LENNOX
EMEA

INSTALLATION, OPERATING AND MAINTENANCE

R410A

WALL MOUNTED PACKAGED INDOOR UNIT

@DNOVA

THN

2,5 - 38 kW

ADNOVA-THN_R410A-IOM-1506-E

www.lennoxemea.com

LENNOX

1 General Description

THND/U “Lennox Telecom units” are air conditioners for low- and medium-powered telephone exchanges. They are designed to be mounted inside shelter.

THND/U air conditioners are direct expansion package units with an air-cooled condenser system. They are distinguished by an innovative air circulation system which significantly enhances performance in all operating conditions.

1.1 Structure

All THND/U units have a galvanised sheet steel supporting base, and enclosing panels made galvanised sheet steel coated with epoxy polyester powder paint oven cured at 180°C (RALxxxx). The unit features an exclusive design which, combined with a rational layout of components and extremely compact dimensions, lends it an attractive appearance.

1.2 Field of application

THND/U units are to be used within the operating limits stated in this manual; failure to comply with said limits will invalidate the warranties provided in the contract of sale (see Tab. 1)

Tab. 1 Operating limis

Model	THND/U/X 045	THND/U/X 056	THND/U/X 073	THND/U/X 090	THND/U/X 105	THND/U/X 120	THND/U/X 150
Power supply	230Vac 10% 24Vdc 16% / 48Vdc 16%			400Vac 10% / 3Ph + N / 50Hz 24Vdc 16% / 48Vdc 16%			
Minimum outdoor temperature T	- 20 °C						
Maximum outdoor temperature T	45 °C	45 °C	45 °C	47,0 °C	45,0 °C	46,0 °C	48,0 °C
Minimum indoor temp./humidity conditions	19 °C / 30 % U.R.						
Maximum indoor temp./humidity conditions	35 °C / 50 % U.R.						
Storage conditions	-10 °C / 90 % U.R. +55 °C / 90 % U.R.						

Model	THND/U/X 170	THND/U/X 180	THND/U/X 200	THND/U/X 220	THND/U/X 250
Power supply	400Vac 10% / 3Ph + N / 50Hz				
Minimum outdoor temperature T	- 20 °C				
Maximum outdoor temperature T	45 °C	46 °	45 °C	46,0 °C	46,0 °C
Minimum indoor temp./humidity conditions	19 °C / 30 % U.R.				
Maximum indoor temp./humidity conditions	35 °C / 50 % U.R.				
Storage conditions	-10 °C / 90 % U.R. +55 °C / 90 % U.R.				

1.3 Cooling circuit

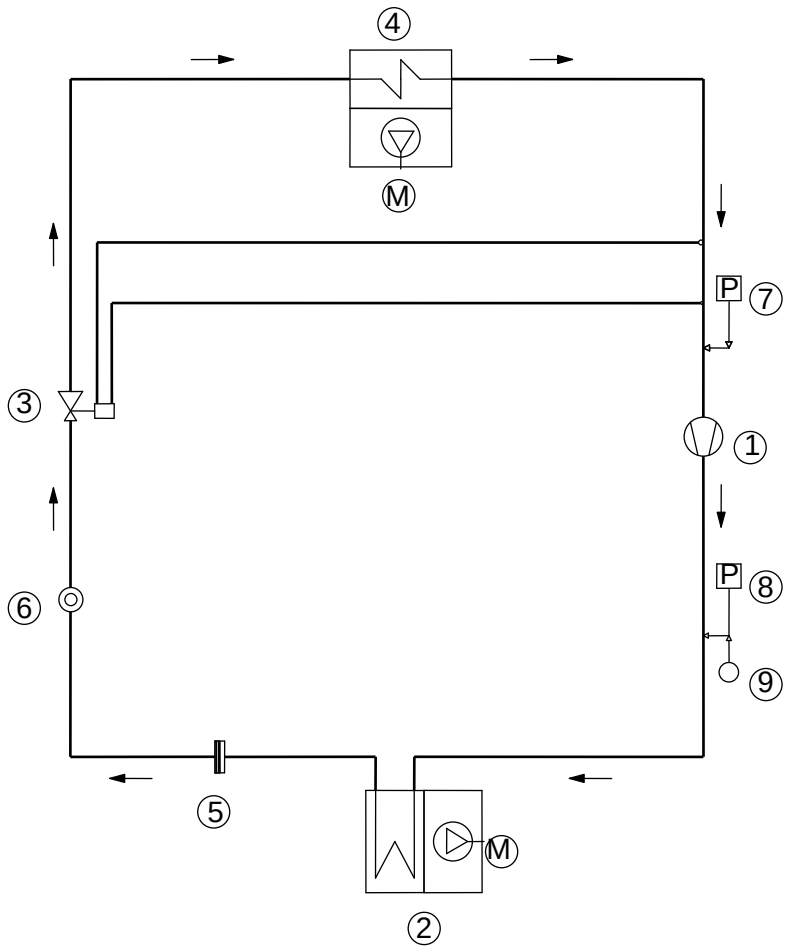
The entire cooling circuit is built in the Lennox factory using only components of the finest quality brands and processes conforming to the specifications of Directive 97/23 for brazing and testing.

- Compressors: only scroll-type compressors of leading international manufacturers are used in the THND/U/X units. Today scroll compressors represent the best solution in terms of reliability, efficiency and MTBF.
- Cooling components:
  - Molecular mesh activated-alumina filter dryer
  - Flow indicator with humidity indicator. Indications are provided directly on the sight glass.
  - Thermostatic valve with external equalization and integrated MOP function.
  - High and low pressure switches
  - Schrader valves for checks and/or maintenance
- Electric control board: The electric control board is constructed and wired in accordance with Directives 73/23/EEC and 89/336/EEC and related standards. The board may be accessed through a door after the main switch has been put off. All the remote controls use 24 V signals powered by an insulating transformer situated on the electric control board. **NOTE**: the mechanical safety devices such as the high pressure switch are of the kind that trigger directly; their efficiency will not be affected by any faults occurring in the microprocessor control circuit, in compliance with 97/23 PED.

