ENGINEERING
TOMORROW

Application Guide

Optyma™ **Trio**



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OPTYMA™
DANFOSS CONDENSING UNITS

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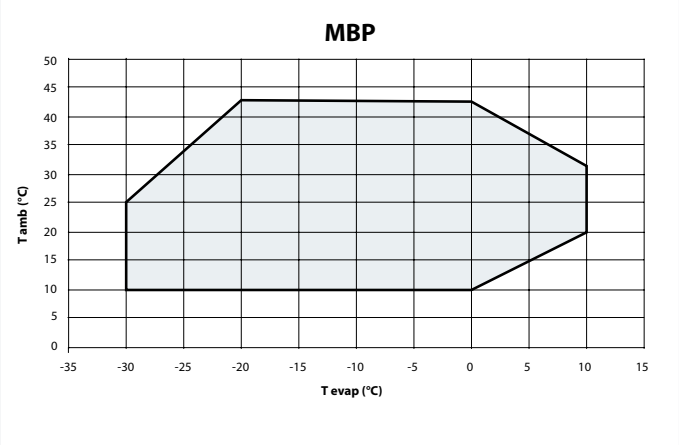
The content of this material applies only to "Optyma™ TRIO" condensing units. This product is a Danfoss technology solution with the use of three in parallel connected scroll compressors in a robust foil framework with high efficiency micro-channel (MCHE) Danfoss condenser.

Even though a lot of benefits for the use of in parallel compressor systems exist, the more important benefits are the use of less equipment, flexibility on the capacity control, use of few tubing lines, better control of energy consumption and reduction of installation time when compared to the use of different equipment with single compressor systems to obtain the same capacity.

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2.1 Application envelope of the Condensing Units for R404A / R507

Figure 1



2.2 Applications

This unit is intended for diverse applications, such as:

- Medium capability refrigeration systems, in general;
- Medium and small sized supermarkets;
- Distribution centers for freezing and food preservation;
- Industrial systems;
- Cold water and liquid cooling units, etc.

