Selection & Application guidelines

Maneurop®

RECIPROCATING COMPRESSORS

MT/MTZ

50 Hz

R22
R407C
R134a
R404A / R507

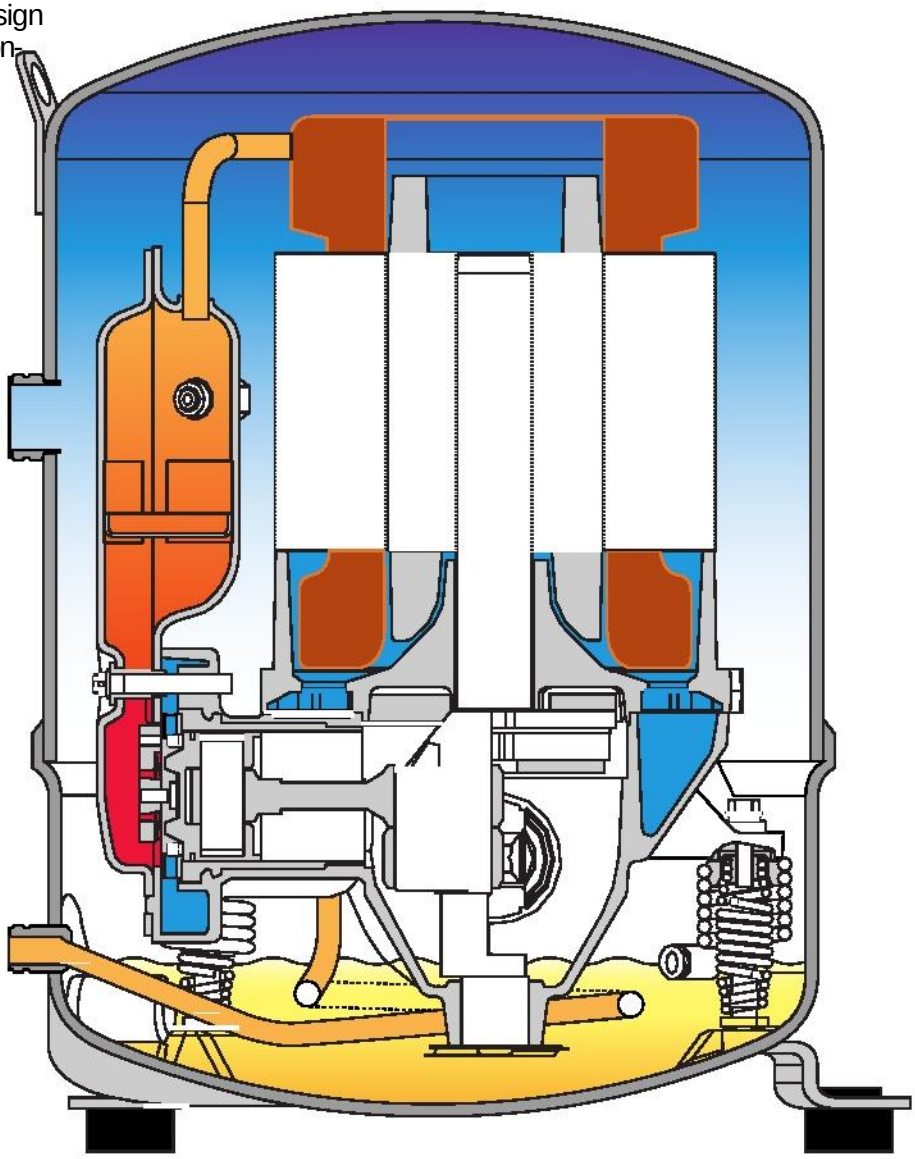
1 CYLINDER
2 CYLINDERS
4 CYLINDERS
8 CYLINDERS

Refrigeration and Air Conditioning

Expect more from us

Danfoss Maneurop Reciprocating Compressors

Danfoss Maneurop reciprocating compressors are specially designed for applications with a wide range of operating conditions.
All components are of high quality and precision in order to assure a long product life.The compressor design allows for the motor to be 100% suction-gas cooled.
The positive benefits of internal motor protection, high efficiency circular valve design and high torque motors provide for a quality installation.



Maneurop® MT and MTZ series compressors are of the hermetic reciprocating type and are designed for medium and high evaporating temperature applications.
The MT series is designed for use with the "traditional" R22 refrigerant, using Danfoss Maneurop® mineral oil 160P as lubricant.
The MT series can also be applied with several R22 based refrigerant blends (substitute refrigerants), using 160 ABM alkylbenzene as lubricant.
The MTZ series is specifically designed for use with the HFC refrigerants R407C, R134a, R404A, and R507, using 160PZ polyester oil as lubricant.
These compressors can be used in new installations and also to replace Maneurop® MTE compressors in existing installations.

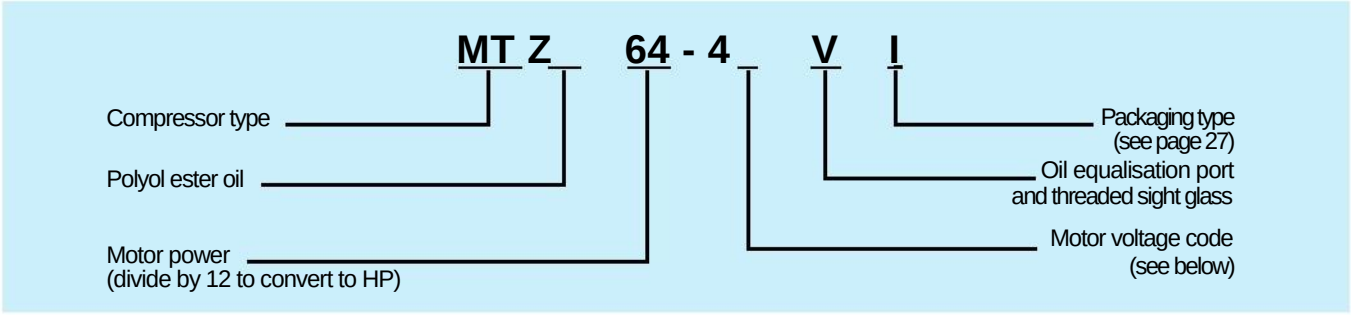
MT and MTZ compressors have a large internal free volume that protects against the risk of liquid hammering when liquid refrigerant enters the compressor.

MT and MTZ compressors are fully suction-gas cooled.This means that no additional compressor cooling is required and allows the compressors to be insulated with acoustic jackets, to obtain lower sound levels, without the risk of compressor overheating.

MT and MTZ compressors are available in 26 different models with displacement ranging from 30 to 543 cm^3/rev. Seven different motor voltage ranges are available for single and three phase power supplies at 50 and 60 Hz. Most compressors exist in two versions:
- standard version
- VE version (oil equalisation + oil sight glass).

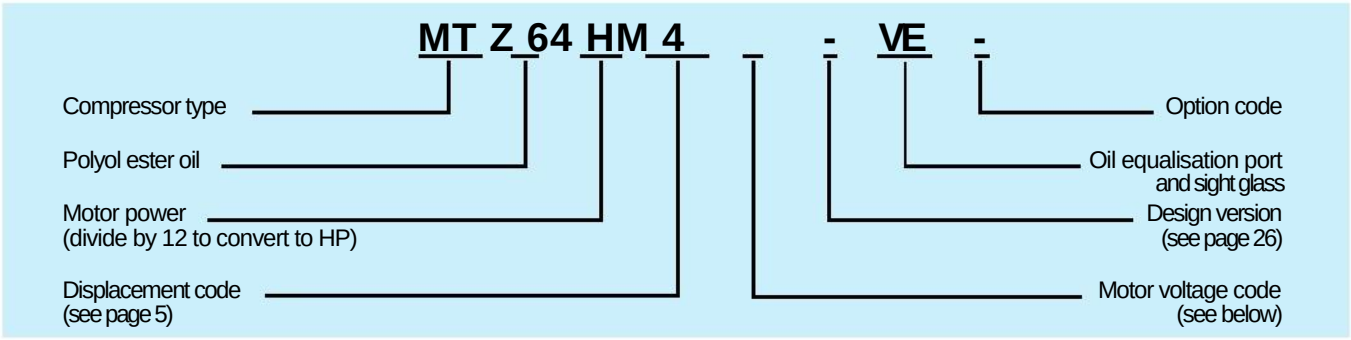
Compressor nomenclature

ORDER REFERENCE



EXAMPLE:
MT 64 - 4I MT 64, individual packaging (I), motor voltage code 4, standard version
MT 64 - 4VI MT 64, individual packaging (I), motor voltage code 4,VE version (V)
MT 64 - 4M MT 64, multiple packaging (M), motor voltage code 4, standard version
MT 64 - 4VM MT 64, multiple packaging (M), motor voltage code 4,VE version (V)
Individual packaging: single packaging per compressor
Multiple packaging: single packaging for several compressors, full pallet (number of compressors per pallet depending on compressor model).

COMPRESSOR REFERENCE (INDICATED ON THE COMPRESSOR NAMEPLATE)



VERSIONS

	S version standard		VE version (optional)	
Models	**Oil sight glass**	**Oil equalisation connection**	**Oil sight glass**	**Oil equalisation connection**
MT / MTZ 18-40 (1 cyl.)	-	-	threaded	3/8" flare
MT / MTZ 44-81 (2 cyl.)	- -	threaded	3/8" flare MT	/
MTZ 100-160 (4 cyl.)	brazed	-	threaded	3/8" flare
MT / MTZ 200-320 (8 cyl.)	threaded	3/8" flare		

MOTOR VOLTAGE

Motor Code	Nominal voltage	Voltage application range
1	208-230 V / 1 ph / 60 Hz	187 - 253 V
3	200-230 V / 3 ph / 60 Hz	180 - 253 V
4	400 V / 3 ph / 50 Hz 460 V / 3 ph / 60 Hz	360 - 440 V 414 - 506 V
5	230 V / 1 ph / 50 Hz	207 - 253 V
6	230 V / 3 ph / 50 Hz	207 - 253 V
7	500 V / 3 ph / 50 Hz 575 V / 3 ph / 60 Hz	450 - 550 V 517 - 632 V
9	380 V / 3 ph / 60 Hz	342 - 418 V

Specifications

TECHNICAL SPECIFICATIONS

Compressor model	Displacement		Cyl. number	Oil charge	Net weight	Design versions** motor voltage code						
	(cm^3/rev)	(m^3/h)*		(dm^3)	(kg)	1	3	4	5	6	7	9
MT / MTZ 18 JA	30.23	5.26	1	0.95	21	S-VE	S-VE	S-VE	S-VE	-	-	-
MT / MTZ 22 JC	38.12	6.63	1	0.95	21	S-VE	S-VE	S-VE	S-VE	S-VE	-	-
MT / MTZ 28 JE	48.06	8.36	1	0.95	23	S-VE	S-VE	S-VE	S-VE	S-VE	-	-
MT / MTZ 32 JF VE	53.86	9.37	1	0.95	24	S-VE	S-VE	S-VE	S-VE	S-VE	S-VE	S-
MT / MTZ 36 JG	60.47	10.52	1	0.95	25	S-VE	S-VE	S-VE	S-VE	S-VE	-	-
MT / MTZ 40 JH	67.89	11.81	1	0.95	26	S-VE	S-VE	S-VE	-	S-VE	-	-
MT / MTZ 44 HJ	76.22	13.26	2	1.8	35	S-VE	S-VE	S-VE	-	S-VE	-	-
MT / MTZ 45 HJ	76.22	13.26	2	1.8	37	S-VE	S-VE	S-VE	-	-	-	-
MT / MTZ 50 HK VE	85.64	14.90	2	1.8	35	S-VE	S-VE	S-VE	-	S-VE	S-VE	S-
MT / MTZ 51 HK	85.64	14.90	2	1.8	37	S-VE	S-VE	S-VE	-	S-VE	-	-
MT / MTZ 56 HL VE	96.13	16.73	2	1.8	37	S-VE	S-VE	S-VE	-	S-VE	S-VE	S-
MT / MTZ 57 HL	96.13	16.73	2	1.8	39	S-VE	S-VE	S-VE	-	-	-	-
MT / MTZ 64 HM VE	107.71	18.74	2	1.8	37	S-VE	S-VE	S-VE	-	S-VE	-	S-
MT / MTZ 65 HM	107.71	18.74	2	1.8	39	S-VE	S-VE	S-VE	-	S-VE	-	-
MT / MTZ 72 HN VE	120.94	21.04	2	1.8	40	-	S-VE	S-VE	-	S-VE	-	S-
MT / MTZ 73 HN	120.94	21.04	2	1.8	41	-	S-VE	S-VE	-	S-VE	-	-
MT / MTZ 80 HP VE	135.78	23.63	2	1.8	40	-	S-VE	S-VE	-	S-VE	-	S-
MT / MTZ 81 HP	135.78	23.63	2	1.8	41	-	S-VE	S-VE	-	-	-	-
MT / MTZ 100 HS VE	171.26	29.80	4	3.9	60	-	S-VE	S-VE	-	S-VE	S-VE	S-
MT / MTZ 125 HU VE	215.44	37.49	4	3.9	64	-	S-VE	S-VE	-	S-VE	S-VE	S-
MT / MTZ 144 HV VE	241.87	42.09	4	3.9	67	-	S-VE	S-VE	-	S-VE	S-VE	S-
MT / MTZ 160 HW VE	271.55	47.25	4	3.9	69	-	S-VE	S-VE	-	S-VE	S-VE	S-
MT / MTZ 200 HSS	342.52	2 x 29.80	8	10.4	170	-	S	S	-	S	-	-
MT / MTZ 250 HUU	430.88	2 x 37.49	8	10.4	175	-	S	S	-	S	-	-
MT / MTZ 288 HVV	483.74	2 x 42.09	8	10.4	178	-	S	S	-	-	-	-

MT / MTZ 320 HWW	543.10	2 x 47.25	8	10.4	180	-	S	S	-	S	-	-

** At 2900 rpm*
*** S & VE versions, see table on page 4.*

NOMINAL PERFORMANCE
R22, R407C - 50 HZ

	NOMINAL RATINGS * MT - R22				NOMINAL RATINGS ** MTZ - R407C			
Compressor model	Cooling capacity	Power input	Current input	COP capacity	Cooling input	Power input (W)	Current (kW)	COP (A)
	(W/W)	(W)	(kW)	(A)	(W/W)			
MT / MTZ 18 JA	3881	1.45	2.73	2.68	3726	1.39	2.47	2.68
MT / MTZ 22 JC	5363	1.89	3.31	2.84	4777	1.81	3.31	2.64
MT / MTZ 28 JE	7378	2.55	4.56	2.89	6137	2.35	4.39	2.61
MT / MTZ 32 JF	8064	2.98	4.97	2.70	6941	2.67	5.03	2.60
MT / MTZ 36 JG	9272	3.37	5.77	2.75	7994	3.12	5.71	2.56
MT / MTZ 40 JH	10475	3.85	6.47	2.72	9128	3.61	6.45	2.53
MT / MTZ 44 HJ	11037	3.89	7.37	2.84	9867	3.63	6.49	2.72
MT / MTZ 50 HK	12324	4.32	8.46	2.85	11266	4.11	7.34	2.74
MT / MTZ 56 HL	13771	5.04	10.27	2.73	12944	4.69	8.36	2.76
MT / MTZ 64 HM	15820	5.66	9.54	2.79	14587	5.25	9.35	2.78
MT / MTZ 72 HN	17124	6.31	10.54	2.71	16380	5.97	10.48	2.74
MT / MTZ 80 HP	19534	7.13	11.58	2.74	18525	6.83	11.83	2.71
MT / MTZ 100 HS	23403	7.98	14.59	2.93	22111	7.85	13.58	2.82
MT / MTZ 125 HU	30429	10.66	17.37	2.85	29212	10.15	16.00	2.88
MT / MTZ 144 HV	34340	11.95	22.75	2.87	32934	11.57	18.46	2.85
MT / MTZ 160 HW	38273	13.39	22.16	2.86	37386	13.28	21.40	2.82
MT / MTZ 200 HSS	46807	15.97	29.19	2.93	43780	15.54	26.90	2.82
MT / MTZ 250 HUU	60858	21.33	34.75	2.85	57839	20.09	31.69	2.88
MT / MTZ 288 HVV	68379	23.91	45.50	2.87	65225	22.92	36.56	2.85
MT / MTZ 320 HWW	76547	26.79	44.32	2.86	74024	26.30	42.37	2.81

NOMINAL RATINGS* MT HIGH EFFICIENCY COMPRESSORS R22 - 50HZ

Compressor	Cooling capacity (W)	Power input (kW)	Current input (A)	COP (W/W)
MT 45 HJ	10786	3.62	6.86	2.98
MT 51 HK	12300	4.01	7.86	3.07
MT 57 HL	13711	4.54	9.24	3.02
MT 65 HM	15763	5.23	8.81	3.01
MT 73 HN	17863	5.98	9.99	2.99
MT 81 HP	20298	6.94	11.27	2.93

** Ratings at ARI conditions with R22: 7.2°C evaporating temperature, 54.4°C condensing temperature, 8.3 K subcooling, 11.1 K superheat, 50 Hz, 400 V.*

*** Ratings at ARI conditions with R407C at dew point: 7.2°C evaporating temperature, 54.4°C condensing temperature, 8.3 K subcooling, 11.1 K superheat, 50 Hz, 400 V.*

Capacity and power input data ± 5%.