- Control microprocessor: the microprocessor built into the unit allows the different operating parameters to be controlled from a set of pushbuttons situated on the electric control board;
  - Switching on/off of compressor to maintain the temperature set point T inside the shelter
  - Alarm management
    - High / low pressure
    - Dirty filters alarm
    - Air flow alarm
  - Alarm signalling
  - Display of operating parameters
  - RS232, RS485 serial output management (optional)
  - Phase sequence error [Not displayed by the mP, but prevents the compressor from starting up]

  [see microprocessor control manual for further details, also in relation to particular customer specifications]

Fig. 1 Basic cooling circuit



1	Compressor
2	Condenser
3	Thermostatic valve
4	Evaporator
5	Filter dryer
6	Sight glass
7	Low pressure switch
8	High pressure switch
9	Condensing pressure probe

1.4 Installation warnings

General rules

- When installing or servicing the unit, you must strictly follow the rules provided in this manual, comply with the directions on the units themselves and take all such precautions as are necessary.
- The fluids under pressure in the cooling circuit and the presence of electrical components may cause hazardous situations during installation and maintenance work.

All work on the unit must be carried out by qualified personnel only, trained to do their job in accordance with current laws and regulations

- Failure to comply with the rules provided in this manual or any modification made to the unit without prior authorisation will result in the immediate invalidation of the warranty.

Warning: Before performing any kind of work on the unit, make sure it has been disconnected from the power supply.

2 Inspection / Transport / Positioning

2.1 Inspection on receipt

On receiving the unit, check that it is perfectly intact: the unit left the factory in perfect conditions; immediately report any signs of damage to the carrier and note them on the Delivery Slip before signing it. Lennox or its Agent must be promptly notified of the entity of the damage. The Customer must submit a written report describing every significant sign of damage.

2.2 Lifting and Transport

While the unit is being unloaded and positioned, utmost care must be taken to avoid abrupt or violent manoeuvres. The unit must be handled carefully and gently; avoid using machine components as anchorages or holds and always keep it in an upright position. The unit should be lifted using the pallet it is packed on; a transpallet or similar conveyance means should be used

Warning: In all lifting operations make sure that the unit is securely anchored in order to prevent accidental falls or overturning.

2.3 Unpacking

The packing must be carefully removed to avoid the risk of damaging the unit. Different packing materials are used: wood, cardboard, nylon etc. It is recommended to keep them separately and deliver them to suitable waste disposal or recycling facilities in order to minimise their environmental impact.

2.4 Positioning

Bear in mind the following aspects when choosing the best site for installing the unit and the relative connections:

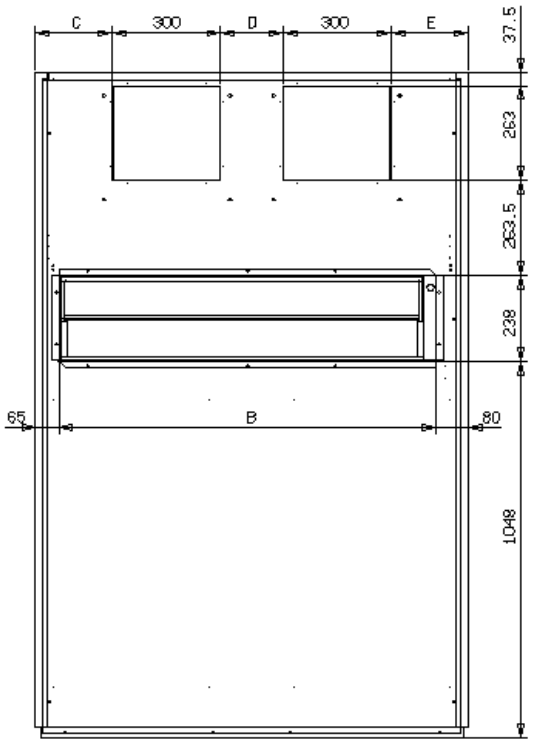
- positioning and dimensions of the coupling flanges;
- location of power supply;
- solidity of the supporting wall;

It is recommended to first prepare holes in the wall for passing through the power cables, for the air intake and outlet flanges and for the screw anchors that will secure the unit on the wall.

The dimensions of the air outlet/intake flanges and the positions of the holes for the screw anchors and power cables are shown Fig. 2:

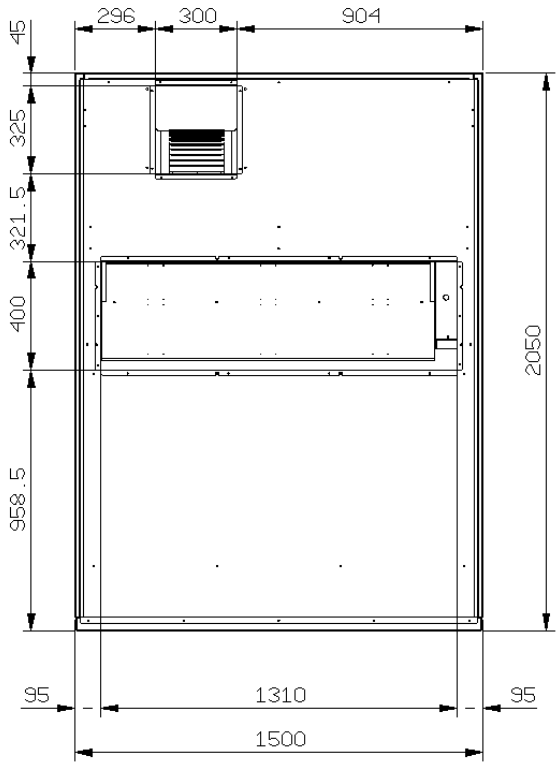
Fig. 2

THND/X 045...170 (rear view)

