Correct oil level.

If Oil Top-up is needed, it must be done while the compressor is idle. Use the schrader connector or any other accessible connector on the compressor suction line. Always use new cans. For more detailed information see "Lubricants filling in instructions for Danfoss Commercial Compressors" TI 2-025-0402.

Oil level checking and top-up

In installations with good oil return and line runs up to 50 ft, no additional oil is required. If installation lines exceed 50 ft, additional oil may be needed. 1 or 2% of the total system refrigerant charge (in weight) can be used to roughly define the required oil top-up quantity.

Always use oil from new cans. Top-up the oil while the compressor is idle. Use any accessible connector on the compressor suction line and a suitable pump.

GENERAL INFORMATION
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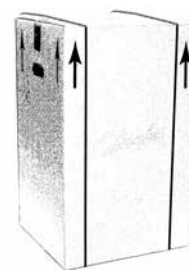
Danfoss recommends that compressors and compressor oil should be recycled by a suitable company at its site.

Packaging

Single pack

Compressors are packed individually in a cardboard box. They can be ordered in any quantity. Minimum ordering quantity = 1. As far as possible, Danfoss will ship the boxes on full pallets of 8,9, or 16 compressors according below table.

- Each box also contains following accessories:
- 4 grommets
- 4 assemblies of self tapping US thread bolts, washers and sleeves
- 4 additional sleeves
- 1 screw for earth connection
- Run capacitors are not provided

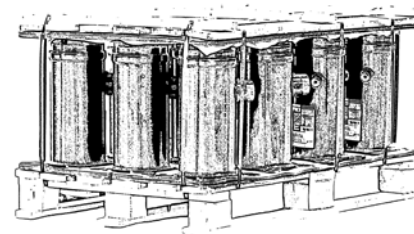


Industrial pack

Compressors are not packed individually but are shipped all together on one pallet. They can be ordered in quantities of full pallets only, multiples of 12 or 16 compressors, according below table.

Each industrial pack pallet contains following accessories:

- 4 grommets per compressor
- 4 sleeves per compressor



Packaging details

According to delivery region, packaging dimensions and compressor quantities are different.

See below for details. For US made H-series compressors (code number starting with 120U)

Delivered region	Packaging	Nbr	Pallet type	Comments
Americas Asia Pacific Middle East	Single pack	16	US pallet	Optimised for overseas container loading
	Industrial pack	16	US pallet	
Europe	Single pack	8	Danfoss pallet	-
	Industrial pack	12	Danfoss pallet	

* Nbr : number of compressors/pallet

For CN made H series compressors (code number starting with 121L)

Delivered region	Packaging	Nbr	Pallet type	Comments
All	Single pack	9	Danfoss pallet	-
	Industrial pack	12	Danfoss pallet	

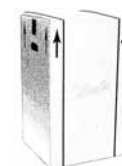
* Nbr : number of compressors/pallet

Compressor code numbers

Danfoss H-series scroll compressors can be ordered in either industrial packs or in single packs.

Please use the code numbers from below tables for ordering.

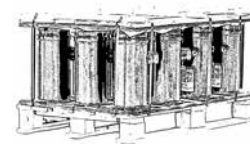
R22 Single pack



Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRM032	U	P	6	120U0921					
HRM034	U	P	6	120U0926	120U1081	120U1001			
	T	P	6			120U2367			120U2087
HRM038	U	P	6	120U0931	120U1091	120U1011	120U0966	120U1056	
	T	P	6						120U2092
HRM040	U	P	6	120U0936	120U1101	120U1021			
HRM042	U	P	6	120U0941	120U1111	120U1031		120U1066	
	T	P	6			120U2127	120U2152		120U2107
HRM045	U	P	6	120U0946	120U1121	120U1041		120U1071	
HRM047	U	P	6	120U0951	120U1131	120U1051	120U0991	120U1076	
	T	P	6			120U2132	120U2162		120U2097
HRM048	U	C	8			120U1671			
	U	P	6	120U1496		120U1666		120U1791	
HRM051	T	P	6			120U1676			
	U	P	6	120U1506					
HRM054	U	C	6	120U1516					
	U	P	6	120U1511	120U1871	120U1696		120U1811	
	T	P	6						120U2292
HRM058	T	P	6	120U1521					
	U	C	6	120U1536					
	U	P	6	120U1531	120U1876	120U1711		120U1821	
HRM060	T	P	6	120U1541	120U2760	120U1721			120U2082
	U	C	6	120U1551	120U2077				
	U	P	6	120U1546	120U1881	120U1736	120U1611	120U1831	
HLM068	T	C	6		120U1891	120U1746			
	T	P	6	120U1556					
HLM072	T	C	6		120U1896	120U1751		120U2602	120U1856
	T	P	6	120U1566					
HLM075	T	C	6		120U1901	120U1761		120U1836	
	T	P	6	120U1576			120U1636		
HLM078	T	C	6			120U1771			
HLM081	T	C	6		120U1911	120U1776			120U2102
	T	P	6	120U1586					
HCM094	T	C	6		120U0891	120U0581		120U0711	120U0746
	T	C	7			120U0586			
	T	C	8			120U0596		120U0721	
HCM109	T	C	6		120U2506	120U0366			
	T	C	6		120U0761	120U0391			
HCM120	T	C	7			120U0396			
	T	C	8			120U2207			

Made in US

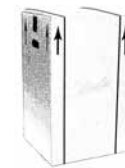
R22 Industrial pack



Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRM032	U	P	6	120U0918					
HRM034	T	P	6			120U2364			120U2084
	U	P	6	120U0923	120U1078	120U0998			
HRM038	T	P	6						120U2089
	U	P	6	120U0928	120U1088	120U1008	120U0963	120U1053	
HRM040	U	P	6	120U0933	120U1098	120U1018			
HRM042	T	P	6			120U2124	120U2149		120U2104
	U	P	6	120U0938	120U1108	120U1028		120U1063	
HRM045	U	P	6	120U0943	120U1118	120U1038		120U1068	
HRM047	T	P	6			120U2129	120U2159		120U2094
	U	P	6	120U0948	120U1128	120U1048	120U0988	120U1073	
HRM048	U	C	8			120U1668			
	U	P	6	120U1493		120U1663		120U1788	
HRM051	T	P	6			120U1673			
	U	P	6	120U1503					
HRM054	T	P	6						120U2289
	U	C	6	120U1513					
	U	P	6	120U1508	120U1868	120U1693		120U1808	
HRM058	T	P	6	120U1518					
	U	C	6	120U1533					
	U	C	8			120U1716			
HRM060	U	P	6	120U1528	120U1873	120U1708		120U1818	
	T	P	6	120U1538	120U2757	120U1718			120U2079
	U	C	6	120U1548	120U2074				
HLM068	U	P	6	120U1543	120U1878	120U1733	120U1608	120U1828	
	T	C	6		120U1888	120U1743			
HLM072	T	P	6	120U1553					
	T	C	6		120U1893	120U1748		120U2599	120U1853
HLM075	T	P	6	120U1563					
	T	C	6		120U1898	120U1758		120U1833	
HLM078	T	P	6	120U1573			120U1633		
	T	C	6			120U1768			
HLM081	T	C	6		120U1908	120U1773			120U2099
	T	P	6	120U1583					
HCM094	T	C	6		120U0888	120U0578		120U0708	120U0743
	T	C	7			120U0583			
	T	C	8			120U0593		120U0718	
HCM109	T	C	6		120U2503	120U0363			
	T	C	6		120U0758	120U0388			
HCM120	T	C	7			120U0393			
	T	C	8			120U2204			

Made in US

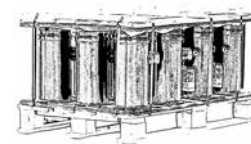
R407C Single pack



Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRP025	T	P	6			120U3088			
HRP034	T	P	6			120U2024	120U2019		
HRP038	T	P	6		120U1086	120U1006	120U0961		
HRP040	T	P	6		120U1096	120U1016	120U1929		
HRP042	T	P	6			120U1026	120U2157		
HRP045	T	P	6			120U1036	120U0976		
HRP047	T	P	6		120U1126	120U1046	120U0986		
HRP048	T	C	8			120U1661			
HRP048	T	P	6			120U1656			
HRP051	T	P	6	120U1501	120U1861	120U1681			
HRP054	T	P	6			120U1691	120U2197		
HRP058	T	P	6			120U1701	120U1596		
HRP060	T	C	8			120U1731			
	T	P	6		120U2297	120U1726	120U1606		
HLP068	T	C	6			120U2014			
	T	P	6	120U1561			120U1621		
HLP072	T	C	6			120U1756			
	T	C	8			120U2072			
	T	P	6	120U1571			120U1631		
HLP075	T	C	6			120U1766			
HLP078	T	C	6		120U2458	120U2454			
HLP081	T	C	6		120U1916	120U1781			
	T	C	8			120U1786			
	T	P	6	120U1591			120U1651		
HCP094	T	C	6		120U0906	120U0601			
	T	C	7			120U0606			
	T	C	8		120U0916	120U0611			
HCP109	T	C	6			120U0376			
	T	C	7			120U0381			
	T	C	8			120U0386			
HCP120	T	C	6		120U0766	120U0401			
	T	C	7			120U0406			
	T	C	8			120U0411			

Made in US

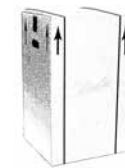
R407C Industrial pack



Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRP025	T	P	6			120U3087			
HRP034	T	P	6			120U2021	120U2016		
HRP038	T	P	6		120U1083	120U1003	120U0958		
HRP040	T	P	6		120U1093	120U1013	120U1926		
HRP042	T	P	6			120U1023	120U2154		
HRP045	T	P	6			120U1033	120U0973		
HRP047	T	P	6		120U1123	120U1043	120U0983		
HRP048	T	C	8			120U1658			
HRP048	T	P	6			120U1653			
HRP051	T	P	6	120U1498	120U1858	120U1678			
HRP054	T	P	6			120U1688	120U2194		
HRP058	T	P	6			120U1698	120U1593		
HRP060	T	C	8			120U1728			
	T	P	6		120U2297	120U1723	120U1603		
HLP068	T	C	6			120U2011			
	T	P	6	120U1558			120U1618		
HLP072	T	C	6			120U1753			
	T	C	8			120U2069			
	T	P	6				120U1628		
HLP075	T	C	6			120U1763			
HLP078	T	C	6		120U2455	120U2451			
HLP081	T	C	6		120U1913	120U1778			
	T	C	8			120U1783			
	T	P	6	120U1588			120U1648		
HCP094	T	C	6		120U0903	120U0598			
	T	C	7			120U0603			
	T	C	8		120U0913	120U0608			
HCP109	T	C	6			120U0373			
	T	C	7			120U0378			
	T	C	8			120U0383			
HCP120	T	C	6		120U0763	120U0398			
	T	C	7			120U0403			
	T	C	8			120U0408			

Made in US

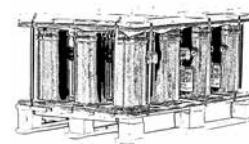
R410A Single pack



Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRH029	U	P	6	120U2277	120U2282	120U2287			
HRH031	U	P	6	120U1136	120U1251	120U1191	120U1166		
HRH032	U	P	6	120U1141	120U1256	120U1196	120U1171	120U1221	
HRH034	U	P	6	120U1146	120U1261	120U2443	120U2650	120U1226	
HRH036	U	P	6	120U1151	120U1266	120U1201	120U1176	120U1231	
HRH038	U	P	6	120U1156	120U1271	120U1206	120U1181		120U2658
HRH039	U	P	6	120U2466					
HRH040	U	P	6	120U1161	120U1276	120U1211	120U1186	120U1241	
HRH041	U	P	6	120U1281	120U1451	120U1356		120U1406	
	U	C	8		120U2407	120U2397			
HRH044	U	P	6	120U1286	120U1456	120U1361			
HRH047	U	P	6	120U2362					
HRH048	U	P	6	120U2582					
HRH049	U	P	6	120U1291	120U1461	120U1366			
	U	C	8		120U2482	120U2474		120U2478	
HRH050	U	P	6	120U2470					
HRH051	U	P	6	120U1296	120U1466	120U1371	120U1326	120U1421	
HRH054	U	P	6	120U1301	120U1471	120U1376	120U1331	120U1426	
HRH056	U	C	6			120U1386		120U2237	
	U	P	6	120U1306	120U1476	120U1381	120U1336	120U1431	
HLH061	T	C	6		120U2062	120U2052		120U2057	120U2450
	T	P	6	120U2042			120U2047		
	T	C	8		120U2494	120U2486		120U2490	
HLH068	T	C	6		120U1481	120U1391		120U1436	
	T	P	6	120U1311			120U1341		
	T	C	8		120U2427	120U2417		120U2422	
HLJ072	T	C	6		120U1486	120U1396		120U2037	
	T	P	6	120U1316			120U1346		
	T	C	8		120U2177	120U2167		120U2498	
HLJ075	T	C	6		120U2272	120U2267			
HLJ083	T	C	6		120U1491	120U1401		120U1441	120U2387
	T	P	6	120U1321			120U1351		
	T	C	8		120U2182	120U2172		120U2502	
HCJ090	T	C	6		120U2307	120U2302		120U2312	
	T	C	7		120U2542	120U2534		120U2510	
	T	C	8		120U2546	120U2538			
HCJ105	T	C	6		120U2327	120U2322		120U2332	
	T	C	7			120U2574			
	T	C	8		120U2554	120U2578			
HCJ120	T	C	6		120U2347	120U2342		120U2352	
	T	C	7			120U2558			
	T	C	8		120U2570	120U2562			

Made in US

R410A Industrial pack



Compressors	Model Variation	Connections	Features	Code no.					
				1	2	4	5	7	9
HRH029	U	P	6	120U2274	120U2279	120U2284			
HRH031	U	P	6	120U1133	120U1248	120U1188	120U1163		
HRH032	U	P	6	120U1138	120U1253	120U1193	120U1168	120U1218	
HRH034	U	P	6	120U1143	120U1258	120U2446	120U2647	120U1223	
HRH036	U	P	6	120U1148	120U1263	120U1198	120U1173	120U1228	
HRH038	U	P	6	120U1153	120U1268	120U1203	120U1178		120U2655
HRH039	U	P	6	120U2463					
HRH040	U	P	6	120U1158	120U1273	120U1208	120U1183	120U1238	
HRH041	U	P	6	120U1278	120U1448	120U1353		120U1403	
	U	C	8		120U2404	120U2394			
HRH044	U	P	6	120U1283	120U1453	120U1358			
HRH047	U	P	6	120U2359					
HRH048	U	P	6	120U2579					
HRH049	U	P	6	120U1288	120U1458	120U1363			
	U	C	8		120U2479	120U2471		120U2475	
HRH050	U	P	6	120U2467					
HRH051	U	P	6	120U1293	120U1463	120U1368	120U1323	120U1418	
HRH054	U	P	6	120U1298	120U1468	120U1373	120U1328	120U1423	
HRH056	U	C	6			120U1383		120U2234	
HRH056	U	P	6	120U1303	120U1473	120U1378	120U1333	120U1428	
HLH061	T	P	6	120U2039			120U2044		
	T	C	6		120U2059	120U2049		120U2054	120U2447
	T	C	8		120U2491	120U2483		120U2487	
HLH068	T	C	6		120U1478	120U1388		120U1433	
	T	C	8		120U2424	120U2414		120U2419	
	T	P	6	120U1308			120U1338		
HLJ072	T	C	6		120U1483	120U1393		120U2034	
	T	C	8		120U2174	120U2164		120U2495	
	T	P	6	120U1313			120U1343		
HLJ075	T	C	6		120U2269	120U2264			120U1443
HLJ083	T	C	6		120U1488	120U1398		120U1438	120U2384
	T	C	8		120U2179	120U2169		120U2499	
	T	P	6	120U1318			120U1348		
HCJ090	T	C	6		120U2304	120U2299		120U2309	
	T	C	7		120U2539	120U2531		120U2507	
	T	C	8		120U2543	120U2535			
HCJ105	T	C	6		120U2324	120U2319		120U2329	
	T	C	7			120U2571			
	T	C	8		120U2551	120U2575			
HCJ120	T	C	6		120U2344	120U2339		120U2349	
	T	C	7			120U2555			
	T	C	8		120U2567	120U2559			

Made in US

Model		Model variation	Voltage code	Connections	Features	Industrial pack	Single pack
R22	HRM025	T	4	P	6	121L2781	121L2784
	HRM034	T	4	P	6	121L2364	121L2367
	HRM034	T	5	P	6	121L2119	121L2122
	HRM038	T	9	P	6	121L2089	121L2092
	HRM042	T	4	P	6	121L2124	121L2127
	HRM051	T	4	P	6	121L1673	121L1676
	HRM054	T	4	P	6	121L2749	121L2752
	HRM060	T	4	P	6	121L1718	121L1721
	HRM060	T	2	P	6	121L2757	121L2760
	HRM060	T	9	P	6	121L2079	121L2082
	HRM060	T	4	C	8	121L3071	121L3072
	HLM072	T	4	C	6	121L1748	121L1751
	HLM072	T	9	C	6	121L1853	121L1856
	HLM081	T	4	C	6	121L1773	121L1776
	HLM081	T	2	C	6	121L1908	121L1911
	HLM081	T	9	C	6	121L2099	121L2102
	HCM094	T	4	C	6	121L0578	121L0581
	HCM109	T	4	C	6	121L0363	121L0366
	HCM120	T	4	C	6	121L0388	121L0391
R407C	HRP054	T	4	P	6	121L1688	121L1691
	HRP054	T	4	C	6	121L3183	121L3184
	HRP060	T	4	P	6	121L1723	121L1726
	HLP072	T	4	C	6	121L1753	121L1756
	HLP081	T	4	C	6	121L1778	121L1781
	HCP094	T	4	C	6	121L0598	121L0601
	HCP109	T	4	C	6	121L0373	121L0376
	HCP120	T	4	C	6	121L0398	121L0401
R410A	HRH047	U	4	P	6	121L2848	121L2851
	HRH049	U	4	P	6	121L1363	121L1366
	HRH051	U	4	P	6	121L1368	121L1371
	HRH054	U	4	P	6	121L1373	121L1376
	HRH054	U	4	C	8	121L3030	121L3033
	HLH061	T	9	C	6	121L2447	121L2450
	HLH061	T	4	C	6	121L2049	121L2052
	HLH061	T	4	C	8	121L2483	121L2486
	HLH068	T	4	C	6	121L1388	121L1391
	HLJ072	T	9	C	6	121L2989	121L2992
	HLJ072	T	4	C	6	121L1393	121L1396
	HLJ072	T	4	C	8	121L2164	121L2167
	HLJ075	T	4	C	6	121L2264	121L2267
	HLJ083	T	4	C	6	121L1398	121L1401
	HLJ083	T	4	C	8	121L2169	121L2172
	H CJ091	T	4	C	6	121L3112	121L3113
	H CJ091	T	4	C	8	121L3118	121L3119
	H CJ106	T	4	C	6	121L3114	121L3115
	H CJ106	T	4	C	8	121L3120	121L3121
	H CJ121	T	4	C	6	121L3116	121L3117
	H CJ121	T	4	C	8	121L3121	121L3123

Industrial pack: 12 compressors per pallet

Single pack: 1 compressor in cardboard box, 9pcs on a full pallet

Made in China

Run capacitors for PSC wiring



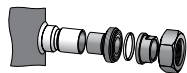
Type	Code n°	Description	Application	Packaging	Pack size
70 µF	120Z0051	PSC wiring Run Capacitor 70 µF,	50Hz, Motor Code 5: HRM025-042/HRP025-042/HRH029-036 60Hz, Motor Code 1: HRM051-054/HRP051/HRH041-HRH051	Multipack	10
60 µF	120Z0050	PSC wiring Run Capacitor 60 µF,	50Hz, Motor Code 5: HRM045-047/HRP045-047/HRH038-040 60Hz, Motor Code 1: HRM040-048/HRH038-HRH040	Multipack	10
55 µF	8173234	PSC wiring Run Capacitor 55 µF,	50Hz, Motor Code 5: HRM054-HLM081/HRP054-HLP081/ HRH051-HLJ083 60Hz, Motor Code 1: HRM058-060/HRH036	Multipack	10
50 µF	8173233	PSC wiring Run Capacitor 50 µF,	50Hz, Motor Code 5: HRM051/HRP051 60Hz, Motor Code 1: HRH032-034	Multipack	10
45 µF	8173232	PSC wiring Run Capacitor 45 µF,	60Hz, Motor Code 1: HRM025-034/HRH031	Multipack	10

Start capacitors and starting relay for CSR wiring



Type	Code n°	Description	Application	Packaging	Pack size
145-175 µF	120Z0399	CSR wiring Start Capacitor 145-175 µF,	"50Hz, Motor Code 5: HRM025-047/HRP025-047/HRH029-040 60Hz, Motor Code 1: HRM025-034/HRH031"	Multipack	10
161-193 µF	120Z0400	CSR wiring Start Capacitor 161-193 µF,	"50Hz, Motor Code 5: HRM051-054/HRP051-054 60Hz, Motor Code 1: HRM048-054/HRP051/ HRH041-HRH051"	Multipack	10
88-108 µF	8173001	CSR wiring Start Capacitor 88-108 µF,	"50Hz, Motor Code 5: HRM058-HLM081/HRP058-HLP081/ HRH051-HLJ083 60Hz, Motor Code 1: HRM038-047/HRM058-060/HRH032-40"	Multipack	10
RVA9CKL	120Z0393	CSR wiring Starting Relay, motor voltage code 5 - 220-240V / 1 / 50Hz	HRM/P032-047 HRH031-040	Multipack	10
RVA3EKL	120Z0394	CSR wiring Starting Relay, motor voltage code 5 - 220-240V / 1 / 50Hz	HRM/P051-054	Multipack	10
RVA4GKL	120Z0395	CSR wiring Starting Relay, motor voltage code 5 - 220-240V / 1 / 50Hz	HRM/P058-060 HLM/P068-081 HRH051-056 HLH061- 068 HLJ072-083	Multipack	10
RVA2ACKL	120Z0396	CSR wiring Starting Relay, motor voltage code 1 -208-230V / 1 / 60Hz	HRM/P032-034 HRH031	Multipack	10
RVA2ABKL	120Z0397	CSR wiring Starting Relay, motor voltage code 1 -208-230V / 1 / 60Hz	HRM/P038-058U-060U HLM/068-081 HRH032-056, HLH061-068, HLJ072-083	Multipack	10
RVAA4IKL	120Z0398	CSR wiring Starting Relay, motor voltage code 1 -208-230V / 1 / 60Hz	HRM058T1-060T1	Multipack	10

Rotolock adaptor set



Type	Code n°	Description	Application	Packaging	Pack size
	120Z0126	Rotolock adaptor set (1-1/4" ~ 3/4"), (1" ~ 1/2")	HRP/HRM025-034-038-040-042 HRH029-031-032-034-036038 - group 1	Multipack	6
	120Z0127	Rotolock adaptor set (1-1/4" ~ 7/8"), (1" ~ 1/2")	HRP/HRM045-047-051-057-058- 060-068-072-075 HRH040-041-044-049-051-056- 061-068-072-075-083 - group 2	Multipack	6
	120Z0128	Rotolock adaptor set (1-1/4" ~ 7/8"), (1-1/4" ~ 3/4")	HRM/HRP078-081 - group 3	Multipack	6
	120Z0129	Rotolock adaptor set (1-3/4" ~ 1-1/8"), (1-1/4" ~ 7/8")	HCM/P094-109-120 HCJ090-091- 105-106-120-121 - group 4	Multipack	6

Rotolock adaptor



Type	Code n°	Description	Application (see above group)	Packaging	Pack size
	120Z0366	Rotolock adaptor (1-1/4" ~ 3/4")	Group 1 suction	Multipack	10
	120Z0367	Rotolock adaptor (1-1/4" ~ 7/8")	Group 2 & 3 suction	Multipack	10
	120Z0364	Rotolock adaptor (1-3/4" ~ 1-1/8")	Group 4 suction	Multipack	10
	120Z0365	Rotolock adaptor (1" ~ 1/2")	Group 1 & 2 discharge	Multipack	10
	120Z0366	Rotolock adaptor (1-1/4" ~ 3/4")	Group 3 discharge	Multipack	10
	120Z0367	Rotolock adaptor (1-1/4" ~ 7/8")	Group 4 discharge	Multipack	10

Crankcase heater



Type	Code No	Description	Application	Packaging	Pack Size
	120Z0055	Belt type crankcase heater, 40 W, 230 V, CE mark	HRM032-034-038-040-042-045-047 - HRP025-038-040-042-045-047 - HRH029-032-034-036-038-040	Multipack	6
	120Z0056	Belt type crankcase heater, 40 W, 400 V, CE mark		Multipack	6
	120Z0057	Belt type crankcase heater, 50 W, 230 V, CE mark	HRM048-051-054-058-060 / HLM068-072-075 - HRP048-051-054-058-060 / HLP068-072-075 - HRH041-049-051-054-056 / HLH061-068 / HLJ072 / HLJ075	Multipack	6
	120Z0058	Belt type crankcase heater, 50 W, 400 V, CE mark		Multipack	6
	120Z0059	Belt type crankcase heater, 65 W, 230 V, CE mark, UL		Multipack	6
	120Z5011	Belt type crankcase heater, 70 W, 230 V, UL, CE mark	HLM078-081 / HCM094-109-120 - HLP081 / HCP094-109-120 - HLJ083	Multipack	6
	120Z0060	Belt type crankcase heater, 65 W, 400 V, CE mark, UL	- HCJ090-091-105-106-120-121	Multipack	6
	120Z5012	Belt type crankcase heater, 70 W, 460 V, UL, CE mark		Multipack	6
	120Z5013	Belt type crankcase heater, 70 W, 575 V, UL, CE mark		Multipack	6

Discharge temperature protection



Type	Code No	Description	Application	Packaging	Pack Size
	7750009	Discharge thermostat kit	All models	Multipack	10
	7973008	Discharge thermostat kit	All models	Industry pack	50

Spare parts & accessories

Lubricant



Type	Code No	Description	Application	Packaging	Pack Size
	120Z5034	PVE (0.95 liter can) 320HV (FVC68D)	HRH, HLH, HLJ, HCJ, HRP, HLP & HCP	Multipack	1

Mounting hardware



Type	Code No	Description	Application	Packaging	Pack Size
	120Z5017	Mounting grommet	All models	Single pack	1
	120Z5014	Mounting sleeve	All models	Single pack	1
	120Z5031	Mounting kit, including 1 bolt, 1 sleeve, 1 washer	All models	Single pack	1
	120Z5064	Mounting kit for 1 scroll compressor including 4 grommets, 4 sleeves, 4 bolts, 4 washers	All models	Single pack	1

Acoustic hoods



Type	Code No	Description	Application	Packaging	Pack Size
	120Z5083	Acoustic hood	HRM032-047, HRP 032-047, HRH 031-040, HRH047, HRH048, HRH050	Single pack	1
	120Z5084	Acoustic hood	HRM048-081, HRP048-081, HRH044, HRH049, HRH051-056, HLH061-068, HLJ072-083	Single pack	1
	120Z5085	Acoustic hood	HRM094-120, HCP094-120, HCJ090-121	Single pack	1

IP54 upgrade kit



Type	Code No	Description	Application	Packaging	Pack Size
	118U0056	IP54 upgrade kit for round terminal box (P & T version)	HRM, HLM, HCM, HRP, HLP, HCP, HRH, HLH, HLJ	Multipack	6
	118U0057	IP54 upgrade kit for square terminal box (C & Q version)	HRM, HLM, HCM, HRP, HLP, HCP, HRH, HLH, HLJ, HCJ	Multipack	6

Terminal box



Code No	Description	Application	Packaging	Pack Size
120Z5015	Round terminal box (P & T version)	P and T version	Multipack	10
120Z5018	Square terminal box (C & Q version)	C and Q version	Multipack	10

Previous version

- Page 18: Dimensions - Tandem
- Page 19: Wiring connections
- Page 25: Tandem requirements
- Page 30: Recommended pump-down switch settings
- Page 32: Evaluate the risk
- Page 34: Manage off cycle migration

Current version

- Page 18: Updated text content in Dimensions - Tandem
- Page 19: Updated Wiring connections
- Page 20-23: Added Three phase & Single phase electrical characteristics
- Page 29: Updated text contents in Tandem requirements
- Page 34: Updated Recommended pump-down switch settings
- Page 36: Updated Evaluate the risk
- Page 38: Updated Manage off cycle migration

Danfoss Commercial Compressors

is a worldwide manufacturer of compressors and condensing units for refrigeration and HVAC applications. With a wide range of high quality and innovative products we help your company to find the best possible energy efficient solution that respects the environment and reduces total life cycle costs.

We have 40 years of experience within the development of hermetic compressors which has brought us amongst the global leaders in our business, and positioned us as distinct variable speed technology specialists. Today we operate from engineering and manufacturing facilities spanning across three continents.



Our products can be found in a variety of applications such as rooftops, chillers, residential air conditioners, heatpumps, coldrooms, supermarkets, milk tank cooling and industrial cooling processes.

<http://cc.danfoss.com>

Danfoss Commercial Compressors, BP 331, 01603 Trévoux Cedex, France | +334 74 00 28 29

Application guidelines

Danfoss Scroll for Refrigeration **MLM / MLZ**

50 - 60 Hz - R404A - R507 - R134a - R22

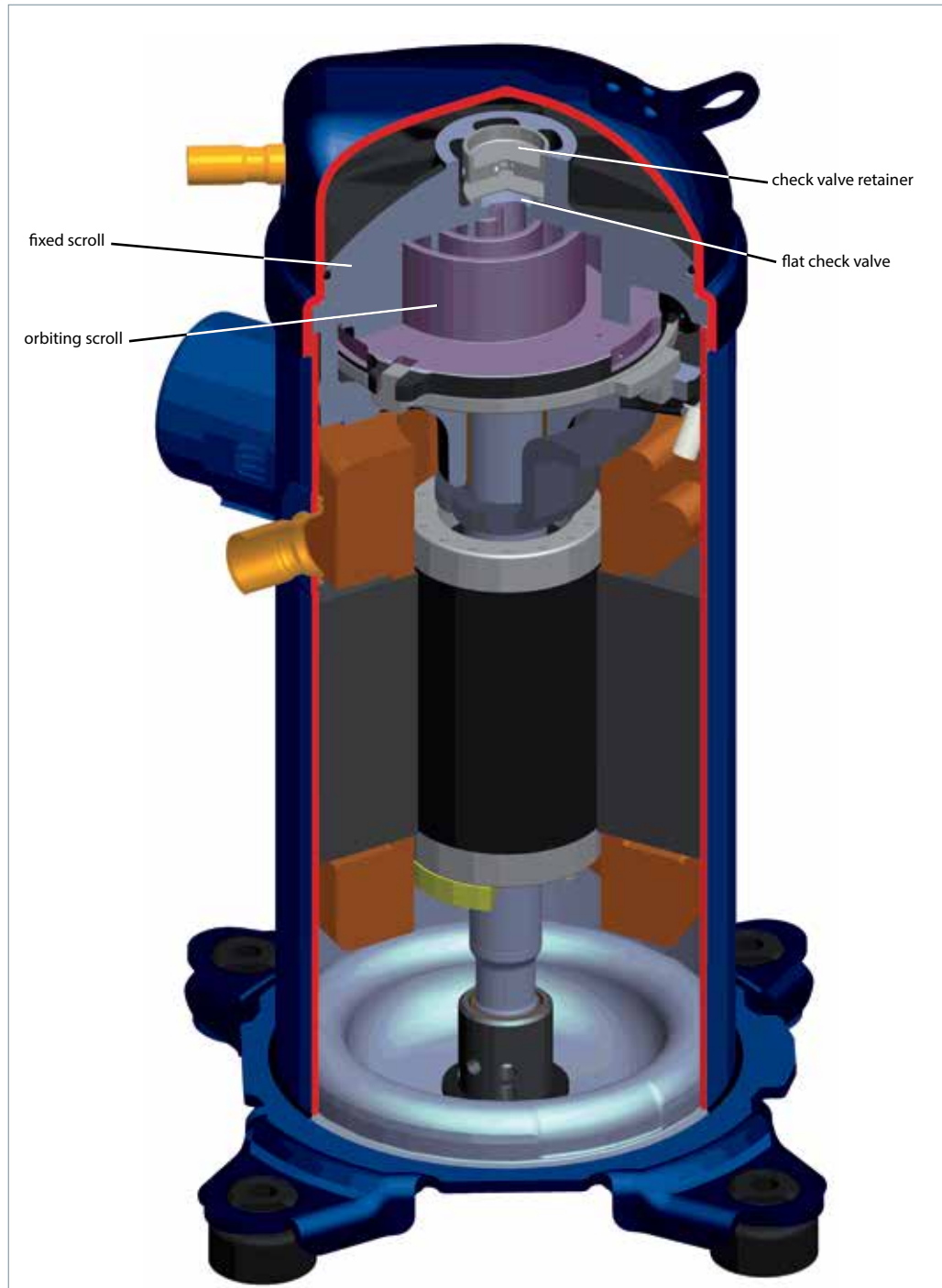


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With its unique scroll design and manufacturing process flexibility, the new Danfoss MLZ/MLM refrigeration compressor offers a highly efficient solution for demanding refrigeration applications.

This new family of refrigeration compressors includes 10 sizes of medium temperature

scroll compressors designed for commercial refrigeration applications. These compressors are engineered for refrigeration, and offer cooling capacity from 3.4 to 21 kW (2 to 10 HP) at common voltages and frequencies as well as any of the common refrigerants (R404A - R134a - R507 - R22).



Thanks to its dedicated refrigeration design, the MLZ/MLM scroll compressor delivers a number of powerful advantages. With its high efficiency motor and optimised scroll design it reduces

energy cost in normal operating conditions and delivers high capacity and an optimised pressure ratio for refrigeration applications.

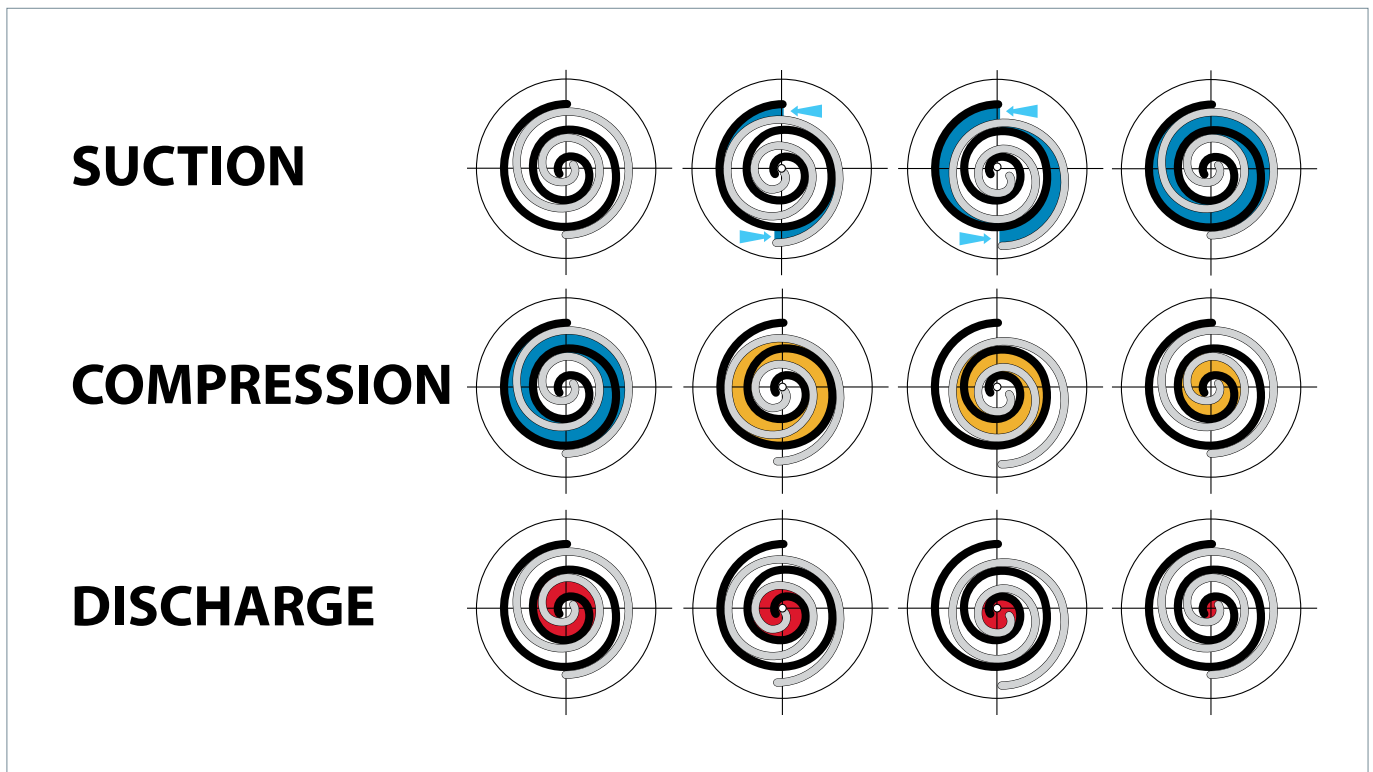
The scroll compression process

The entire scroll compression process is illustrated below. The centre of the orbiting scroll traces a circular path around the centre of the fixed scroll. This movement creates compression pockets between the two scroll elements.

Low pressure suction gas is trapped within each crescent-shaped pocket as it forms; continuous motion of the orbiting scroll serves to seal the pocket, which decreases in volume as the

pocket moves towards the centre of the scroll set, with corresponding increase in gas pressure. Maximum compression is achieved, as the pocket reaches the discharge port at the centre.

Scroll compression is a continuous process: when one pocket of gas is being compressed during the second orbit, another gas quantity enters a new pocket formed at the periphery, and simultaneously, another is being discharged.




Danfoss scroll compressors are manufactured using the most advanced machining, assembly, and process control techniques. In design of both the compressor and the factory, very high

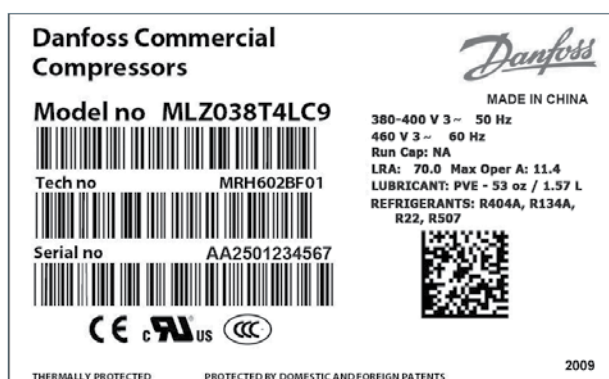
standards of reliability and process control were first priority. The result is a highly efficient product with the highest reliability obtainable, and a low sound level.

