ENGINEERING
TOMORROW

Application guidelines

Maneurop® reciprocating compressors **NTZ**

50 - 60 Hz
Group 2: R404A, R507A, R452A
Group 1: R454C, R455A



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Danfoss reciprocating compressors are designed and manufactured with state of the art technology and follow European and US regulations. There is an added emphasis placed on safety and reliability. Critical instructions are highlighted with the following icons:

 This icon indicates instructions to avoid safety risk.

 This icon indicates instructions to avoid reliability risk.

The purpose of this guideline is informational, with the intent to educate customers as to how the compressors should properly function.
If you need any additional assistance, please contact Danfoss Technichal Support. In any case, Danfoss manufacturing accepts no liability as a result of misuse or improper integration of the compressor unit.

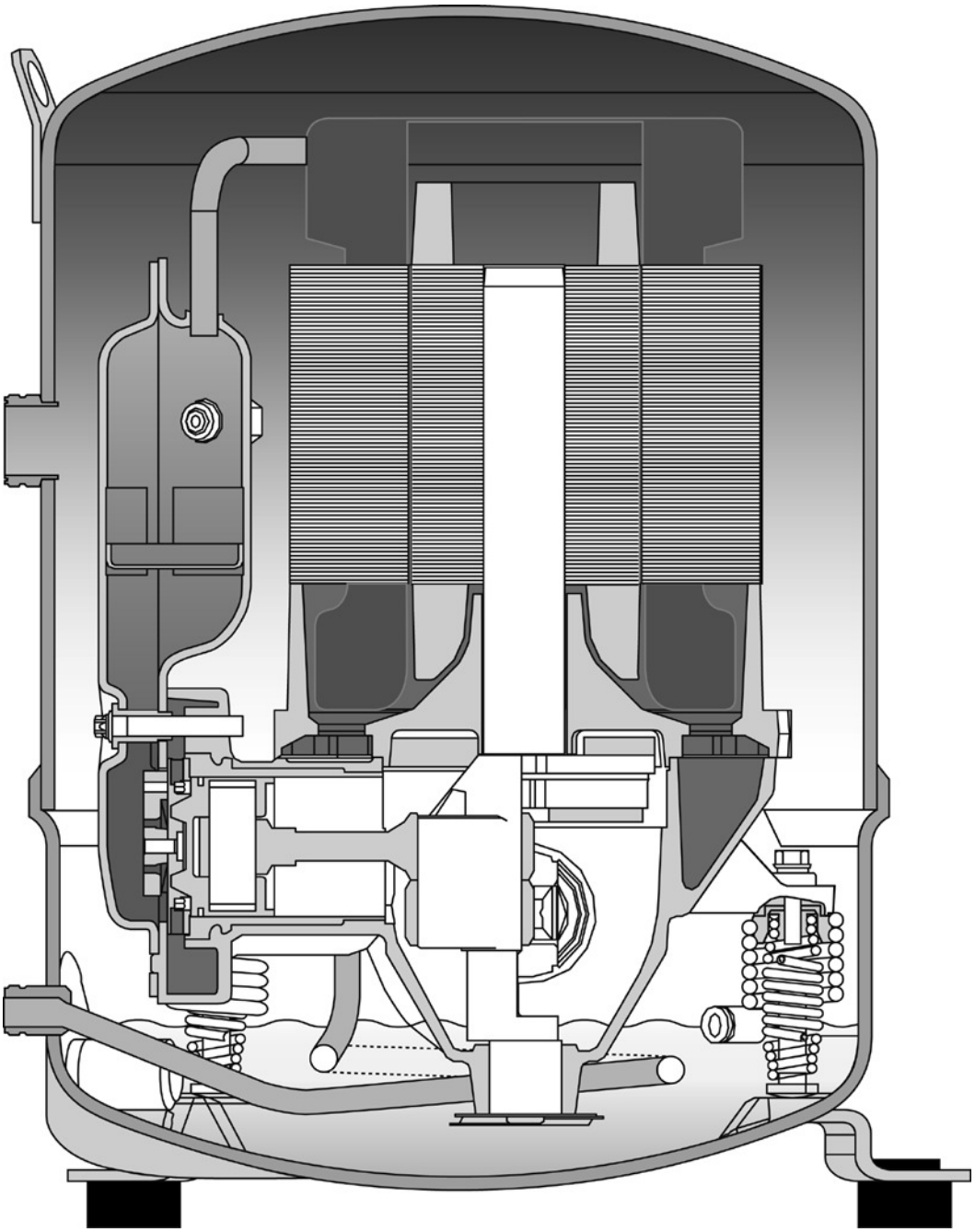
Features

The Maneurop® NTZ series from Danfoss Commercial Compressors is a range of hermetic reciprocating compressors for low evaporating temperature applications. These compressors replace the former LTZ range.

The NTZ series is engineered as a true low temperature compressor, optimised with R404A at -35°C with an extended evaporating temperature range from -45°C up to -10°C. The compressors can be operated at a return gas temperature (suction gas temperature) of 20°C even at low evaporating temperatures.

A liquid injection system is not required. All components are of high quality and precision to assure a long product life.

NTZ compressors have a large internal free volume that helps to reduce the risk of liquid hammering. The electrical motor is fully suction gas cooled which means that no additional body cooling is required and it allows the compressor to be insulated with an acoustic hood when the installation requirements call for extra low sound characteristics.



Technical specifications and nominal ratings

Compressor model	Swept volume cm3/rev	Displacement		Nominal ratings*				Number of cylinders	Oil charge litre	Net weight kg
		50 Hz 2900 rpm m3/hr	60 Hz 3500 rpm m³/hr	50 Hz		60 Hz				
				Cooling capacity W	COP W/W	Cooling capacity W	COP W/W			
NTZ048	48	8.4	10.1	995	1.15	1190	1.13	1	0.95	21
NTZ068	68	11.8	14.3	1749	1.15	2065	1.15	1	0.95	23
NTZ096	96	16.7	20.2	2002	1.15	2395	1.16	2	1.8	35
NTZ108	108	18.7	22.6	2465	1.16	2788	1.10	2	1.8	35
NTZ136	136	23.6	28.5	3225	1.11	3739	1.12	2	1.8	35
NTZ215	215	37.5	45.2	4948	1.19	5886	1.19	4	3.9	62
NTZ271	271	47.3	57.0	6955	1.24	8058	1.21	4	3.9	64

(*) Motor code 4 operating conditions: R404A, Evap. temp.: -35°C, Cond. temp.: 40°C, RGT: 20°C, SC: 0K
For full NTZ data details and capacity tables refer to selection software **Coolselector®2**

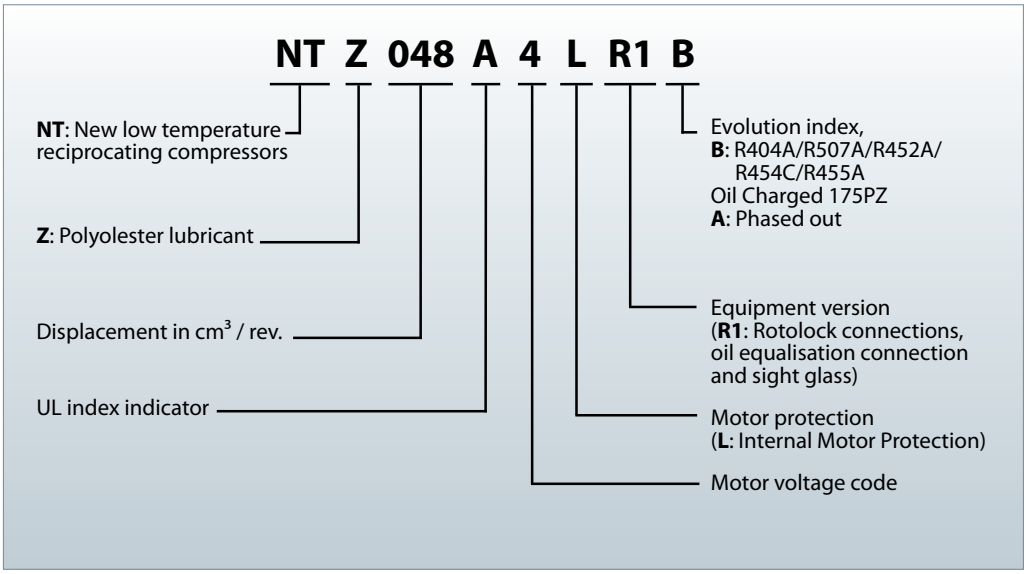
Versions

Available equipment version:

- R1: Rotolock suction and discharge connections, 3/8" flare oil equalisation connection, threaded sight glass.

Compressor reference

(indicated on the compressor nameplate)



Nominal performance data for R404A

R404A	Refrigeration							
Compressor model	50 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, SH = 10K				50 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, RGT = 20°C			
	Cooling capacity W	Power input kW	Current input A	COP W/W	Cooling capacity W	Power input kW	Current input A	COP W/W
NTZ048-4	860	0.87	2.08	0.99	990	0.87	2.08	1.15
NTZ068-4	1510	1.52	3.42	1.00	1750	1.52	3.42	1.15
NTZ096-4	1730	1.73	3.29	1.00	2000	1.73	3.29	1.15
NTZ108-4	2130	2.08	4.53	1.02	2470	2.08	4.53	1.19
NTZ136-4	2790	2.90	6.10	0.96	3230	2.90	6.1	1.11
NTZ215-4	4280	4.15	7.52	1.03	4950	4.15	7.52	1.19
NTZ271-4	6010	5.62	9.65	1.07	6960	5.62	9.65	1.24

R404A	Refrigeration							
Compressor model	60 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, SH = 10K				60 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, RGT = 20°C			
	Cooling capacity W	Power input kW	Current input A	COP W/W	Cooling capacity W	Power input kW	Current input A	COP W/W
NTZ048-4	1030	1.06	1.99	0.97	1190	1.06	1.99	1.13
NTZ068-4	1790	1.79	3.42	1.00	2070	1.79	3.42	1.15
NTZ096-4	2070	2.06	3.30	1.00	2390	2.06	3.30	1.16
NTZ108-4	2410	2.53	4.50	0.95	2790	2.53	4.50	1.10
NTZ136-4	3230	3.35	5.67	0.96	3740	3.35	5.67	1.12
NTZ215-4	5050	4.90	7.52	1.03	5840	4.90	7.52	1.19
NTZ271-4	7090	6.64	9.65	1.07	8210	6.64	9.65	1.24

Note: R404A data is also valid for refrigerant R507A.

