ELECTRIC

ALL-ELECTRIC ROOFTOP AIR CONDITIONING UNIT FOR ELECTRIC AND HYBRID BUSES

CC356-E

Owner's Manual
Warranty Certificate

Rev.01/August 2025
Code: 036-00365-001

SPHEROS

OBSERVATION: to get the best air conditioner performance we recommend that you read this manual carefully before starting operation.
Keep this manual with your vehicle for reference.

SPHEROS DO BRASIL - S/A offers a full line of equipment for bus air conditioning systems for vans, micro and midi buses, commuter, articulated, coaches and double-deckers.

Air conditioning system that is modern and high quality, the products of SPHEROS DO BRASIL - S/A have been developed looking for comfort and tranquility to passengers that uses the public transport.

However, you need to take care to assure a good use and operation of the air conditioning system, and then you can obtain a better performance of its technology resources.

It is mandatory to do the preventive and corrective maintenance procedures, they must be accomplished by experts or dully technicians. Looking for improving and updating the refrigeration technical teams, this manual describes the fundamentals of our air conditioning system based on the most important thermodynamic formulas.

You can find operation instructions of SPHEROS DO BRASIL - S/A air conditioning too, besides it advises you to follow technical procedures of adequate preventive maintenance obeying environmental and safety rules.

Frequent training for technical team make them able to get right diagnosis from equipment (appliances) to accomplish the servicing.

correctly with quality and responsibility, assuring to the whole fleet a perfect operation of SPHEROS DO BRASIL - S/A equipment.

During operation these equipments have energized parts, so any irregularity in the system, please contact a Spheros authorized dealer.

WARNING!
The use of the equipment at altitudes above 3,000 meters is prohibited. Risk of electric shock.

Warrant Terms

SPHEROS DO BRASIL - S/A warrants its products for two-years period in accordance with the terms listed below:

1- The warranty will be valid for the period above specified, counting from the date when the equipment is installed in keeping with the warrant certificate, even after the property there of has ben transfered.

2- Should the equipment be installed by a third part, SPHEROS DO BRASIL - S/A warrant only the product and not its instalations.

3- During the stipulated period, the warranty completely covers the workmanship and spare parts used to repair defects duly identified as being:
premature failure of material and components defects used on its manufacture.

4- Only a techinician from the SPHEROS DO BRASIL - S/A authorized network of services is qualified to repair the defects coverd under the warranty.

5- The warranty approval is subject to the technical analysis of the defects shown in the components and operational conditions to which the equipment has been subjected.

6- No claims will be accepted if the vehicle is still in use after the defect is found, even if there is lack of pieces, delay in transportation or any other such incident.

7 - The Warrant Loses its Validity

a) If the installation or use of the product is not in accordance with the SPHEROS DO BRASIL - S/A technical recommendations.

b) If the product suffers any damage caused by improper use, neglect, accident, failures caused by external agents and even lack of maintenance (see owner's manual) or services performed by unqualified person.

c) If the warranty certificate and/or the serial number of the product are adulterated, overwritten or damaged.

d) If defects or unsatisfactory performance are caused by the use of non original spare parts and in disagreement with the technical specifications from SPHEROS DO BRASIL - S/A.

8- The Warranty Does Not Cover

a) Displacement of the bus for repairing of the equipment. In case the customer requests to be attended in the same place where products is operating, the collection or not of the visitation charge will be the criterion of the authorized service provider.

b) The attending to the consumer, free or paid, in cities that do not have authorized services providers. So the expenses with displacement are the sole responsibility of the owner.

c) Lack of proper preventive maintenance, as described in the preventive maintenance item in this manual.

d) Loss or loss of profits caused by the stoppage of the vehicle due to non-operation of the equipment.

Technical Basis / Related Standards (Mandatory requirements):

a) Regulatory Standard No. 10 (NR-10): establishes the requirements and conditions minimum aiming at the implementation of control measures and systems preventive measures, in order to guarantee the safety and health of workers who, directly or indirectly, interact in electrical installations and services with electricity.

b) Regulatory Standard No. 35 (NR-35): establishes the requirements and conditions minimum for work at height.

General Provisions:

Air conditioning equipment for electric vehicles Spheros has input voltage from 480 to 880 Vdc.
The voltage levels found can cause serious damage to health and even death.