2.3 Features

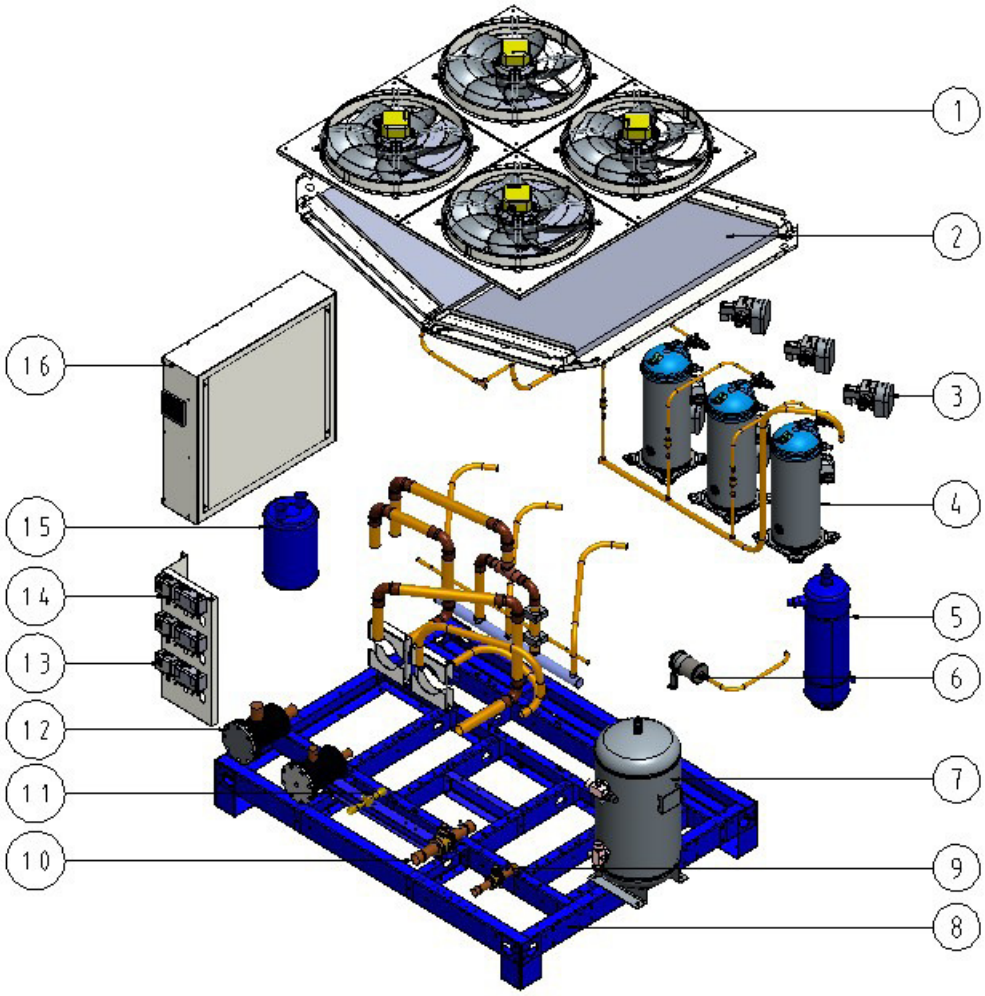
- Scroll Compressors;
- High efficiency micro-channel condenser;
- Designed to operate in locations with high ambient temperature;
- Motorized fans of high performance and low energy consumption to obtain the maximum thermal efficiency;
- Motorized fans developed specially to guarantee the perfect operation in humid environments and great diversity of dirt;
- 6 pole motorized fans selected to assist in low noise level operations with dynamic balancing;
- Designed for use in outdoor environments;
- Designed for easy installation and maintenance;
- Framework assembled in galvanized steel with electrostatic painting resistant to corrosion;
- Removable fan guards to facilitate the cleaning of the serpentine and general maintenance;
- Service valves in the liquid line and suction;
- Liquid receiver with service valves in the inlet and outlet connections, according to the NR10 norm;
- Combined oil separator and oil reservoir;
- Individual oil control for each compressor through the electronic level regulators;
- Compressor with thermal shield for motor protection against high temperatures and currents;
- Applications for R404A;
- Electric panel according to the NR13 norm;
- There is enough space for the installation of additional controls, if necessary.

2.4 Benefits

- Compact, light and resistant unit;
- Easy handling;
- Low noise level, 6-pole fan;
- High performance;
- Low energy consumption.

3.1 Illustrative Image

Figure 2



Components

1 - Fan
2 - Micro-channel type condenser
3 - Electronic oil level control valve
4 - Scroll Compressors
5 - Combined separator and oil reservoir
6 - Oil filter
7 - Liquid receiver
8 - Base
9 - Service valve (GBC) liquid line
10 - Service valve (GBC) suction line
11 - Sight glass
12 - Suction filters and liquid line
13 - High and low security pressure switch
14 - Fan's control pressure switch
15 - Suction accumulator
16 - Complete electric panel (including sectionalizers, compressor contactor, overload relay, fan contactor, circuit breaker, timers, fault relay/ phase sequence).

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3.2 Nomenclature

3.2.1 Code and model

Nomenclature for the Optyma™ Trio line

H U 5100 D 50 Q

1 2 3 4 5 6

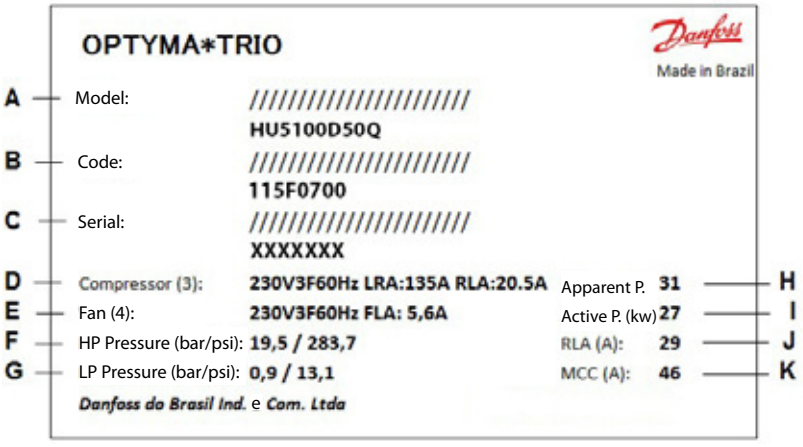
1 Application	H - High and medium evaporating temperature
2 Coolant gas	U - R404A / R507
3 Compressors' capacity (Kcal/h)	51(00) - 51000 Kcal/h for HBP/MBP
4 Condenser's technology	D - Micro-channel
5 Productconfiguration	Table 1
6 Electrical Codes	Q - 220V/3F/60Hz V - 380V/3F/60Hz