NOMINAL PERFORMANCE
R134a, R404A, R507 - 50 HZ

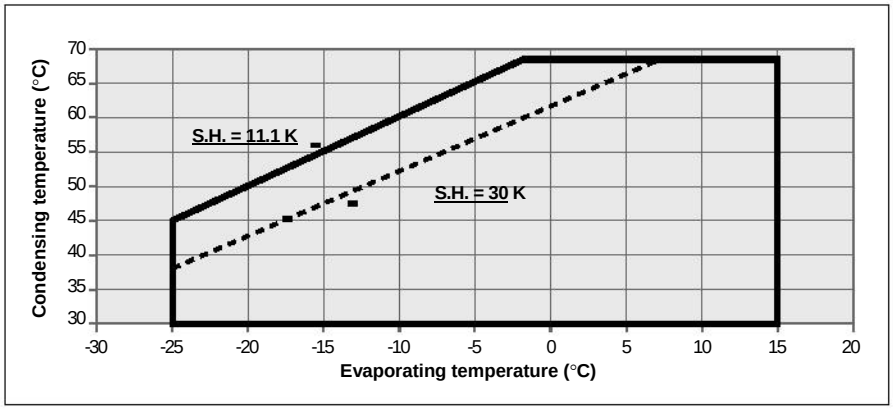
	NOMINAL RATINGS * R134a				NOMINAL RATINGS ** R404A / R507			
Compressor model	Cooling capacity	Power input	Current input	COP capacity	Cooling input	Power input (W)	Current (kW)	COP (A)
	(W/W)	(W)	(kW)	(A)	(W/W)			
MT / MTZ 18 JA	2553	0.99	2.19	2.58	1865	1.20	2.47	1.56
MT / MTZ 22 JC	3352	1.20	2.51	2.80	2673	1.56	2.96	1.71
MT / MTZ 28 JE	4215	1.53	3.30	2.75	3343	1.95	3.80	1.72
MT / MTZ 32 JF	4951	1.87	3.94	2.65	3747	2.28	4.51	1.64
MT / MTZ 36 JG	6005	2.13	4.09	2.81	4371	2.66	4.91	1.64
MT / MTZ 40 JH	6398	2.33	4.89	2.74	4889	3.00	5.36	1.63
MT / MTZ 44 HJ	6867	2.52	5.65	2.72	5152	3.16	6.37	1.63
MT / MTZ 50 HK	8071	2.88	5.50	2.80	6152	3.61	6.53	1.70
MT / MTZ 56 HL	9069	3.21	5.83	2.82	7001	4.00	7.07	1.75
MT / MTZ 64 HM	10352	3.62	6.96	2.86	8132	4.54	8.30	1.79
MT / MTZ 72 HP	11853	4.01	7.20	2.96	9153	4.99	8.64	1.84
MT / MTZ 80 HP	13578	4.63	8.45	2.93	10524	5.84	10.12	1.80
MT / MTZ 100 HS	15529	5.28	10.24	2.94	12020	6.83	12.16	1.76
MT / MTZ 125 HU	19067	6.29	10.80	3.03	15714	8.53	13.85	1.84
MT / MTZ 144 HV	23620	7.83	13.78	3.02	18076	9.74	16.25	1.86
MT / MTZ 160 HW	25856	8.57	14.67	3.02	20253	11.00	17.94	1.84
MT / MTZ 200 HSS	30756	10.45	20.28	2.94	23800	13.53	24.06	1.76
MT / MTZ 250 HUU	37746	12.45	21.38	3.03	31121	16.88	27.43	1.84
MT / MTZ 288 HVV	46773	15.49	27.29	3.02	35779	19.28	32.18	1.86
MT / MTZ 320 HWW	51169	16.98	29.06	3.01	40093	21.76	35.51	1.84

** Ratings at ARI conditions with R134a: 7.2°C evaporating temperature, 54.4°C condensing temperature, 8.3 K subcooling, 11.1 K superheat, 50 Hz, 400 V.*

*** Ratings with R404A / R507 at dew point conditions: -10°C evaporating temperature, 45°C condensing temperature, 0 K subcooling, 10 K superheat, 50 Hz, 400 V.*

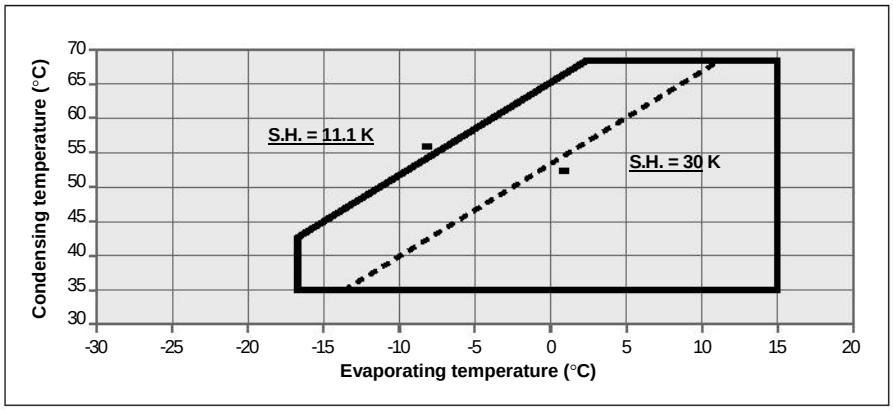
Capacity and power input data ± 5%.

Operating envelopes



Application Envelope for MT compressors with

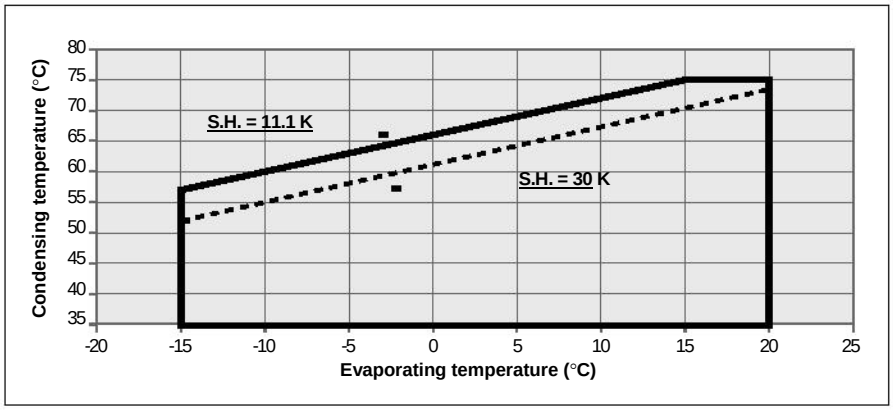
R22



Application Envelope for MTZ compressors with

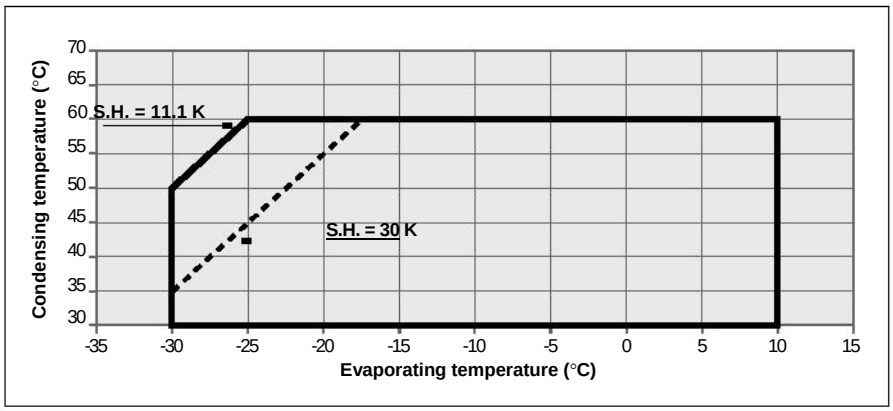
R407C

at DEW POINT



Application Envelope for MTZ compressors with

R134a



Application Envelope for MTZ compressors with

R404A/R507

ZEOTROPIC REFRIGERANT MIXTURES

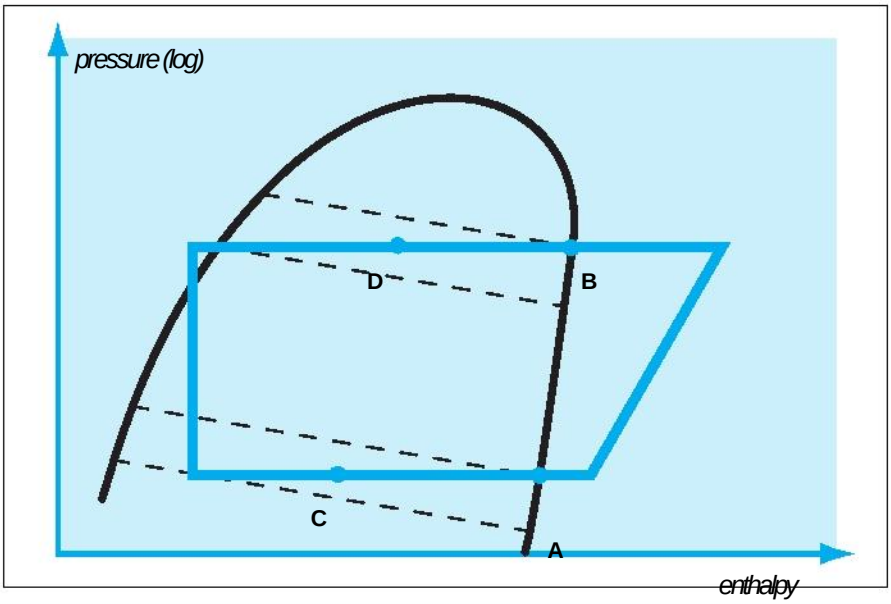
Refrigerant mixtures can be either zeotropic or azeotropic.
An azeotropic mixture (like R502 or R507) behaves like a pure refrigerant. During a phase transition (from vapour to liquid or from liquid to vapour) the composition of vapour and liquid stays the same.
In a zeotropic mixture (like R407C) on the other hand the composition of vapour and liquid changes during the phase transition. When the effect of this phase transition is very small, the mixture is often called a near-azeotropic mixture. R404A is such a near-azeotropic mixture.

The composition change has two resulting effects:

Phase shift
In system components where both vapour and liquid phase are present (evaporator, condenser, liquid receiver), the liquid phase and vapour phase do not have the same composition. In fact both phases form two different refrigerants.

Therefore zeotropic refrigerants need some special attention.
Zeotropic refrigerants must always be charged in liquid phase. Flooded evaporators and suction accumulators should not be applied in systems with zeotropic refrigerants. This also applies to near-azeotropic mixtures.

Temperature glide
During the evaporating process and the condensing process at constant pressure, the refrigerant temperature will decrease in the condenser and rise in the evaporator.Therefore when speaking about evaporating and condensing temperatures, it is important to indicate whether this is a DEW point temperature or a MEAN point value. In the figure below, the dotted lines are lines of constant temperature.
They do not correspond to the lines of constant pressure.
Points A and B are DEW point values.These are temperatures on the saturated vapour line.
Points C and D are MEAN point values.These are temperatures which correspond more or less with the average temperature during the evaporating and condensing process. For the same R407C cycle, MEAN point temperatures are typically about 2 to 3°C
lower than DEW point temperatures. According to Asercom recommendations, Danfoss Maneurop uses DEW point temperatures for selection tables and application envelopes etc.
To obtain exact capacity data at mean point temperatures, the mean point temperatures must be converted to dew point temperatures with help of refrigerant data tables from the refrigerant manufacturer.



DEW temperature and MEAN temperature for
R407C

Performance tables

R22

Models	TE	-25		-20		-15		-10		-5		0		5		10		15	
	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.	P.F.	P.A.
MT 18	30	850	0.59	1240	0.69	1740	0.79	2360	0.88	3120	0.95	4040	1.00	5140	1.04	6430	1.04	7920	1.02
	40	650	0.63	1000	0.74	1440	0.85	2000	0.96	2680	1.05	3500	1.13	4490	1.19	5660	1.22	7030	1.23
	50	-	-	-	-	1160	0.91	1630	1.03	2210	1.15	2930	1.25	3800	1.34	4830	1.41	6050	1.45
	60	- - -	- -	- -	- 1740	1.24	2330	1.38	3050	1.50	3940	1.60	4990	1.68 30	1320	0.71	1930	0.86	2
MT 22	650	1.00	3510	1.13	4500	1.24	5650	1.32	6970	1.36	8470	1.37	10160	1.32 40	930	0.76	1500	0.93	2
	170	1.09	2960	1.24	3870	1.38	4930	1.49	6150	1.57	7540	1.61	9110	1.61					
	50	-	-	-	-	1670	1.14	2380	1.32	3210	1.49	4160	1.64	5270	1.76	6530	1.85	7960	1.90
	60	- -	- -	- -	- -	2510	1.57	3350	1.76	4320	1.93	5430	2.07	6710	2.18 30		2150	1.18	2
MT 28	950	1.35	3880	1.50	4940	1.62	6150	1.71	7520	1.76	9060	1.76	10790	1.70	12710	1.57 40	1690	1.22	2
	450	1.41	3330	1.59	4320	1.75	5460	1.89	6750	1.99	8190	2.05	9810	2.06	11610	2.01			
	50	-	-	-	-	2730	1.65	3660	1.87	4700	2.06	5890	2.23	7220	2.36	8720	2.44	10390	2.48
	60	- -	- -	- -	- -	3880	2.21	4950	2.45	6160	2.66	7510	2.84	9030	2.97 30		2380	1.38	3
MT 32	220	1.56	4220	1.74	5390	1.89	6750	2.01	8320	2.10	10110	2.15	12150	2.14	14460	2.07 40	1800	1.44	2
	590	1.65	3520	1.85	4610	2.04	5870	2.21	7320	2.35	8990	2.45	10890	2.50	13030	2.51			
	50	-	-	-	-	2890	1.95	3870	2.18	5020	2.40	6340	2.60	7860	2.76	9590	2.89	11560	2.97
	60	- -	- -	- -	- -	4220	2.59	5390	2.85	6740	3.09	8290	3.30	10060	3.47 30		2910	1.52	3
MT 36	920	1.71	5070	1.89	6390	2.06	7870	2.21	9540	2.33	11410	2.41	13490	2.46	15790	2.46 40	2280	1.63	3
	240	1.84	4330	2.05	5580	2.25	6980	2.44	8550	2.61	10310	2.75	12260	2.85	14420	2.92			
	50	-	-	-	-	3560	2.20	4710	2.45	6010	2.69	7470	2.91	9090	3.11	10900	3.29	12910	3.43
	60	- -	- -	- -	- -	4980	2.94	6300	3.22	7780	3.50	9430	3.75	11260	3.97 30		3190	1.54	4
MT 40	270	1.80	5500	2.04	6900	2.24	8480	2.41	10250	2.52	12230	2.57	14440	2.54	16880	2.43 40	2430	1.71	3
	480	2.00	4680	2.28	6030	2.54	7570	2.77	9290	2.95	11210	3.07	13340	3.13	15700	3.11			
	50	-	-	-	-	3830	2.47	5140	2.79	6610	3.08	8270	3.34	10110	3.56	12160	3.71	14440	3.80
	60	- -	- -	- -	- -	5630	3.34	7210	3.69	8970	4.01	10930	4.27	13100	4.47 30		3140	1.55	4
MT 44	180	1.81	5460	2.05	7030	2.26	8920	2.42	11160	2.52	13810	2.56	16880	2.51	20420	2.37 40	2590	1.75	3
	540	2.05	4710	2.33	6130	2.58	7850	2.80	9910	2.97	12330	3.09	15160	3.13	18430	3.08			
	50	-	-	2960	2.19	3980	2.52	5230	2.84	6750	3.14	8580	3.39	10750	3.59	13300	3.73	16260	3.79
	60	- -	- -	- -	4340	3.01	5630	3.39	7190	3.74	9080	4.04	11310	4.29	13940	4.48 30	3200	1,55	4
MT 45	450	1,83	5870	2,07	7490	2,25	9340	2,37	11470	2,41	13900	2,37	16690	2,22	19850	1,95 40	2160	1,58	3
	390	1,91	4750	2,22	6290	2,48	8040	2,68	10030	2,82	12310	2,87	14910	2,83	17860	2,69			
	50	-	-	2390	1,91	3660	2,29	5080	2,64	6690	2,94	8520	3,18	10600	3,35	12980	3,44	15690	3,43
	60	- -	- -	- -	3890	2,71	5320	3,12	6950	3,48	8810	3,78	10940	4,00	13370	4,14 30	3650	1.67	4
MT 50	750	1.95	6130	2.23	7820	2.49	9880	2.73	12330	2.94	15240	3.11	18630	3.23	22550	3.29 40	2910	1.90	3
	940	2.20	5210	2.51	6770	2.81	8680	3.09	10960	3.34	13660	3.56	16830	3.74	20510	3.87			
	50	-	-	3140	2.40	4280	2.74	5680	3.08	7400	3.41	9470	3.72	11940	4.00	14860	4.25	18260	4.45
	60	- -	- -	- -	4560	3.29	6070	3.68	7900	4.06	10110	4.41	12740	4.74	15830	5.02 30	3510	1,79	4
MT 51	930	2,06	6540	2,30	8380	2,48	10490	2,61	12920	2,67	15720	2,65	18910	2,55	22560	2,36 40	2660	1,80	3
	990	2,14	5480	2,46	7180	2,72	9140	2,94	11380	3,10	13970	3,18	16930	3,19	20320	3,11			
	50	-	-	3060	2,17	4410	2,57	5940	2,93	7700	3,24	9740	3,50	12080	3,70	14780	3,83	17880	3,87
	60	- -	- -	- -	4680	3,07	6220	3,49	8000	3,87	10080	4,19	12480	4,44	15270	4,62 30	3830	1.98	5
MT 56	310	2.33	7050	2.64	9070	2.91	11410	3.12	14090	3.25	17140	3.28	20590	3.21	24470	3.00 40	3040	2.16	4
	420	2.55	6040	2.93	7910	3.27	10080	3.56	12560	3.79	15380	3.94	18570	3.99	22170	3.93			
	50	-	-	3570	2.70	5030	3.15	6720	3.59	8670	3.99	10910	4.34	13470	4.62	16380	4.81	19650	4.91
	60	- -	- -	- -	5510	3.85	7220	4.37	9190	4.86	11450	5.29	14030	5.65	16950	5.92 30	4320	2,17	5
MT 57	690	2,30	7360	2,45	9350	2,59	11690	2,72	14410	2,81	17530	2,85	21090	2,83	25100	2,73 40	3720	2,44	4
	940	2,60	6420	2,78	8200	2,98	10310	3,17	12760	3,35	15590	3,48	18830	3,57	22510	3,58			
	50	-	-	4220	2,82	5490	3,06	7020	3,33	8850	3,61	11010	3,88	13510	4,13	16400	4,34	19690	4,49
	60	- -	- -	- -	5830	3,62	7350	4,00	9170	4,39	11320	4,77	13810	5,12	16690	5,43 30	4400	2.18	6
MT 64	010	2.56	7940	2.92	10230	3.25	12920	3.52	16050	3.73	19660	3.86	23800	3.89	28510	3.81 40	3470	2.47	4
	960	2.89	6740	3.31	8850	3.69	11320	4.04	14200	4.34	17530	4.56	21360	4.70	25710	4.75			
	50	-	-	4100	3.11	5690	3.59	7570	4.06	9780	4.50	12370	4.90	15370	5.23	18830	5.50	22790	5.68
	60	- -	- -	- -	6460	4.31	8370	4.86	10620	5.37	13250	5.84	16310	6.25	19830	6.58 30	5240	2,37	6
MT 65	780	2,56	8650	2,77	10900	2,97	13550	3,14	16660	3,29	20260	3,38	24400	3,40	29100	3,34 40	4250	2,70	5
	640	2,93	7340	3,19	9360	3,45	11770	3,70	14590	3,92	17880	4,10	21660	4,23	25990	4,30			
	50	-	-	4700	3,19	6160	3,51	7930	3,85	10040	4,18	12540	4,50	15470	4,80	18860	5,05	22750	5,25
	60	-	-	-	-	-	-	6670	4,13	8440	4,57	10570	5,01	13090	5,43	16040	5,82	19470	6,16

