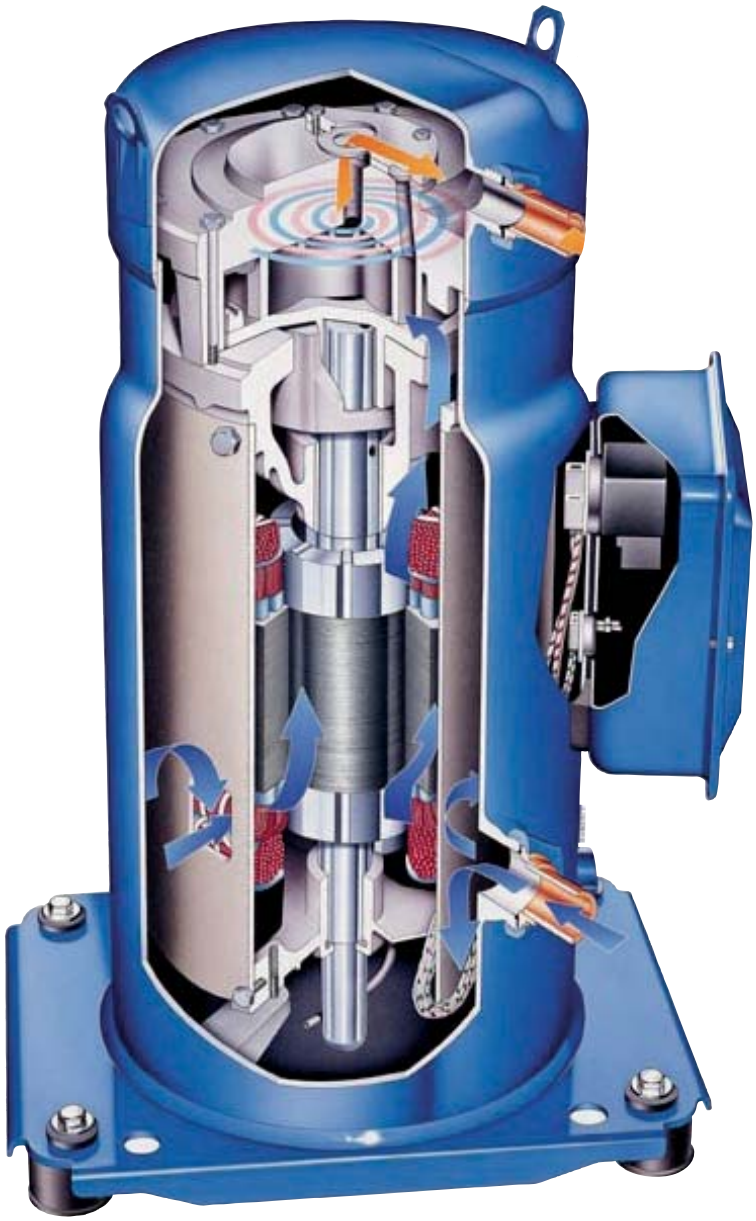
MAKING MODERN LIVING POSSIBLE

Performer® scroll compressors

SM - SY - SZ - 50 - 60 Hz
R22 - R407C - R134a - R404A - R507A

Selection & application guidelines

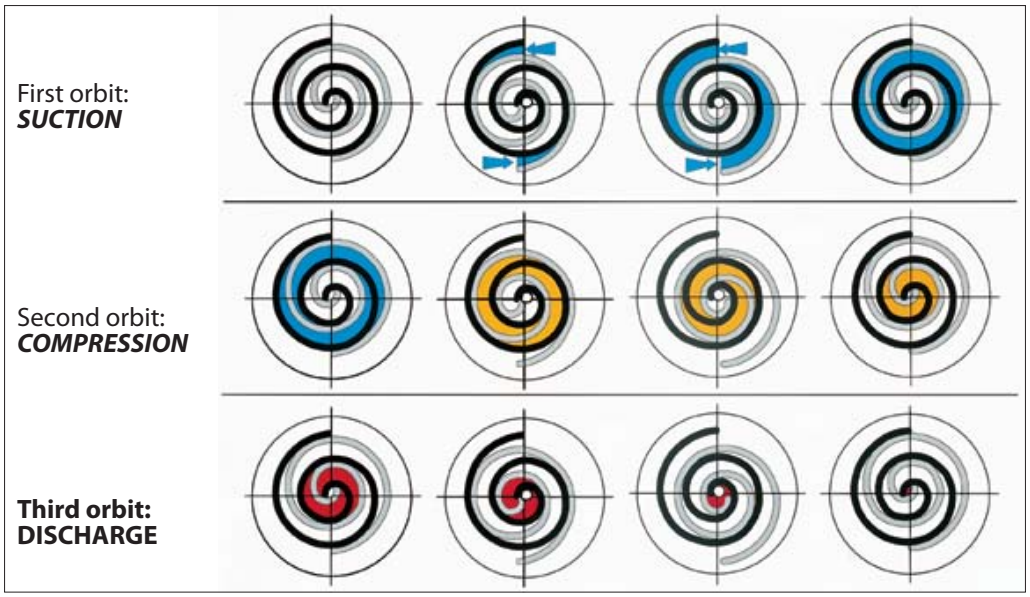


SM / SY / SZ 084-120.148-380

In a Performer® 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.

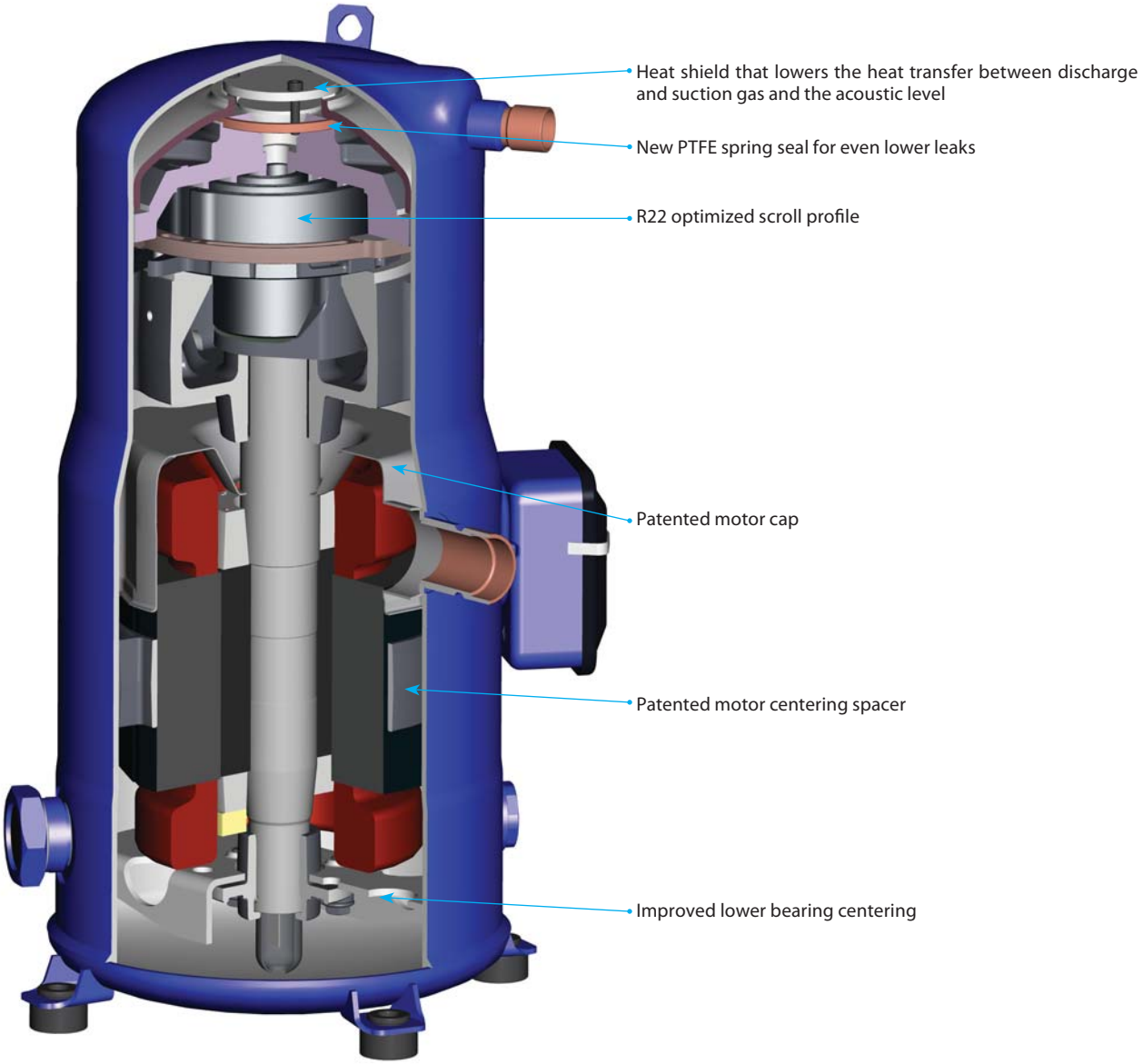
The figure below illustrates the entire compression process. The centre of the orbiting scroll (in grey) traces a circular path around the centre of the fixed scroll (in black). This movement creates symmetrical compression pockets between the two scroll elements. Low-pressure suction gas is trapped 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.



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

The new SM112-124 and 147 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.



SM 112-124 - 147

Performer® 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 on page 49.

For tandem and trio assemblies, please refer to the Performer® 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**	**AA**	**A**	Single compressors

Family, lubricant & refrigerant
SM: Scroll, Mineral oil, R22
SY: Scroll, POE lubricant, R22 (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 115-125-160-175-185
	R	: rotolock		
Electronic protection module	**J**	: brazed	24 V DC	
	P	: brazed	24 V AC	
	U	: brazed	115 V	
	X	: brazed	230 V	
	K	: rotolock	24 V DC	
	S	: rotolock	24 V AC	
	W	: rotolock	115 V	
	Y	: rotolock	230 V	
	AF	**A**: brazed	**F**: 24V DC	S 240 - 300
	AA		**A**: 24V AC	
	AB		**B**: 115/230V	
	MA	**M**: rotolock	**A**: 24V AC	
	MB		**B**: 115/230V	
	CA	**C**: brazed	**A**: 24V AC	S 380 *
	CB		**B**: 115/230V	
	CF		**F**: 24V DC	

* SY380 only available for 400V/3~/50 Hz, SZ380 available for both 400V/3~/50 Hz and 460V/3~/60 Hz

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	cm³/rev	m³/h	dm³	kg
R22 SINGLE	**SM084**	7	20 400	69 600	6.12	3.33	11.4	114.5	19.92	3.3	64
	SM090	7.5	21 800	74 400	6.54	3.33	11.4	120.5	20.97	3.3	65
	SM100	8	23 100	79 000	6.96	3.33	11.3	127.2	22.13	3.3	65
	SM110	9	25 900	88 600	7.82	3.32	11.3	144.2	25.09	3.3	73
	SM112	9.5	27 600	94 400	7.92	3.49	11.9	151.5	26.36	3.3	64
	SM115	9.5	28 000	95 600	8.31	3.37	11.5	155.0	26.97	3.8	78
	SM120	10	30 100	102 800	8.96	3.36	11.5	166.6	28.99	3.3	73
	SM124	10	31 200	106 300	8.75	3.56	12.2	169.5	29.5	3.3	64
	SM125	10	30 100	102 800	8.93	3.37	11.5	166.6	28.99	3.8	78
	SM147	12	36 000	123 000	10.08	3.58	12.2	193.5	33.7	3.3	67
	SM148	12	36 100	123 100	10.80	3.34	11.4	199.0	34.60	3.6	88
	SM160	13	39 100	133 500	11.60	3.37	11.5	216.6	37.69	4.0	90
	SM161	13	39 000	133 200	11.59	3.37	11.5	216.6	37.69	3.6	88
	SM175	14	42 000	143 400	12.46	3.37	11.5	233.0	40.54	6.2	100
	SM/SY185	15	45 500	155 300	13.62	3.34	11.4	249.9	43.48	6.2	100
	SY240	20	61 200	208 700	18.20	3.36	11.5	347.8	60.50	8.0	150
	SY300	25	78 200	267 000	22.83	3.43	11.7	437.5	76.10	8.0	157
	SY380	30	94 500	322 700	27.4	3.46	11.8	531.2	92.40	8.4	158
R407C SINGLE	**SZ084**	7	19 300	66 000	6.13	3.15	10.7	114.5	19.92	3.3	64
	SZ090	7.5	20 400	69 600	6.45	3.16	10.8	120.5	20.97	3.3	65
	SZ100	8	21 600	73 700	6.84	3.15	10.8	127.2	22.13	3.3	65
	SZ110	9	24 600	84 000	7.76	3.17	10.8	144.2	25.09	3.3	73
	SZ115	9.5	26 900	91 700	8.49	3.16	10.8	155.0	26.97	3.8	78
	SZ120	10	28 600	97 600	8.98	3.18	10.9	166.6	28.99	3.3	73
	SZ125	10	28 600	97 500	8.95	3.19	10.9	166.6	28.99	3.8	78
	SZ148	12	35 100	119 800	10.99	3.19	10.9	199.0	34.60	3.6	88
	SZ160	13	38 600	131 800	11.77	3.28	11.2	216.6	37.69	4.0	90
	SZ161	13	37 900	129 500	11.83	3.21	10.9	216.6	37.69	3.6	88
	SZ175	14	40 100	136 900	12.67	3.17	10.8	233.0	40.54	6.2	100
	SZ185	15	43 100	147 100	13.62	3.16	10.8	249.9	43.48	6.2	100
	SZ240	20	59 100	201 800	18.60	3.18	10.9	347.8	60.50	8.0	150
	SZ300	25	72 800	248 300	22.70	3.20	10.9	437.5	76.10	8.0	157
	SZ380	30	89 600	305 900	27.60	3.25	11.1	531.2	92.40	8.4	158

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

Rating conditions

	SM/SY compressors	SZ compressors
Refrigerant	R22	R407C
Frequency	50 Hz	50 Hz
Standard rating conditions	ARI standard conditions	-
Evaporating temperature	7.2 °C	7.2 °C (dew point)
Condensing temperature	54.4 °C	54.4 °C (dew point)
Sub-cooling	8.3 K	8.3 K
Superheat	11.1 K	11.1 K

Subject to modification without prior notification
For full data details and capacity tables refer to Online Datasheet Generator : **www.danfoss.com/odsg**