Nomenclature

	Type	Size	Motor	Features											
	M LZ	021	T 4 L	P 9											
Application	Other features														
M: medium temperature refrigeration	<table><tr><td>Oil sight glass</td><td>Oil equalisation</td><td>Oil drain</td><td>LP gauge port</td><td>Gas equalisation port</td></tr><tr><td>9 Threaded</td><td>None</td><td>Schrader</td><td>None</td><td>None</td></tr></table>					Oil sight glass	Oil equalisation	Oil drain	LP gauge port	Gas equalisation port	9 Threaded	None	Schrader	None	None
Oil sight glass	Oil equalisation	Oil drain	LP gauge port	Gas equalisation port											
9 Threaded	None	Schrader	None	None											
Family, Refrigerant & lubricant	Tubing and electrical connections														
LZ: R404A - R507 - R134a - R22, PVE lubricant	P: brazed connections, spade terminals														
LM: R22, alkylbenzene lubricant	C: brazed connections, screw terminals														
Nominal capacity	Motor protection														
In thousand Btu/h at 60 Hz, ARI, MBP conditions	L: internal motor protection														
Model variation	Motor voltage code														
T: design optimised for refrigeration	4: 380-400V/3~/50 Hz & 460V/3~/60 Hz														
	5: 220-240V/1~/50 Hz														
	9: 380V/3~/60 Hz														



Label



Serial number

Year code	Month code	Country of origin
2010 A	January A	China 25
2011 B	February B	
2012 C	March C	
2013 D	April D	
2014 E	May E	
2015 F	June F	
2016 G	July G	
2017 H	August H	
2018 J	September J	
2019 K	October K	
	November L	
	December M	

50 Hz

Model		HP	Nominal cooling capacity *		Power input *	Efficiency *		Swept volume	Displacement	Oil charge	Net weight (with oil)
						COP	EER				
			W	Btu/h	kW	W/W	Btu/h/W				
R404A **	MLZ015	2	3300	11300	1.75	1.89	6.45	33.8	5.9	1.1	31
	MLZ021	3	4700	16000	2.27	2.08	7.10	46.2	8.0	1.1	31
	MLZ026	3.5	5800	19800	2.9	2.00	6.83	57.1	9.9	1.1	31
	MLZ030	4	7100	24200	3.35	2.11	7.20	68.8	12.0	1.6	41
	MLZ038	5	8400	28700	3.86	2.19	7.47	81.0	14.1	1.6	41
	MLZ045	6	10200	34800	4.81	2.11	7.20	98.6	17.2	1.6	41
	MLZ048	7	11100	37900	5.17	2.14	7.30	107.5	18.7	1.6	41
	MLZ058	7.5	13000	44400	6.08	2.13	7.27	126.0	21.9	2.7	47
	MLZ066	9	15100	51500	7.01	2.15	7.34	148.8	25.9	2.7	47
	MLZ076	10	17300	59000	7.93	2.18	7.44	162.4	28.3	2.7	47
R134a	MLZ015	2	2000	6800	1.02	1.95	6.66	33.8	5.9	1.1	31
	MLZ021	3	2700	9200	1.33	2.04	6.96	46.2	8.0	1.1	31
	MLZ026	3.5	3300	11300	1.62	2.06	7.03	57.1	9.9	1.1	31
	MLZ030	4	4000	13700	1.93	2.09	7.13	68.8	12.0	1.6	41
	MLZ038	5	4700	16000	2.34	2.02	6.89	81.0	14.1	1.6	41
	MLZ045	6	5900	20100	2.69	2.17	7.41	98.6	17.2	1.6	41
	MLZ048	7	6200	21200	2.91	2.14	7.30	107.5	18.7	1.6	41
	MLZ058	7.5	7400	25300	3.61	2.06	7.03	126.0	21.9	2.7	47
	MLZ066	9	8600	29400	4.1	2.10	7.17	148.8	25.9	2.7	47
	MLZ076	10	9600	32800	4.67	2.06	7.03	162.4	28.3	2.7	47
R22	MLZ/MLM015	2	3300	11300	1.53	2.15	7.34	33.8	5.9	1.1	31
	MLZ/MLM021	3	4600	15700	2.02	2.27	7.75	46.2	8.0	1.1	31
	MLZ/MLM026	3.5	5700	19500	2.43	2.33	7.95	57.1	9.9	1.1	31
	MLZ/MLM030	4	6800	23200	2.93	2.33	7.95	68.8	12.0	1.6	41
	MLZ/MLM038	5	8100	27600	3.45	2.34	7.99	81.0	14.1	1.6	41
	MLZ/MLM045	6	9300	31700	4.14	2.24	7.65	98.6	17.2	1.6	41
	MLZ/MLM048	7	10600	36200	4.53	2.33	7.95	107.5	18.7	1.6	41
	MLZ/MLM058	7.5	12300	42000	5.29	2.33	7.95	126.0	21.9	2.7	47
	MLZ/MLM066	9	14100	48100	5.94	2.38	8.12	148.8	25.9	2.7	47
	MLZ/MLM076	10	16600	56700	6.96	2.38	8.12	162.4	28.3	2.7	47

* at EN12900 conditions: To= -10°C, Tc= 45°C, RGT= 20°C, SC= 0K

** R507 performance data are nearly identical to R404A performance data

Motor voltage code 4: 400V/3~/50 Hz & 460V/3~/60 Hz

60 Hz

Model		HP	Nominal cooling capacity *		Power input *	Efficiency *		Swept volume	Displacement	Oil charge	Net weight (with oil)
						COP	EER				
			W	Btu/h	kW	W/W	Btu/h/W	cm3/rev	m3/h	Litres	kg
R404A **	MLZ015	2	4100	14000	2.1	1.94	6.62	33.8	7.1	1.1	31
	MLZ021	3	5800	19800	2.74	2.13	7.27	46.2	9.7	1.1	31
	MLZ026	3.5	7200	24600	3.44	2.1	7.17	57.1	12.0	1.1	31
	MLZ030	4	8500	29000	3.9	2.18	7.44	68.8	14.4	1.6	41
	MLZ038	5	10200	34800	4.7	2.18	7.44	81.0	17.0	1.6	41
	MLZ045	6	12400	42300	5.64	2.19	7.47	98.6	20.7	1.6	41
	MLZ048	7	13500	46100	6.15	2.2	7.51	107.5	22.6	1.6	41
	MLZ058	7.5	15700	53600	7.35	2.14	7.30	126.0	26.4	2.7	47
	MLZ066	9	18400	62800	8.4	2.18	7.44	148.8	31.2	2.7	47
	MLZ076	10	20900	71300	9.59	2.18	7.44	162.4	34.1	2.7	47
R134a	MLZ015	2	2400	8200	1.19	2.05	7.00	33.8	7.1	1.1	31
	MLZ021	3	3300	11300	1.58	2.1	7.17	46.2	9.7	1.1	31
	MLZ026	3.5	4100	14000	1.91	2.15	7.34	57.1	12.0	1.1	31
	MLZ030	4	5000	17100	2.35	2.11	7.20	68.8	14.4	1.6	41
	MLZ038	5	5800	19800	2.8	2.09	7.13	81.0	17.0	1.6	41
	MLZ045	6	7100	24200	3.32	2.14	7.30	98.6	20.7	1.6	41
	MLZ048	7	7600	25900	3.54	2.14	7.30	107.5	22.6	1.6	41
	MLZ058	7.5	9100	31100	4.28	2.13	7.27	126.0	26.4	2.7	47
	MLZ066	9	10400	35500	4.85	2.15	7.34	148.8	31.2	2.7	47
	MLZ076	10	11700	39900	5.61	2.09	7.13	162.4	34.1	2.7	47
R22	MLZ/MLM015	2	3900	13300	1.74	2.26	7.71	33.8	7.1	1.1	31
	MLZ/MLM021	3	5600	19100	2.36	2.36	8.05	46.2	9.7	1.1	31
	MLZ/MLM026	3.5	7000	23900	2.93	2.39	8.16	57.1	12.0	1.1	31
	MLZ/MLM030	4	8200	28000	3.46	2.36	8.05	68.8	14.4	1.6	41
	MLZ/MLM038	5	9600	32800	4.06	2.36	8.05	81.0	17.0	1.6	41
	MLZ/MLM045	6	11700	39900	4.91	2.38	8.12	98.6	20.7	1.6	41
	MLZ/MLM048	7	12900	44000	5.36	2.4	8.19	107.5	22.6	1.6	41
	MLZ/MLM058	7.5	14900	50900	6.34	2.34	7.99	126.0	26.4	2.7	47
	MLZ/MLM066	9	17000	58000	7.14	2.38	8.12	148.8	31.2	2.7	47
	MLZ/MLM076	10	20100	68600	8.4	2.39	8.16	162.4	34.1	2.7	47

* at EN12900 conditions: To= -10°C, Tc= 45°C, RGT= 20°C, SC= 0K

** R507 performance data are nearly identical to R404A performance data

Motor voltage code 4: 400V/3~/50 Hz & 460V/3~/60 Hz

R404A / R507

Model		To	-25			-20			-15			-10			-5			0			5			10		
		Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe				
50 Hz	MLZ015T4	30	2300	1.3	2900	1.2	3500	1.2	4300	1.2	5200	1.2	6200	1.2	7400	1.1	8700	1.1								
		40	1900	1.6	2400	1.6	3000	1.6	3700	1.5	4400	1.5	5300	1.5	6300	1.5	7400	1.5								
		50	-	-	1800	2.1	2400	2.1	2900	2.0	3600	2.0	4300	1.9	5100	1.9	6000	1.9								
	MLZ021T4	30	3200	1.6	4000	1.6	4900	1.6	5900	1.6	7100	1.6	8500	1.6	10000	1.7	11800	1.7								
		40	2800	2.0	3500	2.0	4300	2.0	5100	2.0	6200	2.0	7300	2.0	8700	2.0	10300	2.0								
		50	-	-	2900	2.5	3500	2.5	4300	2.6	5100	2.6	6100	2.5	7300	2.5	8600	2.4								
	MLZ026T4	30	3900	2.0	4900	2.0	6000	2.0	7300	2.1	8800	2.1	10500	2.1	12500	2.1	14800	2.0								
		40	3400	2.6	4200	2.6	5200	2.6	6300	2.6	7600	2.6	9100	2.6	10800	2.6	12800	2.6								
		50	-	-	3600	3.3	4400	3.3	5300	3.3	6400	3.3	7600	3.3	9100	3.2	10800	3.2								
	MLZ030T4	30	4800	2.3	6000	2.4	7300	2.4	8800	2.4	10600	2.4	12700	2.4	15000	2.4	17700	2.4								
		40	4100	3.0	5100	3.0	6300	3.0	7700	3.0	9300	3.0	11100	3.0	13100	3.0	15500	3.0								
		50	-	-	4300	3.8	5300	3.8	6400	3.8	7800	3.8	9300	3.8	11100	3.7	13100	3.7								
	MLZ038T4	30	5800	2.7	7200	2.7	8700	2.7	10500	2.7	12600	2.8	15000	2.8	17700	2.9	20800	3.0								
		40	5000	3.5	6200	3.4	7600	3.4	9200	3.4	11000	3.4	13200	3.5	15600	3.5	18300	3.6								
		50	-	-	5100	4.4	6300	4.4	7600	4.4	9200	4.3	11000	4.3	13100	4.4	15400	4.4								
	MLZ045T4	30	7000	3.4	8600	3.4	10600	3.4	12800	3.5	15400	3.5	18300	3.5	21600	3.4	25300	3.3								
		40	6100	4.3	7500	4.3	9100	4.3	11100	4.3	13300	4.3	15900	4.3	18800	4.3	22000	4.2								
		50	-	-	6200	5.5	7600	5.4	9200	5.4	11100	5.4	13200	5.4	15700	5.4	18500	5.3								
	MLZ048T4	30	7600	3.7	9400	3.7	11500	3.7	13900	3.7	16700	3.7	19900	3.7	23600	3.7	27900	3.6								
		40	6600	4.6	8200	4.6	10000	4.6	12100	4.6	14500	4.6	17300	4.6	20500	4.6	24200	4.6								
		50	-	-	6800	5.8	8300	5.8	10100	5.8	12100	5.8	14400	5.8	17100	5.8	20300	5.7								
	MLZ058T4	30	8700	4.2	10900	4.3	13500	4.3	16400	4.4	19800	4.5	23500	4.5	27800	4.6	32500	4.6								
		40	7200	5.3	9300	5.3	11600	5.4	14200	5.4	17200	5.5	20500	5.6	24200	5.6	28400	5.7								
		50	-	-	7400	6.8	9400	6.8	11700	6.8	14300	6.9	17100	6.9	20400	6.9	24000	7.0								
	MLZ066T4	30	10000	4.9	12600	4.9	15600	5.0	19100	5.0	23100	5.1	27700	5.3	32900	5.4	38900	5.7								
		40	8500	6.2	10800	6.2	13400	6.2	16400	6.2	19900	6.3	23900	6.4	28500	6.6	33700	6.7								
		50	-	-	8900	7.9	11100	7.9	13600	7.9	16600	8.0	19900	8.1	23800	8.2	28200	8.3								
	MLZ076T4	30	12200	5.7	15200	5.7	18500	5.8	22400	5.8	26800	5.9	31900	6.1	37800	6.2	44600	6.3								
		40	10600	7.0	13100	7.0	15900	7.1	19100	7.2	22900	7.2	27200	7.3	32300	7.4	38200	7.5								
		50	-	-	11000	8.7	13000	8.7	15400	8.8	18300	8.9	21800	8.9	25900	9.0	30800	9.0								
60 Hz	MLZ015T4	30	2800	1.5	3500	1.5	4300	1.5	5200	1.5	6200	1.5	7500	1.5	8900	1.4	10500	1.4								
		40	2300	1.9	2900	1.9	3600	1.9	4500	1.9	5400	1.9	6400	1.8	7600	1.8	9000	1.8								
		50	-	-	2300	2.3	3000	2.4	3700	2.4	4400	2.4	5300	2.3	6300	2.3	7500	2.3								
	MLZ021T4	30	4000	1.8	4900	1.9	6000	2.0	7300	2.0	8700	2.0	10400	2.0	12200	2.0	14200	2.1								
		40	3400	2.3	4300	2.4	5200	2.5	6300	2.5	7600	2.4	9000	2.4	10600	2.4	12400	2.5								
		50	-	-	3600	3.0	4400	3.1	5300	3.1	6400	3.1	7600	3.0	9000	3.0	10500	3.0								
	MLZ026T4	30	5000	2.3	6100	2.4	7500	2.5	9100	2.5	10900	2.5	12900	2.5	15200	2.5	17800	2.5								
		40	4300	2.9	5300	3.0	6500	3.1	7900	3.1	9400	3.1	11200	3.1	13200	3.1	15400	3.1								
		50	-	-	4400	3.7	5400	3.8	6600	3.8	7900	3.8	9400	3.8	11100	3.8	13000	3.8								
	MLZ030T4	30	5800	2.8	7200	2.8	8800	2.8	10700	2.8	12800	2.9	15200	2.9	17800	2.8	20800	2.8								
		40	5100	3.5	6300	3.5	7600	3.5	9300	3.5	11100	3.5	13200	3.5	15500	3.5	18200	3.5								
		50	-	-	5200	4.4	6400	4.3	7700	4.4	9300	4.4	11100	4.4	13100	4.4	15400	4.4								
	MLZ038T4	30	7000	3.4	8600	3.4	10500	3.4	12700	3.4	15300	3.4	18100	3.4	21400	3.4	25100	3.3								
		40	6000	4.2	7500	4.2	9200	4.2	11100	4.2	13300	4.2	15800	4.3	18600	4.2	21800	4.2								
		50	-	-	6200	5.2	7700	5.2	9300	5.2	11200	5.3	13300	5.3	15600	5.3	18300	5.2								
	MLZ045T4	30	8500	4.0	10500	4.0	12800	4.0	15500	4.1	18600	4.1	22000	4.1	26000	4.1	30400	4.1								
		40	7400	4.9	9100	5.0	11100	5.0	13400	5.1	16100	5.1	19100	5.1	22600	5.1	26400	5.1								
		50	-	-	7600	6.3	9300	6.3	11300	6.3	13500	6.3	16100	6.3	19000	6.3	22300	6.3								
	MLZ048T4	30	9300	4.3	11400	4.4	14000	4.4	16900	4.4	20300	4.5	24100	4.5	28400	4.4	33100	4.3								
		40	8100	5.4	9900	5.4	12100	5.5	14700	5.5	17600	5.6	21000	5.6	24700	5.6	28800	5.5								
		50	-	-	8300	6.8	10100	6.8	12300	6.8	14800	6.9	17600	6.9	20800	6.9	24300	6.8								
	MLZ058T4	30	10800	5.2	13600	5.3	16800	5.4	20500	5.5	24800	5.6	29600	5.7	35000	5.8	40900	5.8								
		40	9000	6.6	11400	6.5	14200	6.6	17400	6.6	21100	6.8	25300	6.9	29900	7.0	35100	7.0								
		50	-	-	8900	8.3	11200	8.2	13900	8.2	17000	8.2	20400	8.3	24300	8.4	28500	8.5								
	MLZ066T4	30	12600	6.0	15500	6.1	18900	6.2	22900	6.4	27600	6.5	32800	6.7	38800	6.8	45500	6.9								
		40	10900	7.3	13500	7.4	16500	7.5	19900	7.6	23900	7.8	28500	7.9	33600	8.1	39300	8.2								
		50	-	-	11200	9.1	13800	9.2	16700	9.3	20100	9.4	23800	9.5	28100	9.6	32900	9.7								
	MLZ076T4	30	14600	6.7	17900	6.9	21800	7.1	26400	7.2	31700	7.4	37800	7.6	44800	7.9	52900	8.3								
		40	12600	8.2	15500	8.4	18900	8.6	22800	8.7	27300	8.8	32500	9.0	38500	9.2	45300	9.6								
		50	-	-	12900	10.4	15700	10.5	18900	10.6	22600	10.7	26800	10.8	31700	11.0	37300	11.1								

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Model	To	-20		-15		-10		-5		0		5		10		
	Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	
50Hz	MLZ/MLM015T4	30	2600	1.1	3200	1.1	3800	1.1	4600	1.1	5500	1.2	6600	1.2	7800	1.2
		40	-	-	2800	1.4	3500	1.4	4200	1.4	5100	1.4	6000	1.4	7100	1.4
		50	-	-	-	-	-	-	3800	1.7	4500	1.7	5400	1.8	6400	1.8
	MLZ/MLM021T4	30	3600	1.4	4400	1.5	5300	1.5	6400	1.5	7600	1.6	9000	1.6	10600	1.6
		40	-	-	4000	1.8	4800	1.8	5800	1.9	6900	1.9	8200	1.9	9800	1.9
		50	-	-	-	-	-	-	5200	2.3	6200	2.3	7400	2.3	8800	2.3
	MLZ/MLM026T4	30	4400	1.8	5400	1.8	6600	1.8	7900	1.8	9600	1.8	11500	1.7	13800	1.8
		40	-	-	4900	2.2	6000	2.2	7200	2.2	8800	2.2	10600	2.2	12700	2.2
		50	-	-	-	-	-	-	6500	2.7	7900	2.7	9500	2.7	11400	2.7
	MLZ/MLM030T4	30	5100	2.1	6400	2.1	7900	2.2	9700	2.3	11600	2.3	13800	2.4	16200	2.5
		40	-	-	5800	2.6	7200	2.7	8800	2.7	10700	2.8	12700	2.8	14900	2.9
		50	-	-	-	-	-	-	7900	3.3	9600	3.4	11500	3.4	13600	3.4
	MLZ/MLM038T4	30	5800	2.4	7400	2.5	9200	2.6	11300	2.7	13700	2.8	16300	2.8	19100	2.9
		40	-	-	6800	3.0	8500	3.1	10400	3.2	12600	3.3	14900	3.4	17500	3.4
		50	-	-	-	-	-	-	9400	3.9	11400	4.0	13600	4.0	15900	4.1
	MLZ/MLM045T4	30	7000	3.1	8800	3.1	11000	3.1	13600	3.1	16500	3.1	19700	3.1	23200	3.2
		40	-	-	7900	3.7	9900	3.8	12300	3.8	15000	3.8	18000	3.8	21200	3.8
		50	-	-	-	-	-	-	10800	4.6	13300	4.6	16100	4.7	19100	4.7
	MLZ/MLM048T4	30	8100	3.3	10000	3.4	12200	3.4	14800	3.4	17800	3.4	21300	3.4	25300	3.5
		40	-	-	9000	4.1	11100	4.1	13500	4.1	16300	4.1	19500	4.1	23200	4.2
		50	-	-	-	-	-	-	12200	5.1	14700	5.1	17600	5.1	20900	5.1
	MLZ/MLM058T4	30	9200	3.9	11500	4.0	14300	4.0	17400	4.0	21100	3.9	25300	4.0	30200	4.1
		40	-	-	10500	4.8	13000	4.8	15900	4.8	19300	4.8	23200	4.8	27800	4.9
		50	-	-	-	-	-	-	14100	5.9	17300	5.9	20900	5.9	25100	6.0
	MLZ/MLM066T4	30	10200	4.3	12900	4.4	16200	4.4	20000	4.5	24300	4.5	29100	4.6	34400	4.7
		40	-	-	11900	5.3	14900	5.4	18300	5.4	22300	5.5	26800	5.5	31600	5.7
		50	-	-	-	-	-	-	16500	6.6	20200	6.7	24200	6.7	28700	6.8
	MLZ/MLM076T4	30	12400	5.3	15400	5.3	19000	5.2	23200	5.1	27900	5.1	33300	5.1	39300	5.3
		40	-	-	14100	6.4	17400	6.3	21300	6.3	25600	6.2	30500	6.3	36100	6.4
		50	-	-	-	-	-	-	19100	7.7	23100	7.6	27600	7.7	32600	7.8
60Hz	MLZ/MLM015T4	30	3000	1.2	3800	1.3	4600	1.3	5600	1.3	6700	1.4	7900	1.4	9300	1.5
		40	-	-	3400	1.5	4200	1.6	5100	1.6	6100	1.7	7200	1.7	8500	1.7
		50	-	-	-	-	-	-	4500	2.0	5500	2.0	6500	2.0	7700	2.0
	MLZ/MLM021T4	30	4100	1.7	5200	1.7	6400	1.8	7800	1.8	9400	1.8	11200	1.9	13200	2.0
		40	-	-	4800	2.1	5900	2.2	7200	2.2	8700	2.2	10300	2.2	12100	2.3
		50	-	-	-	-	-	-	6400	2.6	7800	2.7	9300	2.7	11000	2.7
	MLZ/MLM026T4	30	5100	2.0	6300	2.1	7800	2.1	9500	2.2	11500	2.2	13700	2.2	16300	2.2
		40	-	-	5900	2.6	7300	2.6	8900	2.7	10600	2.7	12600	2.8	14900	2.7
		50	-	-	-	-	-	-	8100	3.3	9700	3.4	11500	3.4	13500	3.4
	MLZ/MLM030T4	30	6000	2.4	7500	2.5	9400	2.6	11500	2.7	13800	2.7	16400	2.8	19300	2.9
		40	-	-	6900	3.1	8600	3.1	10500	3.2	12700	3.3	15100	3.3	17800	3.4
		50	-	-	-	-	-	-	9500	3.9	11500	4.0	13800	4.0	16200	4.1
	MLZ/MLM038T4	30	6900	2.8	8800	2.9	11000	3.0	13500	3.1	16300	3.3	19400	3.4	22800	3.4
		40	-	-	8100	3.6	10100	3.7	12400	3.8	15000	3.9	17900	4.0	20900	4.0
		50	-	-	-	-	-	-	11200	4.6	13600	4.7	16200	4.8	19000	4.8
	MLZ/MLM045T4	30	8600	3.5	10800	3.6	13500	3.6	16500	3.7	20000	3.8	23800	3.9	28000	4.0
		40	-	-	9800	4.4	12300	4.5	15100	4.5	18400	4.6	21900	4.6	25800	4.7
		50	-	-	-	-	-	-	13600	5.5	16500	5.6	19800	5.6	23400	5.7
	MLZ/MLM048T4	30	9700	3.8	12200	3.8	15000	3.9	18300	4.0	21900	4.1	26000	4.2	30500	4.4
		40	-	-	10900	4.7	13600	4.8	16700	4.9	20100	5.0	23900	5.1	28200	5.1
		50	-	-	-	-	-	-	14900	6.0	18100	6.1	21600	6.2	25600	6.2
	MLZ/MLM058T4	30	10900	4.5	13800	4.6	17200	4.7	21100	4.9	25600	5.0	30600	5.1	36200	5.3
		40	-	-	12600	5.6	15700	5.8	19300	5.9	23500	6.0	28200	6.1	33400	6.2
		50	-	-	-	-	-	-	17300	7.2	21100	7.3	25500	7.3	30400	7.4
	MLZ/MLM066T4	30	12200	5.0	15500	5.2	19400	5.4	24000	5.5	29200	5.7	35000	5.8	41300	6.0
		40	-	-	14200	6.3	17800	6.5	22100	6.7	26900	6.8	32300	7.0	38200	7.1
		50	-	-	-	-	-	-	20000	8.1	24500	8.2	29400	8.4	34700	8.5
	MLZ/MLM076T4	30	14500	6.1	18300	6.2	22800	6.3	28000	6.4	33900	6.5	40400	6.7	47400	6.9
		40	-	-	16900	7.5	21000	7.6	25800	7.7	31200	7.9	37100	8.0	43500	8.1
		50	-	-	-	-	-	-	23400	9.4	28300	9.6	33700	9.7	39600	9.8

Legend: To: Evaporating temperature in °C

Qo: Cooling capacity in W

RGT = 20°C

Tc: Condensing temperature in °C

Pe: Power input in kW

Subcooling = 0 K

Capacity data at other conditions are available in the datasheets at: www.danfoss.com/odsg

R134a

Model	To	-10		-5		0		5		10		15	
	Tc	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe	Qo	Pe
50Hz	MLZ/MLM015T4	30	2400	0.7	3000	0.8	3700	0.8	4500	0.8	5400	0.8	-
		40	-	-	2700	0.9	3300	0.9	4100	0.9	4900	1.0	5900
		50	-	-	2400	1.1	3000	1.2	3600	1.2	4400	1.2	5200
	MLZ/MLM021T4	30	3300	1.0	4100	1.0	5000	1.0	6100	1.0	7400	1.0	-
		40	-	-	3700	1.2	4600	1.2	5600	1.3	6700	1.3	8000
		50	-	-	3300	1.5	4000	1.5	4900	1.5	6000	1.5	7200
	MLZ/MLM026T4	30	4100	1.2	5100	1.2	6200	1.2	7600	1.2	9100	1.3	-
		40	-	-	4600	1.5	5600	1.5	6900	1.5	8300	1.5	9900
		50	-	-	4100	1.8	5000	1.9	6100	1.9	7400	1.9	8900
	MLZ/MLM030T4	30	4900	1.4	6100	1.4	7500	1.5	9100	1.5	11000	1.5	-
		40	-	-	5500	1.8	6800	1.8	8300	1.8	10000	1.8	12000
		50	-	-	4900	2.2	6000	2.2	7400	2.2	8900	2.2	10700
	MLZ/MLM038T4	30	5800	1.7	7200	1.8	8800	1.8	10700	1.8	12900	1.8	-
		40	-	-	6500	2.2	8000	2.2	9700	2.2	11700	2.2	14000
		50	-	-	5700	2.6	7100	2.7	8700	2.7	10500	2.7	12500
	MLZ/MLM045T4	30	7100	2.0	8900	2.0	11000	2.0	13300	2.0	16000	2.0	-
		40	-	-	8000	2.5	9900	2.5	12100	2.5	14600	2.5	17400
		50	-	-	7100	3.0	8800	3.1	10800	3.1	13000	3.1	15600
	MLZ/MLM048T4	30	7600	2.1	9500	2.2	11600	2.2	14100	2.2	16900	2.2	-
		40	-	-	8500	2.7	10500	2.7	12800	2.7	15400	2.7	18300
		50	-	-	7500	3.3	9300	3.3	11400	3.4	13800	3.4	16400
	MLZ/MLM058T4	30	9100	2.6	11300	2.7	13800	2.8	16600	2.8	20000	2.9	-
		40	-	-	10100	3.3	12400	3.4	15100	3.4	18100	3.5	21600
		50	-	-	9000	4.1	11100	4.2	13400	4.2	16100	4.2	19200
	MLZ/MLM066T4	30	10500	3.0	13000	3.1	16000	3.1	19300	3.2	23200	3.2	-
		40	-	-	11800	3.8	14500	3.9	17500	3.9	21100	3.9	25000
		50	-	-	10400	4.6	12800	4.7	15600	4.8	18800	4.8	22300
	MLZ/MLM076T4	30	11800	3.4	14600	3.5	17900	3.6	21600	3.7	25800	3.7	-
		40	-	-	13100	4.3	16100	4.4	19600	4.4	23500	4.5	28000
		50	-	-	11600	5.3	14300	5.4	17400	5.4	21000	5.4	25000
60Hz	MLZ/MLM015T4	30	3000	0.9	3700	0.9	4600	0.9	5500	0.9	6600	1.0	-
		40	-	-	3400	1.1	4200	1.1	5100	1.1	6100	1.2	7200
		50	-	-	3000	1.3	3700	1.4	4600	1.4	5500	1.4	6500
	MLZ/MLM021T4	30	4100	1.2	5100	1.2	6200	1.2	7600	1.3	9100	1.3	-
		40	-	-	4600	1.5	5700	1.5	6900	1.5	8300	1.5	9900
		50	-	-	4100	1.8	5100	1.8	6200	1.9	7500	1.9	8900
	MLZ/MLM026T4	30	5000	1.4	6300	1.5	7700	1.5	9300	1.5	11200	1.6	-
		40	-	-	5700	1.8	7000	1.8	8600	1.9	10300	1.9	12200
		50	-	-	5100	2.2	6300	2.2	7700	2.3	9300	2.3	11000
	MLZ/MLM030T4	30	6000	1.8	7500	1.8	9300	1.8	11300	1.9	13500	1.9	-
		40	-	-	6800	2.2	8500	2.2	10300	2.2	12400	2.3	14700
		50	-	-	6100	2.6	7600	2.7	9300	2.7	11200	2.8	13300
	MLZ/MLM038T4	30	7100	2.1	8800	2.1	10900	2.2	13200	2.2	15900	2.3	-
		40	-	-	8000	2.6	9900	2.6	12100	2.7	14600	2.7	17300
		50	-	-	7200	3.1	8900	3.2	10900	3.2	13200	3.3	15700
	MLZ/MLM045T4	30	8800	2.5	11000	2.5	13500	2.5	16300	2.6	19500	2.7	-
		40	-	-	9900	3.1	12200	3.1	14800	3.1	17800	3.2	21100
		50	-	-	8600	3.7	10700	3.8	13100	3.8	15800	3.9	18900
	MLZ/MLM048T4	30	9300	2.6	11600	2.7	14200	2.7	17200	2.8	20600	2.9	-
		40	-	-	10400	3.3	12900	3.3	15600	3.4	18800	3.4	22200
		50	-	-	9200	4.0	11300	4.1	13900	4.1	16700	4.2	19900
	MLZ/MLM058T4	30	11100	3.1	13700	3.2	16800	3.4	20200	3.5	24000	3.6	-
		40	-	-	12400	4.0	15200	4.1	18300	4.2	21900	4.2	25900
		50	-	-	11000	4.8	13500	5.0	16300	5.1	19600	5.1	23300
	MLZ/MLM066T4	30	12700	3.6	15700	3.7	19200	3.8	23200	4.0	27600	4.1	-
		40	-	-	14200	4.5	17400	4.7	21100	4.8	25200	4.9	29800
		50	-	-	12600	5.5	15500	5.7	18800	5.8	22500	5.9	26700
	MLZ/MLM076T4	30	14300	4.1	17600	4.2	21500	4.4	26000	4.5	31000	4.7	-
		40	-	-	16000	5.2	19600	5.3	23600	5.5	28300	5.6	33400
		50	-	-	14200	6.4	17400	6.5	21100	6.6	25300	6.7	29800

Legend: To: Evaporating temperature in °C

Qo: Cooling capacity in W

RGT = 20°C

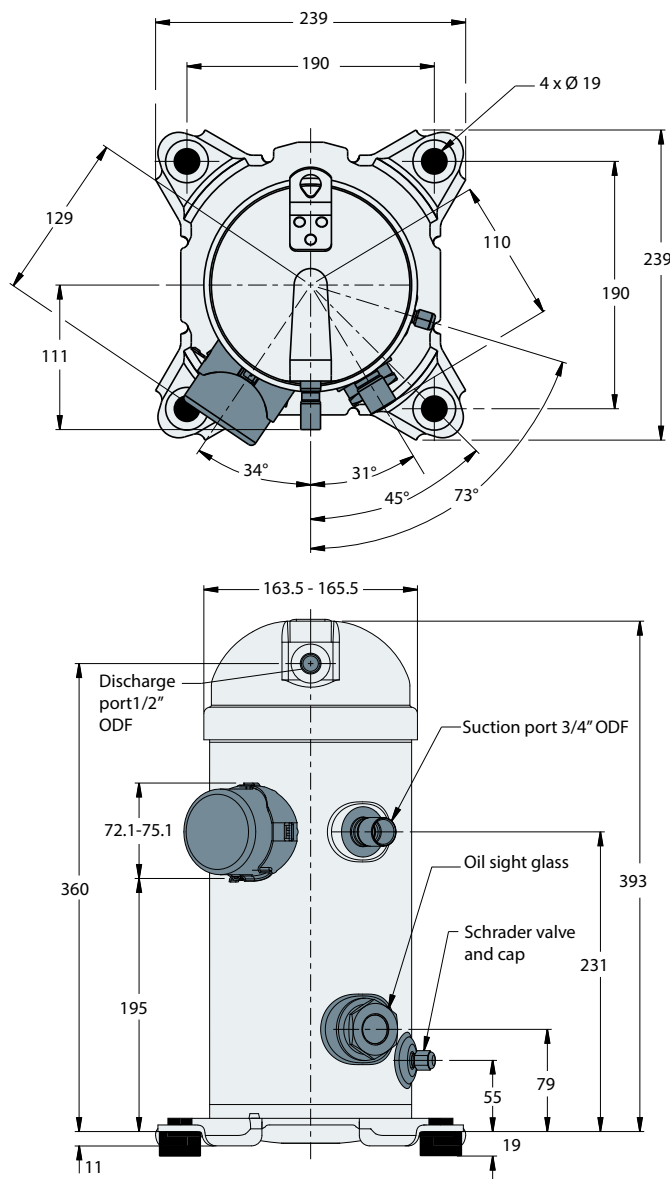
Tc: Condensing temperature in °C

Pe: Power input in kW

Subcooling = 0 K

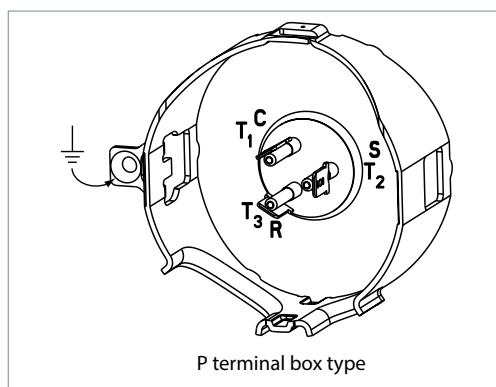
Capacity data at other conditions are available in the datasheets at: www.danfoss.com/odsg

MLZ/MLM015-021-026



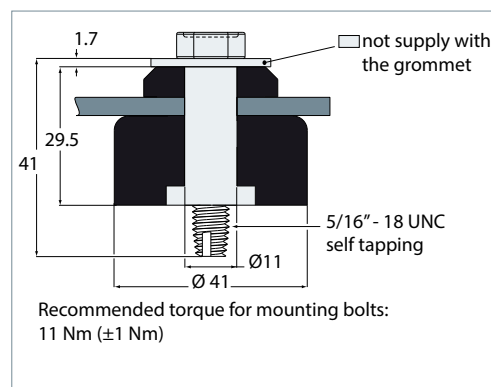
All dimensions in mm

Terminal box (spade terminals)



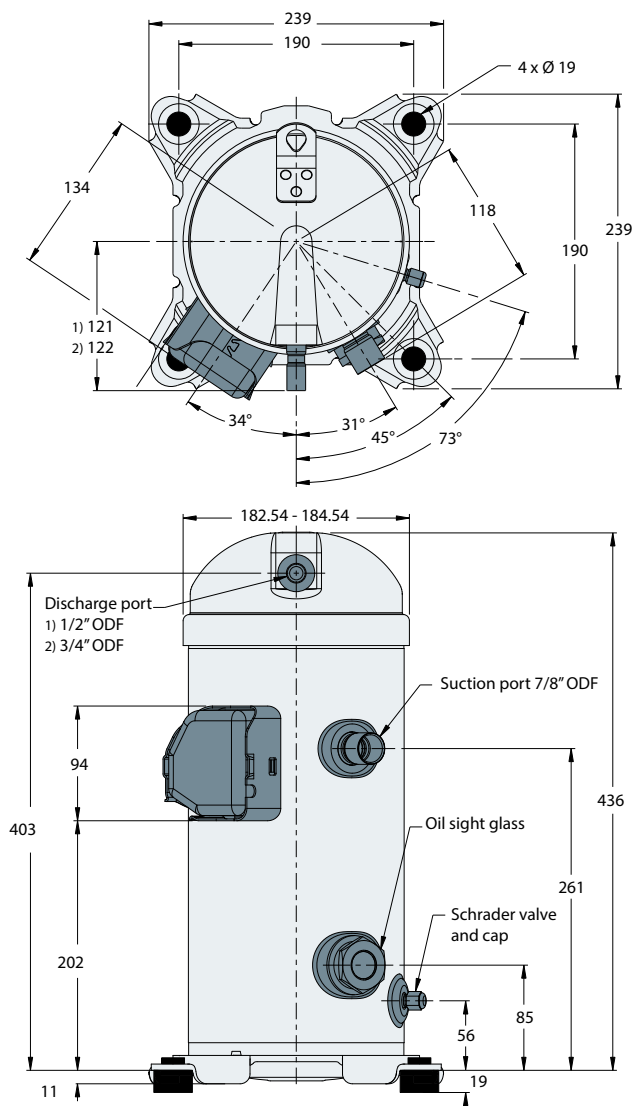
P terminal box type

Mounting grommet



Refer to section "Ordering information and packaging" for overview of shipped mounting accessories

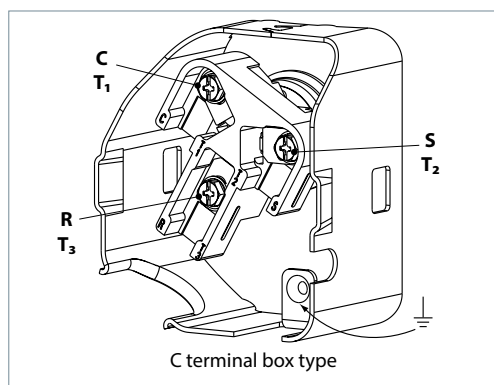
MLZ/MLM030-038-045-048



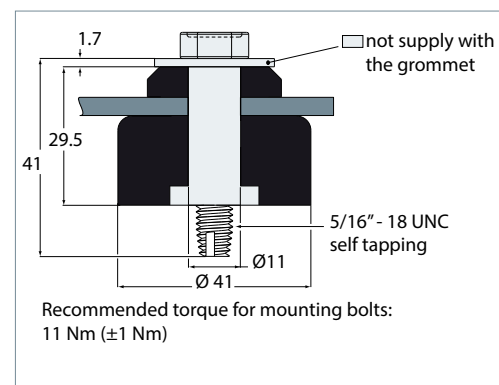
- 1) MLZ/MLM 030-038-042-045
2) MLZ/MLM 048

All dimensions in mm

Terminal box (screw terminals)

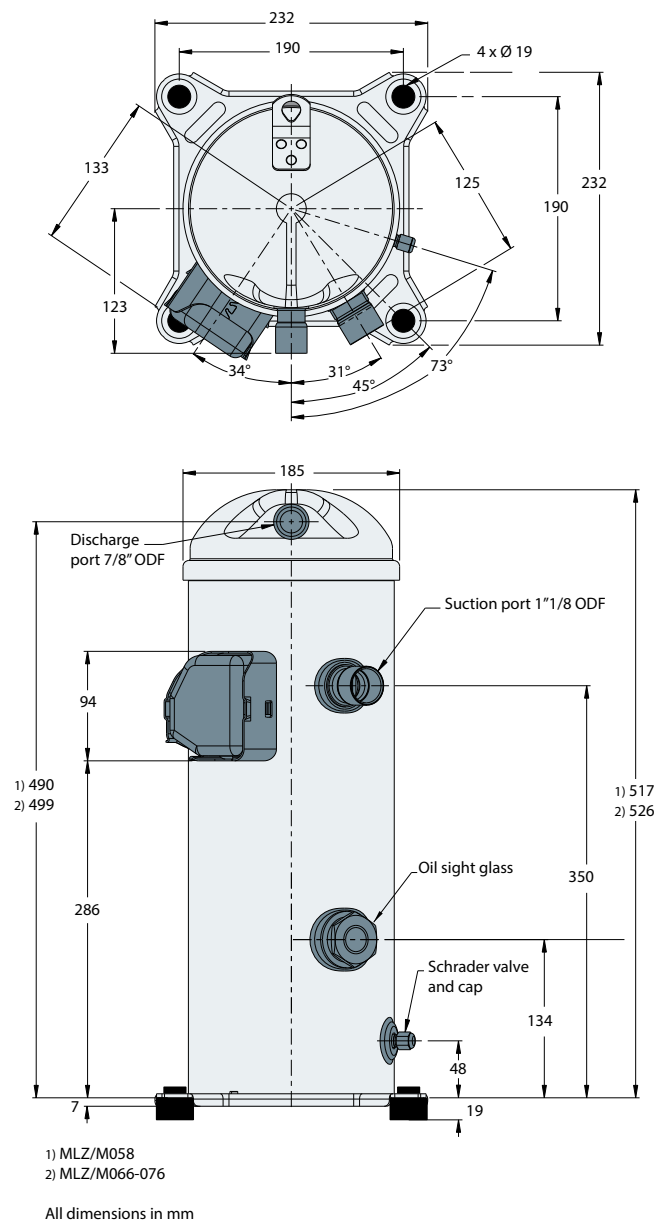


Mounting grommet

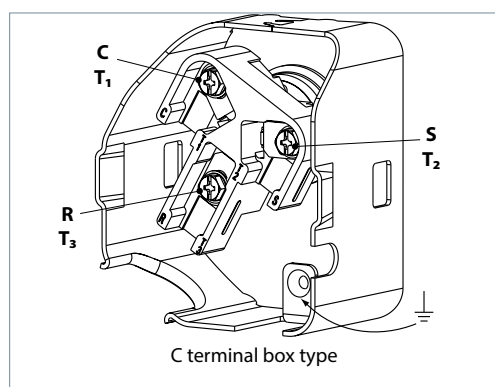


Refer to section "Ordering information and packaging" for overview of shipped mounting accessories

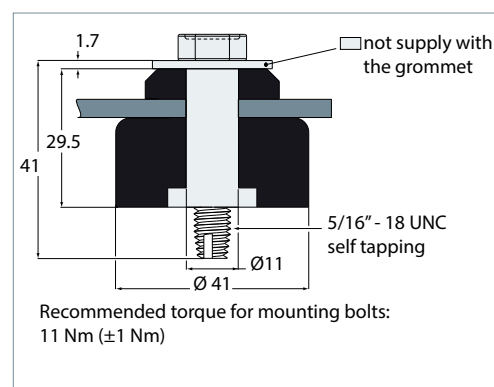
MLZ/MLM058-066-076



Terminal box (screw terminals)



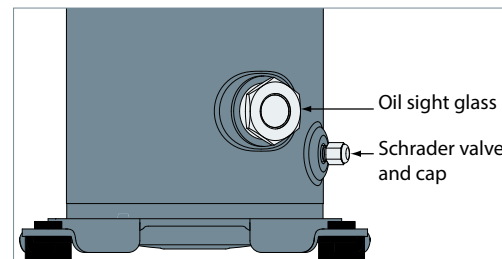
Mounting grommet



Refer to section "Ordering information and packaging" for overview of shipped mounting accessories

Oil sight glass

MLZ / MLM scroll compressors come equipped with a threaded oil sight glass with 1"1/8 - 18 UNEF connection. It can be used for a visual check of the oil amount and condition or it may be replaced by an accessory oil management device. The oil level must be visible in the sight glass during operation.
Torque requirement= 52.5 ±2.5Nm



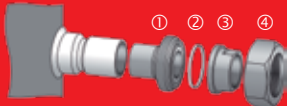

Schrader

The oil fill and drain connection and gauge port is a 1/4" male flare connector incorporating a schrader valve.
Torque requirements:
Schrader valve core: 0.6 ±0.2 Nm
Schrader valve cover: 14.5 ±1Nm

Suction and discharge connections

MLZ / MLM scroll compressors are factory delivered with brazed connections only.

Dedicated rotolock adaptors and adaptor sets are available as accessory.

						
Compressor models	Brazed connection size		RotoLock adaptor set (①adaptor, ②gasket, ③sleeve, ④nut)			RotoLock adaptor (① adaptor only)
			RotoLock	Solder sleeve ODF	Code Number	Code Number
MLZ/MLM 015-021-026	Suction	3/4"	1-1/4"	3/4"	120Z0126	120Z0366
	Discharge	1/2"	1"	1/2"		120Z0365
MLZ/MLM 030-038-045	Suction	7/8"	1-1/4"	7/8"	120Z0127	120Z0367
	Discharge	1/2"	1"	1/2"		120Z0365
MLZ/MLM 048	Suction	7/8"	1-1/4"	7/8"	120Z0128	120Z0367
	Discharge	3/4"	1-1/4"	3/4"		120Z0366
MLZ/MLM 058-066-076	Suction	1-1/8"	1-3/4"	1-1/8"	120Z0129	120Z0364
	Discharge	7/8"	1-1/4"	7/8"		120Z0367

Tightening torque for rotolock connection: 90Nm ±20

Motor voltage

MLZ/MLM scroll compressors are available in 6 different motor voltages.

