

Selection & Application guidelines

# **Maneurop**<sup>®</sup>

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## **RECIPROCATING COMPRESSORS**

**MT/MTZ**

**50 Hz**

R22

R407C

R134a

R404A / R507



1 CYLINDER

2 CYLINDERS

4 CYLINDERS

8 CYLINDERS



Expect more from us

**Danfoss Maneurop**

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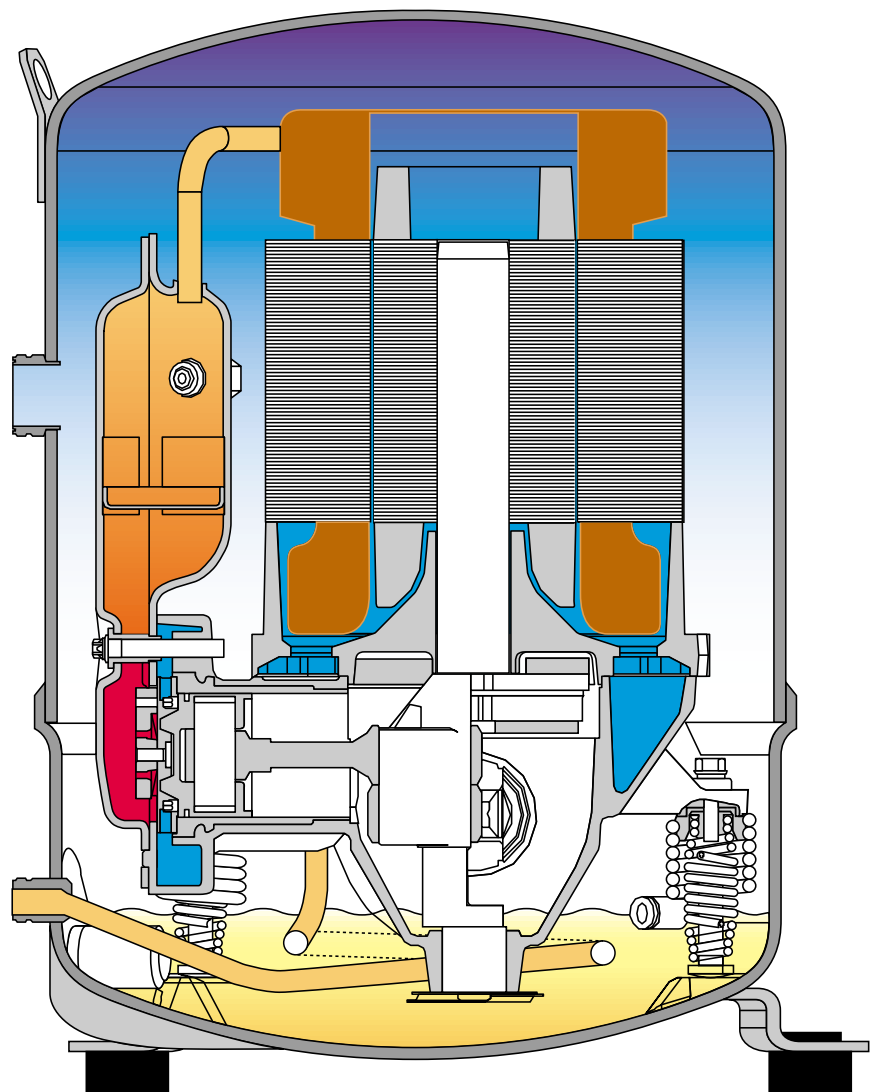
# Danfoss Maneurop Reciprocating Compressors

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



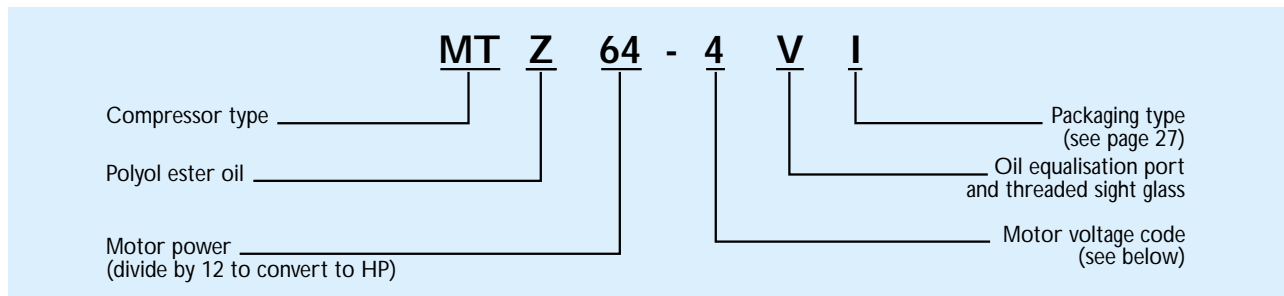
the compressors to be insulated with acoustic jackets, to obtain lower sound levels, without the risk of compressor overheating.

MT and MTZ compressors are available in 26 different models with displacement ranging from 30

to 543 cm<sup>3</sup>/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)

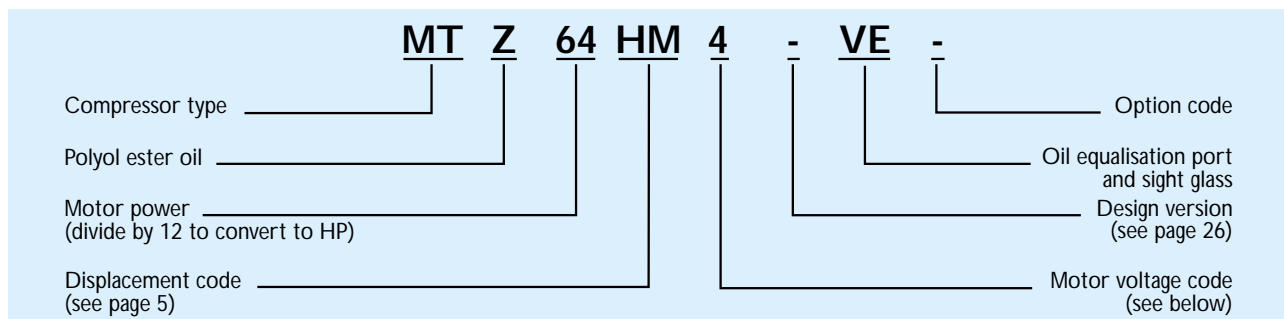
**MT 64 - 4M** MT 64, multiple packaging (M), motor voltage code 4, standard version

**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

Models	S version standard		VE version (optional)	
	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	360 - 440 V
	460 V / 3 ph / 60 Hz	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	450 - 550 V
	575 V / 3 ph / 60 Hz	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**						
	(cm <sup>3</sup> /rev)	(m <sup>3</sup> /h)*				motor voltage code						
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	53.86	9.37	1	0.95	24	S-VE	S-VE	S-VE	S-VE	S-VE	S-VE	S-VE
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	85.64	14.90	2	1.8	35	S-VE	S-VE	S-VE	-	S-VE	S-VE	S-VE
MT / MTZ 51 HK	85.64	14.90	2	1.8	37	S-VE	S-VE	S-VE	-	S-VE	-	-
MT / MTZ 56 HL	96.13	16.73	2	1.8	37	S-VE	S-VE	S-VE	-	S-VE	S-VE	S-VE
MT / MTZ 57 HL	96.13	16.73	2	1.8	39	S-VE	S-VE	S-VE	-	-	-	-
MT / MTZ 64 HM	107.71	18.74	2	1.8	37	S-VE	S-VE	S-VE	-	S-VE	-	S-VE
MT / MTZ 65 HM	107.71	18.74	2	1.8	39	S-VE	S-VE	S-VE	-	S-VE	-	-
MT / MTZ 72 HN	120.94	21.04	2	1.8	40	-	S-VE	S-VE	-	S-VE	-	S-VE
MT / MTZ 73 HN	120.94	21.04	2	1.8	41	-	S-VE	S-VE	-	S-VE	-	-
MT / MTZ 80 HP	135.78	23.63	2	1.8	40	-	S-VE	S-VE	-	S-VE	-	S-VE
MT / MTZ 81 HP	135.78	23.63	2	1.8	41	-	S-VE	S-VE	-	-	-	-
MT / MTZ 100 HS	171.26	29.80	4	3.9	60	-	S-VE	S-VE	-	S-VE	S-VE	S-VE
MT / MTZ 125 HU	215.44	37.49	4	3.9	64	-	S-VE	S-VE	-	S-VE	S-VE	S-VE
MT / MTZ 144 HV	241.87	42.09	4	3.9	67	-	S-VE	S-VE	-	S-VE	S-VE	S-VE
MT / MTZ 160 HW	271.55	47.25	4	3.9	69	-	S-VE	S-VE	-	S-VE	S-VE	S-VE
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.

## Specifications

### NOMINAL PERFORMANCE R22, R407C - 50 HZ

Compressor model	NOMINAL RATINGS * MT - R22				NOMINAL RATINGS ** MTZ - R407C			
	Cooling capacity (W)	Power input (kW)	Current input (A)	COP (W/W)	Cooling capacity (W)	Power input (kW)	Current input (A)	COP (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, 400V.

Capacity and power input data ± 5%.

## Specifications

### NOMINAL PERFORMANCE R134a, R404A, R507 - 50 HZ

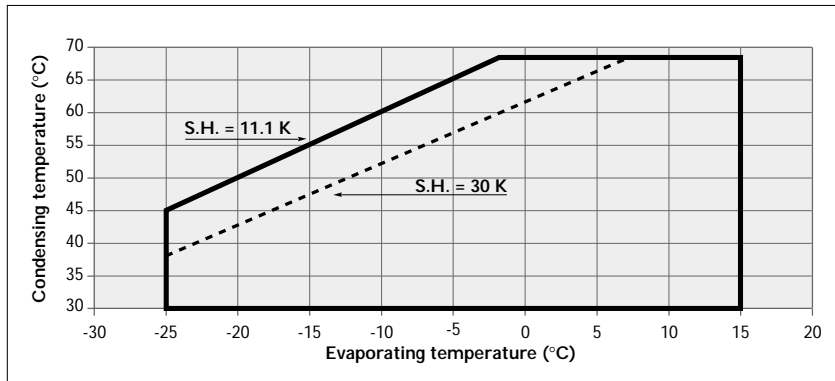
Compressor model	NOMINAL RATINGS * R134a				NOMINAL RATINGS ** R404A / R507			
	Cooling capacity (W)	Power input (kW)	Current input (A)	COP (W/W)	Cooling capacity (W)	Power input (kW)	Current input (A)	COP (W/W)
MT / MTZ 18 JA	2553	0.99	2.19	2.58	1865	1.20	2.47	1.56
MT / MTZ 22 JC	3352	1.20	2.51	2.80	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.

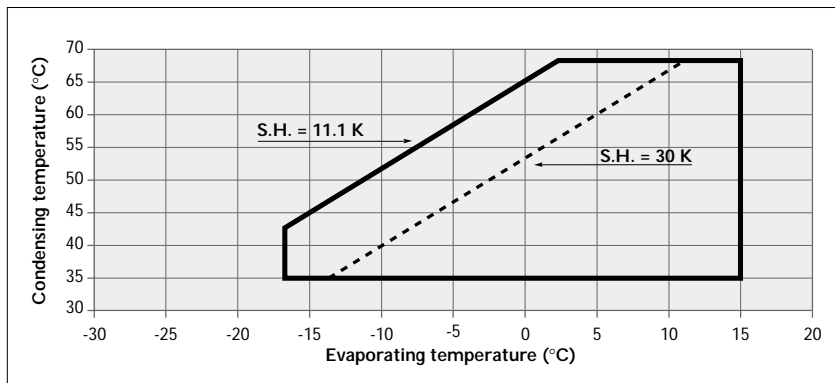
\*\* Ratings with R404A / R507 at dew point conditions: -10°C evaporating temperature, 45°C condensing temperature, 0 K subcooling, 10 K superheat, 50 Hz, 400 V.

Capacity and power input data ± 5%.

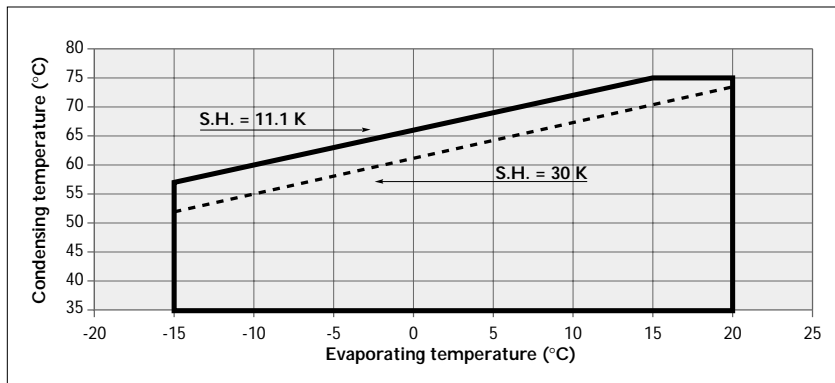
# Operating envelopes



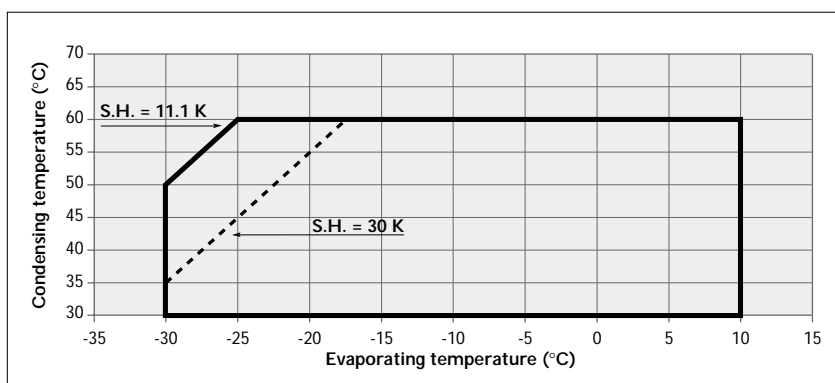
Application Envelope  
for MTZ compressors with  
**R22**



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.