Nominal performance data for R452A

R452A	Refrigeration							
Compressor model	50 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, SH = 10K				50 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, RGT = 20°C			
	Cooling capacity W	Power input kW	Current input A	COP W/W	Cooling capacity W	Power input kW	Current input A	COP W/W
NTZ048-4	850	0.79	1.85	1.08	960	0.79	1.85	1.22
NTZ068-4	1490	1.28	3.31	1.16	1680	1.28	3.31	1.31
NTZ096-4	1820	1.65	3.25	1.10	2060	1.65	3.25	1.25
NTZ108-4	2090	1.98	4.32	1.06	2370	1.98	4.32	1.20
NTZ136-4	2950	2.78	6.11	1.06	3350	2.78	6.11	1.21
NTZ215-4	4210	3.98	7.30	1.06	4780	3.98	7.30	1.20
NTZ271-4	5580	5.00	8.94	1.12	6330	5.00	8.94	1.27

R452A	Refrigeration							
Compressor model	60 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, SH = 10K				60 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, RGT = 20°C			
	Cooling capacity W	Power input kW	Current input A	COP W/W	Cooling capacity W	Power input kW	Current input A	COP W/W
NTZ048-4	1100	1.04	1.96	1.06	1250	1.04	1.96	1.20
NTZ068-4	1700	1.51	3.16	1.13	1930	1.51	3.16	1.28
NTZ096-4	2230	2.05	3.43	1.09	2530	2.05	3.43	1.24
NTZ108-4	2820	2.50	4.64	1.13	3190	2.50	4.64	1.28
NTZ136-4	3560	3.33	6.13	1.07	4030	3.33	6.13	1.21
NTZ215-4	5330	4.96	7.72	1.07	6050	4.96	7.72	1.22
NTZ271-4	7050	6.47	9.85	1.09	8000	6.47	9.85	1.24

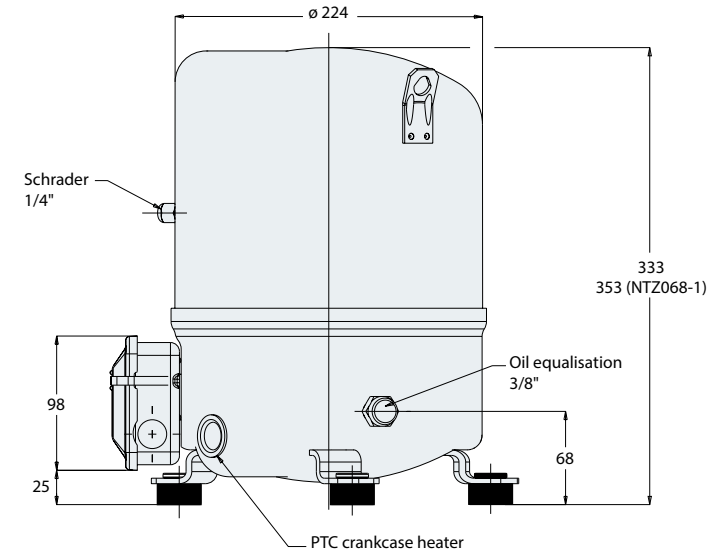
Nominal performance data for R454C

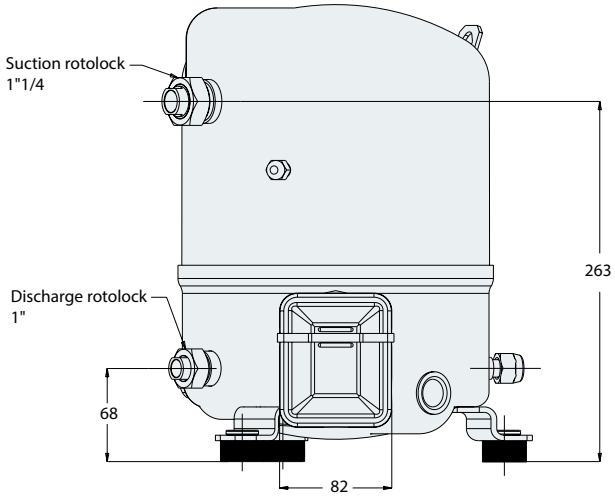
Compressor model	50 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, SH = 10K				60 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, SH = 10K			
	Cooling capacity W	Power input kW	Current input A	COP W/W	Cooling capacity W	Power input kW	Current input A	COP W/W
NTZ048-4	604	0.67	1.81	0.9	680	0.83	1.71	0.82
NTZ068-4	1033	1.16	3.41	0.89	1177	1.25	3.11	0.94

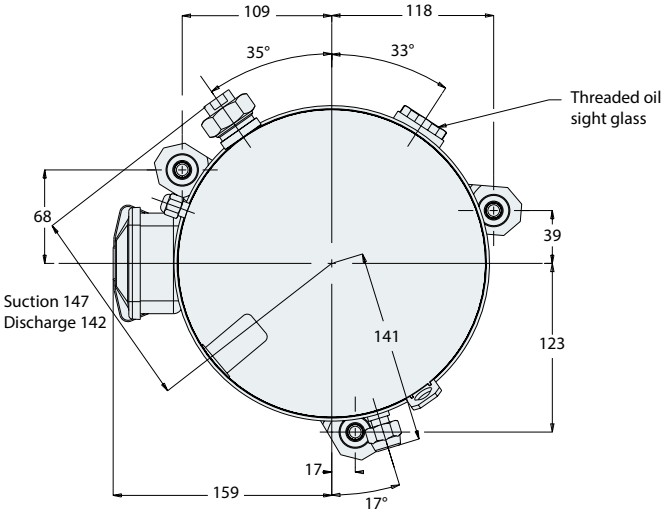
Nominal performance data for R455A

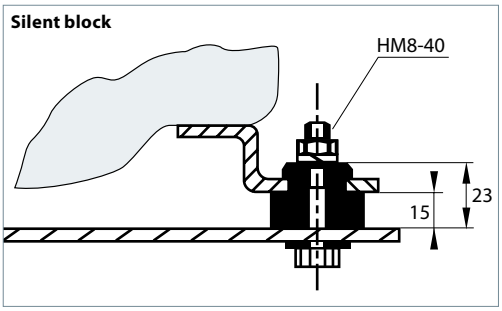
Compressor model	50 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, SH = 10K				60 Hz, EN12900 ratings To = -35°C, Tc = 40°C, SC = 0K, SH = 10K			
	Cooling capacity W	Power input kW	Current input A	COP W/W	Cooling capacity W	Power input kW	Current input A	COP W/W
NTZ048-4	677	0.72	1.88	0.95	807	0.94	1.86	0.86
NTZ068-4	1282	1.28	3.5	1.0	1438	1.35	3.28	1.07

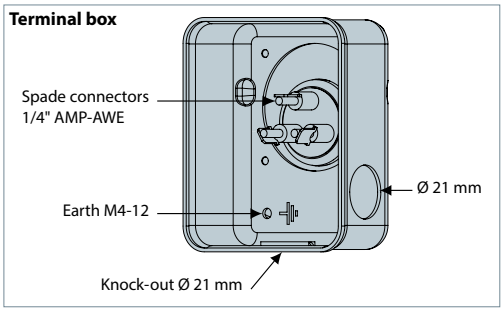
1 cylinder







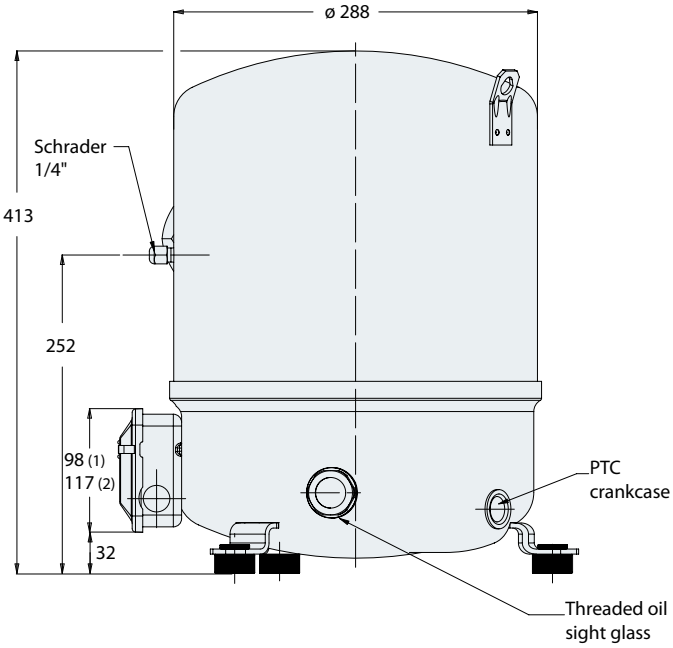


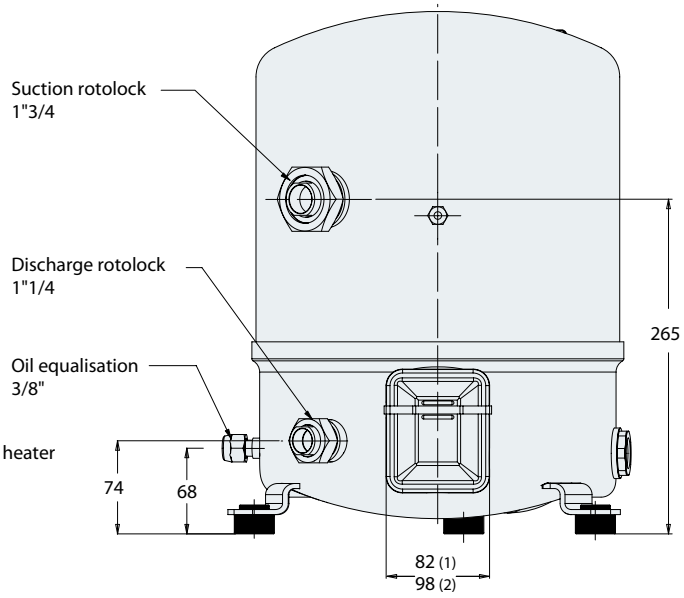


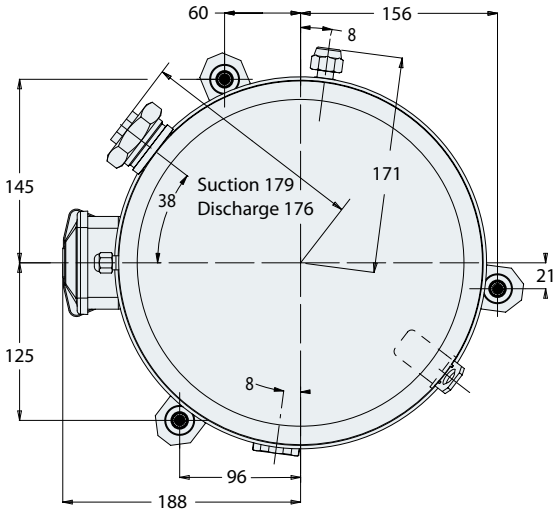
IP rating: 55 (with cable gland)

	Rotolock connections size		Pipe sizing		Rotolock valve	
	Suction	Discharge	Suction	Discharge	Suction	Discharge
NTZ048 NTZ068	1"1/4	1"	5/8"	1/2"	V09	V06