		Motor voltage code 4	Motor voltage code 5	Motor voltage code 9
Nominal voltage	50 Hz	380-400 V - 3 ph *	220-240 V - 1 ph	-
Voltage range	50 Hz	340 - 460 V	198 - 264 V	-
Nominal voltage	60 Hz	460 V - 3 ph	-	380 V - 3 ph
Voltage range	60 Hz	414 - 506 V	-	342 - 418 V

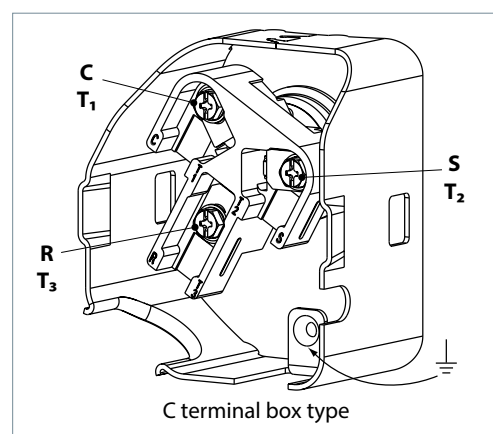
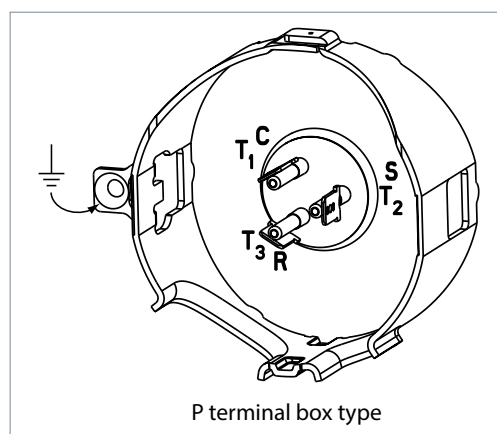
* most of the range is now qualified for 380V-415V, please ask us for confirmation per model.

Wiring connections

MLZ/MLM scroll compressors will only compress gas while rotating counter-clockwise (when viewed from the compressor top). Since single-phase motors will start and run in only one direction, reverse rotation is not a major consideration. Three-phase motors, however, will start and run in either direction, depending on the phase angles of the supplied power. Care must be taken during installation to ensure that

the compressor operates in the correct direction (see "Phase sequence and reverse rotation protection").

The drawings below show electrical terminal labelling and should be used as a reference when wiring the compressor. For three phase applications, the terminals are labelled T1, T2, and T3. For single-phase applications the terminals are labelled C (common), S (start), and R (run).

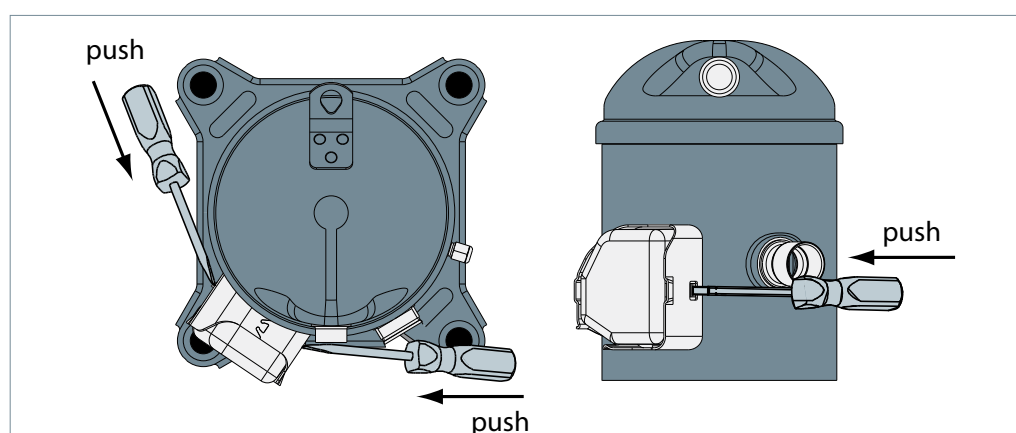


Terminal cover mounting

The terminal cover and gasket should be installed prior to operation of the compressor. Respect the "up" marking on gasket and cover and ensure

that the two outside tabs of the cover engage the terminal box.

Terminal cover removal



IP rating

The compressor terminal box IP rating according to CEI 529 is **IP22** for all models.

- First numeral, level of protection against contact and foreign objects
2 protection against object size over 12.5 mm (fingers of similar)
- Second numeral, level of protection against water
2 protection against dripping water when tilted up to 15°

The IP rating can be upgraded to IP54 with accessory kit (see section Spare parts & Accessories).

Three phase electrical characteristics

Compressor model		LRA	MCC	Max Oper A	Winding resistance (Ohm)		
		A	A	A	T1-T3	T1-T2	T2-T3
Motor voltage code 4 380-400 V / 3ph / 50 Hz. 460 V / 3 ph / 60 Hz	MLZ/MLM015T4	30	7.0	4.9	5.0	6.7	6.7
	MLZ/MLM021T4	45	9.5	6.8	3.4	4.7	4.7
	MLZ/MLM026T4	45	11.0	8.3	3.4	4.7	4.7
	MLZ/MLM030T4	60	13.0	9.8	2.6	2.6	2.6
	MLZ/MLM038T4	70	15.0	11.7	2.3	2.3	2.4
	MLZ/MLM045T4	82	15.0	14.1	1.9	1.9	1.8
	MLZ/MLM048T4	87	16.0	15.3	1.7	1.7	1.7
	MLZ/MLM058T4	95	20.0	18.1	1.4	1.4	1.4
	MLZ/MLM066T4	110	24.0	20.3	1.3	1.3	1.3
Motor voltage code 9 380 V / 3ph / 60 Hz	MLZ/MLM015T9	40	7.5	6.0	3.2	4.4	4.4
	MLZ/MLM021T9	52	12	8.3	2.2	3.0	3.0
	MLZ/MLM026T9	52	12.5	10.1	2.2	3.0	3.0
	MLZ/MLM030T9	81	14	11.8	1.5	1.5	1.5
	MLZ/MLM038T9	81	17	14.2	1.5	1.5	1.5
	MLZ/MLM045T9	96	20	17.0	1.3	1.3	1.3
	MLZ/MLM048T9	110	19	18.5	1.1	1.1	1.1
	MLZ/MLM058T9	135	25	21.9	0.91	0.93	0.93
	MLZ/MLM066T9	135	28	24.6	0.88	0.89	0.87
	MLZ/MLM076T9	135	28	28.9	0.88	0.89	0.87

Single phase electrical characteristics

Compressor model		LRA	MCC	Max.Oper.A	Winding resistance (Ω)	
		A	A	A	Run	Start
Motor code 5 220-240 V / 1 ph / 50 Hz	MLZ/MLM015T5	60	19.0	13.8	1.02	1.60
	MLZ/MLM021T5	97	25.0	19.5	0.69	1.51
	MLZ/MLM026T5	97	26.0	24.2	0.69	1.51
	MLZ/MLM030T5	127	32.0	28.9	0.42	1.31
	MLZ/MLM038T5	130	38.0	33.9	0.39	1.02

LRA (Locked Rotor Amp)

LRA is the higher average current as measured on a mechanically blocked compressor tested under nominal voltage. LRA is printed on the nameplate.

The LRA value can be used as a rough estimation for the starting current. However in most cases, the real starting current will be lower. Many countries have defined limits for the starting current in domestic use. A soft starter can be applied to reduce starting current.

MCC (Maximum Continuous Current)

The MCC is the current at which the internal motor protection trips under maximum load and low voltage conditions.

This MCC value is the maximum at which the compressor can be operated in transient conditions and out of the application envelope. Above this value the overload will switch off to protect the motor.

Max Oper. A (Maximum Operating Amp)

The Max Oper. A is the current when the compressor operates at maximum load conditions and 10% below nominal voltage.

This value which is the max rated load current for the compressor is new on the nameplate.

Max Oper. A can be used to select cables and contactors.

In normal operation, the compressor current consumption is always less than the Max Oper. A value.

Winding resistance

Winding resistance is the resistance between indicated terminal pins at 25°C (resistance value +/- 7%).

Winding resistance is generally low and it requires adapted tools for precise measurement. Use a digital ohm-meter, a '4 wires' method and measure under stabilised ambient temperature. Winding resistance varies strongly with winding temperature ; If the compressor is stabilised at a different value than 25°C, the measured resistance must be corrected with following formula:

$$R_{t_{amb}} = R_{25^{\circ}\text{C}} \frac{a + t_{amb}}{a + t_{25^{\circ}\text{C}}}$$

$t_{25^{\circ}\text{C}}$: reference temperature = 25°C

t_{amb} : temperature during measurement (°C)

$R_{25^{\circ}\text{C}}$: winding resistance at 25°C

$R_{t_{amb}}$: winding resistance at t_{amb}

coefficient $a = 234.5$

Electrical connections

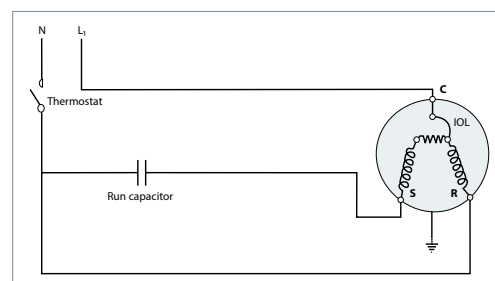
MLZ / MLM single phase scroll compressors are designed to operate without any assistance. If

starting within the defined voltage range, PSC wiring is sufficient.

PSC wiring

PSC wiring with a run capacitor only is the default wiring solution for single phase MLZ and MLM compressors.

The start winding (C-S) of the motor remains in circuit through a permanent (run) capacitor. This permanent (run) capacitor is connected between the start winding (S) and the run winding (R).



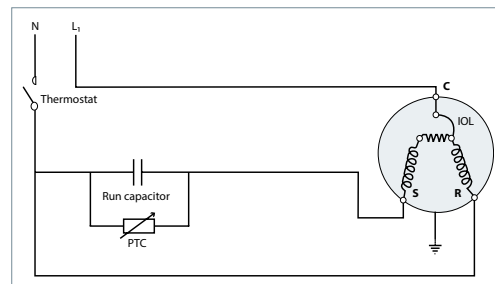
PTCSCR wiring

If the starting torque of the PSC wiring is not sufficient due to pressures not fully equalized during the off-cycle or some voltage drop during starting, the PTCSCR wiring might be an option. PTCSCR wiring provides more motor torque than PSC wiring but less than CSR wiring. The PTC is wired in parallel to the run capacitor.

When starting the compressor, the PTC, which is at low resistance, provides additional starting current to the motor's start winding. The current passing through the PTC causes it to heat up and, at a certain temperature, change to a very high resistance. At this time the motor is up to nominal speed and the run capacitor determines the current through the start winding. The PTC remains at high temperature and thus at high resistance as long as power is connected to the compressor. When the compressor is switched off, the PTC cools down to its initial low resistance and becomes available to support the next compressor start.

It is important to provide sufficient time between motor starts to allow the PTC to cool down close to ambient temperature. Depending on the ambient conditions and the cooling of the PTC, this may take about 5 minutes. A restart before the PTC is back to low resistance may be successful or the motor may stall in a locked-rotor state depending on the ambient and system's conditions. A locked-rotor state causes the internal protector to open and would cause even further delay until the overload is reset.

The following PTC types are recommended for the MLZ/MLM single phase compressors:



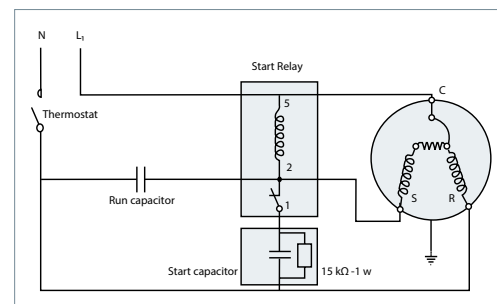
Model	Voltage code 5 220-240 V/1~/50 Hz
MLZ/MLM015	305C9* / 305C11*
MLZ/MLM021	305C9* / 305C11*
MLZ/MLM026	305C9* / 305C11*
MLZ/MLM030	305C9* / 305C11*
MLZ/MLM038	305C9* / 305C11*

Note: MLZ compressors with PTCSCR are not approved by UL. It is the customers' responsibility to get final approval for the system when required.

CSR wiring

CSR wiring provides additional motor torque at start-up, by the use of a start capacitor in combination with the run capacitor. The start capacitor is only connected during the starting operation, a potential relay is used to disconnect it after the start sequence.

Some applications with high differential pressure and start duty as "soft serve ice cream machine" can require CSR wiring. This configuration can also be used to reduce erratic starting at unfavourable conditions such as very low ambient temperature or weak voltage.



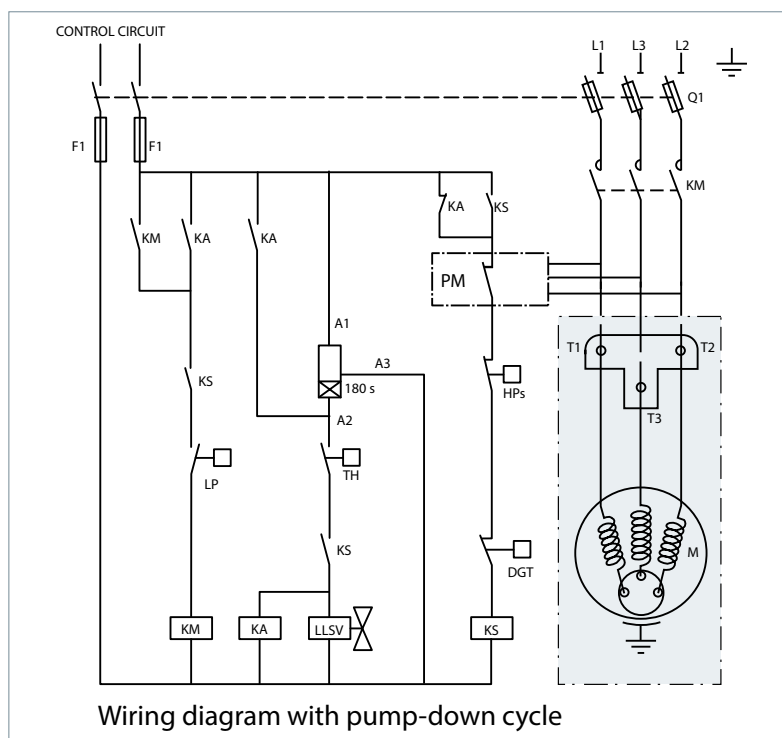
Nominal capacitor value and relays

	Compressor models	Default solution: PSC wiring with run capacitor only		Additional components for CSR wiring			
		PSC wiring		CSR wiring			
		Run capacitor		Start capacitor		Relay	
		μF	Volt	μF	Volt	Reference	
220-240 V / 1/50 Hz Motor voltage code 5	MLZ/MLM015	40	370	145-175	330	3ARR3J3AL4	RVA9CKL
	MLZ/MLM021-026	70	370	145-175	330	3ARR3J3AL4	RVA9CKL
	MLZ/MLM030	50	440	161-193	250	3ARR3J24AP4	RVA3EKL
	MLZ/MLM038	55	440	88-108	330	3ARR3J25AS4	RVA4GKL

Three phase

Suggested wiring diagram with "one shot" pump down cycle and safety lock-out relay

Control device..... TH
Optional short cycle timer (3 min) 180 s
Control relay KA
Liquid Line Solenoid valve..... LLSV
Compressor contactor..... KM
Phase monitor..... PM
Safety lock out relay..... KS
Pump-down control low pressure switch .. LP
High pressure safety switch..... HPs
Fused disconnect Q1
Fuses F1
Compressor motor M
Discharge gas thermostat..... DGT



Internal motor protection

MLZ/MLM scroll compressors are equipped with an internal line break protector mounted on the motor windings. The protector is an automatic reset device, containing a snap action bimetal switch.

Internal protectors respond to over-current and overheating. They are designed to interrupt

motor current under a variety of fault conditions, such as failure to start, running overload, and fan failure.

If the internal overload protector trips out, it must cool down to about 60°C to reset. Depending on ambient temperature, this may take up to several hours.

Phase sequence and reverse rotation protection

The compressor will only operate properly in a single direction. Use a phase meter to establish the phase orders and connect line phases L1, L2 and L3 to terminals T1, T2 and T3, respectively. For three-phase compressors, the motor will run equally well in both directions. Reverse rotation results in excessive noise; no pressure differential between suction and discharge; and suction line warming rather than immediate cooling. A service technician should be present at initial start-up to verify that supply power is properly phased and that compressor and auxiliaries are rotating in the correct direction.

MLZ/MLM015-038 scroll compressors are designed to operate for a maximum of 150 hours in reverse, but as a reverse rotation situation can go unnoticed for longer periods, phase monitors are recommended.

For compressors MLZ/MLM048 and larger, phase monitors are required. The selected phase monitor should lock out the compressor from operation in reverse.

At brief power interruptions, reverse rotation can occur with single phase compressors. In this case the internal protector will stop the compressor. It will have to cool down and will restart safely afterwards.

Voltage imbalance

For three-phase applications the voltage measured at the compressor terminals for each

phase should be within $\pm 2\%$ of the average for all phases.

Approvals and certificates

MLZ scroll compressors comply with the following approvals and certificates.

Certificates are listed on the product datasheets:
<http://www.danfoss.com/odsg>

CE 0062 or CE 0038 (European Directive)	CE	All MLZ models
UL (Underwriters Laboratories)	UL US	Models with motor code 1, 2 & 4 except when using PTCSCR system
Other approvals / certificates		Contact Danfoss

Conformity to directives

Pressure equipment directive 97/23/EC
Machinery directive 98/35/EC annex II b

Low voltage directive 2006 / 95 EC
Electromagnetic compatibility 2004/108/CE

Products	MLZ / MLM 015 to 076
Refrigerating fluids	Group 2
Category PED	I
Evaluation module	no scope
Service temperature - Ts	-35°C < Ts < 55°C
MLZ - Service pressure - Ps	25.44 bar(g)
MLM - Service pressure - Ps	20.74 bar(g)
Declaration of conformity	contact Danfoss
Marking of conformity	CE

Internal free volume

Products	Internal free volume at LP side without oil (litre)
MLZ/MLM 015 - 026	1.85
MLZ/MLM 030-048	1.85
MLZ/MLM 058-076	6.15

The scroll compressor application range is influenced by several parameters which need to be monitored for a safe and reliable operation. These parameters and the main recommendations for good practice and safety devices are explained hereunder.

- **Refrigerant and lubricants**
- **Motor supply**
- **Compressor ambient temperature**
- **Application envelope** (evaporating temperature, condensing temperature, return gas temperature)

Refrigerant and lubricants

General information

When choosing a refrigerant, different aspects must be taken into consideration:

- Legislation (now and in the future)
- Safety
- Application envelope in relation to expected running conditions
- Compressor capacity and efficiency
- Compressor manufacturer recommendations & guidelines

Additional points could influence the final choice:

- Environmental considerations
- Standardisation of refrigerants and lubricants
- Refrigerant cost
- Refrigerant availability

R22

R22 is an HCFC refrigerant and is still a wide use today. It has a low ODP (Ozone Depletion Potential) and therefore it will be phased out in the future. Check local legislation.

When R22 is applied in refrigeration applications it can lead to high discharge temperature. Carefully check all other parameters that can influence the discharge temperature.

R134a

Refrigerant R134a is an HFC refrigerant. R134a has zero ozone depletion potential (ODP = 0) and is commonly accepted as the best R12 alternative. R134a is a pure refrigerant and

has zero temperature glide. For applications with high evaporating and high condensing temperatures, R134a is the ideal choice.

R404A

R404A is an HFC refrigerant. R404A has zero ozone depletion potential (ODP = 0). R404A is especially suitable for low evaporating temperature applications but it can also be applied to medium evaporating temperature applications. R404A is a mixture and has a very

small temperature glide, and therefore must be charged in its liquid phase, but for most other aspects this small glide can be neglected. Because of the small glide, R404A is often called a near-azeotropic mixture.

R507

R507 is an HFC refrigerant with properties comparable to R404A. R507 has no ozone depletion potential (ODP = 0). As with R404A, R507 is particularly suitable for low evaporating

temperature applications but it can also be used for medium evaporating temperature applications. R507 is an azeotropic mixture with no temperature glide.

PVE

Polyvinyl ether (PVE) is an innovative refrigeration lubricant for HFC refrigerant systems. PVE is as hygroscopic as existing polyolester lubricants (POE), but PVE doesn't chemically react with water; no acids are formed and compressor evacuation is easier. As PVE can be mixed with POE, oil top up can be done with up to 25% POE.

The compressor technology applied in MLZ compressors in combination with PVE lubricant provides the best possible result in terms of reliability and compressor lifetime. The PVE lubricant is compatible with R22 which makes the MLZ compressors a very versatile multi-refrigerant solution. Very high care has to be taken for vacuum as PVE is much more hygroscopic than alkylbenzene or mineral oil.

Alkylbenzene oil

Alkylbenzene oil can be applied in systems using HCFC refrigerants (R22). Compared to a mineral oil it provides distinct advantages: excellent miscibility, excellent thermal stability, compatibility with mineral oils and constant quality.

MLM series compressors are charged with Alkylbenzene oil and herewith offer an economically interesting alternative to the MLZ series in regions where R22 is still the predominant refrigerant. Note however that MLM compressors can not be used with HFC refrigerants.

Motor supply

MLZ / MLM scroll compressors can be operated at nominal voltages as indicated in table section "Motor voltage". Under-voltage and over-voltage operation is allowed within the indicated voltage

ranges. In case of risk of under-voltage operation, special attention must be paid to current draw and start assist for single-phase compressors may be required.

Compressor ambient temperature

MLZ / MLM compressors can be applied from -35°C to 50°C ambient temperature. The compressors are designed as 100 % suction gas

cooled without need for additional fan cooling. Ambient temperature has very little effect on the compressor performance.

High ambient temperature

In case of enclosed fitting and high ambient temperature it's recommend to check the temperature of power wires and conformity to their insulation specification.

In case of safe tripping by the internal compressor overload protection the compressor must cool down to about 60°C before the overload will reset. A high ambient temperature can strongly delay this cool-down process.

Low ambient temperature

Although the compressor itself can withstand low ambient temperature, the system may require specific design features to ensure safe

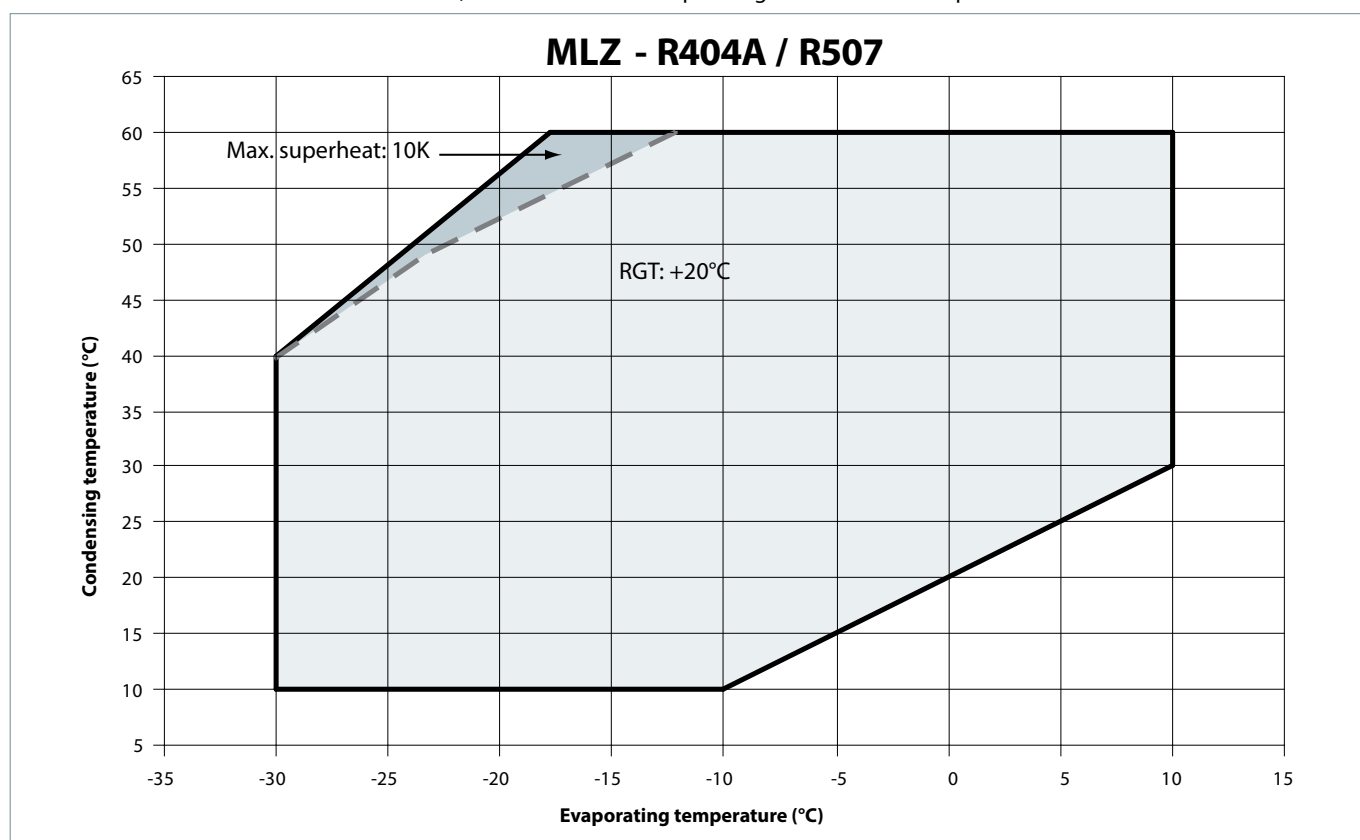
and reliable operation. See section 'Specific application recommendations'.

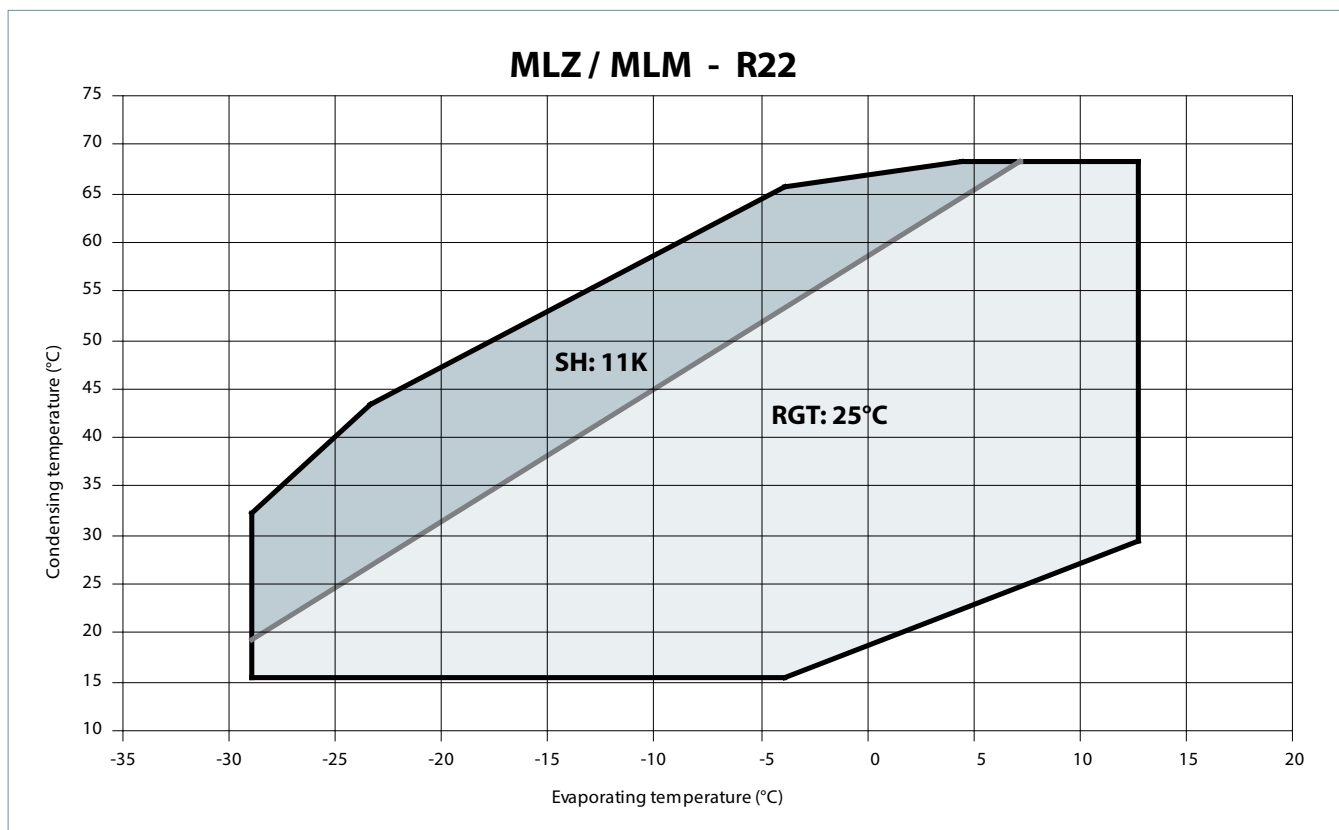
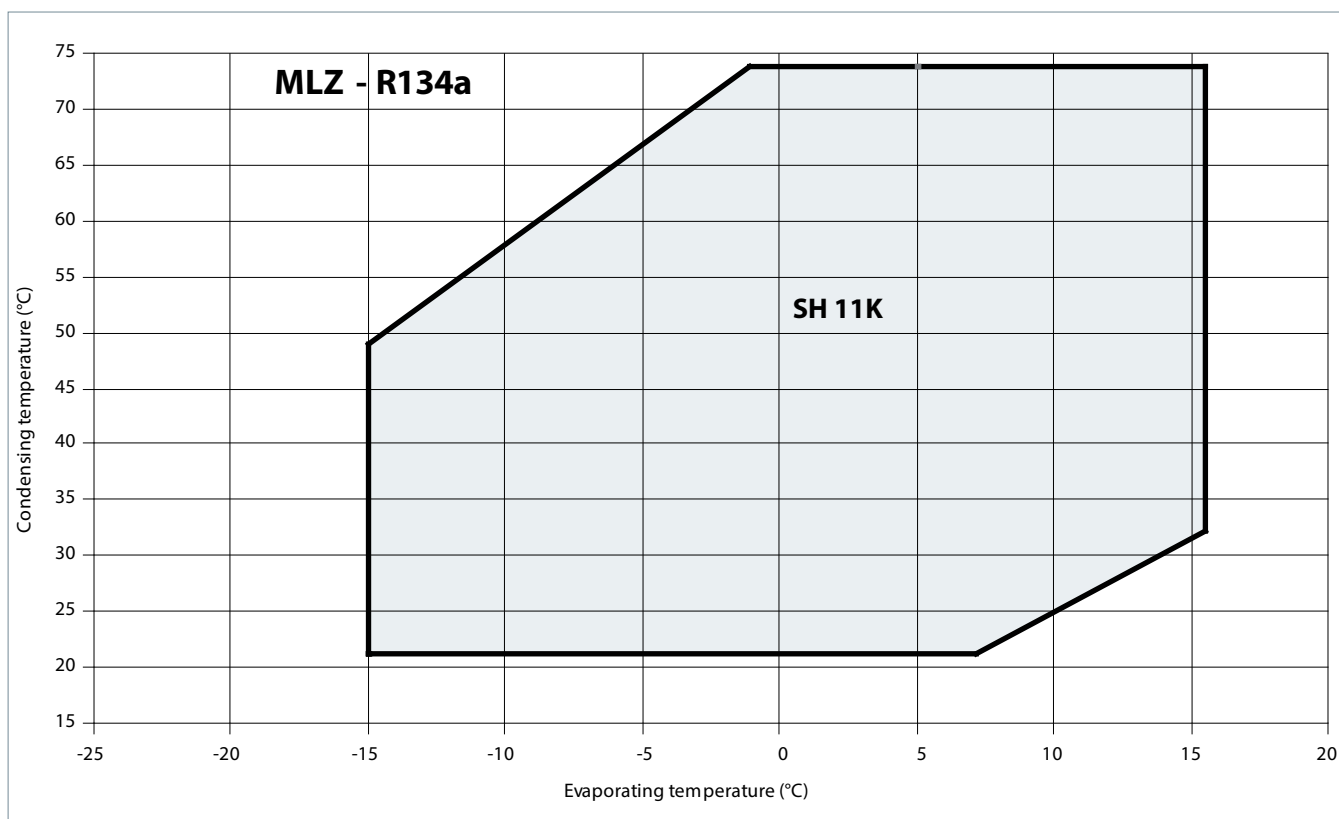
Application envelope

The operating envelopes for MLZ/MLM scroll compressors are given in the figures below, where the condensing and evaporating temperatures represent the range for steady-state operation. Under transient conditions, such as start-up and defrost, the compressor may operate outside this envelope for short periods. The figures below show the operating envelopes for MLZ compressors with refrigerants R404A/507, R134a and R22. The operating

limits serve to define the envelope within which reliable operations of the compressor are guaranteed:

- Maximum discharge gas temperature: +135°C
- A suction superheat below 5 K is not recommended due to the risk of liquid flood back
- Minimum and maximum evaporating and condensing temperatures as per the operating envelopes.





Maximum discharge gas temperature

The discharge temperature depends mainly on the combination of evaporating temperature, condensing temperature and suction gas superheat. Discharge gas temperature should be controlled with an isolated thermocouple or

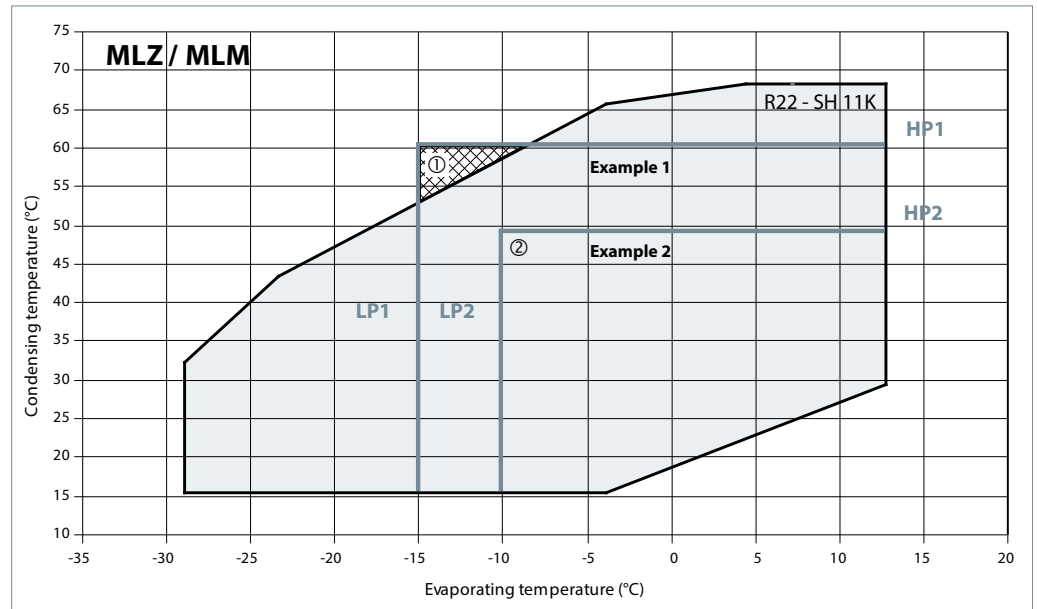
thermostat attached to the discharge line 15 cm (6 inches) from the compressor shell. Maximum discharge gas temperature must not exceed 135°C (275°F) when the compressor is running within the approved operating envelope.

Discharge gas temperature protection (DGT)

DGT protection is required if the high and low pressure switch settings do not protect the compressor against operations beyond its specific application envelope. Please refer to the examples below, which illustrate where DGT protection is required (n°1) and where it is not (n°2).

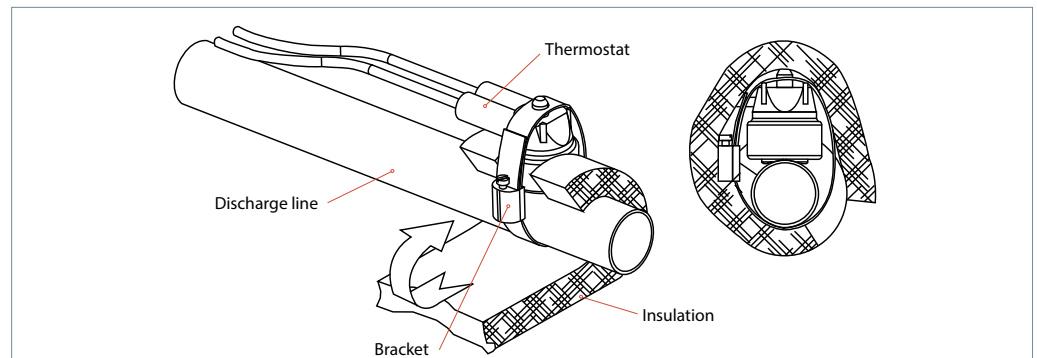
The compressor must not be allowed to cycle on the discharge gas thermostat. Continuous operations beyond the compressor's operating range will cause serious damage to the compressor!

A DGT accessory is available from Danfoss: refer to section "Spare parts & accessories".



Example 1 (R22, SH = 11 K)
LP switch setting: LP1 = 2 bar (g) (-15°C)
HP switch setting: HP1 = 23.8 bar (g) (61°C)
① The LP and HP switches don't protect sufficiently from operation outside the envelope. A DGT protection is required to avoid operation in the hatched area.

Example 2 (R22, SH = 11 K)
LP switch setting: LP2 = 2.5 bar (g) (-10°C)
HP switch setting: HP2 = 18 bar (g) (49°C)
② The LP and HP switches protect from operation outside the envelope. No DGT protection required.



High and low pressure protection

		R22	R404A	R134a
Working pressure range high side	bar (g)	7.03 - 27.9	7.20 - 27.7	4.91 - 22.1
Working pressure range low side	bar (g)	0.71 - 6.4	1.04 - 7.2	0.64 - 4.0
Maximum high pressure safety switch setting	bar (g)	29.8	29.7	23.6
Minimum low pressure safety switch setting ①	bar (g)	0.51	0.80	0.45
Recommended pump-down switch settings		1.5 bar below nominal evaporating pressure		
Minimum low pressure pump-down switch setting	bar (g)	0.94	1.31	0.85
Maximum testing pressure	bar (g)	31		

① LP safety switch shall never have time delay.

High pressure

MLZ/MLM 015-048 scroll compressors are equipped with an internal pressure relief valve (IPRV), for protection against blocked condenser and fan failure conditions (IPRV setting 27-34 bar differential pressure HP / LP). Still, a high pressure (HP) safety switch is recommended.

MLZ/MLM058-068-076 scroll compressors are not equipped with an internal pressure relief valve; therefore a high pressure switch is required to shut down the compressor should the discharge

pressure exceed the values shown in the table above.

The high-pressure switch can be set to lower values depending on the application and ambient conditions. The HP switch must either be placed in a lockout circuit or consist of a manual reset device to prevent cycling around the high-pressure limit. If a discharge valve is used, the HP switch must be connected to the service valve gauge port, which must not be isolated.

Low pressure

A low pressure (LP) safety switch is recommended. MLZ/MLM scroll compressors exhibit high volumetric efficiency and may draw very low vacuum levels, which could induce scroll instability and electrical arcing at the internal cluster. The minimum low-pressure safety switch setting is given in the above table. For systems

without pump-down, the LP safety switch must either be a manual lockout device or an automatic switch wired into an electrical lockout circuit. The LP switch tolerance must not allow for vacuum operations of the compressor. LP switch settings for pump-down cycles with automatic reset are also listed in the table above.

On/off cycling (cycle rate limit)

Depending on the application, a number higher than 12 starts per hour can reduce the service life of the motor-compressor unit. A one-minute time out is recommended.

The system must be designed in a way that provides a minimum compressor running time of 2 minutes so as to provide for sufficient motor cooling after start-up along with proper oil

return. Note that the oil return may vary since it depends upon system design.

Danfoss recommends a restart delay timer to limit compressor cycling.

General

Successful application of scroll compressors is dependent on careful selection of the compressor for the application. If the compressor is not correct for the system, it will operate

beyond the limits given in this manual. Poor performance, reduced reliability, or both may result.

Essential piping design considerations

Proper piping practices should be employed to ensure adequate oil return, even under minimum load conditions with special consideration given to the size and slope of the tubing coming from the evaporator. Tubing returns from the evaporator should be designed so as not to trap oil and to prevent oil and refrigerant migration back to the compressor during off-cycles.

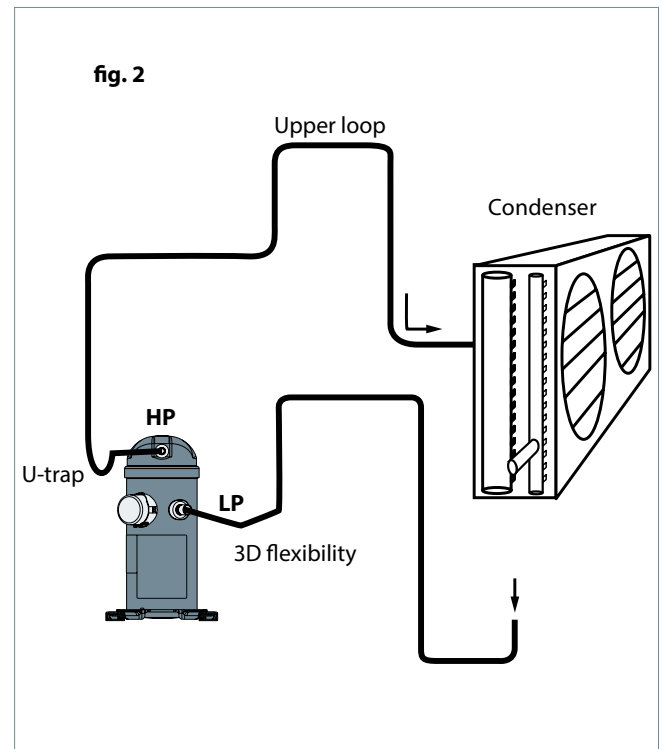
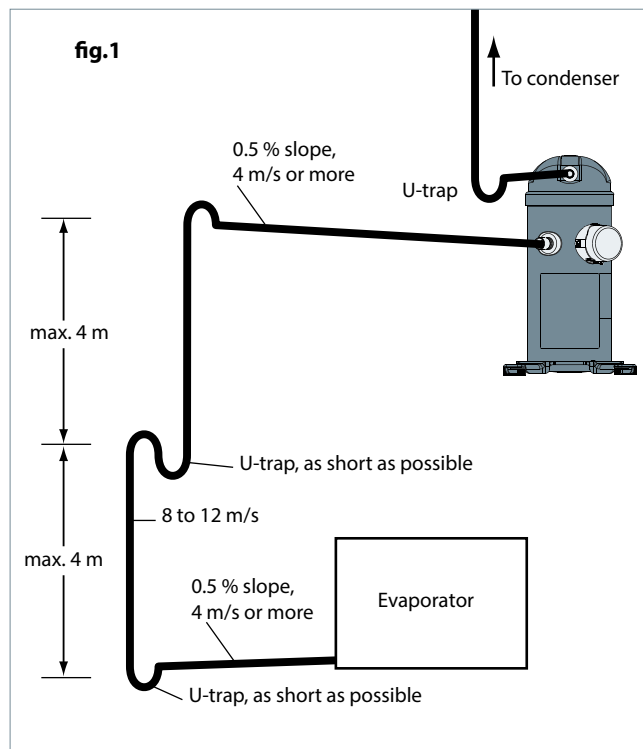
If the evaporator lies above the compressor the addition of a pump-down cycle is strongly recommended. If a pump-down cycle were to be omitted, the suction line must have a loop at the evaporator outlet to prevent refrigerant from draining into the compressor during off-cycles.