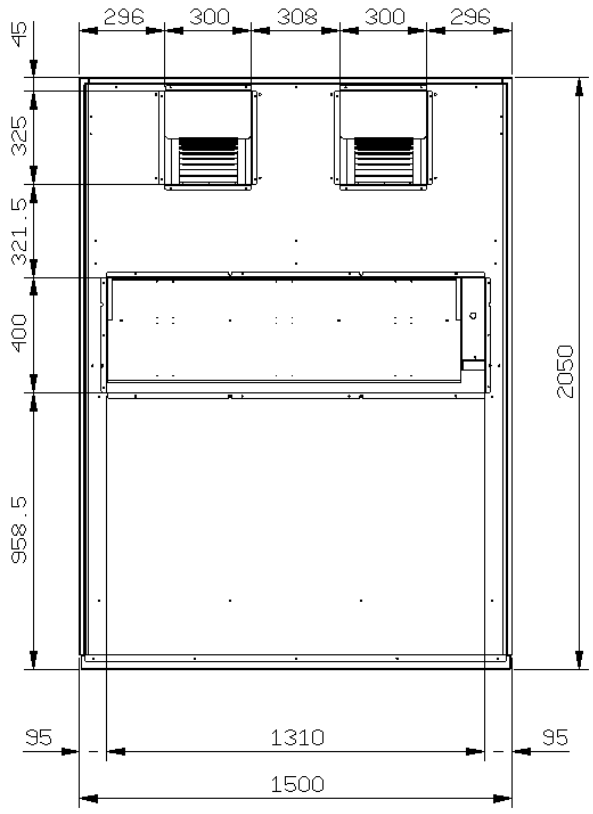


	A	B	C	D	E
HTD 045-073	800	655	250	250	/
HTD 090-120	1000	855	135	130	135
HTD 150-170	1160	1015	150	260	150

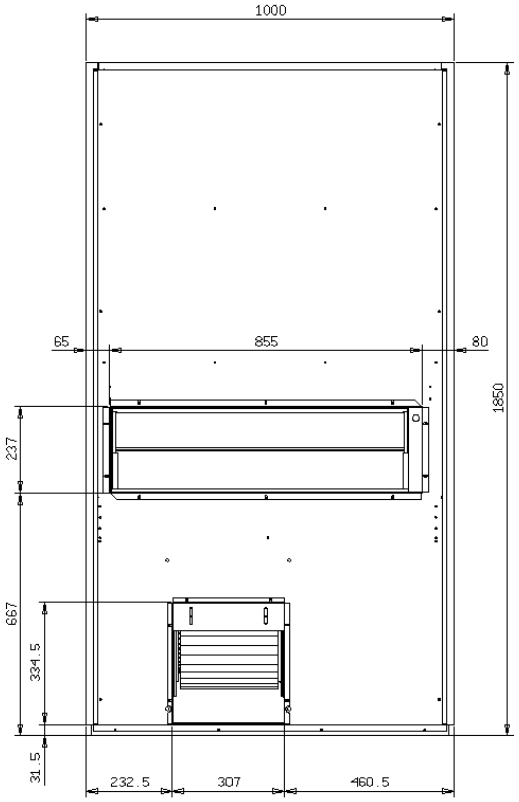
THND/X180-200 (rear view)



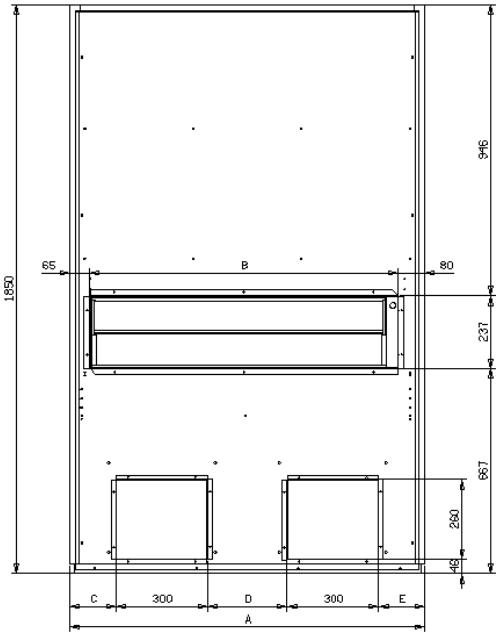
THNU220-250 (rear view)



THNU090..120 (rear view)

