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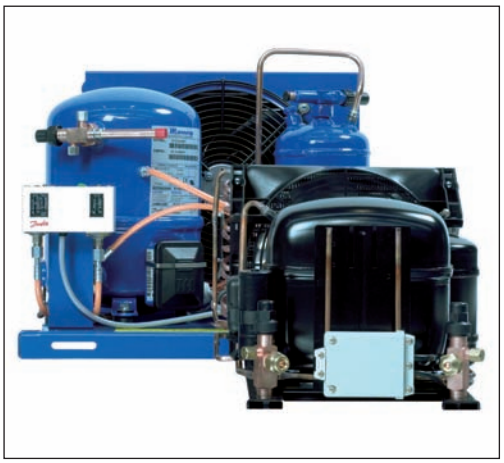
Notes

General information on operating Danfoss condensing units

In the following you will find general information and practical tips for using Danfoss condensing units. Danfoss condensing units represent an integrated range of units with Danfoss reciprocating piston compressors. The versions and configurations of this series correspond to the requirements of the market. To give an overview of the program, the individual subsections are generally divided into the various hermetic compressors mounted on the condensing units.

- Condensing units with 1-cylinder compressors (types TL, FR, NL, GS, SC and SC-TWIN).
- Condensing units with hermetic 1 -2 and 4 cylinder Maneurop® reciprocating piston compressors MTZ, NTZ and MPZ.



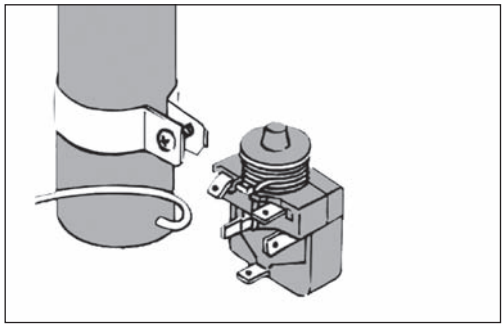
Equipment configuration

Danfoss condensing units are delivered with a compressor and condenser mounted on rails or a base plate. Terminal boxes are prewired. In addition, stop valves, solder adaptors, collectors, dual pressure switches and power cables with 3-pin grounded plugs complete the delivery kit.

Please consult the corresponding Danfoss documentation or the current price list for details and ordering numbers. The Danfoss sales company responsible for your area will be glad to help you make your selection.

Power supply and electrical equipment

- Condensing units with 1-cylinder compressors (types TL, FR, NL, GS, SC and SC-TWIN)
  These condensing units are equipped with hermetic compressors and fans for 230 V 1-, 50 Hz power supply.
  The compressors are equipped with an HST starting device consisting of a starting relay and a starting capacitor. The components can also be delivered as spare parts.
  The starting capacitor is designed for short activation cycles (1.7% ED). In practice, this means that the compressors can perform up to 10 starts per hour with an activation duration of 6 seconds.



- Condensing units with hermetic 1-2 and 4 cylinder Maneurop® reciprocating piston compressors MTZ and NTZ.

  These condensing units are equipped with hermetic compressors and fan(s) for different voltage supplies:
  - 400 V-3ph-50 Hz for compressor and for fan(s).
  - 400 V-3ph-50Hz for compressor and 230 V-1ph-50Hz for fan(s) (the capacitor(s) of the fans are included inside the electrical box).
  - 230 V-3ph-50Hz for compressor and 230 V-1ph-50Hz for fan(s) (the capacitor(s) of the fans are included inside the electrical box).
  - 230 V-1ph-50Hz for compressor (the starting device (capcitors, relay) is included into the electrical box) and 230V-1ph-50Hz for fan(s)

The starting current of the Maneurop® three-phase compressor can be reduced through the use of a soft starter. CI-tronic™ soft start, type MCI-C is recommended for use with this type of compressor. The starting current can be reduced up to 40% depending on the compressor model and the model of soft start used. The mechanical load that occurs at start-up is also reduced, which increases the lifespan of the internal components.

For details on the CI-tronic™ MCI-C soft start, please contact your local Danfoss dealer.
The number of compressor starts is limited to 12 per hour in normal conditions. Pressure equalisation is recommended when MCI-C is used.

Hermetic compressors

The hermetically sealed compressor types w, FR, NL, GS, SC and SC TWIN have a built-in winding protector. When the protector is activated, a switch-off time of up to 45 minutes can occur as the result of heat storage in the motor.

The single-phase Maneurop® compressors MTZ and NTZ are internally protected by a temperature/current sensing bimetallic protector, which senses the main and start winding currents and also the winding temperature.

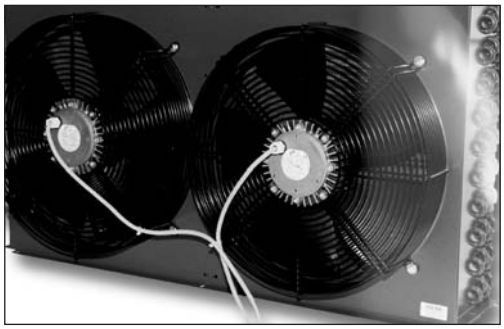
The three-phase Maneurop® reciprocating piston compressors MTZ and NTZ are equipped against over-current and over-temperature by internal motor protection. The motor protection is located in the star point of the windings and opens all 3 phases simultaneously via a bimetallic disk. After the compressor has switched off via the bi-metallic disc, reactivation can take up to 3 hours.

If the motor does not work, you can determine by means of resistance measurement whether the cause is a switched off winding protection switch or a possible broken winding.

Condensers and fans

Highly effective condensers allow a broader range of usage at higher ambient temperatures. One or two fan motors are used per condensing unit depending on the output value.

In addition, the fans can be equipped, e.g. with a Danfoss Saginomiya fan speed regulator, type RGE. This allows good condensing pressure control and reduces the noise level. The fans are provided with self-lubricating bearings, which ensures many years of maintenance-free operation.

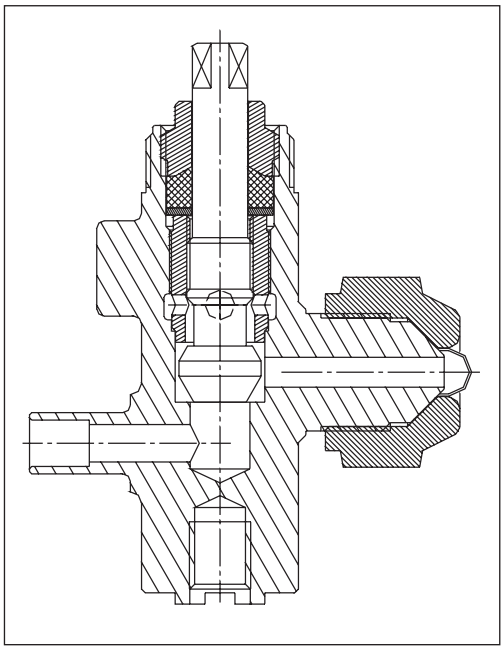


Stop valves

Danfoss condensing units are provided with stop valves on the suction and liquid side.