If the evaporator were situated below the compressor, the suction riser must be trapped to ensure the oil return to the compressor (see fig.1).

When the condenser is mounted at a higher position than the compressor, a suitably sized «U»-shaped trap close to the compressor is necessary to prevent oil leaving the compressor

from draining back to the discharge side of the compressor during off cycle. The upper loop also helps avoid condensed liquid refrigerant from draining back to the compressor when stopped (see fig. 2). The maximum elevation difference between the indoor and outdoor section cannot exceed 8 m. System manufacturers should specify precautions for any applications that exceed these limits to ensure compressor reliability.

Piping should be designed with adequate three-dimensional flexibility (figure 2). It should not be in contact with the surrounding structure, unless a proper tubing mount has been installed. This protection proves necessary to avoid excess vibration, which can ultimately result in connection or tube failure due to fatigue or wear from abrasion. Aside from tubing and connection damage, excess vibration may be transmitted to the surrounding structure and generate an unacceptable sound level within that structure as well (for more information on sound and vibration management”).



Refrigerant charge limit

MLZ/MLM scroll compressors can tolerate liquid refrigerant up to a certain extend without major problems. However, excessive liquid refrigerant in the compressor is always unfavourable for service life. Besides, the installation cooling capacity may be reduced because of the evaporation taking place in the compressor and/or the suction line instead of the evaporator. System design must be such that the amount of liquid refrigerant in the

compressor is limited. In this respect, follow the guidelines given in the section: "essential piping design recommendations" in priority. Use the tables below to quickly evaluate the required compressor protection in relation with the system charge and the application. More detailed information can be found in the paragraphs hereafter. Please contact Danfoss for any deviation from these guidelines.

Model	Refrigerant charge limit (kg)
MLZ015-026	3.6
MLZ030-048	5.4
MLZ058-076	7.2

Depending on test results, crankcase heaters, Liquid Line Solenoid Valve, pump down or suction accumulator must be applied see below.

	BELOW charge limit	ABOVE charge limit
Packaged units	<input checked="" type="checkbox"/> No test or additional safeties required	REQ Off cycle migration test REQ Liquid flood back test
System with remote heat exchanger	REC Off cycle migration test	REQ Off cycle migration test REQ Liquid flood back test
REC Recommended	REQ Required	<input checked="" type="checkbox"/> No test or additional safeties required

Note: for special conditions such as low ambient temperature, low load operation or brazed plate heat exchangers please refer to corresponding sections

Off-cycle migration

Off-cycle refrigerant migration is likely to occur when the compressor is located at the coldest part of the installation, when the system uses a bleed-type expansion device, or if liquid could migrate from the evaporator into the compressor sump by gravity. If too much liquid refrigerant accumulates in the sump it will saturate the oil and lead to a flooded start: when the compressor starts, the refrigerant evaporates abruptly

under the sudden decrease of the bottom shell pressure, causing the oil to foam. In extreme situations, this might result in too much oil leaving the compressor, which must be avoided as it causes irreversible damages due to possible lack of lubrication. MLZ/MLM scroll compressors can tolerate occasional flooded starts as long as the system has been evaluated.

A suitable test to evaluate the risk of off-cycle migration is the following:

- Stabilize the non running system at 5°C ambient temperature.
- Raise the ambient temperature to 20°C and keep it for 10 minutes.
- Start the compressor and monitor sump temperature, sight glass indication and sound level.

The presence of liquid in the crankcase can be easily detected by checking the sump level through the oil sight glass. Foam in the oil sump indicates a flooded start.

A noisy start, oil loss from the sump and sump cool down are indications for migration. Depending on the amount of migration graduate measures shall be taken:

- **Crankcase heater**
- **Liquid line solenoid valve**
- **Pump down cycle**

Crankcase heater: when the compressor is idle, the oil temperature in the sump must be maintained at no lower than 10 K above the saturation temperature of the refrigerant on the low-pressure side. This requirement ensures that the liquid refrigerant is not accumulating in the sump. A crankcase heater is only effective if capable of sustaining this level of temperature

difference. Tests must be conducted to ensure that the appropriate oil temperature is maintained under all ambient conditions (temperature and wind). Below -5°C ambient temperature and a wind speed of above 5m/sec, it's recommended to thermally insulated the heaters in order to limit the surrounding energy losses.

Due to the Danfoss scroll compressors inherent ability to handle liquid refrigerant, crankcase heaters are not required when the system charge does not exceed the recommended maximum charge.

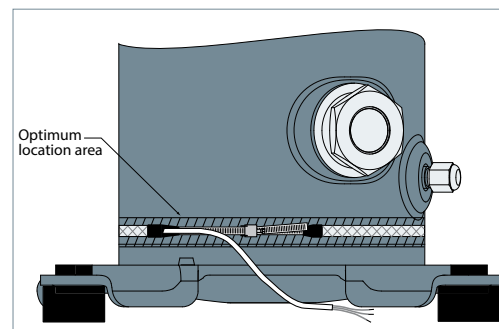
Since the total system charge may be undefined, a crankcase heater is recommended on all systems with remote heat exchangers. In addition, any system containing a refrigerant charge in excess of the maximum recommended system charge for compressors requires a crankcase heater.

Belt-type crankcase heater accessories are available from Danfoss (see section "Spare parts & Accessories").

The heater must be energized whenever the compressor is off.

⚠ Provide separate electrical supply for the heaters so that they remain energized even when the machine is out of service (eg. Seasonal shutdown).

It is recommended that the heater be turned on for a minimum of 12 hours prior to starting the compressor.



Liquid line solenoid valve (LLSV): This feature is very convenient and can be used on all types of applications.

An LLSV is used to isolate the liquid charge in the high pressure side, thereby preventing against

charge transfer or excessive migration to the compressor during off-cycles. The quantity of refrigerant remaining in the low-pressure side of the system can be further reduced by using a pump-down cycle in association with the LLSV.

Pump-down cycle: Once the system has reached its set point and is about to shut off, the LLSV on the liquid line closes. The compressor then pumps the majority of the refrigerant charge into the high pressure side before the system stops on the low pressure pump-down switch. This step reduces the amount of charge on the low side in order to prevent off-cycle migration.

A pump-down cycle represents one of the most effective ways to protect against the off-cycle migration of refrigerant; however it is only convenient to apply on application with thermostatic control.

Rack application with pressostatic control can use timer delay to empty the evaporators before the stop. Time should be carefully set to not interfere with the low safety pressure switch.

For low pressure pump-down switch settings, refer to page 24. For suggested wiring diagrams, please see page 17.

Models MLZ/MLM015-048 incorporate an internal low leak check valve that is appropriate for pump-down operations. This valve prevents the back flow of refrigerant from the high pressure to the low pressure side through the compressor so pump down conditions can be achieved and maintained.

Models MLZ/MLM058-076 are not equipped with this low leak check valve. Under certain conditions, the internal valve may not completely seal, and due to the refrigerant back flow the compressor might restart during pump-down applications. Repeated short cycling can result in a compressor breakdown. It is recommended to install an external magnetic check valve (such as Danfoss Part No. 120Z5046) close to the compressor's discharge connector so the discharge volume is minimized.

A magnetic check valve is recommended for this as it offers the best solution regarding minimal required and maximal pressure drop over the wide application envelope of the MLZ/MLM compressors. If a Danfoss NRV check valve is applied it has to be carefully selected for the specific operation conditions of the individual system.

Tests for pump down cycle approval:

- As the pump-down switch setting is inside the application envelope, tests should be carried out to check unexpected cut-out during transient conditions (ie. defrost – cold starting). When unwanted cut-outs occur, the low pressure pump-down switch can be delayed. In this case a low pressure safety switch without any delay timer is mandatory.

- While the thermostat is off, the number of pressure switch resets should be limited to avoid short cycling of the compressor. Use dedicated wiring and an additional relay which allows for one shot pump-down.

The pump-down allows to store all the refrigerant in the high pressure side circuit. On unitary or close-coupled systems, where the system refrigerant charge is expected to be both correct and definable the entire system charge may be stored in the condenser during pump-down if all components have been properly sized.

Other application needs a liquid receiver to store the refrigerant.

Receiver dimensioning requires special attention. The receiver shall be large enough to contain part of the system refrigerant charge but it shall not be dimensioned too large. A large receiver easily leads to refrigerant overcharging during maintenance operation.

Liquid flood back

During normal operation, refrigerant enters the compressor as a superheated vapour. Liquid flood back occurs when a part of the refrigerant entering the compressor is still in liquid state.

A continuous liquid flood back will cause oil dilution and, in extreme situations lead to lack of lubrication and high rate of oil leaving the compressor.

Liquid flood back test - Repetitive liquid flood back testing must be carried out under TXV threshold operating conditions: a high pressure ratio and minimum evaporator load, along with the measurement of suction superheat, oil sump temperature and discharge gas temperature.

During operations, liquid flood back may be detected by measuring either the oil sump temperature or the discharge gas temperature. If at any time during operations, the oil sump temperature drops to within 10K or less above the saturated suction temperature, or should

the discharge gas temperature be less than 35K above the saturated discharge temperature, this indicates liquid flood back.

Continuous liquid flood back can occur with a wrong dimensioning, a wrong setting or malfunction of the expansion device or in case of evaporator fan failure or blocked air filters.

A suction accumulator providing additional protection as explained hereunder can be used to solve light continuous liquid flood back.

Suction accumulator: a suction accumulator offers protection against refrigerant flood back at start-up, during operations or defrosting by trapping the liquid refrigerant upstream from the compressor. The suction accumulator also protects against off-cycle migration by providing additional internal free volume to the low side of the system.

A suction accumulator must be carefully dimensioned, taking into account the refrigerant charge as well as the gas velocity in the suction line. Depending on the operating conditions it may happen that the recommended connections of the accumulator are one size smaller than the suction line.

Low ambient application

Low ambient start-up

Under cold ambient conditions ($<0^{\circ}\text{C}$), upon start-up the pressure in the condenser may be so low that a sufficient pressure differential across the expansion device cannot be developed to properly feed the evaporator.

As a result, the compressor may go into a deep vacuum, which can lead to compressor failure due to internal arcing and instability in the scroll wraps. Under no circumstances should the compressor be allowed to operate under vacuum. The low-pressure control must be set in accordance with the table from section "High and low pressure control" in order to prevent this from happening.

Early feeding of the evaporator and management of the discharge pressure could help to attenuate these effects.

Low pressure differentials can also cause the expansion device to «hunt» erratically, which might cause surging conditions within the evaporator, with liquid spillover into the compressor. This effect is most pronounced during low load conditions, which frequently occur during low ambient conditions.

Low ambient operations

It is recommended that the unit be tested and monitored at minimum load and low ambient conditions as well. The following considerations should be taken into account to ensure proper system operating characteristics.

The expansion device should be sized to ensure proper control of the refrigerant flow into the evaporator. An oversized valve may result in erratic control. This consideration is especially important in manifolded units where low load conditions may require the frequent cycling of compressors. This can lead to liquid refrigerant entering the compressor if the expansion valve does not provide stable refrigerant super-heat control under varying loads.

The superheat setting of the expansion device should be sufficient to ensure proper superheat levels during low loading periods. A minimum of 5 K stable superheat is required.

Head pressure control under low ambient conditions: Several possible solutions are available to prevent the risk of compressor to vacuum and low pressure differential between the suction and discharge pressures.

In air-cooled machines, cycling the fans with a head pressure controller will ensure that the fans remain off until the condensing pressure has reached a satisfactory level. Variable speed fans can also be used to control the condensing pressure. In water-cooled units, the same can be performed using a water regulator valve that is also operated by head pressure, thereby ensuring that the water valve does not open until the condensing pressure reaches a satisfactory level. The minimum condensing pressure must be set at the minimum saturated condensing temperature shown in the application envelopes.

Under very low ambient conditions, in which testing has revealed that the above procedures might not ensure satisfactory condensing and suction pressures, the use of a head pressure control valve is recommended. Note: This solution requires extra refrigerant charge, which can introduce other problems. A non-return valve in the discharge line is recommended and special care should be taken when designing the discharge line.

For further information, please contact Danfoss.

Scroll and reciprocating

Unlike the reciprocating compressor, a scroll doesn't have dead volume. Neither does it have a suction valve causing pressure drop. As a result a scroll compressor has a high volumetric efficiency even at low suction pressure. In systems such as ice makers and milk cooling tanks this high capacity at low temperature shortens the cooling time.

When moving from a reciprocating compressor to a scroll compressor, the selection shall always be made based on cooling capacity at the application rating point. Never make a selection based on equivalent displacement.

Low load operations

The compressor should be run for a minimum period to ensure that the oil has sufficient time to properly return to the compressor sump and

that the motor receives enough cooling under conditions of lowest refrigerant mass flow.

Brazed plate heat exchangers

A brazed plate heat exchanger needs very little internal volume to satisfy the heat transfer requirements. Consequently, the heat exchanger offers very little internal volume for the compressor to draw vapour from the suction side. The compressor can then quickly enter into a vacuum condition. It is therefore important that the expansion device be sized correctly and that a sufficient pressure differential across the expansion device be available to ensure adequate refrigerant feed into the evaporator. This aspect is of special concern when operating the unit under low ambient and load conditions. For further information on these conditions, please refer to the previous sections.

Due to the small volume of the brazed plate heat exchanger, no pump-down cycle is normally required. The suction line running from the heat exchanger to the compressor must be trapped to avoid refrigerant migration to the compressor.

When using a brazed plate condenser heat exchanger, a sufficient free volume for the discharge gas to accumulate is required in order to avoid excess pressure build-up. At least 1 meter of discharge line is necessary to generate this volume. To help reduce the discharge gas volume immediately after start-up, the supply of cooling water to the heat exchanger may be opened before the compressor starts, to remove superheat and condense the incoming discharge gas more quickly.

Water utilising systems

Apart from residual moisture in the system after commissioning, water could also enter the refrigeration circuit during operation. Water in the system shall always be avoided. Not only because it can shortly lead to electrical failure, sludge in sump and corrosion but in particular because it can cause serious safety risks.

Common causes for water leaks are corrosion and freezing.

Corrosion: Materials in the system shall be compliant with water and protected against corrosion.

Freezing: When water freezes into ice its volume expands which can damage heat exchanger walls and cause leaks. During off periods water inside heat exchangers could start freezing when ambient temperature is lower than 0°C. During on periods ice banking could occur when the circuit is running continuously at too low load. Both situations should be avoided by connecting a pressure and thermostat switch in the safety line.

Starting sound level

During start-up transients it is natural for the compressor sound level to be slightly higher than during normal running. MLZ/MLM scroll compressors exhibit very little increased start-up transient sound. If a 3-phase model is miswired, the compressor will run in reverse. Reverse

compressor rotation is characterized by an objectionable sound. To correct reverse rotation, disconnect power and switch any two of the three power leads at the unit contactor. Never switch leads at the compressor terminals.

Running sound level

MLZ/MLM are designed with features to reduce the sound level when a compressor is running.

Sound levels are at rated (medium temperature) conditions.

Model	50 Hz		60 Hz	
	Sound power (dBA) Without jacket	Sound power (dBA) With jacket	Sound power (dBA) Without jacket	Sound power (dBA) With jacket
MLZ/MLM015	67	57	71	60
MLZ/MLM021	67	57	71	60
MLZ/MLM026	67	59	71	62
MLZ/MLM030	69	62	73	65
MLZ/MLM038	69	63	74	66
MLZ/MLM045	71	63	74	66
MLZ/MLM048	72	64	74	67
MLZ/MLM058	74	66	78	70
MLZ/MLM066	74	66	78	70
MLZ/MLM 076	74	66	78	70

Maximum sound is +5dBA

Stopping sound level

MLZ/MLM have a unique discharge valve design that minimizes stopping noise. This results in very low shutdown sound.

Sound generation in a refrigeration system

Typical sound and vibration in refrigeration systems encountered by design and service engineers may be broken down into the following three source categories.

Sound radiation: This generally takes an airborne path.

Mechanical vibrations: These generally extend along the parts of the unit and structure.

Gas pulsation: This tends to travel through the cooling medium, i.e. the refrigerant.

The following sections will focus on the causes and methods of mitigation for each of the above sources.

Compressor sound radiation

For sound radiating from the compressor, the emission path is airborne and the sound waves are travelling directly from the machine in all directions.

The MLZ/MLM scroll compressors are designed to be quiet and the frequency of the sound generated is pushed into the higher ranges, which not only are easier to reduce but also do not generate the penetrating power of lower-frequency sound.

Use of sound-insulation materials on the inside of unit panels is an effective means of substantially reducing the sound being transmitted to the outside. Ensure that no components capable of transmitting sound/vibration within the unit come into direct contact with any non insulated parts on the walls of the unit. Because of the unique design of a full-suction gas & oil cooled motor, compressor body insulation across its entire operating range is possible.

Mechanical vibrations

Vibration isolation constitutes the primary method for controlling structural vibration. MLZ/MLM scroll compressors are designed to produce minimal vibration during operations. The use of rubber isolators on the compressor base plate or on the frame of a manifolded unit is very effective in reducing vibration being transmitted from the compressor(s) to the unit. Rubber grommets are supplied with all MLZ/MLM compressors. Once the supplied rubber grommets have been properly mounted, vibration transmitted from the compressor base plate to the unit are held to a strict minimum.

In addition, it is extremely important that the frame supporting the mounted compressor be of sufficient mass and stiffness to help dampen any residual vibration potentially transmitted to the frame. The tubing should be designed so as to both reduce the transmission of vibrations to other structures and withstand vibration without incurring any damage. Tubing should also be designed for three-dimensional flexibility. For more information on piping design, please see the section entitled "Essential piping design considerations".

Gas pulsation

The MLZ/MLM scroll compressors have been designed and tested to ensure that gas pulsation has been minimized for the most commonly encountered refrigeration pressure ratio. On installations where the pressure ratio lies beyond the typical range, testing should be conducted under all expected conditions and operating

configurations to ensure that minimum gas pulsation is present. If an unacceptable level is identified, a discharge muffler with the appropriate resonant volume and mass should be installed. This information can be obtained from the component manufacturer.

Each MLZ/MLM compressor is shipped with printed Instructions for installation. These Instructions can also be downloaded from our web site

www.danfoss.com or directly from:
http://instructions.cc.danfoss.com

System cleanliness

The refrigeration system, regardless of the type of compressor used, will only provide high efficiency and good reliability, along with a long operating life, if the system contains solely the refrigerant and oil it was designed for. Any other substances within the system will not improve performance and, in most cases, will be highly detrimental to system operations.

The presence of non-condensable substances and system contaminants, such as metal shavings, solder and flux, have a negative impact on compressor service life. Many of these contaminants are small enough to pass through a

mesh screen and can cause considerable damage within a bearing assembly. The use of highly hygroscopic PVE oil in MLZ compressors requires that the oil be exposed to the atmosphere just as little as possible.

During the manufacturing process, circuit contamination may be caused by:

- Brazing and welding oxides,
- Filings and particles from the removal of burrs in pipe-work,
- Brazing flux,
- Moisture and air.

Compressor handling and storage

Compressors are provided with a lifting lug. This lug should always be used to lift the compressor. Once the compressor is installed, the lifting lug should never be used to lift the complete installation. The compressor must be handled

with caution in the vertical position, with a maximum inclination of 15° from vertical. Store the compressor between -35°C and 55°C, not exposed to rain or corrosive atmosphere.

Compressor mounting

Maximum inclination from the vertical plane, while operating must not exceed 7 degrees. All compressors are delivered with 4 rubber grommets and metal sleeves. Compressors

must always be mounted with these grommets. Recommended torque for mounting bolts: 11 Nm (±1 Nm).

Compressor holding charge

Each compressor is shipped with a nominal dry nitrogen holding charge between 0.4 bar and 0.7 bar, and is sealed with elastomer plugs. The plugs should be removed with care to avoid oil loss when the holding charge is released. Remove the suction plug first and the discharge plug

afterwards. The plugs shall be removed only just before connecting the compressor to the installation in order to avoid moisture entering the compressor. When the plugs are removed, it is essential to keep the compressor in an upright position to avoid oil spillage.

Tube brazing procedure

Do not bend the compressor discharge or suction lines or force system piping into the compressor connections, because this will increase

stresses that are a potential cause of failure. Recommended brazing procedures and material, are described on following page.

Brazing material

For copper suction and discharge fittings, use copper-phosphorus brazing material. Sil-Fos® and other silver brazing materials are also acceptable.

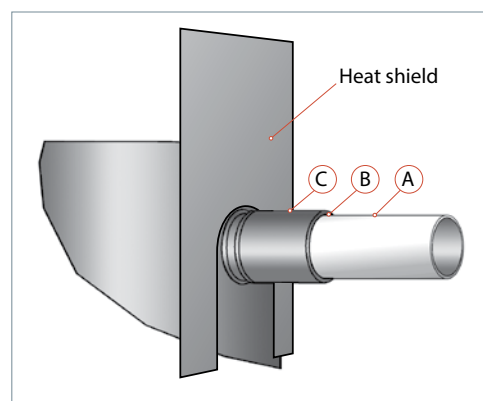
If flux is required for the brazing operation, use coated rod or flux core wire. To avoid system contamination, do not brush flux on.

Compressor connection

When brazing the compressor fittings, do not overheat the compressor shell, which could severely damage certain internal components due to excessive heating. Use of a heat shield and/or a heat-absorbent compound is highly recommended. For brazing the suction and discharge connections, the following procedure is advised:

- Make sure that no electrical wiring is connected to the compressor.
- Protect the terminal box and compressor painted surfaces from torch heat damage (see diagram).
- Use only clean refrigeration-grade copper tubing and clean all connections.
- Purge nitrogen through the compressor in order to prevent against oxidation and flammable conditions. The compressor should not be exposed to the open air for extended periods.
- Use of a double-tipped torch is recommended.
- Apply heat evenly to area (A) until the brazing temperature is reached. Move the torch to area (B) and apply heat evenly until the brazing temperature has been reached there as well, and then begin adding the brazing material. Move the torch evenly around the joint, in applying only enough brazing material to flow the full circumference of the joint.
- Move the torch to area (C) only long enough to draw the brazing material into the joint, but not into the compressor.
- Remove all remaining flux once the joint has been soldered with a wire brush or a wet cloth. Remaining flux would cause corrosion of the tubing.

Ensure that no flux is allowed to enter into the tubing or compressor. Flux is acidic and can cause




substantial damage to the internal parts of the system and compressor.

The PVE oil used in MLZ compressors is highly hygroscopic and will rapidly absorb moisture from the air. The compressor must therefore not be left open to the atmosphere for a long period of time. The compressor fitting plugs shall be removed just before brazing the compressor.

⚠ Before eventual unbrazing the compressor or any system component, the refrigerant charge must be removed from both the high and low pressure sides. Failure to do so may result in serious personal injury. Pressure gauges must be used to ensure all pressures are at atmospheric level.

For more detailed information on the appropriate materials required for brazing or soldering, please contact the product manufacturer or distributor. For specific applications not covered herein, please contact Danfoss for further information.

			Brazed connection ODF tube
MLZ/MLM015-026	Suction		3/4"
	Discharge		1/2"
MLZ/MLM030-045	Suction		7/8"
	Discharge		1/2"
MLZ/MLM048	Suction		7/8"
	Discharge		3/4"
MLZ/MLM058-076	Suction		1"1/8
	Discharge		7/8"

Vacuum evacuation and moisture removal

Moisture obstructs the proper functioning of the compressor and the refrigeration system.

Air and moisture reduce service life and increase condensing pressure, and cause excessively high discharge temperatures, which can destroy the lubricating properties of the oil. Air and moisture also increase the risk of acid formation, giving rise to copper plating. All these phenomena can cause mechanical and electrical compressor failure.

For these reasons it's important to perform a vacuum dehydration on the system to remove all residual moisture from the pipe-work after assembly;

MLZ and MLM compressors are delivered with < 100 ppm moisture level. The required moisture level in the circuit after vacuum dehydration must be < 100 ppm for systems with an MLZ and < 300 ppm for systems with an MLM compressor.

- Never use the compressor to evacuate the system.
- Connect a vacuum pump to both the LP & HP sides.
- Evacuate the system to a pressure of 500 μ m Hg (0.67 mbar) absolute.
- Do not use a megohm meter nor apply power to the compressor while it's under vacuum as this may cause internal damage.

Liquid line filter driers

A properly sized & type of drier is required. Important selection criteria include the driers water content capacity, the system refrigeration capacity, and the system refrigerant charge. The drier must be able to reach and maintain a moisture level of 50 ppm end point dryness (EPD). Danfoss recommends DCL (solid core) driers for the MLM compressor (R22 with Alkylbenzene) and DML (100% molecular sieve) driers for MLZ compressors (R404A, R507, R134a, R22) with PVE oil.

For servicing of existing installations where acid formation may be present, the Danfoss DCL solid core filter drier containing activated alumina is recommended.

After burn out, remove & replace the liquid line filter drier and install a Danfoss type DAS burnout drier of the appropriate capacity. Refer to the DAS drier instructions and technical information for correct use of the burnout drier on the liquid line.

Refrigerant charging

It is recommended that system charging be done using the weighed charge method, adding refrigerant to the high side of the system. Charging the high and low sides of a system with gas simultaneously at a controlled rate is also an acceptable method. Do not exceed the recommended unit charge, and never charge liquid to the low side.

Vacuum or charge from one side can seal the scrolls and result in a non-starting compressor. When servicing, always ensure that LP/HP pressures are balanced before starting the compressor.

Be sure to follow all government regulations regarding refrigerant reclamation and storage.

Insulation resistance and dielectric strength

Insulation resistance must be higher than 1 megohm when measured with a 500 volt direct current megohm tester.

Each compressor motor is tested at the factory with a high potential voltage (hi-pot) that exceeds the UL requirement both in potential and in duration. Leakage current is less than 0.5 mA.

MLZ/MLM scroll compressors are configured with the pump assembly at the top of the shell, and the motor below. As a result, the motor can be partially immersed in refrigerant and oil. The presence of refrigerant around the motor windings will result in lower resistance

values to ground and higher leakage current readings. Such readings do not indicate a faulty compressor, and should not be cause for concern.

In testing insulation resistance, Danfoss recommends that the system be first operated briefly to distribute refrigerant throughout the system. Following this brief operation, retest the compressor for insulation resistance or current leakage.

Never reset a breaker or replace a fuse without first checking for a ground fault (a short circuit to ground). Be alert for sounds of arcing inside the compressor.

Packaging

Single pack

Compressors are packed individually in a cardboard box. They can be ordered in any quantity. Minimum ordering quantity = 1. As far as possible, Danfoss will ship the boxes on full pallets of 6 compressors.

- Each box also contains following accessories:
- 4 grommets
- 4 assemblies of self tapping US thread bolts, washers and sleeves
- 4 additional sleeves
- 1 screw for earth connection
- Run capacitors are available as accessories for motor code 5 (220-240V/1/50Hz)



Industrial pack

Compressors are not packed individually but are shipped all together on one pallet. They can be ordered in quantities of full pallets only, multiples of 12 compressors.

Each industrial pack pallet contains following accessories:

- 4 grommets per compressor
- 4 sleeves per compressor



Packaging details

		Danfoss pallets Optimized for overseas container loading & European storage racks	
	Code number	121L....	
	Pack type	Industrial pack	Single pack
	Compressors per pallet	12	6 *
	Static stacking of pallets **	4	4
Shipped accessories	Run capacitor (for single phase models)	Not included	Not included
	Screw for earth connection	Included	Included
	4 grommets per compressor	Included	Included
	4 assemblies of self tapping US thread bolt + washer + sleeve per compressor	Not included	Included
	4 extra sleeves per compressor	Included	Included

* Quantity for full pallets. Single packs can be ordered per 1.

** Stacking only allowed for full pallets with identical products per pallet

Single pack

	Compressors	Model variation	Connections	Features	Voltage code 4	Voltage code 5	Voltage code 9
Danfoss palette	MLM015	T	P	9	121L8072		
	MLM021	T	P	9	121L8076	121L8098	
	MLM026	T	P	9	121L8078	121L8100	
	MLM030	T	C	9	121L8080	121L8102	
	MLM038	T	C	9	121L8082		
	MLM045	T	C	9	121L8084		
	MLM048	T	C	9	121L8086		
	MLM058	T	C	9	121L8088		
	MLM066	T	C	9	121L8090		
	MLM076	T	C	9	121L8092		
	MLZ015	T	P	9	121L8002		
	MLZ021	T	P	9	121L8006	121L8028	121L8272
	MLZ026	T	P	9	121L8008	121L8030	
	MLZ030	T	C	9	121L8010	121L8032	
	MLZ038	T	C	9	121L8012		121L8296
	MLZ045	T	C	9	121L8014		
	MLZ048	T	C	9	121L8016		121L8308
	MLZ058	T	C	9	121L8018		
	MLZ066	T	C	9	121L8020		
	MLZ076	T	C	9	121L8022		

Industrial pack

	Compressors	Model variation	Connections	Features	Voltage code 4	Voltage code 5	Voltage code 9
Danfoss palette	MLM015	T	P	9	121L8071		
	MLM021	T	P	9	121L8075	121L8097	
	MLM026	T	P	9	121L8077	121L8099	
	MLM030	T	C	9	121L8079	121L8101	
	MLM038	T	C	9	121L8081		
	MLM045	T	C	9	121L8083		
	MLM048	T	C	9	121L8085		
	MLM058	T	C	9	121L8087		
	MLM066	T	C	9	121L8089		
	MLM076	T	C	9	121L8091		
	MLZ015	T	P	9	121L8001		
	MLZ021	T	P	9	121L8005	121L8027	121L8271
	MLZ026	T	P	9	121L8007	121L8029	
	MLZ030	T	C	9	121L8009	121L8031	
	MLZ038	T	C	9	121L8011		121L8295
	MLZ045	T	C	9	121L8013		
	MLZ048	T	C	9	121L8015		121L8307
	MLZ058	T	C	9	121L8017		
	MLZ066	T	C	9	121L8020		
	MLZ076	T	C	9	121L8021		

Run capacitors for PSC wiring



Code n°	Description	Application	Packaging	Pack size
8173231	PSC wiring Run capacitor 40 µF, motor voltage code 5 - 220-240V / 1 / 50 Hz	MLZ/MLM015	Multipack	10
120Z0051	PSC wiring Run Capacitor 70 µF, motor voltage code 5 - 220-240V / 1 / 50Hz	MLZ/MLM021-026	Multipack	10
8173233	PSC wiring Run Capacitor 50 µF, motor voltage code 5 - 220-240V / 1 / 50Hz	MLZ/MLM030	Multipack	10
8173234	PSC wiring Run Capacitor 55 µF, motor voltage code 5 - 220-240V / 1 / 50Hz	MLZ/MLM038	Multipack	10

Start capacitors for CSR wiring



Code n°	Description	Application	Packaging	Pack size
120Z0399	CSR wiring Start Capacitor 145-175 µF, motor voltage code 5 - 220-240V / 1 / 50Hz	MLZ/MLM015-021-026	Multipack	10
120Z0400	CSR wiring Start Capacitor 161-193 µF, motor voltage code 5 - 220-240V / 1 / 50Hz	MLZ/MLM030	Multipack	10
8173001	CSR wiring Start Capacitor 88-108 µF, motor voltage code 5 - 220-240V / 1 / 50Hz	MLZ/MLM038	Multipack	10

Starting relays for CSR wiring



Code n°	Description	Application	Packaging	Pack size
120Z0393	Starting relay RVA9CKL	MLZ/MLM 015-021-026	Multipack	10
120Z0394	Starting relay RVA3EKL	MLZ/MLM 030	Multipack	10
120Z0395	Starting relay RVA4GKL	MLZ/MLM 038	Multipack	10

Solder sleeve adapter sets



Code n°	Description	Application	Packaging	Pack size
120Z0126	Rotolock adaptor set (1-1/4" ~ 3/4") , (1" ~ 1/2")	MLZ/MLM 015-021-026	Multipack	6
120Z0127	Rotolock adaptor set (1-1/4" ~ 7/8") , (1" ~ 1/2")	MLZ/MLM 030-038-045	Multipack	6
120Z0128	Rotolock adaptor set (1-1/4" ~ 7/8") , (1-1/4" ~ 3/4")	MLZ/MLM 048	Multipack	6
120Z0129	Rotolock adaptor set (1-3/4" ~ 1-1/8") , (1-1/4" ~ 7/8")	MLZ/MLM 058-066-076	Multipack	6

Rotolock nuts and sleeves kit



Code n°	Description	Application	Packaging	Pack size
120Z5074	Rotolock nuts 1"1/4 and 1" with sleeves and gaskets	MLZ/MLM015-045	Multipack	6
120Z5076	2 rotolock nuts 1"1/4 with sleeves and gaskets	MLZ/MLM048	Multipack	6
120Z5075	Rotolock nuts 1"1/4 and 1"3/4 with sleeves and gaskets	MLZ/MLM058-066-076	Multipack	6

Rotolock adapters



Code n°	Description	Application	Packaging	Pack size
120Z0366	Rotolock adaptor (1-1/4" ~ 3/4")	MLZ/MLM 015-021-026 suction	Multipack	10
120Z0367	Rotolock adaptor (1-1/4" ~ 7/8")	MLZ/MLM 030-038-045-048 suction	Multipack	10
120Z0364	Rotolock adaptor (1-3/4" ~ 1-1/8")	MLZ/MLM 058-066-076 suction	Multipack	10
120Z0365	Rotolock adaptor (1" ~ 1/2")	MLZ/MLM 015-021-026-030-038-045 discharge	Multipack	10
120Z0366	Rotolock adaptor (1-1/4" ~ 3/4")	MLZ/MLM 048 discharge	Multipack	10
120Z0367	Rotolock adaptor (1-1/4" ~ 7/8")	MLZ/MLM 058-066-076 discharge	Multipack	10

Rotolock service valves and valve sets (without gasket)



Code n°	Description	Application	Packaging	Pack size
7968004	Rotolock valve, V06, (1" Rotolock, 1/2" ODF)	Discharge MLM/Z015-026-045	Industry pack	50
8168031	Rotolock valve, V06, (1" Rotolock, 1/2" ODF)		Multipack	6
7968006	Rotolock valve, V04, (1" 1/4 Rotolock, 3/4" ODF)	Suction MLM/Z015-026 Discharge MLM/Z048	Industry pack	42
8168029	Rotolock valve, V04, (1" 1/4 Rotolock, 3/4" ODF)		Multipack	6
7968007	Rotolock valve, V05, (1" 1/4 Rotolock, 7/8" ODF)	Suction MLM/Z030-048 Discharge MLM/Z058-076	Industry pack	36
8168030	Rotolock valve, V05, (1" 1/4 Rotolock, 7/8" ODF)		Multipack	6
7968009	Rotolock valve, V02, (1" 3/4 Rotolock, 1" 1/8 ODF)	Suction MLM/Z058-076	Industry pack	24
8168028	Rotolock valve, V02, (1" 3/4 Rotolock, 1" 1/8 ODF)		Multipack	6
7703008	Valve set V02 (1" 3/4 rotolock, 1" 1/8 ODF), V05 (Rotolock 1" 1/4, 7/8" ODF)	MLZ/MLM058-066-076	Multipack	6

Mounting kits



Code n°	Description	Application	Packaging	Pack size
120Z5005	Mounting kit for 1 scroll compressor including 4 grommets, 4 sleeves, 4 bolts, 4 washers	MLZ/MLM	Single pack	1
120Z5067	Mounting kit for 1 scroll compressor including 4 grommets, 4 sleeves, 4 bolts, 4 washers, rotolock connection kit for suction, discharge and economizer fitting for 1 scroll compressor including 3 Teflon seals, 2 nuts, 3 sleeves	MLZ/MLM015-045 LLZ013-015-018	Single pack	1
120Z5069	Mounting kit for 1 scroll compressor including 4 grommets, 4 sleeves, 4 bolts, 4 washers, rotolock connection kit for suction, discharge fitting for 1 scroll compressor including 3 Teflon seals, 2 nuts, 3 sleeves	MLZ/MLM048	Single pack	1
120Z5068	Mounting kit for 1 scroll compressor including 4 grommets, 4 sleeves, 4 bolts, 4 washers, rotolock connection kit for suction, discharge and economizer fitting for 1 scroll compressor including 3 Teflon seals, 2 nuts, 3 sleeves Teflon seals, sleeves, nuts 1" 1/4 and 1" 3/4	MLZ/MLM058-076 LLZ024-033	Single pack	1
120Z0407	Rigid grommets and washers for tandem / rack assembly. Set for 8 compressors	MLZ/MLM	Single pack	1

Crankcase heater



Code No	Description	Application	Packaging	Pack Size
120Z5040	Belt type crankcase heater, 65 W, 230 V, CE mark, UL (Wire length: 1270 mm)	MLZ/MLM 015-021-026	Multipack	4
120Z5041	Belt type crankcase heater, 55/70W, 400/460 V, CE mark, UL (Wire length: 1270 mm)	MLZ/MLM 015-021-026	Multipack	4
120Z5042	Belt type crankcase heater, 70 W, 575 V, CE mark, UL (Wire length: 1270 mm)	MLZ/MLM 015-021-026	Multipack	4
120Z0059	Belt type crankcase heater, 65 W, 230V, CE mark, UL (Wire length: 1000 mm)	MLZ/MLM 030-038-045- 048-058-066-076	Multipack	6
120Z0060	Belt type crankcase heater, 65 W, 400 V, CE mark, UL (Wire length: 1000 mm)	MLZ/MLM 030-038-045- 048-058-066-076	Multipack	6
120Z5012	Belt type crankcase heater, 70W, 460V, CE mark, UL	MLZ/MLM030-076	Multipack	4
120Z5013	Belt type crankcase heater, 70 W, 575V, CE mark, UL	MLZ/MLM030-076	Multipack	4

Discharge thermostat kit



Code No	Description	Application	Packaging	Pack Size
7750009	Discharge thermostat kit	All models	Multipack	10
7973008	Discharge thermostat kit	All models	Industry pack	50

Magnetic discharge non return valve



Code No	Description	Application	Packaging	Pack Size
120Z5046	Magnetic discharge non return valve	MLZ/MLM058-066-076	Multipack	6

Lubricant



Code No	Description	Application	Packaging	Pack Size
120Z5034	PVE lubricant, 1 litre can 320HV (FVC68D)	MLZ	Multipack	12

IP54 upgrade kit



Code No	Description	Application	Packaging	Pack Size
118U0056	IP54 upgrade kit for round terminal box	MLZ/MLM015-021-026	Multipack	6
118U0057	IP54 upgrade kit for square terminal box	MLZ/MLM030-038-045-048-058-066-076	Multipack	6

Acoustic hood



Code No	Description	Application	Packaging	Pack Size
120Z5043	Acoustic hood	MLZ/MLM015 - 021 - 026	Single pack	1
120Z5044	Acoustic hood	MLZ/MLM030 - 038 - 045 - 048	Single pack	1
120Z5045	Acoustic hood	MLZ/MLM058 - 066 - 076	Single pack	1

Terminal box



Code No	Description	Application	Packaging	Pack Size
120Z5015	Round terminal box (P & T version)	MLZ/MLM015 - 021 - 026	Multipack	10
120Z5018	Square terminal box (C & Q version)	MLZ/MLM030-038-045-058-066-076	Multipack	10

Manifolding service kit



Code No	Description	Application	Packaging	Pack Size
120Z5073	Oil equalisation kit including: 2 oil sight glass adaptors, rotolock nuts, sleeves and gaskets, feet spacers and washers for 2 compressors	All models	Multipack	6

Danfoss Commercial Compressors

is a worldwide manufacturer of compressors and condensing units for refrigeration and HVAC applications. With a wide range of high quality and innovative products we help your company to find the best possible energy efficient solution that respects the environment and reduces total life cycle costs.

We have 40 years of experience within the development of hermetic compressors which has brought us amongst the global leaders in our business, and positioned us as distinct variable speed technology specialists. Today we operate from engineering and manufacturing facilities spread across three continents.



Our products can be found in a variety of applications such as rooftops, chillers, residential air conditioners, heatpumps, coldrooms, supermarkets, milk tank cooling and industrial cooling processes.