Table 1 - Productconfiguration

Code	Application	Pressure switch		Liquid receiver	Separator andoilreservoir	Suction accumulator	Filter Drier		Sight Glass	Service Valve		Electric Component					
		KP15 Safety	KP5 Fan				Suction	L. Liquid		Suction	Liquid line	General Key	Contactor		Circuit breaker		Sequence phase protector
													Compressor	Fan	Compressor	Fan	
50	HBP	3	2	1	1	1	1	1	1	1	1	1	3	4	3	4	3

3.2.2 Label

Figure 3



A: Model
B: Code
C: Serial number and Bar code
D: Compressors Information
E: Fans Information
F: HP pressure test
G: LP pressure test
H: Apparent power
I: Active power
J: RLA nominal current
K: Maximum current of MCC application

3.3 Performance data

HBP R404A/R507 60Hz

Condensing Unit			Ambient Temperature (°C)	Cooling capacity in (Kcal/h) - Evaporating temperature in (°C)													
				-25		-20		-15		-10		-5		0		5	
Model	Electrical Code	Code		C.R.	P.C.	C.R.	P.C.	C.R.	P.C.	C.R.	P.C.	C.R.	P.C.	C.R.	P.C.	C.R.	P.C.
HU4500D50	Q V	115F0559 115F0560	32	22170	22.35	27880	22.68	34510	23.22	42030	23.93	50390	24.74	59540	25.64	69420	26.58
			35	----	----	26120	23.95	32430	24.43	39590	25.09	47560	25.89	56290	26.78	65730	27.73
			38	----	----	24070	25.34	30290	25.76	37090	26.36	44650	27.12	52950	27.99	61950	28.94
			43	----	----	20900	28.00	26610	28.26	32760	28.74	39630	29.41	47210	30.23	----	----
HU5100D50	Q V	115F0561 115F0562	32	26090	25.90	32180	26.58	39200	27.45	47170	28.47	56080	29.60	65900	30.79	76600	31.99
			35	----	----	30490	27.98	37210	28.83	44830	29.84	53330	30.96	62720	32.14	72990	33.34
			38	----	----	28840	28.43	35180	30.31	42430	31.30	50540	32.40	59500	33.57	69320	34.77
			43	----	----	25880	31.05	31780	31.81	38320	33.96	45760	35.02	54000	36.16	----	----

KEY
C. R. capacity (Kcal/h)
P.C. Total power including fans (KW)

OPERATING CONDITIONS:
Overheating: 20 K
Sub-cooling: 0 K

3.2 General Data

60Hz

Application	Chassis	(HP)	Condensing Unit		Compressor					Fan				Condenser		Liquid Receiver	Connection		Weight		Sound level		Sound Power dBA
			Model	Code	Model	Code	Qty	Off (m3/h)	Oil (L)	Diam. (mm)	No. Poles	Qty	Air flow (m3/h)	Type	Internal Vol. (L)		L. Suction (in)	L. Liq. (in)	Liq. (kg)	Raw (kg)	5m dB	2m dB	
HBP	C	23	HU4500D50Q	115F0559	MLZ058T2	121L8816	3	26.4	2.7	630	6	4	33600	Q8	2.54 x 2	40	2 1/8	1 1/8	485	500	64	78	86
			HU4500D50V	115F0560	MLZ058T9	121L8824																	
		27	HU5100D50Q	115F0561	MLZ066T2	121L8826	3	31.2	2.7	630	6	4	33600	Q8	2.54 x 2	40	2 1/8	1 1/8	485	500	64	78	86
			HU5100D50V	115F0562	MLZ066T9	121L8852																	