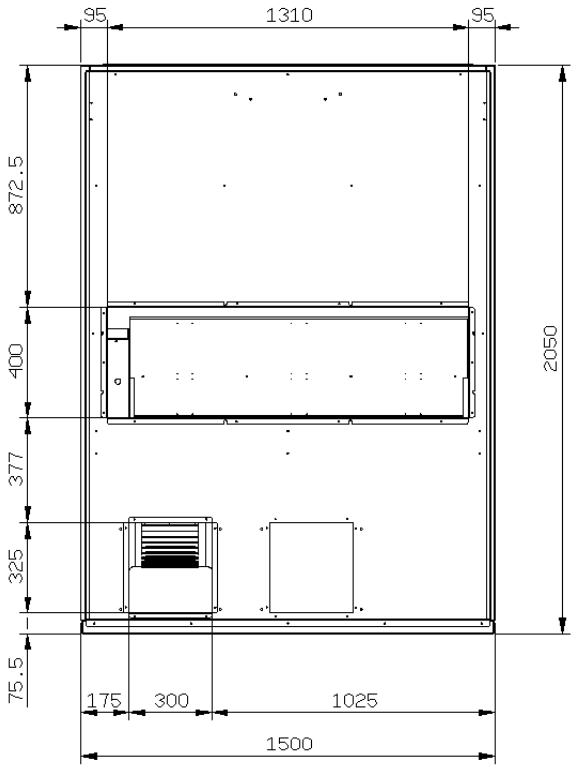


THNU045..073 – 150-170

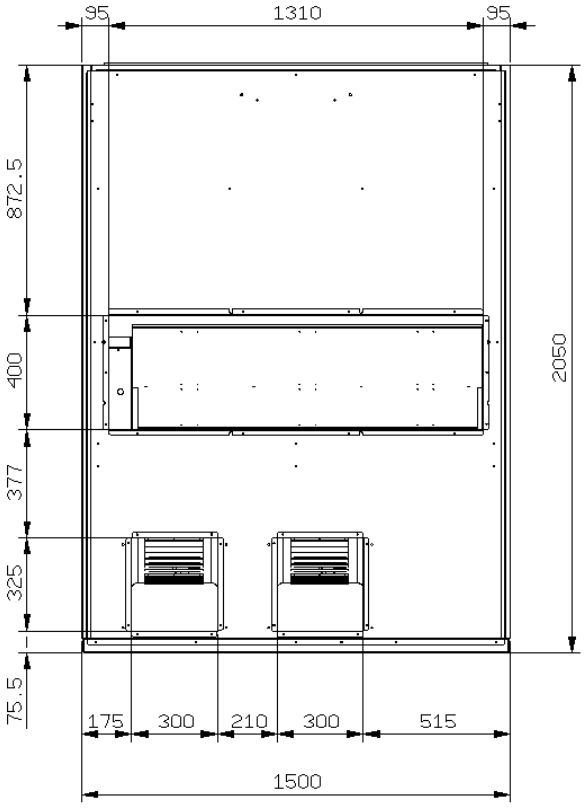


	A	B	C	D	E
HTU 045-073	800	655	250	250	/
HTU 150-170	1160	1015	150	260	150

THNU180-200



THNU220-250



3 Installation

The THND/U/X package air-conditioning unit is suitable for all environments except aggressive ones. Do not place any obstacles near the units and make sure that the air flow is not impeded by obstacles and/or situations causing back suction.

The following steps should be carried out to ensure proper installation

- Apply a vibration-damping rubber lining between the unit and wall
- Position the unit on the wall, fitting the air outlet and intake flanges correctly into place
- carefully seal the entire perimeter of the unit on the interior wall of the shelter and the air intake and outlet flanges on the inside.
- In order to obtain stable indoor conditions, make sure that the shelter interior is insulated from the outside; any openings should be sealed closed

The recommended sizes for the power cables and emergency line are indicated in the attached electrical scheme.

4 Evacuation and Charging Operations

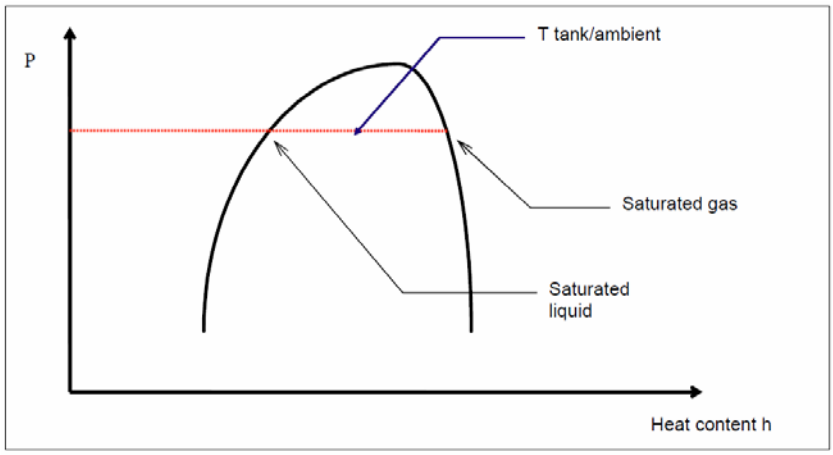
This type of work must be carried out by qualified personnel only trained to do their job in accordance with current laws and regulations.

4.1 Introduction

The simultaneous presence of liquid and vapor makes it necessary for both to be in a state of saturation (Gibbs law), as shown in Fig. 3. In conditions of thermal equilibrium, the pressure in the tank corresponds to the T of the surrounding environment;
a withdrawal of refrigerant charge will cause pressure drops, which will be associated with:

- withdrawal of refrigerant charge: . . . . . pressure drop in tank
- pressure drop in tank: . . . . . T drop change of state
- T drop change of state: . . . . . .evaporation of part of the liquid, causing the liquid itself to cool
- cooling of liquid: . . . . . thermal exchange with ambient air, further evaporation of remaining liquid; the original pressure is restored in the tank after a certain amount of time