The stop valves of the condensing units with the 1-cylinder compressors (types TL, FR, NL, GS, SC and SC TWIN) are closed by turning the spindle clockwise to te soldered piece. This opens the flow between the pressure gauge connection and the flare connection. If you turn the spindle counter-clockwise to the rear stop, the pressure gauge connection is closed. The flow between the soldered and the flare connection is free. In the centre position, the flow through the three connections is free. The accompanying soldered adapters help prevent flare connections and to make the system hermetic.

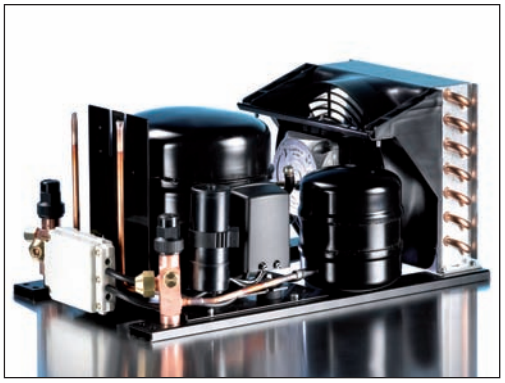
The stop valves of the condensing units with Maneurop® reciprocating piston compressors MTZ and NTZ are directly fitted into the suction and discharge rotalock ports of the compressor and on the receiver. The suction valve is provided with long, straight tube pieces in such a manner that soldered connections can be carried out without disassembling the Rotalock valve.



Receiver

Liquid receiver is standard on Danfoss condensing units for use with expansion valves.

The expansion valve is regulating the level in the receiver buffer (the de- or increasing flow of the refrigerant). The receivers from an internal volume of 3 l onwards are equipped with a Rotolock Valve.



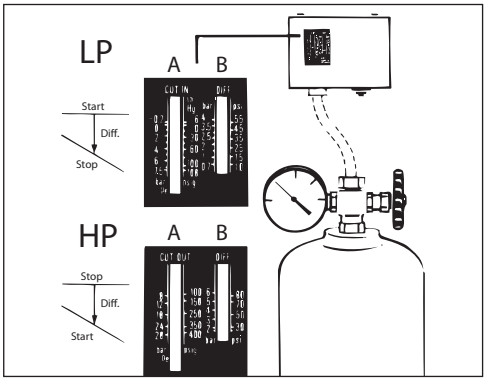
Terminal box

The Danfoss condensing units are electrically pre-wired and equipped with a terminal box. Thus the power supply and additional electrical wiring can be easily fitted. The terminal box of the condensing units with Maneurop® compressors is equipped with screw type connector blocks for both power and controls.

The electrical connections of each component (compressor, fan(s), PTC, pressure switch) are centralised into this box. A wiring diagram is available in the cover of the electrical box. These terminal boxes are protected to a degree of IP 54.

Safety pressure monitors

Danfoss condensing units can be ordered with safety pressure switches KP 17 (W, B…). Condensing units that do not come equipped with pressure switches from the factory must be equipped with a pressure switch at least the high-pressure side in systems with thermostatic expansion valves as per EN 378.



The following settings are recommended:

Refrigerant	Low pressure side		High pressure side	
	Cut in (bar)	Cut off (bar)	Cut in (bar)	Cut off (bar)
R407C	2	1	21	25
R404A/R507 MBP	1.2	0.5	24	28
R404A/R507 LBP	1	0.1	24	28
R134a	1.2	0.4	14	18

Setup

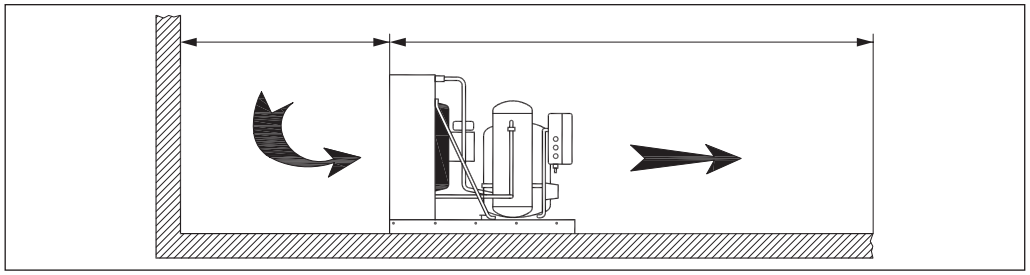
Danfoss condensing units must be set up in a well ventilated location.

You must ensure that there is sufficient fresh air for the condenser at the intake end.

In addition, you must ensure that no cross-flow occurs between the fresh air and the exhaust air.

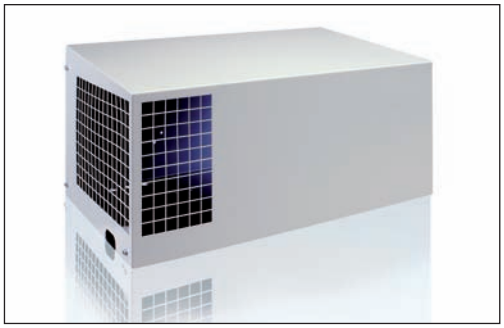
The ventilator motor is connected in such a way that the air is drawn in via the condenser in the direction of the compressor.

For optimal operation of the condensing unit, the condenser must be cleaned regularly.



Protective weather-proof housing

Danfoss condensing units that are set up outside must be provided with a protective roof or with protective weather-resistant housing. The scope of delivery includes optional, high-quality protective weather-proof housings.



Careful installation

More and more commercial cooling and air-conditioning systems are installed with condensing units that are equipped with hermetic compressors. High demands are put on the quality of the installation work and the alignment of such a cooling system.

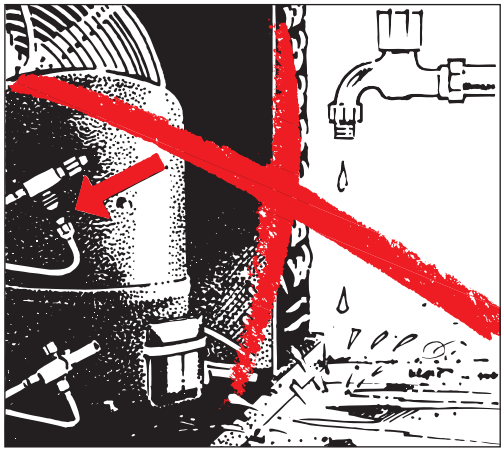
Contamination and foreign particles

Contamination and foreign particles are among the most frequent causes that negatively impact the reliability and lifespan of cooling systems. During the installation, the following types of contamination can enter the system:

- Scaling during soldering (oxidations)
- Flux residue from soldering
- Humidity and outside gasses
- Shavings and copper residues from deburring the tubing

For this reason, Danfoss recommends the following precautions:

- Use only clean and dry copper tubing and components that satisfy standard DIN 8964.
- Danfoss offers a comprehensive and integral range of products for the necessary cooling automation. Please contact your Danfoss dealer for additional information.