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	cm^3/rev	m^3/h	dm^3	kg
R22 SINGLE	**SM084**	7	24 600	84 000	7.38	3.34	11.4	114.5	24.05	3.3	64
	SM090	7.5	26 400	90 000	7.82	3.37	11.5	120.5	25.31	3.3	65
	SM100	8	27 500	94 000	8.14	3.38	11.5	127.2	26.71	3.3	65
	SM110	9	31 600	107 800	9.35	3.38	11.5	144.2	30.28	3.3	73
	SM112	9.5	34 000	116 100	9.62	3.53	12.05	151.5	31.82	3.3	64
	SM115	9.5	33 700	115 200	10.08	3.35	11.4	155.0	32.55	3.8	78
	SM120	10	36 700	125 300	10.80	3.40	11.6	166.6	34.99	3.3	73
	SM124	10.5	37 700	128 800	10.59	3.56	12.2	169.5	35.60	3.3	64
	SM125	10	37 000	126 400	10.99	3.37	11.5	166.6	34.99	3.8	78
	SM147	12	43 600	148 600	12.18	3.58	12.2	193.5	40.64	3.3	67
	SM148	12	43 800	149 500	13.01	3.37	11.5	199.0	41.80	3.6	88
	SM160	13	47 700	163 000	14.22	3.36	11.5	216.6	45.49	4.0	90
	SM161	13	47 600	162 600	14.07	3.39	11.5	216.6	45.49	3.6	88
	SM175	14	51 100	174 300	15.27	3.34	11.4	233.0	48.93	6.2	100
	SM/SY185	15	54 300	185 400	16.22	3.35	11.4	249.9	52.48	6.2	100
	SY240	20	74 100	252 700	22.10	3.35	11.4	347.8	73.00	8.0	150
	SY300	25	94 500	322 500	27.50	3.43	11.7	437.5	91.90	8.0	157
R407C SINGLE	**SZ084**	7	22 500	76 900	7.06	3.19	10.9	114.5	24.05	3.3	64
	SZ090	7.5	24 400	83 300	7.63	3.20	10.9	120.5	25.31	3.3	65
	SZ100	8	26 500	90 500	8.18	3.24	11.0	127.2	26.71	3.3	65
	SZ110	9	30 100	102 800	9.29	3.24	11.1	144.2	30.28	3.3	73
	SZ115	9.5	32 800	112 000	10.22	3.21	10.9	155.0	32.55	3.8	78
	SZ120	10	34 800	118 900	10.75	3.24	11.1	166.6	34.99	3.3	73
	SZ125	10	34 900	119 200	10.89	3.21	10.9	166.6	34.99	3.8	78
	SZ148	12	42 600	145 400	13.35	3.19	10.9	199.0	41.80	3.6	88
	SZ160	13	45 500	155 400	14.08	3.23	11.0	216.6	45.49	4.0	90
	SZ161	13	46 000	156 900	14.32	3.21	10.9	216.6	45.49	3.6	88
	SZ175	14	48 700	166 200	15.28	3.19	10.9	233.0	48.93	6.2	100
	SZ185	15	51 800	176 800	16.43	3.15	10.7	249.9	52.48	6.2	100
	SZ240	20	71 100	242 800	22.70	3.14	10.7	347.8	73.00	8.0	150
	SZ300	25	87 900	300 000	27.49	3.20	10.9	437.5	91.90	8.0	157
	SZ380	30	107 400	366 400	33.50	3.20	11.0	531.2	111.60	8.4	158

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

Rating conditions

	SM/SY compressors	SZ compressors
Refrigerant	R22	R407C
Frequency	60 Hz	60 Hz
Standard rating conditions	ARI standard conditions	-
Evaporating temperature	7.2 °C	7.2 °C (dew point)
Condensing temperature	54.4 °C	54.4 °C (dew point)
Sub-cooling	8.3 K	8.3 K
Superheat	11.1 K	11.1 K

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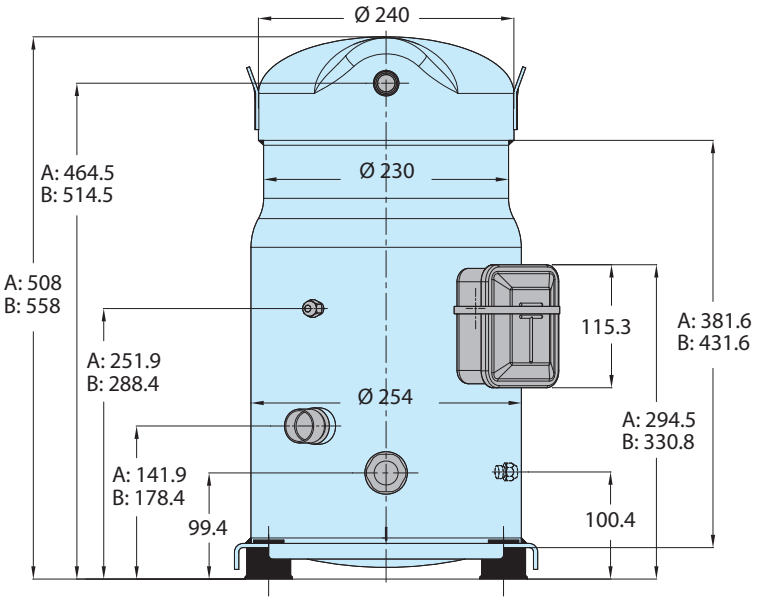
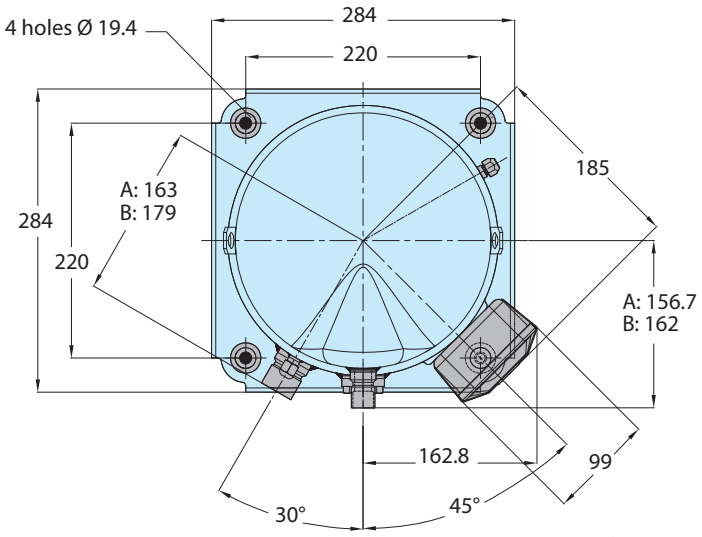
SM/SZ 084-090-100-110-120

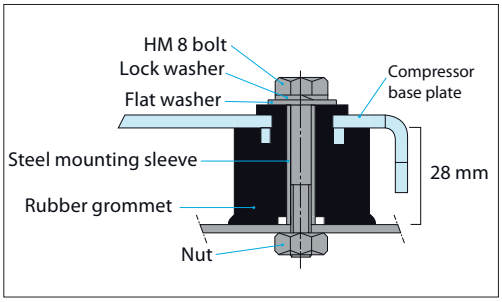




A: SM/SZ 084-090-100
B: SM/SZ 110-120

All dimensions in mm

Grommet



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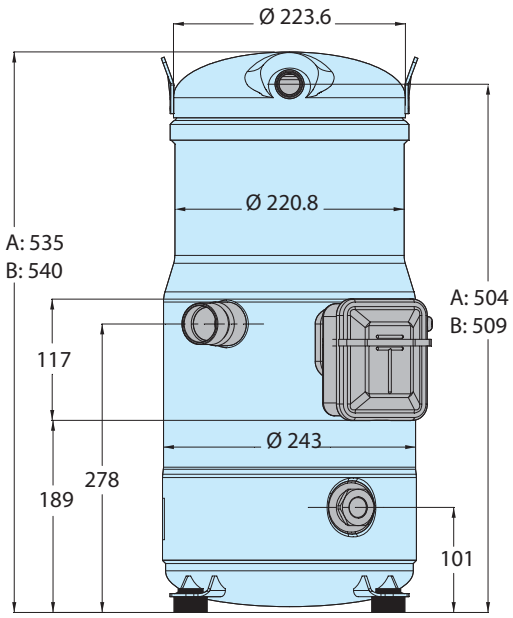
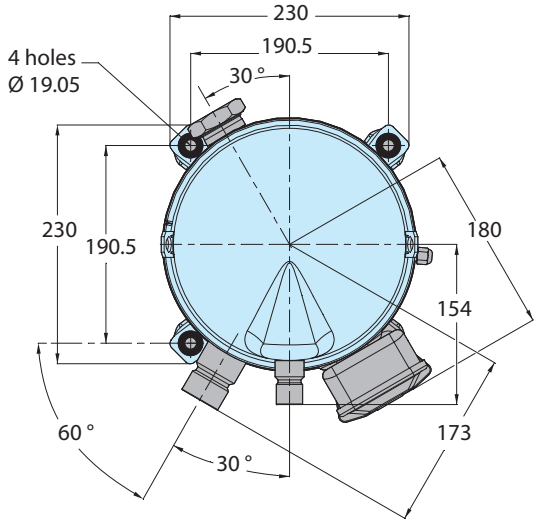
* except code 3





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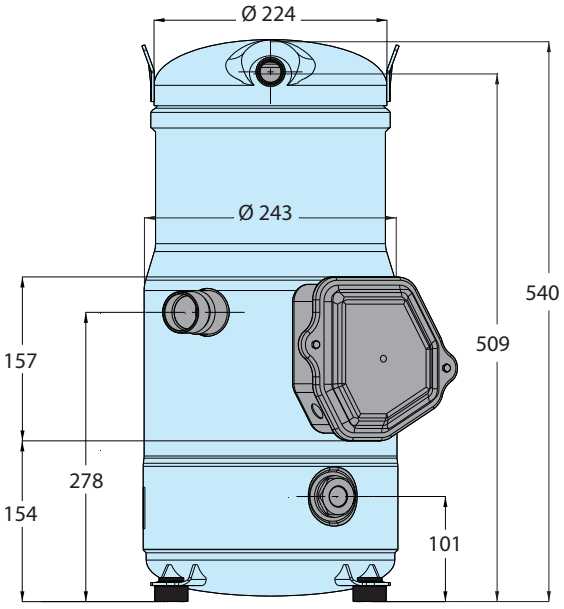
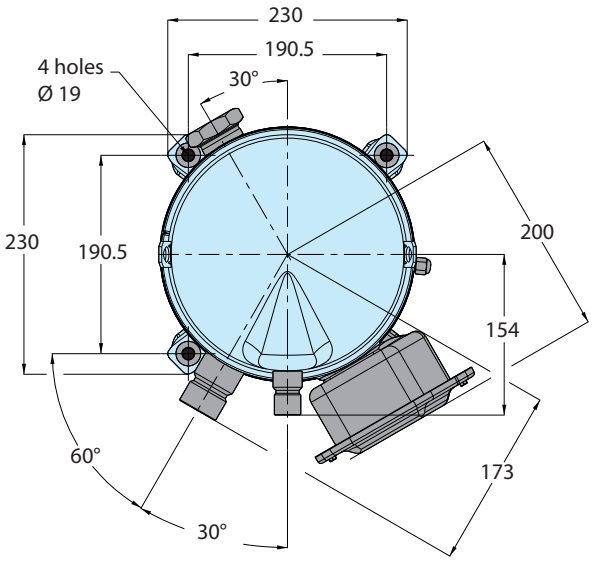
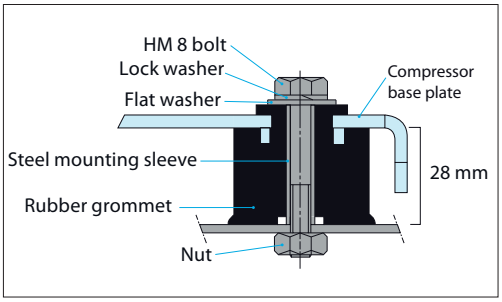
SM 147 code 3