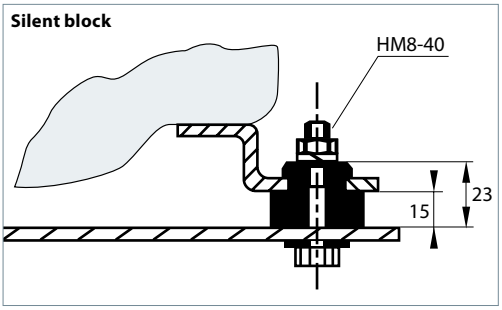
2 cylinders

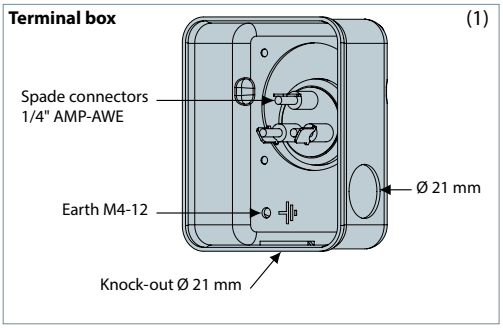




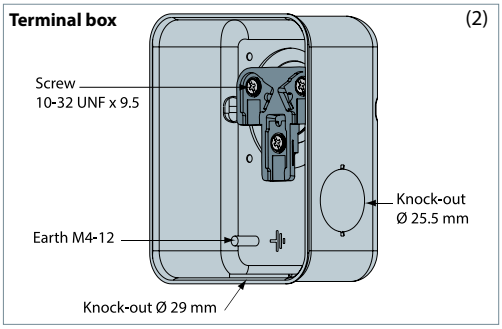


(1) NTZ096 - 108
(2) NTZ136-1





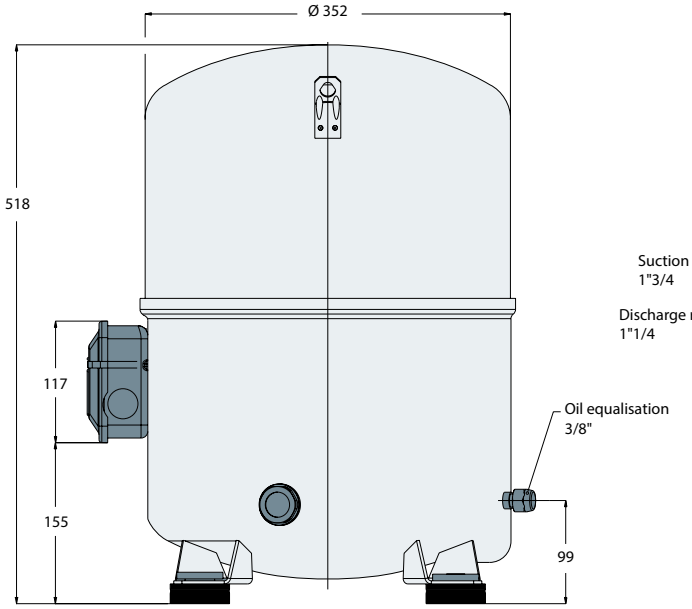
IP rating: 55 (with cable gland)

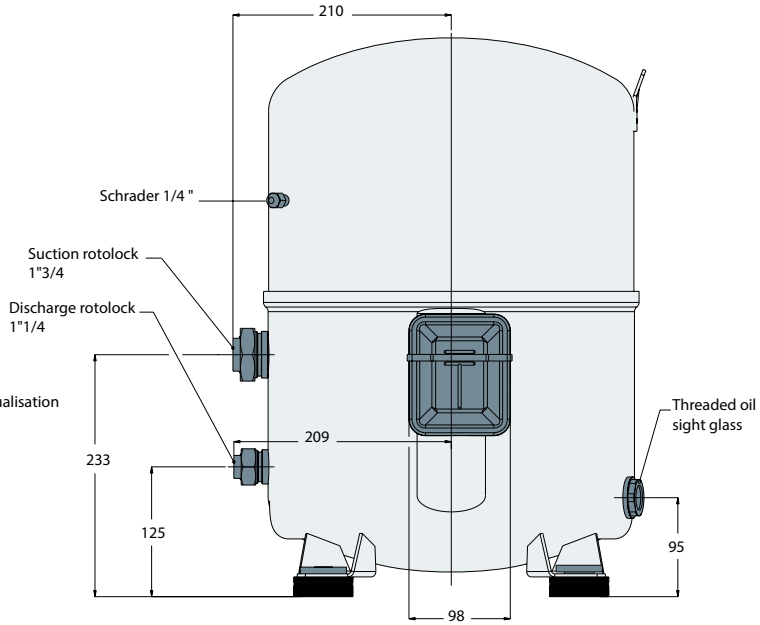


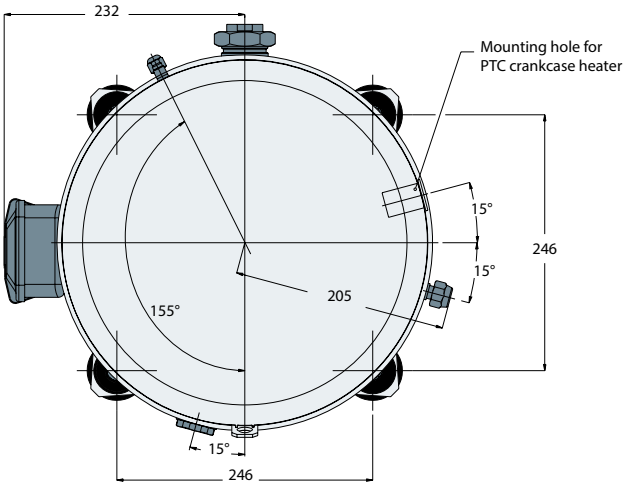
IP rating: 54 (with cable gland)

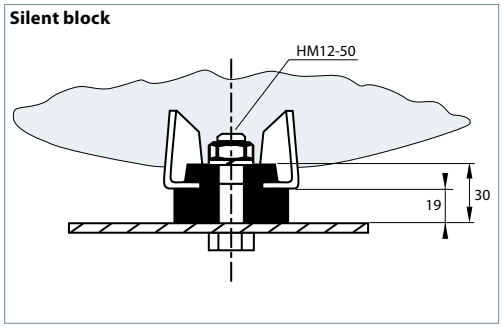
	Rotolock connections size		Pipe sizing		Rotolock valve	
	Suction	Discharge	Suction	Discharge	Suction	Discharge
NTZ096 - NTZ108	1"3/4	1"1/4	7/8"	3/4"	V07	V04
NTZ136	1"3/4	1"1/4	1"1/8	3/4"	V02	V04

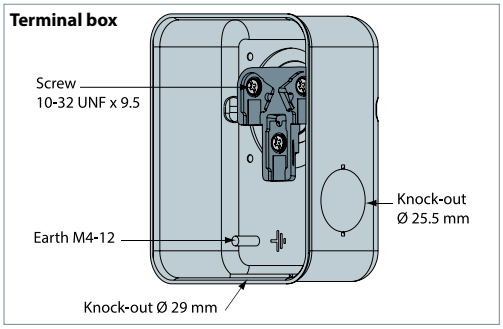
4 cylinders











IP rating: 54 (with cable gland)

	Rotolock connections size		Pipe sizing		Rotolock valve	
	Suction	Discharge	Suction	Discharge	Suction	Discharge
NTZ215 - NTZ271	1"3/4	1"1/4	1"1/8	3/4"	V02	V04

Voltage application range

Motor voltage code	Nominal voltage	Voltage application range
1	208-230V/1/60Hz	187–253V
3	200-230V/3/60Hz	180–253V
4	380-400V/3/50Hz 460V/3/60Hz	340–440V (50Hz) 414–506V (60Hz)
5	220-240V/1/50Hz	198–264V
9	380V/3/60Hz*	342–418V

* Some models are approved for 380-400V/60Hz. Please check data sheet.

Single phase electrical characteristics

	LRA - Locked Rotor Current (A)		MCC - Maximum Continuous Current (A)		Winding resistance (Ω) (± 7 % at 20° C)			
Motor Code	1	5	1	5	1		5	
Winding					run	start	run	start
NTZ048	52	37	13.7	11	1.32	4.16	1.62	3.95
NTZ068	76	53	21	17	0.94	2.01	1.05	3.19
NTZ096	112		31		0.45	1.84		
NTZ108	97		33		0.45	1.84		
NTZ136	140		41		0.36	1.73		

Nominal capacitor values and relays

	Models	PSC/CSR*		CSR only	
		Run capacitors [1]		Start capacitors [2]	Start relay
		(A) µF	(C) µF	(B) µF	
50 Hz	NTZ048	20	10	100	
	NTZ068	20	10	100	
60 Hz	NTZ048	15	10	100	
	NTZ068	25	25	135	RVA6AMKL
	NTZ096	30	15	135	
	NTZ108	30	15	135	
	NTZ136	30	15	135	

* **PSC**: Permanent Split Capacitor, **CSR**: Capacitor Start Run
[1] Run capacitors: 440 volts
[2] Start capacitors: 330 Volts

Single phase motor protection and suggested wiring diagram

Single phase compressor motors are internally protected by a temperature / current-sensing bimetallic protector which senses the main and start winding current as well as motor winding temperature. If the motor were to be overloaded and the protector trips, it might take up to several hours to reset and restart the compressor.

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 in section “Electrical connections and wiring”).

For the larger single phase compressor models larger than NTZ048-068, the use of the PTC crankcase heater is recommended.

PSC wiring

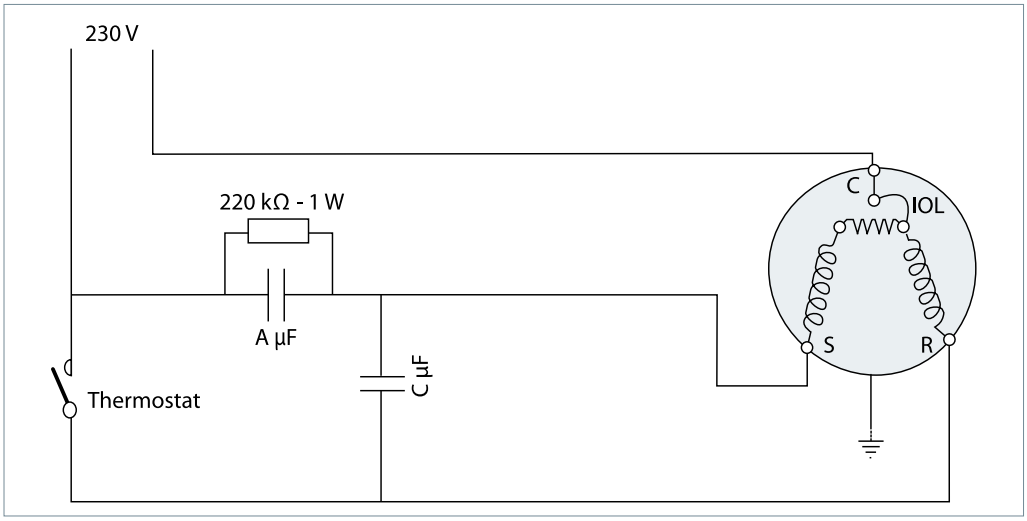
PSC wiring may be used for refrigerant circuits with capillary tubes or expansion valves with bleed ports. Pressure equalisation must be ensured before start-up because of the low starting torque characteristics of this system.

CSR wiring

CSR wiring 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.