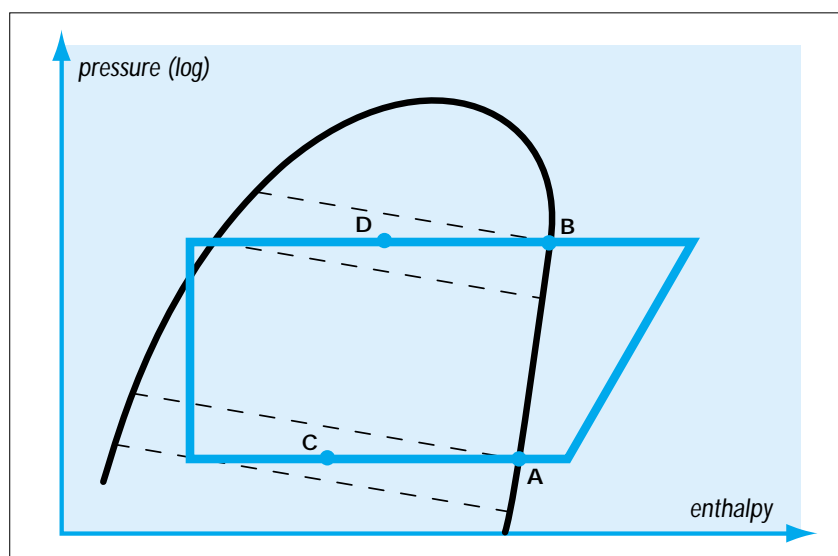
### Temperature glide

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 72	30	4 850	2.64	6 670	2.99	8 820	3.35	11 340	3.69	14 260	4.01	17 610	4.30	21 430	4.56	25 750	4.76	30 620	4.91
	40	3 850	2.91	5 540	3.29	7 520	3.68	9 830	4.07	12 500	4.44	15 560	4.79	19 060	5.11	23 020	5.39	27 490	5.62
	50	-	-	4 680	3.66	6 440	4.10	8 490	4.54	10 860	4.97	13 590	5.39	16 710	5.79	20 260	6.15	24 280	6.48
	60	-	-	-	-	-	-	7 400	5.10	9 420	5.61	11 760	6.11	14 460	6.59	17 550	7.05	21 060	7.48
MT 73	30	6 090	2.93	7 800	3.23	9 910	3.52	12 450	3.77	15 460	3.98	18 970	4.14	23 020	4.25	27 650	4.28	32 890	4.24
	40	4 790	2.90	6 350	3.28	8 270	3.65	10 590	4.00	13 330	4.31	16 540	4.58	20 260	4.80	24 510	4.96	29 340	5.05
	50	-	-	5 170	3.40	6 850	3.87	8 890	4.32	11 330	4.74	14 190	5.13	17 510	5.48	21 340	5.77	25 700	6.01
MT 80	30	5 520	2.94	7 600	3.34	10 050	3.75	12 910	4.14	16 230	4.51	20 030	4.85	24 380	5.14	29 290	5.39	34 820	5.57
	40	4 390	3.27	6 320	3.71	8 580	4.15	11 210	4.59	14 250	5.01	17 740	5.41	21 720	5.78	26 230	6.10	31 320	6.37
	50	-	-	5 320	4.14	7 330	4.63	9 670	5.12	12 380	5.62	15 500	6.09	19 060	6.54	23 110	6.96	27 690	7.32
	60	-	-	-	-	-	-	8 380	5.77	10 700	6.34	13 380	6.90	16 480	7.44	20 010	7.96	24 040	8.44
MT 81	30	6 760	3.19	8 670	3.65	11 060	4.06	13 950	4.40	17 380	4.68	21 410	4.88	26 060	4.98	31 380	4.98	37 410	4.87
	40	5 300	3.07	7 050	3.64	9 220	4.16	11 860	4.63	15 010	5.03	18 700	5.36	22 970	5.61	27 870	5.77	33 440	5.82
	50	-	-	5 700	3.69	7 610	4.34	9 940	4.94	12 730	5.49	16 030	5.97	19 870	6.37	24 290	6.69	29 340	6.92
	60	-	-	-	-	-	-	8 260	5.36	10 650	6.06	13 500	6.70	16 850	7.27	20 740	7.77	25 210	8.18
MT 100	30	7 300	3.90	9 690	4.39	12 580	4.84	16 030	5.22	20 130	5.50	24 930	5.67	30 510	5.71	36 930	5.57	44 250	5.26
	40	5 360	4.03	7 560	4.58	10 210	5.12	13 370	5.60	17 120	6.01	21 520	6.32	26 640	6.51	32 550	6.56	39 320	6.44
	50	-	-	5 870	4.73	8 210	5.37	11 010	5.98	14 340	6.54	18 270	7.02	22 870	7.40	28 190	7.65	34 330	7.76
	60	-	-	-	-	-	-	9 100	6.37	11 950	7.10	15 330	7.77	19 330	8.36	24 010	8.85	29 440	9.20
MT 125	30	9 340	4.82	12 420	5.40	16 140	5.94	20 580	6.43	25 820	6.85	31 940	7.17	39 040	7.38	47 180	7.45	56 450	7.37
	40	7 490	5.30	10 320	5.95	13 710	6.59	17 750	7.20	22 510	7.75	28 090	8.23	34 570	8.62	42 020	8.89	50 530	9.03
	50	-	-	8 480	6.35	11 450	7.11	14 990	7.87	19 190	8.59	24 120	9.26	29 880	9.86	36 540	10.36	44 190	10.74
	60	-	-	-	-	-	-	12 400	8.40	15 930	9.31	20 130	10.20	25 070	11.03	30 510	11.79	37 540	12.46
MT 144	30	10 790	5.45	14 250	6.09	18 450	6.69	23 490	7.23	29 460	7.69	36 470	8.05	44 620	8.29	53 990	8.37	64 710	8.27
	40	8 620	5.97	11 780	6.69	15 590	7.40	20 150	8.08	25 560	8.70	31 920	9.23	39 330	9.67	47 890	9.98	57 690	10.13
	50	-	-	9 640	7.13	12 940	7.98	16 910	8.82	21 650	9.63	27 240	10.38	33 800	11.05	41 420	11.61	50 190	12.05
	60	-	-	-	-	-	-	13 880	9.40	17 820	10.43	22 540	11.43	28 130	12.36	34 700	13.22	42 340	13.98
MT 160	30	11 950	6.15	15 720	6.86	20 310	7.53	25 820	8.13	32 360	8.64	40 030	9.04	48 960	9.30	59 250	9.39	71 010	9.29
	40	9 660	6.72	13 120	7.52	17 300	8.31	22 310	9.06	28 250	9.75	35 250	10.35	43 410	10.84	52 840	11.19	63 640	11.37
	50	-	-	10 810	8.00	14 460	8.95	18 850	9.88	24 090	10.79	30 290	11.63	37 560	12.38	46 000	13.02	55 740	13.52
	60	-	-	-	-	-	-	15 550	10.54	19 960	11.69	25 240	12.80	31 500	13.86	38 840	14.82	47 390	15.68
MT 200	30	14 610	7.80	19 380	8.79	25 150	9.68	32 070	10.44	40 260	11.01	49 870	11.35	61 020	11.41	73 850	11.15	88 510	10.52
	40	10 720	8.05	15 120	9.17	20 410	10.23	26 740	11.19	34 240	12.01	43 040	12.64	53 290	13.02	65 100	13.12	78 630	12.88
	50	-	-	11 740	9.45	16 420	10.74	22 020	11.96	28 680	13.08	36 540	14.04	45 730	14.80	56 390	15.30	68 650	15.52
	60	-	-	-	-	-	-	18 210	12.73	23 890	14.20	30 670	15.54	38 670	16.72	48 030	17.70	58 880	18.41
MT 250	30	18 680	9.64	24 840	10.79	32 280	11.88	41 160	12.86	51 640	13.70	63 890	14.34	78 070	14.76	94 350	14.91	112 900	14.73
	40	14 980	10.60	20 630	11.90	27 420	13.18	35 490	14.39	45 030	15.50	56 190	16.47	69 130	17.24	84 030	17.79	101 050	18.06
	50	-	-	16 950	12.70	22 890	14.23	29 980	15.74	38 370	17.18	48 250	18.52	59 760	19.71	73 090	20.72	88 380	21.49
	60	-	-	-	-	-	-	24 790	16.79	31 860	18.63	40 250	20.40	50 150	22.07	61 700	23.59	75 090	24.92
MT 288	30	21 580	10.90	28 500	12.17	36 900	13.37	46 970	14.46	58 920	15.39	72 940	16.11	89 230	16.57	107 990	16.73	129 410	16.54
	40	17 250	11.94	23 560	13.38	31 180	14.80	40 300	16.15	51 130	17.39	63 850	18.47	78 670	19.34	95 780	19.95	115 380	20.27
	50	-	-	19 270	14.26	25 880	15.96	33 820	17.64	43 290	19.25	54 490	20.75	67 600	22.09	82 840	23.23	100 390	24.11
	60	-	-	-	-	-	-	27 760	18.81	35 650	20.86	45 080	22.85	56 270	24.73	69 400	26.45	84 670	27.96
MT 320	30	23 900	12.31	31 450	13.72	40 620	15.05	51 640	16.26	64 710	17.29	80 070	18.08	97 920	18.60	118 500	18.78	142 020	18.58
	40	19 320	13.45	26 230	15.05	34 590	16.62	44 610	18.13	56 510	19.51	70 510	20.71	86 820	21.68	105 680	22.37	127 290	22.74
	50	-	-	21 610	16.00	28 920	17.90	37 700	19.77	48 180	21.57	60 580	23.25	75 110	24.76	92 000	26.03	111 470	27.04
	60	-	-	-	-	-	-	31 100	21.07	39 930	23.37	50 490	25.60	63 000	27.71	77 690	29.65	94 770	31.36

**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

Performance tables

# 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	1 690	0.80	2 280	0.87	3 020	0.93	3 920	0.98	4 990	1.00	6 270	1.00	7 760	0.98
	40	1 490	0.83	2 040	0.92	2 730	0.99	3 560	1.05	4 570	1.09	5 760	1.11	7 160	1.11
	50	-	-	1 610	1.00	2 180	1.10	2 870	1.19	3 710	1.27	4 720	1.34	5 920	1.38
	60	-	-	-	-	-	-	2 230	1.32	2 890	1.45	3 690	1.56	4 650	1.66
MTZ 22	35	2 150	1.00	2 910	1.11	3 840	1.20	4 940	1.28	6 250	1.32	7 780	1.34	9 540	1.32
	40	1 900	1.04	2 620	1.16	3 490	1.27	4 530	1.36	5 760	1.44	7 190	1.48	8 860	1.49
	50	-	-	2 080	1.24	2 810	1.39	3 690	1.53	4 740	1.66	5 980	1.76	7 420	1.83
	60	-	-	-	-	-	-	2 900	1.68	3 740	1.87	4 750	2.04	5 930	2.18
MTZ 28	35	2 740	1.25	3 720	1.41	4 890	1.55	6 270	1.67	7 880	1.74	9 730	1.78	11 850	1.77
	40	2 430	1.30	3 360	1.47	4 470	1.63	5 770	1.77	7 290	1.88	9 050	1.95	11 050	1.98
	50	-	-	2 680	1.56	3 630	1.78	4 760	1.97	6 080	2.15	7 610	2.30	9 370	2.41
	60	-	-	-	-	-	-	3 760	2.15	4 850	2.41	6 120	2.65	7 590	2.86
MTZ 32	35	3 090	1.41	4 200	1.59	5 510	1.76	7 050	1.89	8 840	1.99	10 880	2.04	13 210	2.04
	40	2 740	1.45	3 800	1.66	5 050	1.85	6 510	2.01	8 200	2.14	10 140	2.23	12 350	2.27
	50	-	-	3 030	1.75	4 120	2.00	5 390	2.23	6 870	2.44	8 570	2.62	10 520	2.76
	60	-	-	-	-	-	-	4 270	2.43	5 500	2.73	6 930	3.01	8 570	3.26
MTZ 36	35	3 710	1.67	4 930	1.89	6 380	2.07	8 060	2.22	9 990	2.32	12 200	2.37	14 710	2.36
	40	3 350	1.74	4 520	1.97	5 900	2.18	7 490	2.36	9 330	2.50	11 430	2.59	13 810	2.63
	50	-	-	3 690	2.10	4 900	2.38	6 300	2.63	7 920	2.86	9 760	3.05	11 860	3.19
	60	-	-	-	-	-	-	5 060	2.87	6 410	3.20	7 970	3.50	9 760	3.77
MTZ 40	35	4 370	1.96	5 720	2.20	7 310	2.41	9 140	2.57	11 240	2.68	13 620	2.73	16 320	2.70
	40	4 000	2.04	5 300	2.30	6 810	2.54	8 550	2.74	10 550	2.89	12 820	2.98	15 380	3.01
	50	-	-	4 410	2.47	5 740	2.78	7 280	3.06	9 040	3.31	11 050	3.51	13 310	3.65
	60	-	-	-	-	-	-	5 910	3.35	7 400	3.71	9 100	4.04	11 030	4.31
MTZ 44	35	4 340	2.06	5 880	2.27	7 740	2.45	9 940	2.59	12 530	2.69	15 550	2.73	19 020	2.71
	40	3 860	2.15	5 330	2.38	7 090	2.59	9 180	2.77	11 640	2.92	14 510	3.01	17 820	3.04
	50	-	-	4 220	2.54	5 750	2.83	7 580	3.10	9 740	3.34	12 270	3.55	15 200	3.72
	60	-	-	-	-	-	-	5 930	3.34	7 740	3.70	9 880	4.05	12 390	4.36
MTZ 50	35	4 940	2.28	6 690	2.54	8 800	2.78	11 310	2.98	14 260	3.13	17 680	3.23	21 610	3.26
	40	4 400	2.36	6 070	2.65	8 070	2.92	10 450	3.15	13 250	3.35	16 500	3.50	20 240	3.60
	50	-	-	4 840	2.80	6 580	3.15	8 660	3.48	11 110	3.79	13 970	4.06	17 290	4.28
	60	-	-	-	-	-	-	6 840	3.75	8 890	4.18	11 300	4.59	14 130	4.96
MTZ 56	35	5 650	2.54	7 670	2.87	10 090	3.17	12 960	3.44	16 330	3.66	20 230	3.83	24 720	3.93
	40	5 040	2.61	6 960	2.97	9 260	3.30	11 980	3.61	15 180	3.88	18 880	4.10	23 140	4.26
	50	-	-	5 580	3.12	7 580	3.54	9 960	3.94	12 760	4.32	16 020	4.66	19 780	4.95
	60	-	-	-	-	-	-	7 930	4.25	10 260	4.75	13 010	5.23	16 210	5.68
MTZ 64	35	6 340	2.80	8 620	3.19	11 350	3.56	14 570	3.89	18 350	4.18	22 730	4.41	27 760	4.58
	40	5 670	2.86	7 830	3.28	10 420	3.68	13 480	4.06	17 060	4.39	21 220	4.68	25 990	4.91
	50	-	-	6 310	3.44	8 560	3.92	11 230	4.39	14 370	4.84	18 020	5.25	22 230	5.61
	60	-	-	-	-	-	-	9 000	4.74	11 610	5.31	14 680	5.86	18 250	6.38
MTZ 72	35	7 330	3.16	9 850	3.61	12 840	4.03	16 370	4.41	20 470	4.74	25 210	5.01	30 620	5.21
	40	6 580	3.24	8 970	3.72	11 820	4.18	15 170	4.61	19 070	4.99	23 570	5.32	28 720	5.59
	50	-	-	7 280	3.90	9 770	4.45	12 710	4.99	16 140	5.50	20 110	5.97	24 670	6.39
	60	-	-	-	-	-	-	10 240	5.37	13 120	6.02	16 480	6.66	20 370	7.25
MTZ 80	35	8 510	3.60	11 310	4.11	14 630	4.60	18 510	5.04	23 010	5.42	28 170	5.73	34 060	5.96
	40	7 670	3.69	10 340	4.24	13 500	4.77	17 200	5.26	21 480	5.71	26 390	6.09	31 990	6.40
	50	-	-	8 440	4.45	11 220	5.09	14 480	5.70	18 260	6.29	22 610	6.84	27 590	7.32
	60	-	-	-	-	-	-	11 730	6.12	14 930	6.88	18 630	7.61	22 900	8.30