3.5 Electrical Data

60Hz

Condensing Unit					Compressor						Fan						
Model	Code	Total power	Voltage, Phases, Frequency	Amps	Model	Code	Qty	Voltage, Phases, Frequency	Amps			Diam. Model	Qty	No. Poles	Power	Voltage, Phases, Frequency	FLA (60Hz)	
		kVA		MCC					LRA	RLA	MCC	mm			W		230V (A)	380V (A)
HU4500D50Q	115F0559	33.53	230V-3F-60Hz	88.00	MLZ058T2	121L8816	3	230V-3F-60Hz	190.0	25.6	40.0	630	4	6	870	230V-3F-60Hz	2.9	1.65
HU4500D50V	115F0560	35.80	380V-3F-60Hz	54.40	MLZ058T9	121L8824	3	380V-3F-60Hz	135.0	16.0	25.0	630	4	6	870	380V-3F-60Hz	2.9	1.65
HU5100D50Q	115F0561	37.99	230V-3F-60Hz	99.70	MLZ066T2	121L8826	3	230V-3F-60Hz	235.0	29.5	46.0	630	4	6	870	230V-3F-60Hz	2.9	1.65
HU5100D50V	115F0562	43.70	380V-3F-60Hz	66.40	MLZ066T9	121L8852	3	380V-3F-60Hz	135.0	20.0	28.0	630	4	6	870	380V-3F-60Hz	2.9	1.65

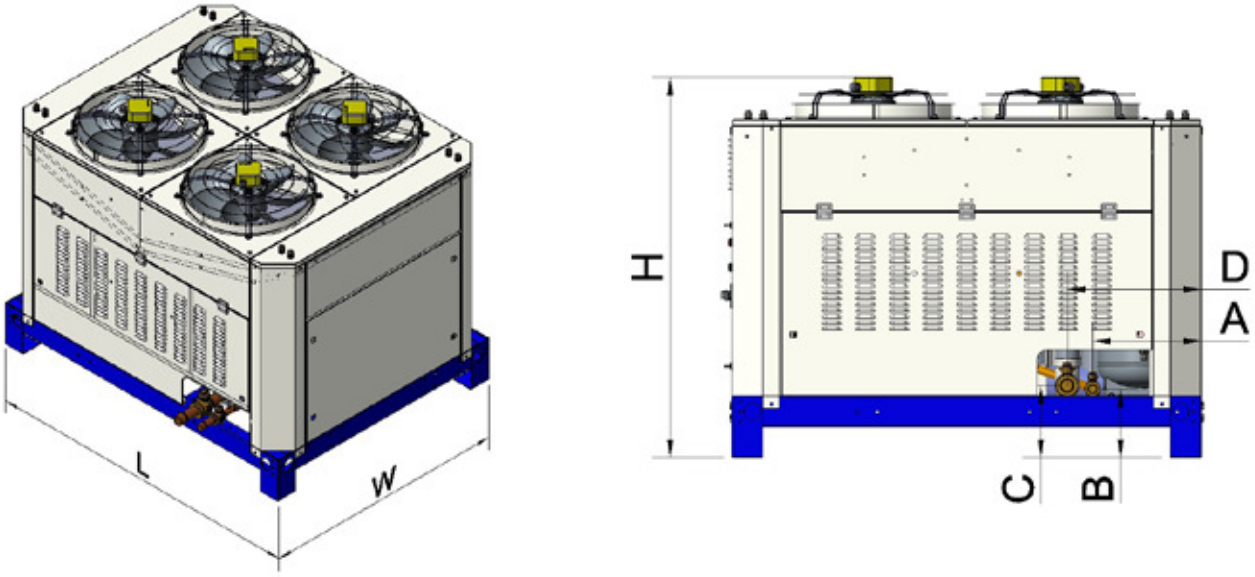
LRA: Rotor amps blocked, **RLA:** Nominal current, **MCC:** Maximum direct current, **FLA:** Full charge current

