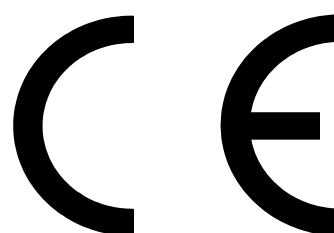


Star Cold
MC-line

CONDENSING UNITS
INSTALLATION, OPERATION AND MAINTENANCE



BE VERY CAREFUL WHEN YOU MEET THIS INDICATION ON THE LEFT SIDE

1. GENERAL INFORMATION AND INTRODUCTION	4
1.1. SYSTEM TECHNICAL DATASHEET	4
2. PROCEDURES BY CLIENT ON DELIVERY	4
2.1. CONDITION CHECK	4
2.2. UNLOADING AND HANDLING OPERATIONS	4
2.2.1 SLINGING AND PRECAUTIONS	4
2.2.2 POSITIONING.....	5
3. LOCATION AND POSITIONING	5
3.1. BASE AND POSITIONING	5
3.1.1 OUTDOOR UNIT POSITIONING.....	5
3.1.2 ACCESSIBILITY	5
3.1.3 CONDENSER COOLING AIR.....	5
3.1.4 CONDENSER COOLING WATER.....	5
3.1.5 ELECTRICAL POWER SUPPLY LINE	5
3.1.6 EARTHING.....	6
3.2. POSITION OF EVAPORATOR UNITS AND THERMOSTAT BULB.....	6
4. REFRIGERATION CONNECTIONS REQUIRE QUALIFIED PERSONNEL	6
4.1. PIPELINES	6
4.2. COLD PIPELINE INSULATION	6
4.3. SEALING EFFICIENCY TESTING.....	6
4.4. UNIT SEALING EFFICIENCY TEST.....	6
4.5. SYSTEM SEALING EFFICIENCY CHECK.....	7
5. ELECTRICAL CONNECTIONS AND HOOK-UP	7
5.1. PRECAUTIONS AND CHECKS.....	7
5.1.1 POWER SUPPLY AND TOLERANCES	7
5.2. ELECTRICAL DRAWING.....	7
5.2.1 WIRE DIMENSIONS.....	7
5.2.2 ELECTRICAL CONNECTIONS BETWEEN THE CONDENSING UNIT AND AIR EVAPORATORS.	7
5.2.3 REMOTE EVAPORATORS/CONDENSERS – SAFETY SWITCH.....	7
5.2.4 ELECTRICAL CONNECTIONS BETWEEN THE CONDENSING UNIT AND CONTROL PANEL.	8
5.2.5 POSITION OF THERMOSTAT SENSOR.....	8
5.3. TESTS	8
5.3.1 PRELIMINARY VISUAL INSPECTIONS	8
6. REFRIGERANT CHARGING OPERATIONS REQUIRE QUALIFIED PERSONNEL	8
6.1. REFRIGERANT TYPE AND LUBRICANT OIL	8
6.2. VACUUMING THE UNIT.....	8
6.3. REFRIGERANT CHARGING.....	8
7. INSPECTION OF THE CONDENSER FANS REQUIRES QUALIFIED PERSONNEL	9
7.1. CHECKING THE DIRECTION OF ROTATION.....	9
7.2. ELIMINATION OF OBSTRUCTIONS TO AIR FLOW.....	9
8. CONTROL AND STATUS PANEL	9
8.1. ACCESS PROCEDURE (only on enclosed units for outdoor installation).....	9
8.2. PROTECTION CALIBRATION AND CHECKS	9
8.3. ACCESS RESTRICTION.....	9
8.4. SETTABLE PROTECTIONS.....	9
8.5. FUSE REPLACEMENT.....	10
9. AUTOMATIC FUNCTIONALITIES	10
9.1. COLD ROOM TEMPERATURE CONTROL	10
9.2. DEFROST MANAGEMENT	10
9.3. CONDENSATION PRESSURE CONTROL.....	10
9.4. MOP ELEMENT IN THERMOSTATIC VALVES	10
9.5. PUMP DOWN MODE OPERATION.....	10
9.6. OIL TEMPERATURE CONTROL IN SYSTEMS WITH SCREW COMPRESSORS	10
10. PROTECTIONS	10
10.1. PRESSURE OVERLOAD IN COOLING CIRCUIT	10
10.2. REFRIGERANT PRESSURE DEFECT	11
10.3. INSUFFICIENT COMPRESSOR LUBRICATION.....	11
10.4. INSUFFICIENT OIL LEVEL IN COMPRESSOR	11
10.5. COMPRESSOR MOTOR TEMPERATURE OVERLOAD thermal cutout module.....	11
10.6. CONDENSER FAN MOTOR TEMPERATURE OVERLOAD	11
10.7. AIR EVAPORATOR FAN MOTOR TEMPERATURE OVERLOAD	11
10.8. INCORRECT PHASE SEQUENCE.....	11
11. SIGNALS	12
11.1. LIQUID TRANSFER SIGHT GAUGE	12
11.2. HUMIDITY INDICATOR.....	12
11.3. OIL LEVEL SIGHT GAUGE	12
11.4. REFRIGERANT PRESSURE GAUGES	12