Performance tables

# 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	10 080	4.53	13 440	4.99	17 510	5.39	22 380	5.72	28 130	5.95	34 830	6.07	42 580	6.05
	40	9 050	4.72	12 230	5.22	16 080	5.68	20 680	6.08	26 110	6.39	32 460	6.60	39 810	6.68
	50	-	-	9 850	5.60	13 170	6.20	17 140	6.75	21 870	7.25	27 420	7.66	33 880	7.98
	60	-	-	-	-	-	-	13 580	7.34	17 470	8.06	22 100	8.71	27 550	9.29
MTZ 125	35	14 030	5.71	18 330	6.33	23 480	6.87	29 580	7.32	36 720	7.64	44 990	7.82	54 490	7.83
	40	12 660	5.94	16 740	6.61	21 640	7.23	27 430	7.77	34 200	8.20	42 060	8.50	51 090	8.64
	50	-	-	13 630	7.11	17 900	7.91	22 960	8.66	28 900	9.33	35 820	9.90	43 800	10.35
	60	-	-	-	-	-	-	18 420	9.49	23 390	10.44	29 230	11.32	36 030	12.11
MTZ 144	35	15 940	6.51	20 700	7.21	26 390	7.84	33 100	8.37	40 940	8.78	49 990	9.05	60 360	9.13
	40	14 500	6.78	19 040	7.54	24 450	8.25	30 830	8.88	38 270	9.41	46 880	9.80	56 750	10.03
	50	-	-	15 670	8.11	20 410	9.02	26 010	9.87	32 560	10.66	40 170	11.34	48 920	11.90
	60	-	-	-	-	-	-	21 020	10.79	26 530	11.87	32 980	12.89	40 470	13.82
MTZ 160	35	18 240	7.47	23 560	8.27	29 890	9.00	37 330	9.64	45 990	10.15	55 970	10.51	67 380	10.69
	40	16 680	7.78	21 760	8.65	27 790	9.47	34 870	10.21	43 110	10.84	52 620	11.35	63 490	11.69
	50	-	-	18 090	9.31	23 400	10.34	29 640	11.32	36 930	12.24	45 350	13.06	55 030	13.75
	60	-	-	-	-	-	-	24 130	12.34	30 290	13.58	37 470	14.77	45 780	15.86
MTZ 200	35	19 960	8.98	26 610	9.89	34 670	10.69	44 310	11.33	55 680	11.79	68 960	12.01	84 300	11.97
	40	17 910	9.34	24 210	10.34	31 830	11.25	40 940	12.03	51 700	12.65	64 280	13.06	78 820	13.22
	50	-	-	19 500	11.08	26 070	12.27	33 950	13.37	43 300	14.35	54 290	15.17	67 080	15.79
	60	-	-	-	-	-	-	26 900	14.54	34 600	15.95	43 760	17.25	54 550	18.39
MTZ 250	35	27 780	11.31	36 290	12.52	46 490	13.60	58 570	14.48	72 700	15.12	89 080	15.48	107 880	15.50
	40	25 060	11.77	33 160	13.10	42 840	14.32	54 300	15.38	67 720	16.23	83 280	16.83	101 150	17.12
	50	-	-	26 990	14.09	35 440	15.67	45 450	17.15	57 220	18.47	70 920	19.60	86 730	20.49
	60	-	-	-	-	-	-	36 480	18.78	46 310	20.67	57 870	22.42	71 340	23.98
MTZ 288	35	31 590	12.90	41 020	14.28	52 290	15.53	65 580	16.58	81 090	17.39	99 010	17.91	119 540	18.09
	40	28 690	13.42	37 680	14.94	48 390	16.34	61 020	17.58	75 760	18.62	92 800	19.40	112 350	19.86
	50	-	-	31 020	16.07	40 410	17.86	51 490	19.55	64 470	21.10	79 530	22.45	96 860	23.56
	60	-	-	-	-	-	-	41 640	21.36	52 540	23.51	65 320	25.53	80 150	27.36
MTZ 320	35	36 120	14.79	46 650	16.38	59 180	17.83	73 910	19.08	91 060	20.10	110 830	20.81	133 420	21.18
	40	33 030	15.41	43 080	17.13	55 020	18.75	69 050	20.21	85 360	21.47	104 190	22.46	125 710	23.14
	50	-	-	35 820	18.43	46 330	20.47	58 690	22.42	73 110	24.23	89 800	25.85	108 950	27.23
	60	-	-	-	-	-	-	47 780	24.43	59 970	26.90	74 190	29.24	90 650	31.40

**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

Performance tables

# 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	1 290	0.67	1 790	0.73	2 380	0.78	3 070	0.82	3 880	0.84	4 820	0.84	5 890	0.83
	50	660	0.62	1 010	0.70	1 430	0.78	1 930	0.85	2 520	0.92	3 220	0.97	4 030	1.01	4 960	1.03
	60	-	-	790	0.70	1 120	0.81	1 510	0.91	1 990	1.00	2 550	1.09	3 220	1.16	3 990	1.22
	70	-	-	-	-	-	-	-	-	-	-	1 890	1.18	2 400	1.30	3 000	1.40
MTZ 22	40	1 170	0.70	1 680	0.79	2 290	0.87	3 040	0.94	3 940	1.00	4 990	1.04	6 220	1.06	7 640	1.05
	50	910	0.73	1 340	0.83	1 870	0.93	2 510	1.03	3 280	1.11	4 200	1.18	5 280	1.23	6 530	1.26
	60	-	-	1 060	0.84	1 480	0.97	2 000	1.09	2 630	1.21	3 400	1.32	4 310	1.41	5 380	1.48
	70	-	-	-	-	-	-	-	-	-	-	2 610	1.44	3 330	1.57	4 200	1.69
MTZ 28	40	1 490	0.88	2 060	0.98	2 790	1.08	3 700	1.17	4 810	1.26	6 150	1.34	7 740	1.40	9 610	1.45
	50	1 240	0.93	1 720	1.05	2 340	1.17	3 120	1.29	4 080	1.41	5 260	1.52	6 660	1.62	8 330	1.71
	60	-	-	1 440	1.10	1 920	1.25	2 550	1.40	3 350	1.55	4 340	1.70	5 540	1.85	6 980	1.98
	70	-	-	-	-	-	-	-	-	-	-	3 400	1.87	4 380	2.06	5 570	2.25
MTZ 32	40	1 750	1.07	2 440	1.21	3 300	1.35	4 370	1.48	5 660	1.58	7 190	1.66	9 010	1.70	11 120	1.71
	50	1 400	1.10	1 990	1.27	2 740	1.44	3 670	1.60	4 800	1.74	6 160	1.86	7 780	1.95	9 680	2.01
	60	-	-	1 610	1.30	2 210	1.50	2 980	1.70	3 930	1.89	5 090	2.05	6 490	2.20	8 150	2.32
	70	-	-	-	-	-	-	-	-	-	-	3 990	2.24	5 150	2.44	6 550	2.63
MTZ 36	40	2 450	1.25	3 240	1.39	4 200	1.53	5 350	1.65	6 700	1.75	8 280	1.83	10 110	1.89	12 210	1.91
	50	2 050	1.33	2 760	1.50	3 610	1.67	4 630	1.83	5 840	1.97	7 260	2.10	8 910	2.21	10 820	2.29
	60	-	-	2 270	1.57	2 990	1.77	3 860	1.98	4 910	2.18	6 150	2.36	7 600	2.53	9 290	2.67
	70	-	-	-	-	-	-	-	-	-	-	4 940	2.60	6 180	2.84	7 630	3.06
MTZ 40	40	2 880	1.40	3 690	1.53	4 640	1.66	5 740	1.77	7 010	1.87	8 450	1.95	10 100	2.01	11 950	2.05
	50	2 470	1.52	3 210	1.68	4 080	1.84	5 080	2.00	6 240	2.15	7 560	2.28	9 070	2.40	10 770	2.49
	60	-	-	2 680	1.79	3 440	1.99	4 330	2.20	5 350	2.40	6 530	2.60	7 880	2.78	9 410	2.95
	70	-	-	-	-	-	-	-	-	-	-	5 350	2.89	6 530	3.15	7 870	3.40
MTZ 44	40	2 560	1.59	3 530	1.75	4 730	1.90	6 210	2.03	7 990	2.14	10 120	2.21	12 610	2.25	15 520	2.24
	50	2 020	1.64	2 850	1.83	3 880	2.02	5 150	2.20	6 700	2.36	8 560	2.49	10 770	2.60	13 350	2.66
	60	-	-	2 320	1.86	3 140	2.10	4 170	2.33	5 450	2.55	7 010	2.76	8 890	2.93	11 120	3.08
	70	-	-	-	-	-	-	-	-	-	-	5 510	2.99	7 020	3.25	8 860	3.49
MTZ 50	40	2 970	1.76	4 110	1.96	5 520	2.14	7 230	2.30	9 290	2.43	11 730	2.53	14 590	2.59	17 910	2.59
	50	2 340	1.81	3 330	2.04	4 550	2.27	6 040	2.49	7 850	2.68	10 010	2.85	12 560	2.98	15 540	3.08
	60	-	-	2 680	2.07	3 670	2.36	4 910	2.64	6 430	2.91	8 270	3.16	10 470	3.38	13 070	3.56
	70	-	-	-	-	-	-	-	-	-	-	6 510	3.43	8 320	3.75	10 500	4.04
MTZ 56	40	3 310	1.92	4 590	2.15	6 170	2.36	8 070	2.55	10 350	2.71	13 050	2.83	16 200	2.91	19 840	2.93
	50	2 600	1.97	3 720	2.24	5 100	2.50	6 780	2.76	8 800	2.99	11 210	3.19	14 040	3.35	17 330	3.47
	60	-	-	2 980	2.27	4 130	2.60	5 540	2.93	7 270	3.24	9 340	3.53	11 810	3.80	14 710	4.03
	70	-	-	-	-	-	-	-	-	-	-	7 510	3.84	9 570	4.22	12 040	4.57
MTZ 64	40	3 750	2.11	5 210	2.38	7 000	2.63	9 160	2.85	11 730	3.04	14 750	3.19	18 280	3.29	22 360	3.32
	50	2 930	2.16	4 220	2.47	5 810	2.79	7 730	3.08	10 030	3.36	12 750	3.60	15 940	3.80	19 640	3.94
	60	-	-	3 370	2.50	4 700	2.89	6 340	3.27	8 320	3.64	10 690	3.99	13 500	4.30	16 790	4.58
	70	-	-	-	-	-	-	-	-	-	-	8 640	4.34	11 030	4.79	13 860	5.20
MTZ 72	40	4 520	2.33	6 190	2.62	8 200	2.90	10 610	3.16	13 450	3.38	16 760	3.56	20 610	3.69	25 020	3.76
	50	3 490	2.29	4 990	2.66	6 800	3.03	8 960	3.39	11 530	3.74	14 540	4.05	18 050	4.34	22 090	4.57
	60	-	-	3 800	2.45	5 370	2.93	7 250	3.42	9 500	3.91	12 170	4.38	15 290	4.83	18 910	5.25
	70	-	-	-	-	-	-	-	-	-	-	9 680	4.49	12 380	5.13	15 540	5.76
MTZ 80	40	5 390	2.71	7 250	3.03	9 490	3.35	12 150	3.66	15 280	3.94	18 930	4.19	23 150	4.40	27 990	4.57
	50	4 340	2.79	6 000	3.17	8 010	3.56	10 390	3.94	13 210	4.31	16 520	4.65	20 350	4.97	24 760	5.25
	60	-	-	4 760	3.24	6 480	3.70	8 540	4.17	11 000	4.64	13 910	5.10	17 300	5.54	21 230	5.96
	70	-	-	-	-	-	-	-	-	-	-	11 100	5.53	14 010	6.10	17 410	6.66