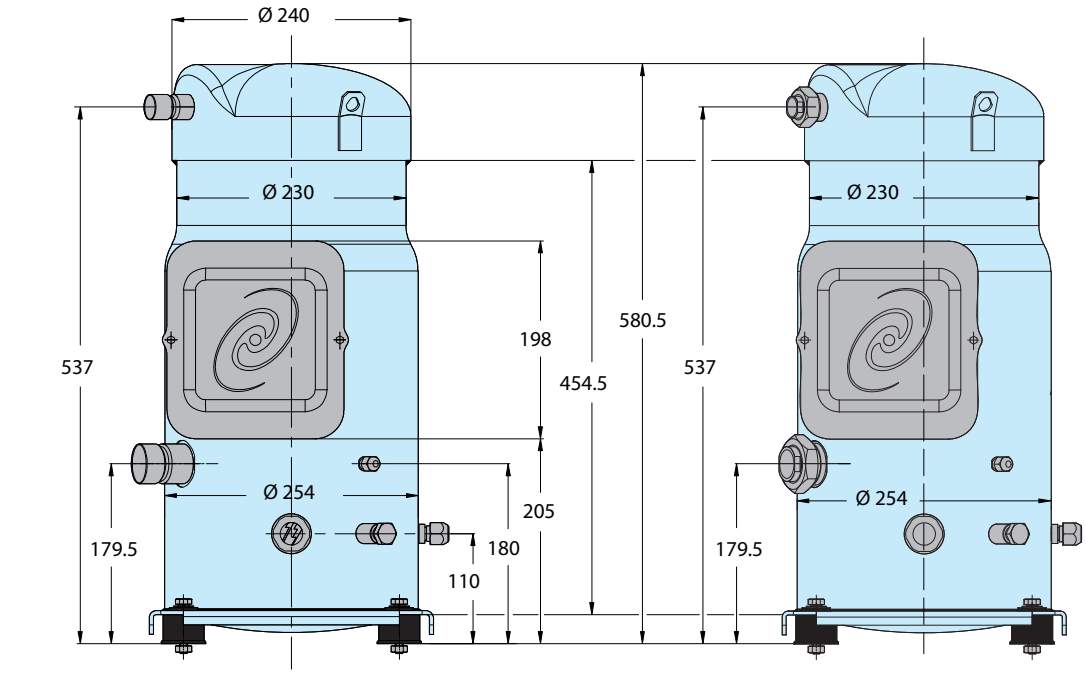
All dimensions in mm

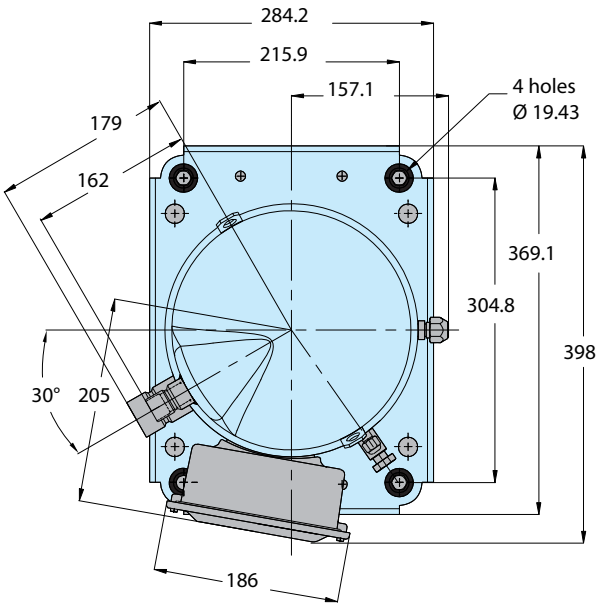
Grommet

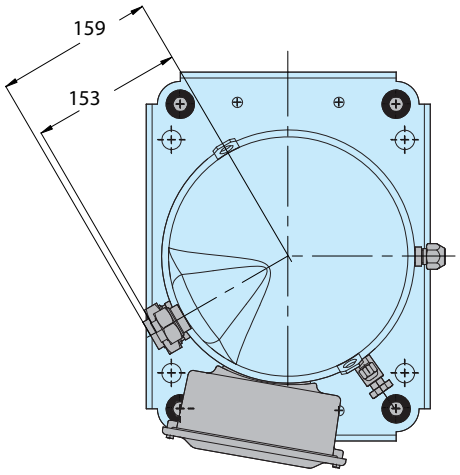


SM/SZ 115-125

Brazed version **Rotolock version**

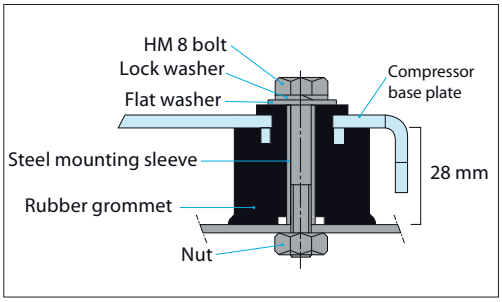






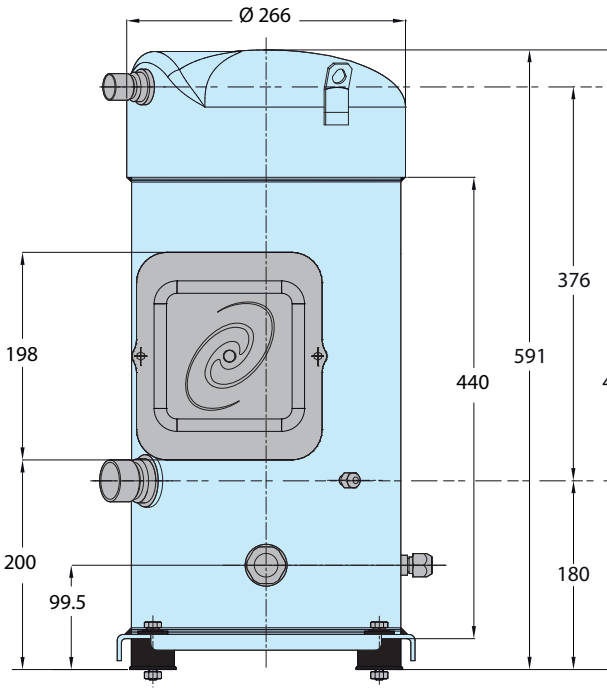
All dimensions in mm

Grommet



SM/SZ 148-161

SM 148-161 code 3



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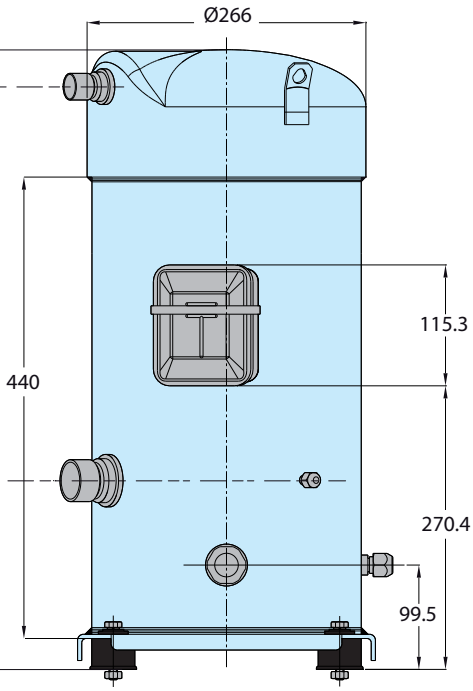
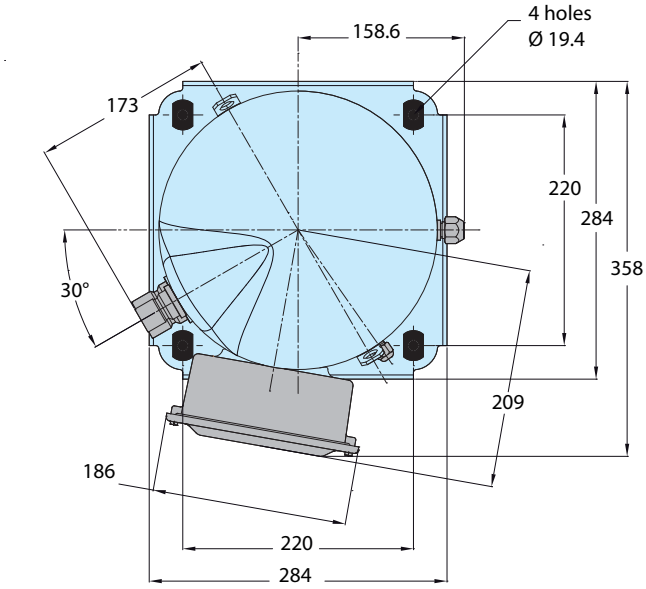
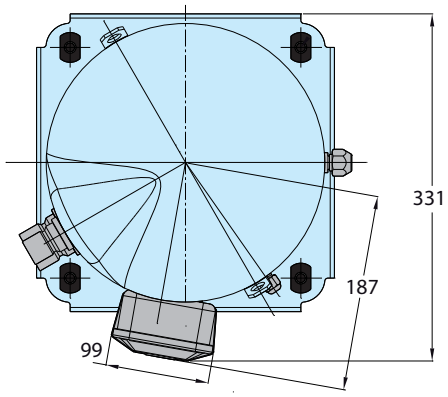
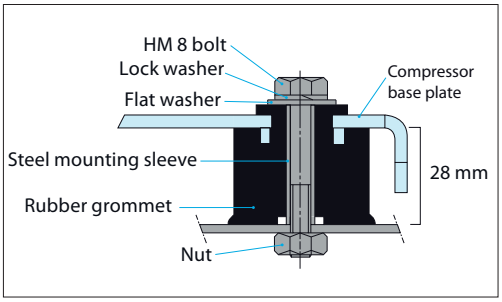






All dimensions in mm

Grommet



SM/SZ 160

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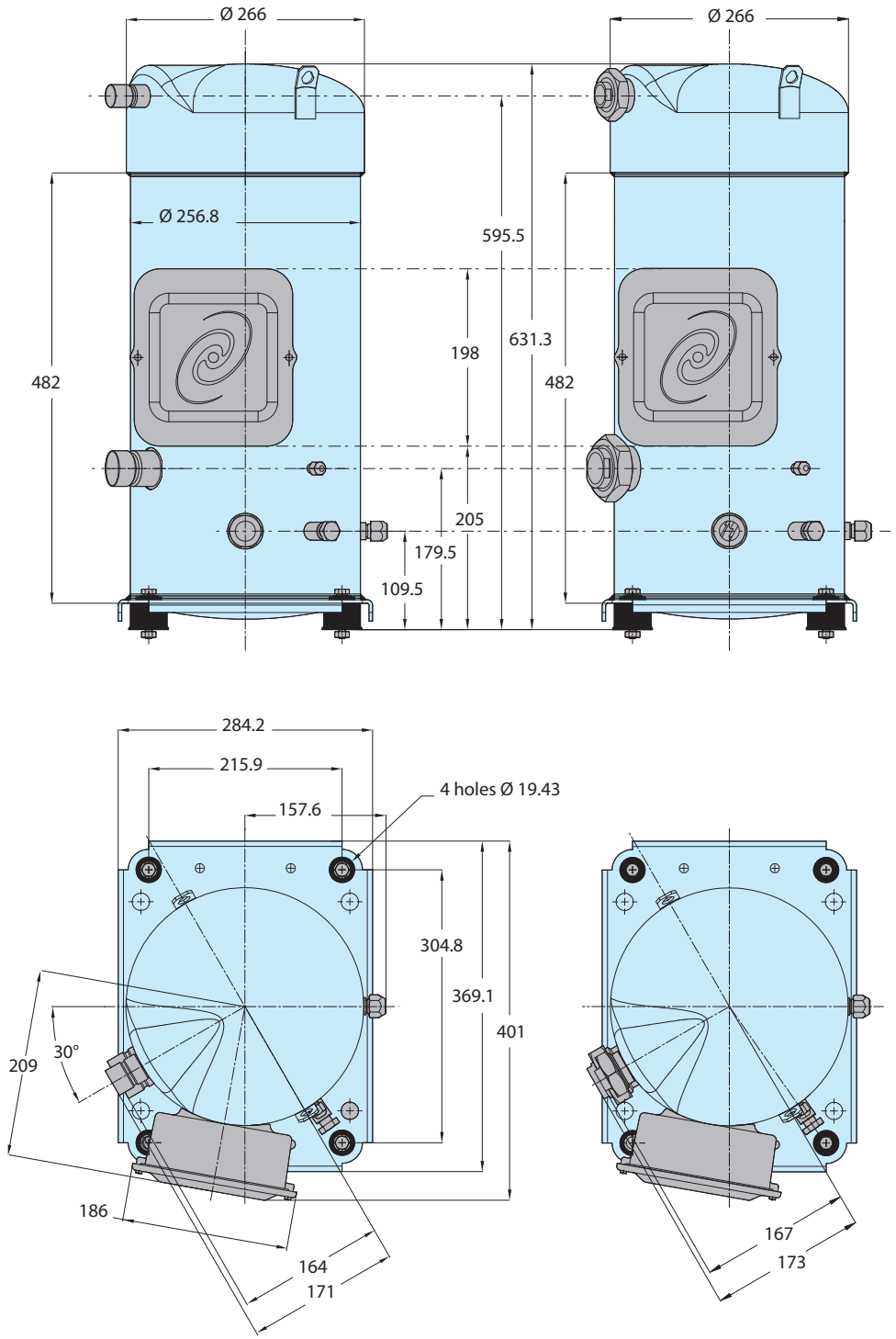
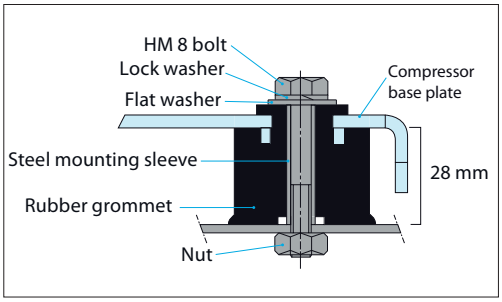


Rotolock version

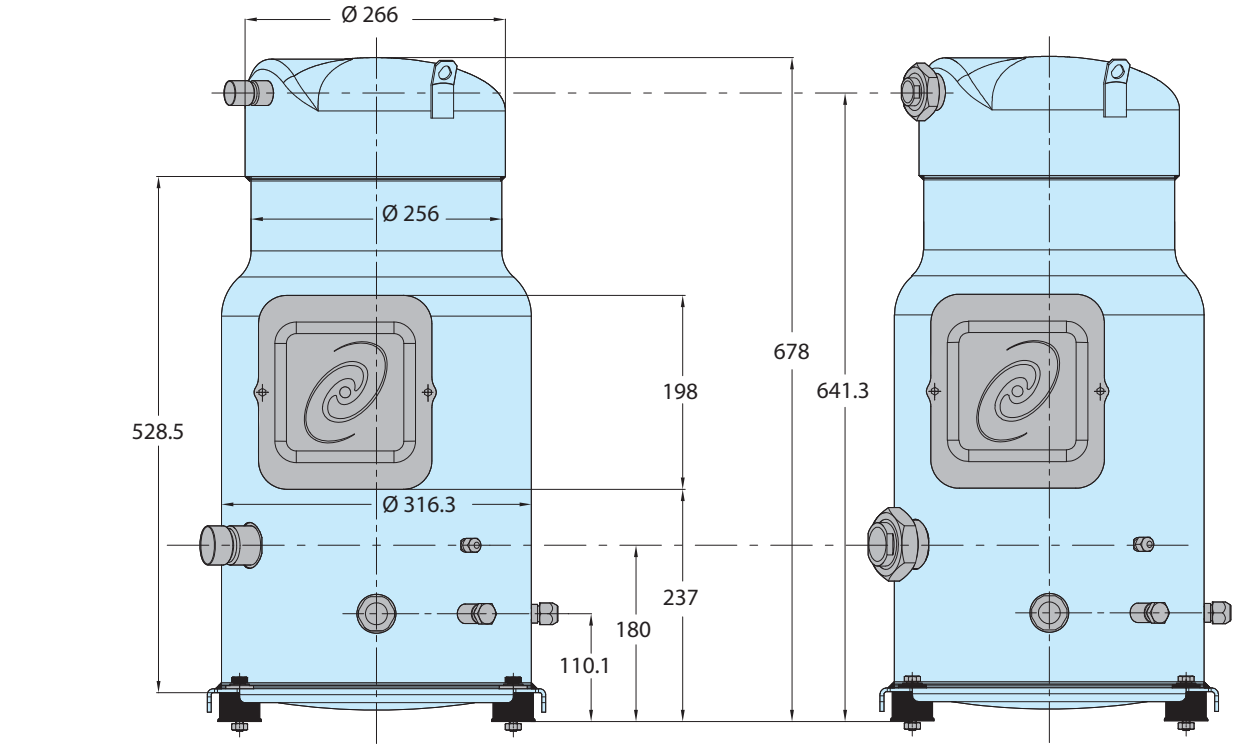
All dimensions in mm

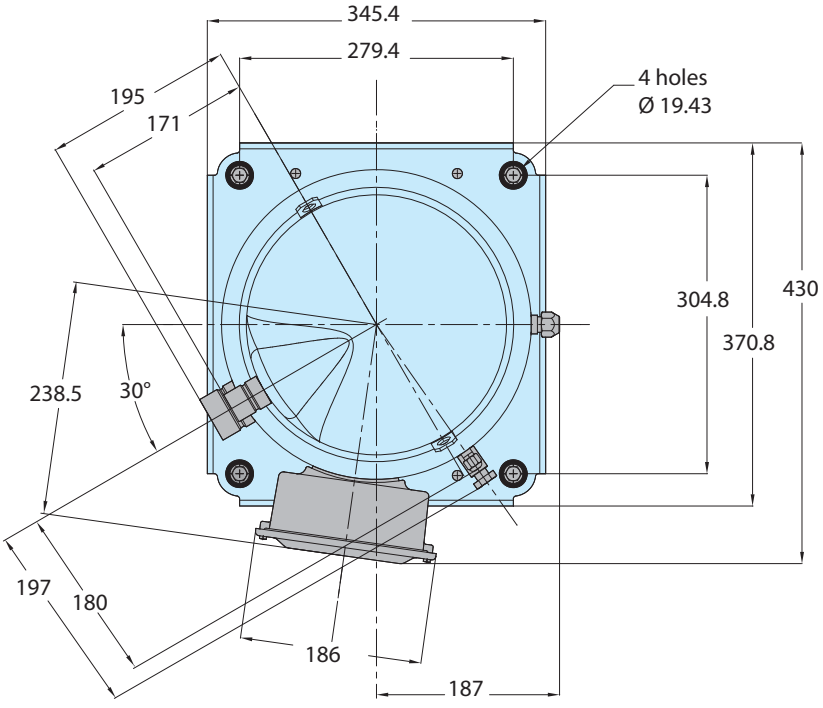
Grommet



SM/SZ 175-185 & SY185

Brazed version





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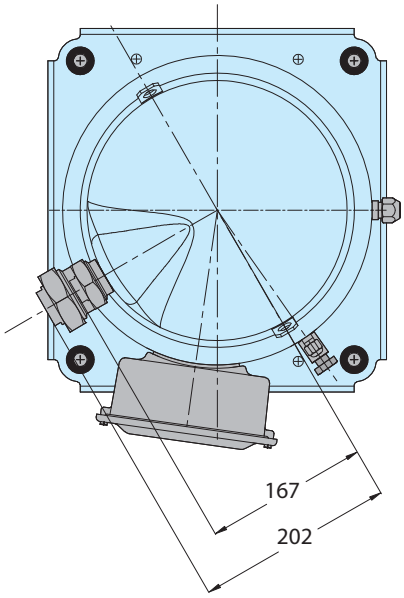
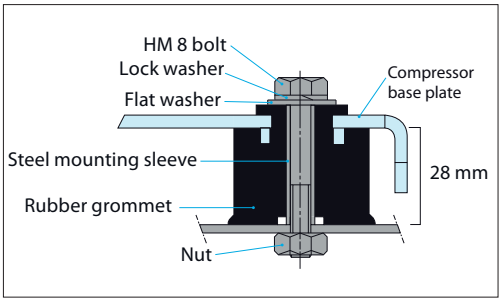
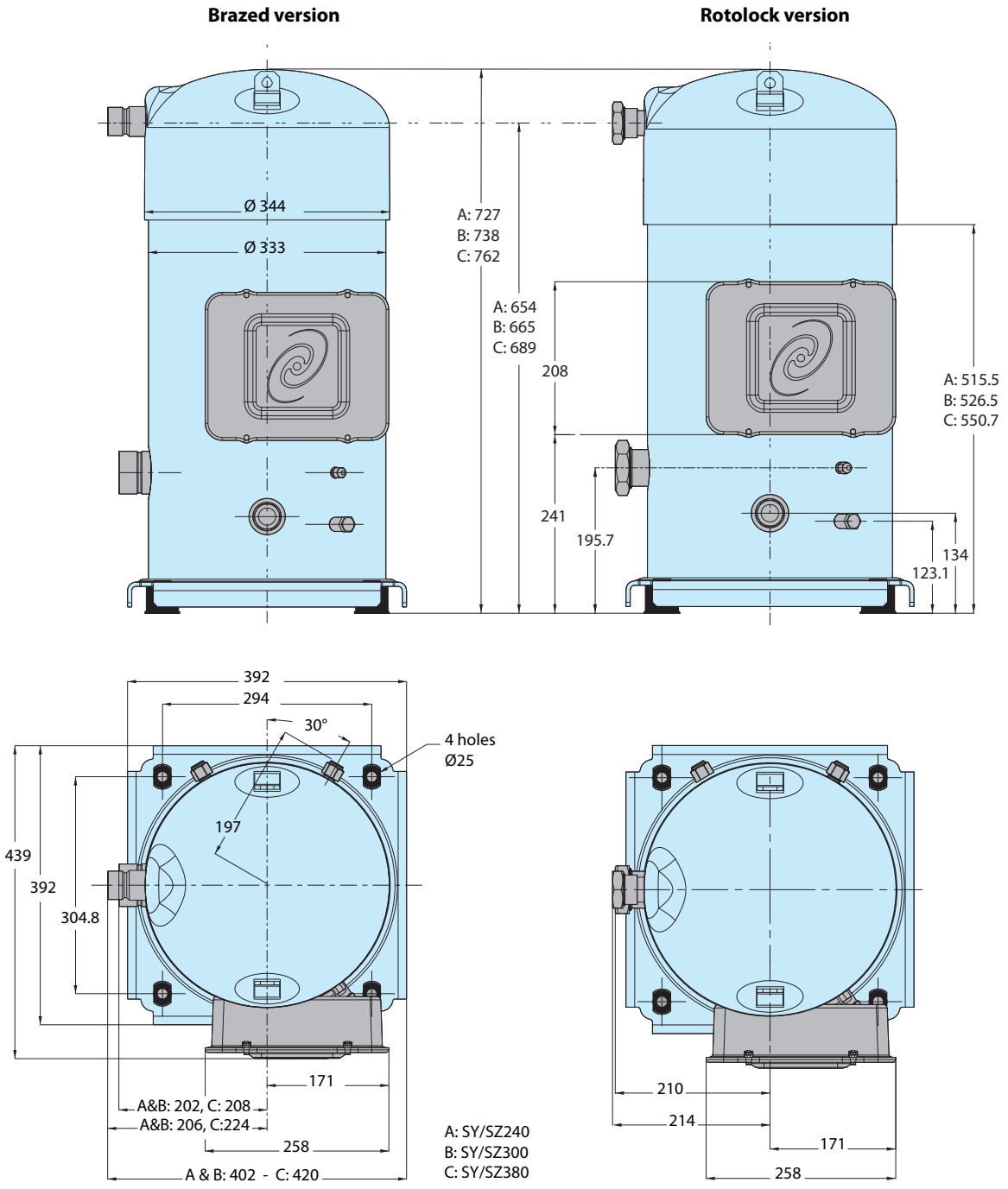


