

Danfoss

Commercial compressors

Selection & Application guidelines
Single and tandem assemblies 20 to 90 kW

Performer[®]

SCROLL COMPRESSORS

50 Hz
R22
R134a
R407C



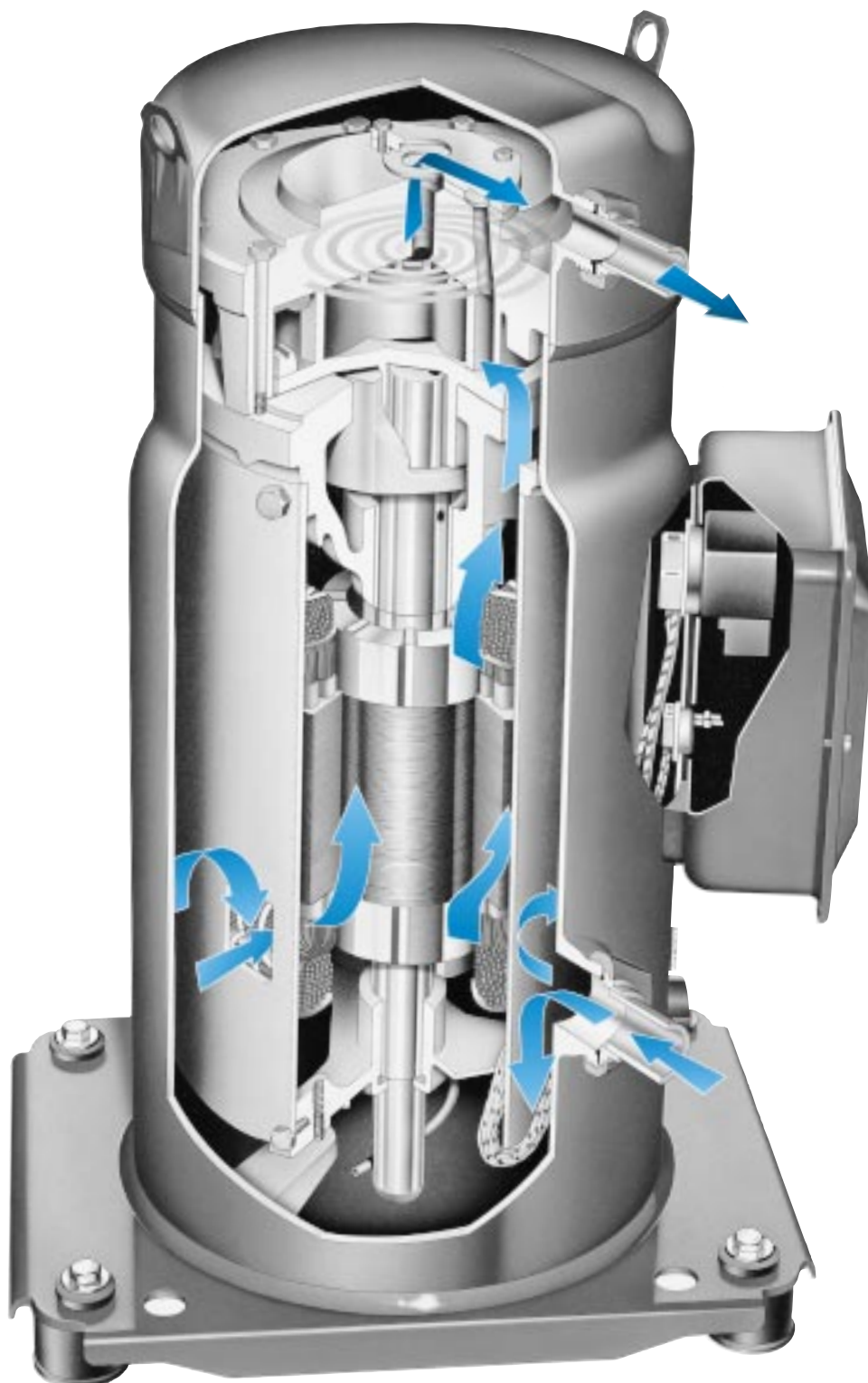
Danfoss Maneurop S.A.

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The principle of Scroll compression

In a Maneurop Performer scroll compressor, the compression is performed by two scroll elements which are located in the upper part of the compressor, above the motor (see figure beside). Suction gas enters the compressor at the suction connection. The gas flows around the motor and enters its housing at the bottom side through openings. Oil droplets separate from the suction gas and fall in the oil sump. All gas passes through the electrical motor, ensuring full motor cooling in all applications. After leaving the electric motor, the gas enters the scroll elements.

There are two scroll elements; an orbiting scroll and a fixed scroll. Figure on page 5 shows the compression process. The centre of the orbiting scroll describes a circular path around the centre of the fixed scroll. This movement creates compression pockets between the two scroll elements. Low pressure suction gas is trapped in each peripheral pocket as it is formed; continued motion of the orbiting scroll seals the pocket, which decreases in volume as the pocket moves towards the centre of the scroll. Maximum compression is achieved when a pocket reaches the centre where the discharge port is located. This happens after three complete orbits. The compression is a continuous process. When gas is being compressed in the second orbit, another quantity of gas enters the scrolls and a quantity of gas is being discharged at the same time.



A check valve is located directly above the fixed scroll discharge port. This prevents the compressor from running backwards after the power has been switched off.

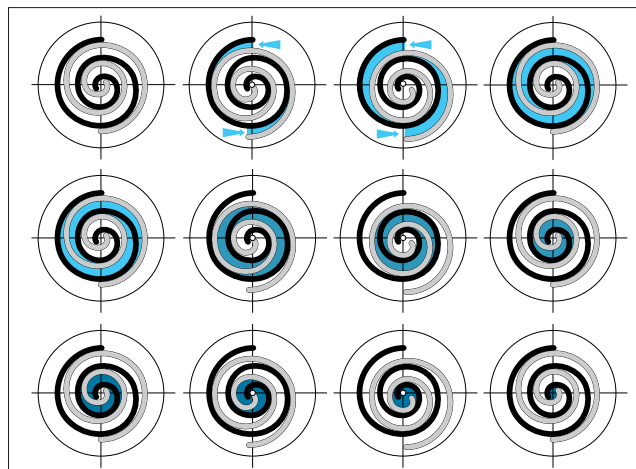
Finally the discharge gas leaves the compressor at the discharge connection.

50 Hz

First orbit:
SUCTION

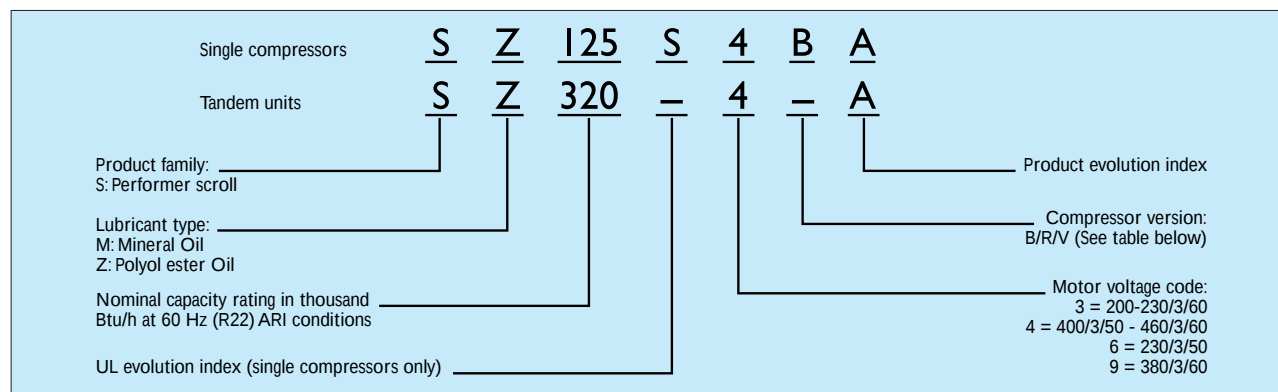
Second orbit:
COMPRESSION

Third orbit:
DISCHARGE



Performer scroll compressors are available as single compressors and tandem units. See table page 6 for the different single and tandem models. The example below explains the compressor nomenclature.

Compressor nomenclature



MODEL ►	SM/SZ 084-090-100-110-120		SM/SZ 115-125-160-175-185	
Version	B	V	B	R
Suction and discharge connection	brazed	brazed	brazed	rotolock
Oil sight glass	-	threaded	welded	threaded
Oil equalization connection	-	3/8"flare	-	3/8"flare
Oil drain connection	-	-	1/4" NPT	1/4" NPT
* Low pressure gauge port (shradet)	1/4"flare	1/4"flare	1/4"flare	1/4"flare

* Tandem units are also fitted with a high side gauge port (1/4" flare).

Specifications

GENERAL SPECIFICATIONS

Model		Nominal tons 60 Hz TR	Specifications at 50 Hz (rating conditions; see below)							Oil charge dm ³	Residual moisture content mg	Net weight kg
			Cooling capacity W	Power input kW	Current input at 400V A	COP W/W	sound power level dBA	displace- ment cm ³ /rev	swept volume m ³ /h			
Single	Tandem											
SM 084	•	7	20 400	6.12	10.9	3.33	74	114.5	19.9	3.25	195	72
SM 090	•	7.5	21 800	6.54	12.2	3.33	74	120.5	21.0	3.25	195	72
SM 100	•	8	23 150	6.96	12.7	3.33	74	127.2	22.1	3.25	195	72
SM 110	•	9	25 950	7.82	14.3	3.32	78	144.2	25.1	3.25	195	80
SM 115	•	9.5	28 000	8.31	14.5	3.37	78	155.0	27.0	3.8	225	80
SM 120	•	10	30 110	8.96	16.4	3.36	78	166.6	29.0	3.25	195	80
SM 125	•	10	30 100	8.93	15.6	3.37	78	166.6	29.0	3.8	225	80
SM 160	•	13	39 100	11.61	21.6	3.37	82	216.6	37.7	4.0	240	94
SM 175	•	14	42 000	12.47	22.1	3.37	84	233.0	40.5	6.6	395	103
SM 180	•	15	42 900	13.08	24.4	3.28	77	241.0	41.9	6.5	390	150
SM 185	•	15	45 500	13.62	24.2	3.34	84	249.9	43.5	6.6	395	103
SM 200	•	16	45 600	13.91	25.4	3.28	77	254.4	44.3	6.5	390	150
SM 220	•	18	51 100	15.63	28.6	3.27	81	288.4	50.2	6.5	390	170
SM 230	•	19	55 150	16.61	29.0	3.32	81	310.0	53.9	7.6	450	170
SM 242	•	20	59 350	17.90	32.7	3.31	81	333.2	58.0	6.5	390	170
SM 250	•	20	59 300	17.90	31.2	3.32	81	333.2	58.0	7.6	450	170
SM 310	•	25	74 450	22.56	39.8	3.30	85	416.5	72.5	10.4	620	200
SM 320	•	26	77 050	23.19	43.1	3.32	85	433.2	75.4	8.0	480	210
SM 350	•	28	82 750	24.92	44.2	3.32	87	466.0	81.1	13.2	790	225
SM 370	•	30	89 650	27.23	48.3	3.29	87	499.8	87.0	13.2	790	225
SZ 084	•	7	19 300	6.13	11.2	3.15	77	114.5	19.9	3.25	195	72
SZ 090	•	7.5	20 400	6.45	11.7	3.16	77	120.5	21.0	3.25	195	72
SZ 100	•	8	21 600	6.84	12.5	3.15	77	127.2	22.1	3.25	195	72
SZ 110	•	9	24 600	7.76	14.2	3.17	79	144.2	25.1	3.25	195	80
SZ 115	•	9.5	26 850	8.49	14.5	3.16	79	155.0	27.0	3.8	225	80
SZ 120	•	10	28 600	8.98	16.5	3.18	79	166.6	29.0	3.25	195	80
SZ 125	•	10	28 550	8.95	15.8	3.19	79	166.6	29.0	3.8	225	80
SZ 160	•	13	37 550	11.58	21.7	3.24	83	216.6	37.7	4.0	240	94
SZ 175	•	14	40 100	12.67	22.4	3.17	85	233.0	40.5	6.6	395	103
SZ 180	•	15	40 200	12.88	23.5	3.12	80	241.0	41.9	6.5	390	150
SZ 185	•	15	43 100	13.62	24.1	3.16	85	249.9	43.5	6.6	395	103
SZ 200	•	16	42 500	13.68	25.0	3.11	80	254.4	44.3	6.5	390	150
SZ 220	•	18	48 450	15.52	28.4	3.12	82	288.4	50.2	6.5	390	170
SZ 230	•	19	52 900	16.97	29.0	3.12	82	310.0	53.9	7.6	450	170
SZ 242	•	20	56 300	17.95	33.0	3.14	82	333.2	58.0	6.5	390	170
SZ 250	•	20	56 300	17.89	31.5	3.15	82	333.2	58.0	7.6	450	170
SZ 310	•	25	70 600	22.57	39.9	3.13	86	416.5	72.5	10.4	620	200
SZ 320	•	26	74 000	23.15	43.4	3.20	86	433.2	75.4	8.0	480	210
SZ 350	•	28	79 000	25.32	44.8	3.12	88	466.0	81.1	13.2	790	225
SZ 370	•	30	84 900	27.22	48.2	3.12	88	499.8	87.0	13.2	790	225

Rating conditions:

	SM 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)
Subcooling	8.3 K	8.3 K
Superheat	11.1 K	11.1 K

50 Hz

CONFIGURATION OF TANDEM UNITS

Tandem units consist of two single compressors connected in parallel and mounted on a frame. The suction connections are inter-connected with an oil separator / gas

restrictor specifically designed to return the oil to the first compressor. A 3/8" overflow tube connects the two compressors to insure oil balance. This type of oil management

does not require a specific loading sequence; either compressor can lead or lag in a tandem unit. The table below gives the configuration of the different tandem units.

Tandem unit	Configuration
SM 180	SM 090 version V + SM 090 version V
SM 200	SM 100 version V + SM 100 version V
SM 220	SM 110 version V + SM 110 version V
SM 230	SM 115 version R + SM 115 version R
SM 242	SM 120 version V + SM 120 version V
SM 250	SM 125 version R + SM 125 version R
SM 310	SM 125 version R + SM 185 version R
SM 320	SM 160 version R + SM 160 version R
SM 350	SM 175 version R + SM 175 version R
SM 370	SM 185 version R + SM 185 version R

Tandem unit	Configuration
SZ 180	SZ 090 version V + SZ 090 version V
SZ 200	SZ 100 version V + SZ 100 version V
SZ 220	SZ 110 version V + SZ 110 version V
SZ 230	SZ 115 version R + SZ 115 version R
SZ 242	SZ 120 version V + SZ 120 version V
SZ 250	SZ 125 version R + SZ 125 version R
SZ 310	SZ 125 version R + SZ 185 version R
SZ 320	SZ 160 version R + SZ 160 version R
SZ 350	SZ 175 version R + SZ 175 version R
SZ 370	SZ 185 version R + SZ 185 version R

ELECTRICAL SPECIFICATIONS

Maneurop Performer scroll compressors are available in four

different motor voltages. Motor voltage code 3 and 9 for 60 Hz,

motor code 6 for 50 Hz and motor code 4 for both 50 and 60 Hz.

	motor voltage code 3	motor voltage code 4	motor voltage code 6	motor voltage code 9
Nominal voltage 50 Hz	-	400 V - 3 - 50 Hz	230 V - 3 - 50 Hz	-
Voltage range 50 Hz	-	340 - 440 V	207 - 253 V	-
Nominal voltage 60 Hz	200-230V - 3 - 60 Hz	460 V - 3 - 60 Hz	-	380 V - 3 - 60 Hz
Voltage range 60 Hz	180 - 253 V	414 - 506 V	-	342 - 418 V

Model	motor voltage code 3				motor voltage code 4				motor voltage code 6				motor voltage code 9			
	MMT A	MCC A	LRA A	R Ω	MMT A	MCC A	LRA A	R Ω	MMT A	MCC A	LRA A	R Ω	MMT A	MCC A	LRA A	R Ω
SM / SZ 084 S	-	35	170	0.44	-	17	86	1.74	-	29	150	0.58	-	20	100	1.22
SM / SZ 090 S	-	35	195	0.38	-	17	98	1.48	-	30	165	0.50	-	22	113	1.05
SM / SZ 100 S	-	35	195	0.38	-	19	98	1.48	-	30	165	0.50	-	22	113	1.05
SM / SZ 110 S	-	45	237	0.26	-	20	130	1.05	-	37	210	*	-	26	160	0.72
SM / SZ 115 S	52	-	265	0.26	25	-	120	1.16	45	-	205	0.39	32	-	155	0.74
SM / SZ 120 S	-	50	237	0.26	-	29	130	1.05	-	43	210	0.35	-	30	160	0.72
SM / SZ 125 S	52	-	265	0.26	25	-	120	1.16	45	-	205	0.39	32	-	155	0.74
SM / SZ 160 S	75	-	380	0.19	35	-	175	0.76	60	-	310	0.25	42	-	235	0.48
SM / SZ 160 T	*	-	*	0.21	29	-	135	0.94	47	-	*	0.31	36	-	170	0.64
SM / SZ 175 S	75	-	380	0.19	35	-	175	0.76	68	-	310	0.25	47	-	235	0.48
SM / SZ 185 S	75	-	380	0.19	35	-	175	0.76	68	-	310	0.25	47	-	235	0.48

Legends :

MMT: Maximum must trip current; The current above which the electrical supply to the motor-compressor must be cut off to prevent damage. This value must never be exceeded in any application.

MCC: Maximum continuous current; The current at which the electrical supply to the motor is cut off by the internal motor protection.

LRA: Locked rotor current; The current draw 4 seconds after power is applied to a motor in a locked rotor condition.

R: Motor winding resistance ($T_1 - T_2$, $T_2 - T_3$, $T_3 - T_1$)

* data not available at the date of printing

For the electrical specifications of tandem units, please refer to the corresponding single compressors.

Operating envelopes

The operating limits define the envelope within which reliable operation of the compressor is insured:

- Minimum evaporating temperature: -20°C (R134a: -15°C)
- Maximum evaporating temperature: +15°C
- Maximum condensing temperature: +68°C (R134a : +70°C)
- Maximum discharge temperature: +135°C
- Maximum ambient temperature: +68°C

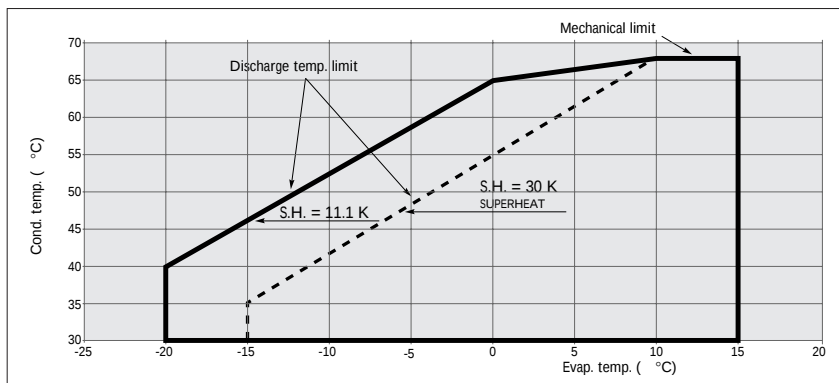
The figures below show the operating envelopes for SM compressors with refrigerant R22 and for SZ compressors with refrigerants R134a or R407C.