Performance tables

# 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	5 700	3.16	7 880	3.52	10 560	3.85	13 790	4.14	17 650	4.36	22 210	4.50	27 520	4.55	33 670	4.49
	50	4 590	3.31	6 490	3.74	8 820	4.16	11 660	4.55	15 070	4.89	19 110	5.17	23 860	5.37	29 390	5.48
	60	-	-	5 340	3.86	7 270	4.39	9 630	4.91	12 520	5.39	15 980	5.83	20 090	6.20	24 920	6.49
	70	-	-	-	-	-	-	-	-	-	-	12 870	6.43	16 270	6.99	20 330	7.49
MTZ 125	40	7 270	3.58	9 980	4.08	13 260	4.54	17 180	4.95	21 820	5.28	27 250	5.51	33 550	5.62	40 790	5.60
	50	5 650	3.63	8 050	4.23	10 960	4.81	14 440	5.35	18 580	5.84	23 450	6.25	29 130	6.56	35 680	6.75
	60	-	-	6 300	4.21	8 750	4.94	11 720	5.65	15 280	6.32	19 510	6.93	24 480	7.46	30 260	7.90
	70	-	-	-	-	-	-	-	-	-	-	15 450	7.54	19 640	8.32	24 580	9.03
MTZ 144	40	9 530	4.70	12 750	5.22	16 620	5.71	21 220	6.16	26 630	6.57	32 930	6.91	40 220	7.17	48 560	7.33
	50	7 770	4.98	10 630	5.57	14 070	6.16	18 170	6.74	23 010	7.27	28 680	7.76	35 250	8.18	42 810	8.52
	60	-	-	8 630	5.83	11 550	6.54	15 060	7.25	19 240	7.94	24 180	8.60	29 950	9.20	36 640	9.75
	70	-	-	-	-	-	-	-	-	-	-	19 500	9.38	24 380	10.20	30 110	10.96
MTZ 160	40	10 540	5.07	14 030	5.65	18 270	6.22	23 330	6.78	29 330	7.31	36 350	7.81	44 490	8.26	53 850	8.64
	50	8 740	5.37	11 800	6.01	15 510	6.67	19 960	7.33	25 260	7.98	31 500	8.60	38 770	9.19	47 180	9.74
	60	-	-	9 650	6.31	12 720	7.07	16 460	7.85	20 950	8.63	26 290	9.41	32 580	10.16	39 920	10.87
	70	-	-	-	-	-	-	-	-	-	-	20 670	10.21	25 870	11.14	32 030	12.05
MTZ 200	40	11 270	6.26	15 600	6.98	20 900	7.63	27 310	8.19	34 950	8.63	43 960	8.91	54 490	9.01	66 650	8.89
	50	9 080	6.55	12 850	7.41	17 470	8.25	23 090	9.02	29 840	9.69	37 850	10.24	47 250	10.64	58 190	10.85
	60	-	-	10 570	7.65	14 380	8.70	19 070	9.72	24 770	10.68	31 630	11.54	39 770	12.27	49 340	12.85
	70	-	-	-	-	-	-	-	-	-	-	25 300	12.76	32 040	13.87	40 090	14.85
MTZ 250	40	14 390	7.09	19 770	8.08	26 260	9.00	34 030	9.80	43 220	10.45	53 970	10.91	66 440	11.13	80 760	11.09
	50	11 190	7.18	15 940	8.37	21 690	9.52	28 600	10.60	36 790	11.56	46 430	12.37	57 670	12.99	70 640	13.37
	60	-	-	12 480	8.34	17 330	9.78	23 210	11.18	30 260	12.51	38 630	13.72	48 470	14.78	59 930	15.65
	70	-	-	-	-	-	-	-	-	-	-	30 720	14.92	39 010	16.48	48 790	17.87
MTZ 288	40	18 870	9.32	25 250	10.33	32 900	11.30	42 010	12.21	52 720	13.01	65 210	13.69	79 630	14.20	96 150	14.51
	50	15 390	9.85	21 060	11.03	27 860	12.20	35 980	13.34	45 570	14.40	56 780	15.37	69 800	16.20	84 770	16.87
	60	-	-	17 090	11.54	22 870	12.95	29 810	14.35	38 090	15.72	47 860	17.02	59 290	18.23	72 540	19.30
	70	-	-	-	-	-	-	-	-	-	-	38 520	18.65	48 180	20.26	59 520	21.77
MTZ 320	40	20 890	10.04	27 810	11.18	36 190	12.31	46 220	13.42	58 090	14.48	71 990	15.46	88 120	16.35	106 650	17.11
	50	17 290	10.63	23 350	11.90	30 690	13.21	39 510	14.51	50 000	15.80	62 350	17.04	76 750	18.21	93 400	19.28
	60	-	-	19 140	12.49	25 220	14.00	32 610	15.55	41 500	17.09	52 080	18.62	64 540	20.11	79 070	21.53
	70	-	-	-	-	-	-	-	-	-	-	41 420	20.19	51 720	22.03	63 910	23.83

**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

Performance tables

# 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	1 210	0.78	1 640	0.87	2 170	0.95	2 830	1.02	3 640	1.07	4 590	1.09	5 720	1.09	7 030	1.06
	40	500	0.73	790	0.85	1 150	0.96	1 610	1.06	2 170	1.15	2 850	1.24	3 670	1.30	4 630	1.34	5 760	1.35
	50	290	0.70	510	0.83	790	0.96	1 140	1.09	1 580	1.22	2 110	1.34	2 760	1.45	3 540	1.54	4 460	1.62
	60	-	-	380	0.71	550	0.87	770	1.04	1 060	1.21	1 430	1.38	1 880	1.54	2 450	1.69	3 130	1.83
MTZ 22	30	1 210	0.75	1 680	0.94	2 240	1.12	2 920	1.28	3 720	1.41	4 650	1.50	5 720	1.55	6 950	1.54	8 350	1.47
	40	840	0.75	1 260	0.96	1 760	1.17	2 350	1.36	3 050	1.53	3 850	1.67	4 780	1.78	5 840	1.84	7 040	1.85
	50	480	0.63	820	0.87	1 230	1.11	1 710	1.35	2 270	1.57	2 920	1.78	3 670	1.96	4 540	2.10	5 520	2.20
	60	-	-	350	0.63	630	0.93	970	1.22	1 370	1.52	1 840	1.80	2 390	2.06	3 020	2.30	3 760	2.49
MTZ 28	30	1 650	1.03	2 190	1.24	2 870	1.43	3 700	1.60	4 700	1.75	5 880	1.86	7 260	1.93	8 860	1.96	10 690	1.93
	40	1 110	1.08	1 600	1.29	2 210	1.50	2 930	1.71	3 800	1.89	4 820	2.05	6 020	2.18	7 420	2.26	9 020	2.30
	50	700	1.03	1 100	1.27	1 590	1.51	2 180	1.76	2 880	1.99	3 720	2.21	4 710	2.40	5 860	2.55	7 190	2.67
	60	-	-	670	1.16	1 010	1.45	1 430	1.74	1 940	2.04	2 550	2.32	3 280	2.58	4 160	2.82	5 180	3.03
MTZ 32	30	1 760	1.24	2 390	1.46	3 190	1.66	4 180	1.85	5 370	2.01	6 800	2.14	8 480	2.24	10 440	2.29	12 700	2.28
	40	1 130	1.32	1 690	1.54	2 390	1.77	3 250	1.99	4 280	2.19	5 510	2.37	6 960	2.53	8 650	2.64	10 610	2.71
	50	720	1.33	1 170	1.59	1 730	1.85	2 410	2.11	3 230	2.37	4 220	2.61	5 390	2.83	6 770	3.03	8 390	3.18
	60	-	-	830	1.59	1 200	1.90	1 660	2.22	2 240	2.54	2 940	2.85	3 790	3.15	4 820	3.44	6 040	3.69
MTZ 36	30	2 250	1.51	2 920	1.73	3 760	1.94	4 820	2.13	6 100	2.31	7 650	2.45	9 470	2.56	11 610	2.62	14 080	2.64
	40	1 590	1.62	2 180	1.86	2 930	2.10	3 840	2.33	4 950	2.55	6 280	2.74	7 860	2.91	9 710	3.04	11 870	3.13
	50	1 110	1.68	1 590	1.94	2 180	2.22	2 910	2.50	3 800	2.77	4 870	3.03	6 160	3.27	7 680	3.49	9 460	3.67
	60	-	-	1 130	1.96	1 520	2.29	2 020	2.63	2 650	2.97	3 420	3.31	4 360	3.63	5 510	3.94	6 870	4.23
MTZ 40	30	2 180	1.59	2 990	1.87	4 000	2.15	5 210	2.42	6 650	2.67	8 350	2.90	10 320	3.10	12 590	3.25	15 180	3.36
	40	1 530	1.70	2 270	2.00	3 160	2.30	4 230	2.60	5 490	2.89	6 970	3.17	8 680	3.42	10 660	3.64	12 930	3.83
	50	1 030	1.73	1 640	2.06	2 370	2.39	3 240	2.74	4 280	3.08	5 490	3.42	6 900	3.74	8 540	4.04	10 430	4.30
	60	-	-	1 090	2.03	1 620	2.41	2 240	2.81	3 000	3.22	3 900	3.63	4 960	4.03	6 210	4.41	7 660	4.77
MTZ 44	30	2 570	1.86	3 390	2.12	4 450	2.36	5 810	2.59	7 490	2.78	9 550	2.94	12 010	3.05	14 930	3.10	18 340	3.09
	40	1 660	1.98	2 380	2.26	3 300	2.53	4 460	2.80	5 910	3.05	7 680	3.27	9 810	3.45	12 350	3.59	15 320	3.67
	50	1 070	1.98	1 630	2.29	2 350	2.62	3 270	2.94	4 420	3.25	5 840	3.55	7 570	3.82	9 660	4.06	12 140	4.25
	60	-	-	1 160	2.22	1 620	2.60	2 230	3.00	3 020	3.39	4 040	3.78	5 310	4.16	6 880	4.51	8 780	4.83
MTZ 50	30	3 170	2.11	4 130	2.40	5 370	2.69	6 950	2.94	8 900	3.16	11 270	3.34	14 100	3.45	17 440	3.50	21 340	3.47
	40	2 080	2.25	2 930	2.57	4 010	2.89	5 370	3.20	7 050	3.48	9 080	3.73	11 530	3.93	14 430	4.08	17 830	4.16
	50	1 370	2.25	2 040	2.61	2 890	2.99	3 950	3.36	5 290	3.72	6 920	4.06	8 910	4.37	11 300	4.63	14 120	4.84
	60	-	-	1 450	2.53	2 000	2.98	2 720	3.43	3 640	3.89	4 800	4.34	6 260	4.77	8 050	5.17	10 210	5.53
MTZ 56	30	3 130	2.20	4 330	2.56	5 810	2.91	7 630	3.22	9 800	3.50	12 370	3.72	15 380	3.88	18 870	3.96	22 860	3.94
	40	2 080	2.37	3 150	2.75	4 470	3.14	6 050	3.51	7 940	3.85	10 170	4.15	12 790	4.40	15 820	4.59	19 300	4.69
	50	1 300	2.41	2 180	2.84	3 250	3.28	4 530	3.72	6 060	4.15	7 880	4.55	10 020	4.91	12 520	5.22	15 420	5.47
	60	-	-	1 460	2.83	2 210	3.35	3 120	3.88	4 220	4.41	5 550	4.93	7 140	5.42	9 020	5.88	11 240	6.28
MTZ 64	30	3 810	2.51	5 160	2.90	6 830	3.29	8 870	3.65	11 300	3.97	14 180	4.24	17 530	4.44	21 410	4.57	25 840	4.61
	40	2 570	2.72	3 790	3.14	5 270	3.56	7 060	3.97	9 180	4.36	11 690	4.72	14 610	5.02	17 990	5.26	21 860	5.43
	50	1 670	2.78	2 680	3.24	3 890	3.73	5 350	4.22	7 080	4.69	9 130	5.15	11 540	5.57	14 340	5.95	17 580	6.26
	60	-	-	1 780	3.21	2 640	3.77	3 690	4.36	4 950	4.94	6 460	5.52	8 270	6.08	10 400	6.61	12 900	7.09
MTZ 72	30	4 580	2.89	6 060	3.31	7 900	3.73	10 130	4.13	12 810	4.49	15 980	4.82	19 690	5.09	23 970	5.29	28 890	5.41
	40	3 090	3.01	4 430	3.46	6 050	3.92	8 020	4.38	10 360	4.82	13 120	5.23	16 350	5.60	20 100	5.92	24 400	6.17
	50	2 000	3.06	3 110	3.56	4 440	4.08	6 040	4.62	7 960	5.15	10 230	5.67	12 900	6.17	16 010	6.62	19 620	7.03
	60	-	-	2 090	3.58	3 040	4.19	4 200	4.82	5 600	5.47	7 280	6.12	9 290	6.76	11 680	7.37	14 470	7.95
MTZ 80	30	5 140	3.36	6 900	3.84	9 030	4.32	11 590	4.78	14 610	5.21	18 140	5.60	22 230	5.93	26 900	6.19	32 210	6.37
	40	3 470	3.57	5 060	4.09	6 970	4.61	9 230	5.14	11 890	5.64	14 980	6.12	18 550	6.56	22 640	6.95	27 300	7.27
	50	2 180	3.66	3 520	4.22	5 100	4.82	6 970	5.42	9 160	6.03	11 720	6.63	14 680	7.20	18 090	7.73	21 990	8.21
	60	-	-	2 280	4.26	3 440	4.94	4 820	5.65	6 450	6.38	8 370	7.11	10 620	7.84	13 240	8.54	16 260	9.20