12.	SYSTEM START-UP IN PRESENCE OF QUALIFIED PERSONNEL	12
12.1.	PRELIMINARY CHECKS.....	12
12.1.1	CASING PREHEATING.....	12
12.1.2	PRECAUTIONS.....	12
12.1.3	CHECKING THE DIRECTION OF COMPRESSOR ROTATION.....	13
12.1.4	CHECKING THE DIRECTION OF FAN ROTATION.....	13
12.1.5	PANEL CLOSURE CHECK.....	13
12.1.6	REFRIGERANT CHARGE CHECK.....	13
12.1.7	LUBRICANT OIL RETURN CHECK.....	13
12.1.8	THERMOSTATIC VALVE CALIBRATION CHECK.....	13
12.1.9	FILTRATION ON SUCTION ON INITIAL START-UP.....	13
13.	PRECAUTIONS IN THE EVENT OF PROLONGED DISUSE	14
13.1.	CLOSURE OF REFRIGERANT VALVES.....	14
13.2.	RE-START AFTER PROLONGED SHUTDOWNS.....	14
13.2.1	ADVANCE POWER-UP.....	14
13.2.2	CHECKS AND PRECAUTIONS.....	14
14.	PERIODIC MAINTENANCE BY QUALIFIED PERSONNEL	14
14.1.	PRECAUTIONS.....	14
14.2.	MONTHLY MAINTENANCE (OR EVERY 200 HOURS).....	14
14.2.1	SAFETY DEVICE AND CONTROL CHECK.....	14
14.2.2	ELECTRIC TERMINAL TIGHTENING CHECK.....	14
14.2.3	ELECTRIC CONTACT CONDITION CHECK.....	14
14.2.4	REFRIGERANT AND OIL LEAK CHECK.....	14
14.2.5	CASING HEATER CHECK.....	15
14.2.6	EARTHING EFFICIENCY CHECK.....	15
14.2.7	CONDENSER CLEANING.....	15
14.2.8	MECHANICAL FILTERS ON INTAKE (when fitted).....	15
14.3.	QUARTERLY MAINTENANCE (OR EVERY 800 HOURS).....	15
14.3.1	REFRIGERANT HUMIDITY CHECK.....	15
14.3.2	DRIER FILTER CARTRIDGE REPLACEMENT.....	15
14.3.3	COMPRESSOR NOISE – VIBRATION CHECK.....	15
15.	PROTECTING THE ENVIRONMENT – MAINTENANCE - SCRAPPING	16
15.1.	REPAIRS TO REFRIGERATION CIRCUITS BY QUALIFIED PERSONNEL.....	16
15.2.	SCRAPPING SYSTEM UNITS.....	16
16.	TROUBLESHOOTING	17

1. GENERAL INFORMATION AND INTRODUCTION

This manual regards the systems designed for cooling, conserving and freezing at medium, low and very low temperatures, with single and multiple circuits, identified with the symbols:

**SP-UM-UMA
UMC- UMCA**

MC – MCC -MCI

The interconnections of the cooling and electrical circuits must be made on site by qualified personnel, who must also ensure correct charging of refrigerant and strict observance of all professional and safety standards (directive 97/23/CE).



The presence of pressurised and electrical equipment require specific qualifications of the personnel assigned for these tasks.

As a general rule, all operations on the machine during installation and maintenance must only be performed after disconnecting the electrical power supply.

1.1. SYSTEM TECHNICAL DATASHEET



This applies to each individual serial number.
It is an integral part of this document and specifies:

- The cooling circuit layout**
- The description of the components installed**
- Specifications of the electrical power supply**
- Type and dimensions of equipment**
- Setting sheet**



The units are supplied with dry cooling circuitry and nitrogen pressurisation.

2. PROCEDURES BY CLIENT ON DELIVERY

On delivery of the equipment, the client should perform a thorough check of all contents.

2.1. CONDITION CHECK

The equipment leaves the supplier's factory after precise testing and in perfect condition. Therefore, if any damage is detected on delivery, this will have been caused during transport and must be reported to the shipping agent and noted on the delivery documentation prior to acceptance.

The supplier or representative in the EU must be notified immediately in detail of the entity of any damage.

2.2. UNLOADING AND HANDLING OPERATIONS

These operations require adequate equipment based on the dimensions and weight of the equipment to be moved.



Take great care to avoid sudden or violent movements.

Avoid using machine components as points of leverage.

Use suitable tools to unpack the equipment and avoid damage to the surface.

2.2.1 SLINGING AND PRECAUTIONS

The units are equipped with attachment points, clearly indicated by means of yellow labels in the form of arrows. If the unit is packed with wooden lateral supports, **these should be removed prior to installation.**

The equipment can be lifted by means of a lift truck or a crane of adequate capacity.

Slings must not generate transversal stress on the machine structure, which must also be protected from friction with any lifting ropes used.

All relative precautions must be observed, including the constant use of anti-release devices, correct balancing of the lift truck, load capacity limits and all other applicable safety standards.

If rollers are used for short transits, the relative distance between rollers must never exceed one metre. Never upturn or incline machine parts.



For SP/UM/UMA/MC/MCI units: the remote control panel, featuring compact dimensions and weight, is not difficult to handle; and is normally located inside the condensing unit, easily removed after detaching one of the side panels. It should be removed from its packaging only at the time of installation.

2.2.2 POSITIONING

When possible, transfer the equipment directly from the transport means to the relative base, which must be flat and stable; if this is not possible, equipment must always be placed on horizontal, stable and even surfaces.

3. LOCATION AND POSITIONING

The following is envisaged:

- for outdoor units, installation outdoors without protections or sheltered, provided that there are no obstructions to the complete and efficient removal of hot cooling air from the condenser (as specified in the [appendix](#)).
 - for machinery room units, ensure adequate clearances for maintenance and suitable room ventilation.
-

3.1. BASE AND POSITIONING

The base must be stable, able to withstand the weight of the unit, perfectly horizontal over the machine-ground contact zone and protected against the build-up of water.

Suitable rubber anti-vibration mounts or a neoprene rubber strip should be inserted between the machine and the base.

3.1.1 OUTDOOR UNIT POSITIONING

See drawing/specifications.

These units must have sufficient perimeter clearances to enable maintenance and adequate space for circulation of air around the condenser coil.

The minimum distance for air intake should be 0.8 m for single coils and 1.2 m for double or inclined coils. During installation, personnel should also ensure free air circulation without obstacles both on intake and delivery.

3.1.2 ACCESSIBILITY



To enable inspections, maintenance and repairs, the condensing units must be accessible from all sides.

3.1.3 CONDENSER COOLING AIR

On standard versions, and therefore in most cases, the condensing unit envisages forced air cooling of condensers, with orthogonal flow, i.e. with horizontal intake and vertical delivery.

No obstacle must impair free flow circulation, therefore:



- intake ports must be completely free
 - filters protecting the ports must be cleaned periodically, as specified in the chapter on maintenance and in any event when clogged, for example during springtime when the air is filled with fluff from poplar trees.
 - the upper space must remain totally free, also from hanging tree branches.
-

3.1.4 CONDENSER COOLING WATER

All suitable precautions must be taken and adequate supervision must be ensured to eliminate the risk of water freezing in the equipment. If the equipment is subject to prolonged disuse, the relative circuits must be emptied completely.