The discharge temperature depends on the combination of evaporating temperature, condensing temperature and suction gas superheat. Because of that, the discharge temperature limits are

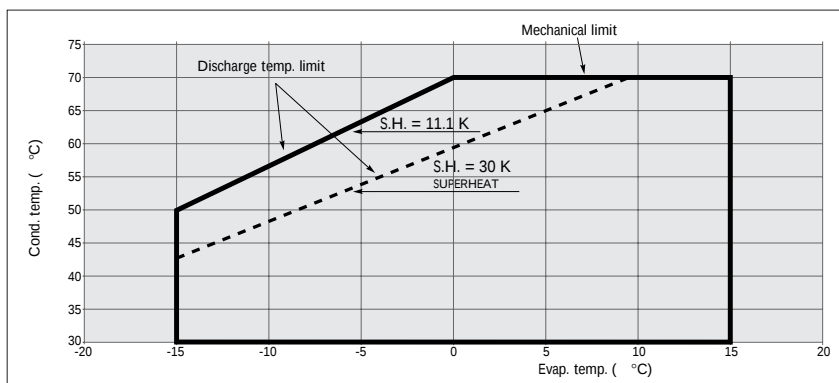
indicated with two lines.

The solid line is the limit if the superheat is 11.1 K or lower. The dotted line is the limit if the superheat is 30 K.

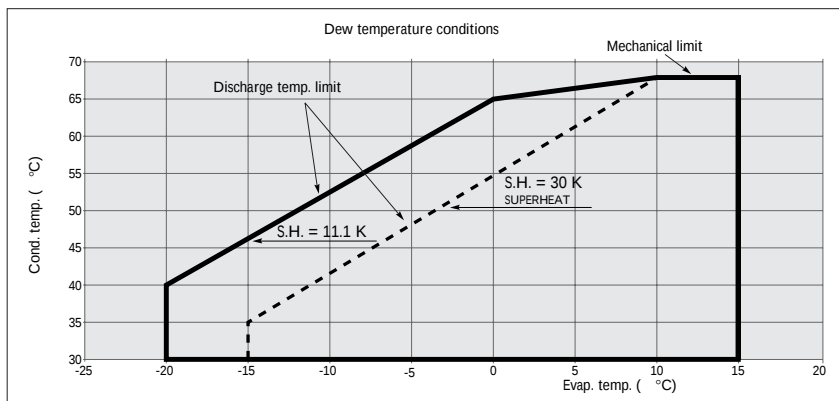
For superheat values between 11.1 K and 30 K, the lines can be interpolated.



**Application Envelope
for SM compressors with
R22**



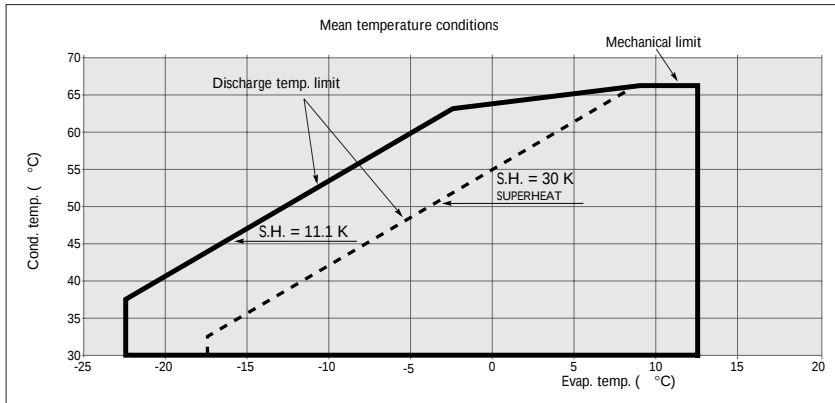
**Application Envelope
for SZ compressors with
R134a**



**Application Envelope
for SZ compressors with
R407C
at DEW temperature**

(refer to the explanation on page 9)

50 Hz



Application Envelope for SZ compressors with R407C at MEAN temperature

(refer to the explanation below)

Refrigerant R407C is a zeotropic mixture. As a result of this, there is a temperature glide in the evaporator and in the condenser.

Therefore, when speaking about evaporating and condensing temperatures, it is important to indicate whether these are DEW point values or MEAN point values.

In the figure below the dotted lines are lines of constant temperature. They do not correspond to the lines of constant pressure.

Point A and B are DEW point values. These are temperatures on the saturated vapor line.

Point C and D are MEAN point values. These are temperatures

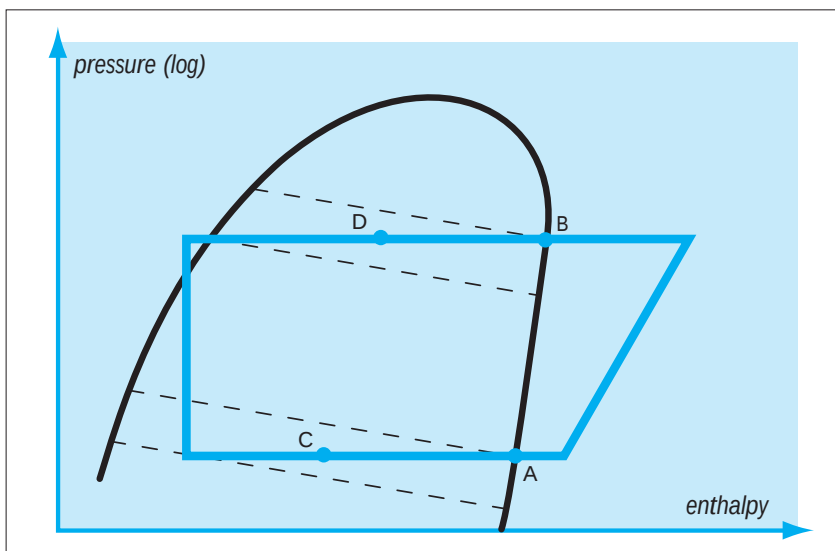
which indicate more or less the average temperature during the evaporating and condensing process.

For the same cycle, MEAN point temperatures are typically about 2 to 3 °C lower than DEW point temperatures. In these Selection and Application Guidelines, Danfoss Maneurop indicates temperatures as DEW point values. Also the performance tables for R407C page 12 - 13 are based on DEW point values.

Only the application envelopes in this section are presented for both temperatures.

To obtain exact capacity data

at mean point temperatures, these mean point temperatures should be converted to dew point temperatures, using refrigerant data tables.



DEW temperature and MEAN temperature for R407C

Performance tables

R22 - SINGLE COMPRESSORS

Models	TE	- 20°C		- 15°C		- 10°C		- 5°C		0°C		+ 5°C		+ 10°C		+ 15°C	
	TC	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.
SM 084	30°C	8 273	3.58	10 532	3.58	13 163	3.58	16 202	3.58	19 683	3.57	23 638	3.56	28 104	3.54	33 114	3.51
	40°C	7 073	4.52	9 252	4.51	11 784	4.50	14 702	4.49	18 041	4.46	21 834	4.43	26 116	4.39	30 922	4.34
	50°C	-	-	-	-	10 176	5.69	12 946	5.66	16 115	5.62	19 719	5.56	23 790	5.50	28 364	5.42
	60°C	-	-	-	-	-	-	-	-	13 887	7.07	17 273	6.99	21 106	6.89	25 421	6.78
SM 090	30°C	9 070	3.89	11 421	3.93	14 173	3.96	17 362	3.98	21 026	4.00	25 200	4.00	29 921	4.00	35 227	3.97
	40°C	8 044	4.81	10 283	4.84	12 893	4.86	15 911	4.88	19 374	4.88	23 317	4.88	27 779	4.86	32 794	4.82
	50°C	-	-	-	-	11 431	6.01	14 239	6.01	17 462	6.01	21 136	5.99	25 298	5.95	29 985	5.89
	60°C	-	-	-	-	-	-	-	-	15 290	7.41	18 655	7.37	22 479	7.32	26 799	7.25
SM 100	30°C	9 534	4.14	12 064	4.17	15 017	4.20	18 430	4.23	22 339	4.25	26 784	4.27	31 800	4.28	37 424	4.28
	40°C	8 461	5.13	10 869	5.15	13 666	5.17	16 892	5.18	20 582	5.19	24 775	5.18	29 506	5.17	34 814	5.15
	50°C	-	-	-	-	12 133	6.41	15 128	6.40	18 557	6.39	22 455	6.36	26 860	6.33	31 809	6.28
	60°C	-	-	-	-	-	-	-	-	16 260	7.91	19 822	7.86	23 858	7.79	28 405	7.71
SM 110	30°C	10 774	4.67	13 651	4.69	16 984	4.70	20 811	4.71	25 168	4.72	30 094	4.73	35 624	4.74	41 797	4.74
	40°C	9 507	5.80	12 250	5.80	15 414	5.80	19 037	5.80	23 155	5.80	27 806	5.79	33 027	5.77	38 855	5.75
	50°C	-	-	-	-	13 655	7.21	17 028	7.20	20 860	7.17	25 190	7.14	30 055	7.10	35 492	7.05
	60°C	-	-	-	-	-	-	-	-	18 299	8.90	22 262	8.84	26 724	8.78	31 723	8.70
SM 115	30°C	11 863	4.83	14 610	4.85	17 823	4.87	21 552	4.89	25 848	4.90	30 763	4.91	36 347	4.91	42 653	4.90
	40°C	10 363	6.10	13 091	6.10	16 280	6.10	19 979	6.10	24 241	6.08	29 115	6.06	34 654	6.03	40 908	5.98
	50°C	-	-	-	-	14 173	7.70	17 836	7.66	22 055	7.62	26 882	7.56	32 368	7.48	38 563	7.39
	60°C	-	-	-	-	-	-	-	-	19 164	9.59	23 937	9.48	29 362	9.36	35 492	9.22
SM 120	30°C	12 625	5.37	16 011	5.36	19 907	5.36	24 351	5.36	29 381	5.35	35 034	5.35	41 348	5.36	48 361	5.36
	40°C	11 051	6.67	14 286	6.66	17 992	6.64	22 205	6.62	26 965	6.60	32 308	6.59	38 272	6.57	44 896	6.54
	50°C	-	-	-	-	15 914	8.27	19 845	8.24	24 282	8.20	29 263	8.16	34 826	8.12	41 008	8.07
	60°C	-	-	-	-	-	-	-	-	21 335	10.21	25 902	10.15	31 010	10.08	36 699	10.00
SM 125	30°C	12 752	5.20	15 705	5.22	19 159	5.24	23 167	5.26	27 786	5.27	33 070	5.28	39 073	5.28	45 851	5.27
	40°C	11 141	6.55	14 074	6.56	17 502	6.56	21 479	6.55	26 060	6.54	31 300	6.51	37 255	6.48	43 978	6.43
	50°C	-	-	-	-	15 236	8.27	19 174	8.24	23 710	8.19	28 899	8.13	34 796	8.04	41 456	7.95
	60°C	-	-	-	-	-	-	-	-	20 601	10.30	25 732	10.20	31 564	10.07	38 154	9.91
SM 160	30°C	16 276	6.94	20 405	7.03	25 211	7.11	30 756	7.20	37 100	7.30	44 304	7.40	52 429	7.50	61 535	7.60
	40°C	14 707	8.39	18 680	8.46	23 285	8.54	28 582	8.63	34 633	8.71	41 499	8.80	49 239	8.89	57 915	8.98
	50°C	-	-	-	-	20 781	10.40	25 770	10.47	31 467	10.55	37 932	10.62	45 227	10.70	53 412	10.77
	60°C	-	-	-	-	-	-	-	-	27 469	12.87	33 473	12.93	40 262	12.99	47 894	13.05
SM 175	30°C	17 945	7.29	22 391	7.37	27 581	7.44	33 583	7.52	40 461	7.58	48 284	7.64	57 116	7.69	67 025	7.72
	40°C	16 002	8.94	20 247	9.02	25 178	9.10	30 861	9.18	37 363	9.25	44 749	9.31	53 087	9.36	62 442	9.40
	50°C	-	-	-	-	22 531	11.16	27 818	11.24	33 864	11.31	40 735	11.38	48 500	11.44	57 223	11.49
	60°C	-	-	-	-	-	-	-	-	29 959	13.85	36 238	13.92	43 350	13.99	51 363	14.04
SM 185	30°C	19 439	7.96	24 255	8.05	29 878	8.13	36 380	8.21	43 832	8.28	52 306	8.35	61 875	8.40	72 610	8.44
	40°C	17 337	9.77	21 936	9.86	27 278	9.95	33 434	10.03	40 478	10.11	48 480	10.17	57 512	10.23	67 647	10.28
	50°C	-	-	-	-	24 409	12.20	30 136	12.28	36 686	12.36	44 131	12.44	52 542	12.50	61 992	12.55
	60°C	-	-	-	-	-	-	-	-	32 455	15.13	39 257	15.21	46 962	15.28	55 642	15.34

LEGEND

P.F. cooling capacity (W)
P.A. power input (kW)

TE evaporating temperature (°C)
TC condensing temperature (°C)

RATING CONDITIONS

• 50 Hz • Superheat 11.1 K
• Subcooling 8.3 K

50 Hz

R22 - TANDEM UNITS

Models	TE	- 20°C		- 15°C		- 10°C		- 5°C		0°C		+ 5°C		+ 10°C		+ 15°C	
	TC	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.
SM 180	30°C	17 867	7.78	22 499	7.86	27 920	7.92	34 203	7.96	41 421	8.00	49 644	8.00	58 945	7.99	69 397	7.94
	40°C	15 847	9.61	20 258	9.67	25 400	9.72	31 345	9.75	38 166	9.76	45 935	9.75	54 724	9.71	64 604	9.63
	50°C	-	-	-	-	22 520	12.01	28 051	12.02	34 399	12.00	41 637	11.96	49 837	11.89	59 070	11.78
	60°C	-	-	-	-	-	-	-	-	30 121	14.80	36 751	14.73	44 285	14.63	52 793	14.48
SM 200	30°C	18 782	8.28	23 766	8.34	29 583	8.40	36 306	8.45	44 009	8.49	52 764	8.53	62 645	8.55	73 726	8.55
	40°C	16 668	10.26	21 411	10.30	26 923	10.33	33 277	10.36	40 547	10.37	48 806	10.36	58 127	10.34	68 584	10.29
	50°C	-	-	-	-	23 901	12.81	29 803	12.80	36 557	12.77	44 236	12.72	52 913	12.65	62 663	12.55
	60°C	-	-	-	-	-	-	-	-	32 033	15.80	39 049	15.70	46 999	15.57	55 958	15.41
SM 220	30°C	21 225	9.34	26 892	9.37	33 458	9.39	40 997	9.42	49 581	9.44	59 285	9.46	70 180	9.48	82 341	9.48
	40°C	18 729	11.59	24 132	11.60	30 366	11.60	37 503	11.60	45 616	11.59	54 778	11.57	65 064	11.54	76 544	11.50
	50°C	-	-	-	-	26 901	14.42	33 544	14.38	41 095	14.33	49 625	14.27	59 209	14.19	69 919	14.09
	60°C	-	-	-	-	-	-	-	-	36 049	17.79	43 856	17.68	52 647	17.54	62 495	17.38
SM 230	30°C	23 370	9.66	28 782	9.70	35 111	9.74	42 457	9.77	50 920	9.80	60 603	9.82	71 604	9.82	84 026	9.80
	40°C	20 415	12.18	25 790	12.19	32 071	12.20	39 359	12.18	47 754	12.16	57 357	12.11	68 269	12.04	80 589	11.95
	50°C	-	-	-	-	27 921	15.39	35 136	15.32	43 449	15.23	52 958	15.11	63 765	14.96	75 970	14.78
	60°C	-	-	-	-	-	-	-	-	37 754	19.16	47 155	18.96	57 844	18.71	69 920	18.43
SM 242	30°C	24 871	10.74	31 542	10.72	39 218	10.71	47 972	10.71	57 881	10.70	69 017	10.70	81 456	10.70	95 272	10.71
	40°C	21 771	13.34	28 144	13.30	35 444	13.27	43 745	13.24	53 121	13.20	63 646	13.16	75 396	13.12	88 445	13.08
	50°C	-	-	-	-	31 350	16.54	39 095	16.47	47 836	16.39	57 648	16.31	68 607	16.23	80 785	16.13
	60°C	-	-	-	-	-	-	-	-	42 029	20.42	51 026	20.28	61 090	20.14	72 297	19.99
SM 250	30°C	25 122	10.39	30 939	10.43	37 743	10.47	45 640	10.51	54 739	10.54	65 147	10.55	76 974	10.56	90 327	10.54
	40°C	21 948	13.10	27 726	13.11	34 479	13.11	42 314	13.10	51 339	13.07	61 662	13.02	73 392	12.94	86 636	12.84
	50°C	-	-	-	-	30 015	16.54	37 772	16.47	46 708	16.37	56 931	16.24	68 548	16.08	81 669	15.88
	60°C	-	-	-	-	-	-	-	-	40 584	20.60	50 691	20.38	62 181	20.12	75 163	19.81
SM 310	30°C	31 708	13.16	39 361	13.27	48 301	13.37	58 654	13.47	70 544	13.56	84 095	13.63	99 434	13.68	116 684	13.71
	40°C	28 051	16.33	35 470	16.42	44 108	16.50	54 090	16.58	65 540	16.64	78 584	16.69	93 346	16.71	109 950	16.70
	50°C	-	-	-	-	39 051	20.47	48 570	20.52	59 490	20.55	71 934	20.56	86 028	20.55	101 897	20.50
	60°C	-	-	-	-	-	-	-	-	52 260	25.44	64 014	25.41	77 349	25.35	92 389	25.25
SM 320	30°C	32 064	13.88	40 197	14.04	49 666	14.21	60 589	14.40	73 087	14.59	87 279	14.79	103 285	14.99	121 225	15.20
	40°C	28 974	16.77	36 800	16.92	45 871	17.08	56 307	17.25	68 228	17.42	81 752	17.59	97 001	17.77	114 092	17.95
	50°C	-	-	-	-	40 938	20.78	50 767	20.93	61 990	21.08	74 727	21.23	89 098	21.38	105 222	21.53
	60°C	-	-	-	-	-	-	-	-	54 113	25.73	65 943	25.85	79 316	25.97	94 352	26.08
SM 350	30°C	35 351	14.57	44 109	14.72	54 335	14.88	66 158	15.02	79 709	15.15	95 119	15.27	112 519	15.36	132 040	15.43
	40°C	31 524	17.87	39 887	18.03	49 601	18.19	60 797	18.34	73 605	18.48	88 156	18.61	104 581	18.71	123 011	18.79
	50°C	-	-	-	-	44 387	22.31	54 801	22.46	66 711	22.61	80 249	22.75	95 544	22.86	112 728	22.96
	60°C	-	-	-	-	-	-	-	-	59 019	27.68	71 389	27.82	85 400	27.95	101 184	28.06
SM 370	30°C	38 295	15.92	47 783	16.09	58 860	16.26	71 668	16.41	86 349	16.56	103 043	16.68	121 894	16.79	143 041	16.86
	40°C	34 154	19.54	43 214	19.71	53 737	19.88	65 866	20.05	79 741	20.20	95 505	20.34	113 299	20.45	133 265	20.54
	50°C	-	-	-	-	48 086	24.38	59 368	24.55	72 271	24.71	86 937	24.86	103 508	24.99	122 124	25.09
	60°C	-	-	-	-	-	-	-	-	63 936	30.25	77 336	30.41	92 516	30.55	109 615	30.67