<http://cc.danfoss.com>

Danfoss Commercial Compressors, BP 331, 01603 Trévoux Cedex, France | +334 74 00 28 29

Application guidelines

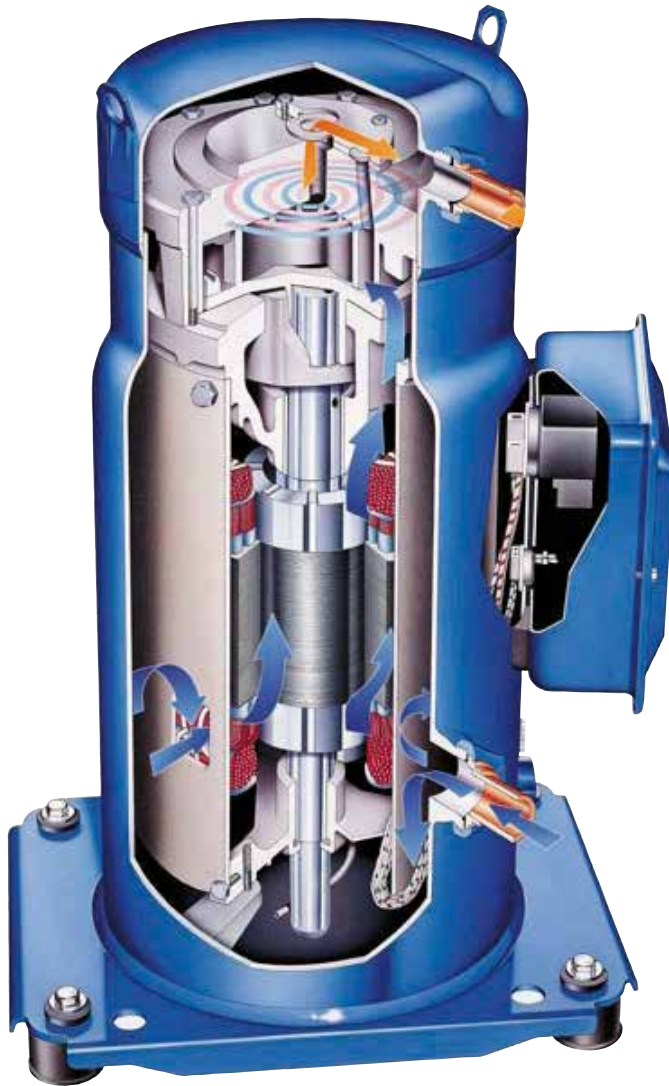
Danfoss scroll compressors

SM - SY - SZ

R22 - R407C - R137a - R404A - R507A - 50 - 60 Hz



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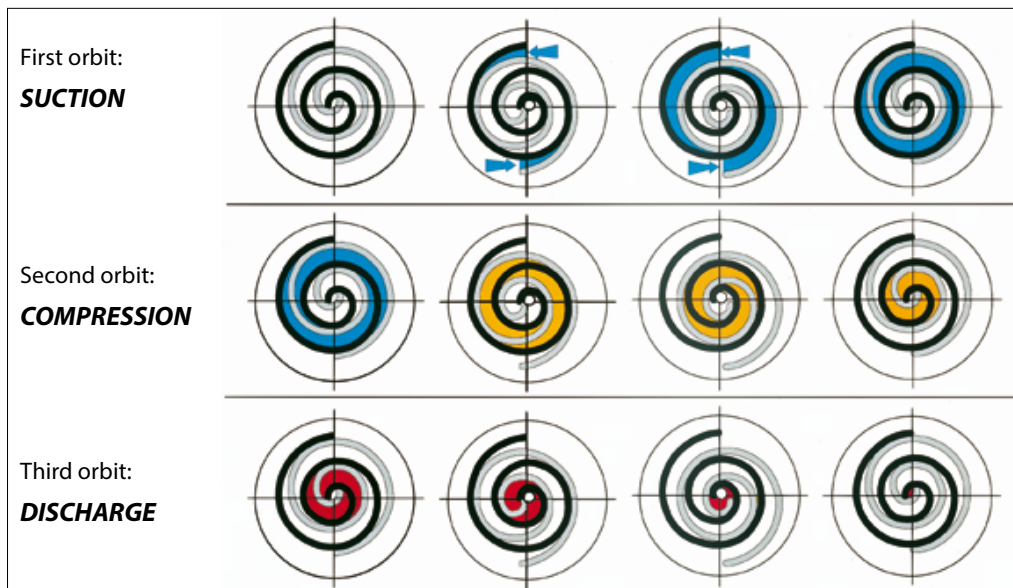


In a Danfoss SM / SY / SZ scroll compressor, the compression is performed by two scroll elements located in the upper part of the compressor.

Suction gas enters the compressor at the suction connection. As all of the gas flows around and through the electrical motor, thus ensuring complete motor cooling in all applications, oil droplets separate and fall into the oil sump. After exiting the electrical motor, the gas enters the scroll elements where compression takes place. Ultimately, the discharge gas leaves the compressor at the discharge connection.

The figure below illustrates the entire compression process. The centre of the orbiting scroll (in grey) traces a circular path around the centre of the fixed scroll (in black). This movement creates symmetrical compression pockets between the two scroll elements. Low-pressure suction gas is trapped within each crescent-shaped pocket as it gets formed; continuous motion of the orbiting scroll serves to seal the pocket, which decreases in volume as the pocket moves towards the centre of the scroll set increasing the gas pressure. Maximum compression is achieved once a pocket reaches the centre where the discharge port is located; this stage occurs after three complete orbits. Compression is a continuous process: the scroll movement is suction, compression and discharge all at the same time.

SM SY SZ 084-090-100-110-120-148-161-175-185-240-300-380



Application guidelines

Features

In addition to the existing SM range compressors previously available, Danfoss is completing its range with 3 compressors.

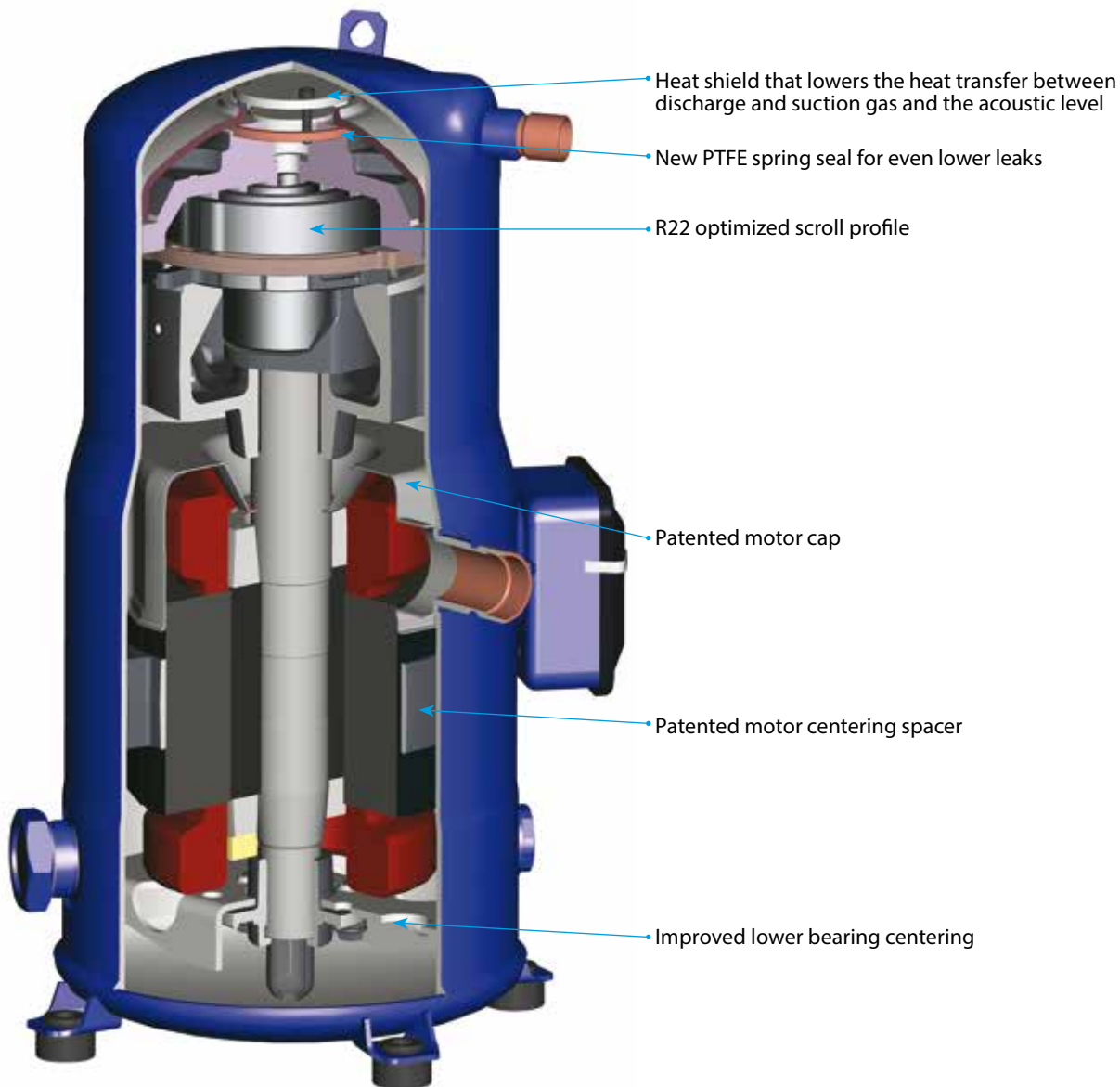
The new SM112-124-147 and SZ147 compressors benefit from a further improved design to achieve the highest efficiency.

Gas circulation, motor cooling and oil behaviour are improved by a new patented motor cap design.

Part protection and assembly reduces internal leaks and increases life durability.

Improved part isolation reduces greatly acoustic levels.

Gas intake design induces higher resistance to liquid slugging.



SM112-124-147 and SZ147

Application guidelines

Compressor model designation

Danfoss scroll compressors are available both as single compressors and as tandem units. The example below presents the single compressor nomenclature which equals the technical reference as shown on the compressor nameplate.

Code numbers for ordering list are section "Ordering information & packaging".

For tandem and trio assemblies, please refer to the Danfoss Parallel Application Guidelines documentation FRCC.PC.005.

Nomenclature

Family, lubricant & refrigerant	Nominal capacity		Voltage	Version	Evolution index	
SZ	185	-	4	R	C	Single compressors
SY	300	A	7	CA	A	Single compressors

Family, lubricant & refrigerant
SM: Scroll, Mineral oil, R22/R417A*
SY: Scroll, POE lubricant, R22/R417A (and R407C for SY185-240-300)
SZ: Scroll, POE lubricant, R407C - R134a (and R404A, R507A for SZ084 to SZ185)

Nominal capacity
in thousand Btu/h at 60 Hz, R22, ARI conditions

Motor voltage code
3: 200-230V/3~/60 Hz
4: 380-400V/3~/50 - 460V/3~/60 Hz
6: 230V/3~/50 Hz
7: 500V/3~/50 Hz - 575V/3~/60 Hz
9: 380V/3~/60 Hz

Motor protection type		Connection	Module voltage	Applies to	
Internal overload protector	V	: brazed		S 084-090-100-110-120-148-161	
	A	: brazed		S 112-124-147	
Internal thermostat	C	: brazed		S 175-185	
	R	: rotolock			
Electronic protection module	P	: brazed	24 V AC		S 240 - 300
	X	: brazed	230 V		
	S	: rotolock	24 V AC		
	Y	: rotolock	230 V		
	CA	C: brazed	A: 24V AC	S 380	
	CB		B: 115/230V		
	PA	P: rotolock	A: 24V AC		
	PB		B: 115/230V		
CA	C: brazed	A: 24V AC			
CB		B: 115/230V			

* When SM compressors are used with R417A, the factory charged mineral oil 160P must be replaced by polyolester oil 160SZ

Application guidelines

Technical specifications

50 Hz data

Model		Nominal Cap. 60 Hz	Nominal cooling capacity		Power input	COP	E.E.R.	Swept volume	Displace- ment ①	Oil charge	Net weight ②
		TR	W	Btu/h	kW	W/W	Btu/h /W	cu.in/rev	cu.ft/h	oz	lbs
R22 SINGLE	SM084	7	20 400	69 600	6.12	3.33	11.4	6.99	703	112.08	141
	SM090	7.5	21 800	74 400	6.54	3.33	11.4	7.35	741	112.08	143
	SM100	8	23 100	78 800	6.96	3.33	11.4	7.76	782	112.08	143
	SM110	9	25 900	88 400	7.82	3.32	11.3	8.80	886	112.08	161
	SM112	9.5	27 600	94 200	7.92	3.49	11.9	9.25	931	112.08	141
	SM120	10	30 100	102 700	8.96	3.36	11.5	10.17	1024	112.08	161
	SM124	10	31 200	106 500	8.75	3.56	12.2	10.34	1042	112.08	141
	SM147	12	36 000	122 900	10.08	3.57	12.2	11.81	1190	112.08	148
	SM148	12	36 100	123 200	10.8	3.34	11.4	12.14	1222	122.26	194
	SM161	13	39 000	133 100	11.59	3.37	11.5	13.22	1331	122.26	194
	SM175	14	42 000	143 300	12.47	3.37	11.5	14.22	1432	210.57	220
	SM/SY185	15	45 500	155 300	13.62	3.34	11.4	15.25	1535	210.57	220
	SY240	20	61 200	208 900	18.2	3.36	11.5	21.22	2137	271.70	331
	SY300	25	78 200	266 900	22.83	3.43	11.7	26.70	2687	271.70	346
	SY380	30	94 500	322 500	27.33	3.46	11.8	32.42	3263	285.28	348
R407C SINGLE	SZ084	7	19 300	65 900	6.13	3.15	10.8	6.99	703	112.08	141
	SZ090	7.5	20 400	69 600	6.45	3.16	10.8	7.35	741	112.08	143
	SZ100	8	21 600	73 700	6.84	3.15	10.8	7.76	782	112.08	143
	SZ110	9	24 600	84 000	7.76	3.17	10.8	8.80	886	112.08	161
	SZ120	10	28 600	97 600	8.99	3.17	10.8	10.17	1024	112.08	161
	SZ147	12	34 900	119 100	9.92	3.52	12.0	11.81	1190	112.08	148
	SZ148	12	35 100	119 800	10.99	3.19	10.9	12.14	1222	122.26	194
	SZ161	13	37 900	129 700	11.84	3.21	11.0	13.22	1331	122.26	194
	SZ175	14	40 100	136 900	12.67	3.17	10.8	14.22	1432	210.57	220
	SZ185	15	43 100	147 100	13.62	3.16	10.8	15.25	1535	210.57	220
	SZ240	20	59 100	201 700	18.55	3.19	10.9	21.22	2137	271.70	331
	SZ300	25	72 800	248 100	22.73	3.2	10.9	26.70	2687	271.70	346
	SZ380	30	89 600	305 800	27.59	3.25	11.1	32.42	3263	285.28	348

TR = Ton of Refrigeration

COP = Coefficient Of Performance

EER = Energy Efficiency Ratio

① Displacement at nominal speed: 2900 rpm at 50 Hz, 3500 rpm at 60Hz

② Net weight with oil charge

Data given for code 4 compressor, for full data details and capacity tables refer to Online Datasheet Generator: www.danfoss.com/ODSG

Rating conditions

	SM/SY compressors	SZ compressors
Refrigerant	R22	R407C
Frequency	50 Hz	50 Hz
Standard rating conditions	ARI standard conditions	-
Evaporating temperature	45°F	45°F (dew point)
Condensing temperature	130°F	130°F (dew point)
Sub-cooling	15°F	15°F
Superheat	20°F	20°F

Subject to modification without prior notification

For full data details and capacity tables refer to Online Datasheet Generator : www.danfoss.com/odsg

Application guidelines

Technical specifications

60 Hz data

Model		Nominal Cap. 60 Hz	Nominal cooling capacity		Power input	COP	E.E.R.	Swept volume	Displace- ment ①	Oil charge	Net weight ②
		TR	W	Btu/h	kW	W/W	Btu/h / W	cu.in/rev	cu.ft/h	oz	lbs
R22 SINGLE	SM084	7	24600	84 000	7.4	3.34	11.4	6.99	849	110	141
	SM090	7.5	26400	90 100	7.8	3.37	11.5	7.35	894	110	143
	SM100	8	27500	93 900	8.1	3.38	11.5	7.76	943	110	143
	SM110	9	31600	107 800	9.3	3.38	11.5	8.80	1069	110	161
	SM112	9.5	34000	116 000	9.6	3.53	12.1	9.25	1124	112	141
	SM120	10	36 700	125 300	10.8	3.4	11.6	10.17	1236	110	161
	SM124	10.5	37 700	128 700	10.6	3.56	12.2	10.34	1257	112	142
	SM147	12	43 600	148 800	12.2	3.58	12.2	11.81	1435	112	148
	SM148	12	43 800	149 500	13	3.37	11.5	12.14	1476	122	194
	SM161	13	47 600	162500	14.1	3.39	11.6	13.22	1606	122	194
	SM175	14	51 100	174 400	15.3	3.34	11.4	14.22	1728	210	220
	SM/SY185	15	55 300	188 700	16.3	3.39	11.6	15.25	1853	210	220
	SY240	20	74 100	252 900	22.1	3.35	11.4	21.22	2579	272	331
	SY300	25	94 500	322 500	27.5	3.43	11.7	26.70	3245	272	346
	SY380	30	115 300	393 500	33.4	3.46	11.8	32.42	3939	285	348
R407C SINGLE	SZ084	7	22 500	76 800	7.1	3.19	10.9	6.99	849	110	141
	SZ090	7.5	24 400	83 300	7.6	3.2	10.9	7.35	894	110	143
	SZ100	8	26 500	90 400	8.2	3.24	11.1	7.76	943	110	143
	SZ110	9	30 100	102 700	9.3	3.24	11.1	8.80	1069	110	161
	SZ120	10	34 800	118 800	10.7	3.24	11.1	10.17	1236	110	161
	SZ147	12	42 300	144 300	12.03	3.52	12.0	11.81	1435	112	148
	SZ148	12	42 600	145 400	13.3	3.19	10.9	12.14	1476	122	194
	SZ161	13	46 000	157 000	14.3	3.21	11.0	13.22	1606	122	194
	SZ175	14	48 700	166 200	15.3	3.19	10.9	14.22	1728	210	220
	SZ185	15	51 800	176 800	16.4	3.15	10.8	15.25	1853	210	220
	SZ240	20	71 100	242 700	22.7	3.14	10.7	21.22	2579	272	331
	SZ300	25	87 900	300 000	27.5	3.2	10.9	26.70	3245	272	346
	SZ380	30	107 300	366 200	33.5	3.2	10.9	32.42	3939	285	348

TR = Ton of Refrigeration

COP = Coefficient Of Performance

EER = Energy Efficiency Ratio

① Displacement at nominal speed: 2900 rpm at 50 Hz, 3500 rpm at 60Hz

② Net weight with oil charge

Data given for code 4 compressor, for full data details and capacity tables refer to Online Datasheet Generator: www.danfoss.com/ODSG

Rating conditions

	SM/SY compressors	SZ compressors
Refrigerant	R22	R407C
Frequency	60 Hz	60 Hz
Standard rating conditions	ARI standard conditions	-
Evaporating temperature	45°F	45°F (dew point)
Condensing temperature	130°F	130°F (dew point)
Sub-cooling	15°F	15°F
Superheat	20°F	20°F

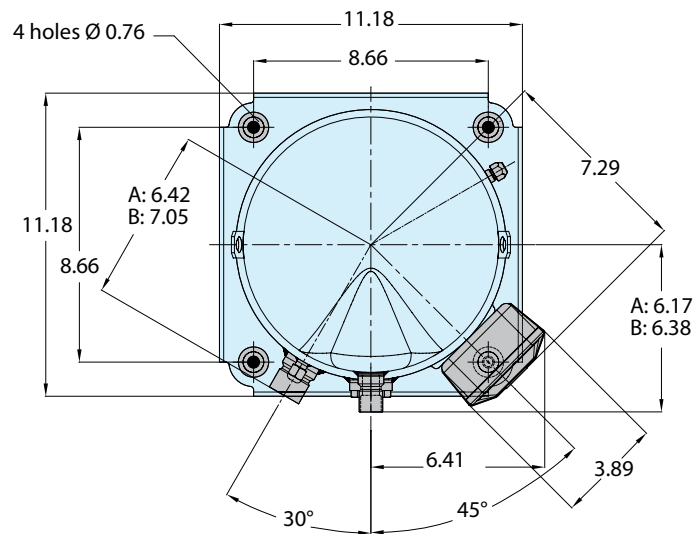
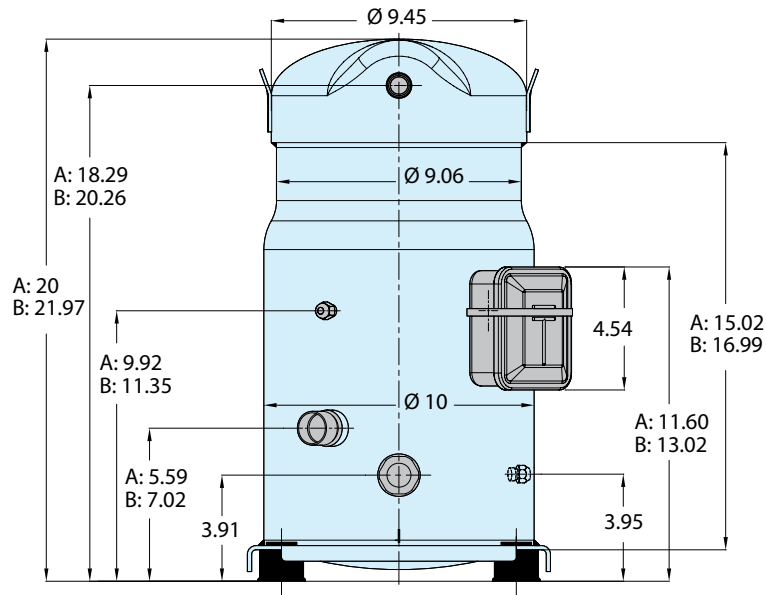
Subject to modification without prior notification

For full data details and capacity tables refer to Online Datasheet Generator : www.danfoss.com/odsg

Application guidelines

Dimensions

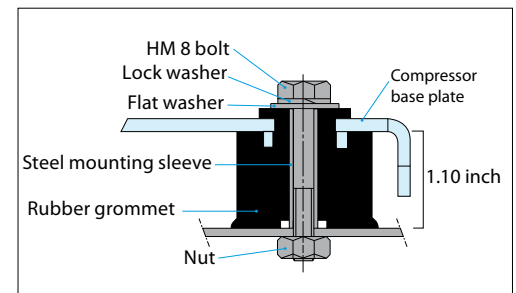
SM/SZ 084-090-100-110-120



All dimensions in inch

A: SM/SZ 084-090-100
B: SM/SZ 110-120

Grommet

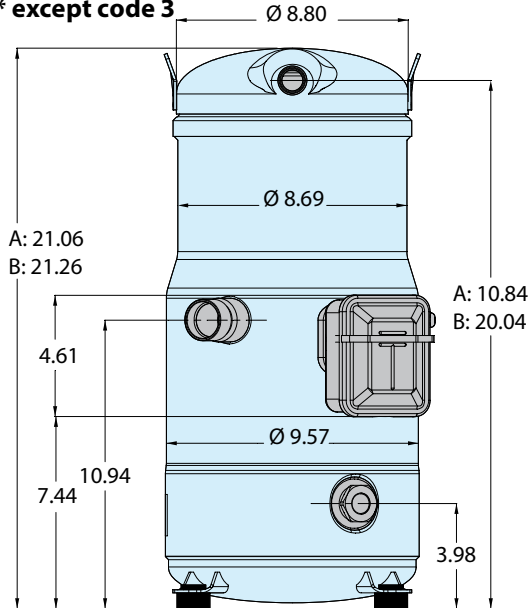


Application guidelines

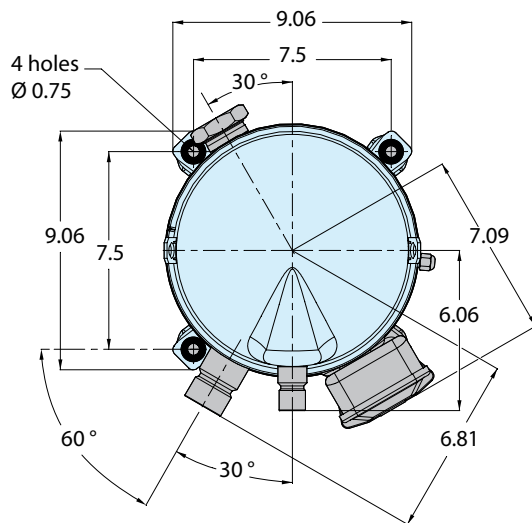
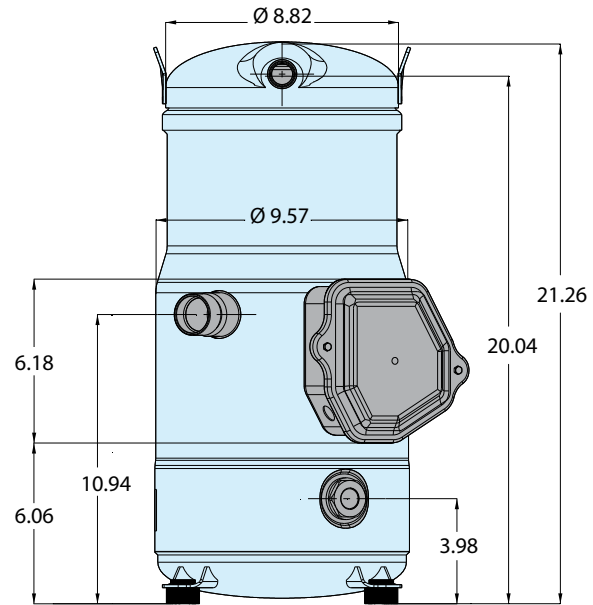
Dimensions

SM 112-124-SM/SZ147*

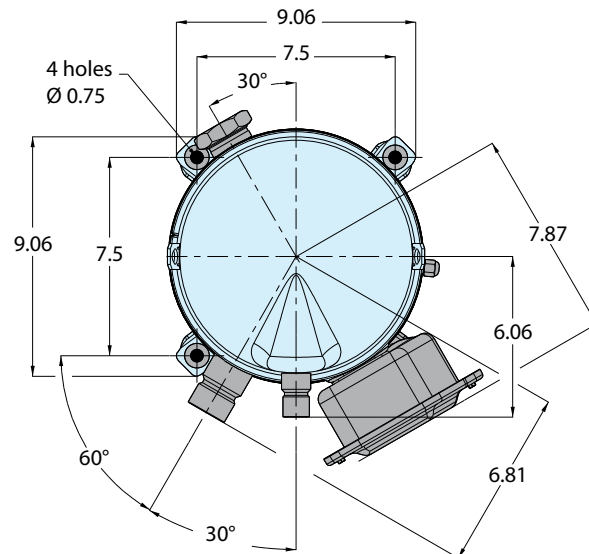
* except code 3



SM/SZ147 code 3

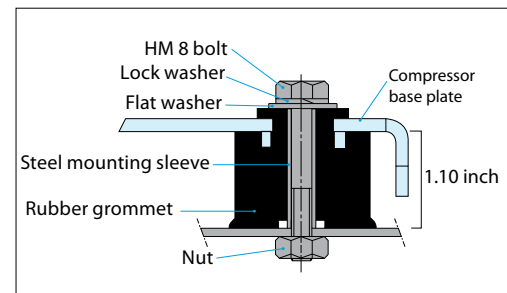


A: SM112
B: SM124-147



All dimensions in inch

Grommet



SM 148-161 code 4



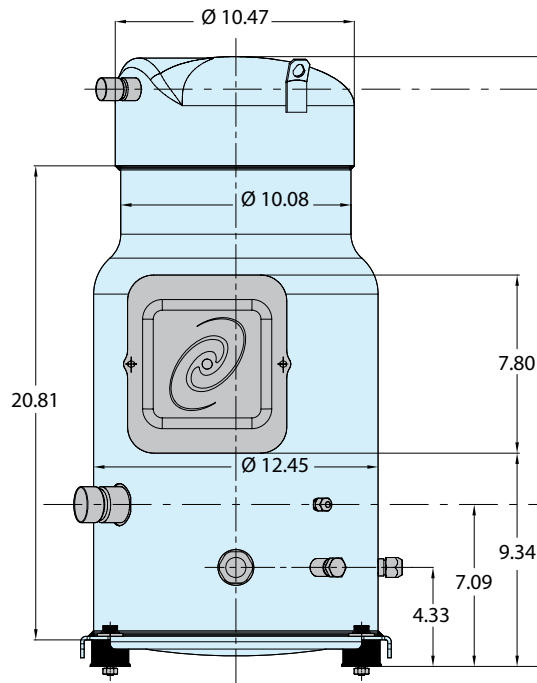
This diagram illustrates the exploded view of the compressor base plate assembly. The components are labeled as follows:

- HM 8 bolt
- Lock washer
- Flat washer
- Compressor base plate
- Steel mounting sleeve
- Rubber grommet
- Nut

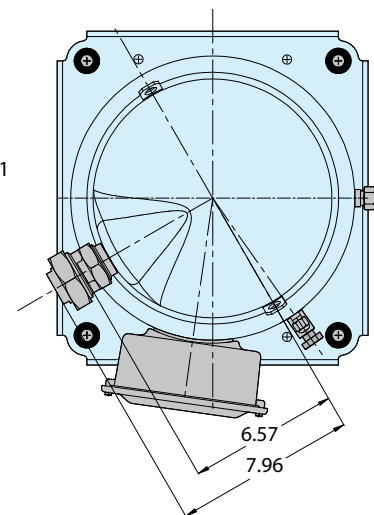
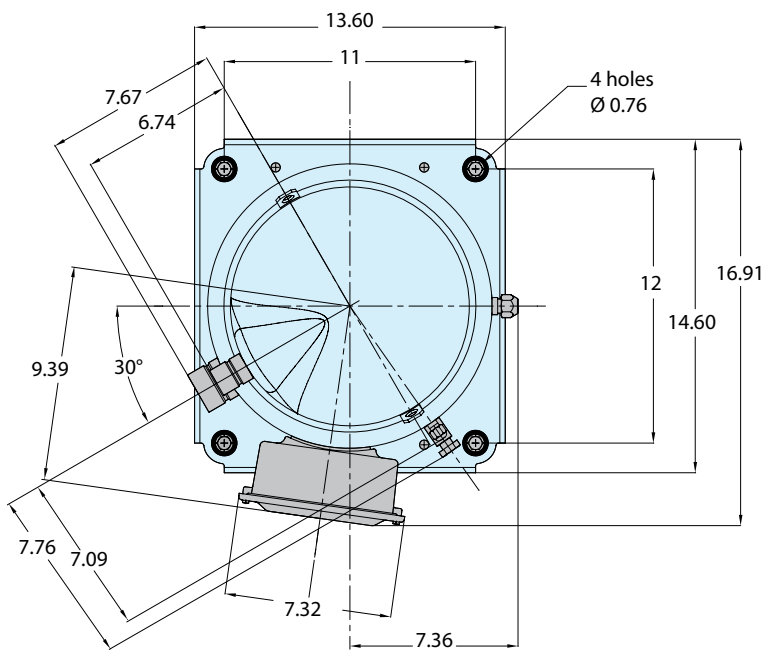
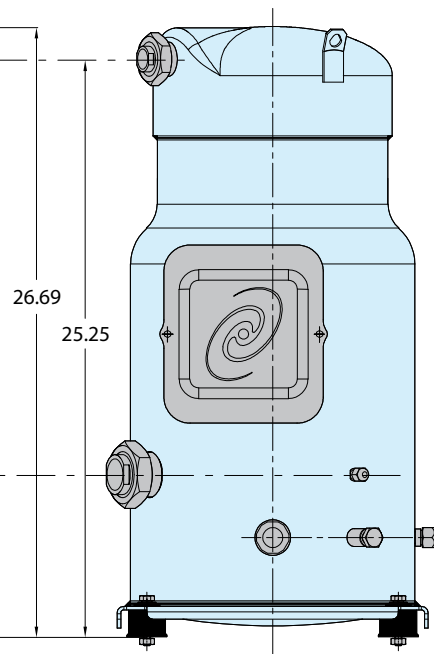
A dimension line on the right indicates a height of 1.10 inch for the assembly.

SM/SZ 175-185 & SY185

Brazed version

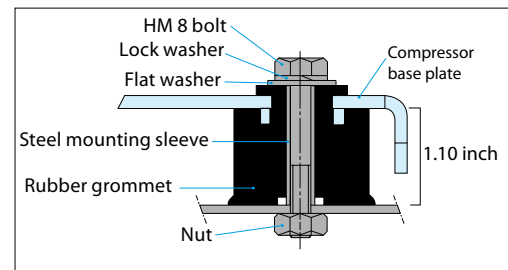


Rotolock version



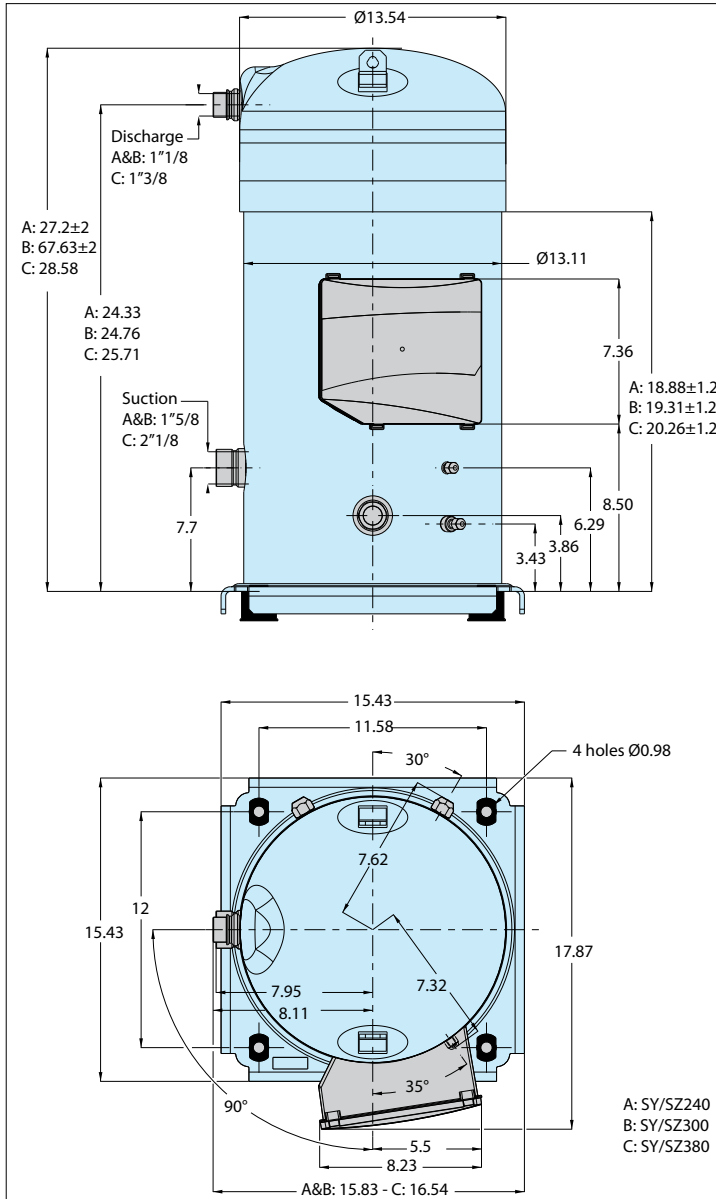
All dimensions in inch

Grommet

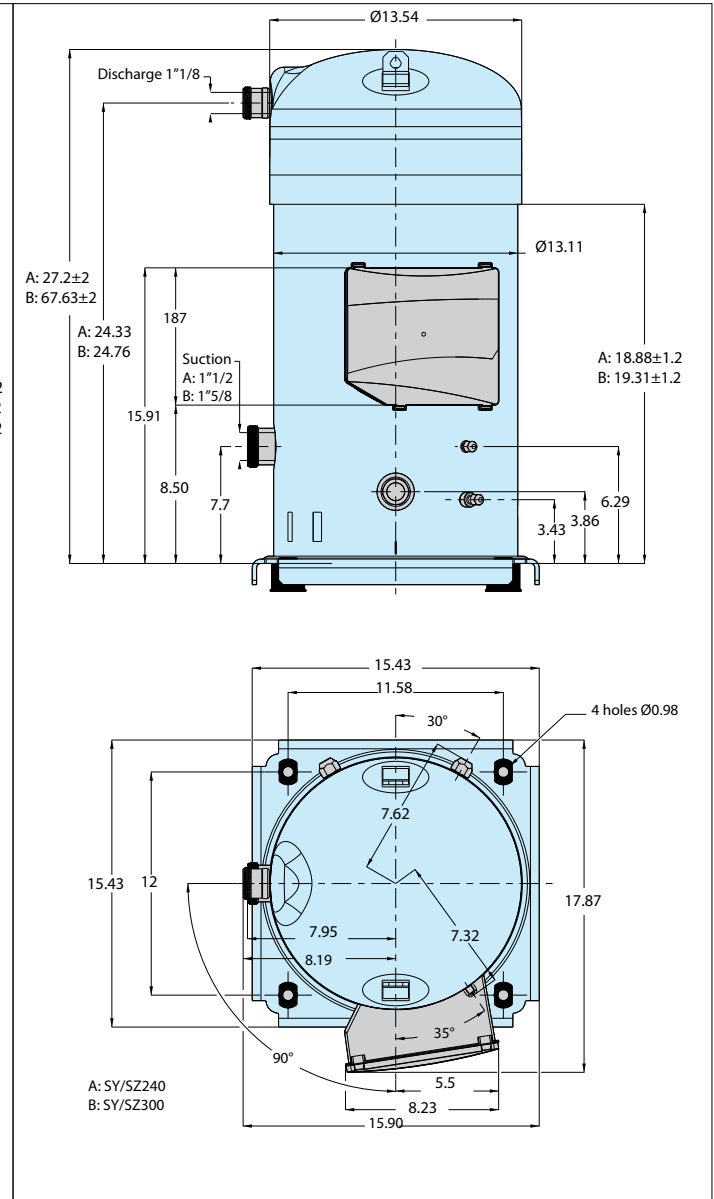


SY/SZ 240-300-380

Brazed version

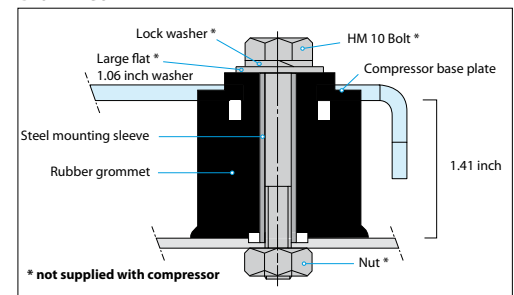


Rotolock version



All dimensions in inch

Grommet




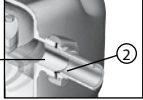

Application guidelines

Dimensions

Connection details

Model	SM/SZ084-090-100-110-120-148-161	SM/SZ 175 - SM/SZ/SY185		SM 112-124 - SM/SZ 147	SY/SZ 240 - 300		SY/SZ 380
Version	V	K-R-S-W-Y	C-J-P-U-X	AL	MA - MB	AA - AB	AA - AB
Suction and discharge connection	brazed	rotolock	brazed	brazed	rotolock	brazed	brazed
Oil sight glass	threaded	threaded	threaded	threaded	threaded	threaded	threaded
Oil equalisation connection	3/8" flare	3/8" flare	3/8" flare	rotolock 1"3/4	1/2" flare	1/2" flare	1/2" flare
Oil drain connection	-	1/4" flare	1/4" flare	-	1/4" flare	1/4" flare	1/4" flare
Low pressure gauge port (schrader)	1/4" flare	1/4" flare	1/4" flare	1/4" flare	1/4" flare	1/4" flare	1/4" flare

Suction and discharge connections

		Brazed version	Rotolock version	
				
		Brazed	Rotolock ①	Sleeve included ②
SM/SZ 084-090-100	Suction	1" 1/8	-	-
	Discharge	3/4"	-	-
SM/SZ 110-112-120-124-147-SM148&161	Suction	1" 3/8	-	-
	Discharge	7/8"	-	-
SM/SZ 175-185	Suction	1" 5/8	2" 1/4	1" 3/8
	Discharge	1" 1/8	1" 3/4	7/8"
SY/SZ 240-300	Suction	1" 5/8	2" 1/4	1" 5/8
	Discharge	1" 1/8	1" 3/4	1" 1/8
SY/SZ 380	Suction	2" 1/8	-	-
	Discharge	1" 3/8	-	-

Oil sight glass

All Danfoss SM / SY / SZ scroll compressors come equipped with a sight glass (1"1/8-18 UNF) which may be used to determine the amount and condition of the oil contained within the sump.

Oil equalisation connection

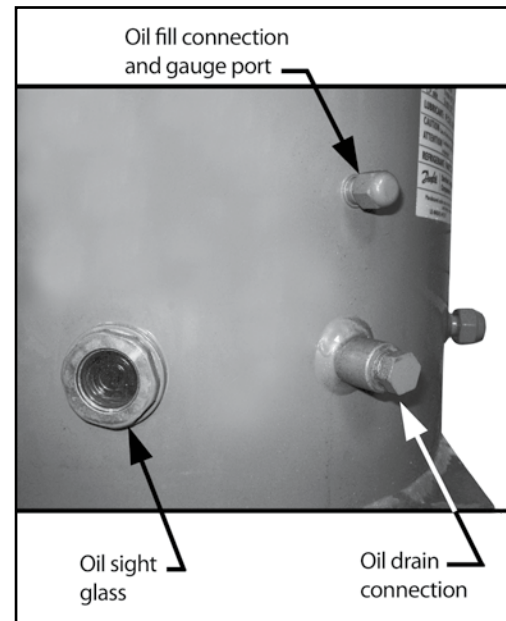
SM/SZ 112-124-147: 1"3/4 rotolock connector allowing use of 1"3/4-7/8" or 1"3/4-1"1/8
SY/SZ240-300-380: 1/2" flare
Other models: 3/8" flare
This connection must be used to mount an oil equalisation line when two or more compressors are mounted in parallel (please refer to Danfoss Parallel Application Guidelines reference FRCC.PC.005 for details).

Oil drain connection

The oil drain connection allows oil to be removed from the sump for changing, testing, etc. The fitting contains an extension tube into the oil sump to more effectively remove the oil. The connection is a female 1/4" flare fitting.
Note: on SY/SZ 240 to 380, it is not possible to drain oil from the suction connection.

Schrader

The oil fill connection and gauge port is a 1/4" male flare connector incorporating a schrader valve.



Application guidelines

Electrical data, connections and wiring

Motor voltage

Danfoss SM / SY / SZ scroll compressors are available in five different motor voltages.

		Motor voltage code 3	Motor voltage code 4	Motor voltage code 7	Motor voltage code 9
Nominal voltage	50 Hz	-	380-400 V - 3 ph	500 V - 3 ph	-
Voltage range	50 Hz	-	340-440 V	450 - 550 V	-
Nominal voltage	60 Hz	200-230 V - 3 ph	460 V - 3 ph	575 V - 3 ph	380 V - 3 ph
Voltage range	60 Hz	180 - 253 V	414 - 506 V	517 - 632 V	342 - 418 V

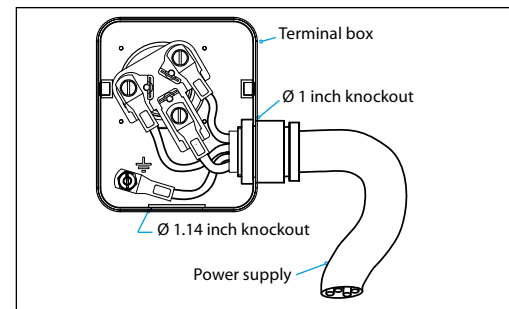
Wiring connections

Electrical power is connected to the compressor terminals by Ø 3/16" (4.8 mm) screws. The maximum tightening torque is 2.2ft.lb. Use a 1/4" ring terminal on the power leads.