If this is not carried out, serious damage could be caused, also due to water entering the cooling circuit.



It is strongly recommended to install an adequate filter on the water inlet to the condenser.

3.1.5 ELECTRICAL POWER SUPPLY LINE

The system electrical line, with input on the electrical panel terminal board located in the unit or on the main disconnect switch, must be suitably sized on the basis of maximum current absorption.

The selection of materials, sizing, installation procedures and testing must comply with national standards. The power line must be suitably protected **according to current standards**.



3.1.6 EARTHING



The installation must be connected to the earthing line, using the terminal supplied by the manufacturer, before the initial power-up of the equipment during installation.
Connections, installation of the earthing line, total efficiency of the latter and compliance with current standards throughout use is the responsibility of the user.

3.2. POSITION OF EVAPORATOR UNITS AND THERMOSTAT BULB

Refer to the relative operation and maintenance manual.

4. REFRIGERATION CONNECTIONS REQUIRE QUALIFIED PERSONNEL



THE UNITS ARE ASSEMBLED/CONSTRUCTED IN COMPLIANCE WITH PED DIRECTIVE 97/23/EC. ALL CONNECTIONS ON THE SYSTEM MUST BE MADE BY QUALIFIED PERSONNEL AND CERTIFIED IN OBSERVANCE OF THE ABOVE STANDARDS.

IT IS THE CLIENT'S RESPONSIBILITY TO EQUIP THE ASSEMBLED CIRCUIT WITH SUITABLE SAFETY DEVICES IN ACCORDANCE WITH DIRECTIVE 97/23/EC. IT IS ALSO THE CLIENT'S RESPONSIBILITY TO DRAW UP THE INSTALLATION DESIGN AND COLLECT CERTIFICATION OF ALL ASSEMBLED COMPONENTS AS WELL AS THAT OF THE CIRCUIT WELDERS FOR SUBSEQUENT REGISTRATION AT THE COMPETENT OFFICES.

THESE INSTRUCTIONS ARE INTENDED AS A REFERENCE TO PROFESSIONAL STANDARDS TO ENSURE INTEGRITY OF THE CONDENSING UNIT, WHICH COULD BE DAMAGED BY INCORRECT CONNECTIONS.

- Circuit leaks are not admitted. The refrigerant is a pollutant and a reduction in charge may impair thermodynamic performance of the system thus increasing electrical power consumption.
- the routing of pipelines and relative sizing must ensure correct operation and circulation of the lubricant oil of the compressors.
- impurities must not be present in the circuit as these may obstruct correct operation of the thermostatic valves and damage the compressor.
- the circuit must not be subject to humidity as this alters the characteristics of the lubricant oil with the risk of damage to the compressor motor windings and may block operation of the thermostatic valves.
- no air must be present in the circuit as this constitutes a hazard and can cause malfunctions or damage of the compressor.
- On systems with remote condensation a check valve should be installed on the discharge line in the vicinity of the unit.

4.1. PIPELINES



ALL PIPELINES, BENDS AND UNIONS MUST BE CERTIFIED ACCORDING TO THE DIRECTIVE 97/23/EC AND COMPLY WITH NATIONAL STANDARDS.
ALL WELDINGS MUST BE PERFORMED BY QUALIFIED PERSONNEL AND CERTIFIED ACCORDING TO THE PED DIRECTIVE 97/23/EC AND COMPLY WITH NATIONAL STANDARDS.

Connection pipelines must, in principle, be as short as possible, both to reduce pressure drops and thereby maintain system performance, and to reduce to overall volume occupied by the refrigerant; therefore the quantity of the latter remains proportional to the volume.

4.2. COLD PIPELINE INSULATION

The pipelines, in particular the cool intake lines, must be efficiently insulated.
This prevents dispersion and condensation of humidity with consequent oxidation and dripping.

4.3. SEALING EFFICIENCY TESTING



In a cooling system, sealing of the unit is absolutely essential.
Sealing testing is therefore a fundamental phase in installation and as such must be carried out with great care.

4.4. UNIT SEALING EFFICIENCY TEST

The unit is delivered immediately after a sealing test in nitrogen pressure conditions.



Therefore, before joining operations, the pressure must be discharged from the machine, paying attention to the fact that this **machine is pressurised**.

If the machine is already discharged, the following may be required:

1. locate the leakage
2. repair
3. pressurise the circuit with nitrogen
4. seal the circuit after inserting a control pressure gauge
5. verify that in the subsequent 12 hours the pressure reading on the gauge does not fall

The operation of joining the unit and utilities must only be performed after setting up all connection lines from the utilities to the machine.

4.5. SYSTEM SEALING EFFICIENCY CHECK

Refer to installation design according to current EC standards.

5. ELECTRICAL CONNECTIONS AND HOOK-UP



ELECTRICAL CONNECTIONS ARE THE TASK AND RESPONSIBILITY OF THE USER. THESE INSTRUCTIONS ARE INTENDED AS A REFERENCE TO PROFESSIONAL STANDARDS TO ENSURE INTEGRITY OF THE CONTROL UNIT, WHICH COULD BE DAMAGED BY INCORRECT CONNECTIONS.

The unit and relative electrical accessories comply with the low voltage directive 73/23/EC. Make all electrical connections to the unit according to indications in the electrical wiring diagram enclosed. Take care to observe the safety standards EN 60204, EN 60335 and all national standards.

The selection of materials, sizing, installation procedures and testing must comply with current national standards.

5.1. PRECAUTIONS AND CHECKS



Before proceeding with any installation or maintenance operation on the electrical system, the operator must ensure that the system is disconnected from the power supply and that the latter cannot be switched on inadvertently during the operations required.

5.1.1 POWER SUPPLY AND TOLERANCES

First of all ensure that parameters available for power supply: number of phases, voltage and frequency, correspond to those specified on the dataplate on board the machine.

The power supply voltage must never be subject to variations exceeding $\pm 5\%$ with respect to the nominal values. Unbalance between the phases must never exceed 5%.

5.2. ELECTRICAL DRAWING

5.2.1 WIRE DIMENSIONS

The section of the wires must be suited to the current conveyed and the distances to be covered (the maximum current absorption values are stated on the electrical wiring diagram enclosed).