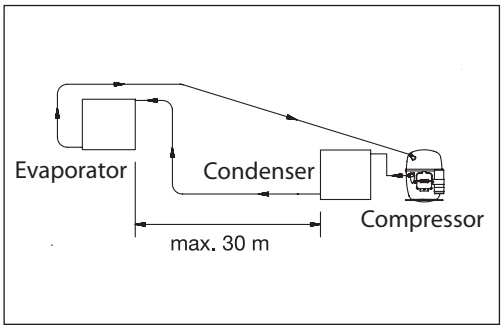


Doing the pipe work

When laying the tubing, you should try to make the shortest and most compact pipe work possible. Low-lying areas (oil traps), where oil might accumulate should be avoided.

Tubing layout of the condensing units with 1-cylinder compressors (types GS, TL, FR, NL, SC and SC-TWIN)

1. **Condensing unit and evaporator are located on the same level.**
   The suction line should be arranged slightly downward from the compressor. The max. permissible distance between the condensing unit and the cooling position (evaporator) is 30 m.

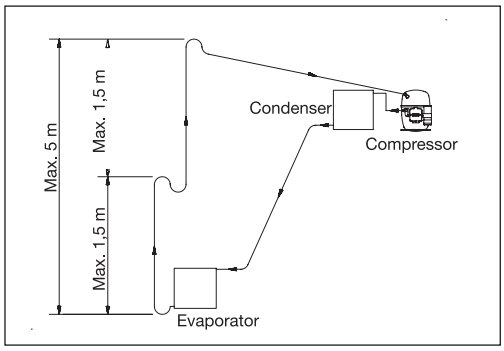


	Suction Line	Liquid Line
	Diameter copper pipe [mm]	
TL	8	6
FR	10	6
NL	10	6
SC	10	8
GS	12/16	10
SC-TWIN	16	10

Tubing layout of the condensing units with 1-cylinder compressors (types TL, FR, NL,SC, GS and SC-TWIN) (continued)

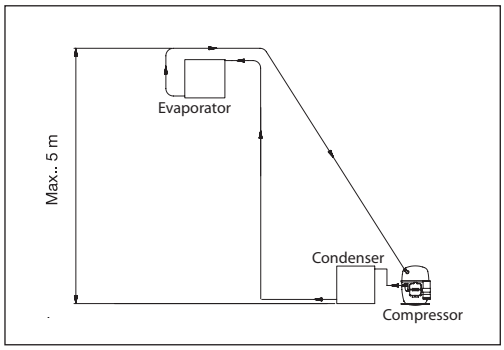
To ensure the oil return, the following cross-sections are recommended for the intake and liquid lines:

2. **The condensing unit is arranged above the evaporator.**
The ideal height difference between the condensing unit and the evaporator position is a max. of 5 m. The tube length between the condensing unit and the evaporator should not exceed 30 m. The suction lines must be laid out with double arcs in the form of oil traps above and below. This is done using a U-shaped arc at the lower end and a P-shaped arc at the upper end of the vertical riser. The max. distance between the arcs is 1 to 1.5 m. To ensure the oil return, the following pipe diameters are recommended for the suction and liquid lines:



	Suction Line	Liquid Line
	Diameter copper pipe [mm]	
TL	8	6
FR	10	6
NL	10	6
SC 12/15	10	8
All other SCs	12	8
GS	16	10
SC TWIN	16	10

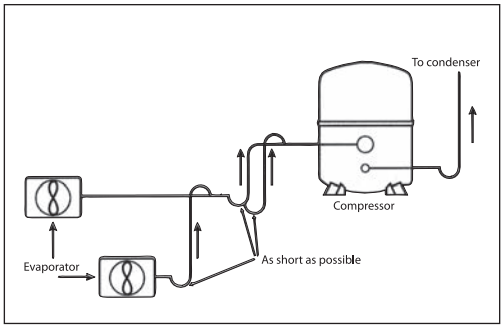
3. **The condensing unit is arranged under the evaporator.**
The ideal height difference between the condensing unit and the evaporator is a max. of 5 m. The tube length between the condensing unit and the evaporator should not exceed 30 m. The suction lines must be laid out with double arcs in the form of oil traps above and below. This is done using a U-shaped arc at the lower end and a P-shaped arc at the upper end of the vertical riser. The max. distance between the arcs is 1 to 1.5 m. To ensure the oil return, the following pipe diameters are recommended for the suction and liquid lines:



	Suction Line	Liquid Line
	Diameter copper pipe [mm]	
TL	8	6
FR	10	6
NL	10	6
SC	12	8
GS	16	10
SC TWIN	16	10

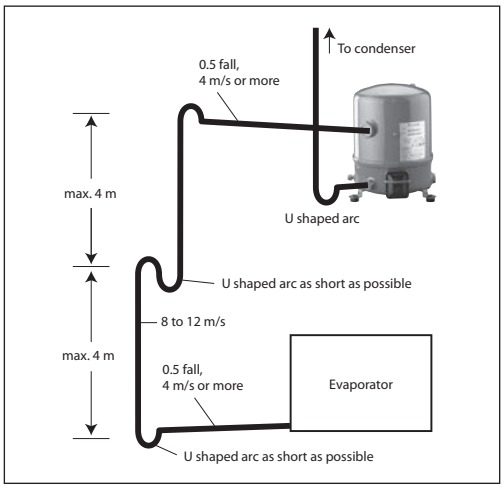
Tubing layout of the condensing units with hermetic Maneurop® reciprocating piston compressors, 1-2-4 cylinder

The tubes should be laid out to be flexible (dispersible in three planes or with "AnaConda"). When laying the tubing, you should try to make the shortest and most compact tubing network possible.

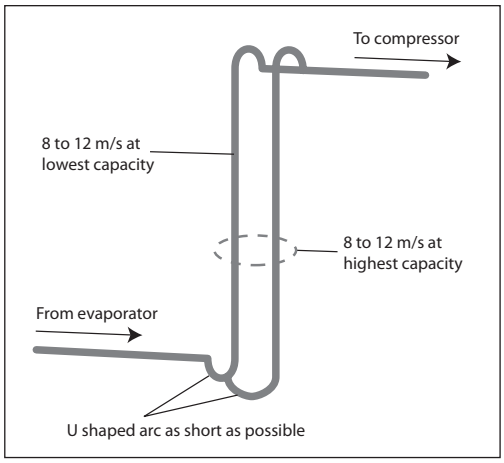


Low-lying areas (oil traps), where oil might accumulate should be avoided. Horizontal lines should be laid inclined slightly downward toward the compressor. To guarantee the oil return, the suction speed at the risers must be at least 8-12 m/s.

For horizontal lines, the suction speed must not fall below 4 m/s. The vertical suction lines must be laid out with double arcs in the form of oil traps above and below. This is done using a U-shaped arc at the lower end and a P-shaped arc at the upper end of the vertical tubing. The maximum height of the riser is 4 m, unless a second U-shaped arc is attached.