R22

Models	TE	-25		-20		-15		-10		-5		0		5		10		15	
	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.	P.F.	P.A.
MT 72	30	4850	2.64	6670	2.99	8820	3.35	11340	3.69	14260	4.01	17610	4.30	21430	4.56	25750	4.76	30620	4.91
	40	3850	2.91	5540	3.29	7520	3.68	9830	4.07	12500	4.44	15560	4.79	19060	5.11	23020	5.39	27490	5.62
	50	-	-	4680	3.66	6440	4.10	8490	4.54	10860	4.97	13590	5.39	16710	5.79	20260	6.15	24280	6.48
	60	- -	- -	- -	7400	5.10	9420	5.61	11760	6.11	14460	6.59	17550	7.05	21060	7.48 30	6090	2,93	7
MT 73	800	3,23	9910	3,52	12450	3,77	15460	3,98	18970	4,14	23020	4,25	27650	4,28	32890	4,24 40	4790	2,90	6
	350	3,28	8270	3,65	10590	4,00	13330	4,31	16540	4,58	20260	4,80	24510	4,96	29340	5,05			
	50	-	-	5170	3,40	6850	3,87	8890	4,32	11330	4,74	14190	5,13	17510	5,48	21340	5,77	25700	6,01
	60	- -	- -	- -	7450	4,73	9520	5,28	11980	5,80	14870	6,28	18210	6,72	22060	7,11 30	5520	2.94	7
MT 80	600	3.34	10050	3.75	12910	4.14	16230	4.51	20030	4.85	24380	5.14	29290	5.39	34820	5.57 40	4390	3.27	6
	320	3.71	8580	4.15	11210	4.59	14250	5.01	17740	5.41	21720	5.78	26230	6.10	31320	6.37			
	50	-	-	5320	4.14	7330	4.63	9670	5.12	12380	5.62	15500	6.09	19060	6.54	23110	6.96	27690	7.32
	60	- -	- -	- -	8380	5.77	10700	6.34	13380	6.90	16480	7.44	20010	7.96	24040	8.44 30	6760	3,19	8
MT 81	670	3,65	11060	4,06	13950	4,40	17380	4,68	21410	4,88	26060	4,98	31380	4,98	37410	4,87 40	5300	3,07	7
	050	3,64	9220	4,16	11860	4,63	15010	5,03	18700	5,36	22970	5,61	27870	5,77	33440	5,82			
	50	-	-	5700	3,69	7610	4,34	9940	4,94	12730	5,49	16030	5,97	19870	6,37	24290	6,69	29340	6,92
	60	- -	- -	- -	8260	5,36	10650	6,06	13500	6,70	16850	7,27	20740	7,77	25210	8,18 30	7300	3.90	9
MT 100	690	4.39	12580	4.84	16030	5.22	20130	5.50	24930	5.67	30510	5.71	36930	5.57	44250	5.26 40	5360	4.03	7
	560	4.58	10210	5.12	13370	5.60	17120	6.01	21520	6.32	26640	6.51	32550	6.56	39320	6.44			
	50	-	-	5870	4.73	8210	5.37	11010	5.98	14340	6.54	18270	7.02	22870	7.40	28190	7.65	34330	7.76
	60	- -	- -	- -	9100	6.37	11950	7.10	15330	7.77	19330	8.36	24010	8.85	29440	9.20 30	9340	4.82	12
MT 125	420	5.40	16140	5.94	20580	6.43	25820	6.85	31940	7.17	39040	7.38	47180	7.45	56450	7.37 40	7490	5.30	10
	320	5.95	13710	6.59	17750	7.20	22510	7.75	28090	8.23	34570	8.62	42020	8.89	50530	9.03			
	50	-	-	8480	6.35	11450	7.11	14990	7.87	19190	8.59	24120	9.26	29880	9.86	36540	10.36	44190	10.74
	60	- -	- -	- -	12400	8.40	15930	9.31	20130	10.20	25070	11.03	30850	11.79	37540	12.46 30	10790	5.45	14
MT 144	250	6.09	18450	6.69	23490	7.23	29460	7.69	36470	8.05	44620	8.29	53990	8.37	64710	8.27 40	8620	5.97	11
	780	6.69	15590	7.40	20150	8.08	25560	8.70	31920	9.23	39330	9.67	47890	9.98	57690	10.13			
	50	-	-	9640	7.13	12940	7.98	16910	8.82	21650	9.63	27240	10.38	33800	11.05	41420	11.61	50190	12.05
	60	- -	- -	- -	13880	9.40	17820	10.43	22540	11.43	28130	12.36	34700	13.22	42340	13.98 30	11950	6.15	15
MT 160	720	6.86	20310	7.53	25820	8.13	32360	8.64	40030	9.04	48960	9.30	59250	9.39	71010	9.29 40	9660	6.72	13
	120	7.52	17300	8.31	22310	9.06	28250	9.75	35250	10.35	43410	10.84	52840	11.19	63640	11.37			
	50	-	-	10810	8.00	14460	8.95	18850	9.88	24090	10.79	30290	11.63	37560	12.38	46000	13.02	55740	13.52
	60	- -	- -	- -	15550	10.54	19960	11.69	25240	12.80	31500	13.86	38840	14.82	47390	15.68 30	14610	7.80	19
MT 200	380	8.79	25150	9.68	32070	10.44	40260	11.01	49870	11.35	61020	11.41	73850	11.15	88510	10.52 40	10720	8.05	15
	120	9.17	20410	10.23	26740	11.19	34240	12.01	43040	12.64	53290	13.02	65100	13.12	78630	12.88			
	50	-	-	11740	9.45	16420	10.74	22020	11.96	28680	13.08	36540	14.04	45730	14.80	56390	15.30	68650	15.52
	60	- -	- -	- -	18210	12.73	23890	14.20	30670	15.54	38670	16.72	48030	17.70	58880	18.41 30	18680	9.64	24
MT 250	840	10.79	32280	11.88	41160	12.86	51640	13.70	63890	14.34	78070	14.76	94350	14.91	112900		14.73 40		14
	980	10.60	20630	11.90	27420	13.18	35490	14.39	45030	15.50	56190	16.47	69130	17.24	84030	17.79	101050		18.06
	50	-	-	16950	12.70	22890	14.23	29980	15.74	38370	17.18	48250	18.52	59760	19.71	73090	20.72	88380	21.49
	60	- -	- -	- -	24790	16.79	31860	18.63	40250	20.40	50150	22.07	61700	23.59	75090	24.92 30	21580	10.90	28
MT 288	500	12.17	36900	13.37	46970	14.46	58920	15.39	72940	16.11	89230	16.57	107990		16.73	129410	16.54 40		17
	250	11.94	23560	13.38	31180	14.80	40300	16.15	51130	17.39	63850	18.47	78670	19.34	95780	19.95	115380		20.27
	50	-	-	19270	14.26	25880	15.96	33820	17.64	43290	19.25	54490	20.75	67600	22.09	82840	23.23	100390	24.11
	60	- -	- -	- -	27760	18.81	35650	20.86	45080	22.85	56270	24.73	69400	26.45	84670	27.96 30	23900	12.31	31
MT 320	450	13.72	40620	15.05	51640	16.26	64710	17.29	80070	18.08	97920	18.60	118500		18.78	142020	18.58 40		19
	320	13.45	26230	15.05	34590	16.62	44610	18.13	56510	19.51	70510	20.71	86820	21.68	105680		22.37	127290	22.74
	50	-	-	21610	16.00	28920	17.90	37700	19.77	48180	21.57	60580	23.25	75110	24.76	92000	26.03	111470	27.04
	60	-	-	-	-	-	-	31100	21.07	39930	23.37	50490	25.60	63000	27.71	77690	29.65	94770	31.36

LEGEND

P.A. power input (kW)

RATING CONDITIONS P.F. cooling capacity (W) **TE** evaporating temperature (°C)
TC condensing temperature (°C)

TE
- 50 Hz • Superheat 11.1 K
- Subcooling 8.3 K

R407C

Models	TE	-15		-10		-5		0		5		10		15	
	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.
MTZ 18	35	1690	0.80	2280	0.87	3020	0.93	3920	0.98	4990	1.00	6270	1.00	7760	0.98
	40	1490	0.83	2040	0.92	2730	0.99	3560	1.05	4570	1.09	5760	1.11	7160	1.11
	50	-	-	1610	1.00	2180	1.10	2870	1.19	3710	1.27	4720	1.34	5920	1.38
	60	- -	- -	- -	2230	1.32	2890	1.45	3690	1.56	4650	1.66 35	2150	1.00	2
MTZ 22	910	1.11	3840	1.20	4940	1.28	6250	1.32	7780	1.34	9540	1.32 40	1900	1.04	2
	620	1.16	3490	1.27	4530	1.36	5760	1.44	7190	1.48	8860	1.49			
	50	-	-	2080	1.24	2810	1.39	3690	1.53	4740	1.66	5980	1.76	7420	1.83
	60	- -	- -	- -	2900	1.68	3740	1.87	4750	2.04	5930	2.18 35	2740	1.25	3
MTZ 28	720	1.41	4890	1.55	6270	1.67	7880	1.74	9730	1.78	11850	1.77 40	2430	1.30	3
	360	1.47	4470	1.63	5770	1.77	7290	1.88	9050	1.95	11050	1.98			
	50	-	-	2680	1.56	3630	1.78	4760	1.97	6080	2.15	7610	2.30	9370	2.41
	60	- -	- -	- -	3760	2.15	4850	2.41	6120	2.65	7590	2.86 35	3090	1.41	4
MTZ 32	200	1.59	5510	1.76	7050	1.89	8840	1.99	10880	2.04	13210	2.04 40	2740	1.45	3
	800	1.66	5050	1.85	6510	2.01	8200	2.14	10140	2.23	12350	2.27			
	50	-	-	3030	1.75	4120	2.00	5390	2.23	6870	2.44	8570	2.62	10520	2.76
	60	- -	- -	- -	4270	2.43	5500	2.73	6930	3.01	8570	3.26 35	3710	1.67	4
MTZ 36	930	1.89	6380	2.07	8060	2.22	9990	2.32	12200	2.37	14710	2.36 40	3350	1.74	4
	520	1.97	5900	2.18	7490	2.36	9330	2.50	11430	2.59	13810	2.63			
	50	-	-	3690	2.10	4900	2.38	6300	2.63	7920	2.86	9760	3.05	11860	3.19
	60	- -	- -	- -	5060	2.87	6410	3.20	7970	3.50	9760	3.77 35	4370	1.96	5
MTZ 40	720	2.20	7310	2.41	9140	2.57	11240	2.68	13620	2.73	16320	2.70 40	4000	2.04	5
	300	2.30	6810	2.54	8550	2.74	10550	2.89	12820	2.98	15380	3.01			
	50	-	-	4410	2.47	5740	2.78	7280	3.06	9040	3.31	11050	3.51	13310	3.65
	60	- -	- -	- -	5910	3.35	7400	3.71	9100	4.04	11030	4.31 35	4340	2.06	5
MTZ 44	880	2.27	7740	2.45	9940	2.59	12530	2.69	15550	2.73	19020	2.71 40	3860	2.15	5
	330	2.38	7090	2.59	9180	2.77	11640	2.92	14510	3.01	17820	3.04			
	50	-	-	4220	2.54	5750	2.83	7580	3.10	9740	3.34	12270	3.55	15200	3.72
	60	- -	- -	- -	5930	3.34	7740	3.70	9880	4.05	12390	4.36 35	4940	2.28	6
MTZ 50	690	2.54	8800	2.78	11310	2.98	14260	3.13	17680	3.23	21610	3.26 40	4400	2.36	6
	070	2.65	8070	2.92	10450	3.15	13250	3.35	16500	3.50	20240	3.60			
	50	-	-	4840	2.80	6580	3.15	8660	3.48	11110	3.79	13970	4.06	17290	4.28
	60	- -	- -	- -	6840	3.75	8890	4.18	11300	4.59	14130	4.96 35	5650	2.54	7
MTZ 56	670	2.87	10090	3.17	12960	3.44	16330	3.66	20230	3.83	24720	3.93 40	5040	2.61	6
	960	2.97	9260	3.30	11980	3.61	15180	3.88	18880	4.10	23140	4.26			
	50	-	-	5580	3.12	7580	3.54	9960	3.94	12760	4.32	16020	4.66	19780	4.95
	60	- -	- -	- -	7930	4.25	10260	4.75	13010	5.23	16210	5.68 35	6340	2.80	8
MTZ 64	620	3.19	11350	3.56	14570	3.89	18350	4.18	22730	4.41	27760	4.58 40	5670	2.86	7
	830	3.28	10420	3.68	13480	4.06	17060	4.39	21220	4.68	25990	4.91			
	50	-	-	6310	3.44	8560	3.92	11230	4.39	14370	4.84	18020	5.25	22230	5.61
	60	- -	- -	- -	9000	4.74	11610	5.31	14680	5.86	18250	6.38 35	7330	3.16	9
MTZ 72	850	3.61	12840	4.03	16370	4.41	20470	4.74	25210	5.01	30620	5.21 40	6580	3.24	8
	970	3.72	11820	4.18	15170	4.61	19070	4.99	23570	5.32	28720	5.59			
	50	-	-	7280	3.90	9770	4.45	12710	4.99	16140	5.50	20110	5.97	24670	6.39
	60	- -	- -	- -	10240	5.37	13120	6.02	16480	6.66	20370	7.25 35	8510	3.60	11
MTZ 80	310	4.11	14630	4.60	18510	5.04	23010	5.42	28170	5.73	34060	5.96 40	7670	3.69	10
	340	4.24	13500	4.77	17200	5.26	21480	5.71	26390	6.09	31990	6.40			
	50	-	-	8440	4.45	11220	5.09	14480	5.70	18260	6.29	22610	6.84	27590	7.32
	60	-	-	-	-	-	-	11730	6.12	14930	6.88	18630	7.61	22900	8.30

R407C

Models	TE	-15		-10		-5		0		5		10		15	
	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.
MTZ 100	35	10080	4.53	13440	4.99	17510	5.39	22380	5.72	28130	5.95	34830	6.07	42580	6.05
	40	9050	4.72	12230	5.22	16080	5.68	20680	6.08	26110	6.39	32460	6.60	39810	6.68
	50	-	-	9850	5.60	13170	6.20	17140	6.75	21870	7.25	27420	7.66	33880	7.98
	60	- -	- -	- -	13580	7.34	17470	8.06	22100	8.71	27550	9.29 35	14030	5.71	18
MTZ 125	330	6.33	23480	6.87	29580	7.32	36720	7.64	44990	7.82	54490	7.83 40	12660	5.94	16
	740	6.61	21640	7.23	27430	7.77	34200	8.20	42060	8.50	51090	8.64			
	50	-	-	13630	7.11	17900	7.91	22960	8.66	28900	9.33	35820	9.90	43800	10.35
	60	- -	- -	- -	18420	9.49	23390	10.44	29230	11.32	36030	12.11 35	15940	6.51	20
MTZ 144	700	7.21	26390	7.84	33100	8.37	40940	8.78	49990	9.05	60360	9.13 40	14500	6.78	19
	040	7.54	24450	8.25	30830	8.88	38270	9.41	46880	9.80	56750	10.03			
	50	-	-	15670	8.11	20410	9.02	26010	9.87	32560	10.66	40170	11.34	48920	11.90
	60	- -	- -	- -	21020	10.79	26530	11.87	32980	12.89	40470	13.82 35	18240	7.47	23
MTZ 160	560	8.27	29890	9.00	37330	9.64	45990	10.15	55970	10.51	67380	10.69 40	16680	7.78	21
	760	8.65	27790	9.47	34870	10.21	43110	10.84	52620	11.35	63490	11.69			
	50	-	-	18090	9.31	23400	10.34	29640	11.32	36930	12.24	45350	13.06	55030	13.75
	60	- -	- -	- -	24130	12.34	30290	13.58	37470	14.77	45780	15.86 35	19960	8.98	26
MTZ 200	610	9.89	34670	10.69	44310	11.33	55680	11.79	68960	12.01	84300	11.97 40	17910	9.34	24
	210	10.34	31830	11.25	40940	12.03	51700	12.65	64280	13.06	78820	13.22			
	50	-	-	19500	11.08	26070	12.27	33950	13.37	43300	14.35	54290	15.17	67080	15.79
	60	- -	- -	- -	26900	14.54	34600	15.95	43760	17.25	54550	18.39 35	27780	11.31	36
MTZ 250	290	12.52	46490	13.60	58570	14.48	72700	15.12	89080	15.48	107880	15.50 40	25060	11.77	33
	160	13.10	42840	14.32	54300	15.38	67720	16.23	83280	16.83	101150	17.12			
	50	-	-	26990	14.09	35440	15.67	45450	17.15	57220	18.47	70920	19.60	86730	20.49
	60	- -	- -	- -	36480	18.78	46310	20.67	57870	22.42	71340	23.98 35	31590	12.90	41
MTZ 288	020	14.28	52290	15.53	65580	16.58	81090	17.39	99010	17.91	119540	18.09 40	28690	13.42	37
	680	14.94	48390	16.34	61020	17.58	75760	18.62	92800	19.40	112350	19.86			
	50	-	-	31020	16.07	40410	17.86	51490	19.55	64470	21.10	79530	22.45	96860	23.56
	60	- -	- -	- -	41640	21.36	52540	23.51	65320	25.53	80150	27.36 35	36120	14.79	46
MTZ 320	650	16.38	59180	17.83	73910	19.08	91060	20.10	110830	20.81	133420	21.18 40	33030	15.41	43
	080	17.13	55020	18.75	69050	20.21	85360	21.47	104190	22.46	125710	23.14			
	50	-	-	35820	18.43	46330	20.47	58690	22.42	73110	24.23	89800	25.85	108950	27.23
	60	-	-	-	-	-	-	47780	24.43	59970	26.90	74190	29.24	90650	31.40