Performance tables

# 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	5 660	3.88	7 590	4.44	10 020	4.97	13 050	5.45	16 730	5.85	21 150	6.16	26 380	6.35	32 490	6.41	39 560	6.30
	40	3 940	4.26	5 660	4.86	7 800	5.46	10 430	6.03	13 620	6.55	17 450	6.99	21 990	7.35	27 310	7.59	33 490	7.70
	50	2 600	4.32	3 990	5.00	5 710	5.70	7 810	6.39	10 390	7.06	13 500	7.68	17 220	8.23	21 620	8.70	26 770	9.05
	60	-	-	2 600	4.78	3 770	5.61	5 240	6.47	7 070	7.31	9 330	8.14	12 080	8.92	15 420	9.64	19 390	10.27
MTZ 125	30	7 900	4.84	10 350	5.52	13 430	6.17	17 220	6.79	21 790	7.34	27 250	7.82	33 670	8.18	41 130	8.42	49 730	8.52
	40	5 570	5.33	7 780	6.05	10 490	6.78	13 790	7.49	17 760	8.17	22 490	8.78	28 060	9.32	34 560	9.76	42 060	10.08
	50	3 800	5.54	5 590	6.34	7 780	7.17	10 440	8.02	13 650	8.85	17 500	9.65	22 060	10.40	27 420	11.07	33 670	11.64
	60	-	-	3 820	6.38	5 330	7.35	7 200	8.36	9 490	9.39	12 290	10.41	15 680	11.39	19 730	12.33	24 530	13.19
MTZ 144	30	9 230	5.79	12 020	6.53	15 500	7.26	19 780	7.95	24 940	8.58	31 080	9.13	38 300	9.58	46 700	9.91	56 360	10.10
	40	6 560	6.22	9 070	7.01	12 150	7.81	15 890	8.61	20 390	9.37	25 740	10.08	32 030	10.72	39 360	11.26	47 830	11.69
	50	4 470	6.42	6 530	7.30	9 040	8.22	12 080	9.16	15 740	10.09	20 120	11.00	25 310	11.86	31 400	12.66	38 480	13.36
	60	-	-	4 450	7.40	6 210	8.48	8 380	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	10 400	6.41	13 500	7.26	17 370	8.11	22 100	8.93	27 810	9.72	34 580	10.45	42 520	11.09	51 740	11.63	62 340	12.05
	40	7 460	6.89	10 250	7.79	13 670	8.72	17 820	9.65	22 790	10.57	28 690	11.46	35 610	12.29	43 660	13.05	52 930	13.71
	50	5 190	7.20	7 490	8.19	10 280	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	-	-	5 200	8.43	7 170	9.63	9 580	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	11 200	7.65	15 010	8.75	19 840	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	7 810	8.44	11 210	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	5 150	8.56	7 900	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	-	-	5 160	9.48	7 470	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	15 540	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	7 520	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	-	-	7 570	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	8 860	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	-	-	8 790	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)

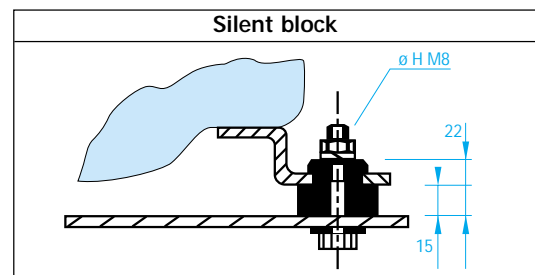
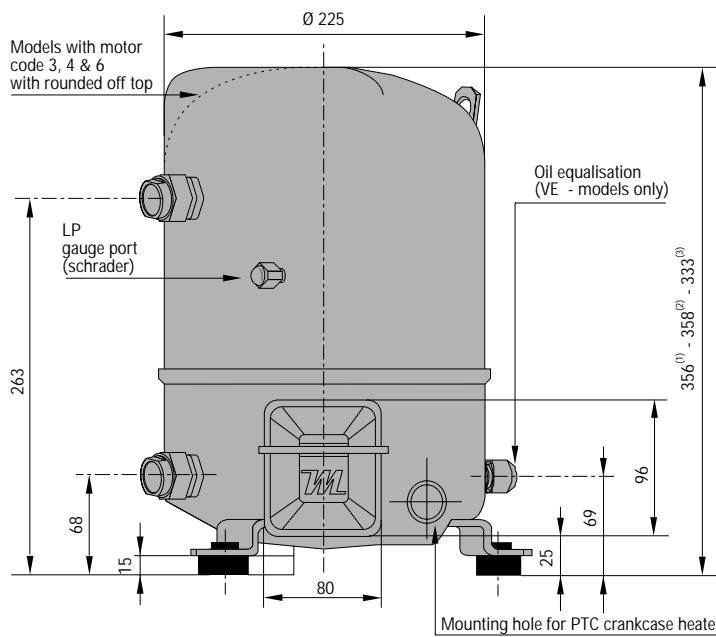
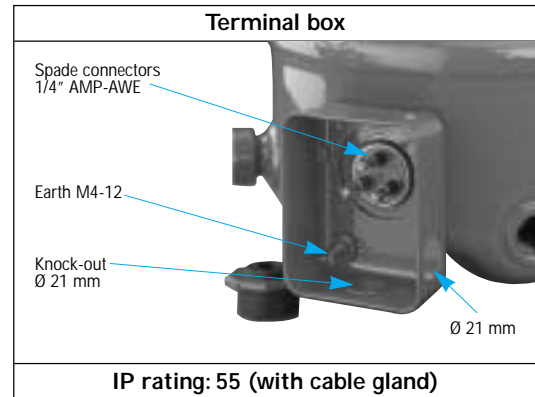
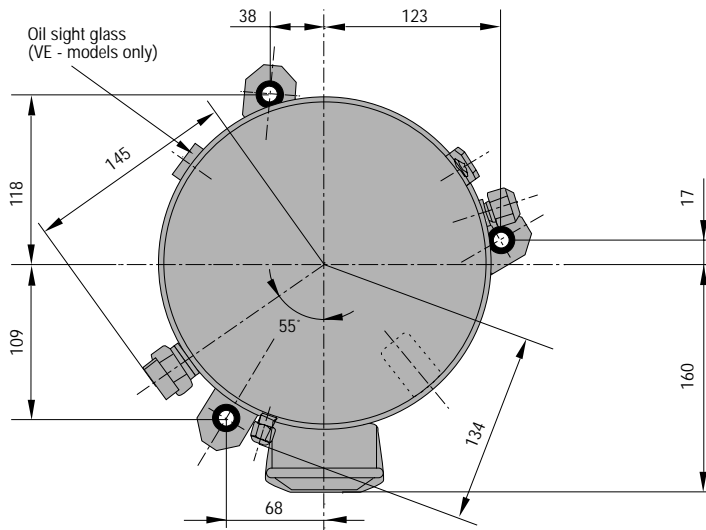
TE evaporating temperature (°C)  
TC condensing temperature (°C)

**RATING CONDITIONS**

• 50 Hz • Superheat 10 K  
• Subcooling 0 K

# Outline drawings

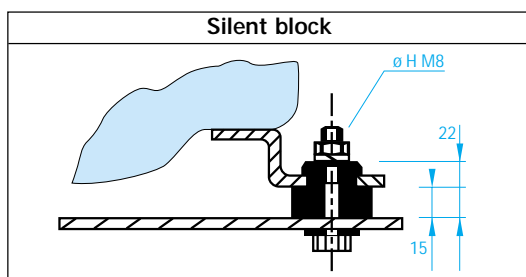
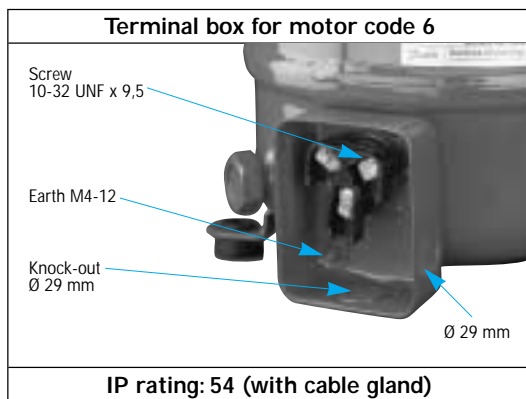
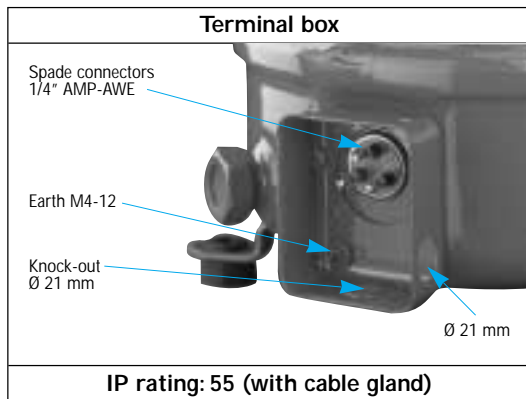
## 1 CYLINDER



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

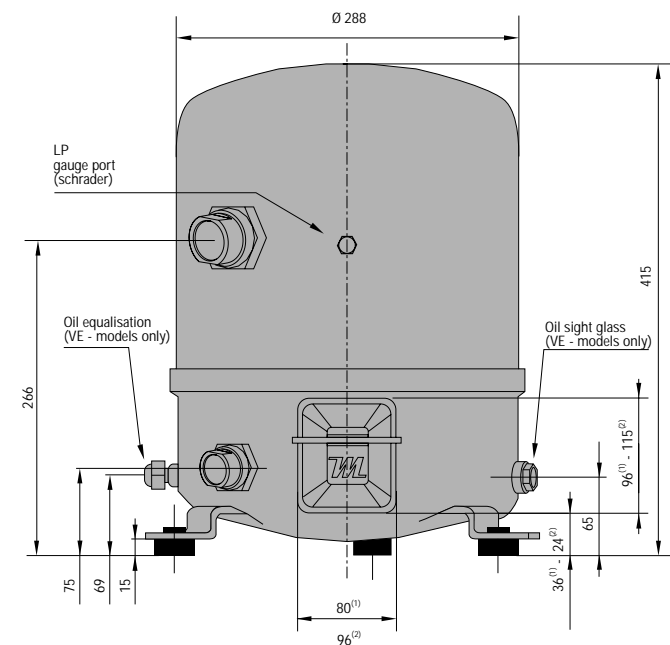
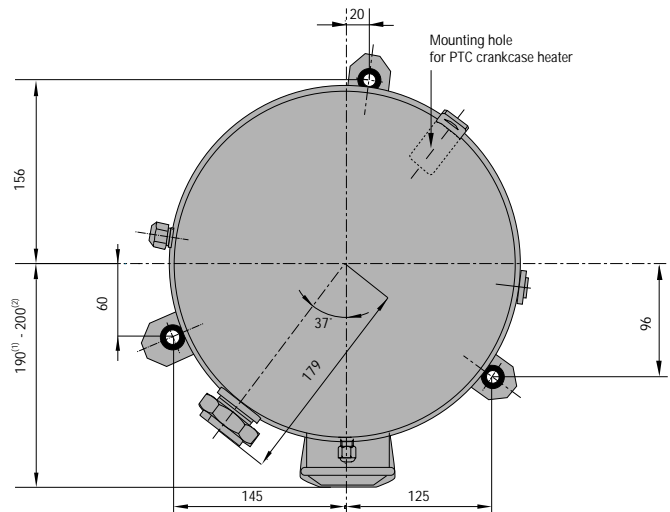
	Rotolock connections size		Pipe sizing size		Rotolock valve	
	Suction	Discharge	Suction	Discharge	Suction	Discharge
MT / MTZ 18 JA MT / MTZ 22 JC 3/4/5/6 MT / MTZ 28 JE 3/4/5/6	1"	1"	1/2"	3/8"	V06	V01
MT / MTZ 22 JC1	1"1/4	1"	5/8"	3/8"	V09	V01
MT / MTZ 28 JE1 MT / MTZ 32 JF MT / MTZ 36 JG MT / MTZ 40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