LEGEND

P.F. cooling capacity (W)
P.A. power input (kW)

TE evaporating temperature (°C)
TC condensing temperature (°C)

RATING CONDITIONS

• 50 Hz • Superheat 11.1 K
• Subcooling 8.3 K

50 Hz

R407C - SINGLE COMPRESSORS

Models	TE	- 20°C		- 15°C		- 10°C		- 5°C		0°C		+ 5°C		+ 10°C		+ 15°C	
	TC	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.
SZ 084	30°C	7 688	3.51	9 833	3.55	12 419	3.58	15 496	3.60	19 113	3.61	23 318	3.60	28 161	3.57	33 691	3.51
	40°C	6 712	4.34	8 725	4.38	11 136	4.42	13 995	4.45	17 350	4.47	21 252	4.47	25 748	4.45	30 888	4.41
	50°C	-	-	-	-	9 687	5.48	12 269	5.52	15 305	5.55	18 844	5.57	22 934	5.56	27 625	5.54
	60°C	-	-	-	-	-	-	-	-	12 973	6.90	16 090	6.93	19 717	6.94	23 901	6.94
SZ 090	30°C	8 150	3.68	10 418	3.72	13 147	3.75	16 389	3.78	20 194	3.78	24 612	3.77	29 694	3.74	35 491	3.68
	40°C	7 112	4.56	9 242	4.61	11 788	4.65	14 801	4.68	18 332	4.69	22 432	4.69	27 151	4.67	32 540	4.62
	50°C	-	-	-	-	10 251	5.78	12 975	5.81	16 171	5.84	19 891	5.85	24 185	5.84	29 104	5.80
	60°C	-	-	-	-	-	-	-	-	13 709	7.28	16 988	7.30	20 796	7.30	25 184	7.28
SZ 100	30°C	8 662	3.90	11 068	3.94	13 957	3.98	17 383	4.00	21 397	4.01	26 053	3.99	31 402	3.96	37 497	3.90
	40°C	7 560	4.85	9 821	4.90	12 518	4.93	15 704	4.96	19 431	4.97	23 752	4.96	28 720	4.94	34 386	4.89
	50°C	-	-	-	-	10 881	6.15	13 763	6.18	17 139	6.20	21 061	6.20	25 583	6.18	30 756	6.14
	60°C	-	-	-	-	-	-	-	-	14 528	7.75	17 988	7.76	21 999	7.75	26 614	7.72
SZ 110	30°C	9 976	4.41	12 730	4.46	16 025	4.49	19 918	4.51	24 465	4.52	29 724	4.51	35 750	4.47	42 602	4.41
	40°C	8 690	5.52	11 282	5.56	14 361	5.60	17 985	5.62	22 210	5.62	27 094	5.61	32 693	5.57	39 064	5.50
	50°C	-	-	-	-	12 478	7.03	15 761	7.05	19 592	7.05	24 029	7.03	29 128	6.99	34 945	6.92
	60°C	-	-	-	-	-	-	-	-	16 615	8.88	20 533	8.85	25 059	8.81	30 252	8.73
SZ 115	30°C	10 821	4.84	13 875	4.87	17 503	4.89	21 764	4.90	26 716	4.91	32 417	4.89	38 924	4.86	46 297	4.81
	40°C	9 412	6.04	12 298	6.07	15 704	6.08	19 689	6.09	24 310	6.08	29 625	6.06	35 693	6.02	42 571	5.96
	50°C	-	-	-	-	13 563	7.70	17 197	7.70	21 413	7.68	26 269	7.65	31 823	7.60	38 133	7.53
	60°C	-	-	-	-	-	-	-	-	17 984	9.81	22 307	9.77	27 273	9.70	32 940	9.62
SZ 120	30°C	11 711	5.08	14 925	5.13	18 754	5.17	23 262	5.19	28 511	5.20	34 564	5.18	41 484	5.15	49 333	5.08
	40°C	10 177	6.40	13 205	6.44	16 789	6.47	20 989	6.49	25 871	6.48	31 495	6.45	37 926	6.40	45 225	6.31
	50°C	-	-	-	-	14 583	8.19	18 394	8.19	22 825	8.17	27 939	8.12	33 798	8.05	40 465	7.94
	60°C	-	-	-	-	-	-	-	-	19 367	10.35	23 888	10.29	29 093	10.20	35 046	10.07
SZ 125	30°C	11 514	5.11	14 763	5.14	18 623	5.16	23 156	5.17	28 424	5.17	34 489	5.16	41 411	5.13	49 254	5.07
	40°C	10 010	6.37	13 081	6.40	16 705	6.41	20 944	6.42	25 860	6.41	31 514	6.39	37 969	6.35	45 286	6.28
	50°C	-	-	-	-	14 428	8.12	18 295	8.12	22 780	8.10	27 946	8.07	33 854	8.01	40 566	7.94
	60°C	-	-	-	-	-	-	-	-	19 134	10.34	23 732	10.30	29 016	10.23	35 045	10.14
SZ 160	30°C	15 113	6.63	19 257	6.72	24 219	6.80	30 084	6.86	36 941	6.91	44 876	6.93	53 977	6.92	64 330	6.88
	40°C	13 315	8.21	17 217	8.30	21 856	8.38	27 321	8.45	33 698	8.50	41 074	8.53	49 537	8.52	59 173	8.49
	50°C	-	-	-	-	19 164	10.38	24 121	10.45	29 910	10.50	36 620	10.54	44 338	10.54	53 150	10.52
	60°C	-	-	-	-	-	-	-	-	25 559	13.01	31 496	13.05	38 361	13.06	46 242	13.04
SZ 175	30°C	16 466	7.14	20 944	7.22	26 279	7.28	32 558	7.34	39 868	7.38	48 296	7.39	57 930	7.39	68 857	7.35
	40°C	14 429	8.89	18 648	8.97	23 637	9.04	29 486	9.10	36 281	9.15	44 110	9.17	53 060	9.18	63 218	9.15
	50°C	-	-	-	-	20 623	11.30	25 928	11.37	32 093	11.42	39 208	11.46	47 358	11.47	56 633	11.46
	60°C	-	-	-	-	-	-	-	-	27 284	14.32	33 569	14.36	40 806	14.39	49 081	14.39
SZ 185	30°C	17 693	7.67	22 504	7.76	28 237	7.83	34 983	7.89	42 837	7.93	51 893	7.95	62 245	7.94	73 985	7.90
	40°C	15 504	9.56	20 036	9.65	25 397	9.72	31 682	9.79	38 983	9.84	47 395	9.87	57 011	9.87	67 925	9.84
	50°C	-	-	-	-	22 159	12.15	27 858	12.23	34 483	12.28	42 127	12.32	50 885	12.34	60 849	12.33
	60°C	-	-	-	-	-	-	-	-	29 315	15.39	36 069	15.44	43 845	15.47	52 736	15.48

LEGEND

P.F. cooling capacity (W)
P.A. power input (kW)

TE evaporating temperature (°C) (dew point)
TC condensing temperature (°C) (dew point)

RATING CONDITIONS

• 50 Hz • Superheat 11.1 K
• Subcooling 8.3 K

50 Hz

R407C - TANDEM UNITS

Models	TE	- 20°C		- 15°C		- 10°C		- 5°C		0°C		+ 5°C		+ 10°C		+ 15°C	
	TC	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.
SZ 180	30°C	16 055	7.35	20 523	7.44	25 900	7.50	32 286	7.55	39 781	7.56	48 485	7.54	58 497	7.47	69 918	7.36
	40°C	14 010	9.12	18 206	9.21	23 222	9.29	29 159	9.35	36 115	9.38	44 191	9.37	53 487	9.33	64 103	9.24
	50°C	-	-	-	-	20 194	11.55	25 560	11.62	31 857	11.67	39 185	11.68	47 645	11.66	57 335	11.60
	60°C	-	-	-	-	-	-	-	-	27 006	14.54	33 466	14.58	40 968	14.59	49 612	14.56
SZ 200	30°C	17 065	7.79	21 804	7.88	27 496	7.95	34 244	7.99	42 152	8.01	51 324	7.98	61 862	7.91	73 870	7.80
	40°C	14 893	9.69	19 347	9.78	24 660	9.86	30 936	9.91	38 279	9.93	46 792	9.92	56 578	9.87	67 741	9.77
	50°C	-	-	-	-	21 435	12.30	27 112	12.36	33 763	12.39	41 491	12.40	50 398	12.36	60 589	12.27
	60°C	-	-	-	-	-	-	-	-	28 621	15.50	35 436	15.52	43 338	15.50	52 430	15.43
SZ 220	30°C	19 653	8.82	25 079	8.91	31 570	8.98	39 238	9.02	48 196	9.04	58 555	9.01	70 428	8.94	83 926	8.81
	40°C	17 120	11.03	22 225	11.12	28 292	11.19	35 431	11.23	43 754	11.24	53 375	11.21	64 405	11.13	76 955	11.00
	50°C	-	-	-	-	24 582	14.05	31 049	14.09	38 597	14.09	47 337	14.05	57 382	13.97	68 843	13.83
	60°C	-	-	-	-	-	-	-	-	32 733	17.74	40 450	17.70	49 367	17.60	59 596	17.46
SZ 230	30°C	21 318	9.68	27 333	9.73	34 481	9.78	42 875	9.80	52 631	9.80	63 861	9.78	76 681	9.72	91 204	9.61
	40°C	18 541	12.08	24 227	12.13	30 938	12.16	38 788	12.17	47 891	12.16	58 362	12.12	70 315	12.04	83 865	11.92
	50°C	-	-	-	-	26 718	15.39	33 878	15.39	42 184	15.36	51 751	15.30	62 692	15.19	75 122	15.05
	60°C	-	-	-	-	-	-	-	-	35 428	19.61	43 944	19.52	53 728	19.40	64 893	19.22
SZ 242	30°C	23 070	10.16	29 401	10.25	36 946	10.33	45 827	10.38	56 167	10.39	68 092	10.36	81 723	10.28	97 185	10.15
	40°C	20 049	12.80	26 015	12.88	33 074	12.93	41 349	12.96	50 965	12.95	62 046	12.90	74 714	12.79	89 093	12.62
	50°C	-	-	-	-	28 728	16.36	36 236	16.36	44 966	16.33	55 040	16.24	66 582	16.09	79 716	15.88
	60°C	-	-	-	-	-	-	-	-	38 154	20.70	47 059	20.57	57 314	20.38	69 041	20.12
SZ 250	30°C	22 683	10.21	29 083	10.27	36 687	10.31	45 617	10.34	55 995	10.34	67 942	10.31	81 581	10.24	97 031	10.14
	40°C	19 720	12.73	25 769	12.78	32 909	12.82	41 260	12.83	50 944	12.82	62 083	12.78	74 799	12.69	89 214	12.56
	50°C	-	-	-	-	28 423	16.23	36 040	16.22	44 877	16.19	55 053	16.13	66 693	16.02	79 916	15.87
	60°C	-	-	-	-	-	-	-	-	37 693	20.67	46 753	20.58	57 161	20.45	69 038	20.27
SZ 310	30°C	28 769	12.78	36 708	12.89	46 157	12.99	57 267	13.06	70 192	13.10	85 086	13.11	102 101	13.07	121 391	12.98
	40°C	25 131	15.93	32 620	16.04	41 471	16.14	51 836	16.21	63 870	16.25	77 725	16.26	93 555	16.22	111 513	16.13
	50°C	-	-	-	-	36 038	20.27	45 460	20.34	56 404	20.39	69 022	20.39	83 468	20.35	99 895	20.26
	60°C	-	-	-	-	-	-	-	-	47 722	25.74	58 904	25.74	71 767	25.70	86 464	25.62
SZ 320	30°C	29 773	13.26	37 937	13.44	47 710	13.59	59 266	13.72	72 773	13.81	88 406	13.85	106 335	13.83	126 731	13.75
	40°C	26 231	16.41	33 917	16.59	43 057	16.76	53 822	16.89	66 384	16.99	80 915	17.04	97 587	17.04	116 570	16.97
	50°C	-	-	-	-	37 753	20.74	47 517	20.89	58 923	21.00	72 142	21.06	87 346	21.07	104 706	21.02
	60°C	-	-	-	-	-	-	-	-	50 350	26.00	62 046	26.08	75 571	26.10	91 096	26.07
SZ 350	30°C	32 438	14.27	41 260	14.42	51 770	14.56	64 139	14.67	78 539	14.74	95 143	14.78	114 122	14.77	135 648	14.70
	40°C	28 426	17.77	36 736	17.93	46 565	18.07	58 088	18.19	71 474	18.28	86 897	18.34	104 528	18.34	124 539	18.30
	50°C	-	-	-	-	40 628	22.59	51 077	22.73	63 224	22.83	77 239	22.91	93 296	22.93	111 566	22.91
	60°C	-	-	-	-	-	-	-	-	53 749	28.62	66 131	28.71	80 388	28.77	96 690	28.77
SZ 370	30°C	34 854	15.34	44 334	15.50	55 626	15.65	68 916	15.76	84 389	15.85	102 229	15.89	122 622	15.87	145 751	15.80
	40°C	30 543	19.11	39 471	19.28	50 033	19.44	62 413	19.57	76 796	19.66	93 368	19.72	112 311	19.73	133 813	19.68
	50°C	-	-	-	-	43 653	24.29	54 880	24.44	67 931	24.55	82 990	24.63	100 243	24.66	119 873	24.64
	60°C	-	-	-	-	-	-	-	-	57 751	30.77	71 056	30.87	86 374	30.93	103 891	30.93

LEGEND

P.F. cooling capacity (W)
P.A. power input (kW)

TE evaporating temperature (°C) (dew point)
TC condensing temperature (°C) (dew point)

RATING CONDITIONS

- 50 Hz • Superheat 11.1 K
- Subcooling 8.3 K

50 Hz

R134a - SINGLE COMPRESSORS

Models	TE	- 20°C		- 15°C		- 10°C		- 5°C		0°C		+ 5°C		+ 10°C		+ 15°C	
	TC	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.
SZ 084	30°C	-	-	6 554	2.51	8 408	2.52	10 590	2.52	13 131	2.51	16 062	2.48	19 414	2.43	23 219	2.37
	40°C	-	-	5 781	3.08	7 532	3.09	9 584	3.09	11 969	3.09	14 717	3.06	17 860	3.02	21 429	2.96
	50°C	-	-	4 953	3.82	6 567	3.84	8 457	3.85	10 652	3.84	13 184	3.83	16 084	3.79	19 384	3.74
	60°C	-	-	-	-	-	-	7 227	4.81	9 199	4.81	11 482	4.80	14 106	4.78	17 104	4.73
SZ 090	30°C	-	-	7 098	2.64	9 052	2.65	11 344	2.66	14 002	2.65	17 059	2.62	20 544	2.58	24 489	2.53
	40°C	-	-	6 336	3.26	8 179	3.28	10 331	3.29	12 821	3.28	15 682	3.27	18 943	3.24	22 634	3.19
	50°C	-	-	5 485	4.05	7 181	4.07	9 158	4.08	11 445	4.09	14 073	4.08	17 074	4.06	20 476	4.02
	60°C	-	-	-	-	-	-	7 843	5.08	9 890	5.09	12 251	5.09	14 955	5.08	18 033	5.05
SZ 100	30°C	-	-	7 716	2.79	9 783	2.80	12 196	2.81	14 986	2.80	18 183	2.79	21 818	2.76	25 919	2.71
	40°C	-	-	6 950	3.47	8 896	3.49	11 159	3.50	13 768	3.50	16 754	3.49	20 146	3.47	23 974	3.44
	50°C	-	-	6 079	4.30	7 866	4.33	9 940	4.35	12 330	4.36	15 066	4.36	18 177	4.35	21 694	4.33
	60°C	-	-	-	-	-	-	8 537	5.37	10 668	5.39	13 115	5.41	15 907	5.41	19 075	5.40
SZ 110	30°C	-	-	8 681	3.14	11 005	3.16	13 735	3.18	16 908	3.18	20 562	3.17	24 735	3.14	29 464	3.10
	40°C	-	-	7 788	3.90	9 980	3.92	12 543	3.94	15 516	3.94	18 936	3.94	22 841	3.92	27 268	3.88
	50°C	-	-	6 781	4.84	8 797	4.87	11 151	4.89	13 881	4.90	17 024	4.90	20 618	4.89	24 701	4.86
	60°C	-	-	-	-	-	-	9 565	6.06	12 009	6.08	14 832	6.09	18 073	6.09	21 768	6.07
SZ 115	30°C	-	-	9 556	3.43	12 156	3.43	15 189	3.43	18 692	3.42	22 703	3.39	27 261	3.35	32 403	3.29
	40°C	-	-	8 478	4.23	10 944	4.24	13 808	4.25	17 107	4.24	20 881	4.23	25 167	4.19	30 003	4.14
	50°C	-	-	7 305	5.25	9 593	5.27	12 244	5.28	15 298	5.29	18 791	5.28	22 761	5.26	27 248	5.22
	60°C	-	-	-	-	-	-	10 513	6.57	13 277	6.58	16 446	6.59	20 059	6.58	24 153	6.55
SZ 120	30°C	-	-	9 958	3.61	12 622	3.64	15 770	3.66	19 448	3.67	23 704	3.67	28 586	3.65	34 141	3.62
	40°C	-	-	8 890	4.47	11 405	4.50	14 364	4.52	17 816	4.53	21 808	4.52	26 388	4.51	31 603	4.48
	50°C	-	-	7 705	5.56	10 022	5.59	12 746	5.61	15 924	5.62	19 604	5.62	23 834	5.60	28 660	5.57
	60°C	-	-	-	-	-	-	10 922	6.98	13 779	6.99	17 098	6.99	20 930	6.97	25 320	6.94
SZ 125	30°C	-	-	10 182	3.65	12 952	3.66	16 183	3.66	19 915	3.64	24 189	3.61	29 045	3.57	34 523	3.50
	40°C	-	-	9 031	4.51	11 658	4.52	14 709	4.53	18 224	4.52	22 245	4.50	26 811	4.46	31 963	4.41
	50°C	-	-	7 782	5.59	10 220	5.61	13 045	5.63	16 298	5.63	20 019	5.62	24 249	5.60	29 030	5.56
	60°C	-	-	-	-	-	-	11 202	6.99	14 146	7.01	17 523	7.01	21 372	7.01	25 734	6.98
SZ 160	30°C	-	-	13 127	4.79	16 693	4.85	20 885	4.90	25 765	4.93	31 391	4.95	37 823	4.93	45 122	4.89
	40°C	-	-	11 660	5.79	15 033	5.86	18 984	5.91	23 573	5.95	28 858	5.98	34 902	5.98	41 763	5.95
	50°C	-	-	10 112	7.07	13 231	7.14	16 878	7.21	21 114	7.26	25 998	7.29	31 591	7.31	37 952	7.30
	60°C	-	-	-	-	-	-	14 595	8.83	18 417	8.89	22 838	8.94	27 918	8.97	33 717	8.97
SZ 175	30°C	-	-	13 948	5.19	17 736	5.26	22 191	5.31	27 375	5.35	33 353	5.36	40 188	5.35	47 944	5.31
	40°C	-	-	12 390	6.28	15 974	6.35	20 172	6.41	25 047	6.45	30 664	6.48	37 085	6.48	44 375	6.45
	50°C	-	-	10 745	7.66	14 058	7.74	17 934	7.81	22 434	7.87	27 624	7.90	33 566	7.92	40 325	7.91
	60°C	-	-	-	-	-	-	15 508	9.57	19 568	9.64	24 265	9.69	29 663	9.72	35 825	9.73
SZ 185	30°C	-	-	14 845	5.53	18 877	5.60	23 618	5.65	29 136	5.69	35 498	5.70	42 773	5.69	51 027	5.64
	40°C	-	-	13 185	6.68	16 999	6.76	21 467	6.82	26 656	6.87	32 633	6.89	39 468	6.89	47 226	6.86
	50°C	-	-	11 435	8.15	14 962	8.24	19 086	8.31	23 876	8.37	29 400	8.41	35 724	8.43	42 917	8.41
	60°C	-	-	-	-	-	-	16 506	10.18	20 827	10.25	25 827	10.31	31 571	10.34	38 129	10.35