Fig. 3 Diagramma legge di Gibbs

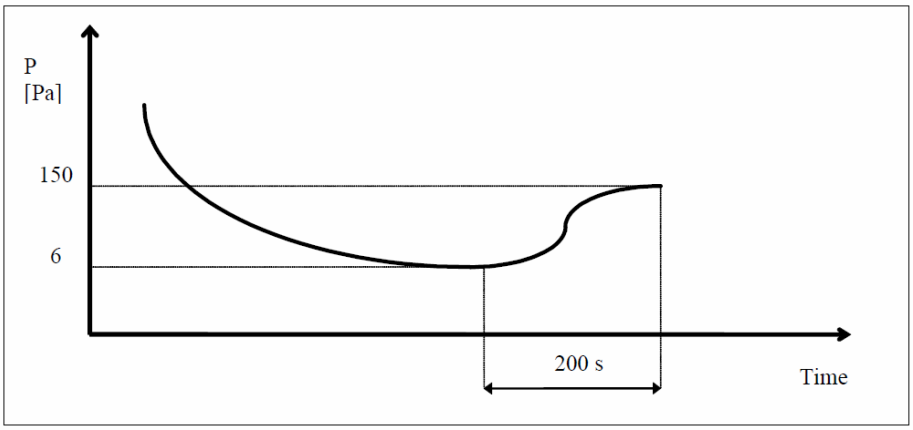


4.2 Vacuum and charging machine

Vacuum cycle

In general it is preferable to apply a “long” rather than “hard” vacuum: reaching low pressures too abruptly may in fact cause any trapped humidity to evaporate instantaneously, thereby freezing part of it.

Fig. 4 Vacuum cycle diagram

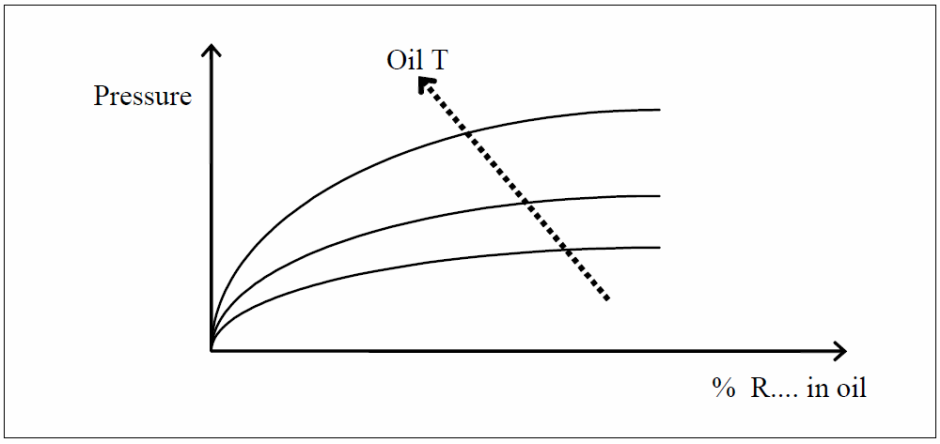


The Fig. 4 represents a vacuum cycle and an optimal subsequent pressure rise for the refrigeration devices we manufacture. As a rule, if there is suspicion of an extensive presence of humidity throughout the circuit or system as a whole, the vacuum must be “broken” with anhydrous nitrogen and then the steps must be repeated as described; this operation facilitates the removal of trapped and/or frozen humidity during the evacuation process.

4.3 Evacuating a circuit “contaminated” with refrigerant

The first step is to remove the refrigerant from the circuit using a specific machine with a dry compressor for recovering the refrigerant. Refrigerants all tend to dissolve in oil (compressor sump) in percentages that are directly proportional to increases in pressure and decreases in the T of the oil itself --- Charles’ Law --- (see Fig. 5).

Fig. 5 Charles’ law diagram



The release of refrigerant tends to cool the oil and thus actually serves to oppose the release itself: for this reason, it is advisable to switch on the crankcase heating elements, if available, during the evacuation process. If a high % of refrigerant gets into contact with the Pirani gauge (vacuum sensor), it may “drug” the sensitive element of the latter, rendering it inefficient for a certain period of time. For this reason, if no machine for recovering refrigerant is available, it is nonetheless advisable to switch on the crankcase heating elements and avoid applying a vacuum until the circuit has been adequately purged of refrigerant: the refrigerant may in fact solubilize in the oil of the vacuum pump, undermining its performance for a long time (hours).

4.4 Charging positions (single point)

The best position for charging the air conditioners is the section between the thermostatic valve and the evaporator; care should be taken to avoid fixing the thermostat bulb until the operation is complete: this is important to ensure that the valve orifice remains open so as to allow the passage of refrigerant also toward the condenser/receiver.
If possible, avoid the inflow of refrigerant into the compressor as this may cause excessive dilution of the lubricant; in any case, first check the compatibility between the crankcase capacity and the required charge volumes.

5 Electrical Connections

5.1 Generalities

Before carrying out any job on electrical parts, make sure the power supply is disconnected.

Check that the mains electricity supply is compatible with the specifications (voltage, number of phases, frequency) shown on the unit rating plate. The power connection for single-phase loads is to be made with a three-pole cable and “N” wire at the centre of the star (optional: power supply w/o neutral).

The size of the cable and line protections must conform to the specifications provided in the wiring diagram.

The supply voltage may not undergo fluctuations exceeding ±5% and the unbalance between phases must always be below 2%.

The above operating conditions must always be complied with: failure to ensure said conditions will result in the immediate invalidation of the warranty.

The electrical connections must be made in accordance with the information shown in the wiring diagram provided with the unit and with current and local regulations. An earth connection is mandatory. The installer must connect the earth wire using the earth terminal situated on the electric control board (yellow and green wire). The power supply to the control circuit is taken from the power line through an insulating transformer situated on the electric control board. The control circuit is protected by suitable fuses or automatic breakers depending on the unit size.