## 2 CYLINDERS



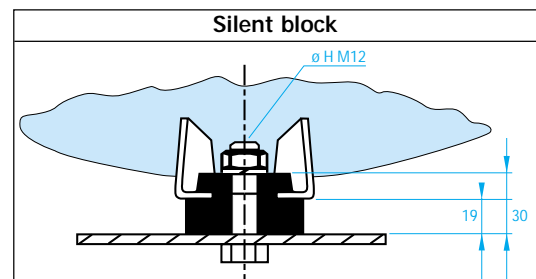
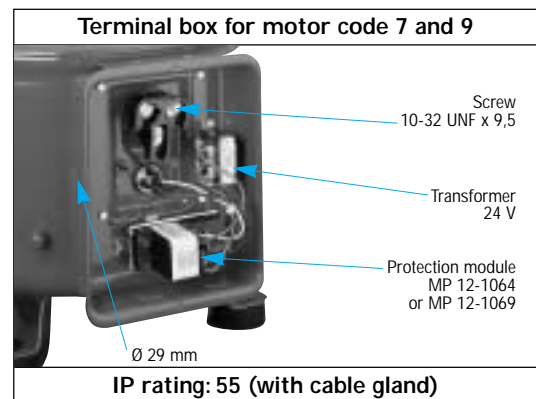
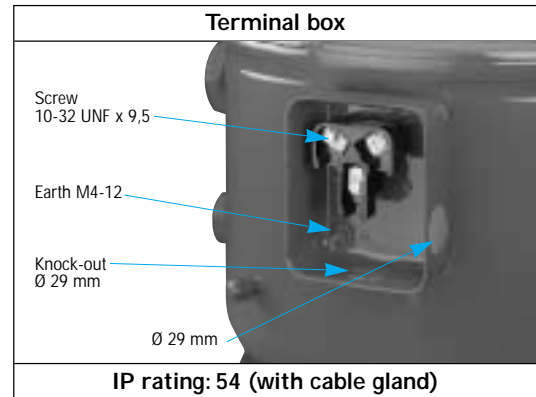
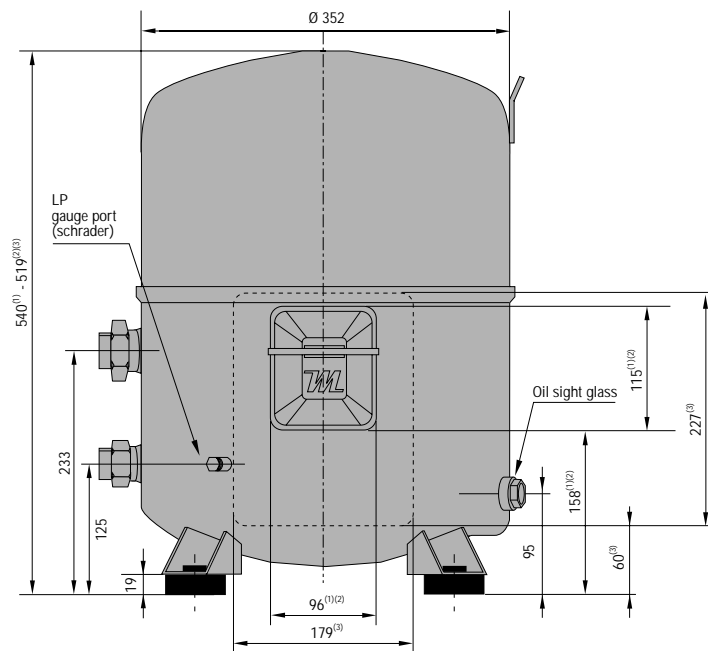
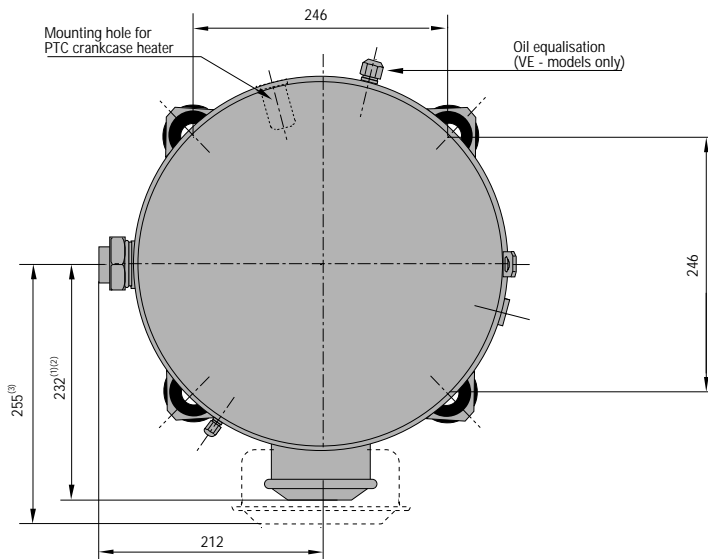
<sup>(1)</sup> MT (Z) 2 cyl. Code 1-3-4-7-9

<sup>(2)</sup> 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 MT / MTZ 81 HP	1"3/4	1"1/4	1"1/8	3/4"	V02	V04

# 4 CYLINDERS

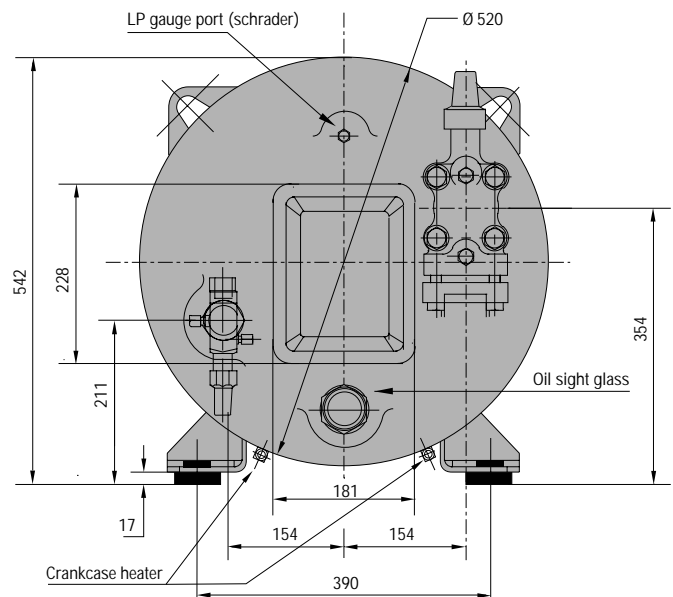
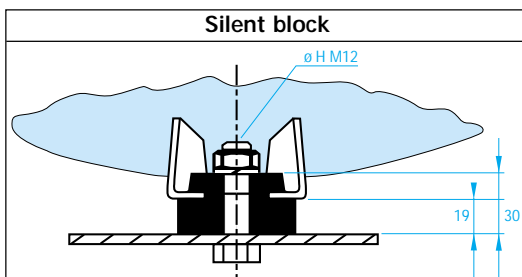
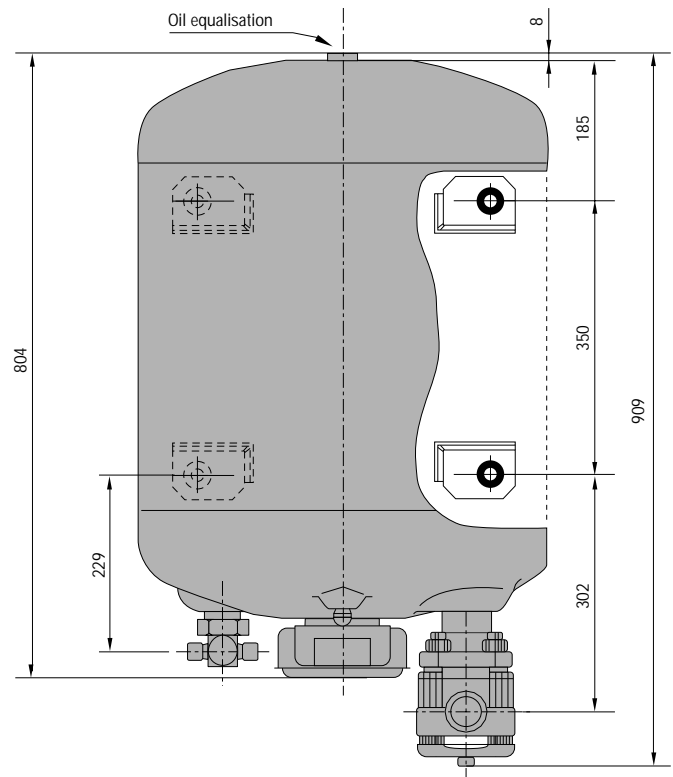
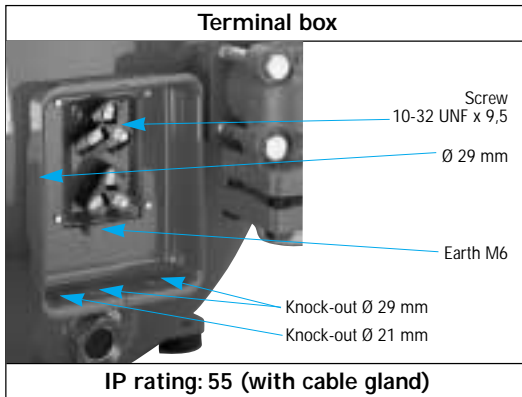


<sup>(1)</sup> MT (Z) 144 - 160/3-4-6  
<sup>(2)</sup> MT (Z) 100 - 125/3-4-6  
<sup>(3)</sup> MT (Z) Code 7 - 9

	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

## Outline drawings

# 8 CYLINDERS



	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

Motor Code	LRA - Locked Rotor Current (A)		MCC - Maximum Continuous Current (A)		Winding resistance ( $\Omega$ ) ( $\pm 7\%$ at 20° C)			
	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		Start relay
	Run capacitors (1)		Start capacitors (2)	Start relay	
	(A) $\mu$ F	(C) $\mu$ F			
MT / MTZ 18 JA-5	20	10	100	all models 3ARR3J4A4	
MT / MTZ 22 JC-5	20	10	100		
MT / MTZ 28 JE-5	20	10	100		
MT / MTZ 32 JF-5	25	10	135		
MT / MTZ 36 JG-5	25	10	135		

60 Hz	PSC/CSR*		CSR only		Start relay
	Run capacitors (1)		Start capacitors (2)	Start relay	
	(A) $\mu$ F	(C) $\mu$ F			
MT / MTZ 18 JA-1	15	10	-	all models 3ARR3J4A4	
MT / MTZ 22 JC-1	15	30	100		
MT / MTZ 28 JE-1	25	25	135		
MT / MTZ 32 JF-1	25	20	100		
MT / MTZ 36 JG-1	25	20	100		
MT / MTZ 40 JH-1	35	20	100		
MT / MTZ 44 / 45 HJ-1	30	15	135		
MT / MTZ 50 / 51 HK-1	30	15	135		
MT / MTZ 56 / 57 HL-1	30	20	200		
MT / MTZ 64 / 65 HM-1	30	25	235		

\* 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

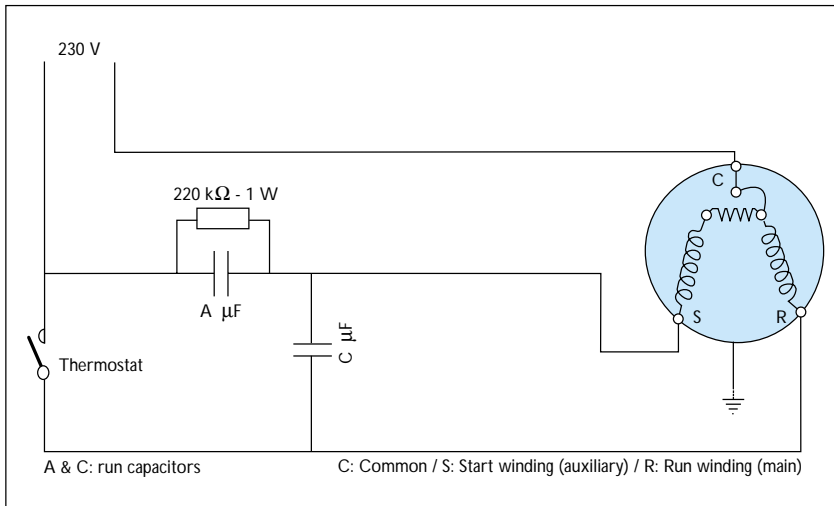
This system provides additional motor torque at start up, by the use of a start capacitor in combination with the run capacitor. This system can be used for refrigerant circuits with capillary tubes or expansion valves.

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

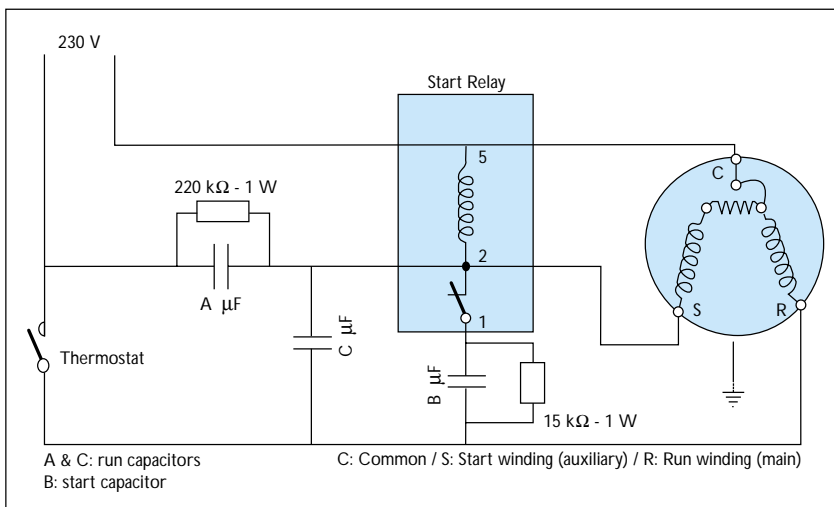
The single phase compressor motors are internally protected by a temperature/current sensing bimetallic protector, which senses the main and start winding currents, and also the winding temperature. Once the protector has tripped, it may take up to two to four hours to reset and restart the compressor.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

## Electrical connections and wiring

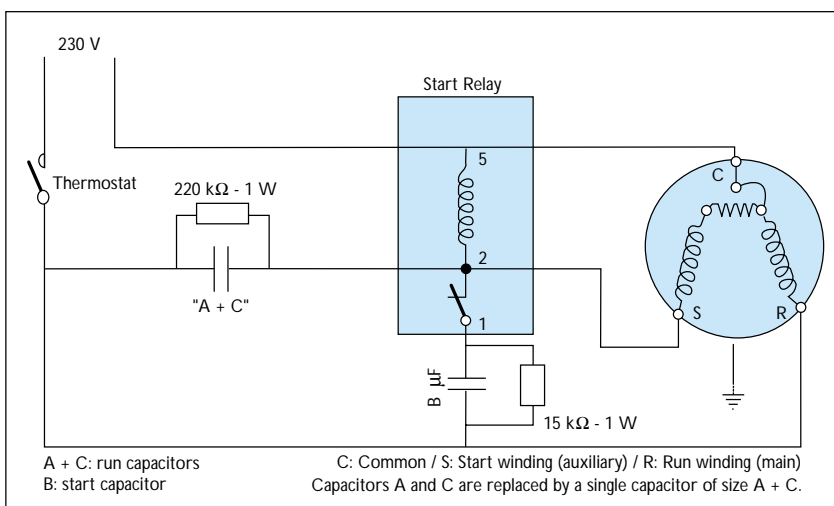
### SUGGESTED WIRING DIAGRAMS



Single phase  
PSC wiring  
with trickle circuit



Single phase  
CSR wiring  
with trickle circuit



Single phase  
CSR wiring  
without trickle circuit

## Electrical connections and wiring

### THREE PHASE ELECTRICAL CHARACTERISTICS

Motor Code	LRA - Locked Rotor Current (A)				MCC - Maximum Continuous Current (A)				Winding resistance ( $\Omega$ ) ( $\pm 7\%$ at $20^\circ\text{C}$ )						
	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

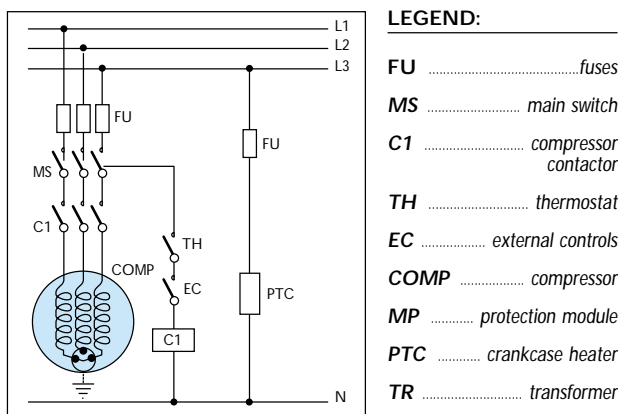
The 3 phase compressors codes 3-4-6, and 2 cylinders compressors codes 7-9, are protected by an internal motor protector, connected to the neutral point of the star connected stator windings, the protector cuts out all 3 phases simultaneously.