LEGEND

P.F. cooling capacity (W)
P.A. power input (kW)

TE evaporating temperature (°C)
TC condensing temperature (°C)

RATING CONDITIONS

• 50 Hz • Superheat 11.1 K
• Subcooling 8.3 K

50 Hz

R134a - TANDEM UNITS

Models	TE	- 20°C		- 15°C		- 10°C		- 5°C		0°C		+ 5°C		+ 10°C		+ 15°C	
	TC	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.	P.F.	P.A.
SZ 180	30°C	-	-	13 983	5.28	17 833	5.30	22 347	5.31	27 585	5.29	33 606	5.24	40 473	5.17	48 244	5.05
	40°C	-	-	12 481	6.52	16 112	6.55	20 351	6.57	25 258	6.56	30 893	6.53	37 317	6.47	44 590	6.37
	50°C	-	-	10 806	8.09	14 148	8.14	18 041	8.16	22 547	8.17	27 725	8.15	33 635	8.11	40 339	8.03
	60°C	-	-	-	-	-	-	15 451	10.15	19 484	10.17	24 134	10.17	29 461	10.15	35 525	10.09
SZ 200	30°C	-	-	15 201	5.57	19 272	5.60	24 026	5.61	29 523	5.60	35 821	5.57	42 981	5.51	51 061	5.41
	40°C	-	-	13 691	6.93	17 525	6.97	21 983	6.99	27 123	7.00	33 004	6.99	39 687	6.94	47 230	6.87
	50°C	-	-	11 975	8.60	15 497	8.65	19 582	8.69	24 290	8.72	29 679	8.72	35 809	8.70	42 738	8.65
	60°C	-	-	-	-	-	-	16 817	10.74	21 016	10.78	25 837	10.81	31 338	10.82	37 578	10.80
SZ 220	30°C	-	-	17 102	6.28	21 680	6.32	27 058	6.35	33 309	6.35	40 508	6.33	48 728	6.28	58 044	6.20
	40°C	-	-	15 343	7.79	19 660	7.84	24 710	7.87	30 567	7.88	37 304	7.87	44 996	7.83	53 717	7.76
	50°C	-	-	13 358	9.68	17 330	9.74	21 968	9.78	27 346	9.80	33 538	9.80	40 618	9.78	48 660	9.72
	60°C	-	-	-	-	-	-	18 842	12.12	23 658	12.16	29 220	12.17	35 604	12.16	42 883	12.13
SZ 230	30°C	-	-	18 825	6.85	23 948	6.87	29 922	6.86	36 823	6.84	44 725	6.78	53 704	6.69	63 835	6.57
	40°C	-	-	16 702	8.46	21 560	8.48	27 201	8.50	33 701	8.48	41 136	8.45	49 579	8.38	59 106	8.28
	50°C	-	-	14 390	10.49	18 898	10.53	24 121	10.56	30 136	10.57	37 018	10.55	44 840	10.51	53 679	10.43
	60°C	-	-	-	-	-	-	20 711	13.13	26 156	13.16	32 399	13.16	39 516	13.15	47 582	13.10
SZ 242	30°C	-	-	19 618	7.22	24 866	7.28	31 067	7.32	38 312	7.34	46 697	7.33	56 314	7.30	67 258	7.23
	40°C	-	-	17 513	8.93	22 467	8.99	28 298	9.03	35 098	9.05	42 963	9.04	51 985	9.01	62 258	8.95
	50°C	-	-	15 179	11.11	19 744	11.17	25 110	11.21	31 371	11.23	38 620	11.23	46 952	11.20	56 461	11.13
	60°C	-	-	-	-	-	-	21 517	13.94	27 144	13.97	33 684	13.97	41 231	13.94	49 880	13.87
SZ 250	30°C	-	-	20 058	7.29	25 516	7.31	31 881	7.31	39 233	7.28	47 652	7.22	57 218	7.13	68 010	7.00
	40°C	-	-	17 791	9.01	22 967	9.04	28 977	9.05	35 902	9.04	43 822	9.00	52 817	8.92	62 967	8.82
	50°C	-	-	15 331	11.18	20 133	11.22	25 698	11.25	32 106	11.26	39 437	11.24	47 771	11.19	57 188	11.11
	60°C	-	-	-	-	-	-	22 067	13.98	27 868	14.01	34 520	14.02	42 102	14.00	50 695	13.95
SZ 310	30°C	-	-	24 651	9.17	31 352	9.25	39 205	9.31	48 316	9.33	58 792	9.32	70 740	9.26	84 267	9.14
	40°C	-	-	21 883	11.18	28 228	11.28	35 634	11.35	44 207	11.39	54 055	11.39	65 284	11.36	78 001	11.27
	50°C	-	-	18 929	13.74	24 804	13.85	31 649	13.94	39 571	14.00	48 677	14.03	59 074	14.03	70 867	13.97
	60°C	-	-	-	-	-	-	27 292	17.17	34 449	17.26	42 699	17.32	52 149	17.35	62 905	17.33
SZ 320	30°C	-	-	25 860	9.58	32 885	9.70	41 144	9.80	50 756	9.86	61 840	9.89	74 512	9.86	88 891	9.78
	40°C	-	-	22 971	11.57	29 616	11.71	37 399	11.82	46 438	11.90	56 851	11.94	68 757	11.94	82 273	11.89
	50°C	-	-	19 921	14.13	26 065	14.27	33 250	14.40	41 594	14.51	51 216	14.58	62 234	14.60	74 765	14.58
	60°C	-	-	-	-	-	-	28 753	17.64	36 281	17.77	44 990	17.87	54 998	17.93	66 423	17.94
SZ 350	30°C	-	-	27 477	10.38	34 940	10.51	43 716	10.62	53 930	10.69	65 706	10.71	79 171	10.69	94 449	10.60
	40°C	-	-	24 409	12.55	31 469	12.69	39 739	12.81	49 343	12.90	60 408	12.95	73 058	12.95	87 419	12.89
	50°C	-	-	21 167	15.31	27 695	15.47	35 329	15.61	44 196	15.72	54 419	15.80	66 126	15.83	79 440	15.81
	60°C	-	-	-	-	-	-	30 550	19.12	38 549	19.26	47 803	19.36	58 437	19.43	70 576	19.44
SZ 370	30°C	-	-	29 245	11.05	37 188	11.18	46 528	11.30	57 398	11.37	69 932	11.40	84 262	11.37	100 523	11.28
	40°C	-	-	25 975	13.35	33 489	13.50	42 290	13.63	52 512	13.72	64 288	13.78	77 751	13.78	93 035	13.72
	50°C	-	-	22 527	16.29	29 475	16.46	37 600	16.61	47 036	16.73	57 917	16.81	70 376	16.84	84 547	16.82
	60°C	-	-	-	-	-	-	32 516	20.34	41 030	20.49	50 878	20.60	62 196	20.67	75 115	20.68

LEGEND

P.F. cooling capacity (W)
P.A. power input (kW)

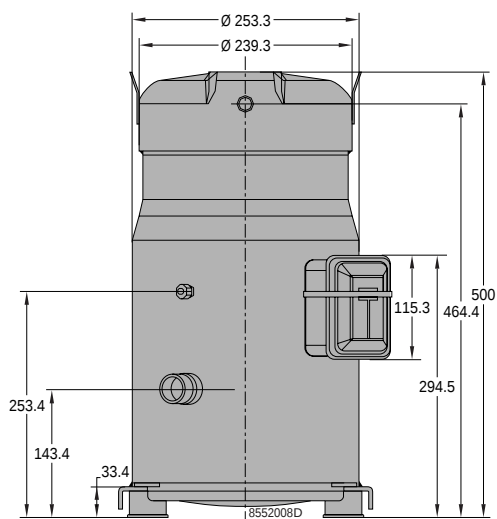
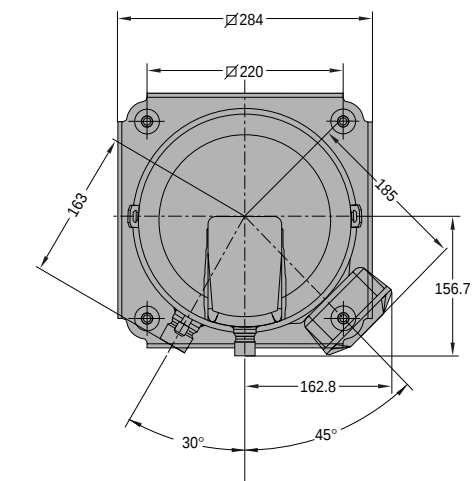
TE evaporating temperature (°C)
TC condensing temperature (°C)

RATING CONDITIONS

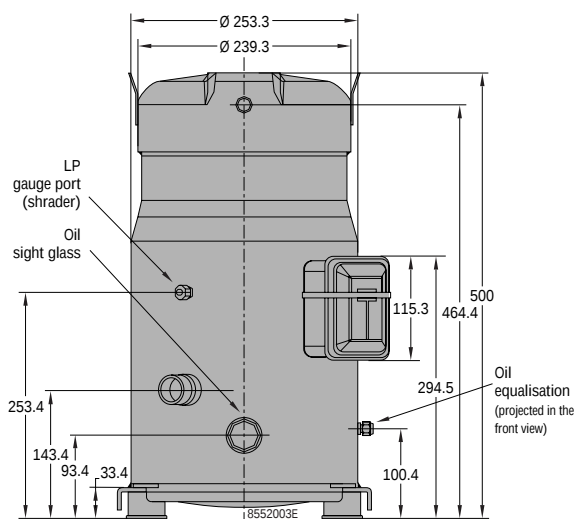
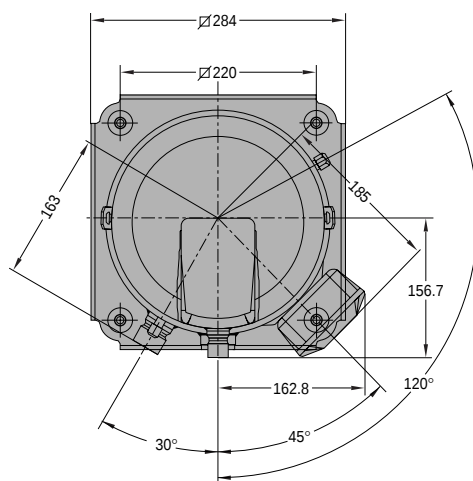
• 50 Hz • Superheat 11.1 K
• Subcooling 8.3 K

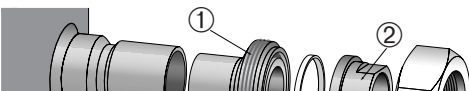
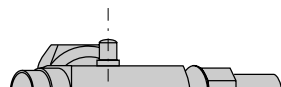
SM-SZ 084 / 090 / 100

Version B



Version V

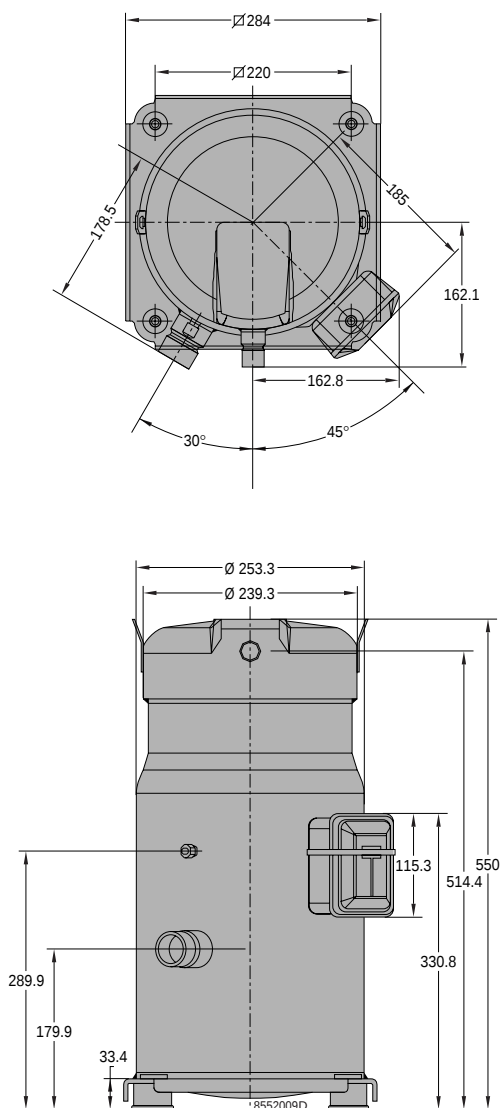


	Version B & V	Accessories				
						
	Tube ODF	Rotolock ①	Adapter ODF ②	Adapter ODF ②	Valve set ODF	Valve ODF
SUCTION	1" 1/8	1" 3/4	1" 1/8	7/8" 1" 3/8	1" 1/8	1" 3/8
DISCHARGE	3/4"	1" 1/4	3/4"	5/8" 7/8"	3/4"	7/8"
		Ref. 77 65 005		Optional size	Ref. 77 03 009	Optional size

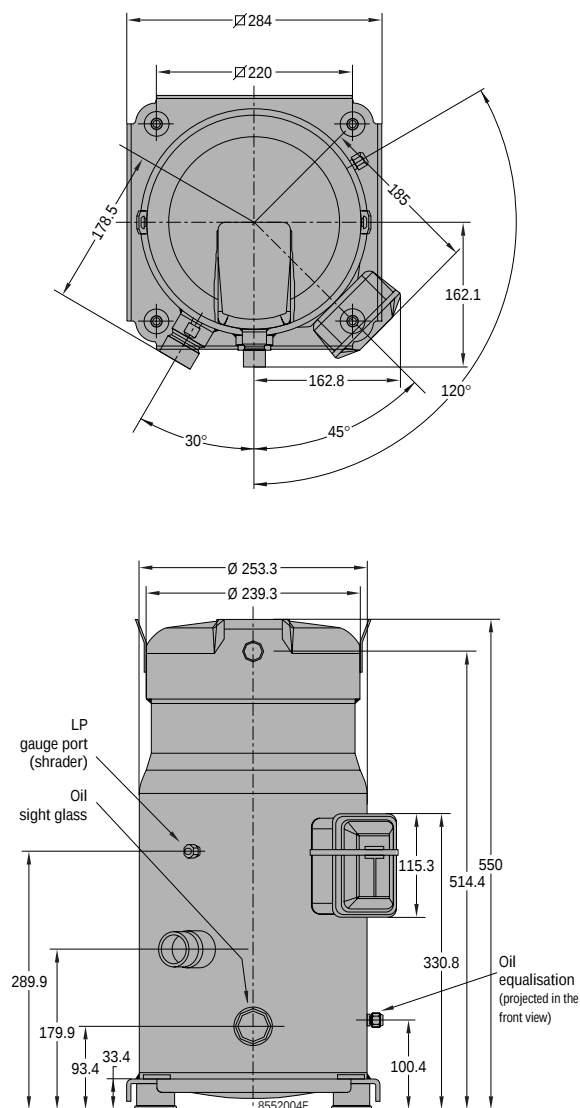
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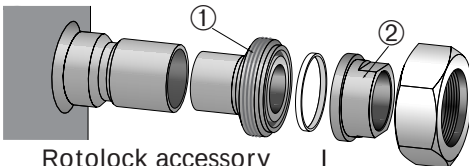
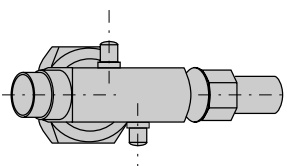
SM-SZ 110 / 120

Version B



Version V

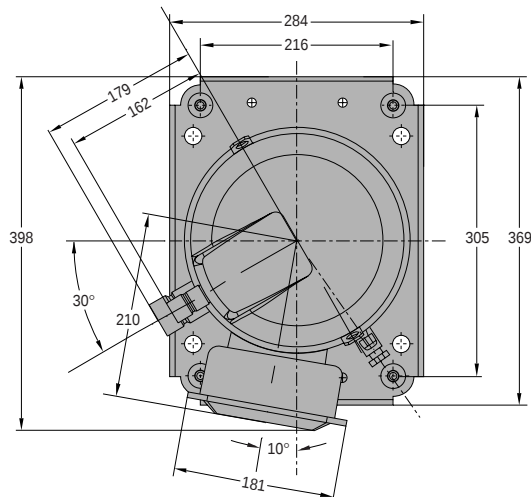


	Version B & V		Accessories			
						
	Tube ODF		Rotolock ①	Adapter ODF ②	Adapter ODF ②	Valve set ODF
SUCTION	1" 3/8		1" 3/4	1" 1/8	1" 3/8	1" 1/8
DISCHARGE	7/8"		1" 1/4	3/4"	7/8"	3/4"
			Ref. 77 65 006		Optional size	Ref. 77 03 009
						Optional size