6 Starting Up

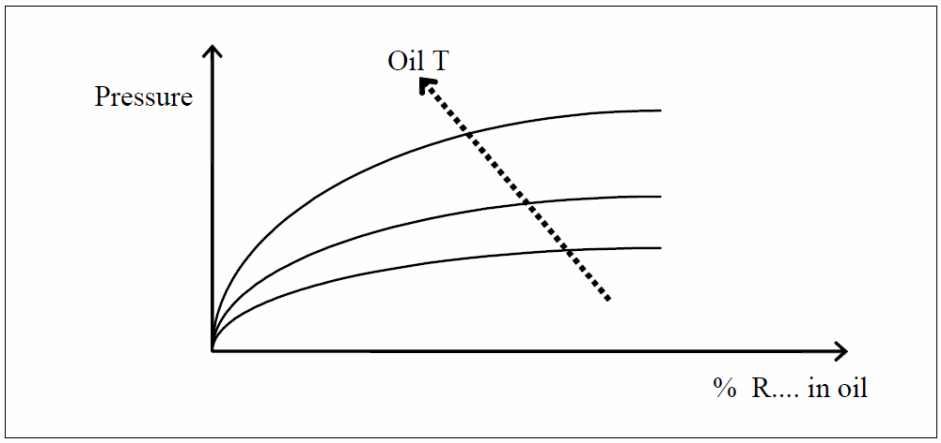
6.1 Preliminary checks

- Check that the electrical connections have been made properly and that all the terminals **are securely tightened**. This check should also be included in a periodic six-month inspection.
- Check that the voltage at the RST terminals is 400 V ± 5%and make sure the yellow indicator light of the phase sequence relay is on. The phase sequence relay is positioned on the electric control board; if the sequence is not duly observed, it will not enable the machine to start.
- Make sure there are no refrigerant leaks that may have been caused by accidental impacts during transport and/or installation.
- Check the power supply to the crankcase heating elements, where present.

The heating elements must be turned on at least 12 hours before the unit is started. They are automatically activated when the main switch is put on. Their function is to raise the T of the oil in the sump and limit the quantity of refrigerant dissolved in it.

To verify whether the heating elements are working properly, check the lower part of the compressors: it should be warm or in any case at a temperature 10---15 °C higher than the ambient temperature.

Fig. 6 Diagramma legge di Charles



The diagram in Fig. 6 illustrates a specific property of gases (Charles' Law), which are more soluble in liquids as the pressure increases but less soluble as the temperature increases: if the oil in the sump is held at a constant pressure, an increase in temperature will significantly reduce the amount of refrigerant dissolved in it, thus ensuring that the desired lubricating function is maintained.

6.2 Starting up instructions

Electric connections and starting up

- Open electrical panel.
- Disconnect the main switch.
- Inlet cables holes are positioned on the bottom side of the unit
- Connect the power supply and the earth connection to the main switch and to the main earth connection.
- 3 phase versions only. In case of wrong phase sequence, the compressor will start in the opposite direction: scroll compressors have to turn in one only direction. The phase sequence relay is connected in series with the air flow switch, so that if wrong R-S-T occurs an "FL" alarm on mP will appear. In this case disconnect the power supply, reverse two phases before the main switch and restart. NB: the R-S-T phase sequence device is positioned in the left part of the E-Panel: green light means power presence and the yellow light means correct phase sequence; if the yellow light doesn't shine, switch of the main switch and reverse two cables before the main switch.
- Close the panel.
- Press button "ON" on the microprocessor keyboard.

Start up

- Make sure that the air flows normally and the flow switch alarm is not present.
- Press the "ON" button on the mP keyboard:
  - The indoor fan will start immediately
  - After 20 second and if no alarm are present, the compressor will start up. NB: the compressor will start if the indoor conditions are according the set point presetted in the mP.
- Check the air Delta T: it has to be between 7 and 10 °C.
- Check for refrigerant leakage.

6.3 Starting operation

Before starting the unit, turn the main switch on, select the operating mode desired from the control panel and press the ”ON” button on the control panel.

If the unit fails to start up, check if the service thermostat has been set according to the nominal values provided.

You should not disconnect the unit from the power supply during periods when it is inoperative but only when it is to be taken out of service for a prolonged period (e.g. at the end of the season). To turn off the unit temporarily follow the directions provided in the section 4.5.

Checks during operation

- Check the phase sequence relay on the control board to verify whether the phases occur in the correct sequence: if they do not, disconnect the unit from power supply and invert two phases of the incoming three-pole cable.

Never attempt to modify internal electrical connections: any undue modifications will immediately invalidate the warranty.

Checking the refrigerant level

- After a few hours of operation, check whether the liquid level indicator has a green ring: a yellow color indicates the presence of humidity in the circuit. In such a case the circuit must be dehumidified by qualified personnel.
- Large quantities of bubbles should not appear through the liquid level indicator. A constant passage of numerous bubbles may indicate that the refrigerant level is low and needs to be topped up.
- Make sure the overheating of the cooling fluid is limited to between 5 and 8 °C: to this end:
  1) read the temperature indicated by a contact thermometer placed on the compressor intake pipe;
  2) read the temperature indicated on the scale of a pressure gauge likewise connected to the intake side; refer to the pressure gauge scale for the refrigerant R410A.The degree of overheating is given by the difference between the temperatures thus determined.
- Make sure that the Sub-cooling of the cooling fluid is limited to between 3 and 5°C: to this end:
  1) read the temperature indicated by a contact thermometer placed on the condenser outlet pipe;
  2) read the temperature indicated on the scale of a pressure gauge connected to the liquid inlet at the condenser outlet; refer to the pressure gauge scale for the refrigerant R410A, The degree of Sub-cooling is given by the difference between the temperatures thus determined.

Warning: all THND/U units are charged with R410A. Any top-ups must be made using the same type of refrigerant. This operation is to be considered extraordinary maintenance work and must be performed by qualified personnel only.

Warning: the refrigerant R410A requires “POE” polyolester oil of the type and viscosity indicated on the compressor rating plate. For no reason should oil of a different type be introduced into the oil circuit.