Check absorption values on the plates affixed to each utility.

5.2.2 ELECTRICAL CONNECTIONS BETWEEN THE CONDENSING UNIT AND AIR EVAPORATORS.

These connections, to be made according to the wiring diagram enclosed, mainly concern:

- fan unit, defrost sensor, air evaporator thermal overload protections, defrost resistances, power interlock
-

5.2.3 REMOTE EVAPORATORS/CONDENSERS – SAFETY SWITCH

The UMA/UM/SP/MC/MCI units are designed with direct power supply to the evaporators.

All maintenance operations require compulsory disconnection of the machine electric power supply; before proceeding with work affix a notice stating "maintenance in progress" on the machine.

The machine power must be shut off when the machine is stationary.

If required, an emergency switch can be fitted and connected between the terminals of the external interlock, marked with the symbol "IE", on the terminal board of the panel on board the machine, which when activated shuts off the auxiliary power supply circuit and stops the machine.



5.2.4 ELECTRICAL CONNECTIONS BETWEEN THE CONDENSING UNIT AND CONTROL PANEL.

thermostat sensor, compressor control elements, defrost indicator lamp, start-stop indicator lamps

5.2.5 POSITION OF THERMOSTAT SENSOR

The position of the thermostat sensor must be chosen with care, avoiding impact with air in anomalous conditions such as air deriving from doors opened in a cold room, from compensation valves or other. For further information refer to the evaporator operation and maintenance manual.

5.3. TESTS

5.3.1 PRELIMINARY VISUAL INSPECTIONS

CEI EN 60204-1, visual inspection:

1. Presence and identification of main terminal PE.
2. Identification of all other terminals with graphic symbol of earth or coloured yellow/green.
3. Exclusive purpose of terminals for equipotential bonding connections.
4. Connection of one wire only to each terminal.
5. Yellow/green colouring of possible insulation on protection wires.
6. Absence of active wires with yellow/green insulation.
7. Absence of tubes or ducts used as protection wire.
8. Absence of fuses, circuit breakers or disconnect switches for equipotential bonding protection.
9. Conformity of wire section to minimum values stated by standards.
10. Check that electrical connections have been made correctly.

In particular the connections of the phases, after opening the box containing the compressor terminal board, must be made according to instructions on the compressor electrical enclosure, according to the type of compressor – direct or part winding start-up – and the machine wiring diagram.

6. REFRIGERANT CHARGING OPERATIONS REQUIRE QUALIFIED PERSONNEL



THE REFRIGERANT CHARGING OPERATIONS, PARTIAL OR COMPLETE, ARE THE TASK AND RESPONSIBILITY OF THE USER.

THESE INSTRUCTIONS ARE INTENDED AS A REFERENCE TO PROFESSIONAL STANDARDS TO ENSURE INTEGRITY OF THE CONTROL UNIT, WHICH COULD BE DAMAGED BY INCORRECT CHARGING.

The procedure can be started after all refrigeration pipelines have been laid and electrical connections completed.

6.1. REFRIGERANT TYPE AND LUBRICANT OIL

The machine dataplate states the following both for the refrigerant and lubricant oil:

- Product type
-

6.2. VACUUMING THE UNIT



Open all valves and solenoid valves on the circuit. Eliminate air from the entire system, including the compressor on the intake side and high pressure side, using a vacuum pump. On completion of the operation a permanent vacuum must be obtained of below 1.5 mbar.

NEVER START UP THE COMPRESSOR IN VACUUM CONDITIONS
NEVER POWER UP THE MACHINE EVEN FOR CHECKING PURPOSES

6.3. REFRIGERANT CHARGING

Only charge with the type of refrigerant stated on the machine dataplate

Before charging:

- Activate the compressor casing resistance
- Check the oil level in the compressors.
- Do not start up the compressor

Charge the liquid refrigerant directly in the liquid receiver.

6.4. CHARGE CHECK

The charge level must be determined with precision, an excessively low or high quantity of refrigerant can impair correct operation.



IMMEDIATELY AFTER CHARGING, CHECK SYSTEM SEALING EFFICIENCY, TESTING ALL COUPLINGS WITH A DETECTOR ABLE TO READ MINIMAL REFRIGERANT LEAKS. IN THE RARE CASE THAT A LEAK IS DETECTED, DO NOT PROCEED WITH REPAIRS BY WELDING UNTIL A REFRIGERATION TECHNICIAN HAS BEEN CALLED AND THE RELATIVE SECTION HAS BEEN CLEANED THOROUGHLY TO REMOVE ALL TRACES OF OIL. BURNT RESIDUE FROM WELDING TEMPERATURES WILL IMPAIR SYSTEM FUNCTIONALITY AND RELIABILITY. CAUTION: IF INSULATION IS MADE OF OLD PRODUCTION POLYURETHANE FOAM, THE DETECTOR MAY READ THE PRESENCE OF GASES SIMILAR TO REFRIGERANT GASES USED FOR THE PRODUCTION OF THIS TYPE OF FOAM. IN THE EVENT OF ANY DOUBT, REMOVE PART OF THE INSULATION TEMPORARILY. THE PIPELINE INSULATION SHOULD ONLY BE COMPLETED AFTER THE LAST CHECK.

7. INSPECTION OF THE CONDENSER FANS REQUIRES QUALIFIED PERSONNEL.



Installation must take into account the compulsory clearances required for optimal circulation of air. Each fan has the blade protected against hazardous accidental contact; these guards must never be removed or tampered with.

7.1. CHECKING THE DIRECTION OF ROTATION

The fans reach the specified flow rate by rotating in a specific direction as indicated on the unit. Check and, if necessary, invert the phases to ensure the correct direction of rotation.

7.2. ELIMINATION OF OBSTRUCTIONS TO AIR FLOW

The air flow must never be obstructed. Refer to the specifications.



Cooling air must never be contaminated; avoid intake from pollutant industrial facilities or from manure yards/slurry or intensive cattle breeding centres, sources of ammonia pollutants. The condenser coils are protected by metal filters which may clog; keep the front of the intake zone clean at all times.