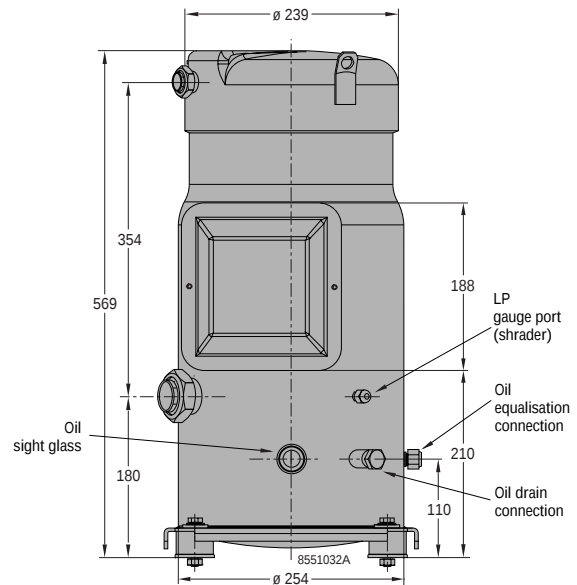
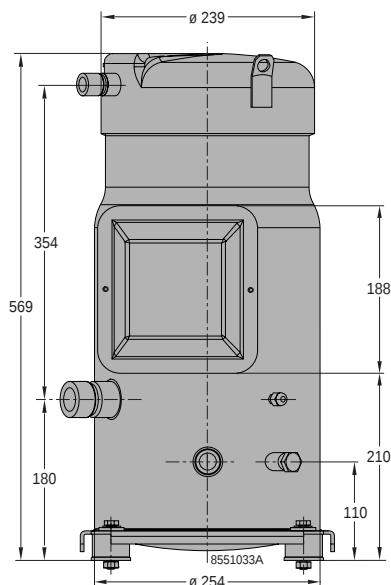
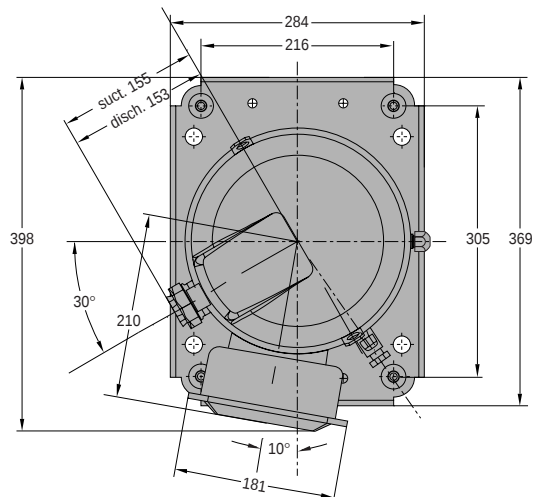
50 Hz

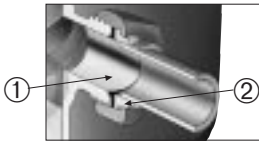
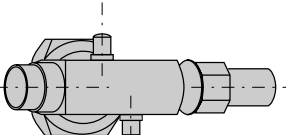
SM-SZ 115 / 125

Version B



Version R

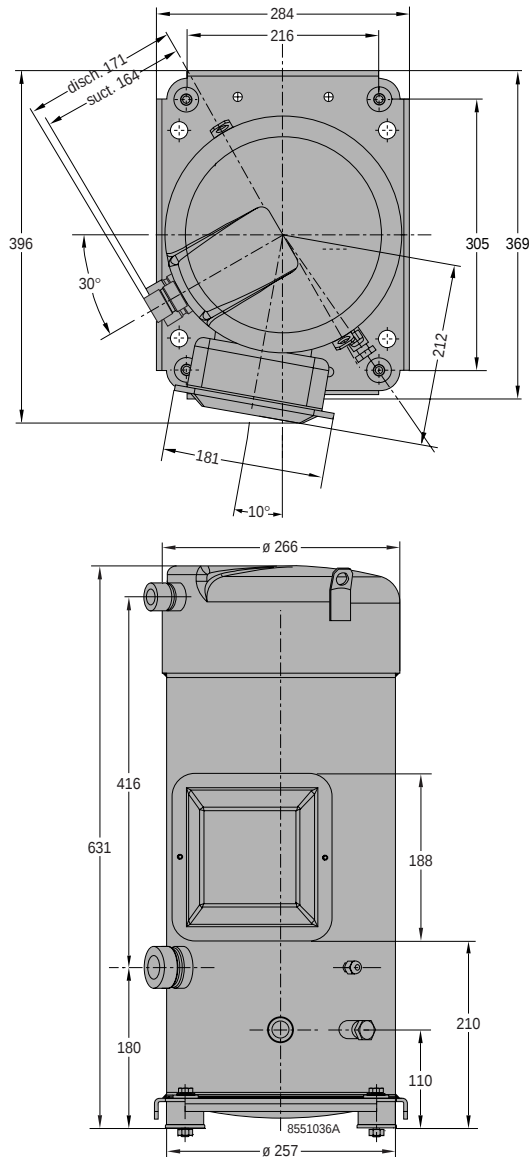


	Version B	Version R		Accessories	
					
	Tube ODF	Standard arrangement		Optional size	Optional size
SUCTION	1" 3/8	Rotolock ①	Adapter ②	Adapter ②	Valve set ODF
DISCHARGE	7/8"	1" 3/4	1" 1/8	1" 3/8	1" 3/8
		1" 1/4	3/4"	7/8"	3/4"
					7/8"
					Ref. 77 03 009

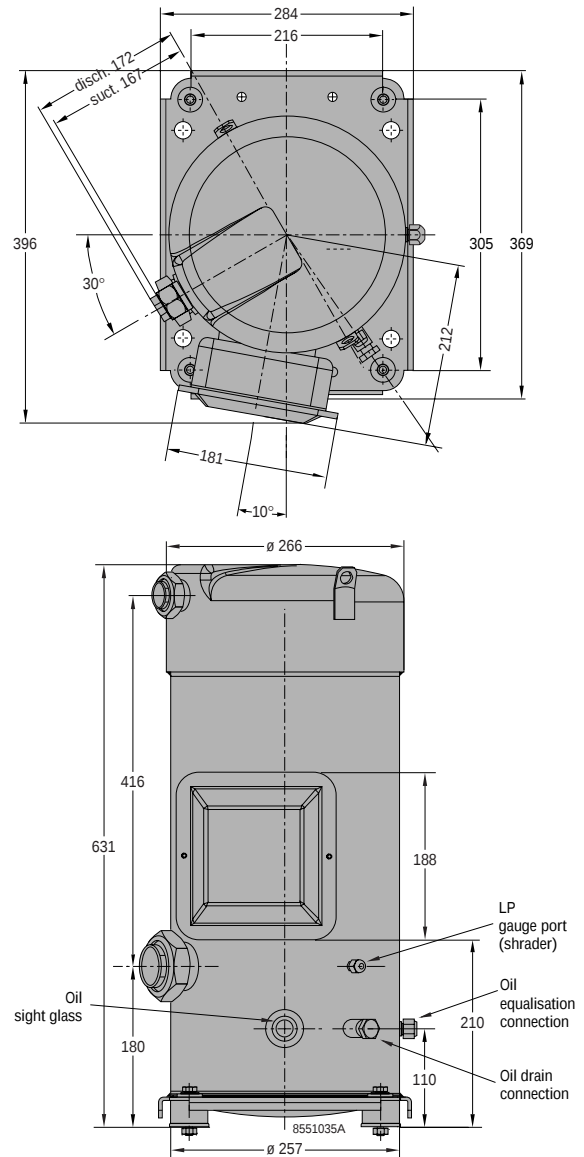
50 Hz

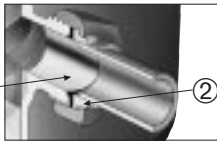
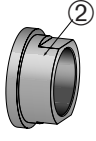
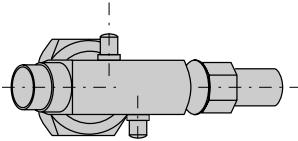
SM-SZ 160

Version B



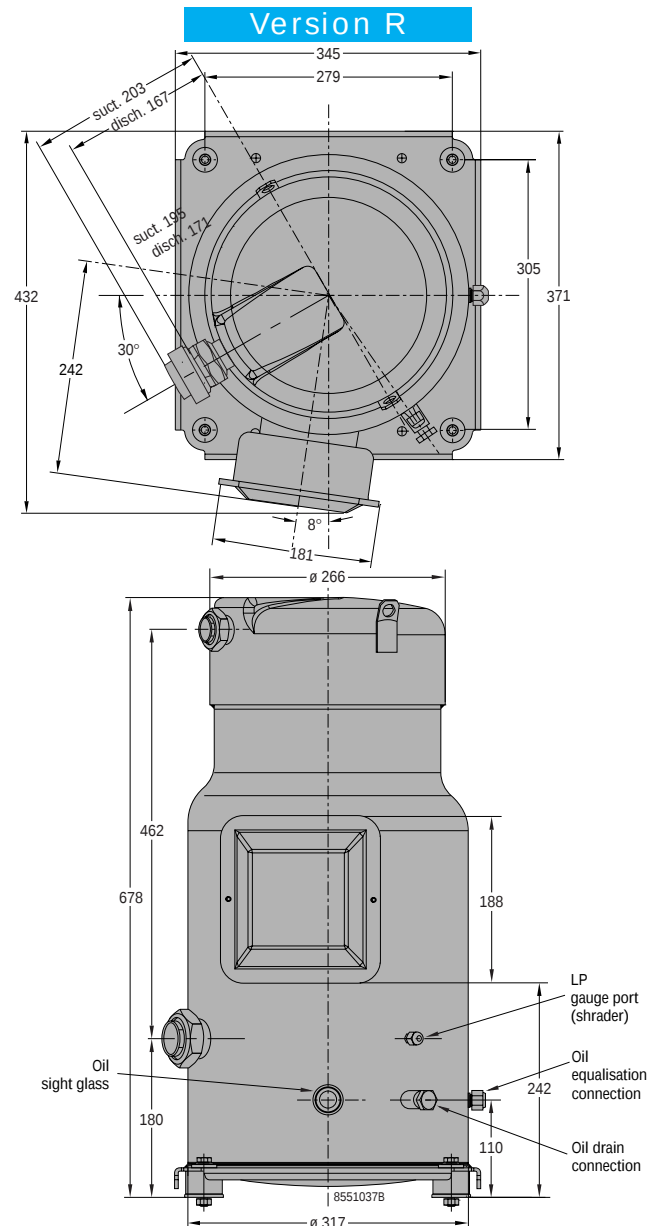
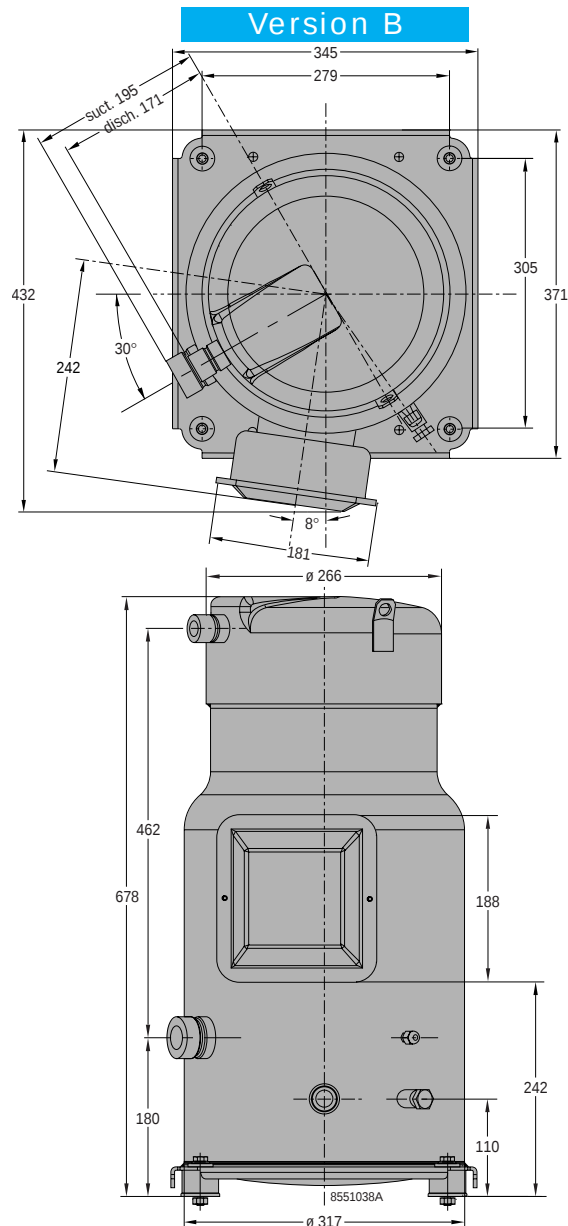
Version R

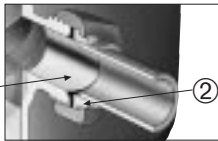
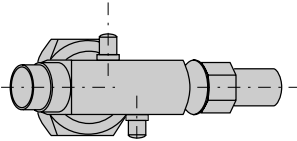


	Version B	Version R		Accessories	
					
	Tube ODF	Standard arrangement		Optional size	Optional size
		Rotolock ①	Adapter ② ODF	Adapter ② ODF	Valve set ODF
SUCTION	1" 5/8	2" 1/4	1" 3/8	1" 5/8	1" 5/8
DISCHARGE	1" 1/8	1" 3/4	7/8"	1" 1/8	1" 1/8
				Ref. 77 03 010	

50 Hz

SM-SZ 175 / 185

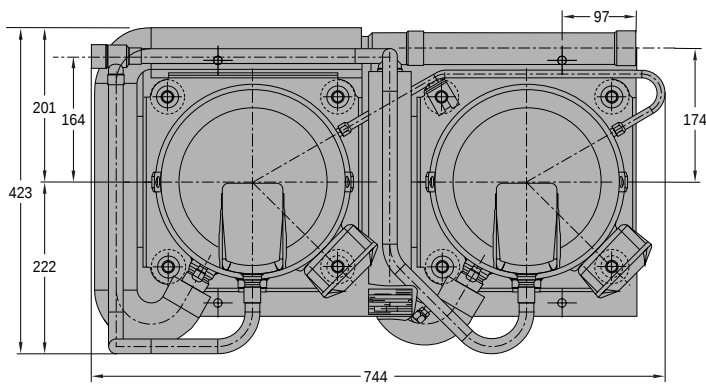


	Version B	Version R		Accessories	
					
	Tube ODF	Standard arrangement		Optional size	Optional size
SUCTION	1" 5/8	Rotolock ①	Adapter ② ODF	Adapter ② ODF	Valve set ODF
DISCHARGE	1" 1/8	2" 1/4	1" 3/8	1" 5/8	1" 5/8
		1" 3/4	7/8"	1" 1/8	1" 1/8
					Ref. 77 03 010

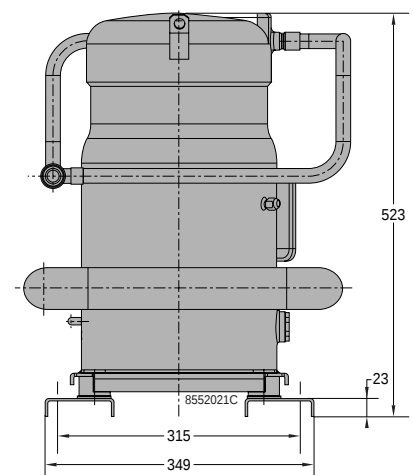
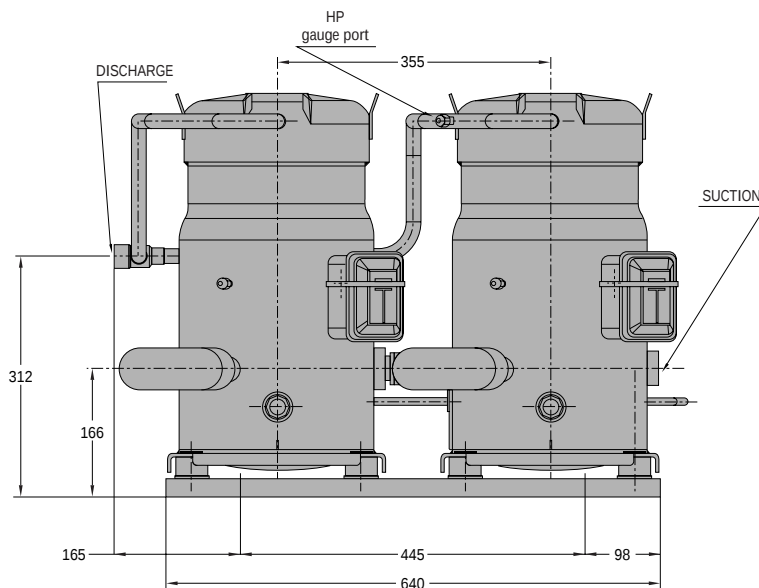
50 Hz

SM-SZ 180 / 200

TANDEM UNITS

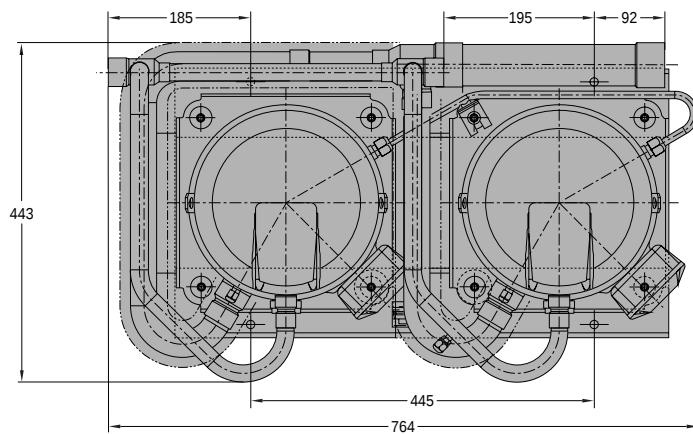


	Tube ODF
SUCTION	1" 5/8
DISCHARGE	1" 1/8



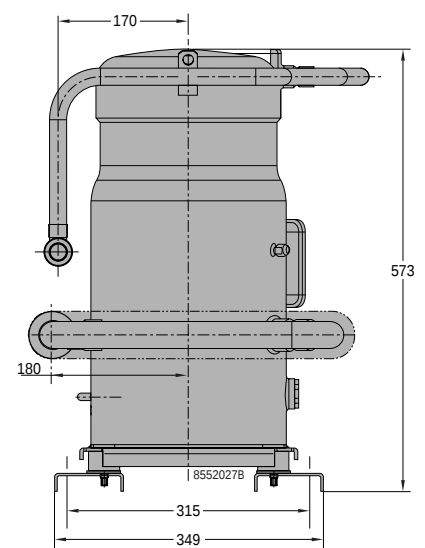
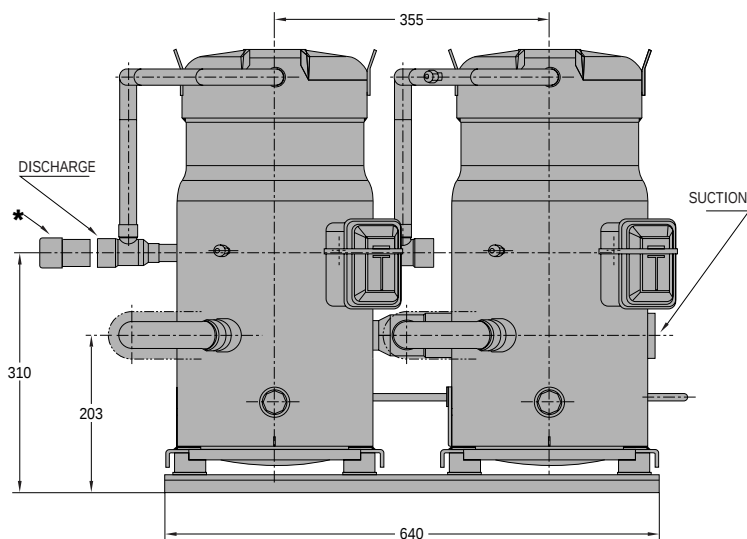
50 Hz