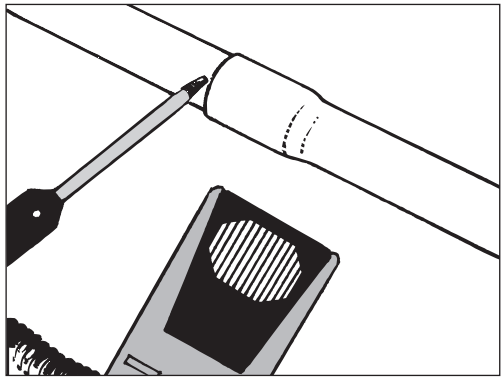


If the evaporator is mounted above the condensing unit, you must ensure that no liquid refrigerant enters the compressor during the work-stoppage phase. To avoid condensation droplets from forming and to prevent an unwanted rise of the intake gas over-heating, the suction line must generally be insulated. Adjusting the intake gas over-heating is done individually for each use. You can find more detailed information in the following sections under "max. permitted temperatures."



Leak check

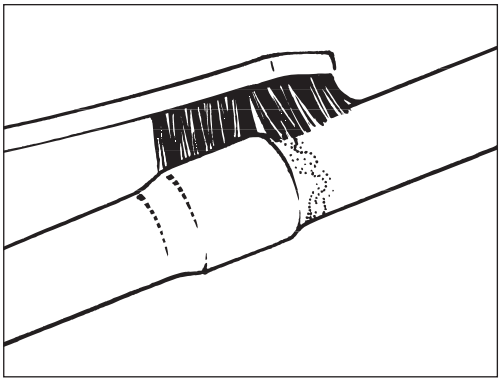
Danfoss condensing units are checked in the factory for leaks using helium. They are also filled with a protective gas and must therefore be evacuated from the system. In addition, the added refrigerant circuit must be leak-checked using nitrogen. The suction and liquid valves of the condensing unit remain closed during this. The use of coloured leak-checking agents will void the warranty.



Soldering

The most common solders are alloys of copper, zinc and tin. For "silver, copper" (silver content ~ 40 %) the melting point is between approx. 655°C and 755°C. The coated silver solder contains the flux needed for soldering. This should be removed after soldering.

Silver solder can be used to solder together various materials, e.g. steel/copper. Ag 15% solder is sufficient to solder copper to copper.



Protective gas

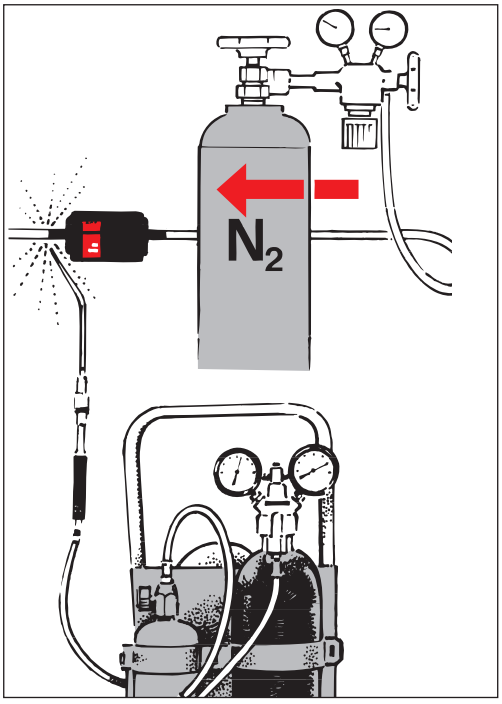
At the high soldering temperatures under the influence of ambient air, oxidation products form (scaling).

The system must therefore have protective gas flowing through it when soldering. Supply a weak stream of a dry, inactive gas through the tubes.

Only begin soldering when there is no atmospheric air left in the affected component. Initiate the work procedure with a strong stream of protective gas, which you can reduce to a minimum when you start soldering.

This weak flow of protective gas must be maintained during the entire soldering process.

The soldering must be done using nitrogen and gas with a gentle flame. Only add the solder when the melting point temperature has been reached.



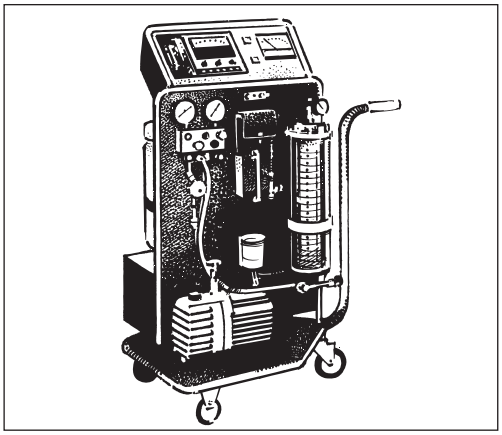
Fork burner:

Evacuating and filling

The vacuum pump should be able to suction off the system pressure to approx. 0.67 mbar, in two stages if possible.

Humidity, ambient air and protective gas should be removed. If possible, provide for a two-ended evacuation, from the suction and the liquid side of the condensing unit.

Use the connections at the suction and discharge valves of the condensing units.



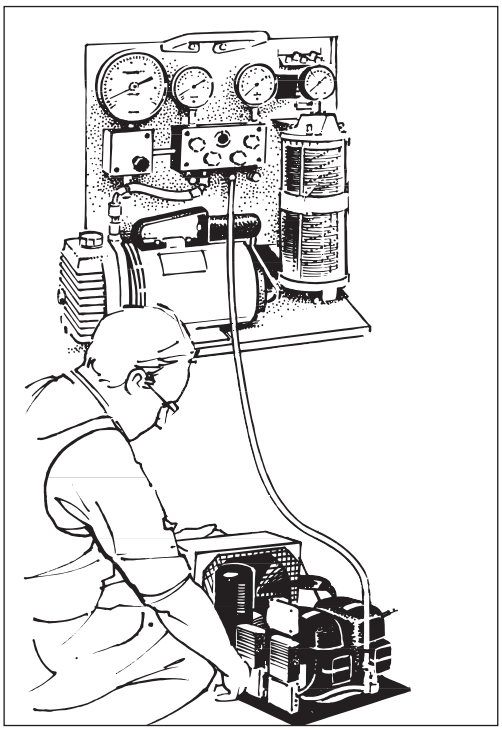
For filling the system, a filling level indicator, filling cylinder and/or a scale is used for smaller condensing units. The refrigerant can be fed into the liquid line in the form of a liquid if a filling valve is installed.

Otherwise, the refrigerant must be fed into the system in gaseous form via the suction stop valve while the compressor is running (break the vacuum beforehand).

Please observe that the refrigerants R404A, R507 and R407C are mixtures.

The refrigerant manufacturers recommend filling R507 as a liquid or gas, whereas R404A and especially R407C should be filled in liquid form. Therefore we must recommend that R404A, R507 and R407C are filled as described using a filling valve.