LEGEND
(°C) (dew point)
P.A. power input (kW)

RATING CONDITIONS P.F. cooling capacity (W)
• 50 Hz • Superheat 11.1 K
TC condensing temperature (°C) (dew point)

TE evaporating temperature
• Subcooling 8.3 K

R134a

Models	TE	-15		-10		-5		0		5		10		15		20	
	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.
MTZ 18	40	880	0.60	1290	0.67	1790	0.73	2380	0.78	3070	0.82	3880	0.84	4820	0.84	5890	0.83
	50	660	0.62	1010	0.70	1430	0.78	1930	0.85	2520	0.92	3220	0.97	4030	1.01	4960	1.03
	60	-	-	790	0.70	1120	0.81	1510	0.91	1990	1.00	2550	1.09	3220	1.16	3990	1.22
	70	-- -	- -	- -	- -	- 1890	1.18	2400	1.30	3000	1.40 40	1170	0.70	1680	0.79	2290	0.87
MTZ 22		3040	0.94	3940	1.00	4990	1.04	6220	1.06	7640	1.05 50	910	0.73	1340	0.83	1870	0.93
		2510	1.03	3280	1.11	4200	1.18	5280	1.23	6530	1.26						
	60	-	-	1060	0.84	1480	0.97	2000	1.09	2630	1.21	3400	1.32	4310	1.41	5380	1.48
	70	- -	- -	- -	- -	- -	2610	1.44	3330	1.57	4200	1.69 40	1490	0.88	2060	0.98	2
MTZ 28	790	1.08	3700	1.17	4810	1.26	6150	1.34	7740	1.40	9610	1.45 50	1240	0.93	1720	1.05	2
	340	1.17	3120	1.29	4080	1.41	5260	1.52	6660	1.62	8330	1.71					
	60	-	-	1440	1.10	1920	1.25	2550	1.40	3350	1.55	4340	1.70	5540	1.85	6980	1.98
	70	-	-	-	-	-	-	-	-	-	-	3400	1.87	4380	2.06	5570	2.25
MTZ 32	40	1750	1.07	2440	1.21	3300	1.35	4370	1.48	5660	1.58	7190	1.66	9010	1.70	11120	1.71
	50	1400	1.10	1990	1.27	2740	1.44	3670	1.60	4800	1.74	6160	1.86	7780	1.95	9680	2.01
	60	-	-	1610	1.30	2210	1.50	2980	1.70	3930	1.89	5090	2.05	6490	2.20	8150	2.32
	70	- -	- -	- -	- -	- -	3990	2.24	5150	2.44	6550	2.63 40	2450	1.25	3240	1.39	4
MTZ 36	200	1.53	5350	1.65	6700	1.75	8280	1.83	10110	1.89	12210	1.91 50	2050	1.33	2760	1.50	3
	610	1.67	4630	1.83	5840	1.97	7260	2.10	8910	2.21	10820	2.29					
	60	-	-	2270	1.57	2990	1.77	3860	1.98	4910	2.18	6150	2.36	7600	2.53	9290	2.67
	70	- -	- -	- -	- -	- -	4940	2.60	6180	2.84	7630	3.06 40	2880	1.40	3690	1.53	4
MTZ 40	640	1.66	5740	1.77	7010	1.87	8450	1.95	10100	2.01	11950	2.05 50	2470	1.52	3210	1.68	4
	080	1.84	5080	2.00	6240	2.15	7560	2.28	9070	2.40	10770	2.49					
	60	-	-	2680	1.79	3440	1.99	4330	2.20	5350	2.40	6530	2.60	7880	2.78	9410	2.95
	70	- -	- -	- -	- -	- -	5350	2.89	6530	3.15	7870	3.40 40	2560	1.59	3530	1.75	4
MTZ 44	730	1.90	6210	2.03	7990	2.14	10120	2.21	12610	2.25	15520	2.24 50	2020	1.64	2850	1.83	3
	880	2.02	5150	2.20	6700	2.36	8560	2.49	10770	2.60	13350	2.66					
	60	-	-	2320	1.86	3140	2.10	4170	2.33	5450	2.55	7010	2.76	8890	2.93	11120	3.08
	70	- -	- -	- -	- -	- -	5510	2.99	7020	3.25	8860	3.49 40	2970	1.76	4110	1.96	5
MTZ 50	520	2.14	7230	2.30	9290	2.43	11730	2.53	14590	2.59	17910	2.59 50	2340	1.81	3330	2.04	4
	550	2.27	6040	2.49	7850	2.68	10010	2.85	12560	2.98	15540	3.08					
	60	-	-	2680	2.07	3670	2.36	4910	2.64	6430	2.91	8270	3.16	10470	3.38	13070	3.56
	70	- -	- -	- -	- -	- -	6510	3.43	8320	3.75	10500	4.04 40	3310	1.92	4590	2.15	6
MTZ 56	170	2.36	8070	2.55	10350	2.71	13050	2.83	16200	2.91	19840	2.93 50	2600	1.97	3720	2.24	5
	100	2.50	6780	2.76	8800	2.99	11210	3.19	14040	3.35	17330	3.47					
	60	-	-	2980	2.27	4130	2.60	5540	2.93	7270	3.24	9340	3.53	11810	3.80	14710	4.03
	70	- -	- -	- -	- -	- -	7510	3.84	9570	4.22	12040	4.57 40	3750	2.11	5210	2.38	7
MTZ 64	000	2.63	9160	2.85	11730	3.04	14750	3.19	18280	3.29	22360	3.32 50	2930	2.16	4220	2.47	5
	810	2.79	7730	3.08	10030	3.36	12750	3.60	15940	3.80	19640	3.94					
	60	-	-	3370	2.50	4700	2.89	6340	3.27	8320	3.64	10690	3.99	13500	4.30	16790	4.58
	70	- -	- -	- -	- -	- -	8640	4.34	11030	4.79	13860	5.20 40	4520	2.33	6190	2.62	8
MTZ 72	200	2.90	10610	3.16	13450	3.38	16760	3.56	20610	3.69	25020	3.76 50	3490	2.29	4990	2.66	6
	800	3.03	8960	3.39	11530	3.74	14540	4.05	18050	4.34	22090	4.57					
	60	-	-	3800	2.45	5370	2.93	7250	3.42	9500	3.91	12170	4.38	15290	4.83	18910	5.25
	70	- -	- -	- -	- -	- -	9680	4.49	12380	5.13	15540	5.76 40	5390	2.71	7250	3.03	9
MTZ 80	490	3.35	12150	3.66	15280	3.94	18930	4.19	23150	4.40	27990	4.57 50	4340	2.79	6000	3.17	8
	010	3.56	10390	3.94	13210	4.31	16520	4.65	20350	4.97	24760	5.25					
	60	-	-	4760	3.24	6480	3.70	8540	4.17	11000	4.64	13910	5.10	17300	5.54	21230	5.96
	70	-	-	-	-	-	-	-	-	-	-	11100	5.53	14010	6.10	17410	6.66

R134a

Models	TE	-15		-10		-5		0		5		10		15		20	
	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.
MTZ 100	40	5700	3.16	7880	3.52	10560	3.85	13790	4.14	17650	4.36	22210	4.50	27520	4.55	33670	4.49
	50	4590	3.31	6490	3.74	8820	4.16	11660	4.55	15070	4.89	19110	5.17	23860	5.37	29390	5.48
	60	-	-	5340	3.86	7270	4.39	9630	4.91	12520	5.39	15980	5.83	20090	6.20	24920	6.49
	70	- -	- -	- -	- -	- -	12870	6.43	16270	6.99	20330	7.49 40	7270	3.58	9980	4.08	13
MTZ 125	260	4.54	17180	4.95	21820	5.28	27250	5.51	33550	5.62	40790	5.60 50	5650	3.63	8050	4.23	10
	960	4.81	14440	5.35	18580	5.84	23450	6.25	29130	6.56	35680	6.75					
	60	-	-	6300	4.21	8750	4.94	11720	5.65	15280	6.32	19510	6.93	24480	7.46	30260	7.90
	70	- -	- -	- -	- -	- -	15450	7.54	19640	8.32	24580	9.03 40	9530	4.70	12750	5.22	16
MTZ 144	620	5.71	21220	6.16	26630	6.57	32930	6.91	40220	7.17	48560	7.33 50	7770	4.98	10630	5.57	14
	070	6.16	18170	6.74	23010	7.27	28680	7.76	35250	8.18	42810	8.52					
	60	-	-	8630	5.83	11550	6.54	15060	7.25	19240	7.94	24180	8.60	29950	9.20	36640	9.75
	70	- -	- -	- -	- -	- -	19500	9.38	24380	10.20	30110	10.96 40	10540	5.07	14030	5.65	18
MTZ 160	270	6.22	23330	6.78	29330	7.31	36350	7.81	44490	8.26	53850	8.64 50	8740	5.37	11800	6.01	15
	510	6.67	19960	7.33	25260	7.98	31500	8.60	38770	9.19	47180	9.74					
	60	-	-	9650	6.31	12720	7.07	16460	7.85	20950	8.63	26290	9.41	32580	10.16	39920	10.87
	70	- -	- -	- -	- -	- -	20670	10.21	25870	11.14	32030	12.05 40	11270	6.26	15600	6.98	20
MTZ 200	900	7.63	27310	8.19	34950	8.63	43960	8.91	54490	9.01	66650	8.89 50	9080	6.55	12850	7.41	17
	470	8.25	23090	9.02	29840	9.69	37850	10.24	47250	10.64	58190	10.85					
	60	-	-	10570	7.65	14380	8.70	19070	9.72	24770	10.68	31630	11.54	39770	12.27	49340	12.85
	70	- -	- -	- -	- -	- -	25300	12.76	32040	13.87	40090	14.85 40	14390	7.09	19770	8.08	26
MTZ 250	260	9.00	34030	9.80	43220	10.45	53970	10.91	66440	11.13	80760	11.09 50	11190	7.18	15940	8.37	21
	690	9.52	28600	10.60	36790	11.56	46430	12.37	57670	12.99	70640	13.37					
	60	-	-	12480	8.34	17330	9.78	23210	11.18	30260	12.51	38630	13.72	48470	14.78	59930	15.65
	70	- -	- -	- -	- -	- -	30720	14.92	39010	16.48	48790	17.87 40	18870	9.32	25250	10.33	32
MTZ 288	900	11.30	42010	12.21	52720	13.01	65210	13.69	79630	14.20	96150	14.51 50	15390	9.85	21060	11.03	27
	860	12.20	35980	13.34	45570	14.40	56780	15.37	69800	16.20	84770	16.87					
	60	-	-	17090	11.54	22870	12.95	29810	14.35	38090	15.72	47860	17.02	59290	18.23	72540	19.30
	70	- -	- -	- -	- -	- -	38520	18.65	48180	20.26	59520	21.77 40	20890	10.04	27810	11.18	36
MTZ 320	190	12.31	46220	13.42	58090	14.48	71990	15.46	88120	16.35	106650	17.11 50	17290	10.63	23350	11.90	30
	690	13.21	39510	14.51	50000	15.80	62350	17.04	76750	18.21	93400	19.28					
	60	-	-	19140	12.49	25220	14.00	32610	15.55	41500	17.09	52080	18.62	64540	20.11	79070	21.53
	70	-	-	-	-	-	-	-	-	-	-	41.420	20.19	51720	22.03	63910	23.83

LEGEND

P.A. power input (kW)

RATING CONDITIONS P.F. cooling capacity (W) **TE** evaporating temperature (°C)
TC condensing temperature (°C)

- 50 Hz • Superheat 11.1 K
- Subcooling 8.3 K

R404A / R507

Models	TE	-30		-25		-20		-15		-10		-5		0		5		10	
	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.	P.F.	P.A.
MTZ 18	30	880	0.67	1210	0.78	1640	0.87	2170	0.95	2830	1.02	3640	1.07	4590	1.09	5720	1.09	7030	1.06
	40	500	0.73	790	0.85	1150	0.96	1610	1.06	2170	1.15	2850	1.24	3670	1.30	4630	1.34	5760	1.35
	50	290	0.70	510	0.83	790	0.96	1140	1.09	1580	1.22	2110	1.34	2760	1.45	3540	1.54	4460	1.62
	60	-- 380	0.71	550	0.87	770	1.04	1060	1.21	1430	1.38	1880	1.54	2450	1.69	3130	1.83	30	1
MTZ 22	210	0.75	1680	0.94	2240	1.12	2920	1.28	3720	1.41	4650	1.50	5720	1.55	6950	1.54	8350	1.47 40	840
		0.75	1260	0.96	1760	1.17	2350	1.36	3050	1.53	3850	1.67	4780	1.78	5840	1.84	7040	1.85	
	50	480	0.63	820	0.87	1230	1.11	1710	1.35	2270	1.57	2920	1.78	3670	1.96	4540	2.10	5520	2.20
	60	- -	350	0.63	630	0.93	970	1.22	1370	1.52	1840	1.80	2390	2.06	3020	2.30	3760	2.49 30	1
MTZ 28	650	1.03	2190	1.24	2870	1.43	3700	1.60	4700	1.75	5880	1.86	7260	1.93	8860	1.96	10690	1.93 40	1
	110	1.08	1600	1.29	2210	1.50	2930	1.71	3800	1.89	4820	2.05	6020	2.18	7420	2.26	9020	2.30	
	50	700	1.03	1100	1.27	1590	1.51	2180	1.76	2880	1.99	3720	2.21	4710	2.40	5860	2.55	7190	2.67
	60	- -	670	1.16	1010	1.45	1430	1.74	1940	2.04	2550	2.32	3280	2.58	4160	2.82	5180	3.03 30	1
MTZ 32	760	1.24	2390	1.46	3190	1.66	4180	1.85	5370	2.01	6800	2.14	8480	2.24	10440	2.29	12700	2.28 40	1
	130	1.32	1690	1.54	2390	1.77	3250	1.99	4280	2.19	5510	2.37	6960	2.53	8650	2.64	10610	2.71	
	50	720	1.33	1170	1.59	1730	1.85	2410	2.11	3230	2.37	4220	2.61	5390	2.83	6770	3.03	8390	3.18
	60	- -	830	1.59	1200	1.90	1660	2.22	2240	2.54	2940	2.85	3790	3.15	4820	3.44	6040	3.69 30	2
MTZ 36	250	1.51	2920	1.73	3760	1.94	4820	2.13	6100	2.31	7650	2.45	9470	2.56	11610	2.62	14080	2.64 40	1
	590	1.62	2180	1.86	2930	2.10	3840	2.33	4950	2.55	6280	2.74	7860	2.91	9710	3.04	11870	3.13	
	50	1110	1.68	1590	1.94	2180	2.22	2910	2.50	3800	2.77	4870	3.03	6160	3.27	7680	3.49	9460	3.67
	60	- -	1130	1.96	1520	2.29	2020	2.63	2650	2.97	3420	3.31	4360	3.63	5510	3.94	6870	4.23 30	2
MTZ 40	180	1.59	2990	1.87	4000	2.15	5210	2.42	6650	2.67	8350	2.90	10320	3.10	12590	3.25	15180	3.36 40	1
	530	1.70	2270	2.00	3160	2.30	4230	2.60	5490	2.89	6970	3.17	8680	3.42	10660	3.64	12930	3.83	
	50	1030	1.73	1640	2.06	2370	2.39	3240	2.74	4280	3.08	5490	3.42	6900	3.74	8540	4.04	10430	4.30
	60	- -	1090	2.03	1620	2.41	2240	2.81	3000	3.22	3900	3.63	4960	4.03	6210	4.41	7660	4.77 30	2
MTZ 44	570	1.86	3390	2.12	4450	2.36	5810	2.59	7490	2.78	9550	2.94	12010	3.05	14930	3.10	18340	3.09 40	1
	660	1.98	2380	2.26	3300	2.53	4460	2.80	5910	3.05	7680	3.27	9810	3.45	12350	3.59	15320	3.67	
	50	1070	1.98	1630	2.29	2350	2.62	3270	2.94	4420	3.25	5840	3.55	7570	3.82	9660	4.06	12140	4.25
	60	- -	1160	2.22	1620	2.60	2230	3.00	3020	3.39	4040	3.78	5310	4.16	6880	4.51	8780	4.83 30	3
MTZ 50	170	2.11	4130	2.40	5370	2.69	6950	2.94	8900	3.16	11270	3.34	14100	3.45	17440	3.50	21340	3.47 40	2
	080	2.25	2930	2.57	4010	2.89	5370	3.20	7050	3.48	9080	3.73	11530	3.93	14430	4.08	17830	4.16	
	50	1370	2.25	2040	2.61	2890	2.99	3950	3.36	5290	3.72	6920	4.06	8910	4.37	11300	4.63	14120	4.84
	60	- -	1450	2.53	2000	2.98	2720	3.43	3640	3.89	4800	4.34	6260	4.77	8050	5.17	10210	5.53 30	3
MTZ 56	130	2.20	4330	2.56	5810	2.91	7630	3.22	9800	3.50	12370	3.72	15380	3.88	18870	3.96	22860	3.94 40	2
	080	2.37	3150	2.75	4470	3.14	6050	3.51	7940	3.85	10170	4.15	12790	4.40	15820	4.59	19300	4.69	
	50	1300	2.41	2180	2.84	3250	3.28	4530	3.72	6060	4.15	7880	4.55	10020	4.91	12520	5.22	15420	5.47
	60	- -	1460	2.83	2210	3.35	3120	3.88	4220	4.41	5550	4.93	7140	5.42	9020	5.88	11240	6.28 30	3
MTZ 64	810	2.51	5160	2.90	6830	3.29	8870	3.65	11300	3.97	14180	4.24	17530	4.44	21410	4.57	25840	4.61 40	2
	570	2.72	3790	3.14	5270	3.56	7060	3.97	9180	4.36	11690	4.72	14610	5.02	17990	5.26	21860	5.43	
	50	1670	2.78	2680	3.24	3890	3.73	5350	4.22	7080	4.69	9130	5.15	11540	5.57	14340	5.95	17580	6.26
	60	- -	1780	3.21	2640	3.77	3690	4.36	4950	4.94	6460	5.52	8270	6.08	10400	6.61	12900	7.09 30	4
MTZ 72	580	2.89	6060	3.31	7900	3.73	10130	4.13	12810	4.49	15980	4.82	19690	5.09	23970	5.29	28890	5.41 40	3
	090	3.01	4430	3.46	6050	3.92	8020	4.38	10360	4.82	13120	5.23	16350	5.60	20100	5.92	24400	6.17	
	50	2000	3.06	3110	3.56	4440	4.08	6040	4.62	7960	5.15	10230	5.67	12900	6.17	16010	6.62	19620	7.03
	60	- -	2090	3.58	3040	4.19	4200	4.82	5600	5.47	7280	6.12	9290	6.76	11680	7.37	14470	7.95 30	5
MTZ 80	140	3.36	6900	3.84	9030	4.32	11590	4.78	14610	5.21	18140	5.60	22230	5.93	26900	6.19	32210	6.37 40	3
	470	3.57	5060	4.09	6970	4.61	9230	5.14	11890	5.64	14980	6.12	18550	6.56	22640	6.95	27300	7.27	
	50	2180	3.66	3520	4.22	5100	4.82	6970	5.42	9160	6.03	11720	6.63	14680	7.20	18090	7.73	21990	8.21
	60	-	-	2280	4.26	3440	4.94	4820	5.65	6450	6.38	8370	7.11	10620	7.84	13240	8.54	16260	9.20