SM-SZ 220 / 242



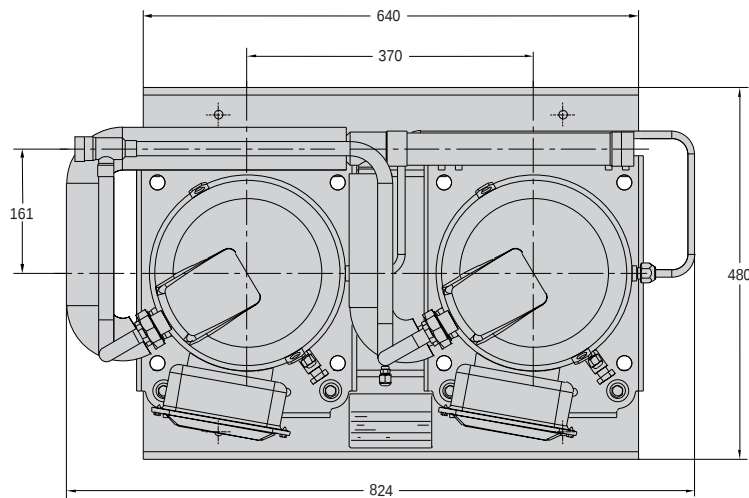
	Tube ODF
SUCTION	2" 1/8
DISCHARGE	1" 3/8

* Right or left brazed cap

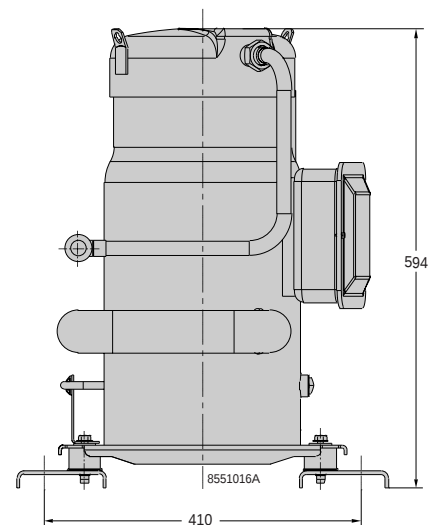
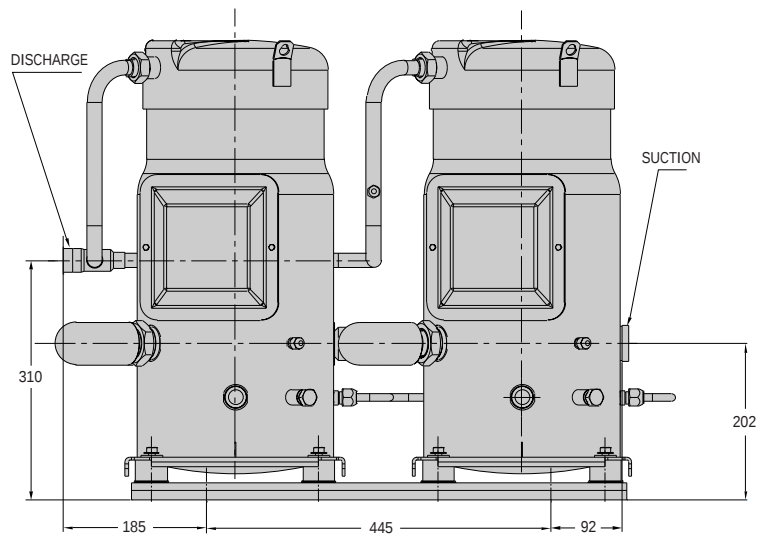


50 Hz

SM-SZ 230 / 250

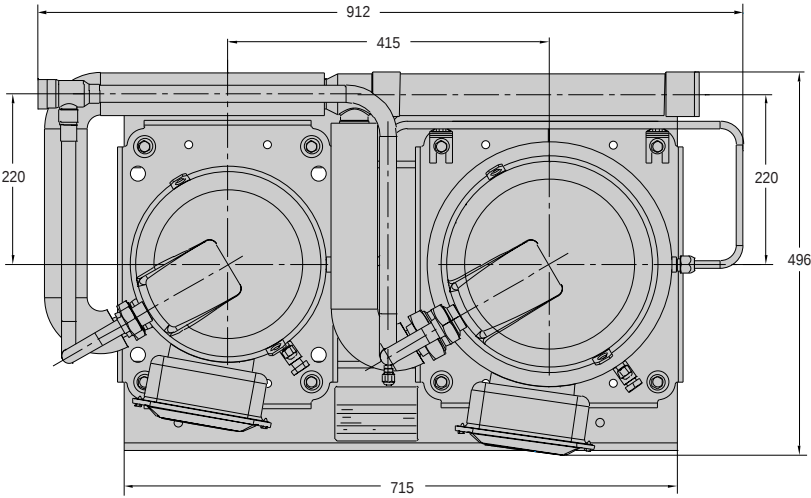


	Tube ODF
SUCTION	1" 5/8
DISCHARGE	1" 1/8

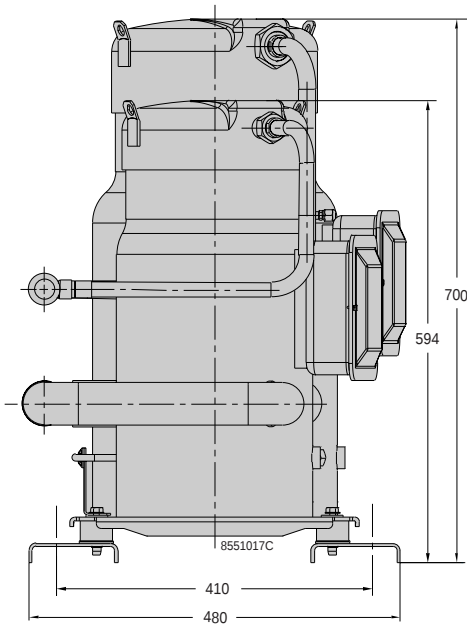
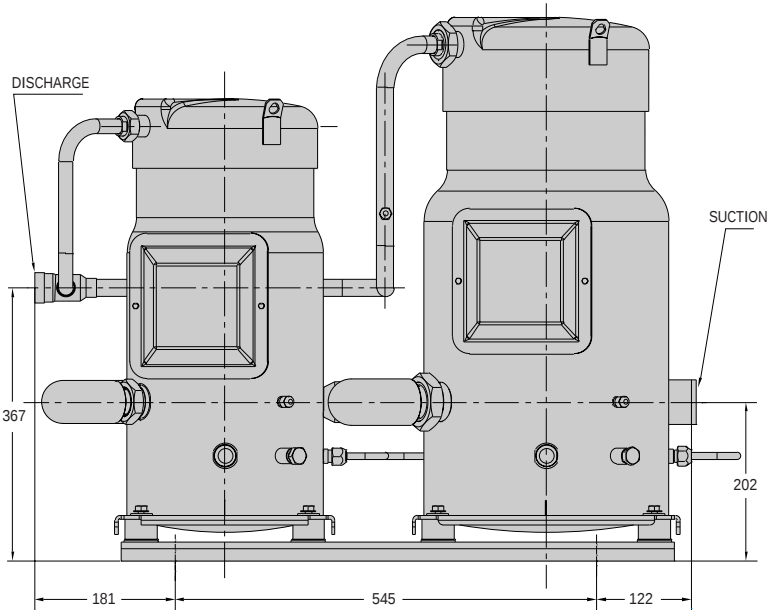


50 Hz

SM-SZ 310

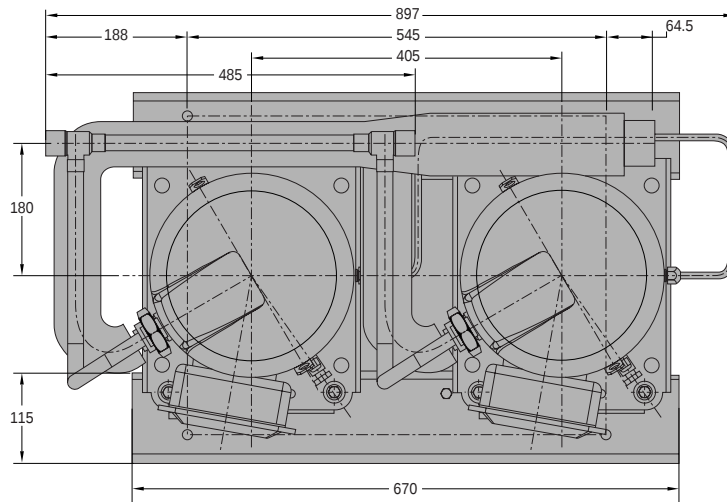


	Tube ODF
SUCTION	2" 1/8
DISCHARGE	1" 1/8



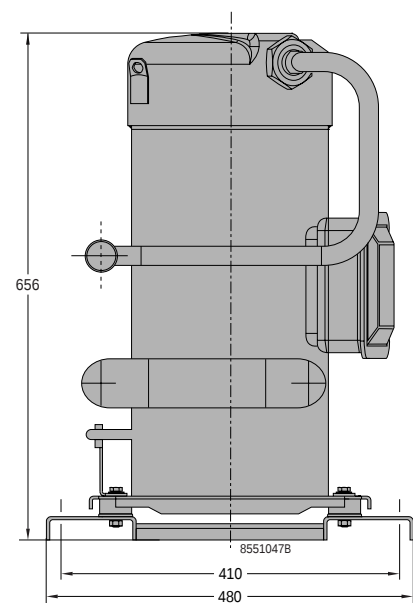
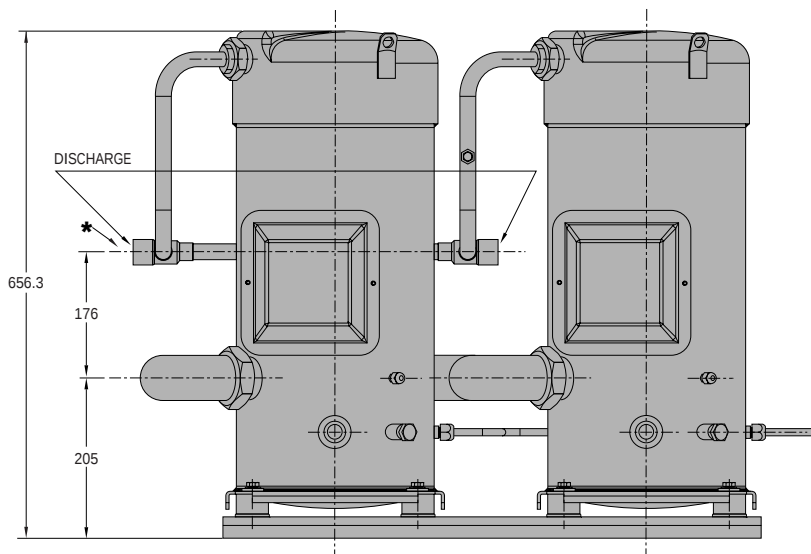
50 Hz

SM-SZ 320



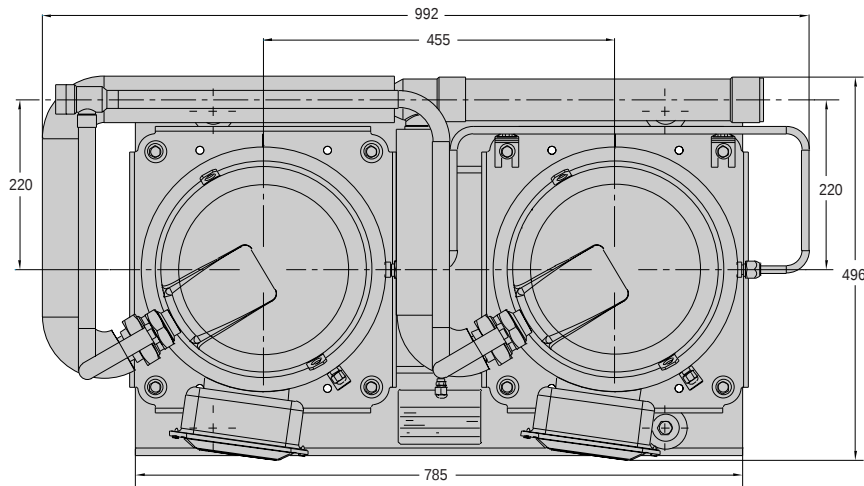
	Tube ODF
SUCTION	2" 1/8
DISCHARGE	1" 3/8

* Right or left brazed cap



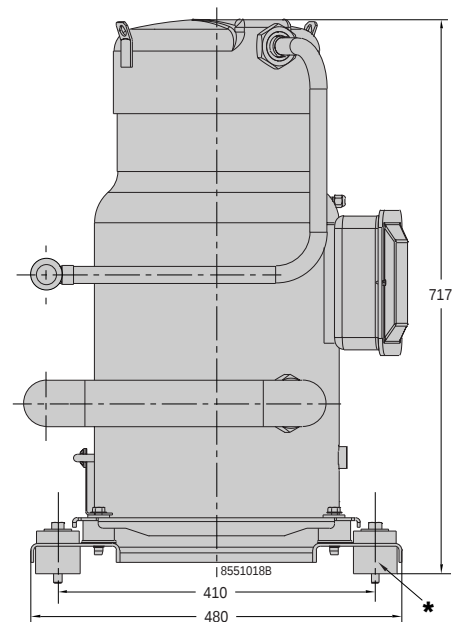
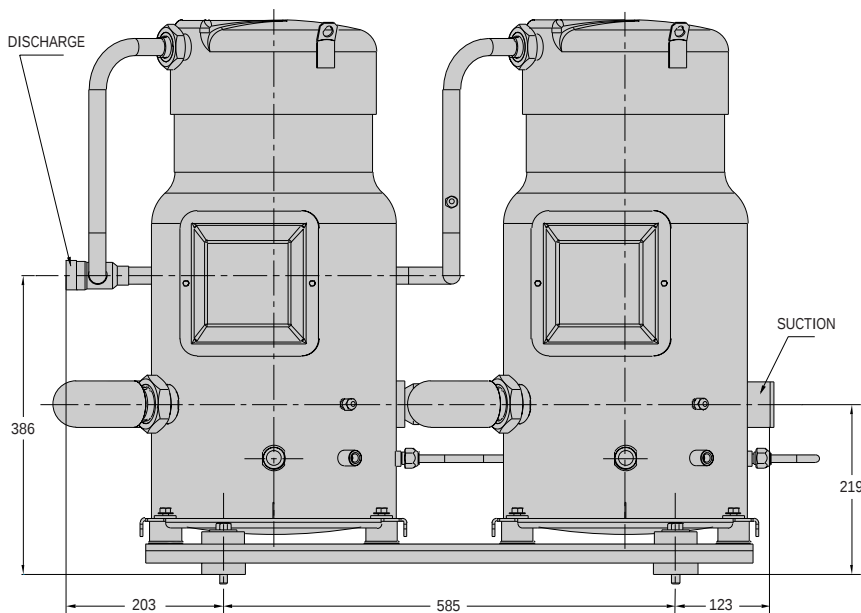
50 Hz

SM-SZ 350 / 370



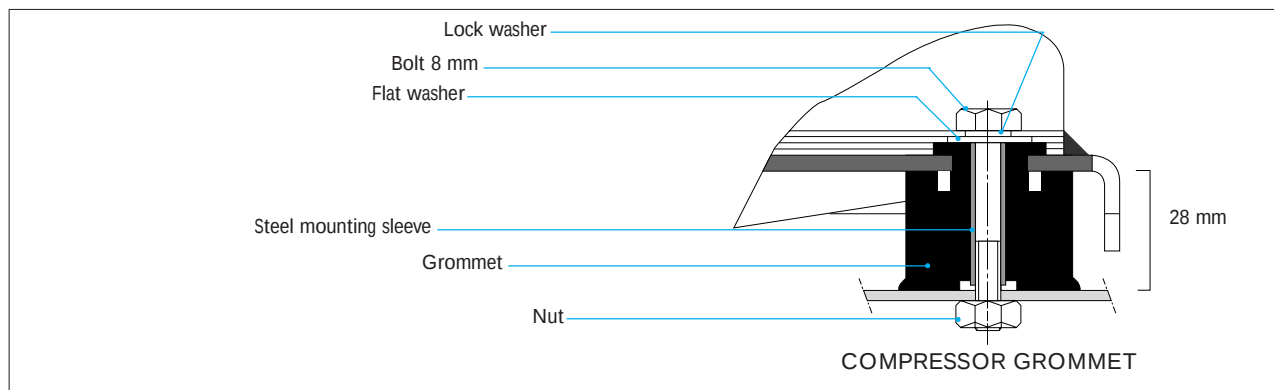
	Tube ODF
SUCTION	2" 1/8
DISCHARGE	1" 3/8

* Tandem units
SM-SZ 350 / 370 only are
supplied with frame assembly
mounting grommets.



50 Hz

MOUNTING GROMMETS



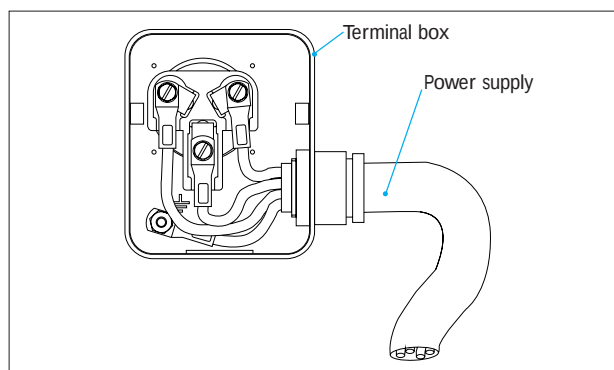
Electrical connections and wiring

ELECTRICAL CONNECTIONS

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

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

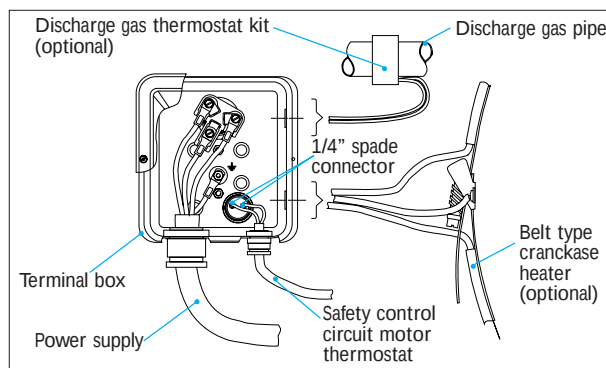
- The terminal box is provided with a $\varnothing 29$ mm hole for the power supply and a $\varnothing 29$ mm knockout.
- The protection rating of the terminal box is IP54 when correctly sized IP54 rated cable glands are applied. (Cable gland size e.g. PG21).