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3.6 Dimensional Data

Condensing Unit	Dimensions (mm)						Connections			
	Without packaging			With packaging			Liquid Line		Liquid Line	
	W	L	H	X	Y	Z	A	B	C	D
HU4500D50Q	1485	2057	1368	1585	2157	1468	250	224	246	348
HU4500D50V	1485	2057	1368	1585	2157	1468	250	224	246	348
HU5100D50Q	1485	2057	1368	1585	2157	1468	250	224	246	348
HU5100D50V	1485	2057	1368	1585	2157	1468	250	224	246	348

Figure 4



To guarantee an adequate protection, it is necessary to observe all emphasized recommendations in this application guide.

The next sections will provide necessary recommendations for the installation and operation of the Optyma ™ Trio unit, as well as safety data and appropriate use of the product.

4.1 Storage and Handling

- It is not recommended to open the packaging before the unit being at the installation site.
- Handle the unit carefully. The framework allows the use of a forklift or handling cart. Use appropriate and safe elevation equipment.
- Keep the unit in a vertical position both in storage and transport.
- Store the unit in an adequate and protected environment.
- Do not expose the packaging to rain or corrosive atmosphere.
- After unpacking, verify if the unit is complete and undamaged.

All the equipment must be examined carefully upon product receipt in order to verify if no damages were caused by handling and transportation.

This equipment was carefully inspected in our factory, in case there is any apparent or hidden malfunction, notify immediately the establishment where it was purchased.

4.2 Precautions

- The installation and maintenance of this unit must only be held by a certified installer / engineer / electrician and in accordance with the local regulatory guidelines.
- Never place the unit in a flammable atmosphere
- Place the unit in a way that it doesn't block or complicate the passage areas, doors, windows, stairs and other accesses.
- Ensure adequate space around the unit for the air circulation and door opening. See Figure 5 to obtain the minimum distance values to the walls.
- Avoid installing the unit in aggressive environments and with difficult access.
- Ensure a base with strong horizontal surface that is stable enough to support all the unit's weight and eliminate the vibrations by misalignment.
- Check if the power supply corresponds to the technical specifications of the unit (see product's marking label).
- By installing units for HFC refrigerants, use specific equipment for that type of refrigerant, in other words, that have never been used before for CFC or HCFC.
- The suction tubing must be flexible in 3 dimensions to muffle the vibrations. Furthermore, the tubing must be done in a way so that the return of the oil to the compressor is ensured and the return of liquid refrigerant to the compressor is avoided.

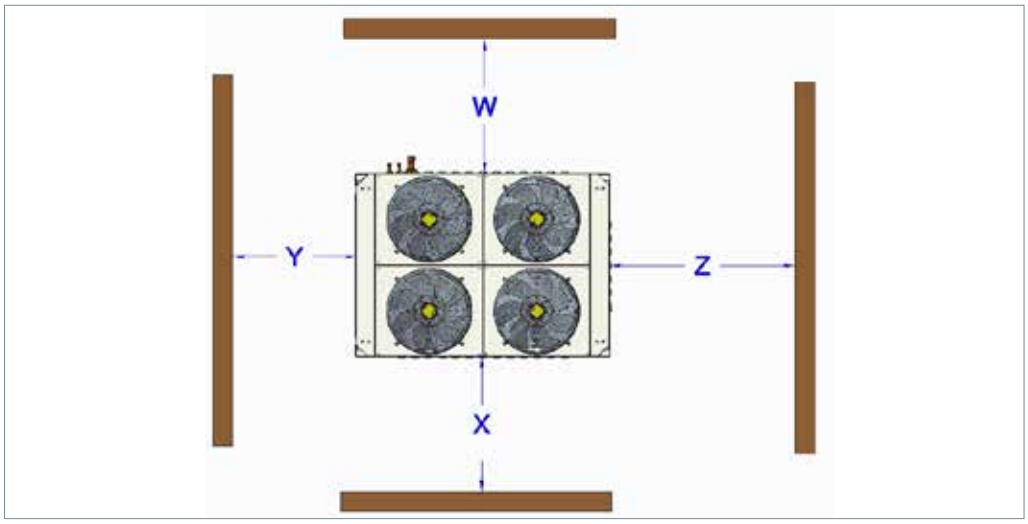
The installation at ground level rarely presents problems, none the less, if it is not installed at ground level, an additional tubing for drainage must be considered in the project.