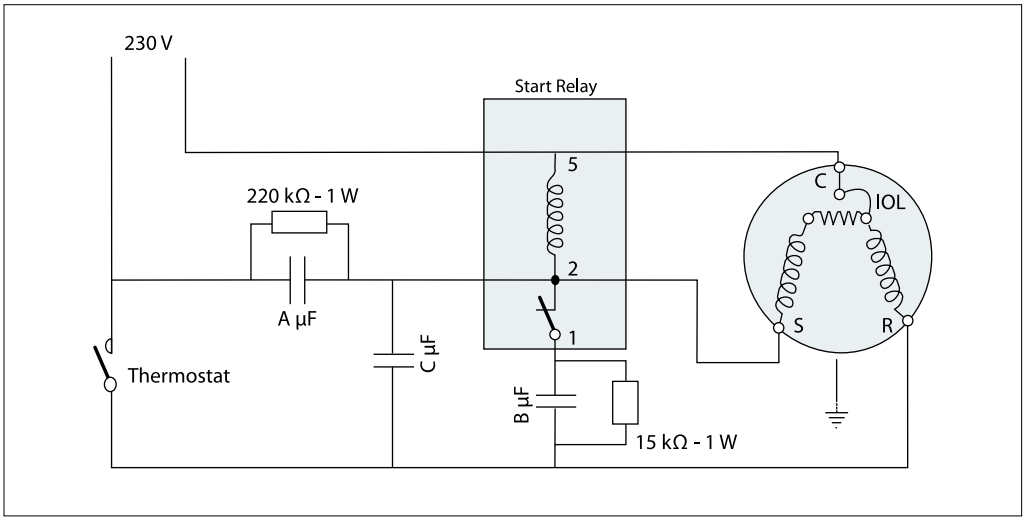
Some applications with high differential pressure can require a very high starting torque. For such cases the CSR starting kit can be converted to a very high starting torque kit by an additional start capcitor of 100 µF parallel to the start capacitor of the CSR kit. This configuration can also be used to reduce erratic starting at unfavourable conditions such as very low ambient temperature or weak voltage.

Single phase PSC wiring with trickle circuit



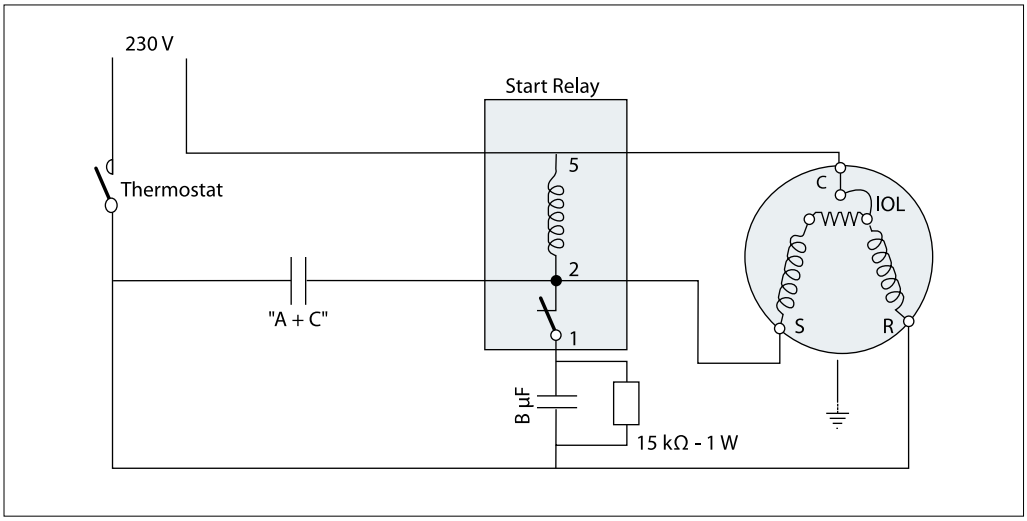
IOL	Motor protector
A & C	Run capacitors
C	Common
S	Start winding (auxiliary)
R	Run winding (main)

Single phase CSR wiring with trickle circuit



IOL	Motor protector
A & C	Run capacitors
B	Start capacitor
C	Common
S	Start winding (auxiliary)
R	Run winding (main)

Single phase CSR wiring without trickle circuit



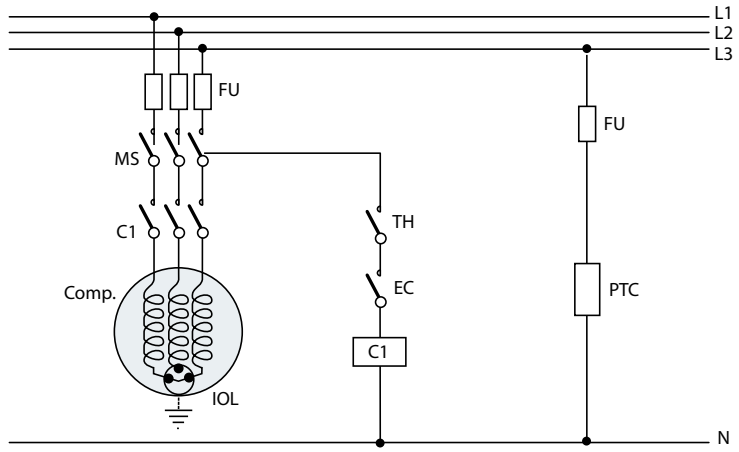
IOL	Motor protector
A + C	Run capacitors
B	Start capacitor
C	Common
S	Start winding (auxiliary)
R	Run winding (main)

Capacitors A and C can be replaced by a single capacitor of size A + C

Three phase electrical characteristics

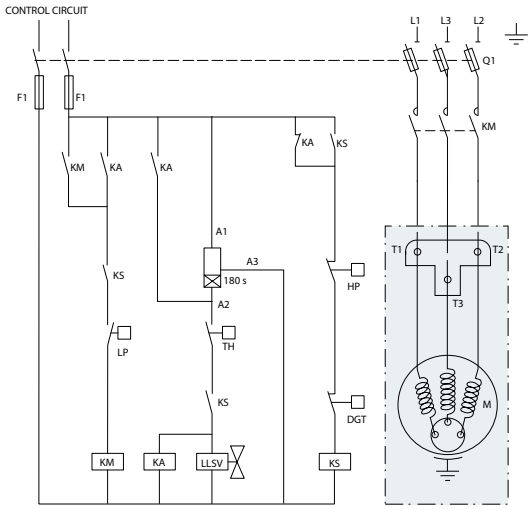
Compressor model	LRA (Locked Rotor Amp) A			MCC (Maximum Continuous Current) A			Winding resistance (between phases +/- 7% at 25°C) Ohm		
	3	4	9	3	4	9	3	4	9
NTZ048	32	16	22	10.1	4.8	5	2.80	11.55	7.3
NTZ068	48.5	25	29	14.8	8.4	8.5	1.58	6.67	9.70
NTZ096	72	32		20.4	10.1		1.20	5.03	
NTZ108	72	45	57	21.4	12.1	11	1.20	4.00	2.54
NTZ136	97.2	51	64	29	14.3	15	0.98	3.80	2.54
NTZ215	147.7	74	110	42.3	22.3	23	0.57	2.23	1.26
NTZ271	198	96	150	56.5	27.0	30	0.41	1.61	0.84

Three phase motor protection and suggested wiring diagram



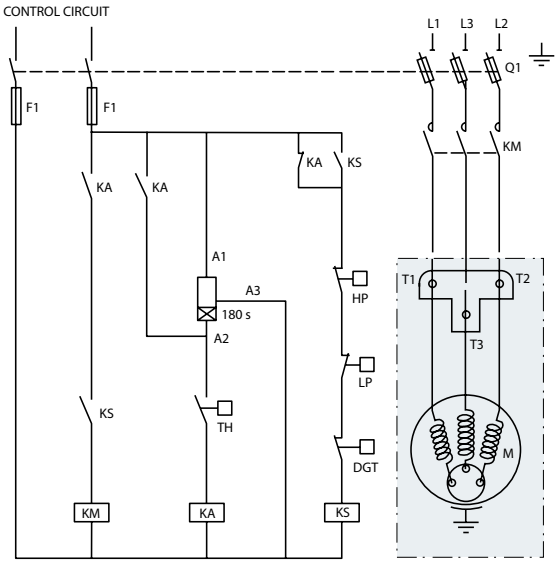
FU	Fuses
MS	Main switch
C1	Compressor contactor
TH	Thermostat
EC	External controls
COMP	Compressor
PTC	Crankcase heater
IOL	Internal overload line break

Wiring diagram with pump-down cycle



Control device	TH
Optional short cycle timer (3 min)	180 s
Control relay	KA
Liquid Solenoid valve	LLSV
Compressor contactor	KM
Safety lock out relay	KS
Pump-down control & L.P. switch	BP
H.P. switch	HP
Fused disconnect	Q1
Fuses	F1
Compressor motor	M
Discharge gas thermostat	DGT

Wiring diagram without pump-down cycle



Control device	TH
Optional short cycle timer (3 min)	180 s
Control relay	KA
Compressor contactor	KM
Safety lock out relay	KS
H.P. switch	HP
Fused disconnect	Q1
Fuses	F1
Compressor motor	M
Discharge gas thermostat	DGT

IP rating

The compressor terminal boxes IP rating according to CEI 529 are:

IP55 for NTZ048-136 except NTZ136-1
IP54 for NTZ136-1 & NTZ215-271

The IP ratings are only valid when correctly sized cable glands of the same IP rating are applied.

IP 5 5

First numeral, level of protection against contact and foreign objects
5 Complete protection against contact and against harmful dust deposits

Second numeral, level of protection against water
4 Protection against water splashing from any direction
5 Protection against jets of water from any direction

Motor protection

Internal motor protection

Three phase compressors are internally protected by a temperature / current-sensing bimetallic protector, connected to the neutral point of the star-connected stator windings. This internal overload line break protects the motor against overheating, current overload and locked rotor conditions. If the motor were to be overloaded and the protector trips, all 3-phases are cut out. It might take up to several hours to reset and restart the compressor.

Voltage unbalance

Operating voltage limits are shown in section "Voltage application range". The voltage applied to motor terminals must lie within these limits during both start-up and normal operation. The maximum allowable voltage unbalance is 2%. Voltage unbalance causes high amperage on one or more phases, which in turn leads to overheating and possible motor damage.

The voltage unbalance is given by the following formula:

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

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

Soft starters

Soft starters are designed to reduce the starting current of 3-phase AC motors

Soft starters can be used with NTZ compressor but, in order to ensure proper lubrication of compressor parts, the settings must ensure that the compressor start-up time is always less than 0.5 seconds.

In case of use with R454C or R455A make sure that the softstarter selected is compatible with A2L refrigerants.

The number of starts should be limited to 6 per hour. HP/LP pressure equalization is required before starting.

Approvals and certificates

Maneurop® NTZ compressors comply with the following approvals and certificates.

Other certificates/approvals please contact Danfoss.

CE (European Directive)	CE	All models
UL (Underwriters Laboratories)	c UL us	All models (Except NTZ108/136/215/271 code9)
CCC (China Compulsory Product Certification)	CCC	Models with motor voltage code 4&5. NTZ271-4 is out of CCC scope
EAC Eurasian conformity mark	EAC	Models with motor voltage code 4&5

Pressure equipment directive 2014/68/EU

Products	NTZ 048 to 068	NTZ 048 to 068	NTZ 096 to 271
Refrigerating fluids	Group 2	Group 1	Group 2
Category PED*	I	II	II
Evaluation module	out of the scope	D1	D1
Maximum / Minimum allowable temperature - TS	50°C > Ts > -35°C	50°C > Ts > -35°C	50°C > Ts > -35°C
Maximum allowable pressure - PS	22.6 bar	22.6 bar	22.6 bar

* According to the PED classification Group1 contains hazardous fluids e.g. flammable, while Group 2 all other fluids

Low voltage directive 2014/35/EU

Products	NTZ 048 to 271
Declaration of conformity	Contact Danfoss

Machinery directive 2014/30/EU

Products	NTZ 048 to 271
Manufacturer's declaration of incorporation	Contact Danfoss

Internal free volume

Products	Internal free volume without oil (litre)		
	Low pressure side	High pressure side	Total
NTZ048-068	7.5	0.3	7.8
NTZ096-108-136	16.5	0.6	17.1
NTZ215-271	31	1.2	32.2

Refrigerants and lubricants

R Maneurop® NTZ compressors are designed and optimised for refrigerants R404A / R507A / R452A / R454C.