Terminal box wiring for SM / SZ 084 - 090 - 100 - 110 - 120 compressors

SM / SZ 115 - 125 - 160 - 175 - 185

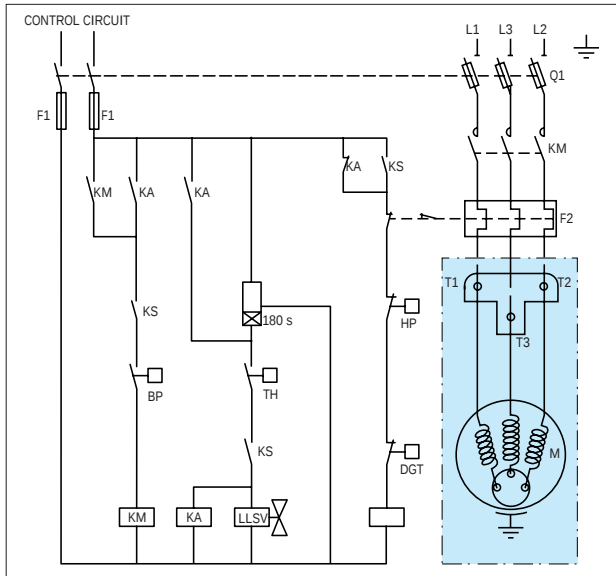
- The terminal box is provided with a $\varnothing 38$ mm knockout for the power supply, and three $\varnothing 20$ mm knockouts (e.g. for the safety control circuit).
- The protection rating of the terminal box is IP55 when correctly sized IP55 rated cable glands are applied. (Cable gland sizes e.g. PG29 & PG11).
- Connect the internal safety thermostat with 1/4" female spade connectors.



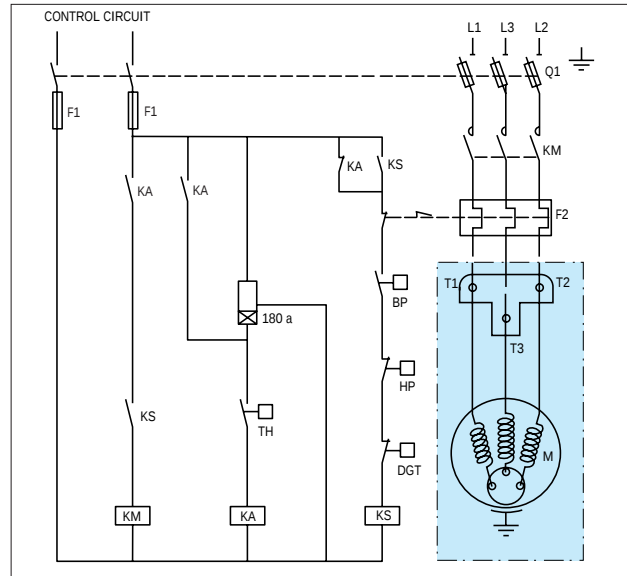
Terminal box wiring for SM / SZ 115 - 125 - 160 - 175 - 185 compressors

SUGGESTED ELECTRICAL WIRING DIAGRAMS

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

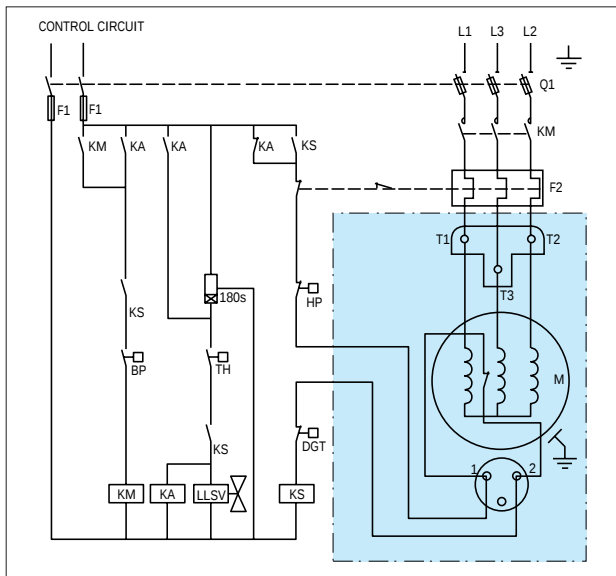


Wiring diagram with pump-down cycle

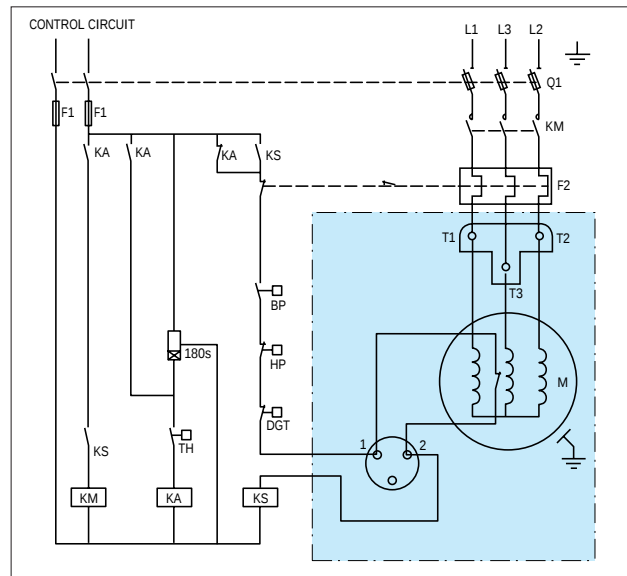


Wiring diagram without pump-down cycle

COMPRESSOR MODELS SM / SZ 115 - 125 - 160 - 175 - 185



Wiring diagram with pump-down cycle



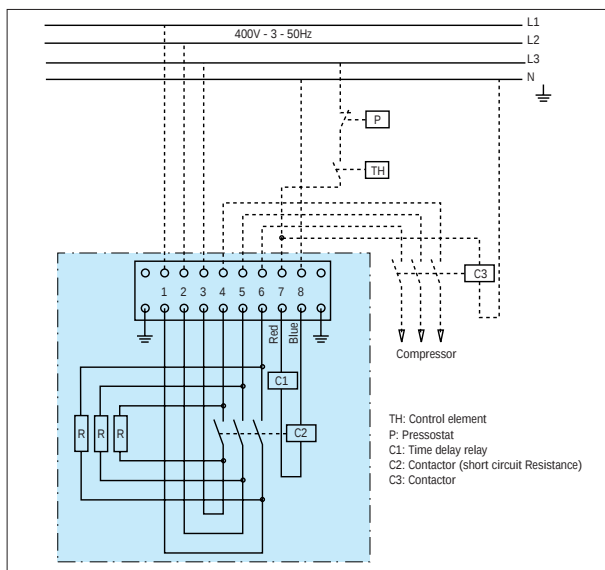
Wiring diagram without pump-down cycle

Control deviceTH
 Optional short cycle timer (3 min)180 s
 Control relay.....KA
 Liquid Solenoid valveLLSV
 Compressor contactorKM
 Safety lock out relay.....KS
 Pump-down control & L.P switchBP

H.P. switchHP
 Fused disconnectQ1
 FusesF1
 External overload protectionF2
 Compressor motorM
 Motor safety thermostat.....thM
 Discharge gas thermostat.....DGT

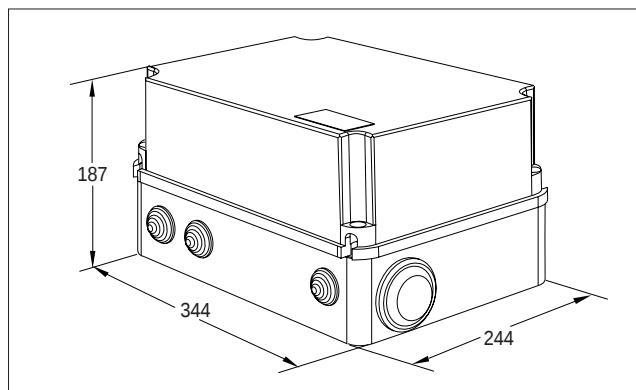
50 Hz

SOFT START ACCESSORY



Soft start accessory wiring diagram

The starting current of scroll compressors motor code 4 (400V/3/50Hz or 460V/3/60Hz) can be reduced using the Danfoss Maneurop soft start accessory with statoric resistors. When a soft start accessory is applied, the number of starts must be limited to a maximum of 6 per hour.



Soft start accessory dimensions

Compressor model motor code 4	Locked rotor current A	Current with Soft start acc. A	Soft start accessory (prewired in box) reference	Resistors	
				type	reference
SM / SZ 084	86	42	7705003	3.3 Ω -140 W	8173220
SM / SZ 090 - 100	98	48	7705004	2.7 Ω -140 W	8173219
SM / SZ 110 - 120	130	63	7705001	2.2 Ω -140 W	8173045
SM / SZ 115 - 125	120	66	7705001	2.2 Ω -140 W	8173045
SM / SZ 160	135	**	**	**	**
SM / SZ 175 - 185	175	100	7705002	2.2 Ω -140 W* 3.9 Ω -140 W*	8173045 8173044

* For soft start kit 7750002 (SCR04) the resistors 2.2 and 3.9 ohms are connected in parallel.

** Data not available at the date of printing.

System design recommendations

Performer scroll compressors incorporate internal safety devices, such as motor temperature protection, reverse rotation protection,

discharge gas check valve, however additional safety devices or system components may be required to ensure adequate protection of the

compressor. Depending on the system configuration and application, one or several of the following methods should be considered:

CRANKCASE HEATER

A crankcase heater protects against off-cycle migration of refrigerant; but it is only effective if the oil temperature is maintained 10 K above the LP saturated

temperature of the refrigerant. Tests must be conducted to ensure that the appropriate oil temperature is maintained at all ambient conditions. A crankcase heater

is recommended on all stand-alone compressors and split systems. Belt type crankcase heaters are available for 110-230-400 volt power supply. See accessory list.

LIQUID LINE SOLENOID VALVE (LLSV)

An LLSV may be used to isolate the liquid charge in the condenser side thus preventing charge transfer or excessive migration to the

compressor during off cycles. The quantity of refrigerant in the low pressure side of the system can be further reduced by using a pump

down cycle in association with the LLSV.

PUMP DOWN CYCLE

A pump down cycle is one of the most effective ways to protect against off-cycle migration of liquid

refrigerant. Recommended settings of the low pressure pump down switch can be found in table p.32.

Suggested wiring diagrams, see p.28.

SUCTION ACCUMULATOR

A suction accumulator offers protection against refrigerant floodback at start-up, during operation or after defrost (heat pump). It helps protect against

off-cycle migration by providing additional internal free volume to the low side of the system. Tests must be conducted to determine the actual refrigerant holding

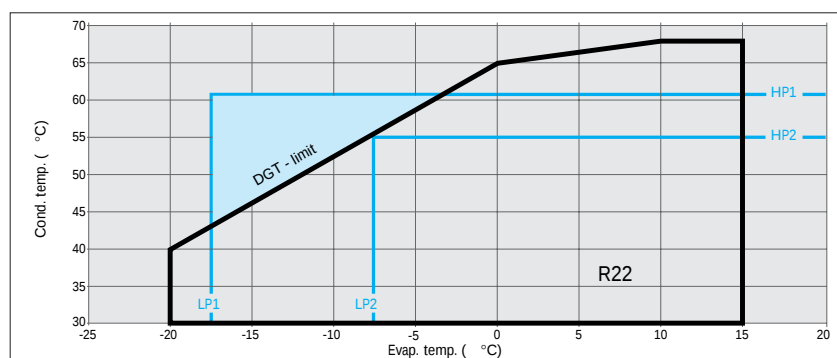
capacity needed for the application. The accumulator should not be sized for less than 50% of the total system charge.

DISCHARGE GAS TEMPERATURE PROTECTION (DGT)

A DGT protection is required if high and low pressure switch settings do not protect the compressor against operation outside its application envelope,

see example 1 below. Example 2 shows system pressure switch settings where a DGT protection is not required. The discharge gas thermostat shall be set to open at

a discharge tube outer temperature of 125°C (corresponding to 135°C gas temperature). DGT accessory is available from Danfoss Maneurop, see p.33.



Area not protected by HP/LP pressure switches; DGT protection required.

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 outside 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 outside application envelope.
No DGT protection required.

PROTECTION AGAINST FLOODED STARTS AND LIQUID FLOODBACK

Flooded starts occur when a compressor starts with a large quantity of liquid refrigerant in the compressor. Liquid finds its way into a compressor by off-cycle migration. Liquid floodback occurs when liquid refrigerant returns to a running compressor. Excessive liquid refrigerant in the compressor will cause oil dilution, liquid washout of oil from the bearings, or loss of oil from the sump. The crankcase heater will not be effective if the system design allows uncontrolled floodback to the compressor during any running or starting condition. Performer scroll

compressors can occasionally tolerate flooded starts as long as the system charge does not exceed that given in the table in the next section. Performer scrolls can also handle intermittent floodback, but the system design must be such that repeated and excessive floodback is not possible. Off-cycle refrigerant migration occurs when the compressor is located at the coldest part of the installation, or when the system uses a bleed-type expansion device, or if liquid can drain from the evaporator into the sump by gravity. If the system charge exceeds the

limit shown in the table, a crankcase heater must be used.

During operation, liquid floodback can be detected by measuring the oil sump temperature, which should be at least 10 K above saturated suction temperature. If at any time during operation the oil sump temperature is less than 10 K above saturated suction temperature, there will be too much dilution of the lubricant, and tests must be performed to select a proper compressor protection method. The tests must be performed under actual operating conditions.

REFRIGERANT CHARGE LIMITS AND COMPRESSOR PROTECTION

The refrigerant charge limits listed below will help evaluate the

required compressor protection in relation with the system charge

and the application.

	Single compressors					Tandem units				
Compressor models	S 084	S 110	S 115	S 160	S 175	S 180	S 220	S 230	S 310	S 350
	S 090	S 120	S 125		S 185	S 200	S 242	S 250	S 320	S 370
	S 100									
Refrigerant charge limits (kg)	8,5	10	11	12,5	13,5	10	12	14,5	16,5	17,5

Compressor protection / system test requirement vs. charge limits and applications

	BELOW charge limit	ABOVE charge limit
Cooling only systems, Packaged units	☒	REQ Refrigerant migration & floodback test REQ Crankcase heater
Cooling only systems, with remote condenser 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 Crankcase heater

☒ No test or additional safeties required

REC Recommended test or additional safety

REQ Required test or additional safety

Note: If the crankcase heater cannot maintain the oil temperature at 10 K above the LP saturated

Reversible heat pump systems
Transients are likely to occur in heat pump systems: change over cycle from cooling to heating, defrost, low load short cycles. These transient modes of operation may lead to liquid refrigerant carry over (floodback) or excessively wet refrigerant return conditions.

temperature of the refrigerant during off-cycles or if repetitive liquid floodback is present, an

Therefore regardless the refrigerant charge of the system specific tests for repetitive floodback have to be performed to confirm whether or not a suction accumulator is required in the system. A crankcase heater and DGT protection are required for reversible heat pump applications.

LLSV, pump down cycle or a suction accumulator is required.

The above represents basic guidelines for reliable compressor operation and safety. Please contact Danfoss Maneurop application engineering department for deviations from above guidelines.

POWER CONNECTION, CYCLE RATE, REVERSE ROTATION PROTECTION

Phase sequencing

Use a phase meter to establish phase orders, and connect line phases L1, L2, and L3 to terminals T1, T2 and T3 respectively.

The compressor will only operate properly in one direction, and the motor is wound so that if connections are made correctly, rotation will be correct.

Reverse rotation is not destructive, even for a long period of time, and will be obvious as soon as power is turned on: The compressor will not build up pressure, noise will be abnormally loud, and power consumption will be minimal. If reverse rotation symptoms occur, shut the compressor down and connect phases to the proper terminals.

If reverse rotation is not halted, the compressor will cycle off on the internal motor protection.

Operating voltage range

Operating voltage limits are shown in the table on page 7.

The voltage applied to the motor terminals must be within these table limits during start-up and normal operation. The maximum

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

$$\frac{|V_{avg} - V_{1-2}| + |V_{avg} - V_{1-3}| + |V_{avg} - V_{2-3}|}{2 \times V_{avg}} \times 100$$

V_{avg} = Mean voltage of phases 1, 2, 3.

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

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

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

Cycle rate limit

There must be no more than 12 starts per hour (6 when a soft start accessory is used). A higher number reduces the service life of the motor-compressor unit. If necessary, use an anti-short-cycle timer in the control circuit.

Connect it as shown in the wiring diagram. A three-minutes (180 s)

time-out is recommended.

The system must be designed in a way that guarantees a minimum compressor running time to provide sufficient motor cooling after its start and to provide proper oil return. Note that the oil return may vary as it is a function of the system design.

PRESSURE LIMITS

High Pressure

A high pressure safety switch is required to stop the compressor, should the discharge pressure exceed the values shown in the table below. The high pressure switch can be set to lower values depending on the application and ambient conditions.

The HP switch must either be in a lockout circuit, or be a manual reset device to prevent cycling around its high pressure limit.

If a discharge valve is used, the HP switch must be connected to the service valve gauge port which

cannot be isolated.

Note: Because the power consumption of scroll compressors is almost directly proportional to the discharge pressure, the high pressure control can be used to indirectly limit the maximum current draw. However a high pressure control used in this way can never replace an external overload protector.

Low pressure

A low pressure safety switch must be used. Deep vacuum operation of a scroll compressor will result in failure due to internal arcing.

Performer scroll compressors have a high volumetric efficiency and can pull very low vacuum levels which could induce this problem. The minimum low pressure safety switch setting is 0.2 bar relative. For systems without pump-down, the LP switch must either be a manual lockout device or an automatic LP switch wired into an electrical lockout circuit.

The LP switch tolerance must not allow vacuum operation of the compressor. LP switch settings for pump-down cycles with automatic reset, are in the table below.