All dimensions in mm

Grommet

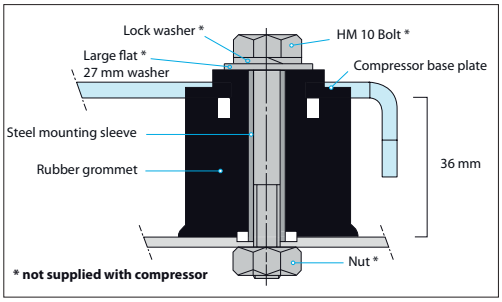


SY/SZ 240-300-380



All dimensions in mm

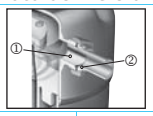
Grommet



Connection details

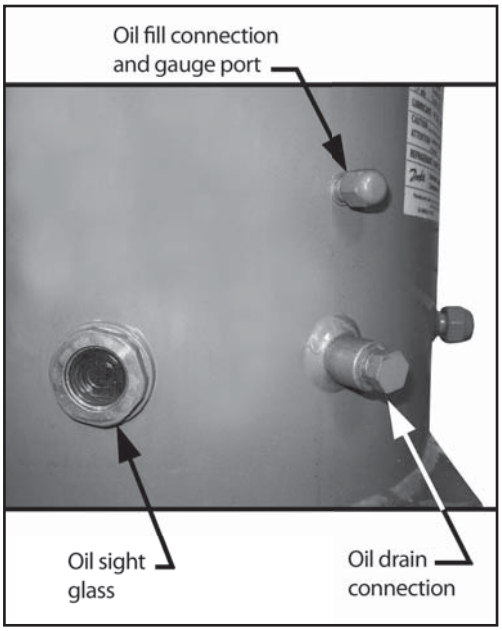
Model	SM/SZ084-090-100-110-120-148-161	SM/SZ 115 - 125 - 160 - 175 - SM/SZ/SY185		SM 112-124 - 147	SY/SZ 240 - 300		SY/SZ 380
Version	V	K-R-S-W-Y	C-J-P-U-X	AL	MA - MB	AA - AB	AA - AB
Suction and discharge connection	brazed	rotolock	brazed	brazed	rotolock	brazed	brazed
Oil sight glass	threaded	threaded	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" NPT	1/4" NPT	-	1/4" NPT	1/4" NPT	1/4" NPT
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 included②**
SM / SZ 084-090-100	Suction	1" 1/8	-	-
	Discharge	3/4"	-	-
SM / SZ 110-112	Suction	1" 3/8	-	-
	Discharge	7/8"	-	-
SM / SZ 115	Suction	1" 3/8	1" 3/4	1" 1/8
	Discharge	7/8"	1" 1/4	3/4"
SM / SZ 120-124	Suction	1" 3/8	-	-
	Discharge	7/8"	-	-
SM / SZ 125	Suction	1" 3/8	1" 3/4	1" 1/8
	Discharge	7/8"	1" 1/4	3/4"
SM 147-148-161	Suction	1"3/8	-	-
	Discharge	7/8"	-	-
SM / SZ 160-175-185	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 Performer® 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 Performer® 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" NPT 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.

Motor voltage

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

		Motor voltage code 3	Motor voltage code 4	Motor voltage code 6	Motor voltage code 7	Motor voltage code 9
Nominal voltage	50 Hz	-	380-400 V - 3 ph	230 V - 3 ph	500 V - 3 ph	-
Voltage range	50 Hz	-	340-440 V	207 - 253 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

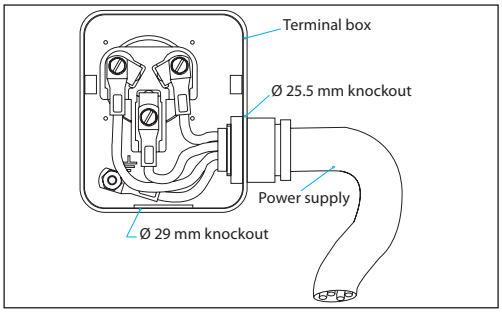
Wiring connections

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

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

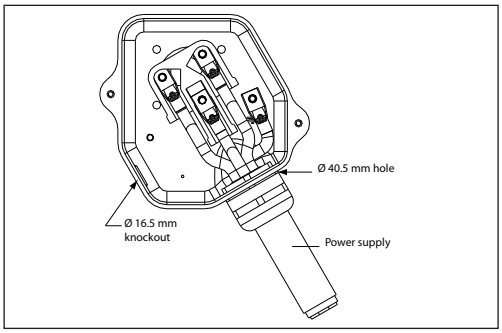
*Except for motor voltage code 3

The terminal box is provided with a Ø 25.5 mm and a Ø 29 mm knockouts.



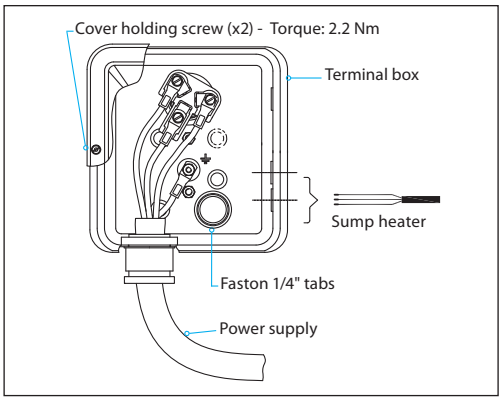
SM/SZ 147 code 3

The terminal box is provided with a Ø 40.5 mm hole for power supply and a Ø 16.5 mm knockout.



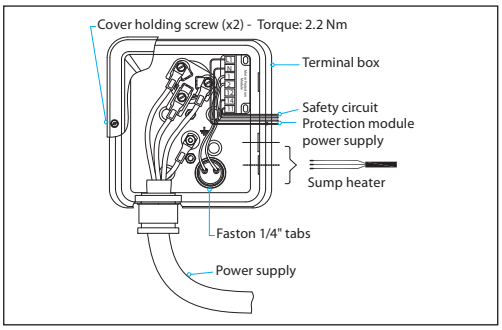
SM / SZ 115-125-148 & 161 code 3-160-175-185 & SY185 - R & C version

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:
Ø44 mm / Ø1"3/4 hole (for a 1"1/4 conduit) and
Ø34mm / Ø1"3/8 hole (for a 1" conduit),
Ø32.1 mm / Ø1.26" hole & Ø25.4 mm / Ø1" hole
The 3 other knockouts are as follows:
Ø20.5 mm / Ø0.81"
Ø22 mm / Ø7/8" (for a 1/2" conduit)
Ø16.5 mm / Ø0.65"

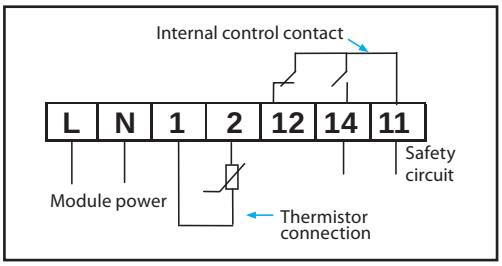


SM/SZ 115-125-160-175-185 - J, K, P, S, U, W, X, Y versions

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:
Ø44 mm / Ø1"3/4 hole (for a 1"1/4 conduit) and
Ø34mm / Ø1"3/8 hole (for a 1" conduit),
Ø32.1 mm / Ø1.26" hole & Ø25.4 mm / Ø1" hole
The 3 other knockouts are as follows:
Ø20.5 mm / Ø0.81"
Ø22 mm / Ø7/8" (for a 1/2" conduit)
Ø16.5 mm / Ø0.65"

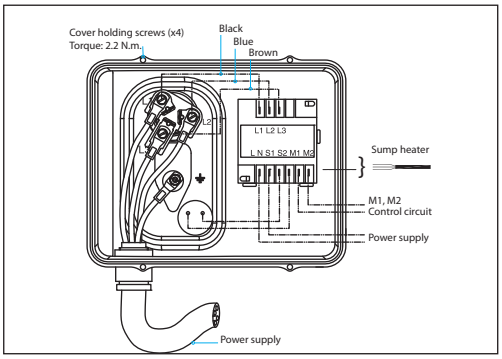


The motor protection module comes preinstalled within the terminal box and has pre-wired thermistor connections. The module must be connected to a power supply of the appropriate voltage. The module terminals are 6.3 mm size Faston type except for 24V DC module (screw connection).

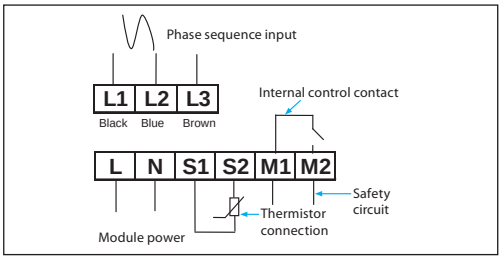


SM/SZ 240 – 300 – 380

The terminal box is provided with 4 double knockouts for the power supply and 4 knockouts for the safety control circuit. The 4 power supply knockouts accommodate the following diameters:
Ø 50 mm / 1" 31/32
Ø 25.2 mm / 0.99"
Ø 43.7 mm / 1"23/32 & 34.5 mm / 1"23/64
Ø 40.5 mm / 1.59" & 32.2 mm / 1.27"
The 4 others knockouts are as follows:
Ø 20.5 mm / 0.81" (2x)
Ø 22 mm / 7/8" & 16.5 mm / 0.65" (2x)



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 6.3 mm 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.

Terminal box temperature

The temperature inside the terminal box may not exceed 70°C. 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 70°C.

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/SZ115 *	265		52	50	0.26
	SM/SZ120	237	50		48	0.26
	SM/SZ124	267	51		45	0.27
	SM/SZ125 *	265		52	51	0.26
	SM/SZ147	304	57		52	0.24
	SM/SZ148	255	64		57	0.29
	SM/SZ160 *	298		61	61	0.21
	SM/SZ161	255	64		61	0.29
	SM/SZ175 *	380		75	70	0.19
	SM/SZ185 *	380		75	73	0.19
	SY/SZ240	460	109		100	0.14
	SY/SZ300	560	130		130	0.12
Motor voltage code 4 380-400V/3 ph/50 Hz	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/SZ115 *	120		25	22	1.16
	SM/SZ120	130	29		24	1.05
	SM/SZ124	142	25		23	1.05
	SM/SZ125 *	120		25	24	1.16
	SM/SZ147	147	27		26	0.92
	SM/SZ148	145	32		29	0.94
	SM/SZ160 *	150		29	29	0.94
	SM/SZ161	145	32		31	0.94
	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	320	79		69	0.46
Motor voltage code 6 230V/3 ph/50 Hz	SM/SZ084	150	29		27	0.58
	SM/SZ090	165	30		27	0.5
	SM/SZ100	165	30		30	0.5
	SM/SZ110	210	37		35	0.35
	SM/SZ115 *	205		45	38	0.39
	SM/SZ120	210	43		39	0.35
	SM/SZ125 *	205		45	41	0.39
	SM/SZ148	200	50		47	0.38
	SM/SZ160 *	225		48	48	0.31
	SM/SZ161	200	54		51	0.38
	SM/SZ175 *	270		68	57	0.25
	SM/SZ185 *	270		68	59	0.25
	SY/SZ240	350	84		78	0.21
	SY/SZ300	425	98		95	0.18
Motor voltage code 7 500V/3 ph/50 Hz 575V/3 ph/60 Hz	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/SZ115 *	80		19	18	1.79
	SM/SZ120	85	19		18	1.57
	SM/SZ125 *	80		19	19	1.79
	SM/SZ148	102	27		23	1.61
	SM/SZ160 *	120		25	24	1.45
	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
Motor voltage code 9 380V/3 ph/60 Hz	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/SZ115 *	155		32	28	0.74
	SM/SZ120	160	30		28	0.72
	SM/SZ124	177	32		27	0.72
	SM/SZ125 *	155		32	29	0.74
	SM/SZ147	181	35		31	0.62
	SM/SZ148	155	38		36	0.75
	SM/SZ160 *	170		36	36	0.64
	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.

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 (+15°C evaporating temperature and +68°C 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 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:

$$R_{amb} = R_{25°C} \frac{a + t_{amb}}{a + t_{25°C}}$$

$t_{25°C}$: reference temperature = 25°C
t_{amb}: temperature during measurement (°C)
$R_{25°C}$: winding resistance at 25°C
R_{amb}: winding resistance at t_{amb}
Coefficient a = 234.5

Danfoss MCI soft-start controller

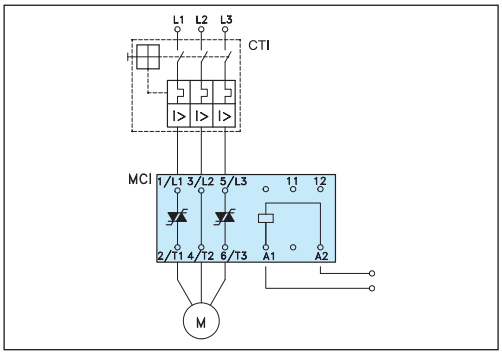
The inrush current for the Performer® scroll compressors with motor code 4 (400V / 3 / 50Hz or 460V / 3 / 60Hz) can be reduced using the Danfoss digitally-controlled MCI compressor soft starter. MCI soft starters are designed to reduce the starting current of 3-phase AC motors; MCI soft starters can 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. 40°C	Soft start reference ambient max. 55°C
SM / SZ 084	MCI 15C	MCI 15C
SM / SZ 090		
SM / SZ 100		MCI 25C
SM / SZ 110		
SM / SZ 115 -125	MCI 25C	MCI 25C*
SM / SZ 120		
SM 112-124 - 147		
SM / SZ 160 - 161 - 148		
SM / SZ 175 - 185		
SY / SZ 240 - 300 - 380	MCI 50CM *	

* By-pass contactor (K1) required.