The use of hydrocarbons is not authorised in NTZ compressors.
Only approved refrigerants and lubricants as listed in below table may be used.

Model	Refrigerant	Type [1]	GWP[2]	Temp.glide[3] (K)	Lubricant
NTZ	R404A	HFC	3922	0.7/0.3	175PZ POE charged
	R507A	HFC	3985	0/0	
	R452A	HFC+HFO	2141	3.9/3.7	
	R454C [4]	HFO	146	6	
	R455A [4]	HFO	145	12	

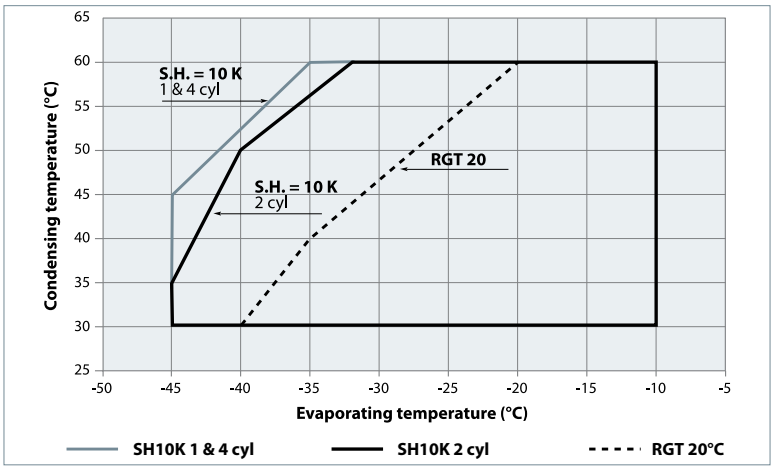
[1]Type: HFC: Hydrofluorcarbon (no chlorine component, "long-term" zero-ODP alternative)
[2]GWP: Global Warning Potential
[3] Temperature glide: difference between saturated vapor temperature and saturated liquid temperature at constant pressure
[4] Only 1 cylinder compressor with voltage code 4 and 5

Operating envelope

R The operating envelopes for NTZ compressors are given in the figures below and guarantees reliable operations of the compressor for steady-state operation.

R404A / R507A

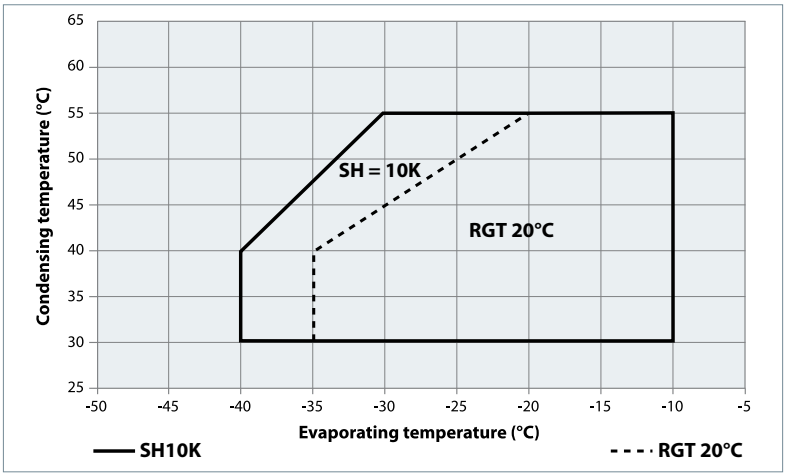
Because of their thermodynamic properties, R404A and R507A are especially suitable for low and medium temperature applications. Danfoss recommends the use of these refrigerants with NTZ compressors. Note that R404A has a small temperature glide. It must therefore be charged in the liquid phase. For most other aspects however, this small glide may be neglected. R507A is an azeotropic mixture without temperature glide.



R452A

Because of its thermodynamic properties R452A is suitable for low temperature applications.

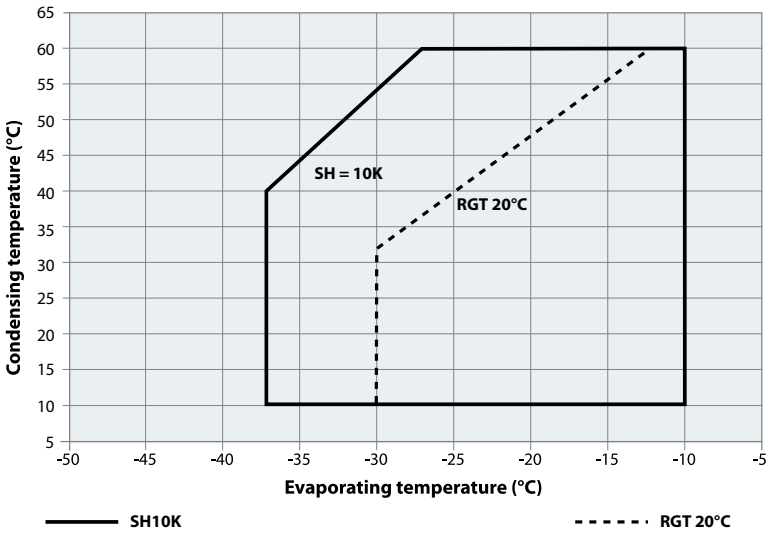
R452A has a medium glide of 4K and must therefore to be charged in the liquid phase.



R454C

R454C is a HFO Blend, with similar thermodynamic properties to R404A. R454C is a zeotropic refrigerant with a temperature glide of about 6K and must therefore be charged in liquid phase.

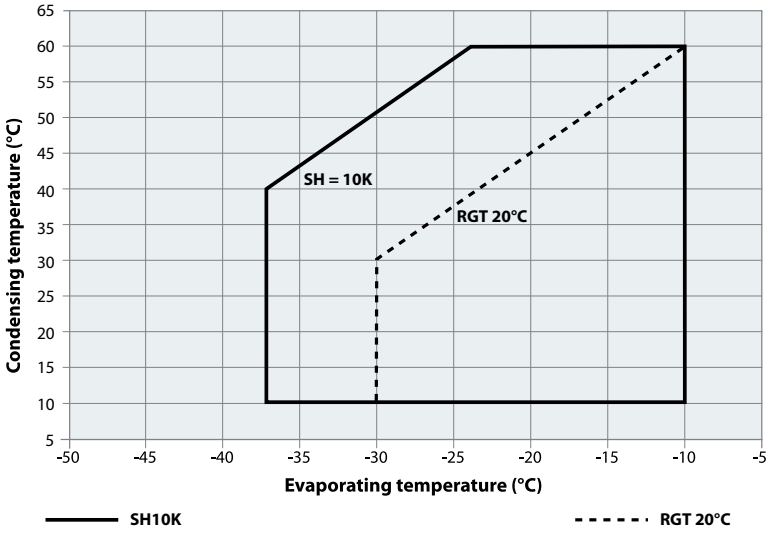
R454C is classified A2L with low flammability properties. Please refer to European regulation and directives about the use of refrigerant of the A2L safety group (EN378, EN60335). Outside Europe refer to the local regulation



R455A

R454C is a HFO Blend, with similar thermodynamic properties to R404A. R455A is a zeotropic refrigerant with a temperature glide of about 12K and must therefore be charged in liquid phase.

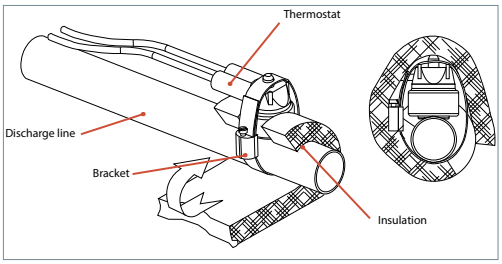
R455A is classified A2L with low flammability properties. Please refer to European regulation and directives about the use of refrigerant of the A2L safety group (EN378, EN60335). Outside Europe refer to the local regulation.



Discharge temperature protection

R Even when the motor windings are protected against overheating by the internal motor protection, the compressor discharge gas temperature could exceed the maximum allowed value of 135°C when the compressor is operated outside its application envelope. The most effective protection against too high discharge gas temperature is to mount a discharge gas thermostat. An accessory kit is available from Danfoss which includes the thermostat, mounting bracket and insulation.

The thermostat must be attached to the discharge line as indicated below at no more than 150 mm from the discharge connection.



Operating limits

High pressure

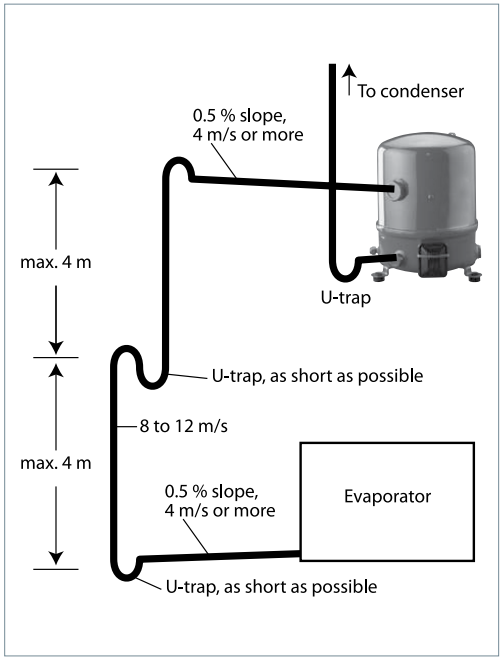
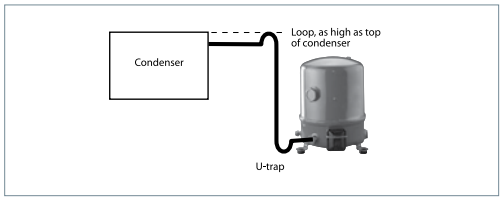
A high-pressure (HP) safety switch is required to shut down the compressor should the discharge pressure exceed the values shown in the table below. This switch can be set at lower values depending on the application and ambient conditions. It must be either located in a lockout circuit or associated with a manual reset device to prevent cycling around the high pressure limit.

If a discharge valve is used, the HP switch must be connected to the service valve gauge port, which cannot be isolated.

Low pressure

R A low-pressure (LP) safety switch must also be used; deep vacuum operations will result in failure. The minimum LP safety switch (loss of charge switch) setting is 0 relative bar (0 bar g). For systems without pump-down feature, the LP safety switch must be either a manual lockout device or an automatic LP safety switch wired into an electrical lockout circuit. LP switch tolerance must not allow for vacuum operation of the compressor. LP safety switch settings for pump-down cycles with automatic reset are listed in the following table.