R404A / R507

Models	TE	-30		-25		-20		-15		-10		-5		0		5		10	
	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.	P.F.	P.A.
MTZ 100	30	5660	3.88	7590	4.44	10020	4.97	13050	5.45	16730	5.85	21150	6.16	26380	6.35	32490	6.41	39560	6.30
	40	3940	4.26	5660	4.86	7800	5.46	10430	6.03	13620	6.55	17450	6.99	21990	7.35	27310	7.59	33490	7.70
	50	2600	4.32	3990	5.00	5710	5.70	7810	6.39	10390	7.06	13500	7.68	17220	8.23	21620	8.70	26770	9.05
	60	-	-	2600	4.78	3770	5.61	5240	6.47	7070	7.31	9330	8.14	12080	8.92	15420	9.64	19 390	10.27
MTZ 125	30	7900	4.84	10350	5.52	13430	6.17	17220	6.79	21790	7.34	27250	7.82	33670	8.18	41130	8.42	49730	8.52
	40	5570	5.33	7780	6.05	10490	6.78	13790	7.49	17760	8.17	22490	8.78	28060	9.32	34560	9.76	42 060	10.08
	50	3800	5.54	5590	6.34	7780	7.17	10440	8.02	13650	8.85	17500	9.65	22 060	10.40	27 420	11.07	33 670	11.64
	60	-	-	3820	6.38	5330	7.35	7200	8.36	9490	9.39	12 290	10.41	15 680	11.39	19 730	12.33	24 530	13.19
MTZ 144	30	9230	5.79	12020	6.53	15500	7.26	19780	7.95	24940	8.58	31080	9.13	38300	9.58	46700	9.91	56 360	10.10
	40	6560	6.22	9070	7.01	12150	7.81	15890	8.61	20390	9.37	25 740	10.08	32 030	10.72	39 360	11.26	47 830	11.69
	50	4470	6.42	6530	7.30	9040	8.22	12080	9.16	15 740	10.09	20 120	11.00	25 310	11.86	31 400	12.66	38 480	13.36
	60	-	-	4450	7.40	6210	8.48	8380	9.59	11 040	10.74	14 270	11.88	18 170	13.00	22 820	14.09	28 310	15.11
MTZ 160	30	10400	6.41	13500	7.26	17370	8.11	22100	8.93	27810	9.72	34 580	10.45	42 520	11.09	51 740	11.63	62 340	12.05
	40	7460	6.89	10250	7.79	13670	8.72	17820	9.65	22 790	10.57	28 690	11.46	35 610	12.29	43 660	13.05	52 930	13.71
	50	5190	7.20	7490	8.19	10280	9.24	13 640	10.31	17 690	11.40	22 520	12.49	28 220	13.55	34 900	14.56	42 660	15.50
	60	-	-	5200	8.43	7170	9.63	9580	10.89	12 510	12.19	16 070	13.51	20 350	14.83	25 450	16.14	31 450	17.40
MTZ 200	30	11200	7.65	15010	8.75	19840	9.79	25 820	10.74	33 120	11.54	41 860	12.15	52 210	12.53	64 320	12.64	78 310	12.43
	40	7810	8.44	11210	9.64	15 450	10.82	20 650	11.94	26 980	12.97	34 560	13.85	43 540	14.56	54 080	15.04	66 320	15.25
	50	5150	8.56	7900	9.90	11 300	11.28	15 470	12.65	20 570	13.98	26 730	15.20	34 090	16.30	42 800	17.21	53 000	17.91
	60	-	-	5160	9.48	7470	11.12	10 370	12.81	13 990	14.49	18 470	16.13	23 930	17.67	30 530	19.09	38 390	20.34
MTZ 250	30	15540	9.61	20 400	10.95	26 490	12.25	33 990	13.47	43 060	14.57	53 850	15.50	66 560	16.23	81 340	16.71	98 370	16.89
	40	11 040	10.55	15 410	11.97	20 770	13.42	27 310	14.83	35 180	16.17	44 540	17.39	55 570	18.46	68 430	19.32	83 290	19.95
	50	7520	10.96	11 070	12.55	15 400	14.21	20 660	15.88	27 030	17.53	34 640	19.11	43 680	20.59	54 290	21.91	66 650	23.05
	60	-	-	7570	12.62	10 570	14.55	14 260	16.56	18 800	18.59	24 350	20.60	31 050	22.55	39 070	24.41	48 580	26.12
MTZ 288	30	18 400	11.47	23 920	12.93	30 820	14.37	39 290	15.74	49 520	16.99	61 680	18.08	75 980	18.97	92 600	19.62	111 730	19.99	40
		12 970	12.31	17 940	13.88	24 040	15.47	31 450	17.04	40 360	18.56	50 950	19.97	63 410	21.23	77 920	22.30	94 680	23.14	
	50	8860	12.71	12 940	14.45	17 900	16.27	23 920	18.13	31 180	19.98	39 850	21.78	50 120	23.49	62 180	25.06	76 200	26.45	
	60	-	-	8790	14.66	12 280	16.78	16 580	19.00	21 840	21.26	28 240	23.52	35 950	25.75	45 160	27.90	56 050	29.92	
MTZ 320	30	20 680	12.69	26 830	14.37	34 480	16.05	43 860	17.69	55 150	19.24	68 560	20.68	84 290	21.96	102 550	23.03	123 540	23.87	
	40	14 750	13.65	20 290	15.43	27 060	17.27	35 270	19.11	45 120	20.94	56 790	22.69	70 490	24.34	86 430	25.84	104 800	27.15	
	50	10 280	14.26	14 830	16.22	20 350	18.29	27 020	20.42	35 040	22.58	44 600	24.73	55 890	26.82	69 110	28.83	84 460	30.70	
	60	-	-	10 280	16.69	14 180	19.07	18 950	21.56	24 760	24.14	31 810	26.75	40 280	29.37	50 370	31.95	62 260	34.46	

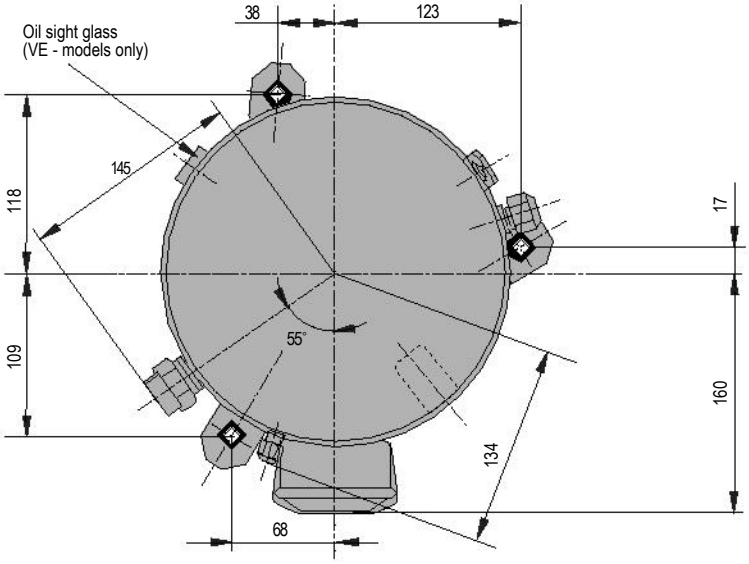
LEGEND
P.F. cooling capacity (W)
P.A. power input (kW)

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

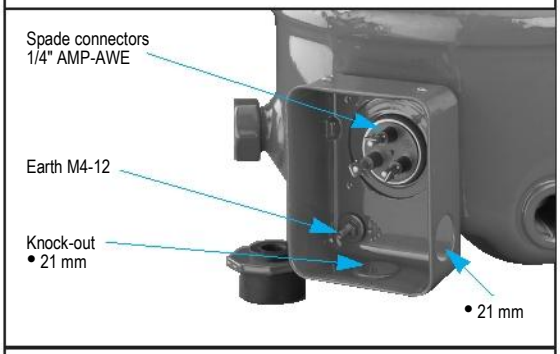
RATING CONDITIONS
- 50 Hz • Superheat 10 K
- Subcooling 0 K

Outline drawings

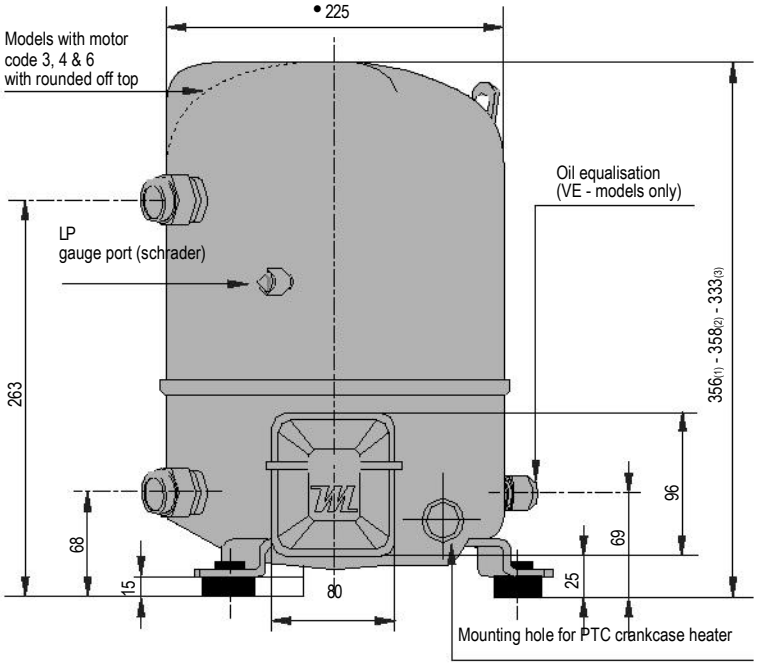
1 CYLINDER



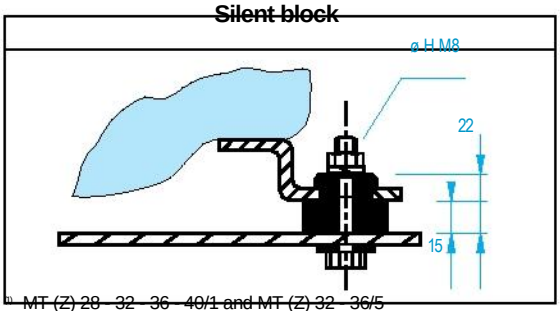
Terminal box



IP rating: 55 (with cable gland)



Silent block

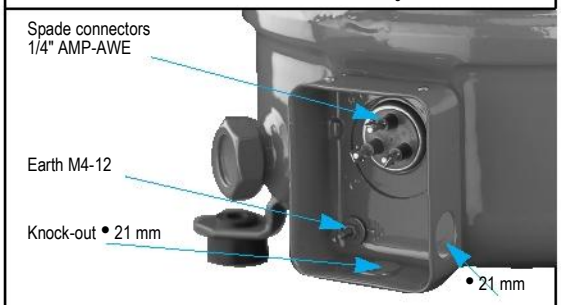


(1) MT (Z) 28 - 32 - 36 - 40/1 and MT (Z) 32 - 36/5
(2) MT (Z) 32 - 36 - 40/3 - 4 - 6
(3) MT (Z) 18 - 22/1 and MT (Z) 18 - 22 - 28/3 - 4 - 5 - 6

	Rotolock connections size		Pipe sizing size		Rotolock valve	
	Suction	Discharge	Suction	Discharge	Suction	Discharge
~~MT / MTZ 18 JA~~						
MT / MTZ 22 JC 3/4/5/6 MT / MTZ 28 JE 3/4/5/6	1"	1"	1/2"	3/8"	V06	V01
~~MT / MTZ 22 JC1~~	~~1"1/4~~	~~1"~~	~~5/8"~~	~~3/8"~~	~~V09~~	~~V01~~
MT / MTZ 28 JE1 MT / MTZ 32 JF MT / MTZ 36 JG MT / MTZ 40 JH	1"1/4	1"	5/8"	1/2"	V09	V06

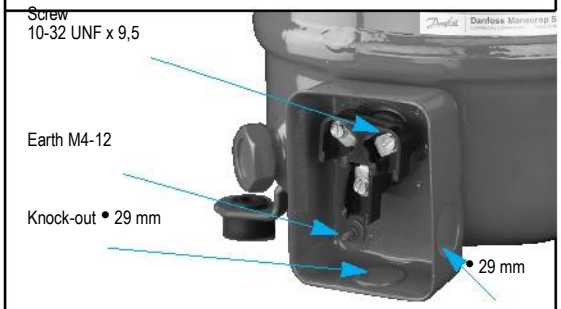
2 CYLINDERS

Terminal box Mounting hole



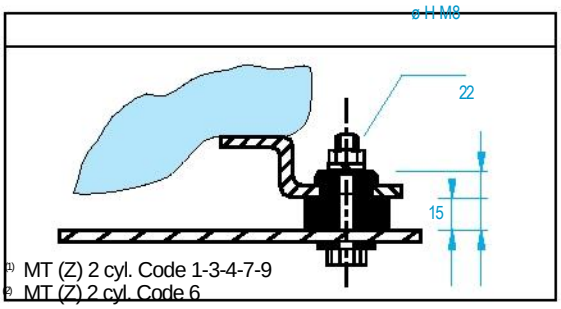
IP rating: 55 (with cable gland)

Terminal box for motor code 6

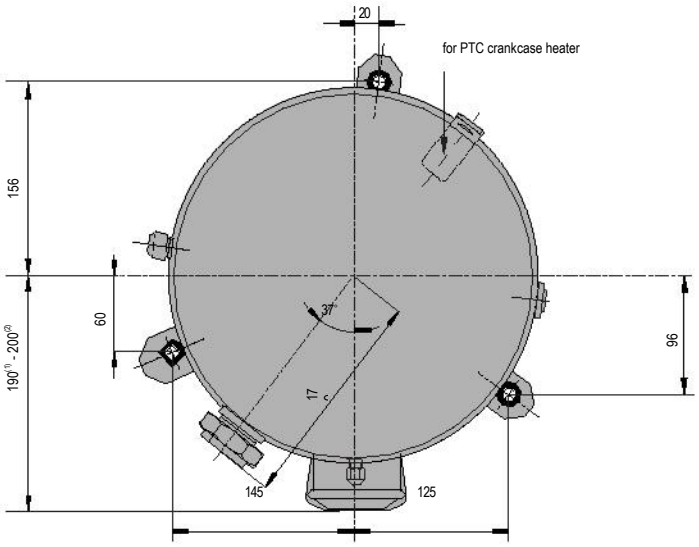


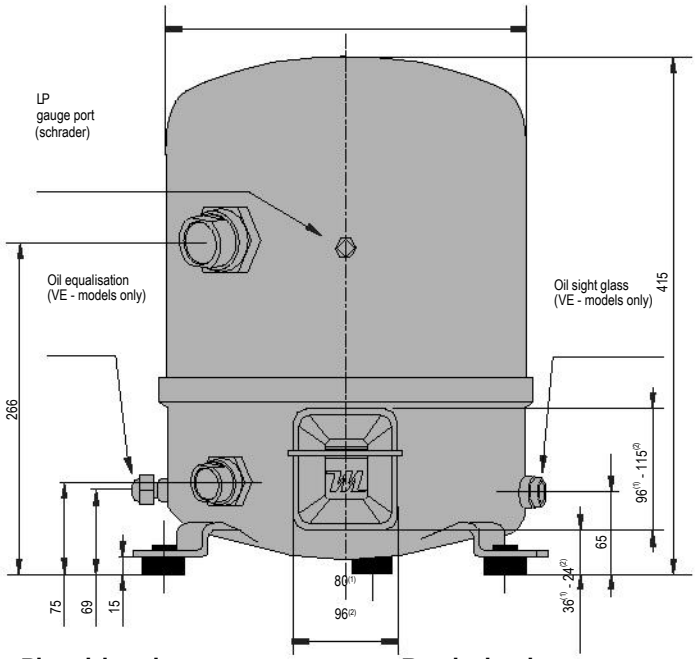
IP rating: 54 (with cable gland)