Pressure settings

		R22	R407C	R134a
Working pressure range high side	bar (g)	10.9 - 27.7	10.5 - 29.1	6.7 - 20.2
Working pressure range low side	bar (g)	1.4 - 6.9	1.1 - 6.4	0.6 - 3.9
Maximum high pressure safety switch setting	bar (g)	28	29.5	20.5
Minimum low pressure safety switch setting *	bar (g)	0.2	0.2	0.2
Minimum low pressure pump-down switch setting **	bar (g)	1.3	1.0	0.5

*LP safety switch shall never be bypassed.

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

MOTOR PROTECTION

Internal motor protection

Compressor models SM/SZ 084 - 090 - 100 - 110 - 120 are provided with an internal overload protection which protects the motor against excessive current and excessive temperature caused by overload, low refrigerant flow, or incorrect motor rotation.

The cut-out current is the MCC value listed in the table on page 7. The cut-out temperature is 105°C. An additional external overload

protection is not compulsory but still advisable for alarm or manual reset. The protector is located in the star point of the motor and, should it react, will cut out all three phases. It will reset automatically.

Compressor models SM/SZ 115 - 125 - 160 - 175 - 185 are provided with a bimetallic single pole single throw thermostat which is located in the motor windings. In case of motor overheating caused by

overload, low refrigerant flow, or incorrect motor rotation, the thermostat will open. Because the thermostat is an automatic reset device, it must be wired in a lockout safety circuit with a manual reset to restart the unit.

An external overload protector, sensitive to single phase failure, is required.

The table below shows the protection method for the different compressor models

Compressor model	overheating protection	overcurrent protection	locked rotor protection	single phase failure protection
SM / SZ 084 - 090 - 100 - 110 - 120	Internal	Internal	Internal	Internal
SM / SZ 115 - 125 - 160 - 175 - 185	Internal	External overload protector compulsory		

External overload protector selection

All safety devices must be in accordance with the requirements of the appropriate certification organizations in the country in which the compressor will be used. The external overload protector can either be a thermal overload relay or a circuit breaker.

A thermal overload relay shall be selected to trip at not more than 140 % of the compressor rated load current. A circuit breaker shall be selected at not more than 125 %

of the compressor rated load current. The rated load current is the maximum running current expected during operation in the considered application. This current can be found in the data sheets for compressors with motor code 4 or in the Danfoss RS+ program for all compressors. The trip current must never be higher than the MMT value (Maximum Must Trip current) of the compressor. MMT values can be found in the table on page 7. The MMT value appears as "A.Max" on the

compressor nameplate.

Further requirements for the external overload protector are:

Overcurrent protection:

The protector must trip within 2 minutes at 110 % of the Maximum Must Trip current.

Locked rotor protection:

The protector must trip within 10 seconds on a start at locked rotor current.

Single phase failure protection:

The protector must trip when one of the three phases fails.

DISCHARGE TEMPERATURE PROTECTION ACCESSORY

The discharge gas temperature must not exceed 135°C. A discharge

temperature protection device shall be installed on all heat pumps.

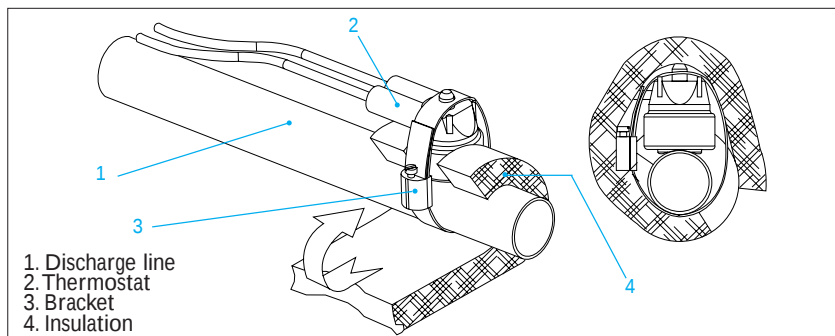
An optional discharge gas thermostat is available as accessory. The thermostat kit includes all the components required for installation as shown at left.

The thermostat must be attached to the discharge line at no more than 150 mm from the compressor discharge port.

In reversible air-to-air and air-to-water heat pumps, the discharge temperature should be monitored.

Discharge thermostat kit

Reference: 77 50 009



Installation and Service

SYSTEM CLEANLINESS

System contamination is one of the main factors that affects equipment reliability and compressor service life. Therefore, it is important to take care of system cleanliness when manufacturing a refrigeration system.

During the manufacturing process, machine contamination can be caused by:

- Brazing and welding oxides,
- Filings and particles from removing burrs from pipe-work,
- Brazing flux,
- Moisture and air.

Consequently, when building equipment and assemblies, the following precautions must be taken:

Pipe-work
Only use clean and dehydrated refrigeration grade copper tubes

and silver alloy braze material. Follow the brazing instructions that are given on page 36.

Never drill holes in the pipe-work after installing.

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. These gasses may form an inflammable mixture.

Compressor model	Leak detection with refrigerant	Leak detection with a mass spectrometer
SM 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.

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. These gasses may form an inflammable mixture.

Do not exceed the following pressures:

Maximum compressor test pressure low side: 25 bar(g)
Maximum compressor test pressure high side: 41 bar(g)

Maximum pressure difference between high and low side of the compressor: 24 bar

Pull down under vacuum - moisture removal
Moisture obstructs proper functioning of the compressor and the refrigeration system. Air and moisture reduce service life and increase condensing pressure, which causes abnormally high discharge temperatures likely

to destroy the oil lubricating properties. The risk of acid formation is also increased by air and moisture, and copper plating can be generated in this way. All these phenomena, can cause mechanical and electrical compressor failures. The usual method of avoiding these problems is vacuum pull-down executed with a vacuum pump creating a minimum vacuum of 500 microns (0.67 mbar).

LUBRICANTS

Two types of lubricants are used: mineral oil for SM compressors and P.O.E (polyol ester) oil

for SZ compressors. The compressor is delivered with an initial oil charge (see page 6).

The table below gives exact references.

Compressor model	Oil type	Oil name	Oil reference		
			1 litre can	2 litre can	5 litre can
SM compressors	Mineral	160P	-	7754001	7754002
SZ compressors	P.O.E.	160SZ	7554023	7754024	-

Always use the original Danfoss Maneurop oil. It is advisable to use oil from new cans only. This is mandatory for P.O.E. oil due to its strong hygroscopic property. The oil in partly-used cans can absorb moisture during storage. The can should only be opened just before using the oil.

Note: The Danfoss Maneurop P.O.E. lubricant 160SZ is free from additives.

Oil level check

The oil level can best be checked when the compressor is running in stabilised conditions, guaranteeing that there is no liquid refrigerant in the lower shell of the compressor. In this case, the oil level must be between 1/2 and 3/4 in the oil sight glass.

Also directly after compressor shutdown the oil level can be checked.

In this case the oil level must be at about 1/3 in the oil sight glass.

Oil top up

Top up oil when the compressor is running. Use the schröder connector and a suitable pump or any other accessible connector on the compressor suction line.

COMPRESSOR ACOUSTIC HOOD ACCESSORY

Compressor acoustic hoods have been developed to meet specific extra low sound requirements. This is made possible with the Danfoss Maneurop Performer unique design of a fully suction gas cooled

motor which allows compressor body insulation on its whole application range. The covers incorporate sound proofing materials and achieve excellent high and low frequency attenuation. These acoustic

hoods are of the quick and easy fit-on type and do not excessively increase the overall size of the compressor. For further technical details on these accessories please contact Danfoss Maneurop.

Compressor model	Hood type	Attenuation* (at 50Hz) dB(A)	Hood reference number
SM / SZ 084 - 090 - 100	full cover	7	7755011
SM / SZ 110 - 120	full cover	8.5	7755010
SM / SZ 115 - 125	full cover	8	7755009
SM / SZ 160	full cover	8	7755008
SM / SZ 175 - 185	full cover	8	7755007

*Attenuation of compressor sound power level measured in free space

COMPRESSOR HANDLING

Each Performer compressor is provided with two lift rings. Always use these rings to lift the compressor. When the compressor is mounted into an installation, never use the lift rings on the compressor to lift the complete installation. The installation may be too heavy to be lifted this way.

It is preferable to keep the compressor in an upright position during handling. Remove the plugs only just before connecting the compressor into the installation to avoid moisture entering the compressor. Remove the discharge plug first and the suction plug second. In this way the nitrogen holding

charge can escape via the discharge connection, and the risk of an oil mist blown out via the suction connection will be minimal. When the plugs are removed, it is important to keep the compressor in an upright position to avoid spilling oil.

COMPRESSOR MOUNTING

All compressors are supplied with four rubber mounting grommets with metal sleeves and M8 bolts and nuts. These grommets largely attenuate the transmission of compressor vibrations to the base frame. The rubber grommets must

be slightly compressed with a torque of 20 Nm. When the compressor is mounted, the distance between the bottom of the compressor base plate folding and the top of the base frame should be about 28 mm. See the picture on

page 27. In uncompressed condition this height is 29.5 mm. Tandem units can be rigidly mounted to a frame.

Note: for shipping, the bolts and washers must be tightened down to the steel mounting sleeves.

BRAZING AND UNBRAZING

Performer compressors version B & V have steel braze connections (starting from the first quarter of 1999, copper coated steel connections will be applied). For compressors with rotolock connections (version R), solder sleeves are available. For brazing the suction and discharge tubes to the compressor, Danfoss Maneurop advises the following procedure:

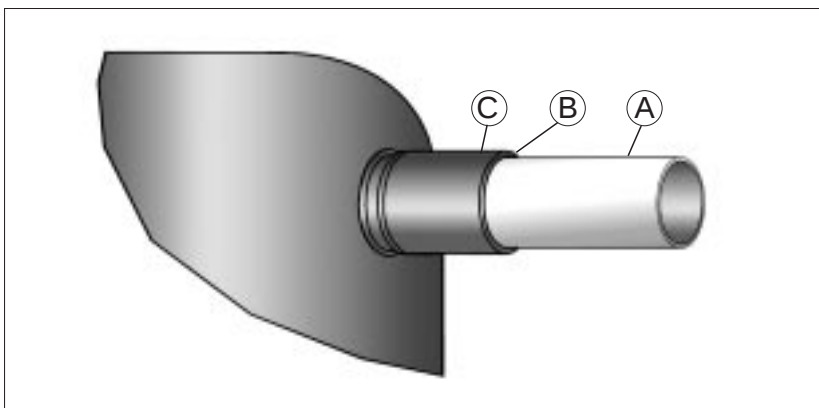
- Make sure that no electrical wiring is connected to the compressor.
- Remove the teflon gaskets when brazing a rotolock compressor with solder sleeves.
- Use clean and dehydrated refrigeration grade copper tubes and clean the compressor connections.
- Use a silver alloy braze material with a minimum of 5 % silver.
- Always purge nitrogen or CO₂ through the compressor during brazing to prevent oxidation and the formation of inflammable

gasses. Leave the compressor open to the atmosphere only for a limited period of time.

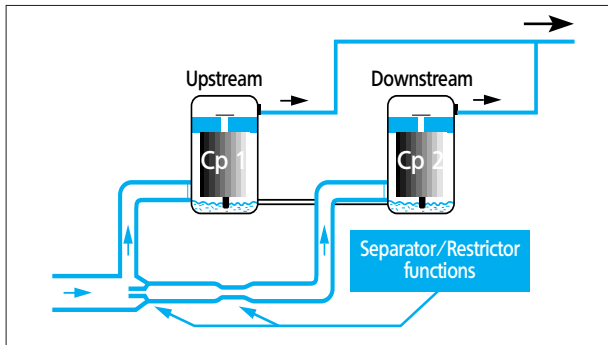
- If flux is used, take every precaution to prevent leakage into the piping or the compressor.
- A double tipped torch is recommended.
- Gently move the torch around the tube and apply heat evenly to area A until the brazing temperature is reached.
- Move the torch to the joint (area B) and apply heat evenly to this area by moving the torch around the joint until the brazing temperature is reached.
- Add braze material and keep moving the torch around the joint. Make the braze material flow around the full circumference of the joint. Do not apply too much braze material.
- Move the torch to area C to draw the braze material into the joint. Only apply heat to area C

for a minimum of time in order to avoid braze material entering the compressor.

Before unbrazing a compressor or another system component, the refrigerant charge must be removed from both the high pressure side and the low pressure side. Both sides must be at atmospheric pressure. Use pressure gauges to check the system pressure before unbrazing. When brazing is performed to a pressurised compressor, the compressor oil could escape and ignite when it gets in contact with the torch which could be harmful to people.



TANDEM UNITS



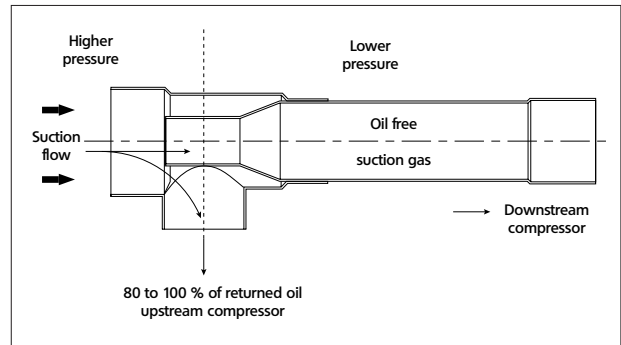
Dynamic oil balancing system

In the Danfoss Maneurop tandem units, the oil management is provided by a dynamic oil balancing system. The suction connections of the two single Performer compressors are interconnected by a suction oil separator / gas restrictor. 80 to 100 % of the oil in the suction gas is returned to the upstream compressor. A restriction in the suction line of the down-

stream compressor creates a slight pressure drop. Therefore the downstream compressor has a slightly lower sump pressure. Driven by the sump pressure difference, the excess oil from the upstream compressor runs into the downstream compressor sump. The active components in this oil balancing system are calibrated and qualified by Danfoss Maneurop.

Tandem model	Tandem assembly kit reference
SM / SZ 180 - 200	7703251
SM / SZ 220 - 242	7703372
SM / SZ 230 - 250	7703251
SM / SZ 310	7703311
SM / SZ 320	7703372
SM / SZ 350 - 370	7703371*

*Kit includes frame assembly mounting grommets.



Suction oil separator / gas restrictor

Sets of components for tandem field assembly are also available for the different tandem units. These sets consist of a suction oil separator / gas restrictor and a discharge header T connector. The table below gives the reference numbers of these sets. The system suction line must be dimensioned in a way that ensures proper oil return when only one compressor is running. The oil level of compressors in a tandem unit must be checked directly after both compressors are shut down. In this case the oil level must be at about 1/3 in the oil sight glass. Both compressors of a tandem unit must be electrically wired individually.

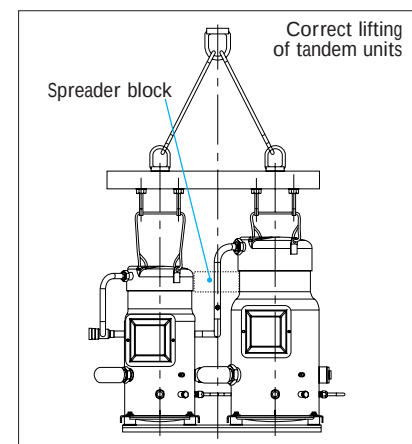
HANDLING OF TANDEM UNITS

Scroll tandem units must be handled with care. Handling must be smooth and gentle. When installing tandem units, Danfoss Maneurop recommends using the lift and handling devices as shown in picture beside, and that the following procedure be used to prevent damage.

- Two lift rings are provided on each compressor. Use all four rings.
- Maximum loads authorized per sling and for the hoist hook must not be lower than the weight of

the machine.

- The minimum hoist hook length must be at least equal to the center distance between the two compressors to prevent bending the chassis.
- When handling, use a spreader block between the compressors to prevent any unit frame damage.
- When the tandem unit is already mounted into an installation, never lift the complete installation by using the lift rings on the compressors. The installation can be too heavy to be lifted this way.



Ordering information and packaging

ORDERING INFORMATION

Performer compressors can be ordered from Danfoss Maneurop in either individual or multiple packaging. When ordering a compressor, an order reference must be used which gives information about the way of packaging. For tandem units, the order reference is the same as the compressor model. For single compressors the compressor model (which is printed on the compressor name plate) can be converted to an order reference as described below;

- The UL evolution index turns into a dash (-).
- The product evolution index

is replaced by an order reference evolution index (if any).

- A letter "I" or "M" is added to indicate individual or multiple packaging.

Note: Local Danfoss sales companies or wholesalers may use different order references.

Example for single compressors

Compressor model:	S	M	120	S	4	V	A
Order reference for individual packaging:	S	M	120	-	4	V	* I
Order reference for multiple packaging:	S	M	120	-	4	V	* M

*Letter denotes evolution index of order reference if any.

Example for tandem compressors

Compressor model:	S	Z	250	-	3
Order reference:	S	Z	250	-	3

PACKAGING

Individual packaging

Compressor model	Packaging dimensions of pallet with individually packed compressors						Packaging dimensions of one individually packed compressor				
	Nbr*	Length mm	Width mm	Height mm	Gross weight kg	Volume dm ³	Length mm	Width mm	Height mm	Gross weight kg	Volume dm ³
SM/SZ 084 - 090 - 100	6	1200	1000	715	433	858	360	365	580	72	76
SM/SZ 110 - 120	6	1200	1000	735	505	882	360	365	630	83	83
SM/SZ 115 - 125	6	1200	1000	890	545	1068	460	385	740	90	131
SM/SZ 160	6	1200	1000	915	615	1098	460	385	780	102	138
SM/SZ 175 - 185	4	1200	1000	990	465	1188	490	450	850	114	187
SM/SZ 180 - 200	1	800	500	700	170	280	800	500	700	170	280
SM/SZ 220 - 242	1	800	500	750	190	300	800	500	750	190	300
SM/SZ 230 - 250	1	1200	600	820	195	590	1200	600	820	195	590
SM/SZ 310	1	1200	600	940	225	677	1200	600	940	225	677
SM/SZ 320	1	1200	600	900	260	648	1200	600	900	260	648
SM/SZ 350 - 370	1	1200	600	940	255	677	1200	600	940	255	677

Multiple packaging

Compressor model	Packaging dimensions of pallet with multiple packed compressors					
	Nbr*	Length mm	Width mm	Height mm	Gross weight kg	Volume dm ³
SM/SZ 084 - 090 - 100	6	1200	1000	800	433	960
SM/SZ 110 - 120	6	1200	1000	850	496	1020
SM/SZ 115 - 125	6	1200	1000	870	545	1044
SM/SZ 160	6	1200	1000	910	615	1092
SM/SZ 175 - 185	6	1200	1000	980	685	1176

Tandem units SM/SZ 180 to 370 are not available in multiple packaging but in individual packaging only.

*Nbr. = number of compressors per pallet.



Certified Quality System



The Danfoss Maneurop facilities



**Anse
France**



**Lawrenceville
Georgia - USA**



**Trévoux
France**



Every effort has been made to provide accurate descriptions and data.
However, due to the continuing process of product improvement and evolution, all information in this brochure is subject to change without notification.

Danfoss Maneurop S.A.

Commercial compressors

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