If the amount of refrigerant to be filled is unknown, continue filling until no bubbles are visible in the inspection glass. During this, you need to keep a constant watch on the condensing and suction gas temperature in order to guarantee normal operating temperatures.



Please observe the following procedures for evacuating and filling the Danfoss condensing units with the 1-cylinder compressors, types TL, FR, NL, SC and SC TWIN.
For evacuating, both external hoses are connected to a service battery aid and the condensing unit is evacuated with stop-valves 1 and 2 open (spindle in the center position).

After evacuation, both valves (4 and 5) are connected to the service battery. Only then is the vacuum pump switched off.

The refrigerant bottle is connected at the centre connection of the service battery aid 3, and the filling piece is briefly vented.

The corresponding valve of service battery aid 4 is opened and the system is filled via the manometer connection of the suction stop valve with the maximum allowable refrigerant operating filling for a compressor that is in operation.

Evacuating and filling
(continued)

Please observe the following recommendation for evacuating and filling the Danfoss condensing units with condensing units with hermetic Maneurop® reciprocating piston compressors MTZ and NTZ.

We recommend that you carry out the evacuation as described in the following:

1. The service valves of the condensing unit must be closed.

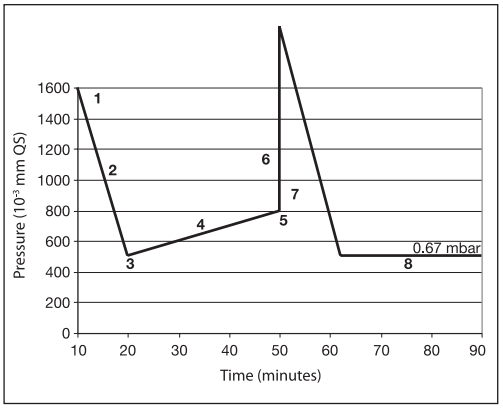
2. After the leak check, if possible, a two-ended evacuation should be carried out using a vacuum pump to 0.67 mbar (abs.)

   It is recommended that you use coupling lines with a large through-put and that you connect them to the service valves.

3. Once a vacuum of 0.67 is reached, the system is separated from the vacuum pump. During the next 30 minutes, the system must not rise. If the pressure rises quickly, the system has a leak.

   A new leak check and evacuation (after 1) must be carried out. If the pressure rises slowly, this is an indication that humidity is present. If this is the case, perform a new evacuation (after 3).

4. Open the service valves of the condensing unit and break the vacuum with nitrogen. Repeat procedures 2 and 3.



General information:
The compressor should only be switched on if the vacuum has been broken.

For compressor operation with a vacuum in the compressor housing, there is a risk of voltage spark-over in the motor winding.

Exceeding the max. allowable operational filling capacity and setting up outdoors

If the refrigerant is filled beyond the max. allowable operational filling capacity or when setting up outdoors, protective precautions must be taken.

You can find the max. allowable operational filling capacities in the technical information and/or installation instructions for the Danfoss compressors. If there are any questions, your local Danfoss sales company will be glad to assist you.

One quick and easy solution for preventing refrigerant displacements during the shut-down phases is the use of a crankcase heater.

Exceeding the max. allowable operational filling capacity and setting up outdoors
(continued)

For Danfoss condensing units that are equipped with 1-cylinder compressors, types TL, FR, NL, GS, SC and SC TWIN, following size of crankcase heaters can be used:

- Crankcase heater for TL/FR/NL 35 W, order no. 118U0050
- Crankcase heater for GS, SC and SC-TWIN 55 W, order no. 118U0051

Housing heaters must be mounted directly above the welded seam. For TWIN compressors, both compressors must have a housing heater. The electrical connection can be carried out as follows:

For activated main switches, the change-over contact of the regulating thermostat (e.g. KP 61) takes over the switching function, i.e. compressor off – heater on, and vice versa. The housing heater should also be switched on approx. 2–3 hours before startup after a long down-time of the cooling system.
For setting up the condensing units outdoors, it is generally recommended to use housing heaters. Please observe the following wiring recommendations.

The Danfoss condensing units with hermetic 1, 2 or 4-cylinder Maneurop® reciprocating piston compressors MTZ and NTZ come standard equipped with a self-regulating PTC 35 W crankcase heater.

The self-regulating PTC heater protects against refrigerant displacement during the shutdown phase. However, reliable protection is only afforded when the oil temperature is 10 K above the saturation temperature of the refrigerant.

It is advisable to check by means of tests that a sufficient oil temperature is reached for both low and high ambient temperatures.

For condensing units that are set up outdoors and exposed to low ambient temperatures or for cooling applications with larger amounts of refrigerant, an additional belt crankcase heater is often required for the compressor.

The heater should be mounted as close to the oil sump as possible in order to ensure efficient transfer of heat to the oil. Belt crankcase heaters are not self-regulating.

The regulating is supposed to be achieved by the heater being switched on when the compressor is stopped and switched off when the compressor is running.

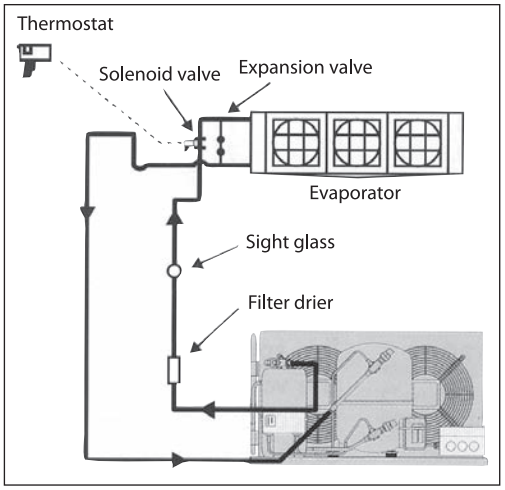
These measures prevent the refrigerant from condensing in the compressor. You must observe that the crankcase heater is switched on at least 12 hours prior to the compressor start-up whenever the condensing units are being restarted after a long down-time.

"Pump-down"

If it is not possible to keep the oil temperature at 10 K over the saturation temperature of the refrigerant using the crankcase heater during compressor down-time or when liquid refrigerant flows back, a pump-down process on the low pressure end must be used to prevent the further possibility of refrigerant displacement during shutdown phases.

The solenoid valve in the liquid line is controlled by a thermostat. If the solenoid valve closes, the compressor provides suction on the low pressure end until the low pressure switch switches off the compressor at the set switching point.

With "pump-down", the activation point of the low pressure switch must be set lower than the saturation pressure of the refrigerant at the lowest ambient temperature of the condensing unit and the evaporator.