8. CONTROL AND STATUS PANEL

8.1. ACCESS PROCEDURE (only on enclosed units for outdoor installation)

To access the control status panel, remove the snap-fit protection panel by lifting and pulling outwards as shown, to detach it from the main panel. The panel must always be refitted with care after inspection.

8.2. PROTECTION CALIBRATION AND CHECKS

For these types of operation, to be performed by qualified personnel, access to the electrical panel interior is required.

8.3. ACCESS RESTRICTION



Before opening the hinged panel, by means of the specific key for access to the interior, the system power must be shut off by turning the disconnect switch lever located on the door of the electrical panel from position 1 to 0, and taking suitable precautions to avoid inadvertent activation. The machine power must be shut off when the machine is stationary.

8.4. SETTABLE PROTECTIONS

Access to the interior of the panel also enables access to the protections for relative calibration procedures. The calibration value is established and set during equipment testing prior to delivery; any modification to these values must be made by qualified personnel and after verifying the specific purpose. Lower values may cause an unjustifiable shutdown of the utility concerned while excessive values may cause burnout due to the lack of protection.

8.5. FUSE REPLACEMENT



This operation also requires access to the interior of the panel.

A blown fuse indicates a serious malfunction of connections or utility, or may be caused by an external source, at times due to atmospheric discharges.

Before replacement, identify the cause of the fault and remedy.

Always replace fuses of with versions of the same type and capacity.

9. AUTOMATIC FUNCTIONALITIES

These are the units that enable automatic system operation.

9.1. COLD ROOM TEMPERATURE CONTROL

The control of the cold room temperature is by means of the thermostat installed on the control panel. This instrument – refer to the specific instructions enclosed – is normally electronic.

9.2. DEFROST MANAGEMENT

Refer to the specific instructions for the instrument and evaporator.

9.3. CONDENSATION PRESSURE CONTROL

Ensure the correct type of condensation control with reference to the electrical wiring diagram.

Maintain the condensation pressure set points specified in appendix . The machine is designed to operate in these specific conditions.

In the case of water type condensers, install a pressure switch valve for condensation control.

9.4. MOP ELEMENT IN THERMOSTATIC VALVES

Always use thermostatic valves with MOP (Max operating pressure) elements.

9.5. PUMP DOWN MODE OPERATION



If this solution is adopted in systems with piston or screw compressors, ensure that the pressure switch trip threshold for shutdown in Pump-down mode is at least 0.5 bar above the low pressure safety pressure switch threshold.

If using scroll compressors, shutdown in pump-down mode is prohibited.

9.6. OIL TEMPERATURE CONTROL IN SYSTEMS WITH SCREW COMPRESSORS

In systems with semi-hermetic screw compressors used at low temperatures, ensure that the oil temperature is maintained within a suitable range. For this purpose an air oil cooler with finned coil or water type heat exchanger is installed to prevent the oil from reaching high temperatures, and a thermostat-controlled electric heater is inserted in the oil separator, fitted with an electro-mechanical control thermostat to limit temperature reductions. The control of the air oil cooler is by means of a multi-step thermostat which activates and deactivates the fans, varying the air flow rate and consequently heat exchange. In the case of water type exchangers, the oil temperature is maintained constant by a pressure controlled valve which acts on the water flow rate.

In both cases refer to the documentation enclosed and the wiring diagram for further details.

10. PROTECTIONS



The system is equipped with protections to safeguard against anomalous situations, acting both on the pressurised circuit and the power circuit.

It is the client's responsibility to equip the assembled circuit with suitable safety devices in accordance with directive 97/23/EC and relative national standards.

10.1. PRESSURE OVERLOAD IN COOLING CIRCUIT

Protection against excessive pressure of refrigerant in the delivery line, which can impair system functionality and constitutes a hazard to personnel, features two activation stages.

- when pressure reaches values over 25 bar, the maximum pressure switch trips, according to factory settings, to cause system shutdown. Operation can be restored manually, only after eliminating the cause of the problem.

- if the maximum pressure switch does not trip, the safety valve is activated. Activation of this device, legally compulsory on all pressure equipment, causes the partial or total exit and loss of the refrigerant charged in the system and must be considered an exceptional event.

10.2. REFRIGERANT PRESSURE DEFECT

If pressure falls to below factory settings, the minimum pressure switch trips.

This shuts down the compressor motor, but not permanently. If the intake pressure returns to normal values, the equipment re-enables start-up. This is acceptable if it concerns a transitory occurrence, but if repeated requires specific maintenance.

10.3. INSUFFICIENT COMPRESSOR LUBRICATION

The oil pressure switch is fitted on all systems with compressors that have pump-operated lubrication (inside compressor). Activation is delayed by a 120" interval to filter pressure transients on compressor start-up. Reset is manual by means of the pushbutton on the front panel of the pressure switch, when possible to be performed after around 15'.

Obviously the oil level must be checked immediately.

If the pressure switch requires replacement, use one of the same brand and type, or request information on other admissible models from the manufacturer.

In systems with semi-hermetic screw compressors, safety of the oil return line to the compressor, and thus adequate internal lubrication is ensured by a flow switch installed on the compressor oil return line from the separator. The signal is sent to an electronic module and activation is delayed by a few seconds by means of a timer to avoid flow stabilising transients after compressor re-start.

10.4. INSUFFICIENT OIL LEVEL IN COMPRESSOR

In systems with semi-hermetic screw compressors, a float is installed in the oil separator to indicate low levels and thus the need to replenish oil levels in the system. This signal is delayed by a few minutes to prevent fluctuations on system start-up from generating unjustified alarms.

10.5. COMPRESSOR MOTOR TEMPERATURE OVERLOAD thermal cutout module

On systems with *semi-hermetic*, reciprocating, screw or *medium output scroll* compressors no lower than 7.5 HP, thermal cutouts are electronic, based on thermistors inserted in each of the motor phase windings. These sensors are connected to an external electronic module, capable of reading resistance unbalance, and therefore temperature levels, and activating to shut off the main power supply.

On systems with *hermetic reciprocating* and *low output scroll* compressors less than 7.5 HP, thermal cutouts are internal and interrupt continuity of the motor phase windings, shutting down the machine without any external signal. For further information refer to the compressor operation and maintenance manual.