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.

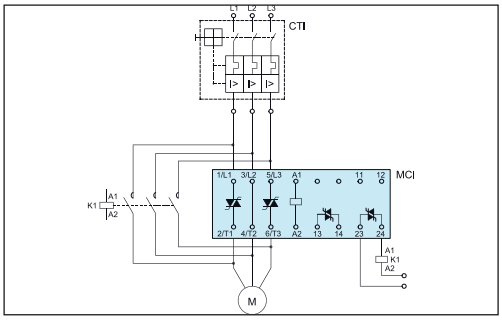


MCI with bypass contactor

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).

13-14 contact not applicable with MCI 25C



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.

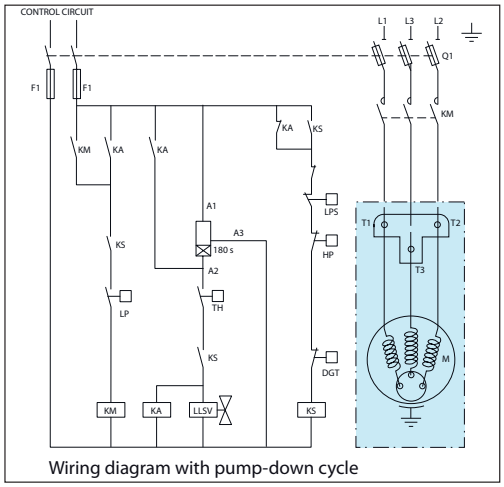
In specific situations, such as winter start operation, an eventual LP control for pump-down cycles may be temporarily bypassed to allow the system to build pressure. But it remains mandatory for compressor protection to apply an LP safety switch.

The LP safety switch must never be bypassed.

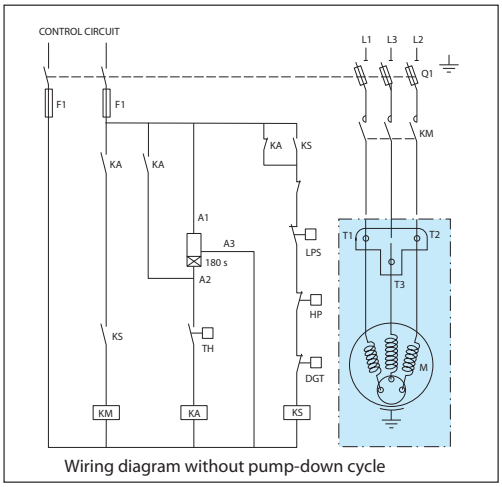
Pressure settings for the LP and HP safety switch and pump-down are on page 33.

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

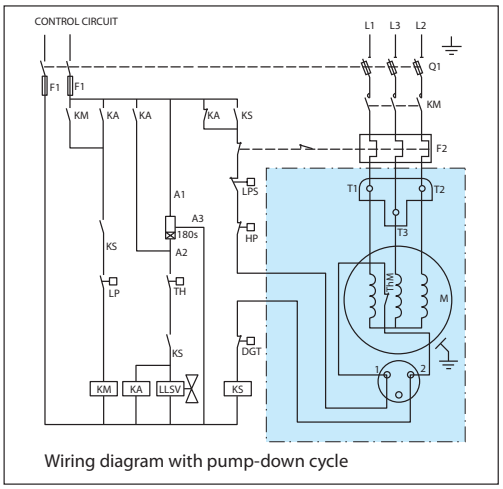


Wiring diagram with pump-down cycle

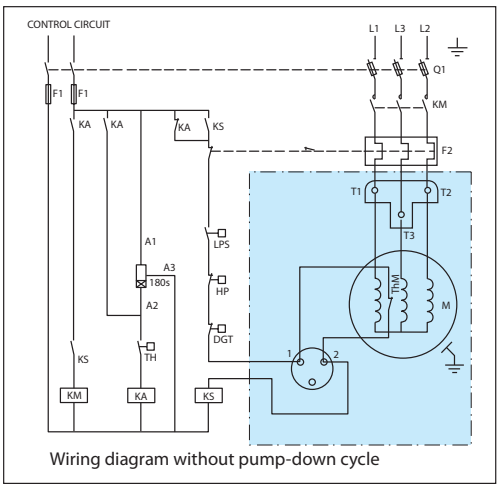


Wiring diagram without pump-down cycle

Compressor models SM / SZ 115 – 125 – 160 – 175 – 185 R and C version

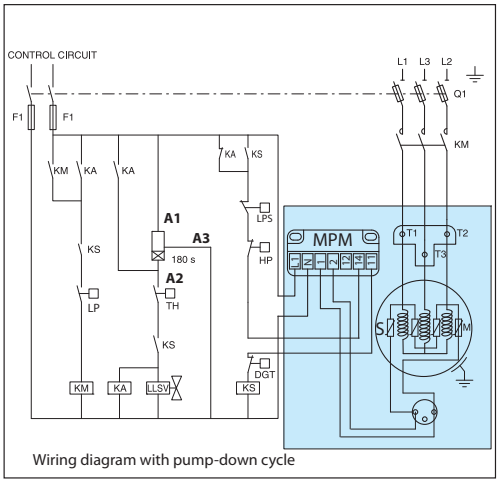


Wiring diagram with pump-down cycle

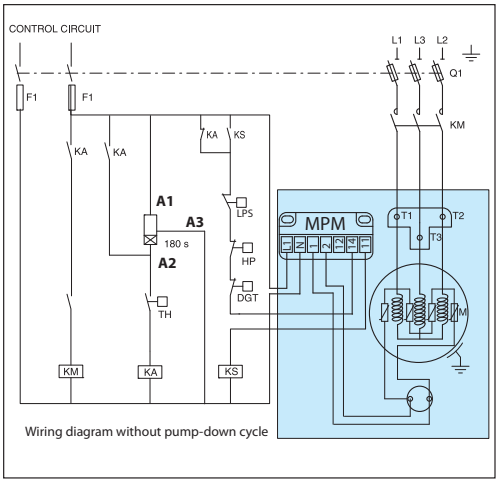


Wiring diagram without pump-down cycle

Compressor models SM/SZ 115-125-160-175-185 (J, K, P, S, U, W, X, Y versions)

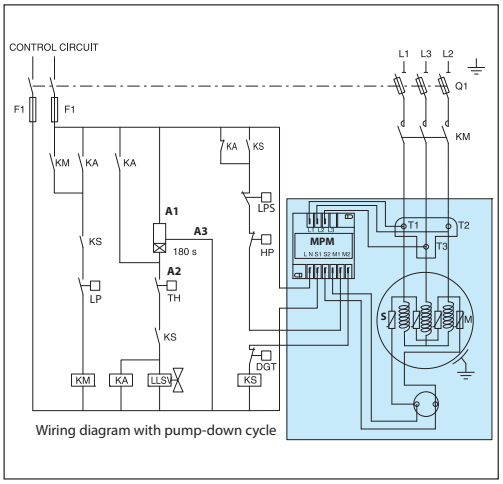


Wiring diagram with pump-down cycle

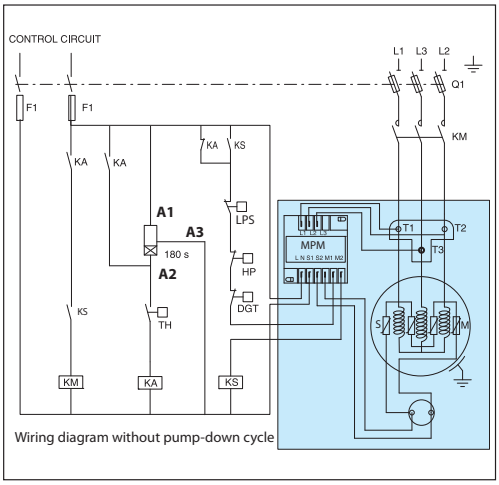


Wiring diagram without pump-down cycle

Compressor models SY / SZ 240 - 300 - 380



Wiring diagram with pump-down cycle



Wiring diagram without pump-down cycle

Legends

Fuses	*F1*	*Liquid Line Solenoid valve*	*LLSV*
Compressor contactor	*KM*	*Discharge gas thermostat*	*DGT*
Control relay	*KA*	*Fused disconnect*	*Q1*
Safety lock out relay	*KS*	*Motor safety thermostat*	*thM*
Optional short cycle timer (3 min)	*180 s*	*Compressor motor*	*M*
External overload protection	*F2*	*Motor Protection Module*	*MPM*
Pump-down pressure switch	*LP*	*Thermistor chain*	*S*
High pressure safety switch	*HP*	*Safety pressure switch*	*LPS*
Control device	*TH*		

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	✓ Internal thermostat	REQ External overload protection		✓ Reverse vent.
SM 112- 124-147		✓ Internal motor protection		REC Phase sequence detector
SM/SZ 084-090-100-110-120-148-161		✓ Internal motor protection		✓ Reverse vent.
SM/SZ 115-125-160-175-185 J-K-P-S-U-W-X-Y version		✓ Electronic module located in terminal box		✓ Reverse vent.
SY/SZ 240-300-380		✓ Electronic module located in terminal box		

REC Recommended REQ Required ✓ 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/SZ115 - 125 - 160 - 175 - 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.

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.

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.

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.

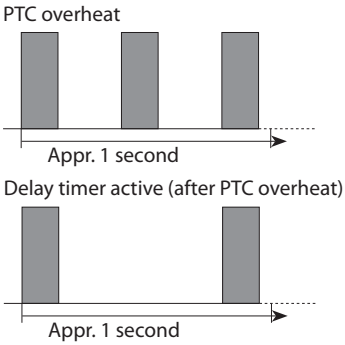
Compressor models SY/SZ 240 - 300 - 380 and SM/SZ115-125-160-175-185 J, K, P, S, U, W, X, Y versions are delivered with a pre-installed motor protection module inside the terminal box. This device provides for efficient and reliable protection against overheating and overloading (as well as phase loss/reversal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

If any thermistor exceeds its response temperature, its resistance increases above the trip level (4,500 Ω) and the output relay then trips -ie. contacts M1-M2 (or 11-14 for SM/SZ 115-125-160-175-185) are open. After cooling to below the response temperature (resistance < 2,750 Ω), 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/SZ 115-125-160-175-185) are closed. The time delay may be cancelled by means of resetting the mains (L-N disconnect) for approximately 5 sec. If present, the led on the module will show the following blink code:



Phase sequence and reverse rotation protection

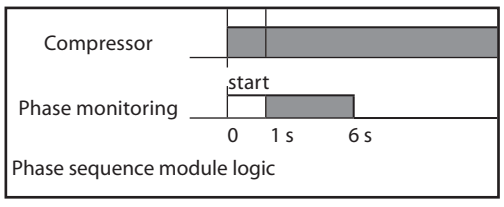
Use a phase meter to establish the phase orders and connect line phases L1, L2 and L3 to terminals T1, T2 and T3, respectively. The compressor will only operate properly in a single direction, and the motor is wound so that if the connections are correct, the rotation will also be correct.

Compressor model SM 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.

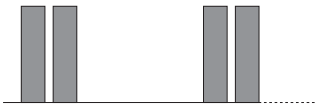
Compressor models SM / SZ 084 to 185 (except SM124 & 147) incorporate an internal reverse vent valve which will react in the presence of reverse rotation and will allow refrigerant to circulate through a by-pass from the suction to the discharge. Although reverse rotation is not destructive, even over 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). If present, the led on the module will show the following blink code:

In case of phase reverse error:



In case of phase loss error:

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:

$$\text{\% voltage unbalance} = \frac{|\,Vavg - V1\text{-}2\,| + |\,Vavg - V1\text{-}3\,| + |\,Vavg - V2\text{-}3\,|}{2 \times Vavg} \times 100$$

Vavg = Mean voltage of phases 1, 2, 3.
V1-2 = Voltage between phases 1 & 2.
V1-3 = Voltage between phases 1 & 3.
V2-3 = Voltage between phases 2 & 3.

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)	All SM / SY / SZ models
UL (Underwriters Laboratories)	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	-35°C < Ts < 63°C	-35°C < Ts < 53°C	-35°C < Ts < 53°C
Service pressure - Ps	25 bar(g)	25 bar(g)	20 bar(g)
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 (litre)
SM/SZ084 - 090 - 100	14.1
SM/SZ 110 - 120	14.7
SM 112 - 124 - 147	14.3
SM/SZ 115 - 125	15.0
SM/SZ 148-161	19.6
SM/SZ 160	20.0
SM/SZ 175 - 185 and SY185	33.0
SY/SZ 240 - 300	37.8
SY/SZ 380	39.2

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 7.4°C 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 exchang-

ers. 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.

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 -35°C to +63°C (for SM/SZ084 to 185) and +53°C (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 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 at dew temperatures

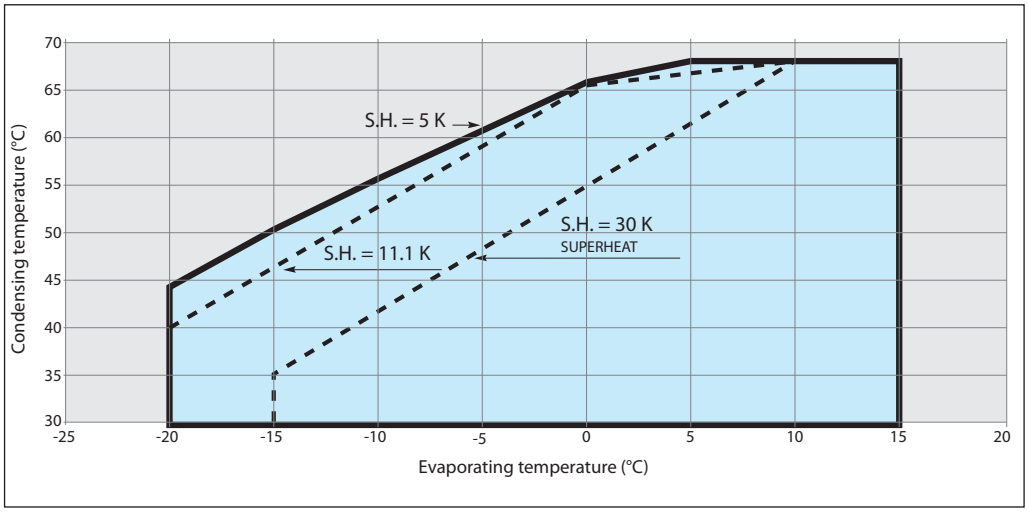
The operating envelopes for SM / SY / SZ scroll compressors are given in the figures below, where the condensing and evaporating temperatures represent the range for steady-state operation. Under transient conditions, such as start-up and defrost, the compressor may operate outside this envelope for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

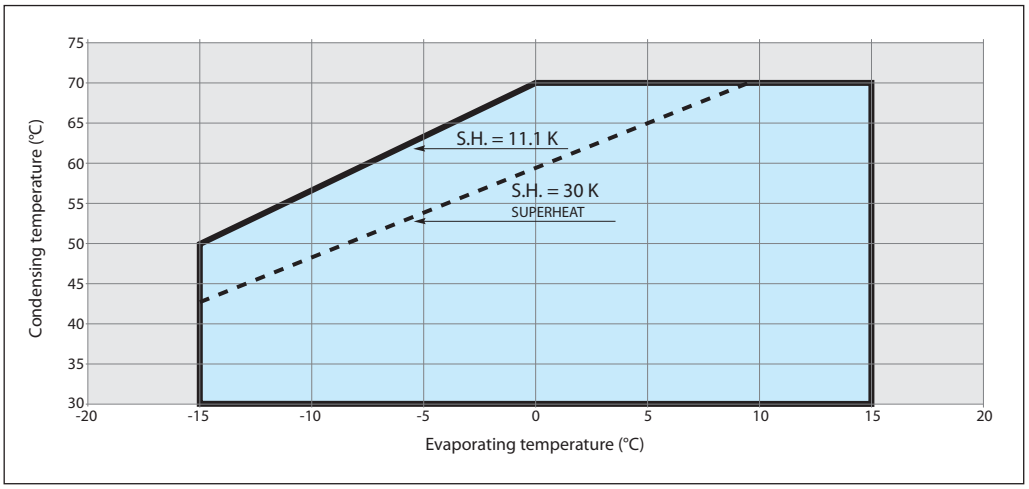
The operating limits serve to define the envelope within which reliable operations of the compressor are guaranteed:

- Maximum discharge gas temperature: +135°C
- A suction superheat below 5 K (10 K for R407C) is not recommended due to the risk of liquid flood back
- Maximum superheat of 30K
- Minimum and maximum evaporating and condensing temperatures as per the operating envelopes.