		R404A / R507A	R452A	R454C	R455A
Working pressure range, high side	(bar gauge)	13.2 – 27.7	12.5 – 24.2	5.2 – 22.3	5.6 – 24.3
Working pressure range, low side	(bar gauge)	0.05 – 3.3	0.18 – 3	0.05 – 2.2	0.12 – 2.4
Minimum low pressure safety switch setting	(bar gauge)	0	0.13	0	0
Minimum low pressure pump-down switch setting	(bar gauge)	0.21	0.35	0.21	0.21
Relief valve opening pressure difference (2 and 4 cyl)	(bar)	30	30	30	30
Relief valve closing pressure difference	(bar)	8	8	8	8

	Maneurop® NTZ compressors have been designed and qualified for stationary equipment using standard alternating power supply.	Danfoss does not warrant the compressors for use on mobile applications such as trucks, railways, subways, ships etc.
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. Therefore, the system piping shall be designed in a way which allows a good oil circulation, avoiding oil being trapped in the system and ensuring a constant oil 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.	Lubricant getting trapped in the evaporator or suction lines will affect system performance and will ultimately lead to compressor lubrication failures. Where a poor oil return situation exists, adding lubricant will not help safeguard the compressor. Only a correct piping design can ensure adequate oil circulation maintaining safe oil level in the compressor.
Suction line	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). Gas velocities higher than 12 m/s will not contribute to significantly better oil return. However they will cause higher noise levels and result in higher suction line pressure drops which will have a negative effect on the system capacity. Note that the suction rotolock valves, which can be ordered from Danfoss 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 average sizes.	The suction line must always be insulated to limit suction gas superheat. 
Discharge line	When the condenser is mounted above the compressor, a loop above the condenser and a U-trap close to the compressor are required to prevent liquid draining from the condenser into the discharge line during standstill.	

Application Guidelines	System design recommendations	
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 section "Oil charge and oil level".
Filter driers	For new installations with NTZ compressors Danfoss recommends using the Danfoss DML 100% molecular sieve, solid core filter drier. Molecular sieve filter driers with loose beads from third party suppliers shall be avoided. For servicing of existing installations where acid formation is present the Danfoss DCL solid core	filter driers containing activated alumina are recommended. The drier is to be oversized rather than undersized. When selecting a drier, always take into account its capacity (water content capacity), the system refrigerating capacity and the system refrigerant charge.
Suction pressure control	An MOP-type expansion valve or suction pressure regulator (i.e. Danfoss KVL) must be used to limit suction pressure at a maximum of 4 bar relative (-5°C). Do not apply both of these devices in combination with one another.	When compressors are mounted onto a rack for a multi-evaporator system (i.e. supermarket) or when evaporators operate at different temperatures, use pressure regulators (Danfoss KVP) without an MOP expansion valve.
Suction line heat exchanger	A suction line heat exchanger is recommended for low temperature applications, better performance and efficiency are expected.	However in hot location this may cause high suction gas superheat which can result in too high discharge temperature.
Low ambient temperature operation	At low ambient temperatures, the condensing temperature and condensing pressure in air cooled condensors will decrease. This low pressure may be insufficient to supply enough liquid refrigerant to the evaporator. As a result the evaporating temperature will decrease, leading to low capacity and eventual poor oil return. At start-up, the compressor will pull into vacuum and it will be switched off by the low pressure protection. Depending on how the low pressure switch and delay timer are set, short cycling can occur. To avoid these problems, several solutions are possible, based on reducing condenser capacity: In air-cooled machines, cycling the fans with a head pressure controller will ensure that the fans remain off until the condensing pressure has reached a satisfactory level. Variable speed fans can also be used to control the condensing pressure. In water-cooled units, the same can be performed using a water regulator valve that is also operated by head pressure, thereby ensuring that the water valve does not open until the condensing pressure reaches a satisfactory level.	The minimum condensing pressure must be set at the minimum saturated condensing temperature shown in the application envelopes. Under very low ambient conditions, in which testing has revealed that the above procedures might not ensure satisfactory condensing and suction pressures, the use of a head pressure control valve is recommended. Note: This solution requires extra refrigerant charge, which can introduce other problems. A non-return valve in the discharge line is recommended and special care should be taken when designing the discharge line. When the compressor is located in a low ambient temperature environment, increased refrigerant migration will occur during shut down periods. For such conditions an extra 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.

Cycle rate limit

R No more than 12 starts per hour (6 when a soft start accessory is used) are allowed. A higher number would reduce the service life of the motor-compressor unit. If necessary, use an anti-short-cycle timer within the control circuit.

The system must be designed in a way that guarantees minimum compressor running time so as to provide sufficient motor cooling after start-up as well as proper oil return from the system to the compressor.
A 5-minute delay between two successive compressor starts is being proposed herein, with a 2-minute runtime after each start and a 3-minute idle time between each stop and start.

Only during the pump-down cycle may the compressor run for much shorter intervals.

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® NTZ 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 will dilute the oil, wash out the bearings causing wear and eventually seizure.

Furthermore, high oil carry over will cause lack of oil in 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.

R Liquid refrigerant can enter a compressor in various ways, with different effects on the compressor as described in the following points.

With R454C/R455A, liquid migration to the compressor must be avoided by maintaining adequate superheat setting of min. 8-10K.

Off-cycle migration

During system standstill and after pressure equalisation, refrigerant will condensate in the coldest part of the system which may be the compressor when it is placed in a cold environment. Ultimately, the full system refrigerant charge can condensate in the compressor crankcase. A large amount will dissolve in the compressor oil until the oil is completely saturated with refrigerant. When the compressor is started, the pressure in the crankcase decreases rapidly and refrigerant will violently evaporate, causing the oil to foam (boiling). Both dilution and foaming reduce the lubrication properties of the oil. In extreme situations liquid could enter the compressor cylinders with immediate compressor break-down as a result.

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 frosted-up evaporator coils.

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.

Crankcase heater

R A crankcase heater protects against the off-cycle migration of refrigerant and proves effective if oil temperature is maintained 10 K above the saturated LP temperature of the refrigerant. Tests must thereby be conducted to ensure that the appropriate oil temperature is maintained under all ambient conditions. A PTC crankcase heater is required with all Maneurop®, NTZ compressors. PTC crankcase heaters are self-regulating.

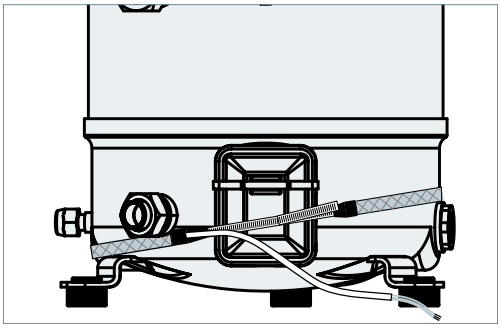
Under extreme conditions such as low ambient temperature at –15°C or lower a belt type crankcase heater could be used in addition to the PTC heater, although this is not a preferred solution for 1 and 2 cylinder compressors. The belt crankcase heater must be positioned on the compressor shell as close as possible to the oil sump to ensure good heat transfer to the oil.

The below illustrated mounting positions are recommended:

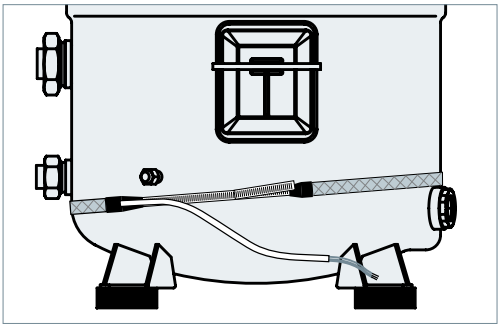
Belt crankcase heaters are not self-regulating. Control must be applied to energise the belt heater once the compressor has been stopped and then to de-energise it while the compressor is running. The belt heater must be energised 12 hours before restarting the compressor following an extended down period.

If the crankcase heater is not able to maintain the oil temperature at 10 K above the saturated LP temperature of the refrigerant during off cycles or if repetitive floodback is present a the Liquid Line Solenoid Valve (LLSV) + pump-down cycle is required, possibly in conjunction with a suction accumulator.

R Crankcase heater or PTC crankcase heater always has to be used when refrigerant R454C/ R455A is used.



Models: NTZ048 - NTZ068 - NTZ096 - NTZ108 - NTZ136



Models: NTZ215 - NTZ271

Liquid line solenoid valve & pump-down

In refrigeration applications, the Liquid Line Solenoid Valve (LLSV) is highly recommended. During the off-cycle, the LLSV isolates the liquid charge in the condensor side, thus preventing refrigerant transfer or excessive migration of refrigerant into the compressor. Furthermore, when using LLSV in conjunction with the pump-down cycle (especially in low-temperature applications), the quantity of refrigerant in the low-pressure side of the system will be reduced.

A pump-down cycle design is required when evaporators are fitted with electric defrost heaters.

Suction accumulator

A suction accumulator offers considerable protection against refrigerant floodback both at start-up and during operation or after the defrost operation. This device also helps protect against off-cycle migration by providing additional internal free volume to the low pressure side of the system.

The suction accumulator must be selected in accordance with the accumulator manufacturer recommendations. As a general rule, Danfoss Commercial Compressors recommends to size the accumulator for at least 50% of the total system charge. Tests however must be conducted to determine the optimal size.

Sound

Compressors in operation are one of the sources of sound and vibration in a refrigeration system. Both phenomena are closely related.

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 an acoustic hood accessory. Because Maneurop® NTZ compressors are 100% suction gas cooled and require no external cooling they can be insulated or enclosed in a sound proofing material lined compartment.

Sound transmitted by mounting feet, pipework and refrigerant should be treated the same way as vibration (see next section).

Compressor model	R404A		R452A		R454C/R455A	
	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz
NTZ048-4	72	75	73	75	68	69
NTZ068-4	69	74	71	74	71	72
NTZ096-4	82	85	80	82	-	-
NTZ108-4	76	80	78	80	-	-
NTZ136-4	77	80	78	80	-	-
NTZ215-4	86	88	83	84	-	-
NTZ271-4	86	88	82	84	-	-

Operating conditions : Evap temp -35°c, Cond temp 40°c, SH10K
Acoustic hood available as accessory can reduce noise level by 6 to 10dBA

Vibration

The mounting grommets delivered with the compressor should always be used. They will largely attenuate the compressor vibration transmitted to the base frame. These rubber grommets have been selected and calculated in accordance with the vibration frequencies that are typical for the compressor. For that reason other grommet types or brands shall not be used.

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 rigidly mounted to the base frame otherwise high vibration transmission would occur and the service life reduced. Suction and discharge lines must have adequate flexibility in 3 planes. Eventually vibration absorbers may be required.

Vibration is also transmitted by the refrigerant gas. Maneurop® NTZ compressors have built-in mufflers to reduce pulsation. To further reduce vibration an extra discharge line muffler can be installed.

System cleanliness

System contamination is one of the main factors that affects equipment reliability and compressor service life. Therefore it is important to take care of the system cleanliness when assembling a refrigeration system. During the manufacturing process, circuit 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_2 through the pipes during brazing to prevent oxidation. If flux is used, take every precaution to prevent the leakage of flux into the piping. The use of flux core or flux coated braze wire or rod instead of brush applied paste flux is strongly recommended. Do not drill holes (e.g. for schrader valves) in parts of the installation that are already completed, when filings and burrs cannot 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 pumps, etc.) dedicated refrigerant.

Compressor handling, mounting and connection

Compressor handling

Maneurop® NTZ compressors must be handled with care and all handling procedures must be performed smoothly and gently. Each NTZ has been fitted with one lift ring which shall always be used to lift the compressor. Once the compressor is installed, the lift ring shall never be used to lift the complete installation.