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.

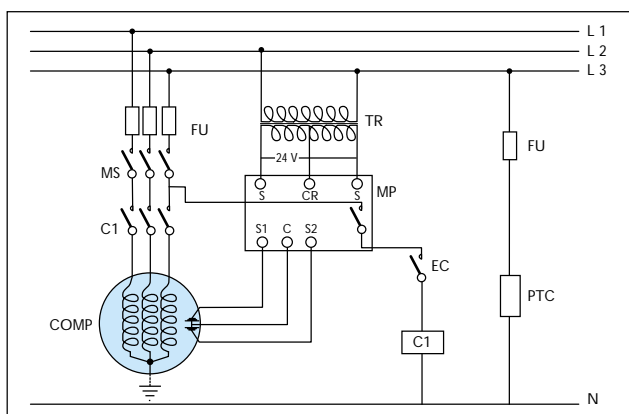
Note: once the overload protector has tripped it may take up to 3 hours to reset and restart the compressor.

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



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.



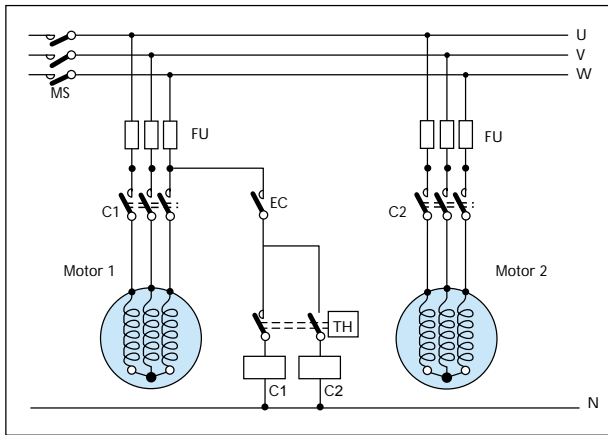
Compressors with external protection module  
(4 cylinder compressors code 7-9)

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



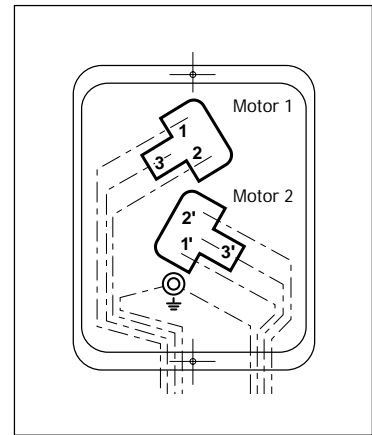
## Electrical connections and wiring

### 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.

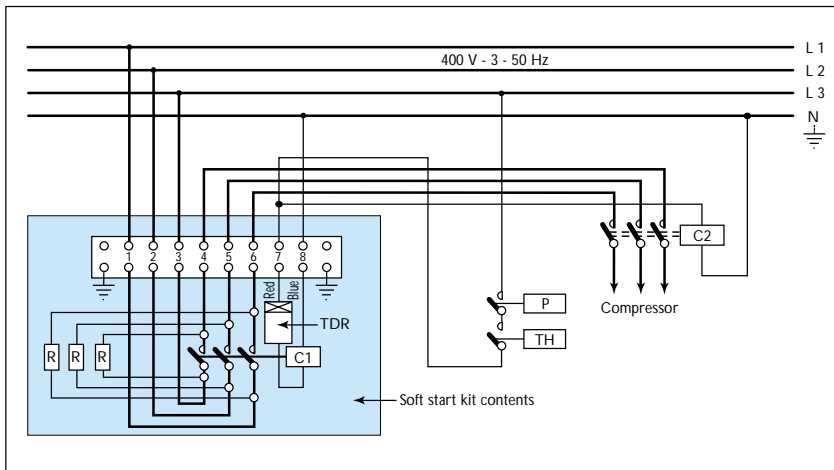
### SOFT START KIT FOR 2 - 4 CYL. CODE 4

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.



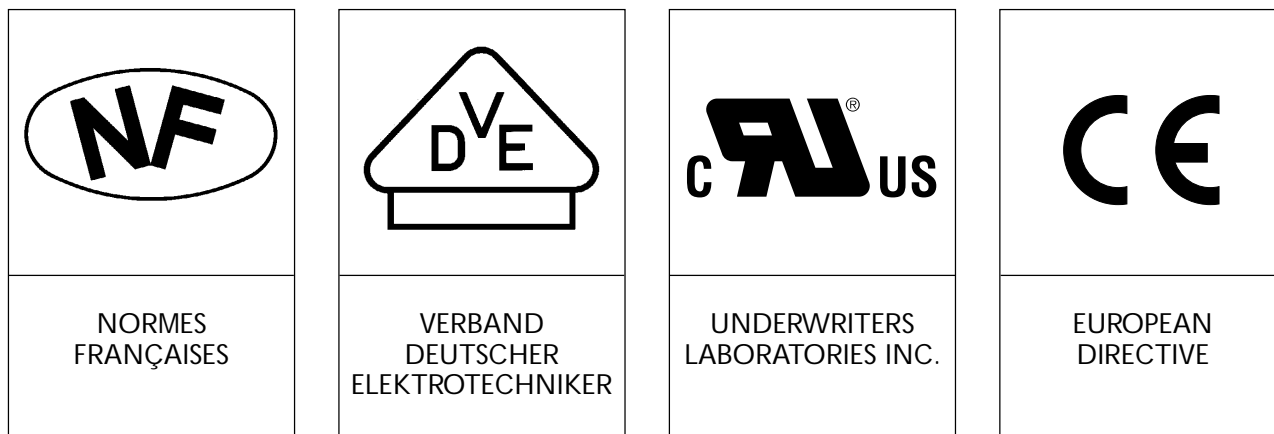
**LEGEND:**

- 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 HS4	78.5	48	
MT / MTZ 125 HU4	105	51	
MT / MTZ 144 HV4	115	58	
MT / MTZ 160 HW4	130	64	SCR 03 - 2.2Ω Ref 7705001

# Miscellaneous

## APPROVALS



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 DVE

	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	-	*
MT 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	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

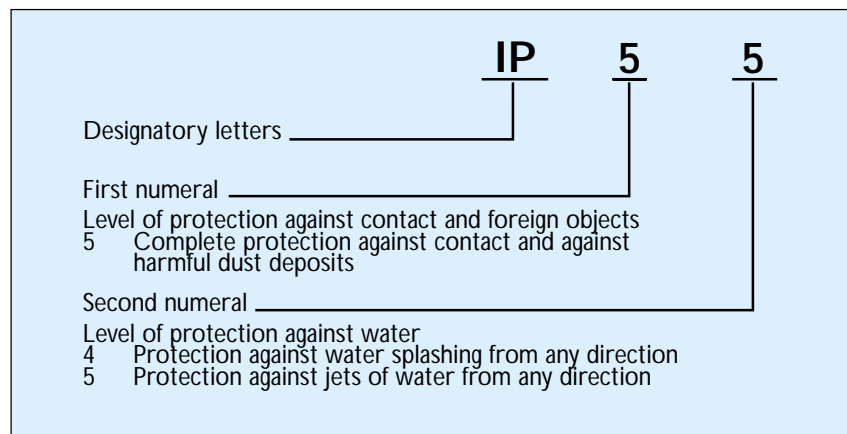
## Miscellaneous

### 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.



### PACKAGING

Models	Net weight (kg)	Individual packaging					Multiple packaging			
		Gross weight (kg)	Nbr	Compressor Packed (mm)	Full pallet dim. (mm)	Stacking	Gross weight (kg)	Nbr	Total dim. (mm)	Stacking
<b>1 cylinder</b>										
MT / MTZ 18	21	142	6	330x295x385	1000x600x510	4		12	1200x800x500	4
MT / MTZ 22	21	142					279			
MT / MTZ 28	23	151					279			
MT / MTZ 32	24	158					295			
MT / MTZ 36	25	164					305			
MT / MTZ 40	26	168					322			
							329			
<b>2 cylinders</b>										
MT / MTZ 44 / 50	35	227	6	395x365x455	1115x800x560	4		8	1200x800x550	4
MT / MTZ 45 / 51	37	239					294			
MT / MTZ 56 / 64	37	239					306			
MT / MTZ 57 / 65	39	254					306			
MT / MTZ 72 / 80	40	257					333			
MT / MTZ 73 / 81	41	262					342			
							347			
<b>4 cylinders</b>										
MT / MTZ 100	60	398	6	485x395x600	1200x1000x730	4		6	1200x800x650	4
MT / MTZ 125	64	414					388			
MT / MTZ 144	67	430					404			
MT / MTZ 160	69	444					420			
							434			
<b>8 cylinders</b>										
MT / MTZ 200	170	184	1	1000x605x585	1000x605x720	4				
MT / MTZ 250	175	189								
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, <b>160P</b>	Medium / High Temperature
R407C	HFC	Polyolester	MTZ	Polyolester oil <b>160PZ</b>	Medium / High temperature
R134a	HFC	Polyolester	MTZ	Polyolester oil <b>160PZ</b>	Medium / High temperature
R404A	HFC	Polyolester	MTZ	Polyolester oil <b>160PZ</b>	Medium temperature
R507	HFC	Polyolester	MTZ	Polyolester oil <b>160PZ</b>	Medium temperature
Transitional refrigerants, R22 based		Alkylbenzene (ABM)	MT	Alkylbenzene oil <b>160 ABM</b> <b>Note:</b> 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.

## Refrigerants and lubricants

### 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<sup>®</sup>, MTZ compressor with Maneurop<sup>®</sup>, 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<sup>®</sup>, 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<sup>®</sup>, LTZ compressors should be used. Refer to the LTZ

selection and application guidelines. For medium temperature R404A applications, always use the Maneurop<sup>®</sup>, 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<sup>®</sup>, 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<sup>®</sup>, LTZ compressor should be used. Refer to the LTZ selection and application guidelines. For medium temperature R507 applications, always use the

Maneurop<sup>®</sup>, MTZ compressor and Maneurop<sup>®</sup>, 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<sup>®</sup>, 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<sup>®</sup>,

MT compressors can be applied with these transitional refrigerants. The initial mineral oil charge must be replaced by Maneurop<sup>®</sup>, 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

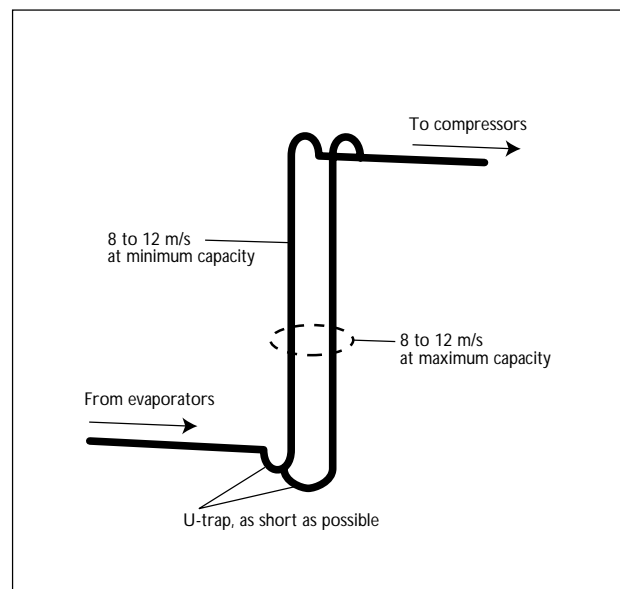
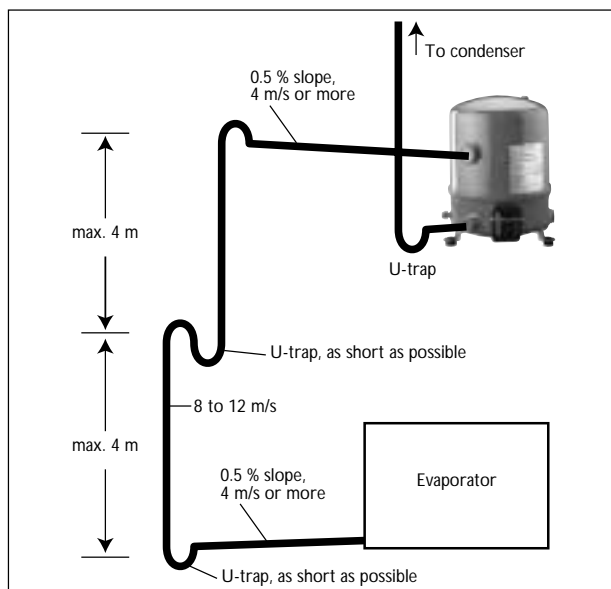
Horizontal suction line sections shall have a slope of 0.5% in the direction of refrigerant flow (5 mm per meter). The cross-section of horizontal suction lines shall be such that the resulting gas velocity is at least 4 m/s. In vertical risers, a gas velocity of 8 to 12 m/s is required to ensure proper 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".

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.

Gas velocities higher than 12 m/s



## System design recommendations

### 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 driers, 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 alumina) 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 R22	MTZ R407C	MTZ R134a	MTZ 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.



## System design recommendations

### 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:

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

$V_{avg}$  = 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 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)



## System design recommendations

### 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	MT / MTZ 18-22-28-32-36-40	2.5
2 cylinder	MT / MTZ 44-50-56-64-72-80 MT 45-51-57-65-73-81	5
4 cylinder	MT / MTZ 100-125-144-160	10
8 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).