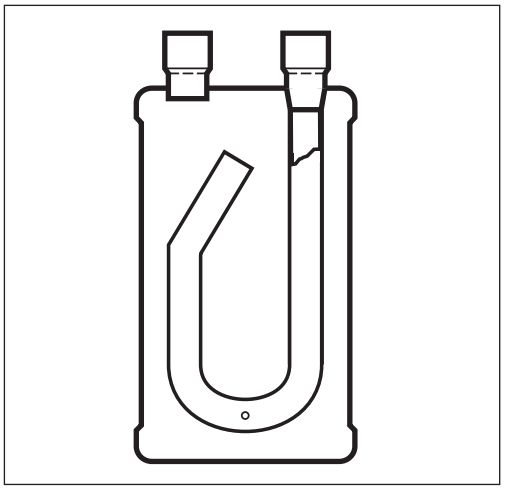
A liquid separator provides protection against refrigerant displacement at the start-up, during operation or after the hot gas defrosting process.

The liquid separator protects against refrigerant displacement during the shut-down period while the internal free volume of the suction end of the system is increased.

The liquid separator should be laid out according to the manufacturer's recommendations.

As a rule, Danfoss recommends that the holding capacity of the liquid separator not be less than 50% of the entire system's filling capacity.

A liquid separator should not be used in systems with zeotropic refrigerants such as R407C, for example.



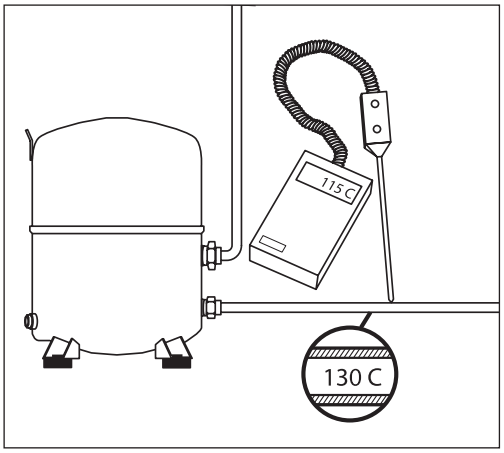
Max. allowable temperatures

For the Danfoss condensing units with 1-cylinder compressors (types TL, FR, NL, GS, SC and SC TWIN), the evaporator superheat (measured at the sensor of the expansion valve meaning the temperature at pressure gauge) should be between 5 and 12 K.

The max. return gas temperature is measured at the compressor intake: 45°C. Impermissibly high intake gas over-heating leads inevitably to a quick rise in the discharge temperature.

This must not exceed 135°C for the SC compressor and 130°C for the TL, NL and FR compressors.

The pressure tube temperature is measured 50 mm away from the pressure connector of the compressor.



For condensing units with hermetic Maneurop® reciprocating piston compressors MTZ and NTZ, the evaporator superheat (E-valve sensor) should be between 5 and 12 K.

The max. return gas temperature, measured at the compressor suction connector is 30°C.

Impermissibly high intake gas superheat inevitably leads to a rapid rise in the pressure gas temperature, the maximum value of which must not be exceeded (130°C).

For special applications (multi-evaporator systems), the use of an oil separator is recommended in the pressure line.

Introduction

These notes pertain to Danfoss packaged condensing units used for refrigeration systems. They provide necessary information regarding safety and proper usage of this product.

The condensing unit includes following:

- Microchannel condenser (Optyma Plus™ New Generation & Optyma™ Slim Pack)
- Fin and tube condenser (Optyma Plus™)
- Reciprocating or scroll compressor
- Receiver with stop valve
- Ball valves
- Sight glass
- High & low pressure switches
- Filter drier
- Electronic controller (only Optyma Plus™ New Generation)
- Main circuit breaker (Main switch with overload protection)
- Fan and compressor capacitors
- Compressor contactor
- Robust weather proof housing

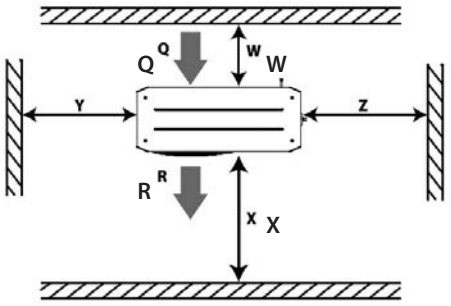
Handling and storage

- Store and transport the unit in an upright position.

Installation precautions

- Ensure adequate space around the unit for air circulation and to open doors.
- Avoid installing the unit in aggressive and dusty environments.
- Ensure a foundation with horizontal surface (less than 3° slope), strong and stable enough to carry the entire unit weight and to eliminate vibrations and interference.
- Ensure that the power supply corresponds to the unit characteristics (see nameplate).
- When installing units for HFC refrigerants, use equipment specifically reserved for HFC refrigerants which was never used for CFC or HCFC refrigerants.
- Use clean and dehydrated refrigeration-grade copper tubes and silver alloy brazing material.
- Use clean and dehydrated system components.
- The suction piping connected to the compressor must be flexible in 3 dimensions to dampen vibrations. Furthermore piping has to be done in such a way that oil return for the compressor is ensured and the risk of liquid slug over in compressor is eliminated.

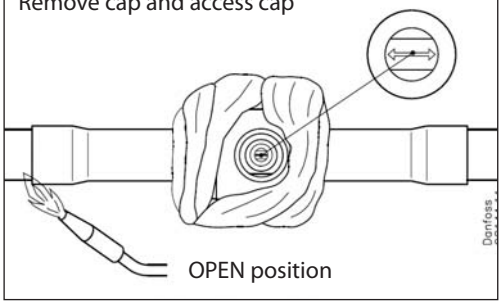
Minimum mounting distances



Q: AIR in **R:** AIR inout

Unit	W (mm)	X (mm)	Y (mm)	Z (mm)
Housing 1 (Code nº 114X31 -- or 114X41 --)	250	550	456	456
Housing 2 (Code nº 114X32 -- or 114X42 --)	250	650	530	530
Housing 3 (Code nº 114X33 -- or 114X43 --)	250	760	581	581
Housing 4 (Code nº 114X31 -- or 114X41 --)	250	900	700	700

Remove cap and access cap

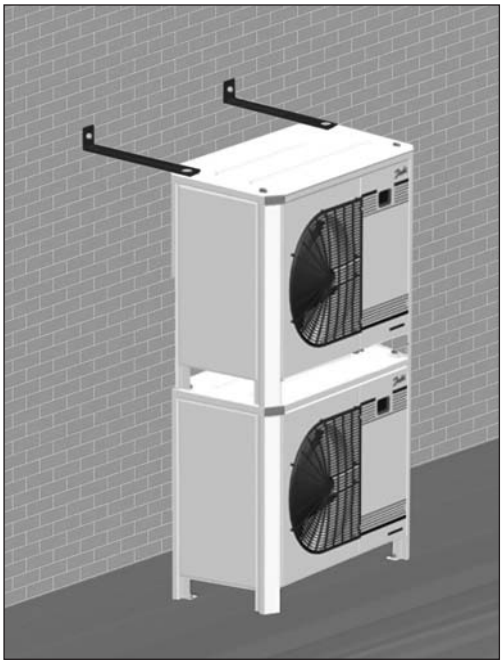


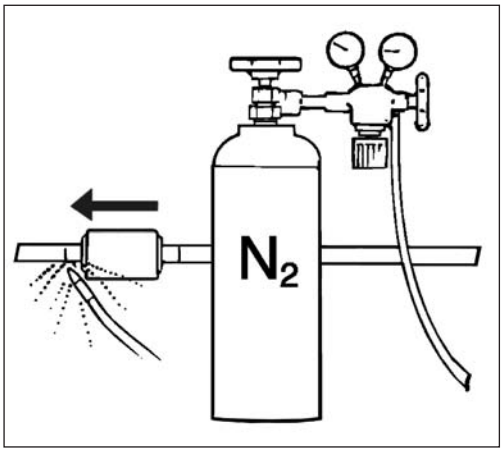
Installation

- The installation in which the condensing unit is installed must comply to EEC Pressure directive (PED) nr. 97/23/EC.
  The condensing unit itself is not a "unit" in the scope this directive.
- It is recommended to install the unit on rubber grommets or vibration dampers (not supplied).
- It is possible to stack units on top of each other (only Optyma Plus™ New Generation).