Always use the proper tools for transporting the compressor. Keep the compressor in an upright position during all handling tasks (manipulating, transport, storage). The angle off the vertical must not exceed 15 degrees.

Compressor mounting

The compressor must be mounted onto a horizontal surface with a maximum slope of 3 degrees. Always use the rubber mounting grommets that are shipped with the compressor. Mounting torques are listed in the below table.

Component	Torque (Nm)	
	Min.	Max.
Rotolock suction valve, NTZ048 - NTZ068	80	100
Rotolock suction valve, NTZ096 - NTZ271	100	120
Rotolock discharge valve, NTZ048 – NTZ068	70	90
Rotolock discharge valve, NTZ096 - NTZ271	80	100
Electrical T-block screws HN°10-32 UNF x 9.5	-	3
Earth screw	-	3
Oil sight glass (with black chloroprene gasket)	40	50
3/8" flare oil equalisation nut	45	50
Schrader nut	11.3	17
Schrader valve (internal)	0.4	0.8
Mounting grommet bolt, NTZ048 – NTZ136	12	18
Mounting grommet bolt, NTZ215 – NTZ271	40	60
Belt crankcase heater	-	4

Compressor connection to the system

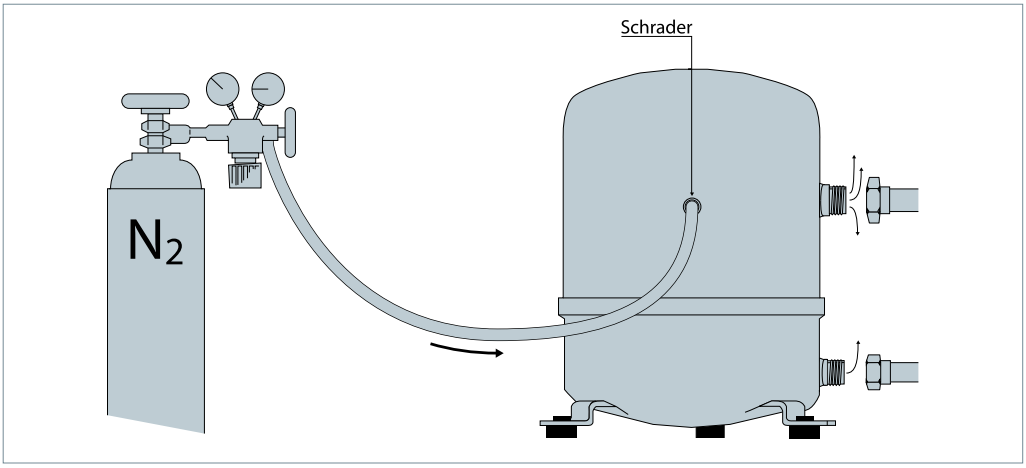
New compressors have a protective nitrogen holding charge.

R Only remove the suction and discharge plugs just before connecting the compressor to the installation, so as to prevent air and moisture from entering the compressor. Remove the discharge plug first and the suction plug next; by proceeding as such, the nitrogen holding charge can escape via the discharge connection and the risk of an oil mist blow-out via the suction connection will be minimal.

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 plugs can be removed and the compressor can be mounted to the system with 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_2 must be purged through the compressor via the schrader valve to prevent air and moisture ingress. Purging must start when the plugs are removed and maintained 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 the "pack" or "rack" as if it were a complete system (see below). the pack must be charged with nitrogen or CO_2 and open tubes must be blocked with caps or plugs.



System pressure test

Always use an inert gas such as nitrogen for the pressure test. Never use other gasses such as oxygen, dry air or acetylene. These gasses may form an inflammable mixture with the compressor oil. Always use the appropriate pressure regulator with gas cylinders. Any attempt to use a high pressure gas supply without a suitable pressure regulator can lead to personal injury or death as well as system damage.

The maximum allowed test pressures for NTZ compressors are:

Maximum compressor test pressure at low pressure side (suction side)	25 bar (g)
Maximum compressor test pressure at high pressure side (discharge side)	30 bar (g)
Maximum test pressure difference between high and low pressure side (to avoid that the internal compressor relief valve will open)	30 bar

Leak detection

Whenever possible the compressor must be kept isolated from the system during leak detection by closing the suction and discharge valves. Use a mixture of nitrogen and the final refrigerant (eg. R404A or R507A) and use a leak detector for the applied refrigerant. A spectrometric detection system using helium can also be applied. Note that leak detection with refrigerant may not be allowed in some countries. Do not use other gasses such as oxygen, dry air or acetylene as these gasses can form an inflammable mixture with the compressor oil. Never use CFC or HCFC refrigerants for leak detection of HFC systems. Leak detecting additives shall not be used as they may affect the lubricant properties. Warranty may be voided if leak detection additives have been used.

Eventual leaks shall be repaired respecting the instructions written above.

Vacuum pump-down and dehydration procedure

Moisture obstructs proper operation of the compressor and the rest of the refrigeration system. Air and moisture reduce service life, increase condensing pressure and cause excessively high discharge temperatures, which are capable of destroying the lubricating properties of the oil. Air and moisture also increase the risk of acid formation, thus giving rise to copper plating. All these phenomena can ultimately induce mechanical and electrical compressor failure. To eliminate these risks, it is recommended to perform the following vacuum pull-down procedure:

1. To the extent possible (i.e. if valves are present), the compressor must be kept isolated from the system.
2. After 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 for the system volume. It is recommended to use connection lines with a large diameter and to connect these lines to the service valves and not to the schrader connection, so as to avoid excessive pressure losses.
3. Once the vacuum level of 500 microns is reached, the system must be isolated from the vacuum pump. Wait 30 minutes during which time the system pressure should not rise. When the pressure rapidly increases, the system is not leak tight. Bring the system pressure up to atmospheric pressure with dry nitrogen or another suitable inert gas in order to reform a new leak detection. After repairing all leaks 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 Steps 2 and 3 should be repeated.
4. Connect the compressor to the system by means of opening the valves. Repeat Steps 2 & 3.
5. Break the vacuum with either nitrogen or the ultimate refrigerant.
6. Repeat Steps 2 and 3 on the total system.

Upon commissioning, the system moisture content may be as high as 100 ppm. During compressor operation, the filter drier must reduce this content to a level of 20 to 50 ppm.

Do not use a megohmmeter or apply power to the compressor while it is under vacuum as this may cause motor winding damage, and never run the compressor under vacuum as this may cause the compressor motor to burnout.

Start-up

Before initial start-up or after a prolonged shut-down period, energise the crankcase heater 12 hours prior to start-up. If the crankcase heater cannot be energised long enough before start-up, the compressor shall be heated in another way (for example with an electric heater or flood light) to boil off refrigerant from the oil. This is particulary important when ambient temperature is low at commissioning.

Refrigerant charging

It is recommended that charging be done to the high side of the system. Charge refrigerant as close as possible to the nominal system charge before starting the compressor. Then slowly add refrigerant on the low pressure side as far away as possible from the compressor suction connection. The refrigerant charge quantity must be suitable for both winter and summer operation. All zeotropic mixtures must be charged in the liquid phase.

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

Oil charge and oil level

The oil charge must be checked before commissioning (1/4 to 3/4 of the oil sight glass). Watch the oil level at start and for the first 15 minutes after start. 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 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. Use Danfoss 175PZ lubrificant for systems with NTZ compressors.

Installation checks

After a few running hours the main system parameters shall be verified to ensure that the system is working correctly or eventually to adjust the settings.

- The evaporating temperature and condensing temperature shall be compared with the design conditions.
- The superheat at the evaporator outlet must be adjusted to optimise the evaporator performance. Generally a value of 10K is recommended.
- The compressor suction temperature gives information about the suction gas superheat at the compressor. NTZ compressors can be operated at a maximum suction gas temperature of 20°C. Note that extremely low superheat values can increase the risk of unwanted liquid floodback to the compressor. When a too high superheat is noted while the expansion valve setting is correct, the suction line insulation between evaporator and compressor should be checked and eventually replaced by a higher quality insulation.
- A too high discharge gas temperature can indicate a malfunctioning condenser, too high suction gas superheat. Measurements through a probe sensor pushed against the discharge tube are not accurate. From 115°C, we recommend to use a thermocouple, brazed and insulated on the discharge tube, 10 cm far from the compressor body. The maximum allowed discharge temperature is 135°C.
- Power and current consumption shall be compared with the table values at measured evaporating and condensing temperature.
- When after commisioning the liquid sight glass indicates moisture, the filter drier must immediately be replaced.

Code numbers (for ordering)

NTZ compressors in single pack*

Compressor model	Motor voltage code				
	1	3	4	5	9
	208-230/1/60	200-230/3/60	460/3/60 400/3/50	230/1/50	380/3/60
NTZ048	120F0293	120F0279	120F0226	120F0228	120F0302
NTZ068	120F0294	120F0280	120F0230	120F0232	120F0303
NTZ096	120F0295	120F0281	120F0234		
NTZ108	120F0296	120F0282	120F0238		120F0304
NTZ136	120F0297	120F0283	120F0236		120F0305
NTZ215		120F0284	120F0240		120F0306
NTZ271		120F0285	120F0242		120F0307

NTZ compressors in industrial pack***

Compressor model	Motor voltage code		
	3	4	5
	200-230/3/60	460/3/60 400/3/50	230/1/50
NTZ048	120F0286	120F0227	120F0229
NTZ068	120F0287	120F0231	120F0233
NTZ096	120F0288	120F0235	
NTZ108	120F0289	120F0239	
NTZ136	120F0290	120F0237	
NTZ215	120F0291	120F0241	
NTZ271	120F0292	120F0243	

Packaging

Compressor model	Single pack*		Multi pack **				Industrial pack***			
	Weight (kg)	Dimensions (mm)	Qty	Weight (kg)	Dimensions (mm)	Static stacking	Qty	Weight (kg)	Dimensions (mm)	Static stacking
NTZ048	23	l: 385 w: 285 h: 370	8	197	l: 1150 w: 800 h: 510		12	278	l: 1150 w: 800 h: 500	
NTZ068	25			213				302		
NTZ096	38	l: 385 w: 375 h: 450	6	238	l: 1150 w: 800 h: 600	4	6	230	l: 1150 w: 800 h: 600	4
NTZ108	38			238				230		
NTZ136	38			238				230		
NTZ215	72	l: 470 w: 400 h: 650	4	299	l: 1150 w: 800 h: 800		6	393	l: 1150 w: 800 h: 710	
NTZ271	73			303				399		

* Single pack: one compressor packed in a cardboard box 4 cyl.: cardboard box on 1/4 euro pallet
** Multi pack: a pallet filled with single-packs
*** Industrial pack: a full pallet of unpacked compressors

Rotolock service valves and valve sets (without gasket)