SM / SZ 084 - 090 - 100 - 110 - 112 - 120 - 124 - 147* - 148* - 161*

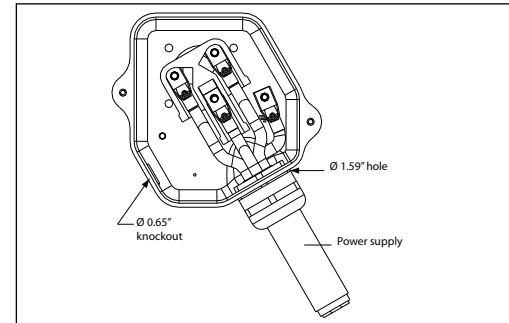
*Except for motor voltage code 3

The terminal box is provided with a Ø 1" and a Ø 1.14" knockouts.



SM/SZ 147 code 3

The terminal box is provided with a Ø 1.59" hole for power supply and a Ø 0.65" knockout.

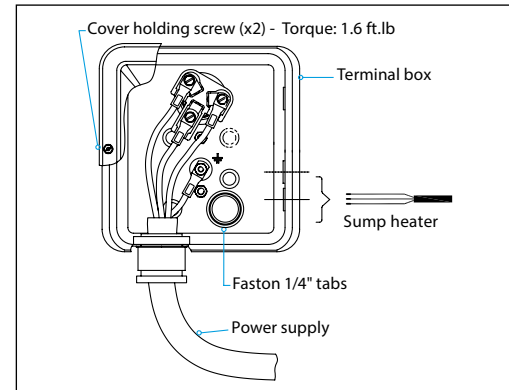


SM / SZ 148 & 161 code 3-175-185 & SY185 - R & C version

The terminal box is provided with 2 double knockouts for the power supply and 3 knockouts for the safety control circuit.

The 2 power supply, double knockouts accommodate the following diameters:
Ø 1 3/4" hole (for a 1 1/4" conduit) and Ø 1 3/8" hole (for a 1" conduit),
Ø 1.26" hole & Ø 1" hole

The 3 other knockouts are as follows:
Ø 0.81"
Ø 7/8" (for a 1/2" conduit)
Ø 0.65"



Application guidelines

Electrical data, connections and wiring

SM/SZ 175-185 - J, K, P, S, U, W, X, Y versions

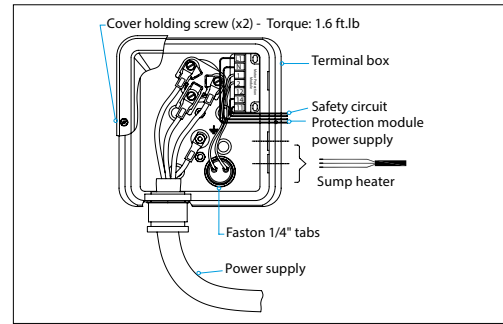
The terminal box is provided with 2 double knockouts for the power supply and 3 knockouts for the safety control circuit.

The 2 power supply, double knockouts accommodate the following diameters:

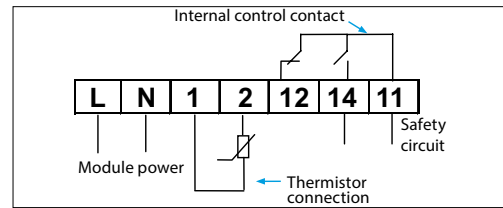
- Ø 1 3/4 hole (for a 1 1/4 conduit) and Ø 1 3/8 hole (for a 1" conduit)
- Ø 1.26" hole & Ø 1" hole

The 3 other knockouts are as follows:

- Ø 0.81", Ø 7/8" (for a 1/2" conduit) and Ø 0.65"



The motor protection module comes preinstalled within the terminal box and has pre-wired thermistor connections. The module must be connected to a power supply of the appropriate voltage. The module terminals are 0.25" size Faston type except for 24V DC module (screw connection).



SY/SZ 240 - 300 - 380

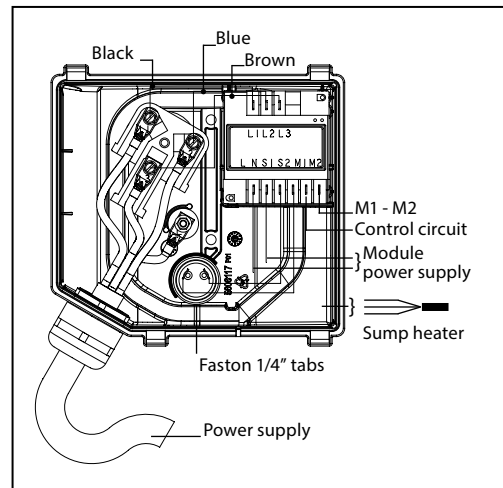
The terminal box is provided with 2 triple knockouts and 1 single knockout for power supply and 4 double knockouts for the safety control circuit.

The 3 power supply knockouts accommodate the following diameters:

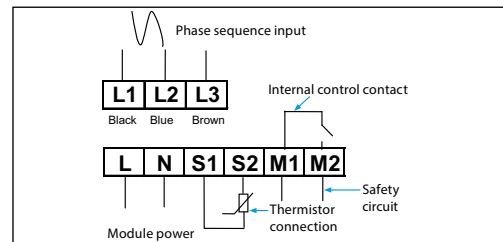
- Ø 2 inch (UL 1 1/2 conduit) & Ø 1.72 inch (UL 1 1/4 conduit) & Ø 1.36 inch (UL 1" conduit)
- Ø 1.59 inch (ISO40) & Ø 1.27 inch (ISO32) & Ø 1 inch (ISO25)
- Ø 1 inch (ISO25)

The 4 others knockouts are as follows:

- Ø 0.89 inch (PG16) (UL 1/2") & Ø 0.65 inch (ISO16) (x2)
- 0.81 inch (ISO20 or PG13.5) (x2)



The motor protection module comes preinstalled within the terminal box. Phase sequence protection connections and thermistor connections are pre-wired. The module must be connected to a power supply of the appropriate voltage. The module terminals are 0.25" size Faston type.



IP rating

The compressor terminal box according to IEC529 is IP54 for all models when correctly sized IP54 rated cable glands are used.

- First numeral, level of protection against contact and foreign objects
5 - Dust protected
- Second numeral, level of protection against water
4 - Protection against water splashing.

Application guidelines

Electrical data, connections and wiring

Terminal box temperature

The temperature inside the terminal box may not exceed 158°F. Consequently, if the compressor is installed in an enclosure, precautions must be taken to avoid that the temperature around the compressor and in the terminal box would rise too much. The installation of ventilation on the enclosure panels may be necessary. If not, the

electronic protection module may not operate properly. Any compressor damage related to this will not be covered by Danfoss warranty. In the same manner, cables must be selected in a way to insure that terminal box temperature does not exceed 158°F.

Three phase electrical characteristics

Compressor model		LRA	MCC	MMT	Max. op. current	Winding resistance
		A	A	A	A	Ω
Motor voltage code 3 200-230V/3 ph/60 Hz	SM/SZ084	170	35		35	0.44
	SM/SZ090	195	35		34	0.38
	SM/SZ100	195	38		32	0.38
	SM/SZ110	237	45		40	0.26
	SM112	267	51		41	0.27
	SM/SZ120	237	50		48	0.26
	SM/SZ124	267	51		45	0.27
	SM/SZ147	304	57		52	0.24
	SM/SZ148	255	64		57	0.29
	SM/SZ161	255	64		61	0.29
	SM/SZ175 *	380		75	70	0.19
	SM/SZ185 *	380		75	73	0.19
Motor voltage code 4 380-400V/3 ph/50 Hz 460V/3 ph/60 Hz	SY/SZ240	460	109		100	0.14
	SY/SZ300	560	130		130	0.12
	SM/SZ084	86	17		17	1.74
	SM/SZ090	98	18.5		17	1.48
	SM/SZ100	98	19		18	1.48
	SM/SZ110	130	22		20	1.05
	SM/SZ112	142	25		21	1.05
	SM/SZ120	130	29		24	1.05
	SM/SZ124	142	25		23	1.05
	SM/SZ147	147	29		26	0.92
	SM/SZ148	145	32		29	0.94
	SM/SZ161	145	32		31	0.94
Motor voltage code 7 500V/3 ph/50 Hz 575V/3 ph/60 Hz	SM/SZ175 *	175		35	34	0.77
	SM/SZ185 *	175		35	35	0.77
	SY/SZ185	175		35	34	0.77
	SY/SZ240	215	50		47	0.62
	SY/SZ300	270	69		58	0.52
	SY/SZ380	300	79		69	0.46
	SM/SZ084	70	13		13	2.58
	SM/SZ090	80	14		13	2.25
	SM/SZ100	80	15		13	2.25
	SM/SZ110	85	18		16	1.57
	SM/SZ120	85	19		18	1.57
	SM/SZ148	102	27		23	1.61
Motor voltage code 9 380V/3 ph/60 Hz	SM/SZ161	102	25		24	1.61
	SM/SZ175 *	140		28	27	1.11
	SM/SZ185 *	140		28	28	1.11
	SY/SZ240	180	40		39	0.94
	SY/SZ300	210	49		49	0.80
	SM/SZ084	100	20		20	1.22
	SM/SZ090	113	22		20	1.05
	SM/SZ100	113	22		19	1.05
	SM/SZ110	160	27		23	0.72
	SM/SZ112	177	32		24	0.72
	SM/SZ120	160	30		28	0.72
	SM/SZ124	177	32		27	0.72
Motor voltage code 9 380V/3 ph/60 Hz	SM/SZ147	181	35		31	0.62
	SM/SZ148	155	38		36	0.75
	SM/SZ161	155	38		38	0.75
	SM/SZ175 *	235		43	42	0.48
	SM/SZ185 *	235		43	43	0.48
	SY/SZ240	260	62		62	0.42
	SY/SZ300	305	74		74	0.36

* For versions with electronic module, see datasheet for electrical data

LRA (Locked Rotor Amp)

Locked Rotor Amp value is the higher current as measured on mechanically blocked compressor tested under nominal voltage. The LRA value can be used as rough estimation for the starting

current. However in most cases, the real starting current will be lower. A soft starter can be applied to reduce starting current.

Application guidelines

Electrical data, connections and wiring

MMT (Max Must Trip current)

The MMT is defined for compressors without their own motor protection. This MMT value is the maximum at which the compressor can be operated in transient conditions and out of the application envelope. The tripping current

of external overcurrent protection (thermal overload relay or circuit breaker not provided with compressor) must never exceed the MMT value.

MCC (Maximum Continuous Current)

The MCC is the current at which the motor protection trips under maximum load and low voltage conditions. This MCC value is the maximum at which the compressor can be operated in transient conditions and out of the

application envelope. Above this value, the internal motor protection or external electronic module will cut-out the compressor to protect the motor.

Max. operating Current

The max. operating current is the current when the compressors operates at maximum load conditions and 10% below the highest value of its nominal voltage (59°F evaporating temperature and 154.4°F condensing temperature).

Max Oper. A can be used to select cables and contactors.
In normal operation, the compressor current consumption is always less than the Max Oper. A value.

Winding resistance

Winding resistance is the resistance between indicated terminal pins at 77°F (resistance value +/- 7%).

Winding resistance is generally low and it requires adapted tools for precise measurement. Use a digital ohm-meter, a "4 wires" method and measure under stabilised ambient temperature. Winding resistance varies strongly with winding temperature ; if the compressor is stabilised at a different value than 77°F, the measured resistance must be corrected with following formula:

$$R_{amb} = R_{77°F} \frac{a + t_{amb}}{a + t_{77°F}}$$

$t_{77°F}$: reference temperature = 77°F
 t_{amb} : temperature during measurement (°F)
 $R_{77°F}$: winding resistance at 77°F
 R_{amb} : winding resistance at t_{amb}
 Coefficient a = 234.5

Danfoss MCI soft-start controller

The inrush current for the Danfoss scroll compressors with motor code 4 (400V / 3 / 50Hz or 460V / 3 / 60Hz) can be reduced using the Danfoss digitally-controlled MCI compressor soft starter. MCI soft starters are designed to reduce the starting current of 3-phase AC motors; MCI soft starters can reduce the in-rush current by up to 40%, thereby eliminating the detrimental

effects of high starting torque surges and costly demand charges from the resultant current spike. Upon starting, the controller gradually increases the voltage supplied to the motor until full-line voltage has been reached. All settings, such as ramp-up time (less than 0.5 sec) and initial torque, are preset and do not require modification.

Compressor model	Soft start reference ambient max. 104°F	Soft start reference ambient max. 131°F
SM / SZ 084	MCI 15C	MCI 15C
SM / SZ 090		MCI 25C
SM / SZ 100		
SM / SZ 110		
SM / SZ 120	MCI 25C	MCI 25C*
SM 112-124 - SM/SZ147		
SM / SZ 161 - 148		
SM / SZ 175 - 185		
SY / SZ 240 - 300 - 380	MCI 50CM *	

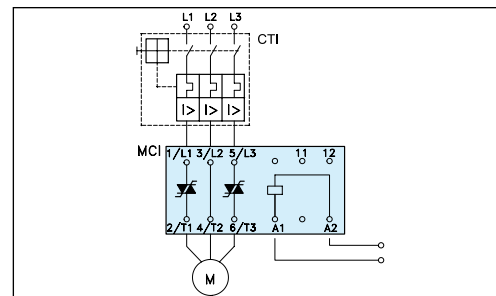
* By-pass contactor (K1) required.

Application guidelines

Electrical data, connections and wiring

Input controlled soft start

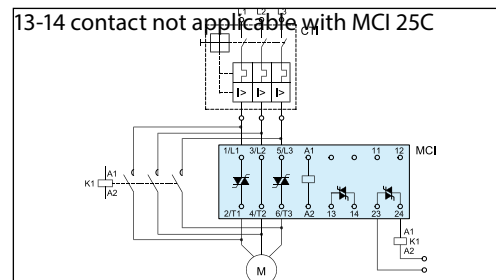
When the control voltage is applied to A1 - A2, the MCI soft starter will start the motor, according to the settings of the ramp-up time and initial torque adjustments. When the control voltage is switched OFF, the motor will switch off instantaneously.



MCI with bypass contactor

By means of the built-in auxiliary contact (23-24) the bypass function is easily achieved, see wiring diagram below.

No heat is generated from the MCI. As the contactor always switches in no-load condition it can be selected on the basis of the thermal current (AC-1).



General wiring information

The wiring diagrams below are examples for a safe and reliable compressor wiring. In case an alternative wiring logic is chosen, it's imperative to respect the following rules.

When a safety switch trips, the compressor must stop immediately and must not re-start until the tripping condition is back to normal and the safety switch is closed again. This applies to the LP safety switch, the HP safety switch, the discharge gas thermostat and the motor safety thermostat.

In specific situations, such as winter start operation, an eventual LP control for pump-down cycles may be temporarily bypassed to

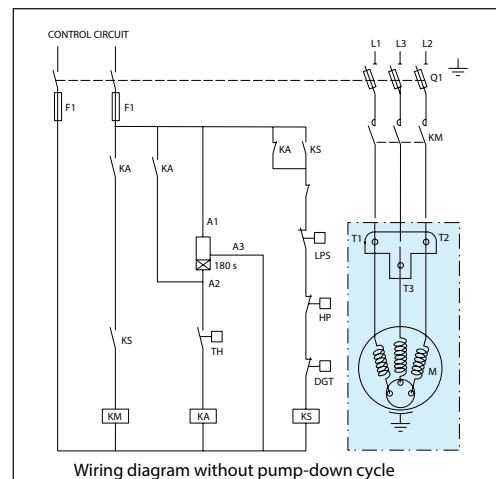
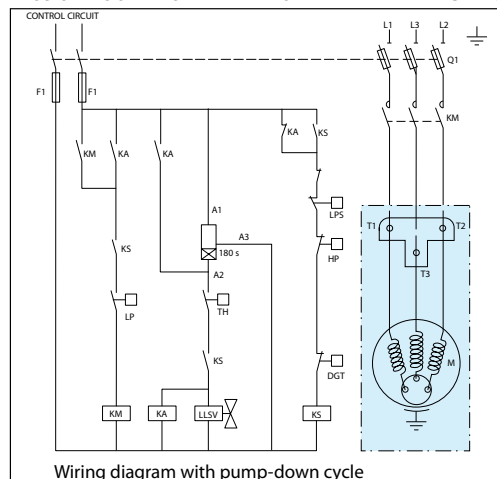
allow the system to build pressure. But it remains mandatory for compressor protection to apply an LP safety switch. The LP safety switch must never be bypassed.

Pressure settings for the LP and HP safety switch and pump-down are indicated section "Operating conditions".

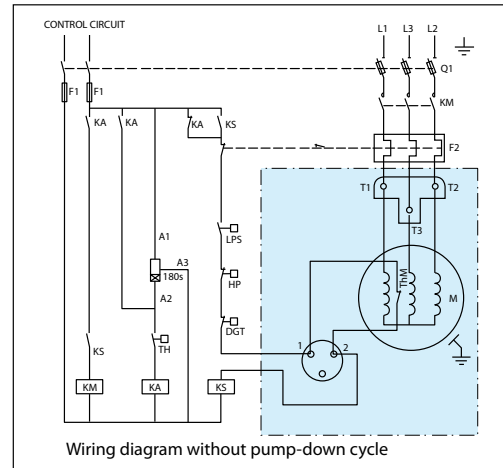
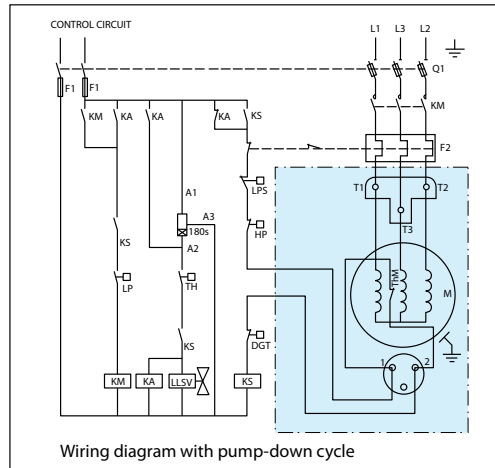
When ever possible (ie. PLC control), it is recommended to limit the possibilities of compressor auto restart to less than 3 to 5 times during a period of 12 hours when caused by motor protection or LP safety switch tripping. This control must be managed as a manual reset device.

Suggested wiring diagrams logic

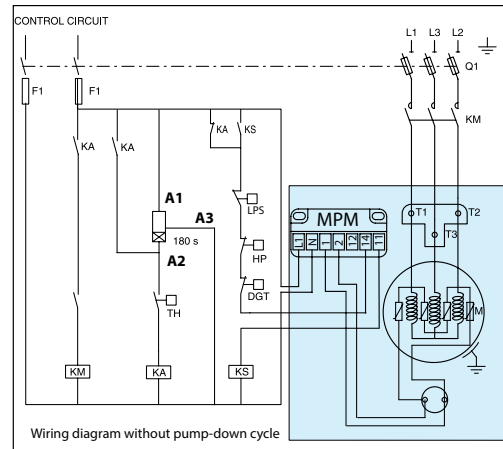
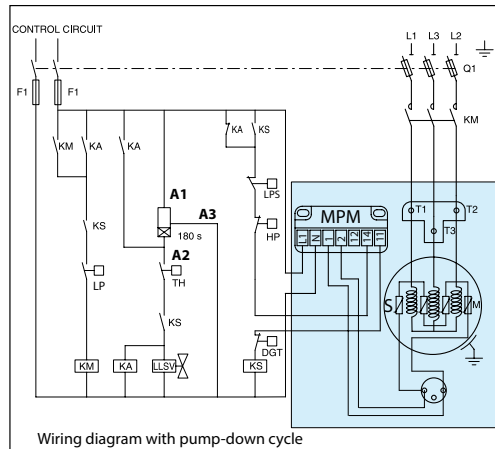
Compressor models SM / SZ 084 - 090 - 100 - 110 - 112 - 120 - 124 - 147 - 148 - 161



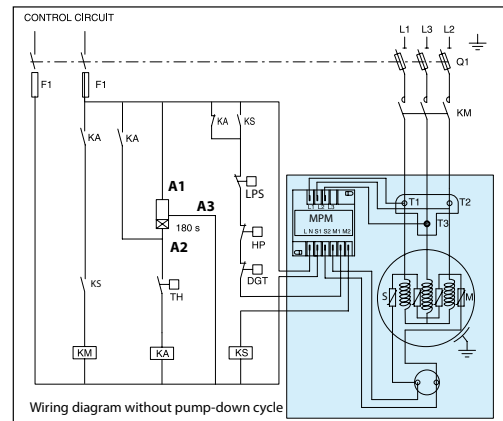
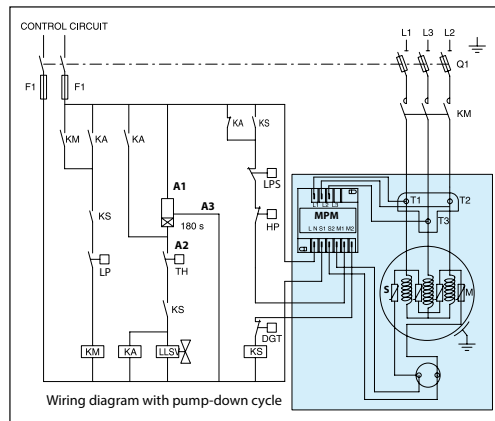
Compressor models SM / SZ 175 – 185 R and C version



Compressor models SM/SZ175-185 (J, K, P, S, U, W, X, Y versions)



Compressor models SY / SZ 240 - 300 - 380



Legends

Fuses
Compressor contactor
Control relay
Safety lock out relay
Optional short cycle timer (3 min)
External overload protection
Pump-down pressure switch
High pressure safety switch
Control device

F1
KM
KA
KS
180 s
F2
LP
HP
TH

Liquid Line Solenoid valve
Discharge gas thermostat
Fused disconnect
Motor safety thermostat
Compressor motor
Motor Protection Module
Thermistor chain
Safety pressure switch

LLSV
DGT
Q1
thM
M
MPM
S
LPS

Application guidelines

Electrical data, connections and wiring

Motor protection

The table below shows the protection method for the various compressors models.

	Overheating protection	Over current protection	Locked rotor protection	Phase reversal protection
SM/SZ 115-125-160-175-185 R & C version	<input checked="" type="checkbox"/> Internal thermostat	REQ External overload protection		<input checked="" type="checkbox"/> Reverse vent.
SM 112- 124-147		<input checked="" type="checkbox"/> Internal motor protection		REC Phase sequence detector
SM/SZ 084-090-100-110-120-148-161 - SZ147		<input checked="" type="checkbox"/> Internal motor protection		<input checked="" type="checkbox"/> Reverse vent.
SM/SZ175-185 J-K-P-S-U-W-X-Y version		<input checked="" type="checkbox"/> Electronic module located in terminal box		<input checked="" type="checkbox"/> Reverse vent.
SY/SZ 240-300-380		<input checked="" type="checkbox"/> Electronic module located in terminal box		
	REC Recommended	REQ Required	<input checked="" type="checkbox"/> No test or additional safeties required	

Compressor models SM/SZ084 - 090 - 100 - 110 - 112 - 120 - 124 - 147 - 148 - 161 have been provided with an internal overload motor protection to prevent against excessive current and temperature caused by overloading, low refrigerant flow phase loss or incorrect motor rotation. The cutout current is the MCC value listed in section "Three phase electrical characteristics".
The protector is located in the star point of the motor and, should it be activated, will cut out all three phases. It will be reset automatically.

While not compulsory, an additional external overload protection is still advisable for either alarm or manual reset.
Then it must be set below MCC value (at max operating current):

- when the motor temperature is too high, then the internal protector will trip
- when the current is too high the external overload protection will trip before the internal protection therefore offering possibility of manual reset.

Compressor models SM/SZ175 - 185 R & C versions have been provided with a bimetallic single-pole, single-throw thermostat located in the motor windings. In the event of motor overheating caused by low refrigerant flow or improper motor rotation, the thermostat will open. Because the thermostat is an automatic reset device, it must be wired within a lockout safety circuit with a manual reset to restart the unit. For over-current and phase loss protection, an external overload protector must be used.

A circuit breaker, on the other hand, should be set at not more than 125% of the compressor rated load current.
The rated load current is the maximum current expected during operations of the considered application.

The external overload protector can be either a thermal overload relay or a circuit breaker:

A thermal overload relay should be set to trip at not more than 140% of the compressor-rated load current.

Further requirements for the external overload protector are:

- **Over-current protection:** the protector must trip within 2 minutes at 110% of the Maximum Must-Trip current (MMT).
- **Locked rotor protection:** the protector must trip within 10 seconds upon starting at a locked rotor current (LRA).
- **Single-phasing protection:** the protector must trip when one of the three phases fails.

Compressor models SY/SZ 240 - 300 - 380 and SM/SZ115-125-160-175-185 J, K, P, S, U, W, X, Y versions are delivered with a pre-installed motor protection module inside the terminal box. This device provides for efficient and reliable protection against overheating and overloading (as well as phase loss/reversal for SY/SZ 240-300-380).

The motor protector comprises a control module and PTC sensors embedded in the motor winding. The close contact between thermistors and windings ensures a very low level of thermal inertia.

The motor temperature is being constantly measured by a PTC thermistor loop connected on S1-S2 (called 1-2 on SM/SZ115-125-160-175-185).

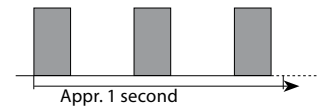
Application guidelines

Electrical data, connections and wiring

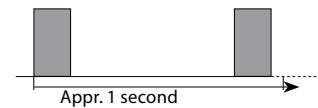
If any thermistor exceeds its response temperature, its resistance increases above the trip level ($4,500 \Omega$) and the output relay then trips -ie. contacts M1-M2 (or 11-14 for SM/SZ175-185) are open. After cooling to below the response temperature (resistance $< 2,750 \Omega$), a 5 minute time delay is activated. After this delay has elapsed, the relay is once again pulled in ie. contacts M1-M2 (11-14 for SM/SZ175-185) are closed. The time delay may be cancelled by means of resetting the mains (L-N disconnect) for approximately 5 sec.

A red/green twin LED is visible on the module. A solid green LED denotes a fault free condition. A blinking red LED indicates an identifiable fault condition:

PTC overheat



Delay timer active (after PTC overheat)



Phase sequence and reverse rotation protection

Use a phase meter to establish the phase orders and connect line phases L1, L2 and L3 to terminals T1, T2 and T3, respectively. The compressor will only operate properly in a single

direction, and the motor is wound so that if the connections are correct, the rotation will also be correct.

Compressor model SM112-124-147 have no internal reverse rotation protection. If reverse rotation occurs it will be obvious as soon as power is turned on. The compressor will not build-up any pressure, the sound level will be abnormally high and power consumption will be minimal. In such case, shut down the compressor

immediately and connect the phases to their proper terminals. Prolonged reverse rotation will damage the compressor.

⚠ A phase sequence detector is strongly recommended.

Compressor models SM / SZ 084 to 185 (except SM112-124 & 147) incorporate an internal reverse vent valve which will react in the presence of reverse rotation and will allow refrigerant to circulate through a by-pass from the suction to the discharge. Although reverse rotation is not destructive, even over long periods of time up to several days it should be corrected as soon as possible. Reverse rotation will be obvious

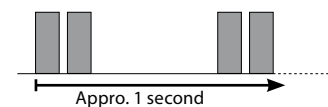
to the user as soon as power is turned on; the compressor will not build up any pressure, the sound level will be abnormally high and power consumption will be minimal. If reverse rotation symptoms occur, shut the compressor down and connect the phases to their proper terminals. If reverse rotation is not halted, the compressor will cycle off on the internal motor protection.

Compressor models SY / SZ 240 to 380 are delivered with an electronic module which provides protection against phase reversal and loss at start-up. Apply the recommended wiring diagrams. The circuit should be thoroughly checked in order to determine the cause of the phase problem before re-energizing the control circuit.

The phase sequencing and phase loss monitoring functions are active during a 5 sec. window 1 sec. after compressor start-up (power on L1-L2-L3).

Should one of these parameters be incorrect, the relay would lock out (contact M1-M2 open). The red led on the module will show the following blink code:

In case of phase reverse error:

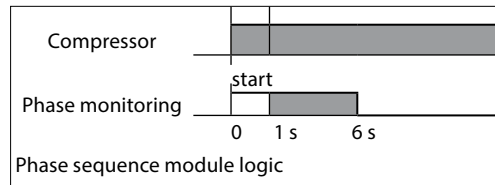


In case of phase loss error:



Application guidelines

Electrical data, connections and wiring



The lockout may be cancelled by resetting the power mains (disconnect L-N) for approximately 5 sec.

Voltage unbalance

The operating voltage limits are shown in the table section "Motor voltage". The voltage applied to the motor terminals must lie within these table limits during both start-up and normal operations. The maximum allowable

voltage unbalance is 2%. Voltage unbalance causes high amperage over one or several phases, which in turn leads to overheating and possible motor damage. Voltage unbalance is given by the formula:

$$\% \text{ voltage unbalance} = \frac{|V_{avg} - V_{1-2}| + |V_{avg} - V_{1-3}| + |V_{avg} - V_{2-3}|}{2 \times V_{avg}} \times 100$$

V_{avg} = Mean voltage of phases 1, 2, 3.
 V_{1-2} = Voltage between phases 1 & 2.

V_{1-3} = Voltage between phases 1 & 3.
 V_{2-3} = Voltage between phases 2 & 3.

Application guidelines

Approval and certifications

Approvals and certificates

SM / SY / SZ scroll compressors comply with the following approvals and certificates.

Certificates are listed on the product datasheets:
<http://www.danfoss.com/odsg>

CE 0062 or CE 0038 or CE0871 (European Directive)	CE	All SM / SY / SZ models
UL (Underwriters Laboratories)	UL	All 60 Hz SM / SY / SZ models
Other approvals / certificates		Contact Danfoss

Pressure Equipment Directive 97/23/EC

Products	SM084 to 185	SZ084 to 185 & SY185	SY/SZ 240 to 380
Refrigerating fluids	Group 2	Group 2	Group 2
Category PED	II	II	II
Evaluation module	D1	D1	D1
Service temperature - Ts	-31°F < Ts < 145°F	-31°F < Ts < 127°F	-31°F < Ts < 127°F
Service pressure - Ps	368 psig	363 psig	290 psig
Declaration of conformity ref Pressure Equipment Directive 97/23/EC	Contact Danfoss		

Low voltage directive 2006/95/EC

Products	SM/SZ084 to SY/SZ380
Declaration of conformity ref. Low voltage Directive 2006/95/EC	Contact Danfoss

Machines directives 2006/42/EC

Products	SM/SZ084 to SY/SZ380
Manufacturer's declaration of incorporation ref. Machines Directive 2006/42/EC	Contact Danfoss

Internal free volume

Products	Internal free volume without oil (in³)
SM/SZ084 - 090 - 100	860
SM/SZ 110 - 120	897
SM 112 - 124 - SM/SZ 147	872
SM/SZ 148-161	1196
SM/SZ 175 - 185 and SY185	2014
SY/SZ 240 - 300	2307
SY/SZ 380	2392

Application guidelines

Operating conditions

The scroll compressor application range is influenced by several parameters which need to be monitored for a safe and reliable operation. These parameters and the main recommendations for good practice and safety devices are explained hereunder.

- **Refrigerant and lubricants**
- **Motor supply**
- **Compressor ambient temperature**

Application envelope (evaporating temperature, condensing temperature, return gas temperature)

Refrigerant and lubricants

General information

When choosing a refrigerant, different aspects must be taken into consideration:

- Legislation (now and in the future)
- Safety
- Application envelope in relation to expected running conditions
- Compressor capacity and efficiency
- Compressor manufacturer recommendations & guidelines

Additional points could influence the final choice:

- Environmental considerations
- Standardisation of refrigerants and lubricants
- Refrigerant cost
- Refrigerant availability

R22

R22 is an HCFC refrigerant and is still a wide use today. It has a low ODP (Ozone Depletion Potential). Starting from 1st January 2010, the use of virgin R22 refrigerant is no longer allowed in the European Union. Refer to FRCC.EN.049 for R22 retrofit recommendations.

When R22 is applied in refrigeration applications it can lead to high discharge temperature. Carefully check all other parameters that can influence the discharge temperature.

R407C

R407C is an HFC refrigerant and has a zero ozone depletion potential (ODP=0). R407C is a zeotropic mixture and has a temperature glide of 45.3°F

but has a superior thermodynamic properties compared to R22.

R134a

R134a is an HFC refrigerant and has zero ozone depletion potential (ODP = 0). R134a is a pure refrigerant and has zero temperature glide. For

applications with high evaporating and high condensing temperatures, R134a is the ideal choice.

R404A

R404A is an HFC refrigerant and has zero ozone depletion potential (ODP = 0). R404A is especially suitable for low evaporating temperature applications but it can also be applied to medium evaporating temperature applications. R404A is a mixture and has a very

small temperature glide, and therefore must be charged in its liquid phase, but for most other aspects this small glide can be neglected. Because of the small glide, R404A is often called a near-azeotropic mixture.

R507

R507 is an HFC refrigerant with properties comparable to R404A. R507 has no ozone depletion potential (ODP = 0). As with R404A, R507 is particularly suitable for low evaporating

temperature applications but it can also be used for medium evaporating temperature applications. R507 is an azeotropic mixture with no temperature glide.

Mineral oil

Mineral oil can be applied in system using HCFC's refrigerant because it has a good miscibility with HCFC and oil that leave the compressor with refrigerant may not be trapped in lines or

exchangers. The chlorine contained in HCFC's improves lubricity in bearings used with mineral oil. Mineral oil has a very low hygroscopicity but may chemically react with water and form acids.

POE oil

Polyol Ester Oil (POE) is miscible with HFC's (while mineral oil is not), but has to be evaluated regarding lubricate ability in compressors. POE oil has better thermal stability than

refrigerant mineral oil. POE is more hygroscopic and also holds moisture more tightly than mineral oil. It also chemically react with water leading to acid and alcohol formation.

Application guidelines

Operating conditions

Motor supply

SM / SY / SZ scroll compressors can be operated at nominal voltages as indicated on page 18. Under-voltage and over-voltage operation is

allowed within the indicated voltage ranges. In case of risk of under-voltage operation, special attention must be paid to current draw.

Compressor ambient temperature

SM / SY / SZ compressors can be applied from -31°F to 145.4°F (for SM/SZ084 to 185) and 127.4°F (for SY/SZ 240 to 380) ambient temperature. The compressors are designed as 100 % suction gas

cooled without need for additional fan cooling. Ambient temperature has very little effect on the compressor performance.

High ambient temperature

In case of enclosed fitting and high ambient temperature it's recommend to check the temperature of power wires and conformity to their insulation specification.

In case of safe tripping by the compressor overload protection the compressor must cool down to about 140°F before the overload will reset. A high ambient temperature can strongly delay this cool-down process.

Low ambient temperature

Although the compressor itself can withstand low ambient temperature, the system may require specific design features to ensure safe

and reliable operation. See section 'Specific application recommendations'.

Application envelope at dew temperatures

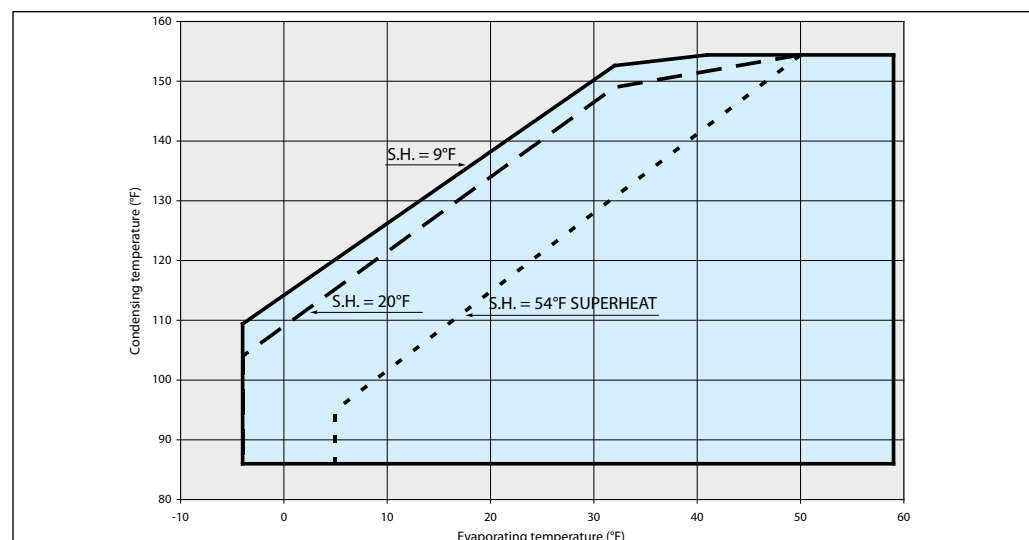
The operating envelopes for SM / SY / SZ scroll compressors are given in the figures below, where the condensing and evaporating temperatures represent the range for steady-state operation. Under transient conditions, such as start-up and defrost, the compressor may operate outside this envelope for short periods.

The figures below show the operating envelopes for SM / SY compressors with refrigerants R22 and for SZ compressors with R407C, R134a, R404A and R507C.

The operating limits serve to define the envelope within which reliable operations of the compressor are guaranteed:

- Maximum discharge gas temperature: 275°F
- A suction superheat below 9°F (18°F for R407C) is not recommended due to the risk of liquid flood back
- Maximum superheat of 54°F
- Minimum and maximum evaporating and condensing temperatures as per the operating envelopes.

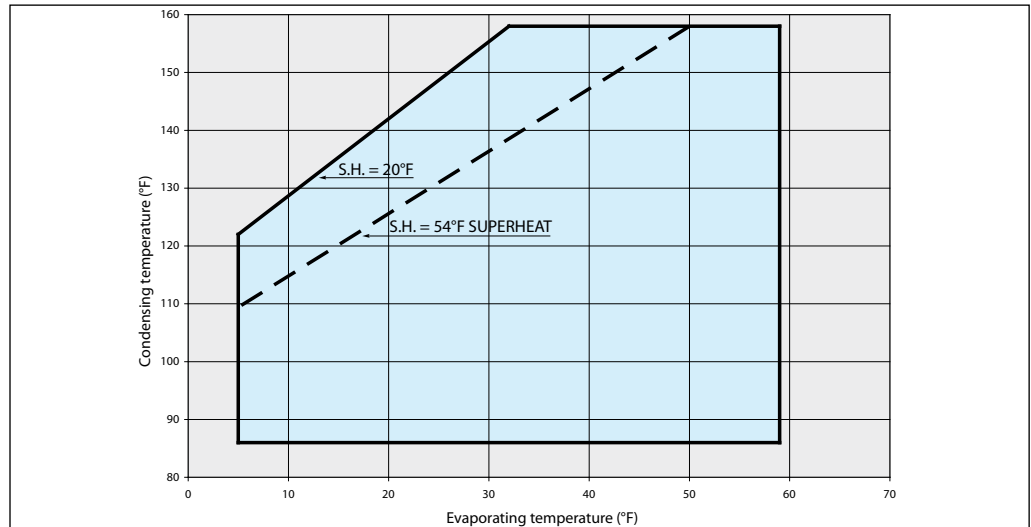
SM084 to 185 SY185 to 380 R22



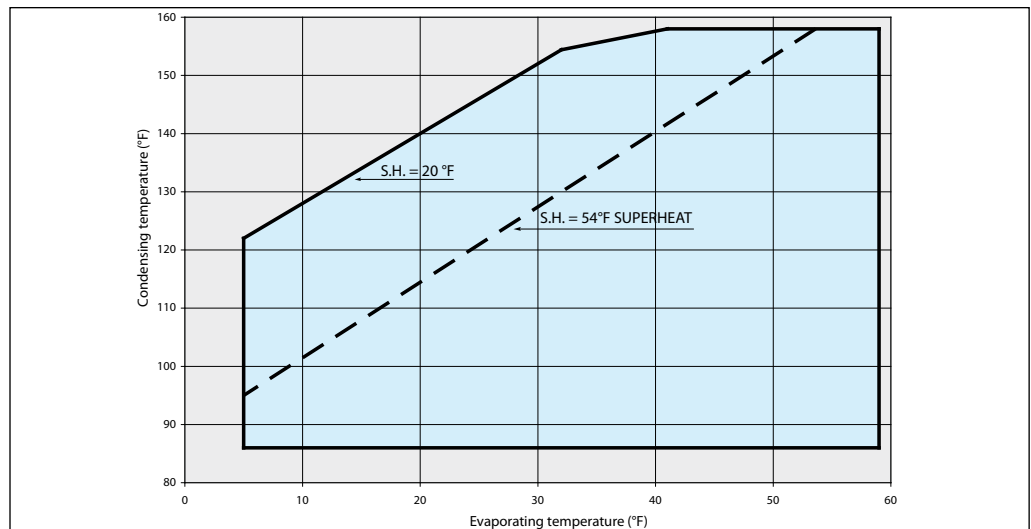
Application guidelines

Operating conditions

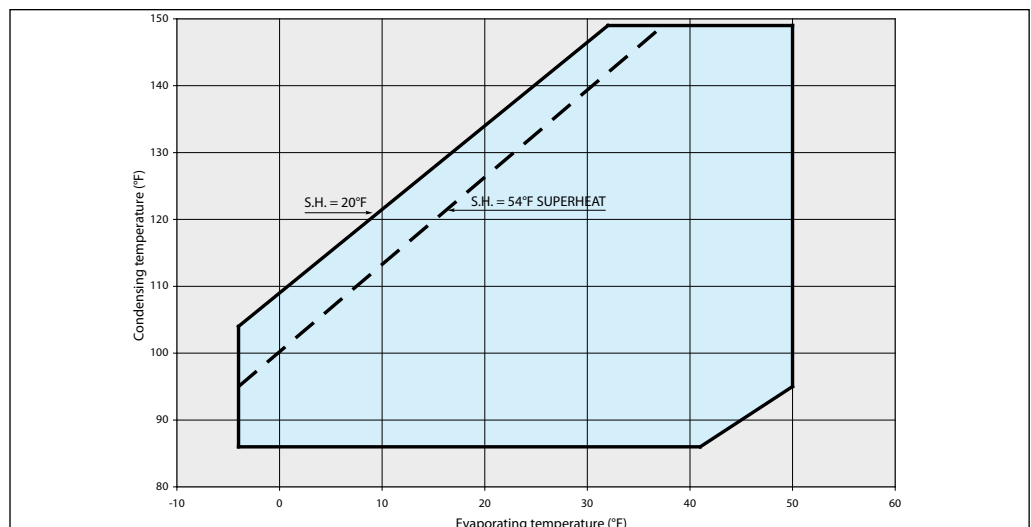
**SZ084 to 185
R134a**



**SZ240 - 380
R134a**



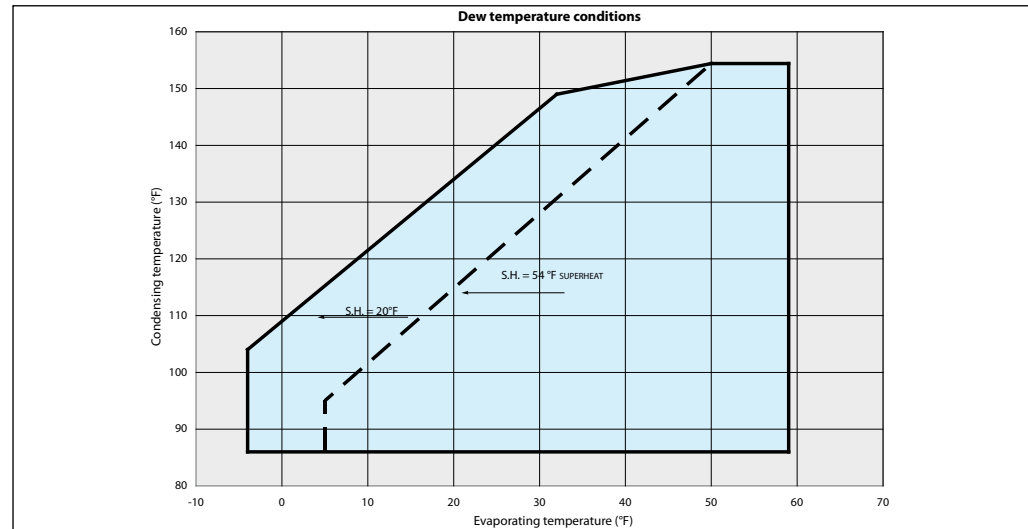
**SZ084 to 185
R404A / R507A**



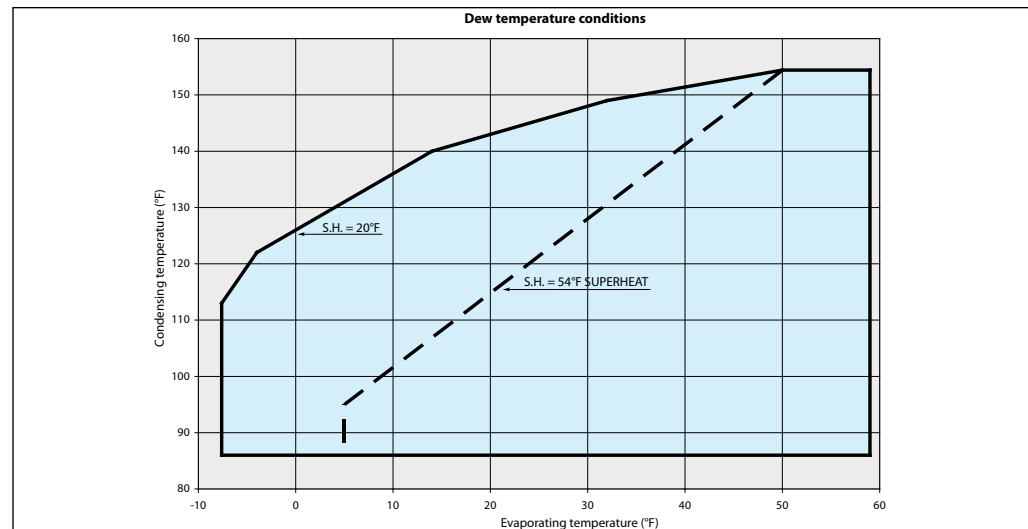
Application guidelines

Operating conditions

**SZ084 to 185 & SY185
R407C
at DEW temperature**



**SZ240 to 380 & SY240-300
R407C
at DEW temperature**



Application envelopes at mean temperatures

Refrigerant R407C is a zeotropic mixture, which causes a temperature glide in both the evaporator and condenser. When discussing evaporating and condensing temperatures therefore, it is important to indicate whether these are DEW point values or MEAN point values. In the figure below, the dashed lines reflect constant temperature and do not correspond with the constant pressure lines.