  Unit maximum stacking
  Housing 1
  (Code no. 114X31-- or 114X41--) → 3
  Housing 2
  (Code no. 114X32-- or 114X42--) → 2
  Housing 3
  (Code no. 114X33-- or 114X43--) → 2
  Housing 4
  (Code no. 114X34-- or 114X44--) → no stacking

- When stacking, the topmost unit must be secured to the wall.
- Slowly release the nitrogen holding charge through the schrader port.
- Connect the unit to the system as soon as possible to avoid oil contamination from ambient moisture.
- Avoid material entering into the system while cutting tubes. Never drill holes where burrs cannot be removed.
- Braze with great care using state-of-the-art technique and vent piping with nitrogen gas flow.
- Connect the required safety and control devices. When the schrader port is used for this, remove the internal valve.
- It is recommended to insulate the suction pipe up to the compressor inlet with 19 mm thick insulation.

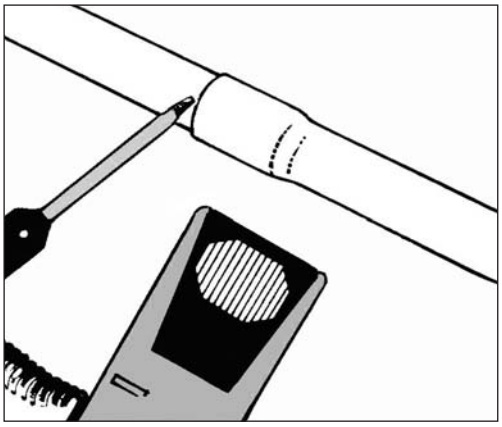




Leak detection

Never pressurize the circuit with oxygen or dry air. This could cause fire or explosion.

- Do not use dye for leak detection
- Perform a leak detection test on the complete system
- The maximum test pressure is 32 bar.
- When a leak is discovered, repair the leak and repeat the leak detection.



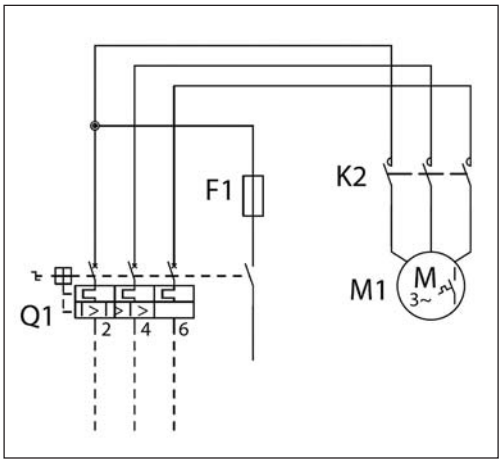
Vacuum dehydration

Never use the compressor to evacuate the system Connect a vacuum pump to both the LP & HP sides.

- Pull down the system under a vacuum of 500 µm Hg (0.67 mbar) absolute.
- Do not use a megaohmmeter nor apply power to the compressor while it is under vacuum as this may cause internal damage.

Electrical connections

- Switch off and isolate the main power supply.
- Ensure that power supply can not be switched on during installation.
- All electrical components must be selected as per local standards and unit requirements.
- Refer to wiring diagram for electrical connections details.
- Ensure that the power supply corresponds to the unit characteristics and that the power supply is stable (nominal voltage ±10% and nominal frequency ±2,5 Hz)
- Dimension the power supply cables according to unit data for voltage and current.
- Protect the power supply and ensure correct earthing.
- Make the power supply according to local standards and legal requirements
- Optyma Plus™ New Generation is equipped with an electronic controller. The controller is regulating fan speed and crankcase heater.
- The unit is equipped with a main switch with overload protection. The overload protection is factory preset but it is recommended to check the value before taking the unit in operation. The value for the overload protection can be found in the wiring diagram in the front door of the unit.
- The unit is equipped with high and low pressure switches, which directly cut the power supply to the compressor in case of activation.
- Parameters for high and low pressure cut outs are preset in the controller, adapted to the compressor installed in the unit (Optyma Plus™ New Generation)
- For units with a 3-phase scroll compressor (OPMPUxxxxxxxE), correct phase sequence for compressor rotation direction shall be observed.
- Determine the phase sequence by using a phase meter in order to establish the phase orders of line phases L1, L2 and L3.
- Connect line phases L1, L2 and L3 to main switch terminals T1, T2 and T3 respectively.



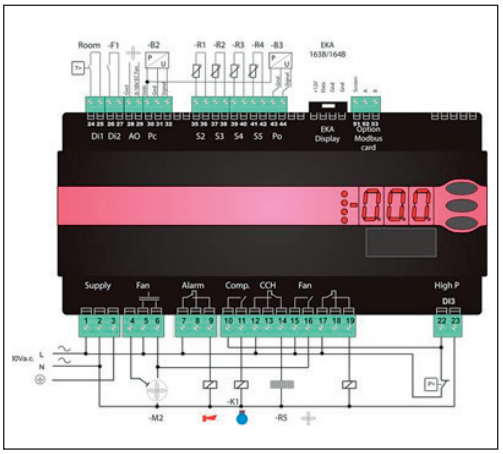
Filling the system

- Never start the compressor under vacuum. Keep the compressor switched off.
- Use only the refrigerant for which the unit is designed for.
- Fill the refrigerant in liquid phase into the condenser or liquid receiver. Ensure a slow charging of the system to 4 – 5 bar for R404A and approx. 2 bar for R134a.
- The remaining charge is done until the installation has reached a level of stable nominal condition during operation.
- Never leave the filling cylinder connected to the circuit.