Silent block



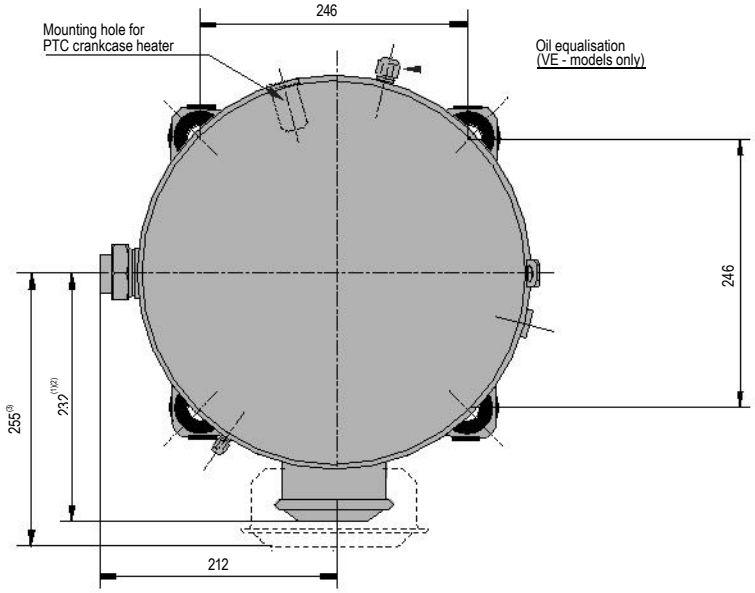
[1] MT (Z) 2 cyl. Code 1-3-4-7-9
[2] MT (Z) 2 cyl. Code 6



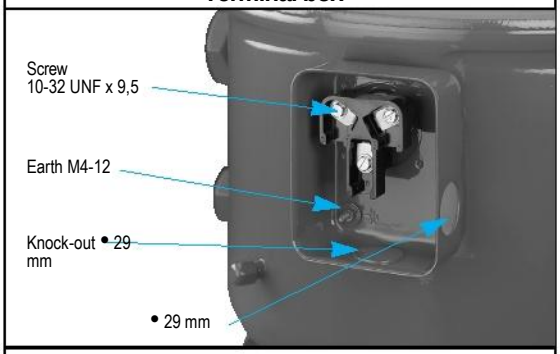


	Rotolock connections size		Pipe sizing size		Rotolock valve	
	Suction	Discharge	Suction	Discharge	Suction	Discharge
MT / MTZ 44 HJ MT / MTZ 45 HJ						
MT / MTZ 50 HK MT / MTZ 51 HK MT / MTZ 56 HL MT / MTZ 57 HL MT / MTZ 64 HM MT / MTZ 65 HM MT / MTZ 72 HN MT / MTZ 73 HN	1"3/4	1"1/4	7/8"	3/4"	V07	V04
MT / MTZ 80 HP	1"3/4	1"1/4	1"1/8	3/4"	V02	V04
MT / MTZ 81 HP						

4 CYLINDERS

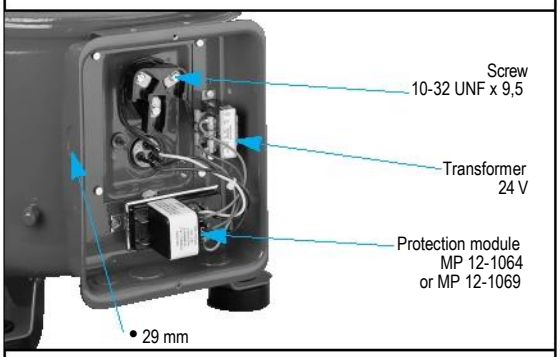


Terminal box

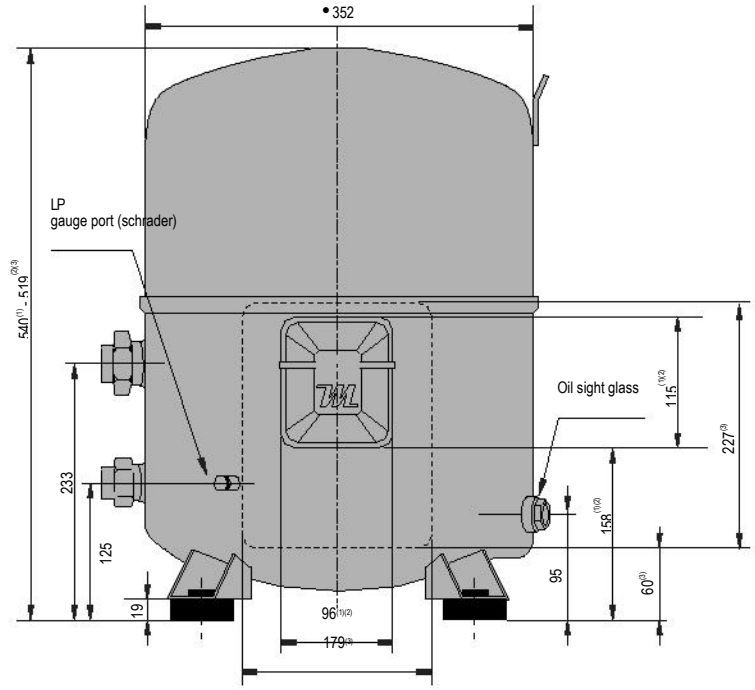


IP rating: 54 (with cable gland)

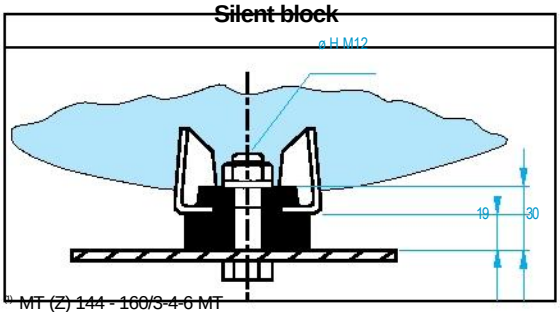
Terminal box for motor code 7 and 9



IP rating: 55 (with cable gland)



Silent block

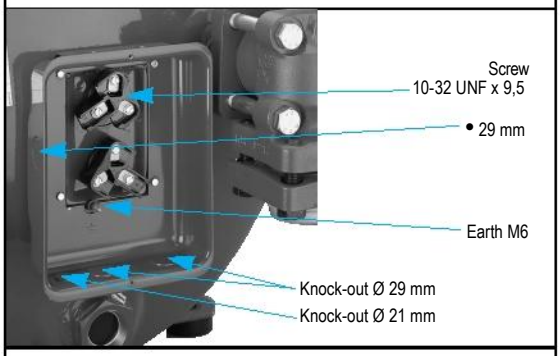


(1) MT (Z) 144 - 160/3-4-6 MT
(2) (Z) 100 - 125/3-4-6
(3) MT (Z) Code 7 - 9

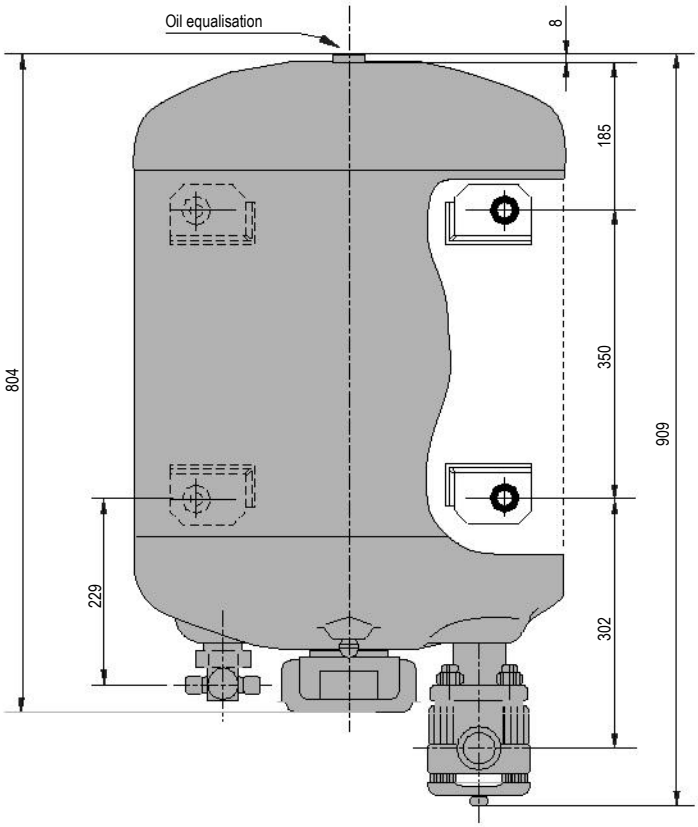
	Rotolock connections size		Pipe sizing size		Rotolock valves	
	Suction	Discharge	Suction	Discharge	Suction	Discharge
MT / MTZ 100 HS MT / MTZ 125 HU MT / MTZ 144 HV MT / MTZ 160 HW	1"3/4	1"1/4	1"1/8	3/4"	V02	V04

8 CYLINDERS

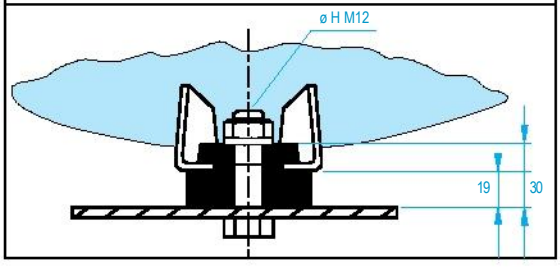
Terminal box

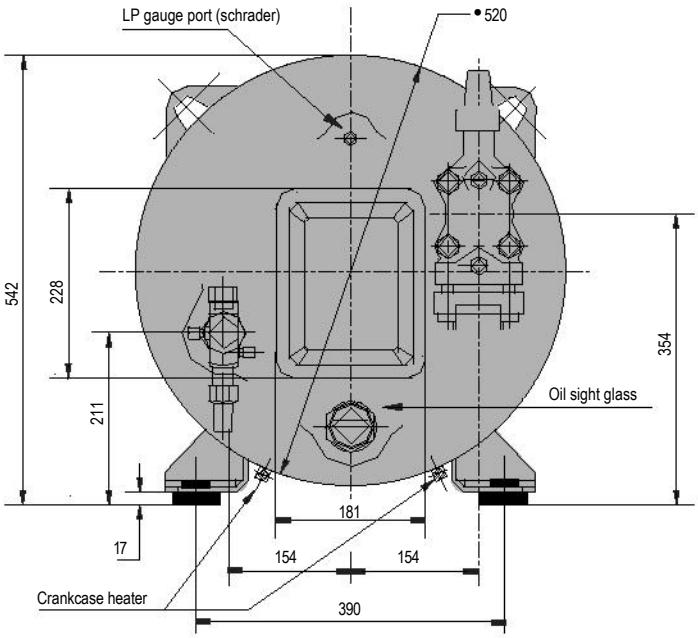


IP rating: 55 (with cable gland)



Silent block





	Rotolock connections size		Pipe sizing size		Rotolock valves	
	Suction	Discharge	Suction	Discharge	Suction	Discharge
MT / MTZ 200 HSS	Flange fitting	1"3/4	1"5/8	1"1/8	V12*	V02
MT / MTZ 250 HUU	Flange fitting	1"3/4	2"1/8	1"1/8		V02
MT / MTZ 288 HVVF	Flange fitting	1"3/4	2"1/8	1"3/8		V10
MT / MTZ 320 HWW	Flange fitting	1"3/4	2"1/8	1"3/8		V10

* valve supplied with appropriate sleeve.

Electrical connections and wiring

SINGLE PHASE ELECTRICAL CHARACTERISTICS

	LRA - Locked Rotor Current (A)		MCC - Maximum Continuous Current (A)		Winding resistance (Ω) (± 7 % at 20° C)			
Motor Code	1	5	1	5	1		5	
Winding					run	start	run	start
MT / MTZ 18 JA	51	41	13	12	1.36	4.82	1.78	4.74
MT / MTZ 22 JC	49.3	41	17	15	1.25	2.49	1.78	4.74
MT / MTZ 28 JE	81	55	25	16	0.74	1.85	1.16	3.24
MT / MTZ 32 JF	84	70	26.5	20	0.64	2.85	0.89	4.35
MT / MTZ 36 JG	84	70	30	20	0.64	2.85	0.89	4.35
MT / MTZ 40 JH	99	-	34	-	0.53	2.00	-	-
MT / MTZ 44 HJ	103	-	34	-	0.41	1.90	-	-
MT / MTZ 45 HJ	143	-	37	-	0.33	1.95	-	-
MT / MTZ 50 HK	143	-	37	-	0.33	1.95	-	-
MT / MTZ 51 HK	146	-	46	-	0.31	2.00	-	-
MT / MTZ 56 HL	146	-	46	-	0.31	2.00	-	-
MT / MTZ 57 HL	148	-	53	-	0.32	1.32	-	-
MT / MTZ 64 HM	148	-	53	-	0.32	1.32	-	-
MT / MTZ 65 HM	148	-	53	-	0.32	1.32	-	-

CAPACITOR AND RELAY SELECTION TABLE

50 Hz	PSC/CSR*		CSR only	
Models	**Run capacitors** (1)		**Start capacitors** (2)	**Start relay**
	(A) µF	**(C) µF**	**(B) µF**	
MT / MTZ 18 JA-5	2	1	10	all models 3ARR3J4A4
MT / MTZ 22 JC-5	0	0	0	
MT / MTZ 28 JE-5	2	1	10	
MT / MTZ 32 JF-5	0	0	0	
MT / MTZ 36 JG-5	2	1	10	
	0	0	0	
	2	1	13	
	5	0	5	
	2	1	13	
	5	0	5	

60 Hz	PSC/CSR*		CSR only	
Models	**Run capacitors** (1)		**Start capacitors** (2)	**Start relay**
	(A) µF	**(C) µF**	**(B) µF**	
MT / MTZ 18 JA-1	1	1	-	all models 3ARR3J4A4
MT / MTZ 22 JC-1	5	0	10	
MT / MTZ 28 JE-1	1	3	0	
MT / MTZ 32 JF-1	5	0	13	
MT / MTZ 36 JG-1	2	2	5	
MT / MTZ 40 JH-1	5	5	10	
MT / MTZ 44 / 45 HJ-1	2	2	0	
MT / MTZ 50 / 51 HK-1	5	0	10	
	2	2	0	
	5	0	10	
	3	2	0	
	5	0	13	
	3	1	5	
	0	5	13	
	3	1	5	
	0	5		
MT / MTZ 56 / 57 HL-1	3	2	200	
MT / MTZ 64 / 65 HM-1	0	0	235	
	3	2		
	0	5		

** PSC Permanent Split Capacitor / CSR Capacitor Start Run*
(1) *Run capacitors: 440 volts - minimum 10 000 hours.*
(2) *Start capacitors: 330 Volts.*

Trickle circuit
The trickle circuit provides the facility of heating the compressor crankcase by feeding a small current to the auxiliary winding and the run capacitor.
See the drawings page 23.
By using PSC or CSR starting systems, compressor models MT/MTZ 18-22 can be operated without crankcase heaters as the heater function is provided by the trickle circuit. For the larger single phase compressor models MT/MTZ 28-64, the use of the PTC crankcase heater is recommended.

PSC wiring
This system may be used for refrigerant circuits with capillary tubes or expansion valves with bleed ports. Pressure equalisation must be ensured before start up because of the low starting torque characteristics of this system.

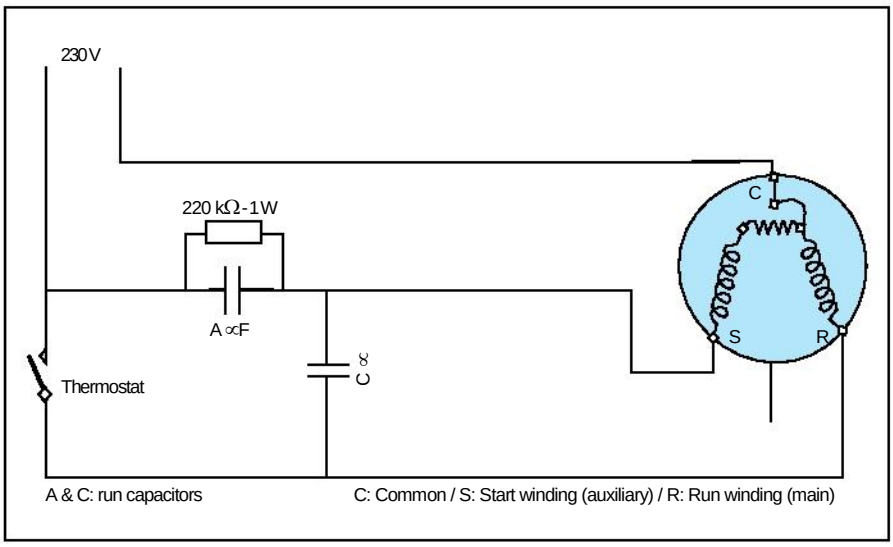
CSR wiring
This system provides additional

motor torque at start up, by the use of a start capacitor in combination with the run capacitor. This system can be used for refrigerant circuits with capillary tubes or expansion valves.

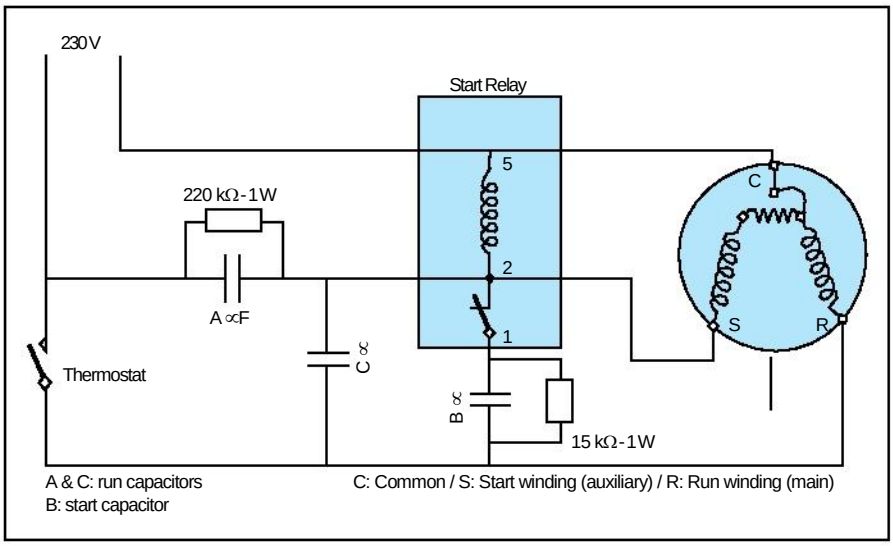
The start capacitor is only connected
during the starting operation, a potential relay is used to disconnect it after the start sequence.