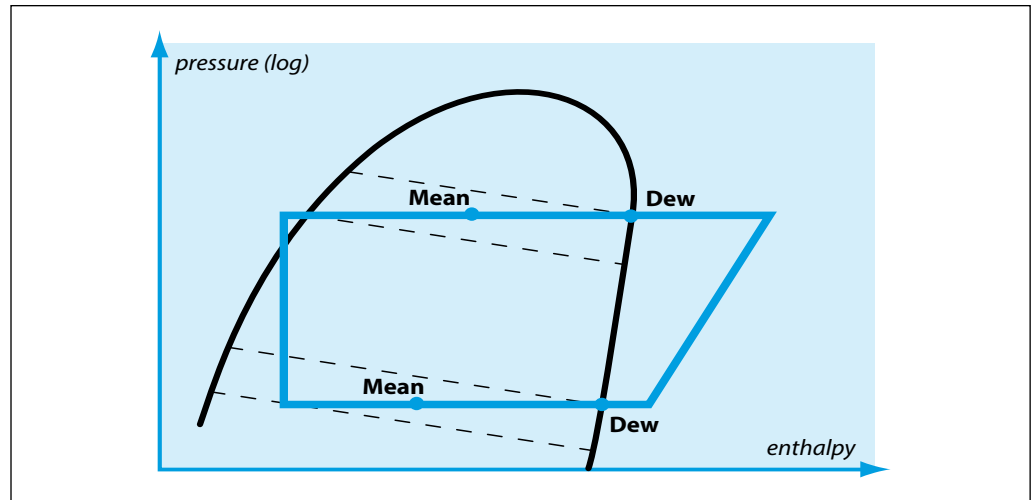
For a given cycle, the MEAN point temperatures are typically about 35.6° to 37.4°F lower than DEW point temperatures. In these Selection and Application Guidelines, Danfoss Commercial Compressors displays temperatures as DEW point values.

The performance tables for R407C are also based on DEW point values.

Application guidelines

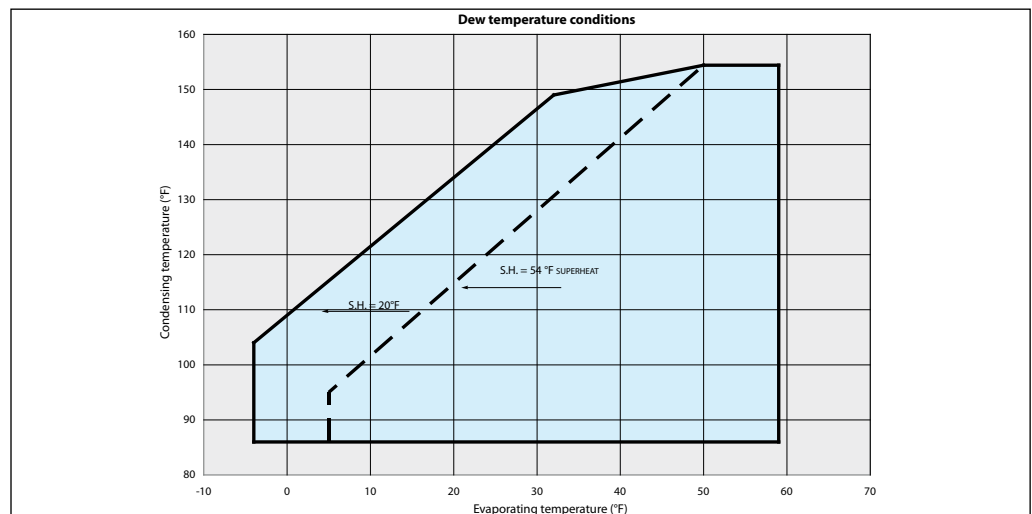
Operating conditions

Dew temperature and mean temperature for R407C

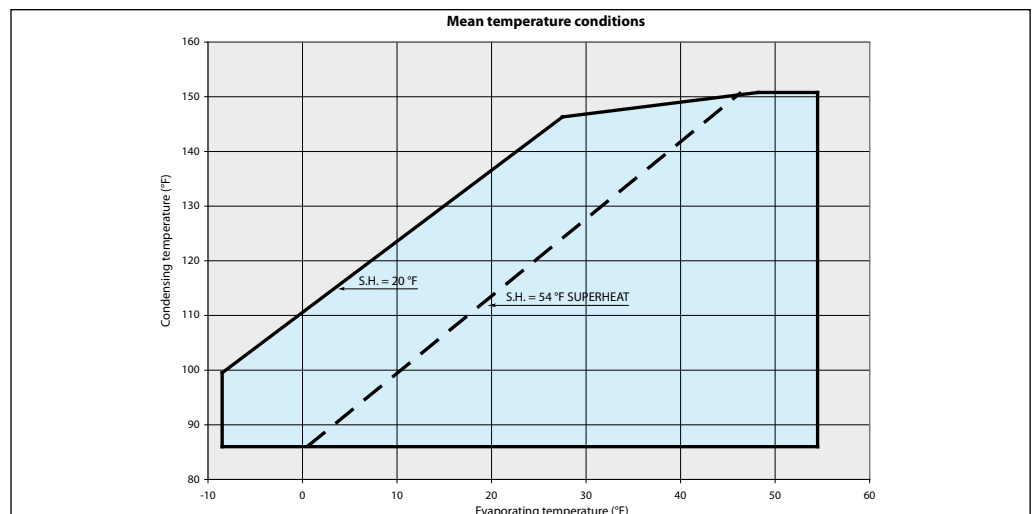


The following operating diagrams show the difference between mean and dew temperature application envelopes.

Dew temperature Example for SZ 084 to 185



Mean temperature Example for SZ 084 to 185



Application guidelines

Operating conditions

Discharge temperature protection

The discharge gas temperature must not exceed 275°F. The discharge gas thermostat accessory kit (code 7750009) includes all components required for installation, as shown below. The thermostat must be attached to the discharge line within 150 mm from the compressor discharge port and must be thermally insulated and highly fixed on the pipe.

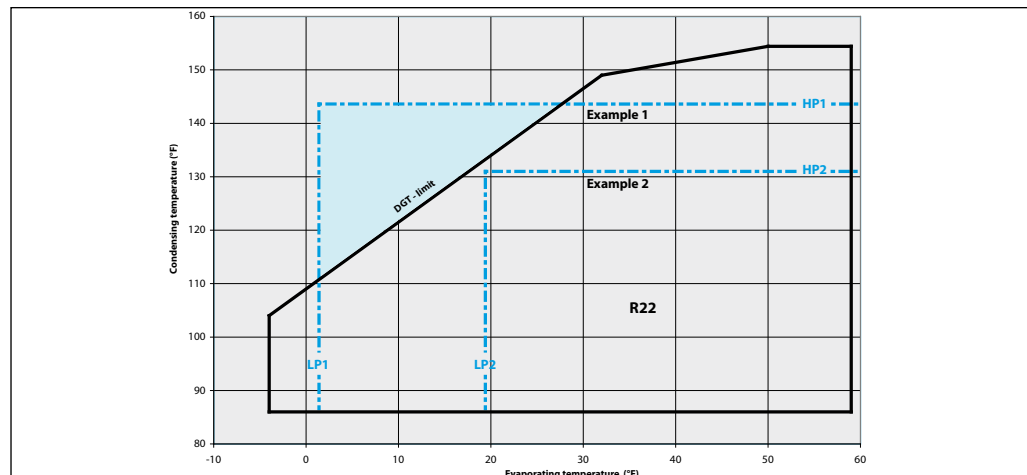
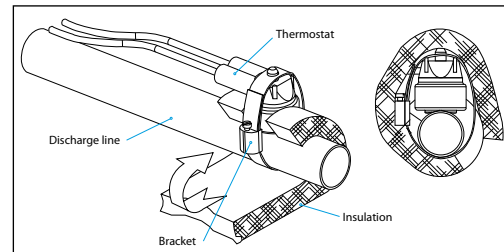
DGT protection is required if the high and low pressure switch settings do not protect the compressor against operations beyond its specific application envelope. Please refer to the examples on following page, which illustrates where DGT protection is required (ex.1) and where it is not (ex.2).

A discharge temperature protection device must be installed on all heat pumps. In reversible air-to-air and air-to-water heat pumps the

discharge temperature must be monitored during development test by the equipment manufacturer.

The DGT should be set to open at a discharge gas temperature of 275°F.

The compressor must not be allowed to cycle on the discharge gas thermostat. Continuous operations beyond the compressor's operating range will cause serious damage to the compressor.



Example 1 (R22, SH = 20°F)

LP switch setting:
LP1 = 26 psig (1.4°F)
HP switch setting:
HP1 = 363 psig (143.6°F)
Risk of operation beyond the application envelope.
DGT protection required.

Example 2 (R22, SH = 20°F)

LP switch setting:
LP2 = 42 psig (19.4°F)
HP switch setting:
HP2 = 305 psig (131°F)
No risk of operation beyond the application envelope.
No DGT protection required.

High and low pressure protection

High pressure

A high-pressure (HP) safety switch is required to shut down the compressor should the discharge pressure exceed the values shown in the table next page. The high-pressure switch can be set to lower values depending on the application and ambient conditions. The HP switch must

either be placed in a lockout circuit or consist of a manual reset device to prevent cycling around the high-pressure limit. If a discharge valve is used, the HP switch must be connected to the service valve gauge port, which must not be isolated.

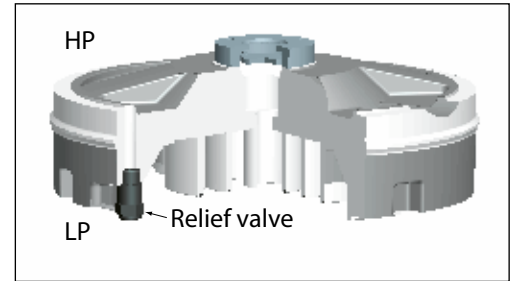
Application guidelines

Operating conditions

Internal pressure relief valve

The SY/SZ240 to SY/SZ380 incorporate an internal relief valve set to open between the internal high and low pressure sides of the compressor when the pressure differential between the discharge and suction pressures surpasses 450 to 551 psi.

This safety feature prevents the compressor from developing dangerously high pressures should the high pressure cutout, for whatever reason, fail to shut down the compressor.



Low pressure

A low pressure (LP) safety switch must be used. Deep vacuum operations of a scroll compressor can cause internal electrical arcing and scroll instability. Danfoss scroll compressors exhibit high volumetric efficiency and may draw very low vacuum levels, which could induce such a problem. The minimum low-pressure safety switch (loss of charge safety switch) setting is

given in the following table. For systems without pump-down, the LP safety switch must either be a manual lockout device or an automatic switch wired into an electrical lockout circuit. The LP switch tolerance must not allow for vacuum operations of the compressor. **LP switch settings for pump-down cycles** with automatic reset are also listed in the table below.

	R22 psig	R407C psig	R134a psig	R404A/R507A psig
Working pressure range high side	158 - 401	152 - 422	97 - 292	184 - 451
Working pressure range low side	20 - 100	15 - 92	8 - 56	29 - 106
Maximum high pressure safety switch setting	406	427	297	457
Minimum low pressure safety switch setting *	7	7	7	7
Minimum low pressure pump-down switch setting **	18	14	7	26

*LP safety switch shall never be bypassed and shall have no time delay.

**Recommended pump-down switch settings: 1.5 bar (R22, R407C, R404A) or 1 bar (R134a) below nominal evaporating pressure.

Note that these two different low pressure switches also require different settings. The low pressure pump down switch setting must always be within the operating envelope, for example 13 psi for R22. The compressor can be operated

full time under such condition. The minimum low pressure safety switch setting may be outside the normal operating envelope and should only be reached in exceptional (emergency) situations, for example 7 psi for R22.

Cycle rate limit

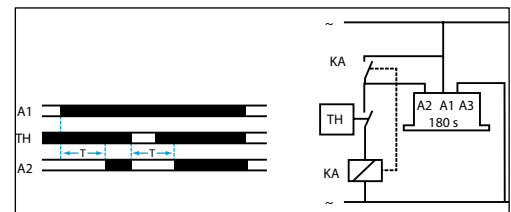
Danfoss recommends a restart delay timer to limit compressor cycling. The timer prevents reverse compressor rotation, which may occur during brief power interruptions.

The system must be designed in a way that guarantees a minimum compressor running time of 2 minutes so as to provide for sufficient motor cooling after start-up along with proper oil return. Note that the oil return may vary since it depends upon system design.

There must be no more than 12 starts per hour (6 when a resistor soft-start accessory is introduced); a number higher than 12 reduces the service life of the motor-compressor unit. If

necessary, place an anti-short-cycle timer in the control circuit, connected as shown in the wiring diagram section "Suggested wiring diagrams logic". A three-minute (180-sec) time out is recommended.

Please contact Danfoss Technical Support for any deviation from this guidelines.



Application guidelines

System design recommendations

General

Successful application of scroll compressors is dependent on careful selection of the compressor for the application. If the compressor is not correct for the system, it will operate

beyond the limits given in this manual. Poor performance, reduced reliability, or both may result.

Essential piping design considerations

Proper piping practices should be employed to ensure adequate oil return, even under minimum load conditions with special consideration given to the size and slope of the tubing coming from the evaporator. Tubing returns from the evaporator should be designed so as not to trap oil and to prevent oil and refrigerant migration back to the compressor during off-cycles.

Piping should be designed with adequate three-dimensional flexibility. It should not be in contact with the surrounding structure, unless

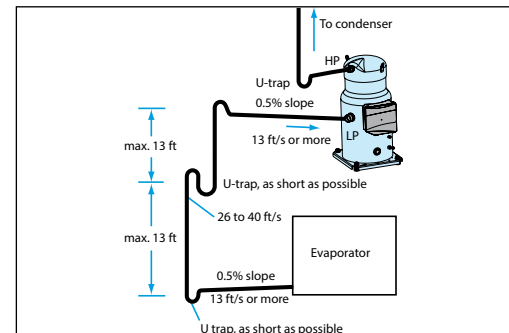
a proper tubing mount has been installed. This protection proves necessary to avoid excess vibration, which can ultimately result in connection or tube failure due to fatigue or wear from abrasion. Aside from tubing and connection damage, excess vibration may be transmitted to the surrounding structure and generate an unacceptable noise level within that structure as well (for more information on noise and vibration, see the section on: "Sound and vibration management").

Suction lines

If the evaporator lies above the compressor, as is often the case in split or remote condenser systems, the addition of a pump-down cycle is strongly recommended. If a pump-down cycle were to be omitted, the suction line must have a loop at the evaporator outlet to prevent refrigerant from draining into the compressor during off-cycles.

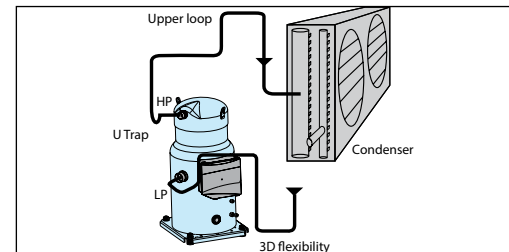
If the evaporator were situated below the compressor, the suction riser must be trapped so as to prevent liquid refrigerant from collecting at the outlet of the evaporator while the system is

idle, which would mislead the expansion valve's sensor (thermal bulb) at start-up.



Discharge lines

When the condenser is mounted at a higher position than the compressor, a suitably sized «U»-shaped trap close to the compressor is necessary to prevent oil leaving the compressor from draining back to the discharge side of the compressor during off cycle. The upper loop also helps avoid condensed liquid refrigerant from draining back to the compressor when stopped.



Heat exchangers

An evaporator with optimized distributor and circuit will give correct superheat at outlet and optimal use of the exchange surface. This is critical for plate evaporators that have generally a shorter circuit and a lower volume than shell & tubes and air cooled coils. For all evaporator types a special care is required for superheat control leaving the evaporator and oil return.

A sub-cooler circuit in the condenser that creates high sub cooling will increase efficiency at high condensing pressure.

Furthermore, for good operation of the expansion device and to maintain good efficiency in the evaporator it is important to have an appropriate sub cooling. Without adequate sub cooling, flash gas will be formed at the expansion device resulting in a high degree of vapor at the expansion device inlet leading to low efficiency.

Application guidelines

System design recommendations

Refrigerant charge limit

Danfoss SM / SY / SZ compressors can tolerate liquid refrigerant up to a certain extend without major problems. However, excessive liquid refrigerant in the compressor is always unfavorable for service life. Besides, the installation cooling capacity may be reduced because of the evaporation taking place in the compressor and/or the suction line instead of the evaporator. System design must be such that the amount of liquid refrigerant in the compressor is limited. In this respect, follow the guidelines given in the section: "essential piping design recommendations" in priority.

Use the tables below to quickly evaluate the required compressor protection in relation with the system charge and the application.

Compressor models	Refrigerant charge limit (lbs)
S 084-090-100	19
S 110-120	22
S 112-124-147	17
S 148-161	28
S 175-185	30
S 240	35
S 300-380	44

	BELOW charge limit	ABOVE charge limit
Cooling only systems, Packaged units	<input checked="" type="checkbox"/> No test or additional safeties required	REQ Refrigerant migration & floodback test REQ Sump heater
Cooling only systems with remote condensor and split system units	REC Refrigerant migration & floodback test REC Crankcase heater, because full system charge is not definable (risk of overcharging)	REQ Refrigerant migration & floodback test REQ Sump heater REC Liquid receiver (in association with LLSV & pump down)
Reversible heat pump system	REQ Specific tests for repetitive floodback REQ Sump heater REQ Defrost test	For more details refer to section "Reversible heat pump system."

REC Recommended

REQ Required

☒ No test or additional safeties required

Note: for special conditions such as low ambient temperature, low refrigerant load or brazed plate heat exchangers please refer to corresponding section "Specific application recommendations".

More detailed information can be found in the paragraphs hereafter. Please contact Danfoss Technical Support for any deviation from these guidelines.

Off-cycle migration

Off-cycle refrigerant migration is likely to occur when the compressor is located at the coldest part of the installation, when the system uses a bleed-type expansion device, or if liquid is allowed to migrate from the evaporator into the compressor sump by gravity. If too much liquid refrigerant accumulates in the sump it will saturate the oil and lead to a flooded start: when the compressor starts running again, the refrigerant evaporates abruptly under the sudden decrease of the bottom shell pressure, causing the oil to foam. In extreme situations, this might result in liquid slugging (liquid entering the scroll elements), which must be avoided as it causes irreversible damage to the compressor.

Danfoss SM/SZ/SY scroll compressors can tolerate occasional flooded starts as long as the total system charge does not exceed the maximum compressor refrigerant charge.

A suitable test to evaluate the risk of off-cycle migration is the following:

- Stabilize the non running system at 41°F ambient temperature,
- Raise the ambient temperature to 68°F and keep it for 10 minutes,
- Start the compressor and monitor sump temperature, sight glass indication and sound level.

The presence of liquid in the crankcase can be easily detected by checking the sump level through the oil sight glass. Foam in the oil sump indicates a flooded start.

A noisy start, oil loss from the sump and sump cool down are indications for migration. Depending on the amount of migration graduate measures shall be taken:

- **Sump heater**
- **Liquid line solenoid valve**
- **Pump down cycle**

Application guidelines

System design recommendations

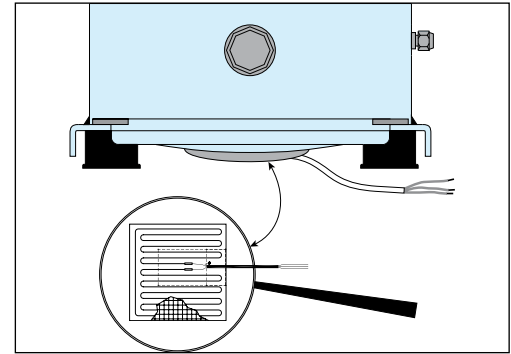
Sump heater

The surface sump heaters are designed to protect the compressor against off cycle migration of refrigerant. When the compressor is idle, the oil temperature in the sump of the compressor must be maintained at no lower than 18°F above the saturation temperature of the refrigerant on the low-pressure side. This requirement ensures that the liquid refrigerant is not accumulating in the sump. A sump heater is only effective if capable of sustaining this level of temperature difference. Tests must be conducted to ensure that the appropriate oil temperature is maintained under all ambient conditions (temperature and wind). However, below 23°F ambient temperature and a wind speed of above 16 ft/sec, we recommend that the heaters be thermally insulated in order to limit the surrounding energy losses.

Since the total system charge may be undefined, a sump heater is recommended on all stand-alone compressors and split systems. In addition, any system containing a refrigerant charge in excess of the maximum recommended system charge for compressors requires a crankcase

heater. A crankcase heater is also required on all reversible cycle applications.

The heater must be energized for a minimum of 6 hours before initial start-up (compressor service valves opened) and must remain energized whenever the compressor is off. Provide separate electrical supply for the heaters so that they remain energized even when the machine is out of service (eg. seasonal shutdown).



Sump heater accessories are available from Danfoss (see section "Accessories").

Liquid line solenoid valve (LLSV)

An LLSV may be used to isolate the liquid charge on the condenser side, thereby preventing against charge transfer or excessive migration to the compressor during off-cycles.

The quantity of refrigerant on the low pressure side of the system can be further reduced by using a pump-down cycle in association with the LLSV.

Pump-down cycle

A pump-down cycle represents one of the most effective ways to protect against the off-cycle migration of liquid refrigerant. Once the controls have been satisfied, a solenoid valve closes on the condenser outlet. The compressor then pumps the majority of the system charge into the condenser and receiver before the system stops on the low pressure pump-down switch. This step reduces the amount of charge on the low side in order to prevent off-cycle migration. Recommended settings of the low-pressure pump-down switch can be found in the table section "High and low pressure protection". For suggested wiring diagrams, please see section "Suggested wiring diagram logic".

In certain conditions, the discharge valve may not completely seal and result in compressor restarts during pump down applications. An external, non-bleeding check valve may need to be installed.

Tests for pump down cycle approval:

- As the pump-down switch setting is inside the application envelope, tests should be carried out to check unexpected cut-out during transient conditions (ie. defrost – cold starting). When unwanted cut-outs occur, the low pressure pump-down switch can be delayed. In this case a low pressure safety switch without any delay timer is mandatory.
- While the thermostat is off, the number of pressure switch resets should be limited to avoid short cycling of the compressor. Use dedicated wiring and an additional relay which allows for one shot pump-down.

The pump-down allows to store all the refrigerant in the high pressure side circuit. On unitary or close-coupled systems, where the system refrigerant charge is expected to be both correct and definable the entire system charge

Application guidelines

System design recommendations

Liquid flood back

may be stored in the condenser during pump-down if all components have been properly sized.

Other application needs a liquid receiver to store the refrigerant.

Receiver dimensioning requires special attention. The receiver shall be large enough to contain part of the system refrigerant charge but it shall not be dimensioned too large. A large receiver easily leads to refrigerant overcharging during maintenance operation.

During normal operation, refrigerant enters the compressor as a superheated vapor. Liquid flood back occurs when a part of the refrigerant entering the compressor is still in liquid state.

Danfoss SM/SY/SZ scroll compressors can tolerate occasional liquid flood back. However

system design must be such that repeated and excessive flood back is not possible.

A continuous liquid flood back will cause oil dilution and, in extreme situations lead to lack of lubrication and high rate of oil leaving the compressor.

Liquid flood back test - Repetitive liquid flood back testing must be carried out under expansion valve threshold operating conditions: a high pressure ratio and minimum evaporator load, along with the measurement of suction superheat, oil sump temperature and discharge gas temperature.

During operations, liquid flood back may be detected by measuring either the oil sump temperature or the discharge gas temperature. If at any time during operations, the oil sump temperature drops to within 10K or less above

the saturated suction temperature, or should the discharge gas temperature be less than 54°F above the saturated discharge temperature, this indicates liquid flood back.

Continuous liquid flood back can occur with a wrong dimensioning, a wrong setting or malfunction of the expansion device or in case of evaporator fan failure or blocked air filters.

A suction accumulator providing additional protection as explained hereunder can be used to solve light continuous liquid flood back.

Suction accumulator

Suction accumulator: a suction accumulator offers protection against refrigerant flood back at start-up, during operations or defrosting by trapping the liquid refrigerant upstream from the compressor. The suction accumulator also protects against off-cycle migration by providing additional internal free volume to the low side of the system.

A suction accumulator must be carefully dimensioned, taking into account the refrigerant charge as well as the gas velocity in the suction line.

The accumulator should not be sized for less than 50% of the total system charge. Tests must be conducted to determine the actual refrigerant holding capacity needed for the application.

Depending on the operating conditions it may happen that the recommended connections of the accumulator are one size smaller than the suction line.

Application guidelines

Specific application recommendations

Low ambient application

Low ambient start-up

Under cold ambient conditions (<32°F), upon start-up the pressure in the condenser and, if present, the receiver may be so low that a sufficient pressure differential across the expansion device cannot be developed to properly feed the evaporator. As a result, the compressor may go into a deep vacuum, which can lead to compressor failure due to internal arcing and instability in the scroll members. Under no circumstances should the compressor be allowed to operate under vacuum. The low-pressure control must be set in accordance with the table section "High and low pressure

protection" in order to prevent this from happening.

Early feeding of the evaporator and management of the discharge pressure could help to attenuate these effects.

Low pressure differentials can also cause the expansion device to «hunt» erratically, which might cause surging conditions within the evaporator, with liquid spillover into the compressor. This effect is most pronounced during low load conditions, which frequently occur during low ambient conditions.

Low ambient operations

The Danfoss SM/SY/SZ scroll compressor requires a minimum pressure differential of 87 to 102 psi between the suction and discharge pressures to force the orbiting scroll down against the oil film on the thrust bearing. Anything less than this differential and the orbiting scroll can lift up, causing a metal-to-metal contact. It is therefore necessary to maintain sufficient discharge pressure in order to ensure this pressure differential. Care should be taken during low ambient operations when heat removal from air-cooled condensers is greatest and head pressure control may be required for low ambient temperature applications. Operation under low pressure differential may be observed by a significant increase in the sound power level generated by the compressor.

It is recommended that the unit be tested and monitored at minimum load and low ambient conditions as well. The following considerations should be taken into account to ensure proper system operating characteristics.

Expansion device: The expansion device should be sized to ensure proper control of the refrigerant flow into the evaporator. An oversized valve may result in erratic control. This consideration is especially important in manifolded units where low load conditions may require the frequent cycling of compressors. This can lead to liquid refrigerant entering the compressor if the expansion valve does not provide stable refrigerant super-heat control under varying loads.

The superheat setting of the expansion device should be sufficient to ensure proper superheat

levels during low loading periods. A minimum of 9 °F stable superheat is required.

Head pressure control under low ambient conditions: Several possible solutions are available to prevent the risk of compressor to vacuum and low pressure differential between the suction and discharge pressures.

In air-cooled machines, cycling the fans with a head pressure controller will ensure that the fans remain off until the condensing pressure has reached a satisfactory level. Variable speed fans can also be used to control the condensing pressure. In water-cooled units, the same can be performed using a water regulator valve that is also operated by head pressure, thereby ensuring that the water valve does not open until the condensing pressure reaches a satisfactory level.

The minimum condensing pressure must be set at the minimum saturated condensing temperature shown in the application envelopes.

Under very low ambient conditions, in which testing has revealed that the above procedures might not ensure satisfactory condensing and suction pressures, the use of a head pressure control valve is recommended. Note: This solution requires extra refrigerant charge, which can introduce other problems. A non-return valve in the discharge line is recommended and special care should be taken when designing the discharge line.

For further information, please contact Danfoss.

Application guidelines	Specific application recommendations	
Sump heaters	Sump heaters are strongly recommended on all systems where the compressor is exposed to low ambient temperatures, especially split and remote condenser installations. The sump heater	will minimize refrigerant migration caused by the large temperature gradient between the compressor and the remainder of the system, please refer to section "Off-cycle migration".
Low load operations	The compressors should be run for a minimum period in order to ensure that the oil has sufficient time to properly return to the	compressor sumps and that the motor has sufficient time to cool under conditions of lowest refrigerant mass flows.
Brazed plate heat exchangers	A brazed plate heat exchanger needs very little internal volume to satisfy the set of heat transfer requirements. Consequently, the heat exchanger offers very little internal volume for the compressor to draw vapor from on the suction side. The compressor can then quickly enter into a vacuum condition; it is therefore important that the expansion device be sized correctly and that a sufficient pressure differential across the expansion device be available to ensure adequate refrigerant feed into the evaporator. This aspect is of special concern when operating the unit under low ambient and load conditions. For further information on these conditions, please refer to the previous sections.	<p>Due to the small volume of the brazed plate heat exchanger, no pump-down cycle is normally required. The suction line running from the heat exchanger to the compressor must be trapped to avoid refrigerant migration to the compressor.</p> <p>When using a brazed plate heat exchanger as the condensing coil, a sufficient free volume for the discharge gas to accumulate is required in order to avoid excess pressure buildup. At least 1 meter of discharge line is necessary to generate this volume. To help reduce the gas volume immediately after start-up even further, the supply of cooling water to the heat exchanger may be opened before the compressor starts up so as to remove superheat and condense the incoming discharge gas more quickly.</p>
Electronic expansion valve	<p>The use of an electronic expansion valve requires a specific compressor start / stop control.</p> <p>A specific compressor start sequence control has to be set when an electronic expansion valve (EXV) is used. The sequence must be adjusted according to the EXV step motor speed to allow time for the EXV to open before the compressor starts to avoid running under vacuum conditions.</p> <p>The EXV should be closed at compressor stop not to let refrigerant in liquid phase entering the</p>	<p>compressor. Ensure that the EXV closes when the supply voltage to the controller is interrupted (ie power cut off) by the use of a battery back up.</p> <div> <p>The diagram shows three horizontal timelines. The top timeline is for the EXV, with 'Opened' and 'Closed' states. The middle timeline is for the Compressor, with 'On' and 'Off' states. The EXV opens before the compressor starts and closes after the compressor stops. Vertical dashed lines indicate the timing of these events.</p> </div>
Reversible heat pump systems	Transients are likely to occur in reversible heat pump systems, i.e. a changeover cycle from cooling to heating, defrost or low-load short cycles. These transient modes of operation may lead to liquid refrigerant carryover (or floodback) or excessively wet refrigerant return conditions. As such, reversible cycle applications require specific precautions for ensuring a long compressor life and satisfactory operating characteristics. Regardless of the refrigerant charge in the system, specific tests for repetitive	<p>floodback are required to confirm whether or not a suction accumulator needs to be installed. A crankcase heater and discharge gas thermostat are required for reversible heat pump applications.</p> <p>The following considerations cover the most important issues when dealing with common applications. Each application design however should be thoroughly tested to ensure acceptable operating characteristics.</p>

Application guidelines	Specific application recommendations	
Sump heaters	Sump heaters are mandatory on reversible cycle applications given the high probability of liquid migration back to the compressor sump	during off-cycles due to the outdoor location of most units and operations during low ambient conditions.
Discharge temperature thermostat	Heat pumps frequently utilize high condensing temperatures in order to achieve a sufficient temperature rise in the medium being heated. At the same time, they often require low evaporator pressures to obtain sufficient temperature differentials between the evaporator and the outside temperature. This situation may result in high discharge temperature; as such, it is mandatory that a discharge gas thermostat be installed on the discharge line to protect	the compressor from excessive temperatures. Operating the compressor at too high discharge temperatures can result in mechanical damage to the compressor as well as thermal degradation of the compressor lubricating oil and a lack of sufficient lubrication. The discharge gas thermostat should be set to shut down the compressor in the event discharge gas rises above 275°F.
Discharge line and reversing valve, solenoid valves	The Danfoss SM/SY/SZ scroll compressor is a high volumetric machine and, as such, can rapidly build up pressure in the discharge line if gas in the line becomes obstructed even for a very short period of time which situation may occur with slow-acting reversing valves in heat pumps. Discharge pressures exceeding the operating envelope may result in nuisance high-pressure switch cutouts and place excess strain on both the bearings and motor. To prevent such occurrences, it is important that a 1-meter minimum discharge line length be allowed between the compressor discharge port and the reversing valve or any other restriction. This gives sufficient free volume for the discharge gas to collect and to reduce the pressure peak during the time it takes for the valve to change	position. At the same time, it is important that the selection and sizing of the reversing or 4-way valve ensure that the valve switches quickly enough to prevent against too high discharge pressure and nuisance high-pressure cutouts. Check with the valve manufacturer for optimal sizing and recommended mounting positions. In applications with heat recovery or condenser partialisation, servo piloted solenoid valve has to be properly sized or associated with a second small valve in parallel, in order to avoid quick discharge pressure drops when opening. This phenomenon could lead to hammering effects and create constraints on the non return valve integrated in discharge fitting (SM/SY/SZ180 to 380).
Defrost and reverse cycle	The Danfoss SM/SY/SZ scroll compressor has the ability to withstand a certain amount of liquid refrigerant dynamic slug. When compressors are installed in parallel, in order to limit liquid amount handled per compressor when beginning and ending defrost, it is recommended to avoid running part load (keep all compressors running or keep them stopped when moving 4-way valves).	For further details, please refer to Parallel application guidelines FRCC.PC.005. EXV can also be opened when compressors are stopped and before 4 way valve is moving in order to decrease pressure difference. Opening degree and time have to be set in order to keep a minimum pressure difference for 4 way valve moving.

Application guidelines

Specific application recommendations

Suction line accumulator

The use of a suction line accumulator is strongly recommended in reversible cycle applications as a result of the possibility of a substantial quantity of liquid refrigerant remaining in the evaporator, which acts as a condenser during the heating cycle.

This liquid refrigerant can then return to the compressor, either flooding the sump with refrigerant or as a dynamic liquid slug when

the cycle switches back to a defrost cycle or to normal cooling operations.

Sustained and repeated liquid slugging and floodback can seriously impair the oil's ability to lubricate the compressor bearings. This situation can be observed in wet climates where it is necessary to frequently defrost the outdoor coil in an air source heat pump. In such cases a suction accumulator becomes mandatory.

Water utilizing systems

Apart from residual moisture in the system after commissioning, water could also enter the refrigeration circuit during operation. Water in the system shall always be avoided. Not only because it can shortly lead to electrical failure, sludge in sump and corrosion but in particular because it can cause serious safety risks. Common causes for water leaks are corrosion and freezing.

Corrosion: Materials in the system shall be compliant with water and protected against corrosion.

Freezing: When water freezes into ice its volume expands which can damage heat exchanger walls and cause leaks. During off periods water inside heat exchangers could start freezing when ambient temperature is lower than 32°F. During on periods ice banking could occur when the circuit is running continuously at too low load. Both situations should be avoided by connecting a pressure and thermostat switch in the safety line.



Application guidelines

Sound and vibration management

Starting sound level

During start-up transients it is natural for the compressor sound level to be slightly higher than during normal running. SM / SY / SZ scroll compressors exhibit very little increased start-up transient sound. If a compressor is miswired, the compressor will run in reverse. Reverse

compressor rotation is characterized by an objectionable sound. To correct reverse rotation, disconnect power and switch any two of the three power leads at the unit contactor. Never switch leads at the compressor terminals.

Running sound level



Model	50 Hz				60 Hz				Acoustic hood code number	Bottom insulation code n° *
	R22		R407C		R22		R407C			
	Sound power dB(A)	Attenuation dB(A)	Sound power dB(A)	Attenuation dB(A)	Sound power dB(A)	Attenuation dB(A)	Sound power dB(A)	Attenuation dB(A)		
S 084	70	8	71	8	74	8	74	8	7755011	120Z0356
S 090	70	8	72	8	75	8	77	8	7755011	120Z0356
S 100	70	8	73	8	75	8	77	8	7755011	120Z0356
S 110	75	8	77	8	78	8	81	8	7755010	120Z0356
S 112	75	6	-	-	78	6	-	-	120Z0035	-
S 120	75	8	77	8	78	8	81	8	7755010	120Z0356
S 124	73	6	-	-	77	6	-	-	120Z0035	-
S 147 ①	74	6	77	8	78	6	81	8	120Z0035	-
S 148 ②	79	8	79	8	83	8	83	8	7755017	120Z0356
S 161 ②	79.5	8	79	8	84	8	83	8	7755017	120Z0356
S 175	80	8	81	8	82.5	8	84	8	7755007	120Z0353
S 185	80	8	81	8	82.5	8	84	8	7755007	120Z0353
S 240	82	7	83.5	7	85	7	87	7	7755016	120Z0355
S 300	82	7	84	7	86	7	87.5	7	7755016	120Z0355
S 380	87	7	87.5	7	92	7	91	7	7755022	120Z0355

① For SM/SZ147-3 - 50 Hz, use acoustic hood reference 120Z135

Sound power and attenuation are given at rated ARI conditions, measured in free space.

Materials are UL approved and RoHS compliant.

Data given for code 4 compressor, for full data details and capacity tables refer to Online Datasheet Generator: www.danfoss.com/ODSG

② For SM148 - 161 code 3, no acoustic hood available

* Bottom insulations are provided in surface sump heater accessories.

Stopping sound level

SM / SY / SZ compressors are equipped with a discharge valve which closes at compressor shut down and thus prevents the compressor from running backwards. This reduces the stopping sound to a metallic click caused by the closing valve.

When the pressure difference or gas flow at shut down should be very low, this can delay the discharge valve from closing and lead to a longer noise duration.

Sound generation in a refrigeration or air conditioning system

Typical sound and vibration in Refrigeration and Air-Conditioning systems encountered by design and service engineers may be broken down into the following three source categories.

Sound radiation: This generally takes an airborne path.

Mechanical vibrations: These generally extend along the parts of the unit and structure.

Gas pulsation: This tends to travel through the cooling medium, i.e. the refrigerant.

The following sections will focus on the causes and methods of mitigation for each of the above sources.

Application guidelines

Sound and vibration management

Compressor sound radiation

For sound radiating from the compressor, the emission path is airborne and the sound waves are travelling directly from the machine in all directions.

The Danfoss SM / SY / SZ scroll compressor is designed to be quiet and the frequency of the sound generated is pushed into the higher ranges, which not only are easier to reduce but also do not generate the penetrating power of lower-frequency sound.

Use of sound-insulation materials on the inside of unit panels is an effective means of substantially reducing the sound being transmitted to the outside. Ensure that no components capable of transmitting sound / vibration within the unit

come into direct contact with any non-insulated parts on the walls of the unit.

Because of the Danfoss's unique design of a full-suction gas-cooled motor, compressor body insulation across its entire operating range is possible. Acoustic hoods are available from Danfoss Commercial Compressors as accessories. They have been developed to meet specific extra low noise requirement. They incorporate sound proofing materials and offer excellent high and low frequency attenuation. These hoods are quick and easy to install and do not increase the overall size of the compressors to a great extend. Refer to section "Running sound level" for sound attenuation and code numbers.