10.6. CONDENSER FAN MOTOR TEMPERATURE OVERLOAD

On all systems with 3-phase motor condenser fans, thermal protection of the motors is guaranteed by means of a thermal relay located downline of the power supply contactor of the corresponding motor. Activation of this device does not shut down the compressor and therefore the system, but only power supply to the motor; it is the condensation pressure that on increase trips the maximum pressure switch and shuts down the compressor.

Reset is manual by means of the pushbutton on the front panel of the relay inside the electrical panel.

Indication of the fault is by means of a lamp on the door of the electrical panel or by means of the alarm and defrost management instrument inside the same electrical panel on board the machine.

10.7. AIR EVAPORATOR FAN MOTOR TEMPERATURE OVERLOAD

On all systems with air evaporators fitted with single phase electric motors, thermal protection of the motors is guaranteed by means of an internal relay which shuts down power supply to the single motor, without however generating an external signal of the fault. When the winding temperature falls to admissible values, power supply is automatically restored.

On systems where the air evaporators have 3-phase electric motors, the temperature overload is indicated by means of an internal thermal relay, known as klixon. Normally, for air coolers with multiple fans, a series of all klixons is implemented and indicated on the unit electrical panel. In this way the alarm of a single fan shuts down the compressor. Reset is automatic and occurs only after the winding temperature has fallen to admissible values (unless an interlock is envisaged on the machine control electronic instrument).

Indication of the fault is by means of a lamp on the door of the electrical panel or by means of the alarm and defrost management instrument inside the same electrical panel on board the machine.

10.8. INCORRECT PHASE SEQUENCE

Control of the electrical phase sequence is important to guarantee correct rotation of the motor in screw and scroll compressors.

In the first case, the correct sequence is guaranteed by an electronic controller named INT389 which also checks for phase failure, winding temperature overload alarms and compressor start-up delays. Activation of this device shuts off power supply to the compressor.

In the second case a simpler electronic controller is installed, which, in the case of incorrect phase sequence, shuts off power supply of the entire auxiliary circuit and therefore the compressor.

11. SIGNALS



As well as the luminous indicators and instruments installed on the panel of the electrical panel, identifiable on the electrical wiring diagram and documentation enclosed, the circuit envisages visual indicator lamps, the access to which, in the case of outdoor installations, may require removal of one or more metal panels enclosing the structure of the condensing unit.

These panels are snap-fit and must be lifted and pulled outwards to remove. Fixing screws may need to be loosened prior to removal.

Always refit these panels with care as they convey the cooling air of the condensers.

11.1. LIQUID TRANSFER SIGHT GAUGE

This is a transparent gauge installed on the liquid line and enables visual inspection of the charge status. At full operating speed, the flow must be continuous without foam or gas bubbles.

If significant turbulence with the presence of gas is noted, take care to wait a few minutes before correcting the charge level. This may be a transitory event caused by rapid opening of a thermostatic valve.

11.2. HUMIDITY INDICATOR

The level gauge also has a coloured element that indicates whether the refrigerant is dry or contains humidity.

On the basis of the gauge indications, if humidity is present, replace the drier cartridges, drain and recharge the machine.

11.3. OIL LEVEL SIGHT GAUGE

The compressor casing is fitted with an oil level gauge which also indicates minimum and maximum admissible level limits. If replenishment is required, also use exclusively the oil type stated on the machine dataplate and in the documentation.

The oil level must be checked immediately after compressor start-up and at regular intervals during operation.

11.4. REFRIGERANT PRESSURE GAUGES

Pressure gauges are installed on the unit to check pressure on various parts of the circuit. hermetic and semi-hermetic compressors without oil pump: pressure gauge on high pressure and low pressure sides.

- semi-hermetic compressors: pressure gauge on high pressure and low pressure sides and on the oil pump.

12. SYSTEM START-UP IN PRESENCE OF QUALIFIED PERSONNEL

Initial system start-up requires observance and attention to a number of procedures.

12.1. PRELIMINARY CHECKS

These checks must be performed on system start-up before reaching operating speed.

12.1.1 CASING PREHEATING

Activate the compressor casing resistance

The casing oil temperature before start-up must be around 15-20 °C higher than the ambient temperature or the saturation temperature on the intake side.

Units designed for outdoor installation, in environments with very low minimum ambient temperatures may also be equipped with electrical resistances, which have the same function as the casing resistances, also on the intake manifold and the oil reserve tank.

12.1.2 PRECAUTIONS

- Check once again to ensure correct installation of the cooling and electrical circuits, ensuring in particular correct earthing of the equipment.
- Ensure that all valves on the cooling circuit are open, and that bypass valves to the outside are closed

and fitted with caps.

- Ensure that the voltage on the terminals between the phases and neutral is as specified.
- For part-winding motors: strictly observe the order of the part-windings indicated on the electrical wiring diagram enclosed. The delay in connection of the second part-winding must be 0.5 s (max. 1 s).
- Check the values of the timed relays.
- Check the oil level in the compressors (in the sector marked in the level gauge)
- Check that the control and safety device settings comply with the calibration table values enclosed and national standards.

12.1.3 CHECKING THE DIRECTION OF COMPRESSOR ROTATION

The direction of reciprocating compressor can be either one; while the correct direction of screw and scroll compressor rotation must be checked.

For systems with these compressors, before starting up the unit:

- Connect a pressure gauge to the intake valve coupling
- Close the intake valve fully and then open by one turn
- On semi-hermetic screw compressors: close the solenoid valve on the oil injection line (remove the coil).
- Start up the compressor briefly (0.5 – 1 sec)
- Correct rotation: pressure of the gauge on intake lowers immediately

Incorrect rotation: pressure of the gauge on intake increases and the electronic protection module trips. In this case invert the two phases on the terminal board.

On semi-hermetic screw compressors: after checking, re-connect the solenoid coil of the oil injection line

12.1.4 CHECKING THE DIRECTION OF FAN ROTATION

Check the direction of fan rotation with 3-phase motors installed, according to the unit model, on:

- air evaporators
- condenser
- head sections for compressor cooling
- finned oil cooling coils
- other special equipment with 3-phase fans

To check, ensure that the direction of the air flow guarantees correct operation of the equipment. Otherwise, invert two of the three power supply wires upline of the relative contactor, taking care that the direction of rotation of other system motors is not altered.