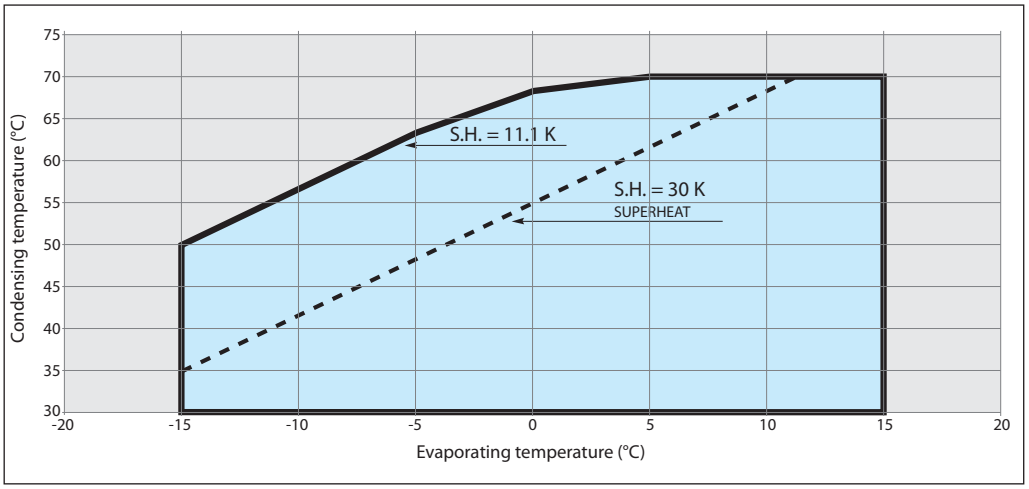
SM084 to 185
SY185 to 380
R22



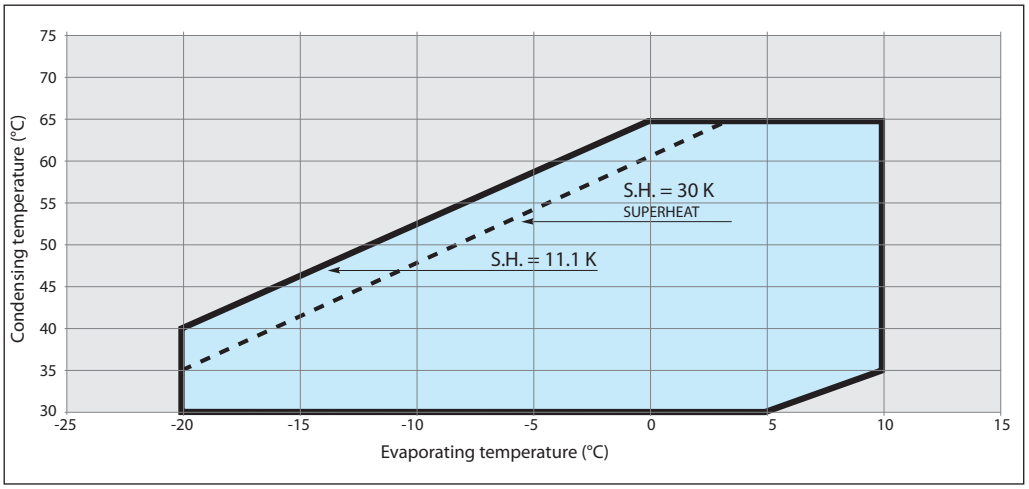
SZ084 to 185
R134a



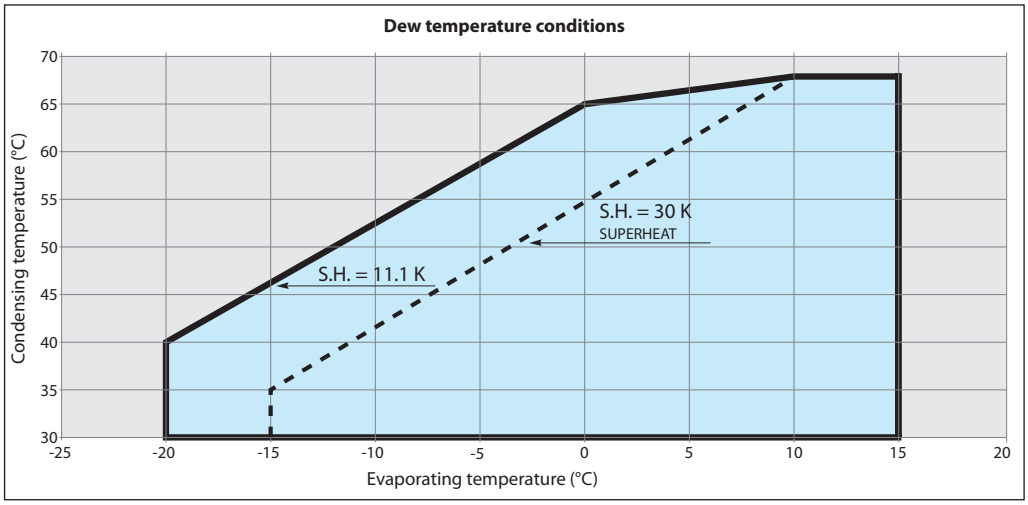
SZ240 - 380
R134a



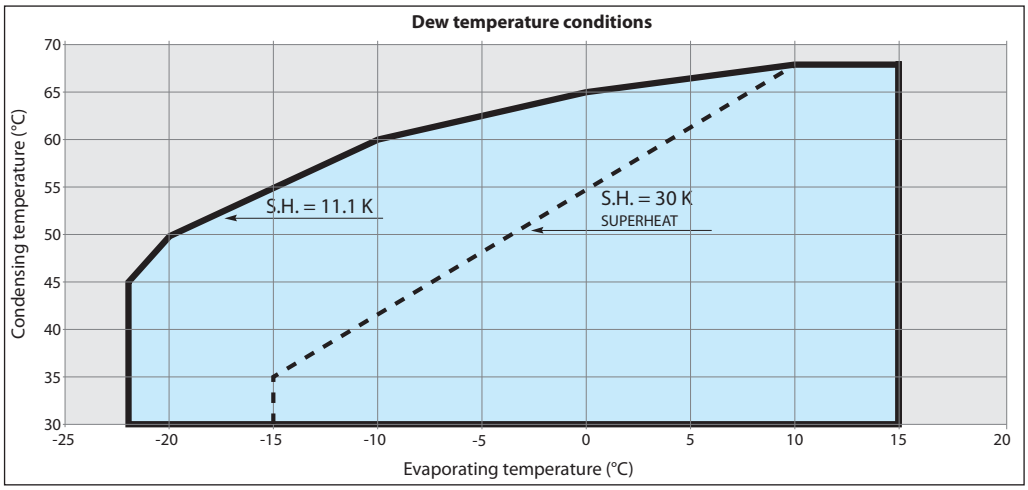
SZ084 to 185
R404A / R507A



SZ084 to 185 & SY185 R407C at DEW temperature (refer to the explanation p. 28)



SZ240 to 380 & SY240-300 R407C at DEW temperature (refer to the explanation p. 28)

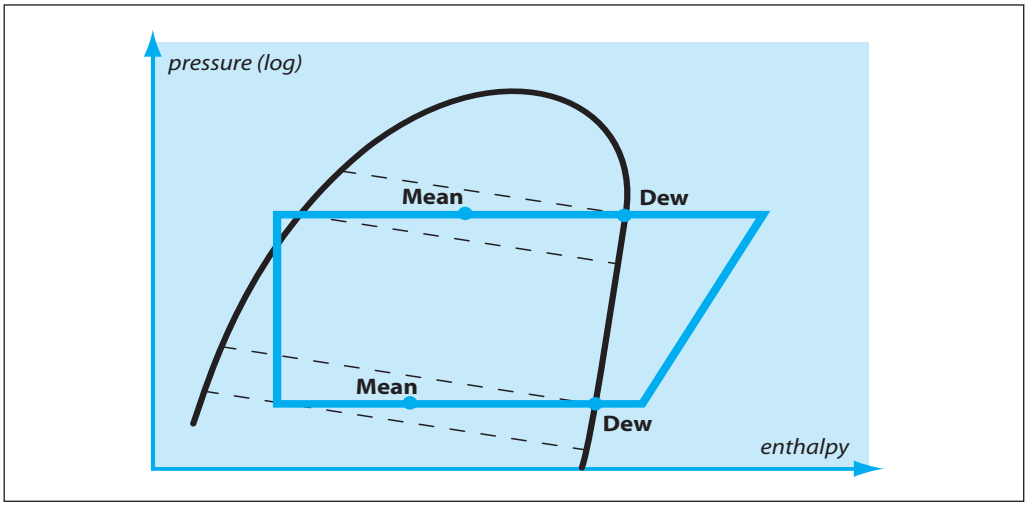


Application envelopes at mean temperatures

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 2° to 3°C 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.

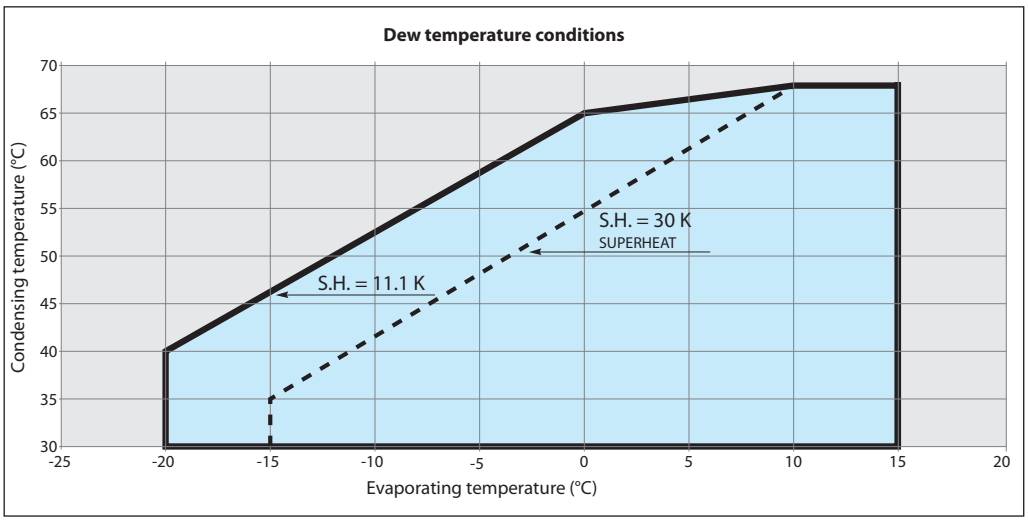
Dew temperature and mean temperature for R407C



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

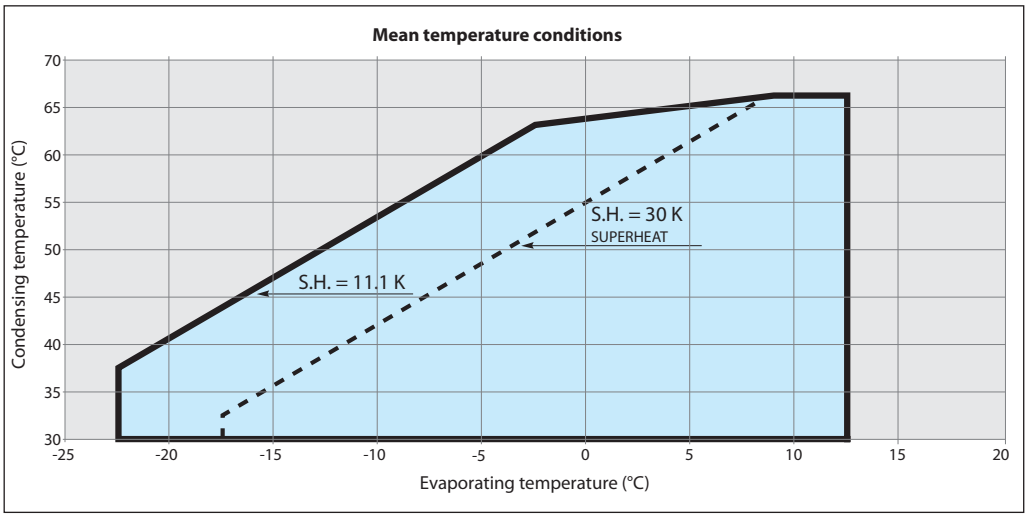
Dew temperature

Example for SZ 084 to 185



Mean temperature

Example for SZ 084 to 185



Discharge temperature protection

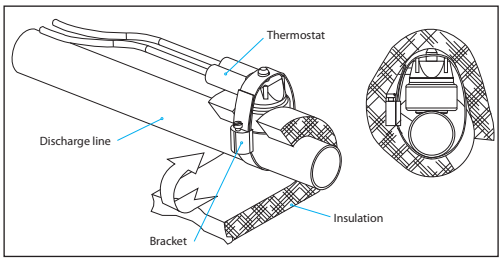
The discharge gas temperature must not exceed 135°C. The discharge gas thermostat accessory kit (code 7750009) includes all components required for installation, as shown below. The thermostat must be attached to the discharge line within 150 mm from the compressor discharge port and must be thermally insulated and highly fixed on the pipe.

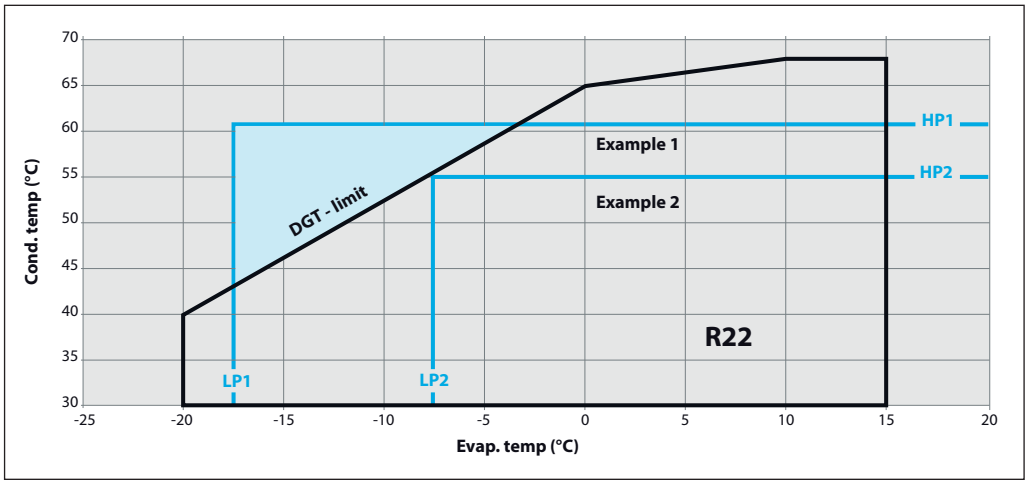
DGT protection is required if the high and low pressure switch settings do not protect the compressor against operations beyond its specific application envelope. Please refer to the examples on following page, which illustrates where DGT protection is required (ex.1) and where it is not (ex.2).

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 135°C.

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 = 11 K)
LP switch setting:
LP1 = 1.8 bar (g) (-17°C)
HP switch setting:
HP1 = 25 bar (g) (62°C)
Risk of operation beyond the application envelope.
DGT protection required.