7 Setting Operating Parameters

7.1 Generalities

All the control devices are set and tested in the factory before the unit is dispatched. However, after the unit has been in service for a reasonable period of time you can perform a check on the operating and safety devices. The settings are shown in Tab. 3 and Tab. 4.

All servicing of the equipment is to be considered extraordinary maintenance and may be carried out BY QUALIFIED TECHNICIANS ONLY: incorrect settings may cause serious damage to the unit and injuries to persons.

The operating parameters and control system settings configurable by means of the microprocessor control are password protected if they have a potential impact on the integrity of the unit.

Tab. 3 Setting of control devices

Control device		Set point	Differential
Differential air pressure switch (outlet air flow)	Pa	50	30
Differential air pressure switch (dirty filter)	Pa	50	20

Tab. 4 Setting of control devices

Control device		Activation	Differential	Resetting
Maximum pressure switch	Bars-r	42.0	4	Manual
Minimum pressure switch	Bars-r	1.5	1.5	Automatic
Modulating condensation control device	Bars-r	20	6.5	
Time lapse between two compressor starts	s	300	-	-

7.2 Maximum pressure switch

The high pressure switch stops the compressor when the outlet pressure exceeds the set value.

Warning: do not attempt to change the setting of the maximum pressure switch: Should the latter fail to trip in the event of a pressure increase, the pressure relief valve will open.

The high pressure switch must be manually reset; this is possible only when the pressure falls below the set differential (see Tab. 4).

7.3 Minimum pressure switch

The low pressure switch stops the compressor when the inlet pressure falls below the set value for more than 1 seconds. The switch is automatically reset when the pressure rises above the set differential (see Tab. 4).

8 Maintenance

The only operations to be performed by the user are to switch the unit On and Off. All other operations are to be considered maintenance work and must thus be carried out by qualified personnel trained to do their job in accordance with current laws and regulations.

8.1 Warnings

All the operations described in this chapter MUST ALWAYS BE PERFORMED BY QUALIFIED PERSONNEL ONLY..

Before carrying out any work on the unit or accessing internal parts, make sure you have disconnected it from the mains electricity supply.

The upper part and the outlet pipe of the compressor reach high temperatures. Be especially careful when working in the surrounding area with the panels off.

Be especially careful when working in proximity to finned coils since the 0.11 mm thick aluminum fins can cause superficial injuries due to cuts.

After completing maintenance jobs, always replace the panels enclosing the units and secure them while fastening screws provided.

8.2 Generalities

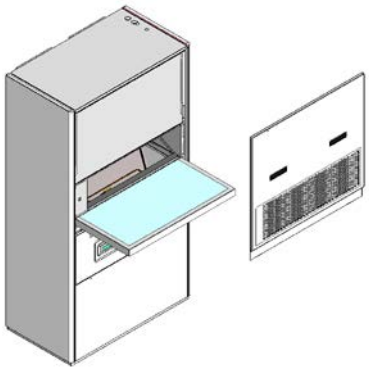
To guarantee a constantly satisfactory performance over time, it is advisable to carry out routine maintenance and checks as described in Tab. 5. The indications below are related to standard tear and wear.

Tab. 5 Routine maintenance

Operation	Frequency
Check the efficiency of all the control and safety devices.	Once a year
Check the terminals on the electric control board and compressor terminal boards to ensure that they are securely tightened. The movable and fixed contacts of the circuit breakers must be periodically cleaned and replaced whenever they show signs of deterioration	Once a year
Check the refrigerant level by means of the liquid level indicator	Every 6 mos.
Check the efficiency of the differential air pressure switch and dirty filter differential pressure switch	Every 6 mos.
Check the condition of the air filter and replace it if necessary	Every 6 mos.
Check the humidity indicator (green=dry, yellow=humid) on the liquid level indicator; if the indicator is not green as shown on the indicator sticker, replace the filter	Every 6 mos.

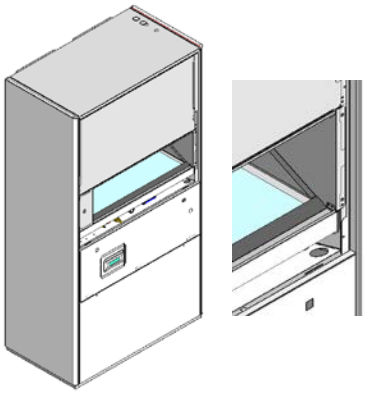
8.3 Inspecting the air filter

1. Remove the panel above the condenser fan to access the damper and air filter compartment.
2. Pull out the air filter.
3. Check the condition of the filter and replace it if necessary

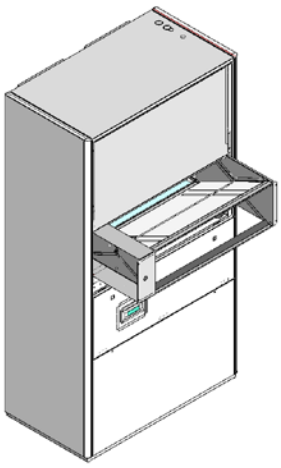


8.4 Inspecting the damper servomotor

1. Remove the panel above the condenser fan
2. Remove the damper fastening screws (see fig. below)



3. Pull out the entire damper section to access the servomotor



8.5 Repairing the cooling circuit

Warning: while performing repairs on the cooling circuit or maintenance work on the compressors, make sure the circuit is left open for as little time as possible. Even if briefly exposed to air, ester oils tend to absorb large amounts of humidity, which results in the formation of weak acids.

If the cooling circuit has undergone any repairs, the following operations must be carried out:

- tightness test;
- evacuation and drying of the cooling circuit;
- charging with refrigerant.