The single phase compressor motors are internally protected by a temperature/current sensing bimetallic protector, which senses
the main and start winding currents, and also the winding temperature. Once the protector has tripped, it may take up to two to four hours to reset and restart the compressor. Check that power supply corresponds to compressor characteristics (refer to compressor nameplate).

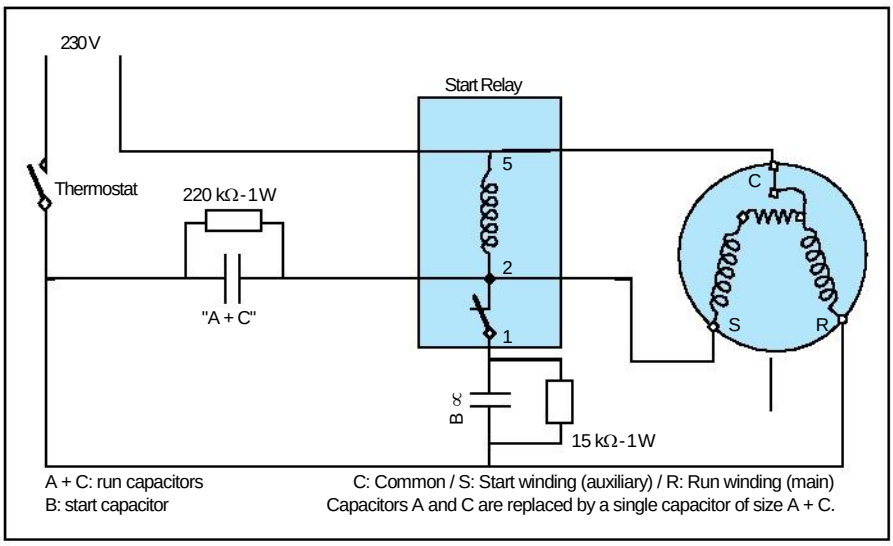
SUGGESTED WIRING DIAGRAMS



Single phase
PSC wiring
with trickle circuit



Single phase
CSR wiring
with trickle circuit



Single phase
CSR wiring
without trickle circuit

THREE PHASE ELECTRICAL CHARACTERISTICS

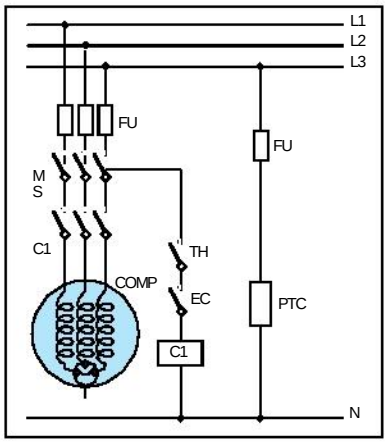
	LRA - Locked Rotor Current (A)					MCC - Maximum Continuous Current (A)					Winding resistance (Ω) (± 7 % at 20° C)				
Motor Code	**3**	**4**	**6**	**7**	**9**	**3**	**4**	**6**	**7**	**9**	**3**	**4**	**6**	**7**	**9**
MT / MTZ 18 JA	38	16	-	-	-	9	5	-	-	-	2.49	10.24	-	-	-
MT / MTZ 22 JC	38	16	38	-	-	11	6	11	-	-	2.49	10.24	2.49	-	-
MT / MTZ 28 JE	57	23	57	-	-	16	7.5	16	-	-	1.37	7.11	1.37	-	-
MT / MTZ 32 JF	60	25	60	-	-	18	8	18	-	-	1.27	6.15	1.27	-	-
MT / MTZ 36 JG	74	30	74	-	-	17	9	17	-	-	1.16	5.57	1.16	-	-
MT / MTZ 40 JH	98	38	74	-	-	22	10	18	-	-	0.95	4.56	0.95	-	-
MT / MTZ 44 HJ	100	42	92	-	-	22	9.5	18	-	-	0.74	3.80	0.96	-	-
MT / MTZ 45 HJ	117	48.5	--	-	23	9.5	--	-0.62	3.32	-	-	-			
MT / MTZ 50 HK	117	42	92	-	68	23	12	18	-	15	0.62	3.80	0.96	-	1.82
MT / MTZ 51 HK	125	48.5	--	-	28	11.5	--	-0.62	3.60	--	-				
MT / MTZ 56 HL	125	60	106	44	68	28	12	21	12	15	0.62	2.41	0.82	2	1.82
MT / MTZ 57 HL	128	64	- -	-31	12	-	-	-0.59	2.39	--	-				
MT / MTZ 64 HM	128	67	117	-	68	31	15	23	-	17	0.59	2.41	0.71	-	1.82
MT / MTZ 65 HM	128	64	- -	-	30	14	-	--	0.59	2.39	-	-	-		
MT / MTZ 72 HN	128	80	135	-	57	30	15.5	27	-	18	0.59	1.90	0.62	-	1.81
MT / MTZ 73 HN	155	80	- -	-	47	17	--	-0.46	1.90	--	-				
MT / MTZ 80 HP	155	80	135	-	85	42	18	29	-	22	0.46	1.90	0.53	-	1.28
MT / MTZ 81 HP	155	80	- -	-	47	19	-	--	0.46	1.90	-	-	-		
MT / MTZ 100 HS	157	78.5	126	61	92	43	22	35	18	24	0.50	1.85	0.67	3.10	1.26
MT / MTZ 125 HU	210	105	170	73	129	54	27	43	19	29	0.38	1.57	0.43	2.51	0.84
MT / MTZ 144 HV	259	115	208	90	143	64	30	51	22	36	0.27	1.19	0.37	2.00	1.10
MT / MTZ 160 HW	259	130	208	99	143	70	36	51	28	36	0.27	1.10	0.37	1.76	1.10
MT / MTZ 200 HSS	314	158	252	--	86	44	70	-	-0.50	1.85	0.67	-	**-MT / MTS 250**		
HUU	420	210	340	--	108	54	86	-	-0.38	1.57	0.43	-	**-MT / MTZ 288**		
HVV	518	230	416	--	128	60	102	-	-0.27	1.19	0.37	-	**-MT / MTZ 320**		
HWW	518	260	416	--	140	72	102	-	-0.27	1.10	0.37	-	-		

Note: for three phase motors, the winding resistances measured at compressor terminals is the sum of two winding resistor values shown above.

MOTOR PROTECTION AND SUGGESTED WIRING DIAGRAMS

The 3 phase compressors codes 3-4-6, and 2 cylinders compressors codes 7-9, are protected by an internal motor protector, connected to the neutral point of the star connected stator windings, the protector cuts out all 3 phases simultaneously.
The 3 phase 4 cylinder compressors code 7-9 are protected by an electronic protection device located in the electrical terminal box with temperature sensors embedded into the stator windings.
Note: once the overload protector has tripped it may take up to 3 hours to reset and restart the compressor.

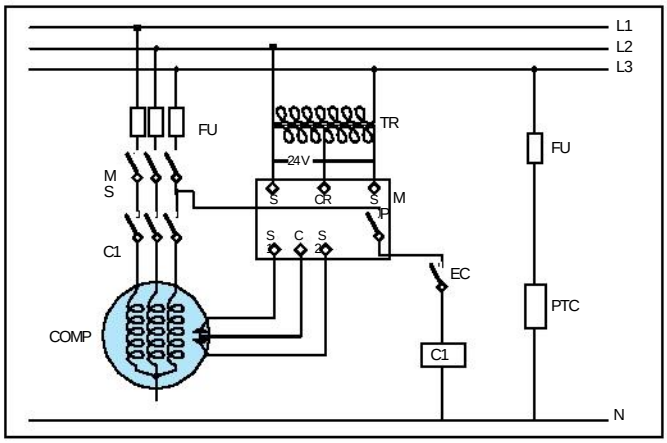
For all 3-phase compressors, a PTC crankcase heater is required.



LEGEND:

FU ..... *fuses*
MS ..... *main switch*
C1 ..... *compressor contactor*
TH ..... *thermostat*
EC ..... *external controls*
COMP ..... *compressor*
MP ..... *protection module*
PTC ..... *crankcase heater*
TR ..... *transformer*

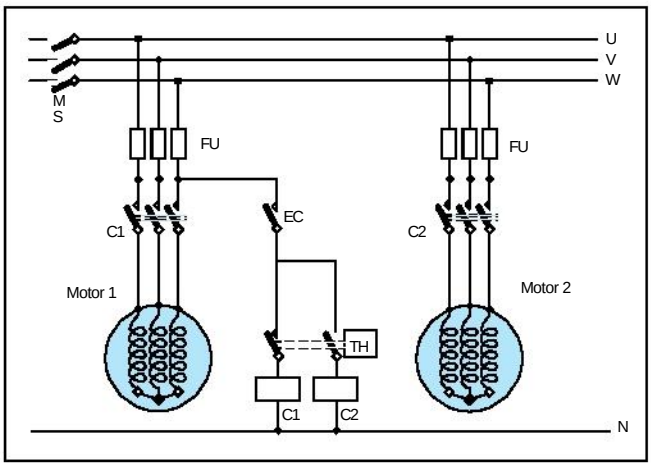
Compressors with IOL (internal overload line break) (all compressors code 3-4-6 and 2 cyl. Code 7-9)
The IOL protects the motor against overheating, current overload and locked rotor conditions.



Compressors with external protection module (4 cylinder compressors code 7-9)
The module protects against motor overheating and locked rotor conditions.An external circuit breaker or thermal overload relay is required to protect the motor against over current conditions

Electrical connections and wiring

8 CYLINDER COMPRESSORS



LEGEND:

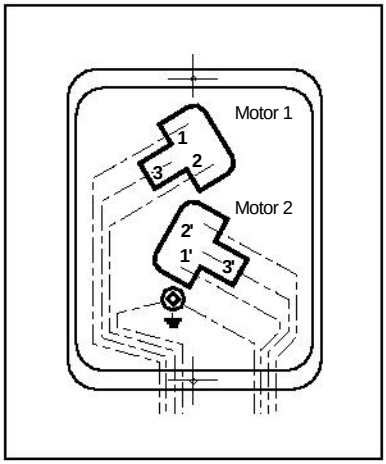
FU ..... *fuses*

MS ..... *main switch*

C1-C2 ..... *compressor contactors*

TH ..... *2 stage thermostat*

EC ..... *external controls*



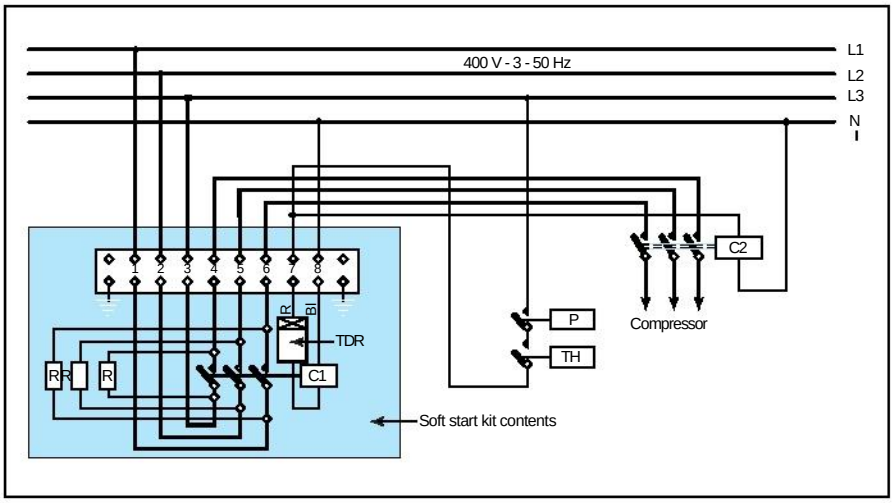
Warning: check that the phase sequences are the same on both connector blocks, when connecting the compressor motors.
The following start and run control sequence must be respected: start motor number 1 first, then motor number 2. Stop motor number 2 first, then motor number 1.

SOFT START KIT FOR 2 - 4 CYL. CODE 4

In many countries limitation of the starting current is requested for 3 phase compressors.
To meet this requirement, Danfoss Maneurop can supply soft start kits with statoric resistors which have the following advantages:

- starting current can be reduced by up to 50% of the direct-on-line value
- can be applied to existing installations using standard Danfoss Maneurop compressors
- reduces the starting mechanical stresses, increasing the life of the internal components.

Important notes: the number of starts should be limited to 6 per hour. HP/LP pressure equalisation is required before starting.



LEGEND:

TH ..... *Control element*

P ..... *Pressostat*

TDR ..... *Time delay relay*

C1 ..... *Contactor short circuit Resistance*

C2 ..... *Contactor*

Models	LRA - Locked rotor Current (A)	Starting current (A) with soft start kit	Soft start kit
MT / MTZ 50 HK4	42	22	SCR 01 - 5.6Ω Ref. 7702003
MT / MTZ 64 HM4	67	26	
MT / MTZ 80 HP4	68	27	
MT / MTZ 100	78.5	48	SCR 03 - 2.2Ω Ref 7705001
MT / MTZ HS4	105	51	
MT / MTZ 125	115	58	
MT / MTZ HU4	130	64	
144			
HV4			
160			
HW4			

Miscellaneous

APPROVALS

NORMES FRANÇAISES	VERBAND DEUTSCHER ELEKTROTECHNIKER	UNDERWRITERS LABORATORIES INC.	EUROPEAN DIRECTIVE

Most Maneurop MT/MTZ compressors comply with international safety and technical standards and are approved by the above mentioned authorities.
All MT & MTZ models have CE marking. Refer to technical information bulletin TI2-011 for a detailed list.

DESIGN VERSION

EX: MT125 HU 4 **D** VE

	1	3	4	5	6	7	9
MT 18	P	M	A	B	-	-	-
MT 22	S	M	A	P	M	-	-
MT 28	R	M	A	N	M	-	-
MT 32	M	E	C	L	A	-	*
AMT 36 -	Q	F	E	B	F	-	
MT 40	N	F	E	-	G	-	-
MT 44	E	A	A	-	*	-	-
MT 45	A	*	A	-	-	-	-
MT 50	E	A	B	-	A	A	*
*MT 51	A	*	A	-	*	-	
-MT 56	C	A	A	-	A	*	
*MT 57	A	*	A	-	-	-	
-MT 64	D	C	C	-	A	-	
*MT 65	A	*	A	-	*	-	
-MT 72	-	A	A	-	A	-	
*MT 73	-	*	A	-	-	-	
-MT 80	-	*	A	-	*	-	
*MT 81	-	*	A	-	-	-	
-MT 100	-	D	D	-	D	*	
*MT 125	-	D	D	-	D	*	
*MT 144	-	*	*	-	*	*	
*MT 160 *	-	D	D	-	D	*	
MT 200	-	A	A	-	A	-	-
MT 250	-	A	A	-	A	-	-
MT 288	-	A	A	-	-	-	-
MT 320	-	A	A	-	A	-	-

	1	3	4	5	6	7	9
MTZ 18	A	A	A	*	-	-	-
MTZ 22	*	A	A	*	A	-	-
MTZ 28	A	A	A	*	A	-	-
MTZ 32	A	A	A	*	A	A	
- MTZ 36	A	A	A	*	A	-	
MTZ 40	A	A	A	-	B	-	-
MTZ 44	*	*	A	-	*	-	-
MTZ 45	A	*	A	-	-	-	-
MTZ 50	*	*	B	-	*	A	
- MTZ 51	A	*	A	-	*	-	
* MTZ 56	*	*	A	-	*	*	
- MTZ 57	A	*	A	-	-	-	
* MTZ 64	*	*	B	-	*	-	
- MTZ 65	A	*	A	-	-	-	
* MTZ 72	-	*	A	-	*	-	
- MTZ 73	-	*	A	-	*	-	
* MTZ 80	-	*	A	-	*	-	
- MTZ 81	-	*	A	-	-	-	
* MTZ 100	-	*	*	-	*	*	
* MTZ 125	-	*	*	-	*	*	
* MTZ 144	-	*	*	-	*	*	
* MTZ 160	-	*	*	-	*	*	
MTZ 200	-	A	A	-	-	-	-
MTZ 250	-	A	A	-	A	-	-
MTZ 288	-	A	A	-	-	-	-
MTZ 320	-	A	A	-	A	-	-

* no letter

IP RATING

The compressor terminal boxes IP rating are shown on the outline drawings section.
The information below gives the different IP rating combinations according to CEI 529.
The compressor terminal boxes IP rating are only valid when

correctly sized cable glands of the same IP rating are applied.

IP 5 5

Designatory letters

First numeral

Level of protection against contact and foreign objects

5 Complete protection against contact and against harmful dust deposits

Second numeral

Level of protection against water

4 Protection against water splashing from any direction

5 Protection against jets of water from any direction

PACKAGING

Models	Net weight (kg)	Gross weight (kg)	Individual packaging Nbr	Compressor Packed (mm)	Full pallet dim. (mm)	Stacking	Multiple packaging Gross weight (kg)	Nbr	Total dim. (mm)	Stacking
1 cylinder										
MT / MTZ 18	21	142					279 **MT**			
/ MTZ 22	21	142					279			
MT / MTZ 28	23	151	6	330x295x385	1000x600x510	4	295	12	1200x800x500	4
MT / MTZ 32	24	158					305			
MT / MTZ 36	25	164					322			
MT / MTZ 40	26	168					329			
2 cylinders										
MT / MTZ 44 / 50	35	227					294 **MT**			
/ MTZ 45 / 51	37	239					306			
MT / MTZ 56 / 64	37	239	6	395x365x455	1115x800x560	4	306	8	1200x800x550	
	4**MT / MTZ 57 / 65**		39		254		333 **MT / MTZ 72 / 80**			
	40	257	342	**MT / MTZ 73 / 81**		41	262	347		
4 cylinders										
MT / MTZ 100	60	398					388			
MT / MTZ 125	64	414	6	485x395x600	1200x1000x730	4	404	6	1200x800x650	4
MT / MTZ 144	67	430					420			
MT / MTZ 160	69	444					434			
8 cylinders										
MT / MTZ 200	170	184								
MT / MTZ 250	175	189	1	1000x605x585	1000x605x720	4**MT /**				
MTZ 288	178	192 **MT / MTZ 320**				180				
	194									

Refrigerants 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

The table below gives an overview of the different refrigerant-lubricant-compressor combinations for Maneurop®, MT & MTZ compressors.