Example 2 (R22, SH = 11 K)
LP switch setting:
LP2 = 2.9 bar (g) (-7°C)
HP switch setting:
HP2 = 21 bar (g) (55°C)
No risk of operation beyond the application envelope.
No DGT protection required.

High and low pressure protection

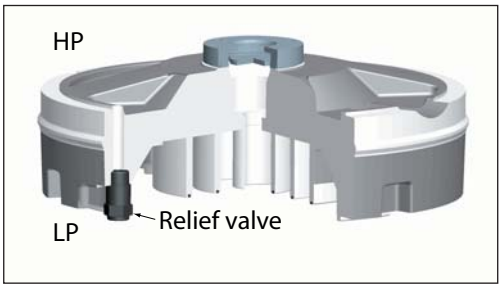
High pressure

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.

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 31 to 38 bar.

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. Performer® 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 bar (g)	R407C bar (g)	R134a bar (g)	R404A/R507A bar (g)
Working pressure range high side	10.9 - 27.7	10.5 - 29.1	6.7 - 20.2	12.7 - 32
Working pressure range low side	1.4 - 6.9	1.1 - 6.4	0.6 - 3.9	2 - 7.3
Maximum high pressure safety switch setting	28	29.5	20.5	32.5
Minimum low pressure safety switch setting *	0.5	0.5	0.5	0.5
Minimum low pressure pump-down switch setting **	1.3	1.0	0.5	1.8

*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 1.3 bar 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 0.5 bar for R22.

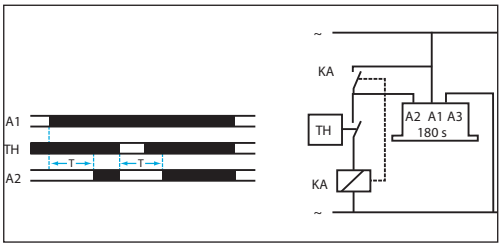
Cycle rate limit

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.



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

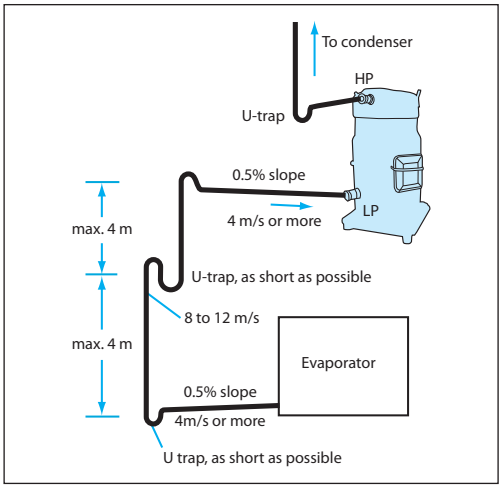
Proper piping practices should be employed to ensure adequate oil return, even under minimum load conditions with special consideration given to the size and slope of the tubing coming from the evaporator. Tubing returns from the evaporator should be designed so as not to trap oil and to prevent oil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

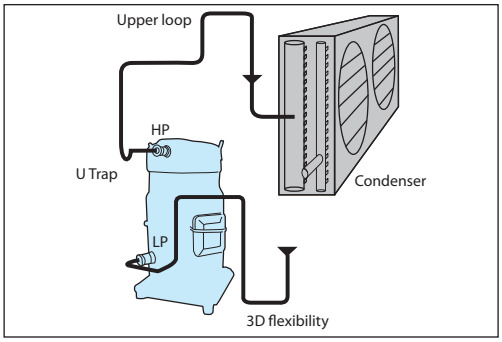
If the evaporator lies above the compressor, as is often the case in split or remote condenser systems, the addition of a pump-down cycle is strongly recommended. If a pump-down cycle were to be omitted, the suction line must have a loop at the evaporator outlet to prevent refrigerant from draining into 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 optimised 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 a high degree of liquid sub cooling. Without adequate sub cooling, flash gas will be formed at the expansion device resulting in a high degree of vapour at the evaporator inlet leading to low efficiency.

Refrigerant charge limit

Performer® 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 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.

Compressor models	Refrigerant charge limit (kg)
S 084-090-100	8.5
S 110-120	10
S 115-125	11
S 112-124-147	7.9
S 148-160-161	12.5
S 175-185	13.5
S 240	16
S 300-380	20

	BELOW charge limit	ABOVE charge limit
Cooling only systems, Packaged units	✓ 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 pages 38 - 39

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.

Performer® 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 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:

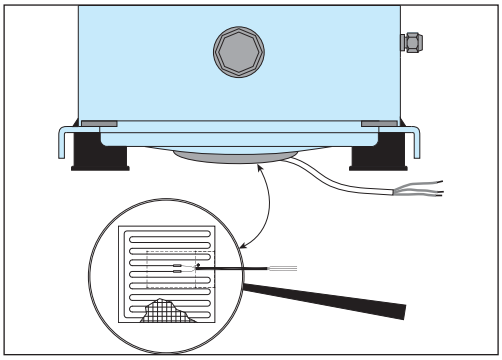
- **Sump heater**
- **Liquid line solenoid valve**
- **Pump down cycle**

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 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 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 –5°C ambient temperature and a wind speed of above 5 m/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 has 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 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.

Performer 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 30K 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.

Low ambient application

Low ambient start-up

Under cold ambient conditions (<0°C), 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 Performer® SM / SY / SZ scroll compressor requires a minimum pressure differential of 6 to 7 bar 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 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.

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 vapour 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.

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.

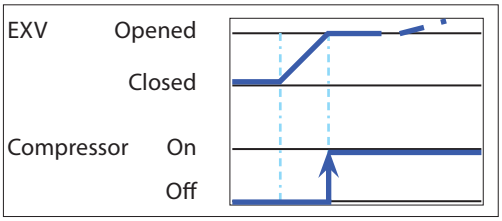
When using a brazed plate heat exchanger as the condensing coil, a sufficient free volume for the discharge gas to accumulate is required in order to avoid excess pressure buildup. At least 1 meter of discharge line is necessary to generate this volume. To help reduce the gas volume immediately after 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.

Electronic expansion valve

The use of an electronic expansion valve requires a specific compressor start / stop control.

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.

The EXV should be closed at compressor stop not to let refrigerant in liquid phase entering the 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.



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 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.

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.

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 135°C.

Discharge line and reversing valve

The Performer® 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.

Defrost and reverse cycle

Performer® SM / SY / SZ scroll compressor has the ability to withstand a certain amount of liquid refrigerant dynamic slug. However we advise that the system is unloaded to the minimum capacity step for defrost or when the cycle is reversed.

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 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. 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	Inferior hood 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 115	76	8	77	8	79	8	81	8	7755009	120Z0357
S 120	75	8	77	8	78	8	81	8	7755010	120Z0356
S 124	73	6	-	-	77	6	-	-	120Z0035	-
S 125	76	8	78	8	79	8	81	8	7755009	120Z0357
S 147 ①	74	6	-	-	78	6	-	-	120Z0035	-
S 148 ②	79	8	79	8	83	8	83	8	7755017	120Z0356
S 160	79.5	8	80.5	8	84	8	83	8	7755008	120Z0357
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	85	7	86.5	7	-	-	89.5	7	7755022	120Z0355

① For SM147-3 - 50 Hz, use acoustic hood reference 120Z135
② For SM148 - 161 code 3, no acoustic hood available
Sound power and attenuation are given at rated ARI conditions, measured in free space.
* Inferior hoods are provided in surface sump heater accessories.
Materials are UL approved and RoHS compliant.

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.

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 Performer® 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 Performer®'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. Performer® 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 Performer® 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 Performer® SM / SY / SZ scroll compressor has been designed and tested to ensure that gas pulsation has been optimised 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.

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

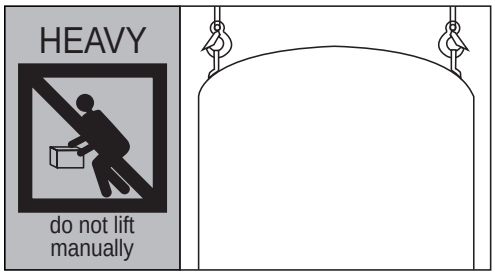
Each Performer® SM / SY / SZ scroll compressor is equipped with two lift rings on the top shell. Always use both these rings when lifting the compressor. Use lifting equipment rated and certified for the weight of the compressor. A spreader bar rated for the weight of the compressor is highly recommended 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 between -35°C and 50°C, not exposed to rain, corrosive or flammable atmosphere.

⚠ 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.

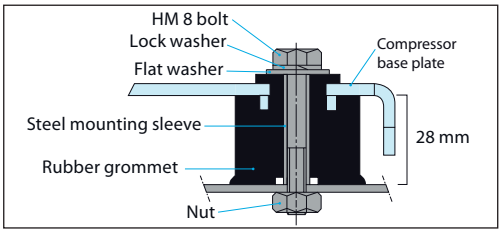
Never apply force to the terminal box with the intention of moving the compressor, as the force placed upon the terminal box can cause extensive damage to both the box and the components contained inside.



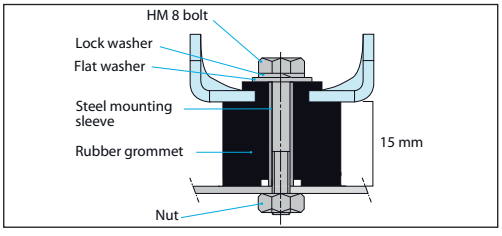
Compressor mounting

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.

Mounting of SM/SZ 084-090-100-110-115-120-125-148-160-161-175-185: the required bolt size is HM8. This bolt must be tightened to a torque of 21 Nm. The bolts and washers are supplied with the assembly kit.

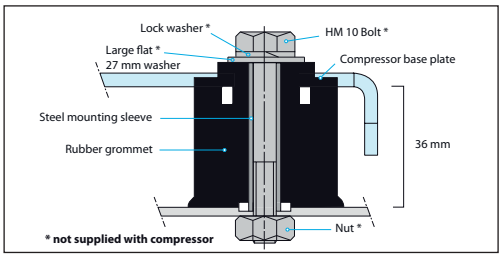


Mounting of SM/SZ 112-124-147: the required bolt size is HM8. This bolt must be tightened to a torque of 15 Nm. The bolt and washers are supplied with the assembly kit. When a surface sump heater is used, it must be applied after grommets are mounted on compressor in order to avoid surface sump heater damage.



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 SY/SZ 240-300-380: the required bolt size is HM10. The minimum required flat washer outside diameter is 27 mm. Mounting bolts must be tightened to a torque of 40 Nm. 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 Performer® parallel application guidelines", FRCC.PC.005.

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.

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 filllings and particuls 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.

Copper to copper connections

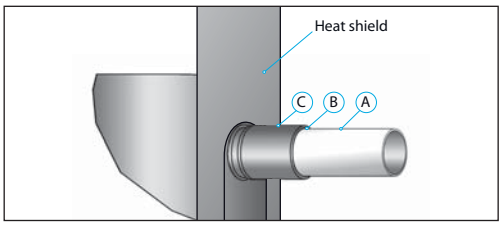
When brazing copper-to-copper connections, the use of a copper / phosphorus brazing alloy containing 5% silver or more with a melting temperature of below 800°C is recommended. No flux is required during brazing.

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 CO_2 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 d amage 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.

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: 25 bar (g)	SZ/SY240 - 380: 20 bar (g)
Maximum compressor test pressure (high side)	32 bar (g)	
Maximum pressure difference between high and low side of the compressor:	24 bar	

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 5 bar.
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 4.8 bar/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 platting. 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 500 µm 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.

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 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.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.

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 10 K 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 20 m, no additional oil is required. If installation lines exceed 20 m, 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.

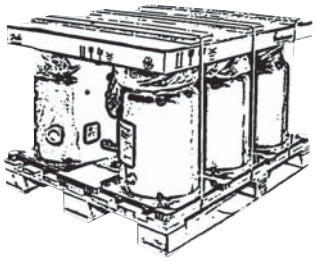
When the compressor is off, the level in the sight glass can be influenced by the presence of refrigerant in the oil.

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».

Packaging



Compressor models	Single pack				Industrial pack					
	Length mm	Width mm	Height mm	Gross weight kg	Nbr*	Length mm	Width mm	Height mm	Gross weight kg	Static stacking pallets
SM/SZ084	470	370	596	67	8	1140	950	707	550	3
SM/SZ090	470	370	596	69	8	1140	950	707	566	3
SM/SZ100	470	370	596	69	8	1140	950	707	566	3
SM/SZ110-120	470	370	596	78	8	1140	950	757	638	3
SM112	380	320	580	65	8	1150	950	745	543	3
SM124	380	320	580	65	8	1150	950	745	543	2
SM147	380	320	580	68	8	1150	950	745	566	2
SM/SZ115-125	470	370	671	82	6	1140	950	768	510	3
SM/SZ160	470	370	671	98	6	1140	950	830	600	3
SM/SZ148-161	470	370	671	88	6	1140	950	790	546	3
SM/SZ175-185 - SY185	470	400	698	106	6	1140	950	877	648	2
SY/SZ240	510	465	780	156	4	1140	950	904	635	2
SY/SZ300	510	465	780	161	4	1140	950	915	635	2
SY/SZ380	510	465	804	164	4	1140	950	939	647	2

* Nbr = number of compressors per pallet

Ordering information

Performer® 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 Performer parallel application guideline reference FRCC.PC.005.

SM112-124-147 compressors in industrial pack

R22

Compressor model	Connections	Motor protection	Code no.				
			3	4	6	7	9
			200-230/3/60	460/3/60 380-400/3/50	230/3/50	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

SM112-124-147 compressors in single pack

R22

Compressor model	Connections	Motor protection	Code no.				
			3	4	6	7	9
			200-230/3/60	460/3/60 380-400/3/50	230/3/50	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