If the system has to be drained, always recover the refrigerant present in the circuit using suitable equipment; the refrigerant should be handled exclusively in the liquid phase.

8.6 Tightness test

Fill the circuit with anhydrous nitrogen supplied from a tank with a pressure---reducing valve until the pressure rises to 22 bars.

During the pressurization phase, do not exceed a pressure of 22 bars on the compressor low pressure side.

The presence of any leaks must be determined using special leak detectors. Should any leaks be detected during the test, empty out the circuit before repairing the leaks with suitable alloys.

Do not use oxygen in the place of nitrogen as a test agent, since this would cause a risk of explosion.

8.7 Hard vacuum and drying of cooling circuit

To achieve a hard vacuum in the cooling circuit it is necessary to use a pump capable of generating a high degree of vacuum, i.e. 150 Pa of absolute pressure with a capacity of approximately 10 m3/h. If such a pump is available, one evacuation will normally suffice to achieve an absolute pressure of 150 Pa. If there is no such vacuum pump available, or whenever the circuit has remained open for long periods of time, you are strongly recommended to adopt the triple evacuation method. This method is also recommended when there is a presence of humidity within the circuit.

The vacuum pump should be connected to the inlets.

The procedure to be carried out is as follows:

- Evacuate the circuit until you reach an absolute pressure of at least 350 Pa: at this point inject nitrogen into the circuit until you reach a relative pressure of about 1 bar.
- Repeat the step described above.
- Carry out the step described above for the third time, but in this case attempting to reach the hardest vacuum possible.

Using this procedure you can easily remove up to 99% of pollutants**.**

8.8 Recharging with refrigerant R410A

- Connect the tank of refrigerant gas to the male 1/4 SAE inlet situated on the liquid line after discharging a little gas to eliminate air in the connection pipe.
- **Fill with refrigerant in liquid form** until you reach 75% of the total charge.
- Then connect to the inlet on the pipe between the thermostatic valve and evaporator and complete the charging process with the refrigerant **in liquid form** until no more bubbles can be seen on the liquid level indicator and the operating parameters specified in section 4.4 have been reached.

Introduce refrigerant through the inlet in the liquid line.

A unit that was originally charged with R410A in the factory must not be charged with other refrigerants without the written authorization of Lennox.

8.9 Environmental protection

The law implementing the regulations (reg. EEC 2037/00) which govern the use of ozone---depleting substances and greenhouse gases bans the dispersal of refrigerant gases in the environment and requires whoever is in their possession to recover them and, at the end of their useful life, either to return them to the dealer or take them to a suitable waste disposal facility.

The refrigerant HFC R410A is not harmful to the ozone layer but is included among the substances responsible for the greenhouse effect and thus falls within the scope of the aforesaid regulations.

Therefore, special care should be taken when carrying out maintenance work to minimise refrigerant leaks.

9 Troubleshooting

On the next pages you will find a list of the most common causes that may cause the package unit to fail or malfunction. These causes are broken down according to easily identifiable symptoms.

You should be extremely careful when attempting to implement any of the possible remedies suggested: overconfidence can result in injuries, even serious ones, to inexpert individuals. Therefore, once the cause has been identified, you are advised to contact the manufacturer or a qualified technician for help.

FAULT	POSSIBLE CAUSES	CORRECTIVE ACTIONS
The unit does not start	No power supply	Check that power is being supplied both to the primary and auxiliary circuits
	The electronic card is cut off from the power supply	Check the fuses
	Alarms have been triggered	Check whether any alarms are signalled on the microprocessor control panel, eliminate the causes and restart the unit
	The phase sequence is wrong	Invert two phases in the primary power line after disconnecting them upstream from the unit
The compressor is noisy	The compressor is rotating in the wrong direction	Check the phase sequence relay. Invert the phases on the terminal board after disconnecting the unit and contact the manufacturer
Presence of abnormally high pressure	Insufficient flow of air to the condenser	Check for the presence of obstructions in the condenser section ventilation circuit
		Check whether the condenser coil surface is obstructed
		Check the condensation control device (optional)
	Presence of air in the refrigerant circuit, as revealed by the presence of bubbles in the flow indicator also with undercooling values exceeding 5 °C	Drain and pressurise the circuit and check for leaks. Evacuate slowly (for more than 3 hours) until reaching a pressure of 0.1 Pa and then recharge in the liquid phase
	Unit overcharged, as revealed by an Sub-cooling of more than 8 °C	Drain the circuit
	Thermostatic valve and/or filter obstructed. These symptoms may also occur in the presence of an abnormally low pressure	Check the temperatures upstream and downstream from the valve and filter and replace them if necessary
Low condensation pressure	Transducer fault	Check the efficiency of the condensation control device (optional)
Low evaporation pressure	Malfunctioning of thermostatic valve	Warming the bulb with your hand, check whether the valve opens and adjust it if necessary. If it does not respond, replace it
	Filter dryer clogged	Pressure drops upstream and downstream from the filter should not exceed 2°C. If they do, replace the filter
	Low condensation T	Check the efficiency of the condensation control device (where present)
	Low level of refrigerant	Check the refrigerant level by measuring the degree of Sub-cooling; if it is below 2°C replenish the charge
	The internal thermal protection device has tripped	In the case of compressors equipped with a protection module, check the thermal contact. Identify the causes after restarting
The compressor does not start	The circuit breakers or line fuses have been tripped by a short circuit	Pinpoint the cause by measuring the resistance of the individual windings and the insulation from the casing before restoring power
	One of the high or low pressure switches has tripped	Check on the microprocessor, eliminate the causes
	The phases have been inverted in the distribution compartment	Check the phase sequence relay

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