Type	Code n°	Description	Application	Packaging	Pack size
V01	8168027	Rotolock valve, V01 (1" Rotolock, 3/8" ODF)	Models with 1" rotolock connection	Multipack	6
V06	8168031	Rotolock valve, V06 (1" Rotolock, 1/2" ODF)	Models with 1" rotolock connection	Multipack	6
V04	8168029	Rotolock valve, V04 (1"1/4 Rotolock, 3/4" ODF)	Models with 1"1/4 rotolock connection	Multipack	6
V04	7968006	Rotolock valve, V04 (1"1/4 Rotolock, 3/4" ODF)		Industry pack	42
V05	8168030	Rotolock valve, V05 (1"1/4 Rotolock, 7/8" ODF)	Models with 1"1/4 rotolock connection	Multipack	6
V05	7968007	Rotolock valve, V05 (1"1/4 Rotolock, 7/8" ODF)		Industry pack	36
V09	8168033	Rotolock valve, V09 (1"1/4 Rotolock, 5/8" ODF)	Models with 1"1/4 rotolock connection	Multipack	6
V09	7968005	Rotolock valve, V09 (1"1/4 Rotolock, 5/8" ODF)		Industry pack	50
V02	8168028	Rotolock valve, V02 (1"3/4 Rotolock, 1"1/8 ODF)	Models with 1"3/4 rotolock connection	Multipack	6
V02	7968009	Rotolock valve, V02 (1"3/4 Rotolock, 1"1/8 ODF)		Industry pack	24
V07	8168032	Rotolock valve, V07 (1"3/4 Rotolock, 7/8" ODF)	Models with 1"3/4 rotolock connection	Multipack	6
V07	7968008	Rotolock valve, V07 (1"3/4 Rotolock, 7/8" ODF)		Industry pack	36
V10	8168022	Rotolock valve, V10 (1"3/4 Rotolock, 1-3/8" ODF)	Models with 1"3/4 rotolock connection	Single pack	1
V09, V06	7703005	Valve set, V09 (1"1/4~5/8"), V06 (1"~1/2")	NTZ048-068	Multipack	4
V07, V04	7703006	Valve set, V07 (1"3/4~7/8"), V04 (1"1/4~3/4")	NTZ096-108	Multipack	6
V02, V04	7703009	Valve set, V02 (1"3/4~1"1/8), V04 (1"1/4~3/4")	NTZ136-271	Multipack	6

Rotolock nuts

Type	Code n°	Description	Application	Packaging	Pack size
	8153122	Rotolock nut, 1"	Models with 1" rotolock connection	Multipack	10
	8153123	Rotolock nut, 1"1/4	Models with 1"1/4 rotolock connection	Multipack	10
	8153124	Rotolock nut, 1"3/4	Models with 1"3/4 rotolock connection	Multipack	10

Solder sleeves

Type	Code n°	Description	Application	Packaging	Pack size
P01	8153010	Solder sleeve, P01 (1" Rotolock, 3/8" ODF)	Models with 1" rotolock connection	Multipack	10
P06	8153007	Solder sleeve, P06 (1" Rotolock, 1/2" ODF)	Models with 1" rotolock connection	Multipack	10
P09	8153011	Solder sleeve, P09 (1"1/4 Rotolock, 5/8" ODF)	Models with 1"1/4 rotolock connection	Multipack	10
P04	8153008	Solder sleeve, P04 (1"1/4 Rotolock, 3/4" ODF)	Models with 1"1/4 rotolock connection	Multipack	10
P05	8153012	Rotolock connector, P05 (1"1/4 Rotolock, 7/8" ODS)	Models with 1"1/4 rotolock connection	Multipack	10
P07	8153013	Solder sleeve, P07 (1"3/4 Rotolock, 7/8" ODF)	Models with 1"3/4 rotolock connection	Multipack	10
P02	8153004	Solder sleeve, P02 (1"3/4 Rotolock, 1"1/8 ODF)	Models with 1"3/4 rotolock connection	Multipack	10
P10	8153003	Solder sleeve, P10	Models with 1"3/4 rotolock connection	Multipack	10

Gaskets and gasket set

Type	Code n°	Description	Application	Packaging	Pack size
G01	8156130	Gasket, 1"	Models with 1" rotolock connection	Multipack	10
G01	7956001	Gasket, 1"		Industry pack	50
G09	8156131	Gasket, 1"1/4	Models with 1"1/4 rotolock connection	Multipack	10
G09	7956002	Gasket, 1"1/4		Industry pack	50
G07	8156132	Gasket, 1"3/4	Models with 1"3/4 rotolock connection	Multipack	10
G07	7956003	Gasket, 1"3/4		Industry pack	50
	8156009	Gasket set, 1", 1"1/4, 1"3/4, OSG gaskets black & white	All 1-2-4 cylinder models	Multipack	10

Belt heaters

Type	Code n°	Description	Application	Packaging	Pack size
	7773106	Belt type crankcase heater, 54 W, 230 V, CE mark, UL	NTZ048-068	Multipack	4
	7773013	Belt type crankcase heater, 54 W, 400 V, UL		Multipack	4
	7773109	Belt type crankcase heater, 65 W, 110 V, CE mark, UL	NTZ096-108-136	Multipack	6
	7973001	Belt type crankcase heater, 65 W, 110 V, CE mark, UL		Industry pack	50
	7773107	Belt type crankcase heater, 65 W, 230 V, CE mark, UL		Multipack	6
	7973002	Belt type crankcase heater, 65 W, 230 V, CE mark, UL		Industry pack	50
	7773117	Belt type crankcase heater, 65 W, 400 V, CE mark, UL		Multipack	6
	120Z0466	Belt type crankcase heater, 65 W, 460 V, CE mark, UL		Multipack	6
	120Z0467	Belt type crankcase heater, 65 W, 575 V, CE mark, UL		Multipack	6
	7773110	Belt type crankcase heater, 75 W, 110 V, CE mark, UL	NTZ215-271	Multipack	6
	7773108	Belt type crankcase heater, 75 W, 230 V, CE mark, UL		Multipack	6
	7973005	Belt type crankcase heater, 75 W, 230 V, CE mark, UL		Industry pack	50
	7773118	Belt type crankcase heater, 75 W, 400 V, CE mark, UL		Multipack	6
	120Z0464	Belt type crankcase heater, 75 W, 460 V, CE mark, UL		Multipack	6
	120Z0465	Belt type crankcase heater, 75 W, 575 V, CE mark, UL		Multipack	6

PTC heaters

Type	Code n°	Description	Application	Packaging	Pack size
PTC27W	120Z0459	PTC heater 27W	All models	Multipack	10
PTC27W	120Z0460	PTC heater 27W	All models	Industry pack	50

Single phase PSC starting kits

Type	Code n°	Description	Application	Packaging	Pack size
PSC	7701026	Permanent capacitors 440V, 20 µF, 10 µF	NTZ 048-5, 068-5	Multipack	4
PSC	7701035	Permanent capacitors 440V, 30 µF, 15 µF	NTZ096-1, 108-1, 136-1	Multipack	4
PSC	7701151	Permanent capacitors 440V, 25 µF, 25 µF	NTZ 068-1	Multipack	4

Single phase CSR starting kits

Type	Code n°	Description	Application	Packaging	Pack size
CSR	7701021	Relay + Capacitors : run (15 + 10 µF), start (98 µF)	NTZ 048-1	Multipack	4
CSR	7701022	Relay + Capacitors : run (20 + 10 µF), start (98 µF)	NTZ 048-5, 068-5	Multipack	4
CSR	7701154	Relay + Capacitors : run (25 + 25 µF), start (140 µF)	NTZ 068-1	Multipack	4
CSR	7701042	Relay + Capacitors : run (30 + 15 µF), start (140 µF)	NTZ096-1, 108-1, 136-1	Multipack	6

Single phase CSR starting kits, prewired box

Type	Code n°	Description	Application	Packaging	Pack size
	7701028	Relay + Capacitors : run (20 + 10 µF), start (98 µF)	NTZ 048-5, 068-5	Single pack	1
	7701049	Relay + Capacitors : run (30 + 15 µF), start (140 µF)	NTZ096-1, 108-1, 136-1	Single pack	1

Relays and capacitors

Type	Code n°	Description	Application	Packaging	Pack size
	8173022	Starting relay type RVA6AMKL	All Single pack phase models (code 1 & 5)	Single pack	1
	8173001	Start capacitor 330V, 98 µF	CSR starting kits	Multipack	10
	8173002	Start capacitor 330V, 140 µF	CSR starting kits	Multipack	10

Acoustic hoods

Type	Code n°	Description	Application	Packaging	Pack size
1 cyl	120Z0575	Acoustic hood for 1 cyl	NTZ048-068	Single pack	1
2 cyl	120Z0576	Acoustic hood for 2 cyl	NTZ096-136	Single pack	1
4 cyl	120Z0577	Acoustic hood for 4 cyl	NTZ215-271	Single pack	1

Mounting kits (Grommets, sleeves, bolts, washers, Ebox cover, Solder sleeves and gaskets)

Type	Code n°	Description	Application	Packaging	Pack size
	8156001	Mounting kit 1 cyl high	NTZ 048 - 068	Single pack	1
	120Z0761	Mounting kit 2 cyl hp	NTZ 136(1)	Single pack	1
	120Z0763	Mounting kit 2 cyl	NTZ 096-108	Single pack	1
	120Z0764	Mounting kit 2 cyl HP	NTZ 136(3,4,9)	Single pack	1
	8156007	Mounting kit 4 cyl	NTZ215-271	Single pack	1

Terminal boxes, covers & T-block connectors

Type	Code n°	Description	Application	Packaging	Pack size
	8156134	Cover 80 x 96 mm ; clamp	NTZ048-136 (except 136-1)	Multipack	10
	8173230	T-block 52 x 57 mm, 3 screws H10-32 UNF9.5	NTZ136-1, NTZ215-271	Multipack	10
	8156135	Covers 96 x 115 mm, clamp	NTZ136-1, NTZ215-271	Multipack	10

Lubricants / oils

Type	Code n°	Description	Application	Packaging	Pack size
175PZ	120Z0638	POE lubricant, 175PZ, 1 litre can	NTZ-B with R404A, R452A, R507A	Multipack	12
175PZ	120Z0639	POE lubricant, 175PZ, 2.5 litre can	NTZ-B with R404A, R452A, R507A	Multipack	8

Miscellaneous

Type	Code n°	Description	Application	Packaging	Pack size
	8156145	Oil sight glass gasket (black)	1-2-4 cyl models produced since 2002	Multipack	10
	8156019	Oil sight glass + gaskets	1-2-4 cylinder VE versions	Multipack	4
	8154001	Blue spray paint	All models	Single pack	1

Current version

- reliability risk icons are added
- Page 8: Nominal performance data for R455A is added
- Page 16: Softstarter - recommendation is added
- Page 18: Operating conditions for R455A is added
- Page 27: Refrigerant R455A is added
- Page 19: Pressures for R455A are added
- Page 24: Sound data for R455A is added

Previous version

- Page 4: and then in the whole document - The safety and reliability risk icons are added
- Page 8: Nominal performance data for R454C is added
- Page 16: Pressure equipment directive - Refrigerant Group 1 is added
- Page 18: Operating conditions for R454C is added
- Page 27: Refrigerant R454C is added
- Page 19: Pressures for R544C are added
- Page 22: Soft starter with flammable refrigeration - recommendation
- Page 23: Crankcase heater recommendation updated
- Page 24: Sound data for R454C is added
- Page 33: Accessories - Mounting kits code numbers are updated

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

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Danfoss Turbocor Compressors



Danfoss Inverter Scrolls



Danfoss Scrolls



Danfoss Optyma Condensing Units



Danfoss Maneurop Reciprocating Compressors



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