SM /SY compressors in industrial pack

R22

Compressor model	Connections	Motor protection	Code no.				
			3	4	6	7	9
			200-230/3/60	460/3/60 380-400/3/50	230/3/50	575/3/60 500/3/50	380/3/60
SM084	Brazed	Internal	SM084-3VM	SM084-4VM	SM084-6VM	SM084-7VM	SM084-9VM
SM090	Brazed	Internal	SM090-3VM	SM090-4VM	SM090-6VM	SM090-7VM	SM090-9VM
SM100	Brazed	Internal	SM100-3VM	SM100-4VM	SM100-6VM	SM100-7VM	SM100-9VM
SM110	Brazed	Internal	SM110-3VM	SM110-4VM	SM110-6VM	SM110-7VM	SM110-9VM
SM115	Brazed	Thermostat	SM115-3CAM	SM115-4CAM	SM115-6CAM	SM115-7CAM	SM115-9CAM
	Brazed	Module 24V AC	SM115-3PBM	SM115-4PBM	-	SM115-7PBM	-
	Rotolock	Thermostat	SM115-3RM	SM115-4RM	SM115-6RM	SM115-7RM	SM115-9RM
	Rotolock	Module 24V AC	SM115-3SBM	SM115-4SBM	-	SM115-7SBM	-
SM120	Brazed	Internal	SM120-3VM	SM120-4VM	SM120-6VM	SM120-7VM	SM120-9VM
SM125	Brazed	Thermostat	SM125-3CAM	SM125-4CAM	SM125-6CAM	SM125-7CAM	SM125-9CAM
	Brazed	Module 24V AC	SM125-3PBM	SM125-4PBM	-	SM125-7PBM	-
	Brazed	Module 24V DC	-	SM125-4JBM	-	-	-
	Rotolock	Thermostat	SM125-3RM	SM125-4RM	SM125-6RM	SM125-7RM	SM125-9RM
	Rotolock	Module 24V AC	SM125-3SBM	SM125-4SBM	-	SM125-7SBM	-
	Rotolock	Module 24V DC	-	SM125-4KBM	-	-	-
SM148	Brazed	Internal	SM148-3VAM	SM148-4VAM	SM148-6VAM	SM148-7VAM	SM148-9VAM
SM160	Brazed	Thermostat	SM160-3CBM	SM160-4CBM	SM160-6CBM	SM160-7CAM	SM160-9CBM
	Brazed	Module 24V AC	SM160-3PBM	SM160-4PBM	-	SM160-7PBM	-
	Brazed	Module 24V DC	-	SM160-4JBM	-	-	-
	Rotolock	Thermostat	SM160-3RAM	SM160-4RAM	SM160-6RAM	SM160-7RAM	SM160-9RAM
	Rotolock	Module 24V AC	SM160-3SBM	SM160-4SBM	-	SM160-7SBM	-
	Rotolock	Module 24V DC	-	SM160-4KBM	-	-	-
SM161	Brazed	Internal	SM161-3VAM	SM161-4VAM	SM161-6VAM	SM161-7VAM	SM161-9VAM
SM175	Brazed	Thermostat	SM175-3CAM	SM175-4CAM	SM175-6CAM	SM175-7CAM	SM175-9CAM
	Brazed	Module 24V AC	SM175-3PCM	SM175-4PCM	-	SM175-7PCM	-
	Rotolock	Thermostat	SM175-3RM	SM175-4RM	SM175-6RM	SM175-7RM	SM175-9RM
	Rotolock	Module 24V AC	SM175-3SCM	SM175-4SCM	-	SM175-7SCM	-
SM185	Brazed	Thermostat	SM185-3CAM	SM185-4CAM	SM185-6CAM	SM185-7CAM	SM185-9CAM
	Brazed	Module 24 V AC	SM185-3PCM	SM185-4PCM	-	SM185-7PCM	-
	Brazed	Module 24 V DC	-	SM185-4JCM	-	-	-
	Brazed	Module 230 V AC	-	SM185-4XCM	-	-	SM185-9XCM
	Rotolock	Thermostat	SM185-3RM	SM185-4RM	SM185-6RM	SM185-7RM	SM185-9RM
	Rotolock	Module 24 V AC	SM185-3SCM	SM185-4SCM	-	SM185-7SCM	-
	Rotolock	Module 24 V DC	-	SM185-4KCM	-	-	-
	Rotolock	Module 230 V AC	-	SM185-4YCM	-	-	SM185-9YCM
SY185 **	Brazed	Thermostat	-	SY185-4CAM	-	-	-
	Rotolock	Thermostat	-	SY185-4RM	-	-	-
SY240	Brazed	Module 24V AC	SY240A3AAM	SY240A4AAM	SY240A6AAM	SY240A7AAM	SY240A9AAM
	Brazed	Module 115-230V AC	SY240A3ABM	SY240A4ABM	SY240A6ABM	SY240A7ABM	SY240A9ABM
	Rotolock	Module 24V AC	SY240A3MAM	SY240A4MAM	SY240A6MAM	SY240A7MAM	SY240A9MAM
	Rotolock	Module 115-230V AC	SY240A3MBM	SY240A4MBM	SY240A6MBM	SY240A7MBM	SY240A9MBM
SY300	Brazed	Module 24V AC	SY300A3AAM	SY300A4AAM	SY300A6AAM	SY300A7AAM	SY300A9AAM
	Brazed	Module 115-230V AC	SY300A3ABM	SY300A4ABM	SY300A6ABM	SY300A7ABM	SY300A9ABM
	Rotolock	Module 24V AC	SY300A3MAM	SY300A4MAM	SY300A6MAM	SY300A7MAM	SY300A9MAM
	Rotolock	Module 115-230V AC	SY300A3MBM	SY300A4MBM	SY300A6MBM	SY300A7MBM	SY300A9MBM
SY380 *	Brazed	Module 24V AC	-	SY380A4CAM	-	-	-
	Brazed	Module 115-230V AC	-	SY380A4CBM	-	-	-

* SY380 only available for 400V/3/50 Hz ** No module version available

SM/SY compressors in single pack: use numbers from above table and replace the last digit by "I". Example: SY240A3AAI

SZ compressors in industrial pack

R407C / R134a

Compressor model	Connections	Motor protection	Code no.				
			3	4	6	7	9
			200-230/3/60	460/3/60 380-400/3/50	230/3/50	575/3/60 500/3/50	380/3/60
SZ084	Brazed	Internal	SZ084-3VM	SZ084-4VM	SZ084-6VM	SZ084-7VM	SZ084-9VM
SZ090	Brazed	Internal	SZ090-3VM	SZ090-4VM	SZ090-6VM	SZ090-7VM	SZ090-9VM
SZ100	Brazed	Internal	SZ100-3VM	SZ100-4VM	SZ100-6VM	SZ100-7VM	SZ100-9VM
SZ110	Brazed	Internal	SZ110-3VM	SZ110-4VM	SZ110-6VM	SZ110-7VM	SZ110-9VM
SZ115	Brazed	Thermostat	SZ115-3CAM	SZ115-4CAM	SZ115-6CAM	SZ115-7CAM	SZ115-9CAM
	Brazed	Module 24 V AC	SZ115-3PBM	SZ115-4PBM	-	SZ115-7PBM	-
	Rotolock	Thermostat	SZ115-3RM	SZ115-4RM	SZ115-6RM	SZ115-7RM	SZ115-9RM
	Rotolock	Module 24 V AC	SZ115-3SBM	SZ115-4SBM	-	SZ115-7SBM	-
SZ120	Brazed	Internal	SZ120-3VM	SZ120-4VM	SZ120-6VM	SZ120-7VM	SZ120-9VM
SZ125	Brazed	Thermostat	SZ125-3CAM	SZ125-4CAM	SZ125-6CAM	SZ125-7CAM	SZ125-9CAM
	Brazed	Module 24 V AC	SZ125-3PBM	SZ125-4PBM	-	SZ125-7PBM	-
	Brazed	Module 24 V DC	-	SZ125-4JBM	-	-	-
	Rotolock	Thermostat	SZ125-3RM	SZ125-4RM	SZ125-6RM	SZ125-7RM	SZ125-9RM
	Rotolock	Module 24 V AC	SZ125-3SBM	SZ125-4SBM	-	SZ125-7SBM	-
	Rotolock	Module 24 V DC	-	SZ125-4KBM	-	-	-
SZ148	Brazed	Internal	SZ148-3VAM	SZ148-4VAM	SZ148-6VAM	SZ148-7VAM	SZ148-9VAM
SZ160	Brazed	Thermostat	SZ160-3CBM	SZ160-4CBM	SZ160-6CBM	SZ160-7CAM	SZ160-9CBM
	Brazed	Module 24 V AC	SZ160-3PBM	SZ160-4PBM	-	SZ160-7PBM	-
	Brazed	Module 24 V DC	-	SZ160-4JBM	-	-	-
	Rotolock	Thermostat	SZ160-3RAM	SZ160-4RAM	SZ160-6RAM	SZ160-7RAM	SZ160-9RAM
	Rotolock	Module 24 V AC	SZ160-3SBM	SZ160-4SBM	-	SZ160-7SBM	-
	Rotolock	Module 24 V DC	-	SZ160-4KBM	-	-	-
SZ161	Brazed	Internal	SZ161-3VAM	SZ161-4VAM	SZ161-6VAM	SZ161-7VAM	SZ161-9VAM
SZ175	Brazed	Thermostat	SZ175-3CAM	SZ175-4CAM	SZ175-6CAM	SZ175-7CAM	SZ175-9CAM
	Brazed	Module 24 V AC	SZ175-3PCM	SZ175-4PCM	-	SZ175-7PCM	-
	Rotolock	Thermostat	SZ175-3RM	SZ175-4RM	SZ175-6RM	SZ175-7RM	SZ175-9RM
	Rotolock	Module 24 V AC	SZ175-3SCM	SZ175-4SCM	-	SZ175-7SCM	-
SZ185	Brazed	Thermostat	SZ185-3CAM	SZ185-4CAM	SZ185-6CAM	SZ185-7CAM	SZ185-9CAM
	Brazed	Module 24 V AC	SZ185-3PCM	SZ185-4PCM	-	SZ185-7PCM	-
	Brazed	Module 24 V DC	-	SZ185-4JCM	-	-	-
	Brazed	Module 230 V	-	SZ185-4XCM	-	-	SZ185-9XCM
	Rotolock	Thermostat	SZ185-3RM	SZ185-4RM	SZ185-6RM	SZ185-7RM	SZ185-9RM
	Rotolock	Module 24 V AC	SZ185-3SCM	SZ185-4SCM	-	SZ185-7SCM	-
	Rotolock	Module 24 V DC	-	SZ185-4KCM	-	-	-
	Rotolock	Module 230 V	-	SZ185-4YCM	-	-	SZ185-9YCM
SZ240	Brazed	Module 24 V AC	SZ240A3AAM	SZ240A4AAM	SZ240A6AAM	SZ240A7AAM	SZ240A9AAM
	Brazed	Module 115/230 V	SZ240A3ABM	SZ240A4ABM	SZ240A6ABM	SZ240A7ABM	SZ240A9ABM
	Rotolock	Module 24 V AC	SZ240A3MAM	SZ240A4MAM	SZ240A6MAM	SZ240A7MAM	SZ240A9MAM
	Rotolock	Module 115/230 V	SZ240A3MBM	SZ240A4MBM	SZ240A6MBM	SZ240A7MBM	SZ240A9MBM
SZ300	Brazed	Module 24 V AC	SZ300A3AAM	SZ300A4AAM	SZ300A6AAM	SZ300A7AAM	SZ300A9AAM
	Brazed	Module 115/230 V	SZ300A3ABM	SZ300A4ABM	SZ300A6ABM	SZ300A7ABM	SZ300A9ABM
	Rotolock	Module 24 V AC	SZ300A3MAM	SZ300A4MAM	SZ300A6MAM	SZ300A7MAM	SZ300A9MAM
	Rotolock	Module 115/230 V	SZ300A3MBM	SZ300A4MBM	SZ300A6MBM	SZ300A7MBM	SZ300A9MBM
SZ 380	Brazed	Module 24 V AC	-	SZ380A4CAM	-	-	-
	Brazed	Module 115/230 V	-	SZ380A4CBM	-	-	-

SZ compressors in single pack: use numbers from above table and replace the last digit by "I". Example: SZ240A4AAI

Rotolock 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")	SM110-112-115-120-124-125-147-148-161& SZ110-115-120-125-148-161	Multipack	8
	7765006*	Solder sleeve adapter set (1"3/4~1"3/8), (1"1/4~7/8")	SM110-112-115-120-124-125-147-148-161& SZ110-115-120-125-148-161	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	Flange	SM/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 with1"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

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

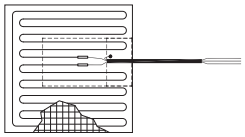
Rotolock service valve

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* (except 160)	Multipack	6
	7703392	Valve set, V10 (1"3/4 ~ 1"3/8), V05(1"1/4 ~ 7/8")	SM / SZ 110 to 161 (except 160)	Multipack	6
	7703383	Valve set, V03 (2"1/4 ~ 1"5/8), V02 (1"3/4 ~ 1"1/8)	SM / SZ 160 & 175 to 300	Multipack	4
	120Z0316	Valve set, V12 (flange 2"1/8), V10(1"3/4 ~ 1"3/8)	SM / SZ 380	Single pack	1

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/SZ115-185	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	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 + inferior hood, CE & UL	SM / SZ 084 - 090 -100 - 110 - 120 - 125 - 148 - 161	Multipack	6
	120Z0380	48W 230V surface sump heater + inferior hood, CE & UL		Multipack	6
	120Z0381	48W 400V surface sump heater + inferior hood, CE & UL		Multipack	6
	120Z0382	48W 460V surface sump heater + inferior hood, CE *		Multipack	6
	120Z0383	48W 575V surface sump heater + inferior hood, CE *		Multipack	6
	120Z0363	48W 24V surface sump heater + inferior hood, CE & UL	SM / SZ 115 - 125 - 160	Multipack	6
	120Z0384	48W 230V surface sump heater + inferior hood, CE & UL		Multipack	6
	120Z0385	48W 400V surface sump heater + inferior hood, CE & UL		Multipack	6
	120Z0386	48W 460V surface sump heater + inferior hood, CE *		Multipack	6
	120Z0387	48W 575V surface sump heater + inferior hood, CE *		Multipack	6
	120Z0360	56W 24V surface sump heater + inferior hood, CE & UL	SM / SZ 175 & SM / SY / SZ 185	Multipack	6
	120Z0376	56W 230V surface sump heater + inferior hood, CE & UL		Multipack	6
	120Z0377	56W 400V surface sump heater + inferior hood, CE & UL		Multipack	6
	120Z0378	56W 460V surface sump heater + inferior hood, CE *		Multipack	6
	120Z0379	56W 575V surface sump heater + inferior hood, CE *		Multipack	6
	120Z0359	80W 24V surface sump heater + inferior hood, CE & UL	SM / SZ 240 to SY / SZ 380	Multipack	4
	120Z0372	80W 230V surface sump heater + inferior hood, CE & UL		Multipack	4
	120Z0373	80W 400V surface sump heater + inferior hood, CE & UL		Multipack	4
	120Z0374	80W 460V surface sump heater + inferior hood, CE *		Multipack	4
	120Z0375	80W 575V surface sump heater + inferior hood, CE *		Multipack	4

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/SZ084-090-100-110-120-125-148-160-161-175-185	Single pack	1
	8156146	Mounting kit for scroll compressors. Grommets, sleeves, bolts, washers, rotolock nuts, solder sleeves, gaskets	SM/SZ115-125	Single pack	1
	8156147	Mounting kit for scroll compressors. Grommets, sleeves, bolts, washers, rotolock nuts, solder sleeves, gaskets	SM/SZ148-160-161-175-185	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	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/SZ115 & 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)	Single pack	1
	120Z0135	Acoustic hood for scroll compressor, SM147-3	SM147 code 3	Single pack	1
	120Z0356	Inferior hood	SM/SZ084-090-100-110-120-125-148-161	Single pack	1
	120Z0357	Inferior hood	SM/SZ115-125-160	Single pack	1
	120Z0353	Inferior hood	SM/SZ175&SM/SY/SZ185	Single pack	1
	120Z0355	Inferior hood	SY/SZ240 to SY/SZ380	Single pack	1

Terminal boxes, covers & T-block connectors

Type	Code No	Description	Application	Packaging	Pack Size
	8156139	Terminal box 186 x 198 mm, incl cover	SM/SZ115.125.148-3.160.161-3.175.185	Single pack	1
	8156142	Terminal box 258 x 208 mm, incl cover	SY/SZ240-380	Single pack	1
	120Z0413	Terminal box cover	SM147-3	Single pack	1
	8156135	Service kit for terminal box 96 x 115 mm, including 1 cover, 1 clamp, 1 T block connector 52 x 57 mm	SM084.090.100.110.112.120.124.14 7.148.161 (except SM148-3.161-3) & SZ084.090.100.110.120.148.161 (except SZ148-3. 161-3)	Multipack	10
	8173230	T block connector 52 x 57 mm	SM/SZ084-110.120.148 (except -3). 161 (except -3). & SM112-124-147	Multipack	10
	8173021	T block connector 60 x 75 mm	SM115.125.148-3.160.161-3.175.185 & SY240.300.380 (except SY240-3.300-3) & SZ115.125.160.175.185.240. 300.380 (except SZ240-3.300-3.)	Multipack	10
	8173331	T block connector 80 x 80 mm	SY/SZ240.300-3	Multipack	10

Lubricant

Type	Code No	Description	Application	Packaging	Pack Size
160SZ	7754023	POE lubricant, 160SZ, 1 litre can	SZ with R407C, R134a, R404A	Multipack	12
160SZ	7754024	POE lubricant, 160SZ, 2 litre can	SZ with R407C, R134a, R404A	Multipack	8
320SZ	7754121	POE lubricant, 320SZ, 1 litre can	SY with R22	Multipack	12
320SZ	7754122	POE lubricant, 320SZ, 2 litre can	SY with R22	Multipack	8
160P	7754001	Mineral oil, 160P, 2 litre can	SM with R22	Multipack	8
160P	7754002	Mineral oil, 160P, 5 litre 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
	8154001	Danfoss Commercial Compressors blue spray paint	All models	Single pack	1

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