## System design recommendations

### Crankcase heater

A crankcase heater protects against off-cycle migration of refrigerant by maintaining the crankcase at a higher temperature. It will not offer protection against continuous liquid floodback. The effectiveness of a crankcase heater can be checked by measuring the

crankcase temperature, which should be maintained at least 10 K above the saturated suction temperature. Checks must be made to insure that the appropriate oil temperature is maintained at all ambient conditions. A crankcase heater is recommended on all stand-alone

compressors and split systems. MT/MTZ 160-200 8 cylinder compressors are factory supplied with 2 x 100 W crankcase heaters. For 1 to 4 cylinder compressors either belt type crankcase heaters or self-regulating PTC crankcase heaters are available as accessories. Refer to the tables below.

### PTC crankcase heater

	MT/MTZ 18-160	
	designation	unit ref
200 - 600 V	PTC 35 W	7773001

### Belt type crankcase heaters

	MT / MTZ 18-40		MT / MTZ 44-80 MT 45-81		MT / MTZ 100-160	
	designation	unit ref	designation	unit ref	designation	unit ref
110 V	-	-	50 W - 110 V	7773010	-	-
230 V	54 W - 230 V	7773002	50 W - 230 V	7773003	75 W - 230 V	7773004
400 V	54 W - 400 V	7773013	50 W - 400 V	7773009	75 W - 400 V	7773014
575 V	-	-	-	-	75 W - 575 V	7773105

**Note:** Belt type crankcase heaters are not self-regulating. They must be switched on when the compressor stops and switched off when the compressor runs.

### 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 refrigerant 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.

Pump down must always be applied to systems with evaporators fitted with defrost heaters.

### 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 volume to the low pressure 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. A suction line accumulator should not be used in systems with zeotropic refrigerants.

**System design  
recommendations**

**SOUND AND VIBRATION**

Running compressors cause sound and vibration. Both phenomena are closely related.

**Sound**

The table on the right shows the sound power levels of Maneurop<sup>®</sup>, compressors. Note that sound power levels are not the same as sound pressure levels often found in documentation.

Sound produced by a compressor is transmitted in every direction by the ambient air, the mounting feet, the pipework and the refrigerant in the pipework.

The easiest way to reduce the sound transmitted through ambient air is to fit a Maneurop<sup>®</sup>, acoustic hood accessory.

Because Maneurop<sup>®</sup>, compressors are 100% suction gas cooled, and require no body cooling, they can be insulated. Values for the sound reduction achieved with acoustic hoods are shown also in the table on the right. For inside mounted compressors, sound insulation of the plantroom is an alternative to sound insulation of the compressor.

Compressor model	Sound power level dB(A)		Acoustic hood unit ref
	without hood	with hood	
MT 18 JA	71.4	64.0	7755001
MT 22 J	71.0	65.0	
MT 28 JE	67.6	60.5	
MT 32 JF	68.0	61.0	
MT 36 JG	67.4	60.5	
MT 40 JH	66.2	61.5	
MT 44 HJ	75.8	69.8	7755002
MT 50 HK	76.5	70.0	
MT 56 HL	76.9	70.0	
MT 64 HM	72.1	66.1	
MT 72 HN	74.7	68.0	
MT 80 HP	74.8	68.8	7755003
MT 100 HS	81.3	75.3	
MT 125 HU	82.7	76.7	
MT 144 HZ	82.8	76.8	
MT 160 HW	82.8	76.8	-
MT 200 HSS	89.0	-	
MT 250 HUU	89.0	-	
MT 288 HVV	92.0	-	
MT 320 HWW	92.0	-	

*\*The acoustic hood for MTZ compressors is the same as for the corresponding MT compressor.*

Sound transmitted by mounting feet, pipework and refrigerant

should be treated the same way as for vibration.

Please refer to the next section.

**Vibration**

The mounting grommets delivered with the compressor should always be used.

They reduce the vibration transmitted by the compressor mounting feet to the base frame.

The base on which the compressor is mounted should be sufficiently rigid and of adequate mass to ensure the full effectiveness of the mounting grommets. The compressor should never be directly mounted to the base frame without the

grommets, otherwise high vibration transmission would occur and the compressor service life reduced. Suction and discharge lines must have adequate flexibility in 3 planes. Eventually vibration absorbers may be required.

Care must be taken to avoid tubing having resonant frequencies close to those of the compressor frequency.

Vibration is also transmitted by the refrigerant gas. Maneurop<sup>®</sup>, compressors have built in mufflers

to reduce this vibration.

To further reduce vibration an extra muffler can be installed.

# Installation and service

## SYSTEM CLEANLINESS

System contamination is one of the main factors affecting equipment reliability and compressor service life.

Therefore it is important to ensure system cleanliness when manufacturing a refrigeration system. During the manufacturing process, system contamination can be caused by:

- Brazing and welding oxides
- Filings and particles from removing burrs from pipe-work

- Brazing flux
- Moisture and air.

Only use clean and dehydrated refrigeration grade copper tubes and silver alloy brazing material. Clean all parts before brazing and always purge nitrogen or CO<sub>2</sub> through the pipes during brazing to prevent oxidation. If flux is used, take every precaution to prevent leakage into the piping. Do not drill holes (e.g. for schröder valves) in parts of the installation that are

already completed, when filings and burrs can not be removed.

Carefully follow the instructions below regarding brazing, mounting, leak detection, pressure test and moisture removal.

All installation and service work shall only be done by qualified personnel respecting all procedures and using tools (charging systems, tubes, vacuum pump, etc.) dedicated for the refrigerant that will be used.

## COMPRESSOR HANDLING, MOUNTING AND CONNECTION TO THE SYSTEM

### Compressor handling

Maneurop®, MT and MTZ compressors are provided with a lifting lug. This lug should always be used to lift

the compressor. Once the compressor is installed, the compressor lifting lug should never be used to lift the complete installation.

Keep the compressor in an upright position during handling.

### Compressor mounting

Mount the compressor on a horizontal plane with a maximum slope of 3 degrees.

All compressors are supplied with three or four rubber mounting

grommets, each complete with metal sleeves and nuts and bolts. Refer to the outline drawings on page 18 to 21.

These grommets largely attenuate the compressor vibration transmit-

ted to the base frame.

The compressor must always be mounted with these grommets. Refer to the table below for torque values.

Designation		Recommended torque Nm
Cable screw of T connector in electrical box	screw 10/32 - UNF x 3	3
Rotolock valves and solder sleeves	1"	80
	1"1/4	90
	1"3/4	110
Flange bolts of 8 cylinder comp suction valve	-	100
Mounting grommet bolts	1 - 2 - 4 cylinder	15
	8 cylinder	30
Oil sight glass	-	50
Oil equalisation connection	1 - 2 - 4 cylinder	30
	8 cylinder	80

### Compressor connection to the system

New compressors have a protective nitrogen holding charge. The suction and discharge caps should only be removed just before connecting the compressor

to the installation to avoid air and moisture entering the compressor.

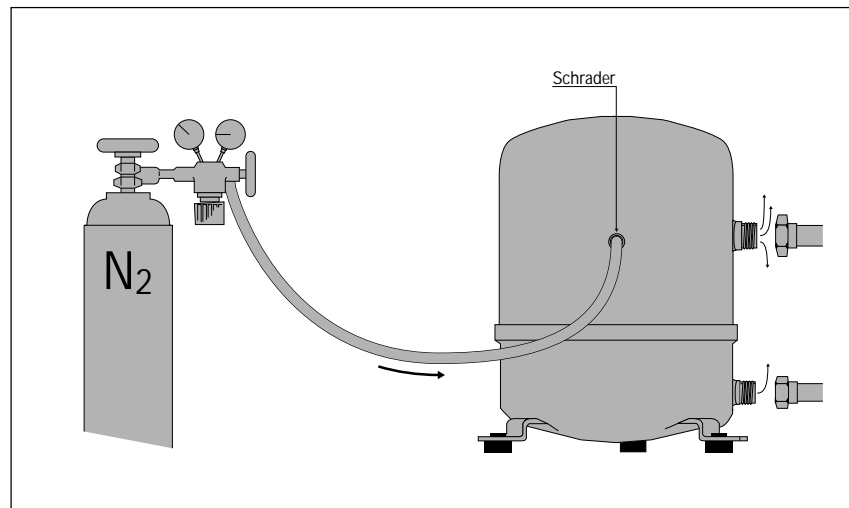
Whenever possible the compressor must be the last component to be integrated in the system. It is advisable to braze the solder

sleeves or service valves to the pipework before the compressor is mounted. When all brazing is finished and when the total system is ready, the compressor caps can be removed and the compressor can be connected to the system

## Installation and service

th a minimum exposure to ambient air. If this procedure is not possible, the sleeves or valves may be brazed to the pipes when mounted on the compressor. In this situation nitrogen or CO<sub>2</sub> must be purged through the compressor via the schrader valve to prevent air and moisture ingress. Purging must start when the caps are removed and proceed during the brazing process. When rotolock valves are used on the compressor, they shall be closed immediately after mounting, thus keeping the compressor isolated from atmosphere or from a not yet dehydrated system.

**Note:** When the compressor is built into a "pack" or "rack"-configuration which is not installed



immediately on its final location, a vacuum pull-down and moisture removal must be performed to this pack (rack) as if it were a complete

system (see below). The pack must be charged with nitrogen or CO<sub>2</sub> and open tubes must be blocked with caps or plugs.

## SYSTEM PRESSURE TEST

It is recommended that an inert gas such as nitrogen be used for pressure testing. Dry air may also be used but care should be taken since it can form an inflammable

mixture with the compressor oil. When performing a system pressure test, the maximum allowed pressure for the different components should not be exceeded.

For MT/MTZ compressors the maximum test pressures are shown in the table below.

	1-2-4 cylinder compressors	8 cylinder compressors
Maximum compressor test pressure, low side	25 bar(g)	18 bar(g)
Maximum compressor test pressure, high side	30 bar(g)	30 bar(g)

Do not exceed 30 bar pressure difference between high pressure

side and low pressure side of the compressor because this will open

the internal compressor relief valve.

## LEAK DETECTION

Whenever possible (if valves are present) the compressor must be kept isolated from the system. Perform a leak detection using the final refrigerant. Pressurise with nitrogen or another neutral gas and

use a leak detector for the applied refrigerant. Any spectrometric detection system using helium can also be applied. Eventual leaks shall be repaired respecting the instructions written above. It is not

recommended to use other gasses such as oxygen, dry air or acetylene as these gasses can form an inflammable mixture. Never use CFC or HCFC refrigerants for leak detection of HFC systems.

**Note 1 :** Leak detection with refrigerant may not be allowed in some countries. Check local regulations.

**Note 2 :** Leak detecting additives shall not be used as they may affect the lubricant properties. Warranty may be voided if leak detecting additives have been used.

## VACUUM PULL-DOWN MOISTURE REMOVAL

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

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

To eliminate these factors, a vacuum pull-down according to the procedure below is recommended:

1. Whenever possible (if valves are present) the compressor must be kept isolated from the system.
2. After the leak detection, the system must be pulled-down under a vacuum of 500 microns

(0.67 mbar). A two stage vacuum pump shall be used with a capacity appropriate to the system volume. It is recommended to use connection lines with a large diameter and to connect these to the service valves and not to the schraeder connection to avoid too high pressure losses.

3. When the vacuum level of 500 micron is reached, the system must be isolated from the vacuum pump. Wait 30 minutes during which the system pressure should not rise. When the pressure rapidly increases, the system is not leak tight.

A new leak detection must be performed and the vacuum pull-down procedure should be restarted from step 1. When the pressure slowly increases, this

indicates the presence of moisture. In this case step 2 and 3 should be repeated.

4. Connect the compressor to the system by opening the valves. Repeat step 2 and 3.
5. Break the vacuum with nitrogen or the final refrigerant.
6. Repeat step 2 and 3 on the total system.

At commissioning, system moisture content may be up to 100 ppm.

During operation the filter drier must reduce this to a level < 20 ppm.

### Warning :

Do not use a megohmmeter or apply power to the compressor while it is under vacuum, as this may cause motor winding damage. Never run the compressor under vacuum as it may cause compressor motor burn-out.

## START UP

Before initial start up or after a prolonged shut down period, energise the crankcase heater (if fitted) 12 hours prior to start up, or turn on power for single phase compressors with trickle circuit.

### Refrigerant charging

Zeotropic and "near-azeotropic" refrigerant mixtures such as R407C and R404A must always be charged in the liquid phase. For the initial charge, the compressor must not run and service valves must be closed. Charge refrigerant as close as possible to the nominal system charge before starting the compressor. Then slowly add refrigerant in the liquid phase, on the low pressure side as far away as possible from the running compressor.

**Warning:** when a liquid line solenoid valve is used, the vacuum in the low pressure side must be broken before applying power to the system.

The refrigerant charge quantity must be suitable for both winter and summer operation. Refer also to section "Protection

against flooded starts and liquid floodback" for information about refrigerant charge limits.

### Oil charge and oil level

The oil charge must be checked before commissioning (1/4 to 3/4 of the oil sight glass). Check the oil level again after a minimum of 2 hours operation at nominal conditions. 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. Normally the quantity of oil added should be no more than 2% of the total refrigerant charge (this percentage does not take into account oil contained in accessories such as oil separators or oil traps). If this amount has already been added and the oil level in the compressor keeps decreasing, the oil return in the installation is insufficient. Refer also to section "Piping design".

In installations where slow oil return is likely such as in multiple

evaporator or multiple condenser installations, an oil separator is recommended.

Refer to the table on page 28 to select the correct oil.

### Suction gas superheat

The optimum suction gas superheat is 8 K.

A lower superheat value will contribute to better system performance (higher mass flow and more efficient use of evaporator surface). Low superheat values however increase the risk of unwanted liquid floodback to the compressor.

For very low superheat values an electronically controlled expansion valve is recommended.

The maximum allowable superheat is about 30K.

Higher values can be accepted but in these cases, tests have to be performed to check that the maximum discharge temperature of 130°C will not be exceeded. Note that high superheat values decrease the compressor application envelope and system performance.

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