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4.3 Mechanical Installation

- The installation of the unit must comply with all the current safety local regulations, under all circumstances.
- The unit must be installed securely on a bracket or a steady and secure base, with the use of the vibration shock absorbers with mounting bolts provided together with the unit. See Figure 6.
- Remove the nitrogen load slowly through the schrader valves located in the suction GBC service valves and liquid line.
- Connect the unit to the system as quickly as possible to avoid the oil contamination from moisture present in the air.
- Avoid the penetration of solid residues derived from the tubing burr and others.
- Weld the tubing with proper material and always use nitrogen gas flow to make the environment inert, avoiding internal carbonation and forming of residue that may damage the system.
- It is recommended to isolate the suction tubing with insulation thickness that meets the specific project conditions for the installation.
- For the initial start-up, the oil level must be verified and completed with a parcial load, with the oil provided together with the condensing unit. If more oil is required, acquire from an oil distributor the oil of the same brand and specification provided with the condensing unit.
- After the operation, the sight glass of the oil compressor must be re-checked and the oil load completed to adjust to the installation tubing length, if necessary.
- It is recommended to put the oil through the service valve of the oil separator/trap through a vacuum pump connected to the high pressure line.
- The refrigerant charge must be done through the liquid's tank service valve or through the schrader of the GBC service valve of the liquid line.

Figure 5

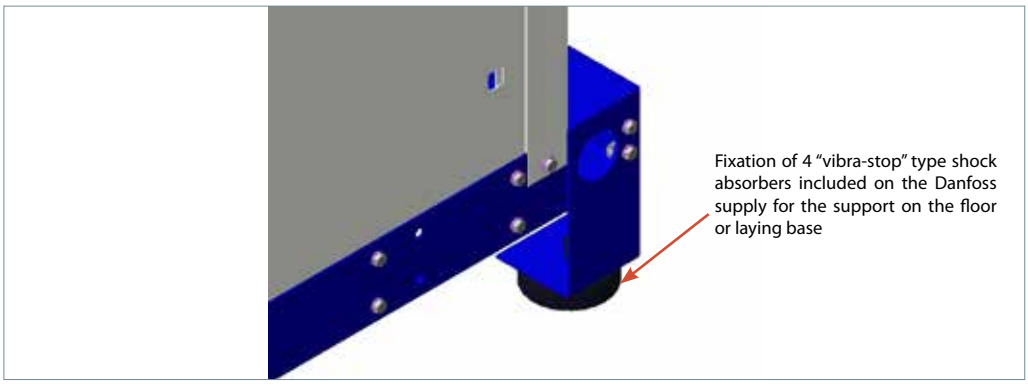


	W [mm]	X [mm]	Y [mm]	Z [mm]
Chassis - C	1092	1092	1000	1900

Note: The specification of the chassis for each model can be found in section "3.6 Dimensional Data" in page 11.

4.3.1 Fixation

Figure 6



4.4 Leak detection

- Never pressurize the circuit with oxygen or dry air. This can cause fire or explosion.
- Do not use dye for leak detection.
- The use of nitrogen or the system's own gas is recommended.
- Perform a leak detection test in the entire system.
- The maximum test pressure is 32 bar.
- When a leak is detected, repair the leak and repeat the leak detection.

4.5 Vacuum dehydration

- Never use the compressor to empty the system.
- Connect a vacuum pump to the system's lower sides LP and HP.
- The vacuum in the system must reach at least a complete 500 µm Hg (0.67 mbar).
- When the vacuum level is reached, keep it for a few hours to guarantee the sealing of the system.
- After this stage, isolate the vacuum pump and place the nitrogen with a pressure of 4 to 5 bar, keeping the system at this pressure for 4 hours.
- If the pressure in the gauge connected to the suction line and discharge lowers in this period, locate the leak, perform the repair and restart the vacuum procedure and check the leak again.
- Do not apply energy to the unit while the system is under vacuum, as this might cause internal damage.