12.1.5 PANEL CLOSURE CHECK

Ensure that the panels of the condensing unit structure are positioned correctly and closed to avoid difficulties in the correct use of the condenser cooling air.

12.1.6 REFRIGERANT CHARGE CHECK

On reaching operating speed, ensure the correct flow of refrigerant via the relative sight gauge on the liquid line.

12.1.7 LUBRICANT OIL RETURN CHECK

Check compressor lubrication immediately after start-up.

- Oil level from $\frac{1}{4}$ to $\frac{3}{4}$ of the sight gauge (repeated checks are recommended during the initial hours of operation).
- On systems with oil pumps, check that the differential pressure of the pump (indicated on the oil pressure gauge) is between 1.4 and 3.5 bar.

During the start-up phase, some foam may form on the oil, which should be minimised on reaching stable operating conditions. If this does not occur, this may indicate a high concentration of liquid in the intake gas.

12.1.8 THERMOSTATIC VALVE CALIBRATION CHECK

See instructions in the specific documentation.

12.1.9 FILTRATION ON SUCTION ON INITIAL START-UP

The units with semi-hermetic screw compressors (or units to client specs) are equipped with containers for mechanical filters on the intake line.

Before starting up the system for the first time, a mesh cartridge should be inserted, which should be checked after around four hours of operation, cleaning if necessary and repeating this check periodically until it can be guaranteed that all impurities have been removed.

At this point the container without cartridge should be closed, to eliminate any cause of pressure drops.

13. PRECAUTIONS IN THE EVENT OF PROLONGED DISUSE

Decommissioning for prolonged disuse requires a number of precautions.

13.1. CLOSURE OF REFRIGERANT VALVES



In the event of prolonged shutdown, the following operations are recommended:

- close the valve downline of the liquid receiver;
 - After restricting most of the refrigerant charge to the high pressure side, close the compressor delivery valve;
- during the re-start phase, ensure that all valves are completely open
-

13.2. RE-START AFTER PROLONGED SHUTDOWNS

This operation requires observance of a specific procedure and a number of precautions.

13.2.1 ADVANCE POWER-UP

This preliminary operation is important together with the casing preheating procedure.

13.2.2 CHECKS AND PRECAUTIONS

The procedure regarding system start-up must be repeated, observing all relative precautions.

14. PERIODIC MAINTENANCE BY QUALIFIED PERSONNEL

Check the system regularly according to national regulations.

The following section provides general instructions regarding periodic maintenance required for units and divided according to the specific frequency required.

The end of this chapter provides specifications regarding maintenance operations recommended according to the type of compressor installed.

In any event refer to the specific component operation and maintenance manual for further information and procedures.

14.1. PRECAUTIONS



All maintenance operations must be performed by, or under the direct supervision and responsibility of qualified personnel.

The system must be completely stationary and disconnected from the power supply before any operation. Disconnect the power supply only when the system is already stopped by means the automatic control devices.

14.2. MONTHLY MAINTENANCE (OR EVERY 200 HOURS)

These operations are required on the units every month or every 200 hours of operation.

14.2.1 SAFETY DEVICE AND CONTROL CHECK

Check operation of all control and safety devices such as pressure switches, safety valves electronic system management instruments.

14.2.2 ELECTRIC TERMINAL TIGHTENING CHECK

Check tightening of all electric terminals both inside the electrical panels and on the terminal boards of all utilities.

Take care also to check tightening of all fuses.

14.2.3 ELECTRIC CONTACT CONDITION CHECK

Clean fixed and mobile contacts of all contactors, replacing in the event of wear or damage.

14.2.4 REFRIGERANT AND OIL LEAK CHECK

Visually check the entire cooling circuit, also inside the machines, to locate possible leaks of refrigerant, which are also indicated by traces of lubricant oil.

Act immediately and investigate if in doubt.

Also ensure the regular flow of refrigerant via the sight gauge on the liquid line. This operation should be performed with care as the system must remain in operation.

14.2.5 CASING HEATER CHECK

Check efficiency of the casing heater.
If necessary, measure continuity by means of a suitable instrument.

14.2.6 EARTHING EFFICIENCY CHECK

Check the earthing terminal and ensure efficiency by means of a suitable instrument.

14.2.7 CONDENSER CLEANING

Cleaning must be by means of compressed air on the internal side, with the jet in the opposite direction to that of air intake. Repeat the same operation also for the condenser finned coil, taking care due to the cutting hazard present in this area.

To clean filters (if required) and remove all adherent or oily particles, use a pressurised water jet, also detergents provided that these are neutral pH. Dry by means of compressed air.

Refit filters with care before restarting the system.

In some periods, often in springtime, cleaning may need to be more frequent due to the presence of vegetal impurities in the air. A clogged filter is indicated by an increase in condensation pressure.

14.2.8 MECHANICAL FILTERS ON INTAKE (when fitted)

To fit or replace filters, proceed as follows:

- close the inlet valve and valves on intake of the compressors.
- discharge and collect the refrigerant trapped between valves.
- proceed with replacement or cleaning as required.
- close the filter container carefully, replacing the seal when possible; vacuum the machine

14.3. QUARTERLY MAINTENANCE (OR EVERY 800 HOURS)

These operations are required on the units every fourth month or every 800 hours of operation.

14.3.1 REFRIGERANT HUMIDITY CHECK

Carefully examine the colour of the sensitive humidity element in the sight gauge on the liquid line.

Compare with the specifications table on the gauge instructions to determine possible presence of water. All is correct if the reading is "dry"

If humidity is detected, shut down the unit immediately and replace the drier cartridges, all refrigerant charge and the oil present in the circuit.

14.3.2 DRIER FILTER CARTRIDGE REPLACEMENT

For replacement, with the plant stationary, proceed as follows:

- isolate the circuit section with the filter by closing the valves up and downline of the filter.
- recover the gas in the isolated section
- replace the cartridge
- vacuum the isolated pipeline section
- open the valves previously closed.