Refrigerant	Type	Lubricant type	Compressor type	Danfoss Maneurop lubricant	Application
R22	HCFC	Mineral	MT	White oil, **160P**	Medium / High Temperature
R407C	HFC	Polyolester	MTZ	Polyolester oil **160PZ**	Medium / High temperature
R134a	HFC	Polyolester	MTZ	Polyolester oil **160PZ**	Medium / High temperature
R404A	HFC	Polyolester	MTZ	Polyolester oil **160PZ**	Medium temperature
R507	HFC	Polyolester	MTZ	Polyolester oil **160PZ**	Medium temperature
Transitional refrigerants, R22 based		Alkylbenzene (ABM)	MT	Alkylbenzene oil **160 ABM** **Note:** Initial mineral oil charge has to be replaced by 160 ABM oil.	Medium / High temperature
Hydrocarbons	Danfoss Maneurop does not authorise the use of hydrocarbons in their compressors				

The Montreal protocol states that CFC refrigerants such as R12 and R502 may no longer be applied in new installations in the signatory members countries.

Therefore capacity and other data for these refrigerants are not published in this document. Danfoss Maneurop, MT compressors however are suitable for use with these refrigerants and can still be used as replacements in existing installations.

R22

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

Always use Maneurop® White oil. The Maneurop®, MT compressor is dedicated for R22 and is supplied with an initial mineral oil charge. Use the application envelopes on page 8 and performance tables on page 10-11 to select the correct compressor.

R407C

Refrigerant R407C is an HFC refrigerant with similar thermodynamic properties to those of R22. R407C has zero ozone depletion potential (ODP=0). Many installers and OEMs consider R407C to be the standard alternative for R22. R407C is a zeotropic mixture and has a temperature glide of about 6 K.

For more specific information about zeotropic refrigerants; refer to section "zeotropic refrigerant mixtures". R407C must be charged in the liquid phase. Always use the Maneurop® MTZ compressors with Danfoss Maneurop 160PZ polyolester oil, which is supplied with the MTZ compressor for R407C applications. Use the application envelope on page 8 and performance tables on page 12-13 to select the correct compressor. Maneurop® MT compressors should never be used with R407C, even when the mineral oil is replaced with polyolester oil.

R134a

Refrigerant R134a is an HFC refrigerant with thermodynamic properties comparable to those of the CFC refrigerant R12. R134a has zero ozone depletion potential (ODP = 0) and is commonly accepted as the best R12 alternative. For applications with high evaporating and high condensing temperatures, R134a is the ideal choice. R134a is a pure refrigerant and has zero temperature glide. Always use polyolester oil in combination with R134a. Always use the Maneurop®, MTZ compressor with Maneurop®, 160PZ polyolester oil which is supplied with the MTZ compressor for R134a applications. Use the application envelope on page 8 and performance tables on page 14-15 to select the correct compressor. Maneurop®, MT compressors should never be used for R134a, even when the mineral oil is replaced by polyolester oil.

R404A

Refrigerant R404A is an HFC refrigerant with thermodynamic properties comparable to those of the CFC refrigerant R502. R404A has zero ozone depletion potential (ODP = 0) and is commonly accepted as one of the best R502 alternatives. 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. For more information refer to section "zeotropic refrigerant mixtures". For low evaporating temperature applications down to -45°C, Maneurop®, LTZ compressors should be used. Refer to the LTZ selection and application guidelines. For medium temperature R404A applications, always use the Maneurop®, MTZ compressor with 160PZ polyolester oil which is supplied with the MTZ compressor. Use the application envelope on page 8 and performance tables on page 16-17 to select the correct compressor. Maneurop®, MT compressors should never be used for R404A, even with the mineral oil replaced by polyolester oil.

R507

Refrigerant R507 is an HFC refrigerant with thermodynamic properties comparable to those of the CFC refrigerant R502 and virtually equal to those of R404A. R507 has no ozone depletion potential (ODP = 0) and is commonly accepted as one of the best R502 alternatives. 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. For low evaporating temperature applications down to -45°C, Maneurop®, LTZ compressor should be used. Refer to the LTZ selection and application guidelines. For medium temperature R507 applications, always use the Maneurop®, MTZ compressor and Maneurop®, 160PZ polyolester oil which is supplied with the MTZ compressor. Use the application envelope on page 8 and performance tables on page 16-17 to select the correct compressor. Maneurop®, MT compressors should never be used for R507, even with the mineral oil replaced by polyolester oil.

R22 based transitional refrigerants

A wide variety of R22 based transitional refrigerants exist (also called service refrigerants or drop-in blends).These were developed as temporary R12 or R502 alternatives. Some examples are R401A, R401B, R409A and R409B as R12 alternatives and R402A, R402B, R403A and R403B as R502 alternatives. Because of the R22 component, they all have a (low) ozone depletion potential. Maneurop®, MT compressors can be applied with these transitional refrigerants. The initial mineral oil charge must be replaced by Maneurop®, 160 ABM alkylbenzene oil.

Hydrocarbons

Hydrocarbons such as propane, isobutane etc. are extremely flammable. Danfoss Maneurop does not authorise the use of hydrocarbons with their MT or MTZ compressors in any way, even with a reduced refrigerant charge.

System design recommendations

PIPING DESIGN

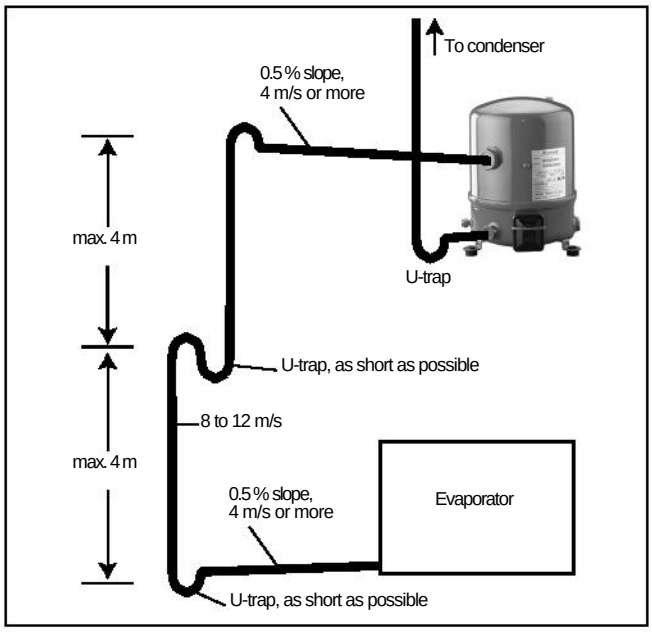
Oil in a refrigeration circuit is required to lubricate moving parts in the compressor. During normal system operation small oil quantities will continuously leave the compressor, with the discharge gas. With good system piping design this oil will return to the compressor. As long as the amount of oil circulating through the system is small it will contribute to good system operation and improved heat transfer efficiency.
However, too large amounts of oil in the system will have a negative effect on condenser and evaporator efficiency. If, in a poorly designed system, the amount of oil returning to the compressor is lower than the amount of oil leaving the compressor, the compressor will become starved of oil and the condenser, evaporator and/or refrigerant lines will become filled with oil. In such situations, additional oil charge will only correct the compressor oil level for a limited period of time and increase the amount of surplus oil in the rest of the system.
Only correct piping design can ensure a good oil balance in the system.

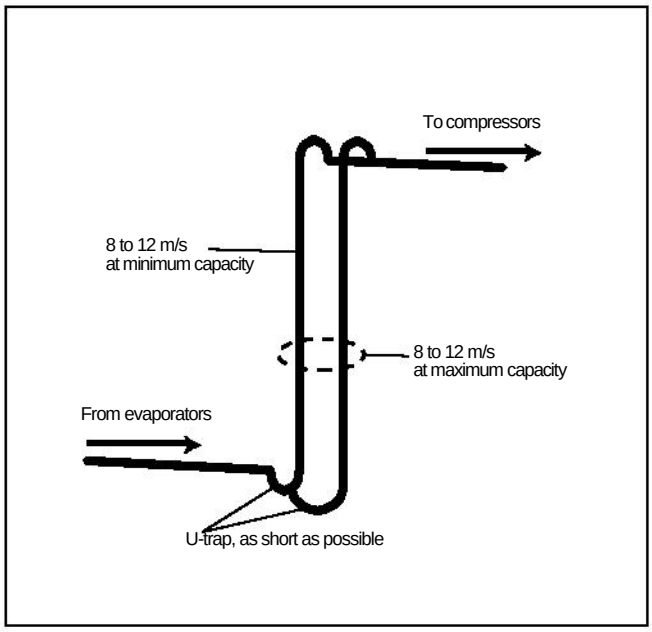
Suction lines
Horizontal suction line sections shall have a slope of 0.5% in the direction of refrigerant flow (5 mm per meter).The cross-section of horizontal suction lines shall be such that the resulting gas velocity is at least 4 m/s. In vertical risers, a gas velocity of 8 to 12 m/s is required to ensure proper oil return. A U-trap is required at the foot of each vertical riser. If the riser is higher than 4 m, additional U-traps are required for each additional 4 meters.The length of each U-trap must be as short as possible to avoid the accumulation of excessive quantities of oil.
See figure below.

For compressors mounted in parallel, the common suction riser should be designed as a double riser. The cross section of the smallest riser must be designed to give a gas velocity of 8 to 12 m/s at minimum capacity (one compressor running).The total cross section of both risers must be designed to give a gas velocity of 8 to 12 m/s at full capacity (all compressors running).
See figure below. Also refer to the Maneurop®, Technical Information bulletin TI 001 "Mounting instructions for installation of Maneurop®, compressors in parallel ".

Gas velocities higher than 12 m/s will not contribute to significantly better oil return. However they will cause higher noise levels and result in higher suction line pressure drops which will have a negative effect on the system capacity.
Note that the suction rotolock valves, which can be ordered from Danfoss Maneurop as accessories, are designed for average pipe sizes, selected for systems running at nominal conditions.
The pipe sizes selected for specific systems may differ from these recommended sizes.

It is recommended that the suction lines are insulated to limit suction gas superheat.





Discharge line
Where the condenser is mounted above the compressor, a suitably sized U-trap may be necessary to prevent oil return to the discharge side of the compressor during standstill. It will also help eliminate liquid refrigerant floodback from the condenser to the compressor.

Oil charge and oil separator
In most installations the initial compressor oil charge will be sufficient. In installations with line runs exceeding 20 m, or with many oil traps or an oil separator, additional oil may be required.
In installations with the risk of slow oil return such as in multiple evaporator or multiple condenser installations, an oil separator is recommended. Also refer to the "Start up" section.

System components
System components such as filter dryers, expansion devices and sight glasses must always be selected in accordance with the refrigerant used.This is especially important for installations using HFC refrigerants. Always refer to the component manufacturers technical documentation.
Apply a 100 % molecular sieves liquid line filter drier (no activated aluminia) which is oversized rather. When selecting a drier, take into account the drier capacity (water content capacity), the system cooling capacity and the system refrigerant charge.

OPERATING 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 compressor cycling around the high pressure limit.
When a discharge valve is used, the HP switch must be connected to the service valve gauge port, which cannot be isolated.

Low pressure
A low pressure safety switch is recommended to avoid compressor operation at too lower suction pressures.

		MT	MTZ	MTZ	MTZ
		R22	R407C	R134a	R404A / R507
Test pressure low side	bar (g)	25*	25*	25*	25*
Working pressure range high side	bar (g)	10.9 - 27.7	12.5 - 29.4	7.9 - 22.6	13.2 - 27.7
Working pressure range low side	bar (g)	1.0 - 7.0	1.4 - 6.6	0.6 - 4.7	1.0 - 7.2
Relief valve opening pressure difference	bar (g)	30	30	30	30
Relief valve closing pressure difference	bar (g)	8	8	8	8

**18 bar gauge for 8 cylinder compressors*

Low ambient temperature operation
At low ambient temperatures, the condensing temperature and condensing pressure in air cooled condensers will decrease.
This low pressure may be insufficient to supply enough liquid refrigerant to the evaporator. As a result the evaporator temperature will strongly decrease with the risk of frosting. At compressor start up, the compressor can pull a deep vacuum and it can be switched off by the low pressure protection. Depending on the low pressure switch setting and delay timer short cycling can occur.To avoid these problems, several solutions are possible, based on reducing condenser capacity;

- Indoor location of condensers
- Liquid flooding of condensers (note: this solution requires extra refrigerant charge, which can introduce other problems. A non-return valve in the discharge line is required and special care should be taken when designing the discharge line.)
- Reduce air flow to condensers

Other problems can also occur when the compressor is operating at low ambient temperature.
During shut down periods, liquid refrigerant can migrate to a cold compressor.
For such conditions a belt-type crankcase heater is strongly recommended.
Note that with 100% suction gas cooled motors, Maneurop®, compressors can be externally insulated.
Refer to section "Liquid refrigerant migration & charge limits" for more details.

OPERATING VOLTAGE AND CYCLE RATE

Operating voltage range
The operating voltage limits are shown in the table on page 4.The voltage applied to the motor terminals must always be within these table limits.The maximum allowable voltage imbalance for 3-phase compressors is 2%.Voltage imbalance causes high current draw on one or more phases, which in turn leads to overheating and possible motor damage.
Voltage imbalance is given by the formula:

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

Vavg = Mean voltage of phases 1, 2, 3.
$V_{1\text{-}2}$ = Voltage between phases 1 & 2.
$V_{1\text{-}3}$ = Voltage between phases 1 & 3.
$V_{2\text{-}3}$ = Voltage between phases 2 & 3.

Cycle rate limit
There may 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. A time-out of six minutes is recommended.The system must be designed in such a way to guarantee a minimum compressor running time in order to provide proper oil return and sufficient motor cooling after starting.
Note that the oil return rate varies as a function of the system design.

LIQUID REFRIGERANT CONTROL AND CHARGE LIMITS

Refrigeration compressors are basically designed as gas compressors. Depending on the compressor design and operating conditions, most compressors can also handle a limited amount of liquid refrigerant. Maneurop®, MT and MTZ compressors have a large internal volume and can therefore handle relatively large amounts of liquid refrigerant without major problems. However even when a compressor can handle liquid refrigerant, this will not be favourable to its service life.
Liquid refrigerant can dilute the oil, wash oil out of bearings and result in high oil carry over, resulting in loss of oil from the sump.
Good system design can limit the amount of liquid refrigerant in the compressor, which will have a positive effect on the compressor service life.
Liquid refrigerant can enter a compressor in different ways, with different effects on the compressor.

Off-cycle migration
During system standstill and after pressure equalisation, refrigerant will condense in the coldest part of the system.The compressor can easily be the coldest spot, for example when it is placed outside in low ambient temperatures.After a while, the full system refrigerant charge can condense in the compressor crankcase. A large amount will dissolve in the compressor oil until the oil is completely saturated with refrigerant. If other system components are located at a higher level, this process can be even faster because gravity will assist the liquid refrigerant to flow back to the compressor.When the compressor is started, the pressure in the crankcase decreases rapidly.
At lower pressures the oil holds less refrigerant, and as a result part of the refrigerant will violently evaporate from the oil, causing the oil to foam.
This process is often called "boiling".
The negative effects from migration on the compressor are:

- oil dilution by liquid refrigerant
- oil foam, transported by refrigerant gas and discharged into the system, causing loss of oil and in extreme situations risk for oil slugging
- in extreme situations with high system refrigerant charge, liquid slugging could occur (liquid entering the compressor cylinders)

Liquid floodback during operation

During normal and stable system operation, refrigerant will leave the evaporator in a superheated condition and enter the compressor as a superheated vapour.
Normal superheat values at compressor suction are 5 to 30 K.
However the refrigerant leaving the evaporator can contain an amount of liquid refrigerant due to different reasons:

- wrong dimensioning, wrong setting or malfunction of expansion device
- evaporator fan failure or blocked air filters.

In these situations, liquid refrigerant will continuously enter the compressor.

The negative effects from continuous liquid floodback are:

- permanent oil dilution
- in extreme situations with high system refrigerant charge and large amounts of floodback, liquid slugging could occur.

Liquid floodback at change over cycles in reversible heat pumps

In heat pumps, change over from cooling to heating cycles, defrost and low load short cycles may lead to liquid refrigerant floodback or saturated refrigerant return conditions.
The negative effects are:

- oil dilution
- in extreme situations with high system refrigerant charge and large amounts of floodback, liquid slugging could appear.

Liquid floodback and zeotropic refrigerants

Liquid floodback in systems working with a zeotropic refrigerant such as R407C introduces additional negative effects.
A part of the refrigerant leaves the evaporator in liquid phase and this liquid has a different composition than the vapour.
This new refrigerant composition may result in different compressor operating pressures and temperatures.

Refrigerant charge limits

Compressor type	Compressor models	System refrigerant charge limit (kg)
1 cylinder 2	MT / MTZ 18-22-28-32-36-40	2.5
cylinder	MT / MTZ 44-50-56-64-72-80 MT 45-51-57-65-73-81	5
4 cylinder 8	MT / MTZ 100-125-144-160	10
cylinder	MT / MTZ 200-250-288-320	20

If the system refrigerant charge does not exceed the charge limits in the table above, no additional precautions are required.
Even the accumulation of the full charge in the compressor can be handled.
However, as described earlier, any limitation of the quantity of liquid refrigerant in the compressor will have a positive effect on service life.
If the system refrigerant charge exceeds the table values, additional compressor protection is required (see page 34).