Setting the electronic controller

(only Optyma Plus™ New Generation)

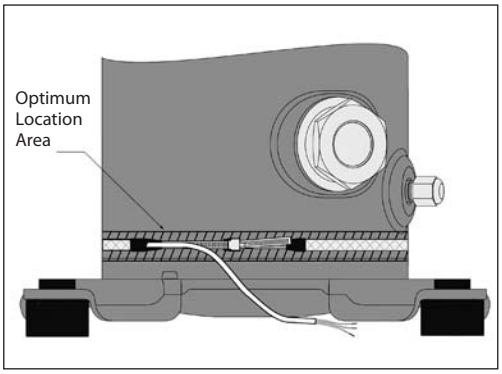
- The unit is equipped with an electronic controller which is factory programmed with parameters for use with the actual unit.
- By default, the electronic controller display shows the temperature value for the suction pressure in °C. To show the temperature value for the condensing pressure, push the lower button.
  The electronic controller is factory preset for operation with refrigerant R404A. If another refrigerant is used, the refrigerant setting must be changed. Parameter r12 must be set to 0 before (software main switch = off).
- Push the upper button for a couple of seconds. The column with parameter codes appears.
- Push the upper or lower button to find parameter code o30.
- Push the middle button until the value for this parameter is shown.
- Push the upper or lower button to select the new value: 2 = R22, 3 = R134a, 13 = User defined, 17 = R507, 19 = R404A, 20 = R407C.
- Push the middle button to confirm the selected value.



Verification before commissioning

Use safety devices such as safety pressure switch and mechanical relief valve in compliance with both generally and locally applicable regulations and safety standards. Ensure that they are operational and properly set. Check that the settings of high-pressure switches and relief valves don't exceed the maximum service pressure of any system component.

- Verify that all electrical connections are properly fastened and in compliance with local regulations.
- When a crankcase heater is required, the unit must be energized at least 12 hours before initial start-up and start-up after prolonged shutdown for belt type crankcase heaters.
- The unit is equipped with a main switch with overload protection. Overload protection is preset from factory, but it is recommended to check the value before taking the unit in operation. The overload protection value can be found in the wiring diagram in the unit front door.

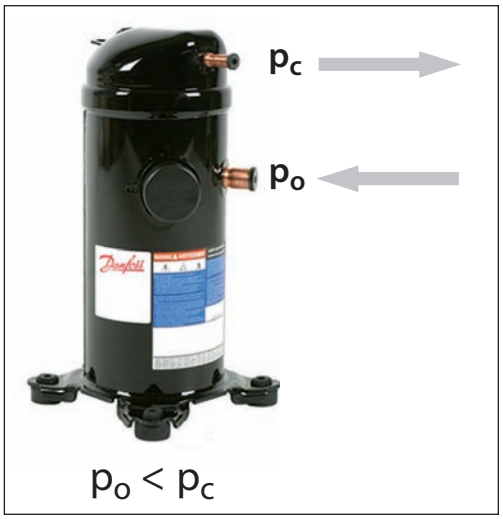


Start-up

- Never start the unit when no refrigerant is charged.
- All service valves must be in the open position.
- Check compliance between unit and power supply.
- Check that the crankcase heater is working.
- Check that the fan can rotate freely.
- Check that the protection sheet has been removed from the backside of condenser.
- Balance the HP/LP pressure.
- Energize the unit. It must start promptly. If the compressor does not start, check wiring conformity and voltage on terminals.

Only for scroll compressors:

- Eventual reverse rotation of a 3-phase compressor can be detected by following phenomena; the compressor doesn't build up pressure, it has abnormally high sound level and abnormally low power consumption. In such case, shut down the unit immediately and connect the phases to their proper terminals.
- If the rotation direction is correct the low pressure indication on the controller (or low pressure gauge) shall show a declining pressure and the high pressure indication (or high pressure gauge) shall show an increasing pressure.



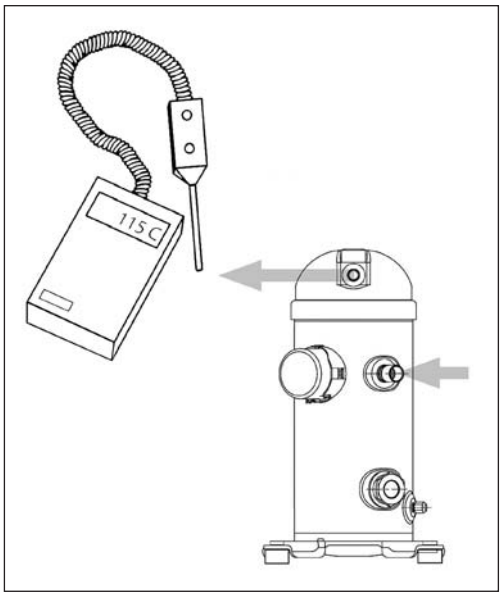
Check with running unit

- Check the fan rotation direction. Air must flow from the condenser towards the fan.
- Check current draw and voltage.
- Check suction superheat to reduce risk of slugging.
- When a sight glass is provided observe the oil level at start and during operation to confirm that the oil level remains visible.
- Respect the operating limits.
- Check all tubes for abnormal vibration. Movements in excess of 1.5 mm require corrective measures such as tube brackets.
- When needed, additional refrigerant in liquid phase may be added in the low-pressure side as far as possible from the compressor. The compressor must be operating during this process.
- Do not overcharge the system.
- Never release refrigerant to atmosphere.
- Before leaving the installation site, carry out a general installation inspection regarding cleanliness, noise and leak detection.
- Record type and amount of refrigerant charge as well as operating conditions as a reference for future inspections.

Maintenance part 1

Always switch off the unit at main switch before opening the fan door (s).
Internal pressure and surface temperature are dangerous and may cause permanent injury. Maintenance operators and installers require appropriate skills and tools. Tubing temperature may exceed 100°C and can cause severe burns.
Ensure that periodic service inspections to ensure system reliability and as required by local regulations are performed.
To prevent system related problems, following periodic maintenance is recommended:

- Verify that safety devices are operational and properly set.
- Ensure that the system is leak tight.
- Check the compressor current draw.
- Confirm that the system is operating in a way consistent with previous maintenance records and ambient conditions.
- Check that all electrical connections are still adequately fastened.



Maintenance part 2

- Keep the unit clean and verify the absence of rust and oxidation on the unit components, tubes and electrical connections.
  The condenser must be checked at least once a year for clogging and be cleaned if deemed necessary. Access to the internal side of the condenser takes place through the fan door or fan panel. Microchannel coils tend to accumulate dirt on the surface rather than inside, which makes them easier to clean than fin-&-tube coils.
- Switch off the unit at main switch before opening the fan door or removing fan panel.
- Remove surface dirt, leaves, fibres, etc. with a vacuum cleaner, equipped with a brush or other soft attachment. Alternatively, blow compressed air through the coil from the inside out (only at Microchannel condensers – at fin and tube condensers blow according to the original air flow direction), and brush with a soft bristle.
  Do not use a wire brush. Do not impact or scrape the coil with the vacuum tube or air nozzle.
- Before closing the fan door, turn the fan blade in the right position to avoid that the door hits the fan.
  If the refrigerant system has been opened, the system has to be flushed with dry air or nitrogen to remove moisture and a new filter drier has to be installed. If evacuation of refrigerant has to be done, it shall be done in such a way that no refrigerant can escape to the environment.