DO NOT UNPACK THE CARTRIDGES UNTIL THE TIME OF INSTALLATION THIS GUARANTEES PERFECT CONSERVATION OF THE COMPONENT

14.3.3 COMPRESSOR NOISE – VIBRATION CHECK

Check the entire system, in particular the pipelines and capillary tubes to ensure there are no abnormal vibrations. If necessary, take suitable additional safety measures.



The presence of strong vibrations may cause damage to the pipelines and leakage of refrigerant and oil onto components of the plant.

15. PROTECTING THE ENVIRONMENT – MAINTENANCE - SCRAPPING



Refrigerant fluids are subject to legal regulations that prohibit disposal into the environment, with compulsory recovery.

Lubricant oils are also subject to similar regulations.

Take into account the above when performing maintenance or scrapping refrigeration systems.

15.1. REPAIRS TO REFRIGERATION CIRCUITS BY QUALIFIED PERSONNEL



ALL PIPELINES, BENDS AND UNIONS MUST BE CERTIFIED ACCORDING TO THE DIRECTIVE 97/23/EC AND COMPLY WITH NATIONAL STANDARDS. ALL WELDINGS MUST BE PERFORMED BY QUALIFIED PERSONNEL AND CERTIFIED ACCORDING TO THE PED DIRECTIVE 97/23/EC AND COMPLY WITH NATIONAL STANDARDS.

In some cases and always when welding is required, the circuit must be emptied of refrigerant.

If the refrigerant cannot be recovered, it must be returned to the retailer or suitable authorised waste disposal firms.

15.2. SCRAPPING SYSTEM UNITS

When the system is to be scrapped, the following procedures are compulsory:

1. total recovery of refrigerant fluid with adequate equipment and delivery to authorised personnel for recovery and disposal.
2. the same procedure applies to lubricant oil in the circuit, in particular that in the compressor casing and filter cartridges impregnated in oil.

separate the components into categories, such as iron and steel, copper and electrical wires, electric motors and motor compressors, soundproofing panels in synthetic foam and heat insulation material. The separated materials must be delivered to suitable collection centres for recycling.

16. TROUBLESHOOTING



Fault finding procedures and repairs must be performed by qualified personnel or may require intervention of the manufacturer.

In the event of faults or malfunctions take care to observe the following section.

Excessive confidence in procedures may cause damage to the environment or physical injury.

All operations must be performed with the machine disconnected from the power supply.

TROUBLESHOOTING TABLE

TROUBLE	CAUSE	SOLUTION
Condensing pressure too high. <i>Air cooled condenser</i>	Filters are dirty. 1Fan or fan motor broken. Air flow direction not correct	Clean the filter and the condenser surface. Remove possible obstacles in order to have a correct air flow. Change the fan. Change the rotation direction, with the inversion of 2 of the 3 phases.
Condensing pressure too high. <i>Water cooled condenser</i>	The internal surface of the condenser is dirty. The water flow is not correct (too small)	Clean the internal surface of the exchanger with proper products. Check the functioning of the pump system.
Condensing pressure too low. <i>Air cooled condenser</i>	Low temperature of the ambient air. Too much air flow through the coils.	In both cases set the correct condensing pressure.
Condensing pressure is too low <i>Water cooled condensers</i>	Water temperature is too low. Too big quantity of water through condenser	In both cases set the correct condensing pressure.
Condensing pressure is not stable.	The differential of the condensing pressure switch is too big.	Set in the correct way the differential of condensing pressure switch.
Discharge pipe temperature is low.	Too much liquid in suction.	Check the expansion valve setting, and its correct installation.
Low liquid level in the receiver.	Lack of refrigerant in the plant.	Find the reason (possible leakages); repair the problem, and fulfill refrigerant if necessary.
High liquid level in the receiver.	Too much refrigerant charged in the plant.	Take out some refrigerant from the plant, keeping the correct condensing temperature; verify that the sight glass does not show any vapour bubble.
Liquid filter cold, or eventually covered by frost	Dirty filter, because of impurities, acidity or humidity.	Check if there are impurities: if necessary clean the plant or substitute the filter. If there is humidity or acidity, change the freon and the oil charge.

INSTALLATION, OPERATION AND MAINTENANCE
MC001E

TROUBLE	CAUSE	SOLUTION
Vapour bubbles on the sight glass.	<p>Low condensing pressure.</p> <p>Liquid receiver shutoff valve not totally open.</p> <p>Lack of refrigerant in the plant.</p>	<p>See: "Condensing pressure too low".</p> <p>Open completely the shut off valve.</p> <p>Add some refrigerant, after checking other problems, in order not to increase too much the refrigerant charge.</p>
Too low Suction pressure.	Low pressure switch broken or with a wrong setting.	Change the pressure switch or set it in the correct way.
Too low suction pressure.	<p>Lack of refrigerant in the evaporator due to:</p> <p>Low liquid level in the receiver.</p> <p>Occlusion of the liquid filter.</p> <p>Solenoid valve stalled.</p> <p>Fault of expansion valve.</p>	<p>See: "Low liquid level in the receiver."</p> <p>See: "Vapour bubbles on the sight glass" .</p> <p>Check the correct functioning of it.</p> <p>Change the expansion valve.</p>
Frequent high pressure alarm	Wrong setting of the high pressure switches.	Check that set value of the pressure switches is correct and set according the setting sheet.
Too high level of oil in the crankcase.	Too much oil in the unit.	Take out oil from the system until you reach the correct quantity: Make sure that the indication is not consequence of the fact that there is refrigerant in the oil.
Too low level of oil in the crankcase.	Not sufficient quantity of oil in the circuit.	Add some oil to the system until you reach the correct quantity: Make sure that the indication is not consequence of the fact that there is a temporary condition due to low oil return.
Boiling of the oil during functioning.	Liquid return from the evaporator to the crankcase of the compressor.	Check the Expansion valve setting.
Cooler fans not running, and consequent stop of the unit.	<p>Fan motor broken.</p> <p>Voltage supply too low.</p> <p>Lack of 1 phase.</p>	<p>Change it.</p> <p>Check if the voltage is OK.</p> <p>Verify it , measuring voltage between phases on the terminal of the fan. Check all the power alimentation supply.</p>
Air temperature in the coldroom too low.	<p>Temperature probes are broken</p> <p>Coldroom set point too low.</p>	<p>Change them.</p> <p>Verify and change the set if necessary</p>