4.6 Electrical Installation

- Switch off and isolate the main power supply.
- Make sure that the power supply can't be switched on accidentally during installation.
- All the electrical components must be selected according to the local standards and according to the unit's requirements.
- Consult the wiring diagram supplied with the installation manual for details on electrical connections.
- Make sure that the power supply matches the unit characteristics and that the energy source is stable (nominal voltage ± 10% and nominal frequency ± 2.5 Hz).
- Dimension the power supply cables according to the unit data on voltage and current.
- Protect the power supply and ensure that the grounding of the unit is done according to the current standards.
- The unit is equipped with high and low pressure switches, which directly shut off the power supply to the compressor in case of activation. The unit is also equipped with a phase sequence relay to protect the unit against phase/ sequence loss / asymmetry and under voltage / over voltage.
- Observe the correct phase sequence in the condensing units which use three-phase compressors.
- Determine the sequence using a phase gauge to establish the sequences of the line phases L1, L2 e L3.
- Connect the line phases L1, L2 e L3 corresponding to the terminals of the compressor T1, T2 e T3 respectively.

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4.7 Refrigerant and oil charge

- Use individual protection equipment (IPE) such as safety glasses and gloves.
- Never start the compressor under vacuum. Keep the compressor switched off.
- Before performing the refrigerant charge, verify if the oil level is between ¼ and ¾ on the compressor oil display. If necessary, add oil to the compressors, refer to the compressor's label for oil type.
- Only use the coolant for which the unit was designed for.
- Perform the refrigerant charge in liquid phase into the condenser and in the liquid receiver. Make sure to perform a slow refrigerant charge until it reaches 4-5 bar in systems with R404A/507.
- Never put liquid refrigerant through the suction line.
- Never use additive or oil mixtures.
- The remaining charge is carried out until the installation has reached a stable nominal condition level during the operation.
- Never leave the filling cylinder connected to the system.

4.8 Verification before operating

- Use safety devices according to locally applicable regulations and security standards.
- Verify if all electrical connections are attached correctly and in accordance with the local regulations.
- Keep the crankcase heater switched on for at least 12 hours before the system start-up, for the guarantee of proper lubrication and elimination of the liquid refrigerant from the compressor's crankcase.

4.9 First start-up

- Never switch on the unit without having performed a refrigerant charge .
- All service valves must be in the open position. See figure 5.
- Verify if the power supply is adequately connected.
- Verify if the crankcase heater is working.
- Verify if the fan can rotate freely.
- Verify if high and low pressure are balanced.
- Energize the unit and verify the conformity of the wiring, the tension in the terminals and the phase sequence.
- The potential reverse rotation of a three-phased compressor can be detected by no pressure increase, an abnormal sound level of the compressor and a lower energy consumption than the one expected. In this case, immediately switch off the unit and connect the phases to their appropriate terminals.
- If the direction of rotation is correct, the indication of low pressure on the low pressure gauge must display a decreasing pressure and the indication of high pressure in the high pressure measurer must display an increasing pressure.
- The electronic buoys must comply with the indication.

4.10 Verification of the unit while operating

- Check the rotation direction of the fan. The air must flow from the condenser to the fan (air flow from bottom to top).
- Check the high pressure stabilization and the power supply stability.
- Check the suction overheating to reduce the risk of the return of liquid to the compressor.
- Observe the compressor oil level in the beginning and during the operation to confirm that the oil level remains visible.
- Verify all tubing with respect to unusual vibration. The movements exceeding 1.5mm require corrective measures, as the use of fixation supports in the tubing.
- Before leaving the installation site, perform a general inspection of the installation on cleanliness, detection of noise and leakage.
- Record type and amount of refrigerant charge, as well as operation conditions as reference for future inspections. Use data check sheet