Mechanical vibrations

Vibration isolation constitutes the primary method for controlling structural vibration. Danfoss SM / SY / SZ scroll compressors are designed to produce minimal vibration during operations. The use of rubber isolators on the compressor base plate or on the frame of a manifolded unit is very effective in reducing vibration being transmitted from the compressor(s) to the unit. Rubber grommets are supplied with all Danfoss compressors. Once the supplied rubber grommets have been properly mounted, vibration transmitted from the compressor base plate to the unit are held to a strict minimum. In addition, it is extremely important that the frame supporting the

mounted compressor be of sufficient mass and stiffness to help dampen any residual vibration potentially transmitted to the frame. For further information on mounting requirements, please refer to the section on mounting assembly.

The tubing should be designed so as to both reduce the transmission of vibrations to other structures and withstand vibration without incurring any damage. Tubing should also be designed for three-dimensional flexibility. For more information on piping design, please see the section entitled "Essential piping design considerations".

Gas pulsation

The Danfoss SM / SY / SZ scroll compressor has been designed and tested to ensure that gas pulsation has been optimized for the most commonly encountered air conditioning pressure ratio. On heat pump installations and other installations where the pressure ratio lies beyond the typical range, testing should be conducted under all expected conditions

and operating configurations to ensure that minimum gas pulsation is present. If an unacceptable level is identified, a discharge muffler with the appropriate resonant volume and mass should be installed. This information can be obtained from the component manufacturer.

Application guidelines

Installation

Each SM / SY / SZ compressor is shipped with printed Instructions for installation. These instructions can also be downloaded from our

web site:
www.danfoss.com or directly from:
http://instructions.cc.danfoss.com

Compressor handling and storage

Each Danfoss SM / SY / SZ scroll compressor is equipped with two lift rings on the top shell. Always use both these rings when lifting the compressor. Use lifting equipment rated and certified for the weight of the compressor. A spreader bar rated for the weight of the compressor is highly recommended to ensure a better load distribution. The use of lifting hooks closed with a clasp and certified to lift the weight of the compressor is also highly recommended. Always respect the appropriate rules concerning lifting objects of the type and weight of these compressors. Maintain the compressor in an upright position during all handling manoeuvres (maximum of 15° from vertical).

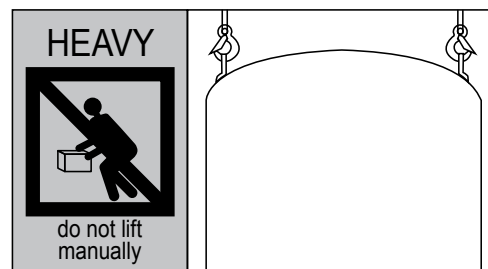
⚠ Never use only one lifting lug to lift the compressor. The compressor is too heavy for the single lug to handle, and the risk is run that the lug could separate from the compressor with extensive damage and possible personal injury as a result.

Store the compressor not exposed to rain, corrosive or flammable atmosphere between -31°F and 122°F when charged with refrigerant

and between -31°F and 158°F when charged with nitrogen.

⚠ When the compressor is mounted as part of an installation, never use the lift rings on the compressor to lift the installation. The risk is run that the lugs could separate from the compressor or that the compressor could separate from the base frame with extensive damage and possible personal injury as a result.

Never apply force to the terminal box with the intention of moving the compressor, as the force placed upon the terminal box can cause extensive damage to both the box and the components contained inside.

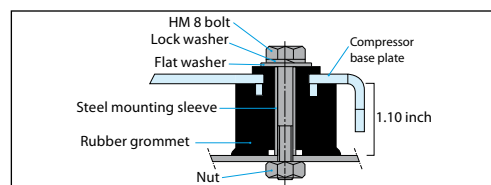


Compressor mounting

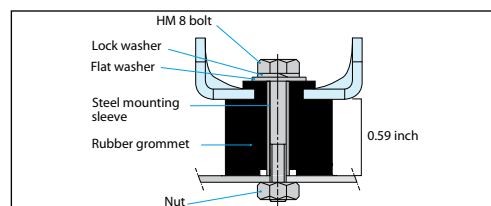
Maximum inclination from the vertical plane while operating must not exceed 3 degrees. All compressors come delivered with four rubber mounting grommets and metal sleeve liners that serve to isolate the compressor from the base frame. These grommets must always be used to

mount the compressor in single application. These grommets attenuate to a great extent the transmission of compressor vibrations to the base frame. The grommets must be compressed until contact between the flat washer and the steel-mounting sleeve is established.

Mounting of SM/SZ 084-090-100-110-120-148-161-175-185: the required bolt size is HM8. This bolt must be tightened to a torque of 15 ft.lbs. The bolts and washers are supplied with the assembly kit.



Mounting of SM/SZ 112-124-147: the required bolt size is HM8. This bolt must be tightened to a torque of 11 ft.lbs. The bolt and washers are supplied with the assembly kit. When a surface sump heater is used, it must be applied after grommets are mounted on compressor in order to avoid surface sump heater damage.

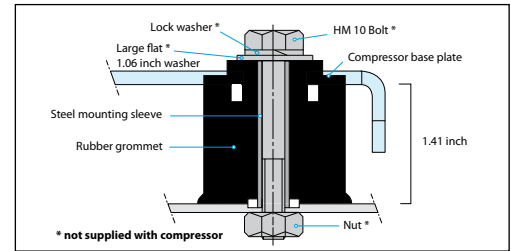


Application guidelines

Installation

Mounting of SY/SZ 240-300-380: the required bolt size is HM10. The minimum required flat washer outside diameter is 20 ft.lbs. Mounting bolts must be tightened to a torque of 30 ft.lbs. These bolts and washers are not supplied with the compressor.

Note: The large flat washer must be positioned in place before shipping the unit with the compressor installed.



Note: for parallel assemblies see specific recommendations in Danfoss parallel application guidelines", FRCC.PC.005.

Compressor holding charge

Each compressor is shipped with a nominal dry nitrogen holding charge between 4 and 10 psi and is sealed with elastomer plugs.

Before the suction and discharge plugs are removed, the nitrogen holding charge must be released via the suction schrader valve to avoid an oil mist blowout. Remove the suction

plug first and the discharge plug afterwards. The plugs shall be removed only just before connecting the compressor to the installation in order to avoid moisture from entering the compressor. When the plugs are removed, it is essential to keep the compressor in an upright position so as to avoid oil spillage.

System cleanliness

The refrigerant compression system, regardless of the type of compressor used, will only provide high efficiency and good reliability, along with a long operating life, if the system contains solely the refrigerant and oil it was designed for. Any other substances within the system will not improve performance and, in most cases, will be highly detrimental to system operations.

The presence of non-condensable substances and system contaminants, such as metal shavings, solder and flux, have a negative impact on compressor service life. Many of these contaminants are small enough to pass through a mesh screen and can cause considerable damage within a bearing assembly. The use of highly-hygroscopic polyester oil in SZ compressors requires that the oil be exposed to the atmosphere just as little as possible.

System contamination is one of main factors affecting equipment reliability and compressor service life. It is important therefore to take system cleanliness into account when assembling a refrigeration system.

During the manufacturing process, circuit contamination may be caused by:

- Brazing and welding oxides,
- Filings and particles from the removal of burrs in pipe-work,
- Brazing flux,
- Moisture and air.

Consequently, when building equipment and assemblies, the precautions listed in the following paragraphs must be taken.

Tubing

Only use clean and dehydrated refrigeration grade copper tubing. Tube cutting must be carried out so as not to deform the tubing roundness and to ensure that no foreign debris remains within the tubing. Only refrigerant-grade fittings should be used and these must be

of both a design and size to allow for a minimum pressure drop through the completed assembly. Follow the brazing instructions next pages.

Never drill holes into parts of the pipe-works where fillings and particles can not be removed.

Brazing and soldering

Do not blend the compressor discharge or suction lines or force system piping into the compressor connections, because this will increase stresses that are a potential cause of

failure. Recommended brazing procedures and material, are described on following page. Never drill holes into parts of the pipe-works. Where fillings and particles can not be removed.

Application guidelines

Installation

Copper to copper connections

When brazing copper-to-copper connections, the use of a copper / phosphorus brazing alloy containing 5% silver or more with a melting

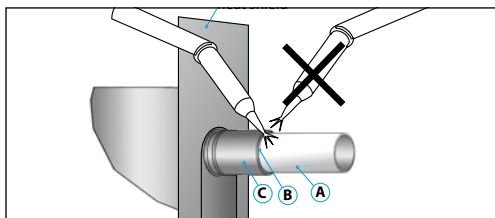
temperature of below 1472°F is recommended. No flux is required during brazing.

Dissimilar metals connection

When manipulating dissimilar metals such as copper and brass or steel, the use of silver solder and anti-oxidant flux is necessary.

Compressor connection

When brazing the compressor fittings, do not overheat the compressor shell, which could severely damage certain internal components due to excessive heating. Use of a heat shield and/or a heat-absorbent compound is highly recommended. Due to the relatively sizable tubing and fitting diameters used for the large scroll, a double tipped torch using acetylene is recommended for the S240-300-380 brazing operation.



For rotolock version compressors, solder sleeves are available. For brazing the suction and discharge connections, the following procedure is advised:

- Make sure that no electrical wiring is connected to the compressor.
- Protect the terminal box and compressor painted surfaces from torch heat damage (see diagram).
- Remove the teflon gaskets when brazing rotolock connectors with solder sleeves.
- Use only clean refrigeration-grade copper tubing and clean all connections.
- Use brazing material with a minimum of 5% silver content.
- Purge nitrogen or CO₂ through the compressor in order to prevent against oxidation and flammable conditions. The compressor should not be exposed to the open air for extended periods.
- Use of a double-tipped torch is recommended.
- Apply heat evenly to Area A until the brazing temperature is reached. Move the torch to Area B and apply heat evenly until the brazing temperature has been reached there as well, and then begin adding the brazing material. Move the torch evenly around the joint, in applying

only enough brazing material to flow the full circumference of the joint.

- Move the torch to Area C only long enough to draw the brazing material into the joint, but not into the compressor.
- Remove all remaining flux once the joint has been soldered with a wire brush or a wet cloth. Remaining flux would cause corrosion of the tubing.

In addition, for discharge connections equipped with a non return valve integrated in discharge fitting (SY/SZ240-300) the direction of the torch has to be as described on the picture, and maximum brazing time should be less than 2 minutes to avoid NRVI damages.

Ensure that no flux is allowed to enter into the tubing or compressor. Flux is acidic and can cause substantial damage to the internal parts of the system and compressor.

The polyolester oil used in SY / SZ compressors is highly hygroscopic and will rapidly absorb moisture from the air. The compressor must therefore not be left open to the atmosphere for a long period of time. The compressor fitting plugs shall be removed just before brazing the compressor.

⚠ Before eventual unbrazing the compressor or any system component, the refrigerant charge must be removed from both the high and low pressure sides. Failure to do so may result in serious personal injury. Pressure gauges must be used to ensure all pressures are at atmospheric level.

For more detailed information on the appropriate materials required for brazing or soldering, please contact the product manufacturer or distributor. For specific applications not covered herein, please contact Danfoss Commercial Compressors for further information.

Application guidelines

Installation

System pressure test

Always use an inert gas such as nitrogen for pressure testing. Never use other gasses such as oxygen, dry air or acetylene as these may form

an inflammable mixture. Do not exceed the following pressures:

Maximum compressor test pressure (low side)	SM/SZ 084 - 185: 363 psig	SZ/SY240 - 380: 290 psig
Maximum compressor test pressure (high side)	464 psig	
Maximum pressure difference between high and low side of the compressor:	348 psig	

Pressurize the system on HP side first then LP side to prevent rotation of the scroll. Never let the pressure on LP side exceed the pressure on HP side with more than 72 psi.
On SY/SZ240-300 models which have an internal non return-valve in discharge fitting

or if an external non return valve is present on the discharge line, we advise to pressurize the system not quicker than 70 psi/s to allow enough pressure equalisation between LP and HP side over the scroll elements.

Leak detection

Leak detection must be carried out using a mixture of nitrogen and refrigerant or nitrogen and helium, as indicated in the table below. Never use other gasses such as oxygen, dry air

or acetylene as these may form an inflammable mixture.
Pressurize the system on HP side first then Low side.

Compressor model	Leak detection with refrigerant	Leak detection with a mass spectrometer
SM-SY compressors	Nitrogen & R22	Nitrogen & Helium
SZ compressors	Nitrogen & R134a or R407C	Nitrogen & Helium

Note 1: Leak detection with refrigerant may be forbidden in some countries. Check local regulations.

Note 2: The use of leak detecting additives is not recommended as they may affect the lubricant properties.

Vacuum evacuation and moisture removal

Moisture obstructs the proper functioning of the compressor and the refrigeration system.

Air and moisture reduce service life and increase condensing pressure, and cause excessively high discharge temperatures, which can destroy the lubricating properties of the oil. Air and moisture also increase the risk of acid formation, giving rise to copper plating. All these phenomena can cause mechanical and electrical compressor failure.

For these reasons it's important to perform a vacuum dehydration on the system to remove all residual moisture from the pipe-work after assembly;

SM / SY / SZ compressors are delivered with < 100 ppm moisture level. The required moisture level in the circuit after vacuum dehydration must be < 100 ppm for systems with an SM / SY / SZ.

- Never use the compressor to evacuate the system.
- Connect a vacuum pump to both the LP & HP sides.
- Evacuate the system to a pressure of 0.02 inHg (300 µm Hg) absolute.

Do not use a megohm meter nor apply power to the compressor while it's under vacuum as this may cause internal damage.

Application guidelines

Installation

Filter driers

A properly sized & type of drier is required. Important selection criteria include the driers water content capacity, the system refrigeration capacity and the system refrigerant charge. The drier must be able to reach and maintain a moisture level of 50 ppm end point dryness (EPD).

For new installations with SM/SY/SZ compressors with polyolester oil, Danfoss recommends using the Danfoss DML (100% molecular sieve) solid core filter drier. Molecular sieve filter driers with loose beads from third party suppliers shall be avoided. For servicing of existing installations where acid formation is present the Danfoss DCL (solid core) filter driers containing activated alumina are recommended.

The drier is to be oversized rather than under sized. When selecting a drier, always take into account its capacity (water content capacity), the system refrigeration capacity and the system refrigerant charge.

After burn out, remove & replace the liquid line filter drier and install a Danfoss type DAS burn-out drier of the appropriate capacity. Refer to the DAS drier instructions and technical information for correct use of the burnout drier on the liquid line. Also for new installations with SM compressors with mineral oil the Danfoss DCL drier is recommended.

Refrigerant charging

For the initial charge the compressor must not run and eventual service valves must be closed. Charge refrigerant as close as possible to the nominal system charge before starting the compressor. This initial charging operation must be done in liquid phase. The best location is on the liquid line between the condenser outlet and the filter drier. Then during commissioning, when needed, a complement of charge can be done in liquid phase: slowly throttling liquid in on the low pressure side as far away as possible from the compressor suction connection while compressor is running. The refrigerant charge quantity must be suitable for both summer and winter operations.

Vacuum or charge from one side can seal the scrolls and result in a non-starting compressor. When servicing, always ensure that LP/HP pressures are balanced before starting the compressor.

Be sure to follow all government regulations regarding refrigerant reclamation and storage. For more detailed information, see "Recommended refrigerant system charging practice" news bulletin FRCC.EN.050.

Insulation resistance and dielectric strength

Insulation resistance must be higher than 1 megohm when measured with a 500 volt direct current megohm tester.

Each compressor motor is tested at the factory with a high potential voltage (hi-pot) that exceeds the UL requirement both in potential and in duration. Leakage current is less than 0.5 mA.

SM/SY/SZ scroll compressors are configured with the pump assembly at the top of the shell, and the motor below. As a result, the motor can be partially immersed in refrigerant and oil. The presence of refrigerant around the motor windings will result in lower resistance

values to ground and higher leakage current readings. Such readings do not indicate a faulty compressor.

In testing insulation resistance, Danfoss recommends that the system be first operated briefly to distribute refrigerant throughout the system. Following this brief operation, retest the compressor for insulation resistance or current leakage.

Never reset a breaker or replace a fuse without first checking for a ground fault (a short circuit to ground). Be alert for sounds of arcing inside the compressor.

Application guidelines

Installation

Commissioning

The system must be monitored after initial start-up for a minimum of 60 minutes to ensure proper operating characteristics such as:

- Proper metering device operation and desired super heat readings,
- Suction and discharge pressure are within acceptable levels,
- Correct oil level in compressor sump indicating proper oil return,

- Low foaming in sight glass and compressor sump temperature 18°F above saturation temperature to show that there is no refrigerant migration taking place,
- Acceptable cycling rate of compressors, including duration of run times,
- Current draw of individual compressors within acceptable values (max. operating current),
- No abnormal vibrations and noise.

Oil level checking and top-up

In installations with good oil return and line runs up to 66 ft, no additional oil is required. If installation lines exceed 66 ft, additional oil may be needed. 1 or 2% of the total system refrigerant charge (in weight) can be used to roughly define the required oil top-up quantity but in any case the oil charge has to be adjusted based on the oil level in the compressor sight glass.

When the compressor is running under stabilized conditions the oil level must be visible in the sight glass.

The presence of foam filling in the sight glass indicates large concentration of refrigerant in the oil and / or presence of liquid returning to the compressor.

The oil level can also be checked a few minutes

after the compressor stops.

When the compressor is off, the level in the sight glass can be influenced by the presence of refrigerant in the oil.

Always use original Danfoss oil from new cans.

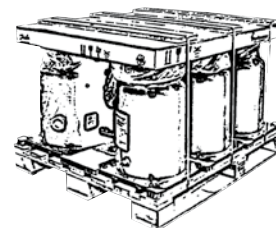
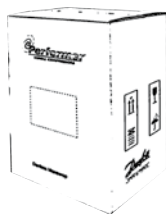
Compressor series	Oil
SM	Mineral oil 160P
SY	P.O.E. 320 SZ
SZ	P.O.E. 160 SZ

Top-up the oil while the compressor is idle. Use the schrader connector or any other accessible connector on the compressor suction line and a suitable pump. See News bulletin «Lubricants filling in instructions for Danfoss Commercial Compressors».

Application guidelines

Ordering information & packaging

Packaging



Compressor models	Single pack				Nbr*	Industrial pack				
	Length in	Width in	Height in	Gross weight lb		Length in	Width in	Height in	Gross weight lb	Static stacking pallets
SM/SZ084	18.5	14.6	23.5	148	8	44.9	37.4	27.8	1213	3
SM/SZ090	18.5	14.6	23.5	152	8	44.9	37.4	27.8	1248	3
SM/SZ100	18.5	14.6	23.5	152	8	44.9	37.4	27.8	1248	3
SM/SZ110-120	18.5	14.6	23.5	172	8	44.9	37.4	29.8	1407	3
SM112	15.0	12.6	22.8	143	8	45.3	37.4	29.3	1197	3
SM124	15.0	12.6	22.8	143	8	45.3	37.4	29.3	1197	2
SM/SZ147	15.0	12.6	22.8	150	8	45.3	37.4	29.3	1248	2
SM/SZ148-161	18.5	14.6	26.4	194	6	44.9	37.4	31.1	1204	3
SM/SZ175-185 - SY185	18.5	15.7	27.5	234	6	44.9	37.4	34.5	1429	2
SY/SZ240	20.1	18.3	30.7	344	4	44.9	37.4	35.6	1400	2
SY/SZ300	20.1	18.3	30.7	355	4	44.9	37.4	36.0	1400	2
SY/SZ380	20.1	18.3	31.7	362	4	44.9	37.4	37.0	1426	2

* Nbr = number of compressors per pallet

Ordering information

Danfoss scroll compressors may be ordered from Danfoss Commercial Compressors in either industrial packs or in single packs as listed in

following tables For tandem assemblies, please refer to the Danfoss parallel application guideline reference FRCC.PC.005.

SM112-124-147 compressors in industrial pack

R22

Compressor model	Connections	Motor protection	Code no.			
			3	4	7	9
			200-230/3/60	460/3/60 380-400/3/50	575/3/60 500/3/50	380/3/60
SM112	Brazed	Internal	120H0610	120H0612	-	120H0614
SM124	Brazed	Internal	120H0184	120H0186	-	120H0188
SM147	Brazed	Internal	120H0190	120H0311	-	120H0198
SZ147	Brazed	Internal	-	120H1097	-	-

SM112-124-147 compressors in single pack

R22

Compressor model	Connections	Motor protection	Code no.			
			3	4	7	9
			200-230/3/60	460/3/60 380-400/3/50	575/3/60 500/3/50	380/3/60
SM112	Brazed	Internal	120H0609	120H0611	-	120H0613
SM124	Brazed	Internal	120H0183	120H0185	-	120H0187
SM147	Brazed	Internal	120H0189	120H0191	-	120H0197
SZ147	Brazed	Internal	-	120H1096	-	-

Application guidelines

Ordering information & packaging

SM /SY compressors in single pack

R22

Compressor model	Connections	Motor protection	Code no.			
			3	4	7	9
			200-230/3/60	460/3/60 380-400/3/50	575/3/60 500/3/50	380/3/60
SM084	Brazed	Internal	SM084-3VI	SM084-4VI	SM084-7VI	SM084-9VI
SM090	Brazed	Internal	SM090-3VI	SM090-4VI	SM090-7VI	SM090-9VI
SM100	Brazed	Internal	SM100-3VI	SM100-4VI	SM100-7VI	SM100-9VI
SM110	Brazed	Internal	SM110-3VI	SM110-4VI	SM110-7VI	SM110-9VI
SM120	Brazed	Internal	SM120-3VI	SM120-4VI	SM120-7VI	SM120-9VI
SM148	Brazed	Internal	SM148-3VAI	SM148-4VAI	SM148-7VAI	SM148-9VAI
SM161	Brazed	Internal	SM161-3VAI	SM161-4VAI	SM161-7VAI	SM161-9VAI
SM175	Brazed	Thermostat	SM175-3CAI	SM175-4CAI	SM175-7CAI	SM175-9CAI
	Brazed	Module 24V AC	SM175-3PCI	SM175-4PCI	SM175-7PCI	-
	Rotolock	Thermostat	SM175-3RI	SM175-4RI	SM175-7RI	SM175-9RI
	Rotolock	Module 24V AC	SM175-3SCI	SM175-4SCI	SM175-7SCI	-
SM185	Brazed	Thermostat	SM185-3CAI	SM185-4CAI	SM185-7CAI	SM185-9CAI
	Brazed	Module 24 V AC	SM185-3PCI	SM185-4PCI	SM185-7PCI	-
	Brazed	Module 230 V AC	-	SM185-4XCI	-	SM185-9XCI
	Rotolock	Thermostat	SM185-3RI	SM185-4RI	SM185-7RI	SM185-9RI
	Rotolock	Module 24 V AC	SM185-3SCI	SM185-4SCI	SM185-7SCI	-
	Rotolock	Module 230 V AC	-	SM185-4YCI	-	SM185-9YCI
SY185 **	Brazed	Thermostat	-	SY185-4CAI	-	-
	Rotolock	Thermostat	-	SY185-4RI	-	-
SY240	Brazed	Module 24V AC	-	SY240A4CAI	-	-
	Brazed	Module 115-230V AC	SY240A3CBI	SY240A4CBI	SY240A7CBI	SY240A9CBI
	Rotolock	Module 24V AC	-	SY240A4PAI	-	-
	Rotolock	Module 115-230V AC	SY240A3PBI	SY240A4PBI	SY240A7PBI	SY240A9PBI
SY300	Brazed	Module 24V AC	-	SY300A4CAI	-	-
	Brazed	Module 115-230V AC	SY300A3CBI	SY300A4CBI	SY300A7CBI	SY300A9CBI
	Rotolock	Module 24V AC	-	SY300A4PAI	-	-
	Rotolock	Module 115-230V AC	SY300A3PBI	SY300A4PBI	SY300A7PBI	SY300A9PBI
SY380	Brazed	Module 24V AC	-	SY380A4CAI	-	-
	Brazed	Module 115-230V AC	-	SY380A4CBI	-	-

** No module version available

SM/SY compressors in industrial pack: use numbers from above table and replace the last digit by "M". Example: SY240A3CAM, except for voltage codes 6 and 7 available in single pack only

SZ compressors in single pack

R407C / R134a

Compressor model	Connections	Motor protection	Code no.			
			3	4	7	9
			200-230/3/60	460/3/60 380-400/3/50	575/3/60 500/3/50	380/3/60
SZ084	Brazed	Internal	SZ084-3VI	SZ084-4VI	SZ084-7VI	SZ084-9VI
SZ090	Brazed	Internal	SZ090-3VI	SZ090-4VI	SZ090-7VI	SZ090-9VI
SZ100	Brazed	Internal	SZ100-3VI	SZ100-4VI	SZ100-7VI	SZ100-9VI
SZ110	Brazed	Internal	SZ110-3VI	SZ110-4VI	SZ110-7VI	SZ110-9VI
SZ120	Brazed	Internal	SZ120-3VI	SZ120-4VI	SZ120-7VI	SZ120-9VI
SZ148	Brazed	Internal	SZ148-3VAI	SZ148-4VAI	SZ148-7VAI	SZ148-9VAI
SZ161	Brazed	Internal	SZ161-3VAI	SZ161-4VAI	SZ161-7VAI	SZ161-9VAI
SZ175	Brazed	Thermostat	SZ175-3CAI	SZ175-4CAI	SZ175-7CAI	SZ175-9CAI
	Brazed	Module 24 V AC	SZ175-3PCI	SZ175-4PCI	SZ175-7PCI	-
	Rotolock	Thermostat	SZ175-3RI	SZ175-4RI	SZ175-7RI	SZ175-9RI
	Rotolock	Module 24 V AC	SZ175-3SCI	SZ175-4SCI	SZ175-7SCI	-
SZ185	Brazed	Thermostat	SZ185-3CAI	SZ185-4CAI	SZ185-7CAI	SZ185-9CAI
	Brazed	Module 24 V AC	SZ185-3PCI	SZ185-4PCI	SZ185-7PCI	-
	Brazed	Module 230 V	-	SZ185-4XCI	-	SZ185-9XCI
	Rotolock	Thermostat	SZ185-3RI	SZ185-4RI	SZ185-7RI	SZ185-9RI
	Rotolock	Module 24 V AC	SZ185-3SCI	SZ185-4SCI	SZ185-7SCI	-
	Rotolock	Module 230 V	-	SZ185-4YCI	-	SZ185-9YCI
SZ240	Brazed	Module 24 V AC	-	SZ240A4CAI	-	-
	Brazed	Module 115/230 V	SZ240A3CBI	SZ240A4CBI	SZ240A7CBI	SZ240A9CBI
	Rotolock	Module 24 V AC	-	SZ240A4PAI	-	-
	Rotolock	Module 115/230 V	SZ240A3PBI	SZ240A4PBI	SZ240A7PBI	SZ240A9PBI
SZ300	Brazed	Module 24 V AC	-	SZ300A4CAI	-	-
	Brazed	Module 115/230 V	SZ300A3CBI	SZ300A4CBI	SZ300A7CBI	SZ300A9CBI
	Rotolock	Module 24 V AC	-	SZ300A4PAI	-	-
	Rotolock	Module 115/230 V	SZ300A3PBI	SZ300A4PBI	SZ300A7PBI	SZ300A9PBI
SZ 380	Brazed	Module 24 V AC	-	SZ380A4CAI	-	-
	Brazed	Module 115/230 V	-	SZ380A4CBI	-	-

SZ compressors in industrial pack: use numbers from above table and replace the last digit by "M". Example: SZ240A4CAM, except for voltage codes 6 and 7 available in single pack only

Application guidelines

Accessories

Solder sleeve adaptor set



Type	Code n°	Description	Application	Packaging	Pack size
	7765005	Solder sleeve adapter set (1"3/4~1"1/8), (1"1/4~3/4")	SM/SZ084-090-100	Multipack	6
	120Z0405	Solder sleeve adapter set (1"3/4~1"3/8), (1"1/4~7/8")	SM110-112-120-124-147-148-161&SZ110-115-120-125-147-148-161	Multipack	8
	7765006*	Solder sleeve adapter set (1"3/4~1"3/8), (1"1/4~7/8")	SM110-112-120-124-147-148-161&SZ110-115-120-125-147-148-161	Multipack	6
	7765028	Solder sleeve adapter set (2"1/4~1"5/8), (1"3/4~1"1/8)	SM/SZ160-175-185, SY/SZ 240-300	Multipack	6
	120Z0317	Solder sleeve adapter set (flange, 2"1/8 ODF), (1"3/4 rotolock, 1"3/8 ODF)	SY/Z380	Single	1

* Diameter restrictor

Rotolock adaptor



Type	Code n°	Description	Application	Packaging	Pack size
	120Z0366	Adaptor (1"1/4 Rotolock - 3/4" ODS)	Models with 3/4" ODF	Multipack	10
	120Z0367	Adaptor (1"1/4 Rotolock - 7/8" ODS)	Models with 7/8" ODF	Multipack	10
	120Z0364	Adaptor (1"3/4 Rotolock - 1"1/8 ODS)	Models with 1"1/8 ODF	Multipack	10
	120Z0431	Adaptor (1"3/4 Rotolock - 1"3/8" ODS)	Models with 1"3/8 ODF	Multipack	10
	120Z0432	Adaptor (2"1/4 Rotolock - 1"5/8 ODS)	Models with 1"5/8 ODF	Multipack	10

Gaskets

Type	Code n°	Description	Application	Packaging	Pack size
G09	8156131	Gasket, 1"1/4	Models with 1"1/4 rotolock connection	Multipack	10
G09	7956002	Gasket, 1"1/4	Models with 1"1/4 rotolock connection	Industry pack	50
G07	8156132	Gasket, 1"3/4	Models with 1"3/4 rotolock connection	Multipack	10
G07	7956003	Gasket, 1"3/4	Models with 1"3/4 rotolock connection	Industry pack	50
G08	8156133	Gasket, 2"1/4	Models with 2"1/4 rotolock connection	Multipack	10
G08	7956004	Gasket, 2"1/4	Models with 2"1/4 rotolock connection	Industry pack	50
	8156013	Gasket set 1"1/4 - 1"3/4 2"1/4, OSG gaskets black & white	All Rotolock models	Multipack	10

Solder sleeves

Type	Code n°	Description	Application	Packaging	Pack size
P02	8153004	Solder sleeve P02 (1"3/4 Rotolock - 1"1/8 ODF)	Models with 1"3/4 rotolock connection	Multipack	10
P02	7953005	Solder sleeve P02 (1"3/4 Rotolock - 1"1/8 ODF)	Models with 1"3/4 rotolock connection	Industry pack	50
P03	8153006	Solder sleeve P03 (2"1/4 Rotolock - 1"5/8 ODF)	Models with 2"1/4 rotolock connection	Multipack	10
P03	7953006	Solder sleeve P03 (2"1/4 Rotolock - 1"5/8 ODF)	Models with 2"1/4 rotolock connection	Industry pack	50
P04	8153008	Solder sleeve P04 (1"1/4 Rotolock - 3/4 ODF)	Models with 1"1/4 rotolock connection	Multipack	10
P04	7953007	Solder sleeve P04 (1"1/4 Rotolock - 3/4 ODF)	Models with 1"1/4 rotolock connection	Industry pack	50
P05	8153012	Rotolock connector P05 (1"1/4 Rotolock - 7/8" ODF)	Models with 1"1/4 rotolock connection	Multipack	10
P05	7953008	Rotolock connector P05 (1"1/4 Rotolock - 7/8" ODF)	Models with 1"1/4 rotolock connection	Industry pack	50
P07	8153013	Solder sleeve P07 (1"3/4 Rotolock - 7/8" ODF)	Models with 1"3/4 rotolock connection	Multipack	10
P07	7953010	Solder sleeve P07 (1"3/4 Rotolock - 7/8" ODF)	Models with 1"3/4 rotolock connection	Industry pack	50
P08	8153005	Solder sleeve P08 (2"1/4 Rotolock - 1"3/8 ODF)	Models with 2"1/4 rotolock connection	Multipack	10
P10	8153003	Solder sleeve P10 (1"3/4 Rotolock - 1"3/8 ODF)	Models with 1"3/4 rotolock connection	Multipack	10



Application guidelines

Accessories

Rotolock nuts

Type	Code n°	Description	Application	Packaging	Pack size
	8153123	Rotolock nut, 1"1/4	Models with 1"1/4 rotolock connection	Multipack	10
	7953002	Rotolock nut, 1"1/4	Models with 1"1/4 rotolock connection	Industry pack	50
	8153124	Rotolock nut, 1"3/4	Models with 1"3/4 rotolock connection	Multipack	10
	7953003	Rotolock nut, 1"3/4	Models with 1"3/4 rotolock connection	Industry pack	50
	8153126	Rotolock nut, 2"1/4	Models with 2"1/4 rotolock connection	Multipack	10
	120Z0047	Rotolock nut, 2"1/4	Models with 2"1/4 rotolock connection	Industry pack	50

Rotolock service valve

Type	Code n°	Description	Application	Packaging	Pack size
	7703009	Valve set, V02 (1"3/4 ~ 1"1/8), V04 (1"1/4 ~ 3/4")	SM / SZ 084 to 100 - 110* to 161*	Multipack	6
	7703392	Valve set, V10 (1"3/4 ~ 1"3/8), V05 (1"1/4 ~ 7/8")	SM / SZ 110 to 161	Multipack	6
	7703010*	Valve set, V08 (2"1/4 ~ 1"3/8), V07 (1"3/4 ~ 7/8")	SY / SM / SZ 175/185*		
	7703383	Valve set, V03 (2"1/4 ~ 1"5/8), V02 (1"3/4 ~ 1"1/8)	SY / SZ 175 to 300	Multipack	4
	120Z0316	Valve set, V12 (flange 2"1/8), V10 (1"3/4 ~ 1"3/8)	SY / SZ 380	Single pack	1

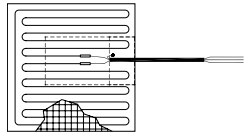
* diameter restriction

3-phase soft start equipment



Type	Code n°	Description	Application	Packaging	Pack size
MCI15C	7705006	Electronic soft start kit, MCI 15 C	SM/SZ084-110	Single pack	1
MCI25C	7705007	Electronic soft start kit, MCI 25 C	SM/SZ120-185	Single pack	1
MCI50CM	7705009	Electronic soft start kit, MCI 50 CM	SY/SZ240-380	Single pack	1

Surface sump heaters



	Code n°	Accessory description	Application	Packaging	Pack size
	120Z0388	80W 24V surface sump heater CE & UL	SM 112 - 124 - 147 - SZ147	Multipack	8
	120Z0389	80W 230V surface sump heater CE & UL		Multipack	8
	120Z0390	80W 400V surface sump heater CE & UL		Multipack	8
	120Z0391	80W 460V surface sump heater CE *		Multipack	8
	120Z0402	80W 575V surface sump heater CE *		Multipack	8
	120Z0361	48W 24V surface sump heater + bottom insulation, CE & UL	SM / SZ 084 - 090 - 100 - 110 - 120 - 148 - 161	Multipack	6
	120Z0380	48W 230V surface sump heater + bottom insulation, CE & UL		Multipack	6
	120Z0381	48W 400V surface sump heater + bottom insulation, CE & UL		Multipack	6
	120Z0382	48W 460V surface sump heater + bottom insulation, CE *		Multipack	6
	120Z0383	48W 575V surface sump heater + bottom insulation, CE *		Multipack	6
	120Z0360	56W 24V surface sump heater + bottom insulation, CE & UL	SM / SZ 175 & SM / SY / SZ 185	Multipack	6
	120Z0376	56W 230V surface sump heater + bottom insulation, CE & UL		Multipack	6
	120Z0377	56W 400V surface sump heater + bottom insulation, CE & UL		Multipack	6
	120Z0378	56W 460V surface sump heater + bottom insulation, CE *		Multipack	6
	120Z0379	56W 575V surface sump heater + bottom insulation, CE *		Multipack	6
	120Z0359	80W 24V surface sump heater + bottom insulation, CE & UL	SM / SZ 240 to SY / SZ 380	Multipack	4
	120Z0372	80W 230V surface sump heater + bottom insulation, CE & UL		Multipack	4
	120Z0373	80W 400V surface sump heater + bottom insulation, CE & UL		Multipack	4
	120Z0374	80W 460V surface sump heater + bottom insulation, CE *		Multipack	4
	120Z0375	80W 575V surface sump heater + bottom insulation, CE *		Multipack	4

Application guidelines

Accessories

Discharge temperature protection



Type	Code No	Description	Application	Packaging	Pack Size
	7750009	Discharge thermostat kit	All models	Multipack	10
	7973008	Discharge thermostat kit	All models	Industry pack	50

Mounting hardware



Type	Code No	Description	Application	Packaging	Pack Size
	8156138	Mounting kit for scroll compressors. Grommets, sleeves, bolts, washers	SM/SZ084-090-100-110-120-148-161-175-185	Single pack	1
	8156147	Mounting kit for scroll compressors. Grommets, sleeves, bolts, washers, rotolock nuts, solder sleeves, gaskets	SM/SZ148-161-175-185	Single pack	1
	8156144	Mounting kit for scroll compressors. Grommets, sleeves	SY/SZ240-300	Single pack	1
	8156148	Mounting kit for scroll compressors. Grommets, sleeves, rotolock nuts, solder sleeves, gaskets	SY/SZ240-300	Single pack	1
	120Z0066	Mounting kit for scroll compressors. Grommets, sleeves, bolts, washers	SM112-124-147 - SZ147	Single pack	1

Acoustic hoods



Type	Code No	Description	Application	Packaging	Pack Size
	7755011	Acoustic hood for scroll compressor S084-S090-S100	SM/SZ084-090-100	Single pack	1
	7755010	Acoustic hood for scroll compressor S110-S120	SM/SZ110 & SM/SZ120	Single pack	1
	7755009	Acoustic hood for scroll compressor S115-S125	SM/SZ125	Single pack	1
	7755017	Acoustic hood for scroll compressor S148-S161 (except code 3)	SM/SZ148.161 except code 3	Single pack	1
	7755008	Acoustic hood for scroll compressor S160	SM/SZ160	Single pack	1
	7755007	Acoustic hood for scroll compressor S175-S185	SM/SZ175-185	Single pack	1
	7755016	Acoustic hood for scroll compressor S240-S300	SY/SZ240-300	Single pack	1
	7755022	Acoustic hood for scroll compressor S380	SY/SZ380	Single pack	1
	120Z0035	Acoustic hood for scroll compressor, SM112-124-147	SM112-124-147 (except SM147 code 3) SZ147	Single pack	1
	120Z0135	Acoustic hood for scroll compressor, SM147-3	SM/SZ147 code 3	Single pack	1
	120Z0356	Bottom insulation	SM/SZ084-090-100-110-120-148-161	Single pack	1
	120Z0353	Bottom insulation	SM/SZ175&SM/SY/SZ185	Single pack	1
	120Z0355	Bottom insulation	SY/SZ240 to SY/SZ380	Single pack	1

Motor protection modules



Type	Code n°	Description	Application	Packaging	Pack size
	8169015	Electronic motor protection module, 24 V AC	SY/SZ240-295-380-485	Single pack	1
	8169016	Electronic motor protection module, 115/230 V		Single pack	1

Application guidelines

Accessories

Terminal boxes, covers & T-block connectors



Type	Code No	Description	Application	Packaging	Pack Size
	8156139	Terminal box 7.3 x 7.8 inch, incl cover	SM/SZ148-3.161-3.175.185	Single pack	1
	120Z0413	Terminal box cover	SM/SZ147-3	Single pack	1
	8156135	Service kit for terminal box 3.8 x 4.5 inch, including 1 cover, 1 clamp, 1 T block connector 2 x 2.2 inch	SM084.090.100.110.112.120.124.147.148.161 (except SM148-3.161-3) & SZ084.090.100.110.120.148.161 (except SZ148-3.161-3)	Multipack	10
	8173230	T block connector 2 x 2.2 inch	SM/SZ084-110.120.148 (except -3). 161 (except -3). & SM112-124-147 (except-3)-SZ147	Multipack	10
	8173021	T block connector 2.4 x 3 inch	SM/SZ147-3.148-3.161-3.175.185 & SY240.300.380 (except SY240-3.300-3) & SZ175.185.240.300.380 (except SZ240-3.300-3.)	Multipack	10
	8173331	T block connector 3.1 x 3.1 inch	SY/SZ240.300-3	Multipack	10
	120Z0458	Terminal box 8.27 x 7.48 inch, incl cover	SY/SZ240.300.380	Single pack	1
	120Z0462	Terminal box 8.27 x 7.48 inch, incl cover and module wiring for 10.16 x 8.19 inch terminal box replacement	SY/SZ240.300.380	Single pack	1

Lubricant



Type	Code No	Description	Application	Packaging	Pack Size
160SZ	7754023	POE lubricant, 160SZ, 1.05 quart can	SZ with R407C, R134a, R404A	Multipack	12
160SZ	120Z0571	POE lubricant, 160SZ, 2.64 quart can	SZ with R407C, R134a, R404A	Multipack	4
320SZ	7754121	POE lubricant, 320SZ, 1.05 quart can	SY with R22	Multipack	12
320SZ	120Z0572	POE lubricant, 320SZ, 2.64 quart can	SY with R22	Multipack	4
160P	7754001	Mineral oil, 160P, 2.64 quart can	SM with R22	Multipack	8
160P	7754002	Mineral oil, 160P, 5.28 quart can	SM with R22	Multipack	4

Miscellaneous



Type	Code No	Description	Application	Packaging	Pack Size
	8156019	Sight glass with gaskets (black & white)	All models	Multipack	4
	8156129	Gasket for sight glasse, 1"1/8 (white teflon)	All models	Multipack	10
	7956005	Gasket for sight glass, 1"1/8 (white teflon)	All models	Multipack	50
	8154001	Danfoss Commercial Compressors blue spray paint	All models	Single pack	1

Danfoss Commercial Compressors is a worldwide manufacturer of compressors and condensing units for refrigeration and HVAC applications. With a wide range of high quality and innovative products we help your company to find the best possible energy efficient solution that respects the environment and reduces total life cycle costs.

We have 40 years of experience within the development of hermetic compressors which has brought us amongst the global leaders in our business, and positioned us as distinct variable speed technology specialists. Today we operate from engineering and manufacturing facilities spread across three continents.



Danfoss Variable Speed scroll compressors



Danfoss Air Conditioning scroll compressors



Danfoss Heat Pump scroll compressors



Maneurop® Variable Speed reciprocating compressors



Danfoss Refrigeration scroll compressors



Maneurop® Reciprocating Compressors



Optyma™ & Optyma Plus™ Condensing Units



Light commercial reciprocating compressors (manufactured by Secop)

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