- Always switch off the unit with the main switch before removing the fan panel, or any other panel of the condensing unit.
- The internal pressure and the surface temperature are hazardous and can cause permanent injuries.
- The installers and/or maintenance operators must be certified in accordance with the current standards and with the use of appropriate tools.
- High pressure tubing temperature may exceed 100°C and cause severe burns.
- Make sure that periodical inspection services are carried out to guarantee the reliability of the system and to meet the mandatory local regulations.
- To ensure the good functioning of the unit and its energy efficiency, it is recommended:
  - Periodic maintenance;
  - Verify if the safety devices are operational and properly set;
  - Make sure the unit retains the fixation steady without fragility;
  - Check if the compressor's current is correct;
  - Confirm if the system is operating consistently with previous maintenance records in the established conditions;
  - Check if all electrical connections still are properly attached;
  - Keep the unit clean and without rust and oxidation of the unit's components, tubing and electrical connections.
- The condenser must be verified at least once a year regarding the blockage of the fins by impurities and must be cleaned if considered necessary. The access to the internal side of the condenser takes place through the fans panel (guard). The micro-channel coils tend to accumulate dirt on the surface and not in the interior, which makes them easier to clean comparing to the tube condensers and fins.
- Remove the dirt from the surface, leaves, fibers, etc., with a vacuum, equipped with a brush or other soft accessory. Alternatively, blow the compressed air through the condenser inside out and brush with a soft bristle. Do not use a wire brush. Do not impact or scrape the condenser with the vacuum tube or air orifice.
- If the refrigeration system is open, the system must be pressurized with nitrogen processed in vacuum to remove the moisture and a new filter drier must be installed.

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Condensing Units	HU4500D50Q	HU4500D50V	HU5100D50Q	HU5100D50V
Accumulator	191U0068	191U0068	191U0068	191U0068
Acoustic Hood	-	-	-	-
Compressor	121L8816	121L8824	121L8826	121L8852
MCHE Condenser	193U0646E	193U0646E	193U0646E	193U0646E
Crankcase Resistance	-	-	-	-
Motor Fan	191U135980	191U135980	191U135980	191U135980
Filter Drier	023U1392	023U1392	023U1392	023U1392
Oil Filter	191U008810	191U008810	191U008810	191U008810
Oil Level Regulator	191U009030	191U009030	191U009030	191U009030
Lubricating Oil	120Z5034	120Z5034	120Z5034	120Z5034
Oil Separator	191U007950	191U007950	191U007950	191U007950
KP HP_LP Pressure Switch	060-126466	060-126466	060-126466	060-126466
KP HP Pressure Switch	060-117166	060-117166	060-117166	060-117166

- Always have the model and serial number of the condensing unit available for any warranty claim.
- The warranty of the product can be rendered void in the following cases:
  - Absence of nameplate.
  - External modifications, mainly drilling, welding, broken feet and shock markings.
  - Open compressor or returned without sealing.
  - Dye for rust detection, water or leak in the compressor.
  - Use of an off-specification refrigerant or lubricant.
  - Any deviation from the recommended instructions regarding the installation, application or maintenance.
  - Use of the unit in an environment with an explosive atmosphere.
  - No model number or serial number was informed in the warranty claim.

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Danfoss recommends that gases, oils and other components that can adversely affect the environment be delivered to dedicated companies in the recycling or disposal of those materials for environment protection.

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Danfoss Commercial Compressors

is a worldwide compressor and condensing units manufacturer for refrigeration and HVAC applications. With a wide range of innovative products of the best quality, we help your company to find the best possible solution in terms of energy efficiency and respect for the environment and that reduces the total costs of the product's life cycle.

We have over 40 years of experience in the development of hermetic compressors which placed us among the global leaders in our business and positioned us as variable speed technology specialists. Currently we act from the engineering and project up to the production stages in three continents.



Danfoss Turbocor Compressors



Danfoss variable speed scroll compressors



Danfoss scroll compressors
for air conditioning



Danfoss OPTYMA condensing units



Maneurop reciprocating compressors



Compressors for light applications
of commercial refrigeration

Our products can be found in diverse applications, such as rooftops, chillers, residential air conditioning, heat pumps, cold rooms, supermarkets, milk cooling tanks and industrial cooling processes.

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