Electrical Risk Control Measures:

Before starting any activity on the equipment, all power sources must be turned off. Even after disconnecting the electrical voltage from the equipment, you must wait at least 20 minutes before performing any procedure on the equipment.
Never, under any circumstances, carry out procedures on Spheros electrical appliances.
with electrical power connected. To make sure that the equipment is completely de-energized, it is necessary to carry out the detection of absence of voltage in the equipment using suitable equipment.

Powers and Responsibilities:

To carry out any type of maintenance and/or intervention and/or procedure on Spheros electric air conditioning equipment, the intervenor must have carried out training in the norms regulatory NR-10 (SAFETY IN FACILITIES AND SERVICES IN ELECTRICITY) and NR-35 (WORK AT HEIGHT) and the certificates must be checked and within the expiry date.
It is important that the intervenor have basic knowledge of automotive electricity, its risks and the operating principles.

Electrical System

Electrical System Care

When performing preventive maintenance procedures, always pay attention to safety in the use of PPE's and other factors that may compromise human integrity.

RISK OF ELECTRIC SHOCK
VOLTAGE 480 - 880 Vdc

Equipment works in two voltage ranges:

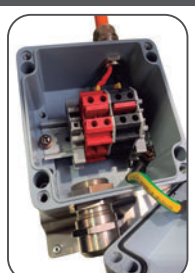
Voltage range 1- 880 Vdc to 480 Vdc
The components operating in this voltage range are identified by the symbol above.
These components **MUST NOT** be opened and cables **MUST NOT** be handled. If any of these covers are open or the cable is damaged, discontinue use and seek Authorized Service immediately.

Voltage range 2- 24Vdc
In this voltage range, the control and signaling components operate.

Distribution Box

Component where the electrical connection is made to the supply in the Spheros air conditioner.

Perform a visual assessment of the cover that must be closed, by tightening the screws and cable connectors as preventive maintenance.



Electrical Conductors

Visually inspect the condition of the cables, with no signs of damage to the covers, tightening of the connections, as described in the preventive maintenance routine.

Orange Conductor
Vcc POWER CABLE

Green Conductor – Yellow
GROUNDING

Frequency Inverter

Converts the voltage range of up to 880 Vdc to 380 Vd three-phase that controls the compressor. It may have a 24 Vdc output.

Perform a visual assessment of the covers, which must be closed and with the tightening of the screws and cable connectors that must be mounted.

Assess the presence of dirt in the air passages and dissipators.
In case of excessive dirt, clean.

WARNING!
The use of the equipment at altitudes above 3,000 meters is prohibited. Risk of electric shock.

Compressor

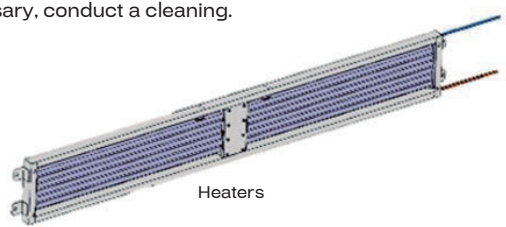
Hermetic compressor mounted next to the ceiling unit, controlled by the frequency inverter. Check if the cable is mounted and without damage marks on the cover.
Check that the cover of the electrical connection is closed and the screws are tightened. Check that the pipe connections are tight.
In the air conditioning model CC356E, refrigerant gas R134a is used.

Caution! Extremely hot surface.

Heating System

It operates with resistive elements attached to the cooling coils and is controlled by an electronic control panel.

Check if the resistive elements are clogged or excessively dirty and if necessary, conduct a cleaning.



Heaters

The heater controller has a panel with an LED display that shows the following activation diagnosis:

- 24 Volts of power
- Enables
- Heater 1 ON
- 2 ON heater

WARNING!
Check the display diagnostics only. Do not access the inside of the controller.

Refrigerant Gas R407C

This appliance uses the R407C refrigerant. The use of gas with different characteristics, low quality or doubtful origin will cause low cooling performance and will also damage components of the air conditioning equipment.

WARNING!
under no circumstances should refrigerants be discharged into the atmosphere.

Drying Filter

We recommend the preventive replacement of the drying filter every 3 years. If the complete loss of the gas charge occurs, we recommend replacing the filter drier to eliminate impurities that may be lodged within the system.

Ducts

The cleaning of the air ducts should be performed on a quarterly basis, and this time can be reduced, depending on the use of the air conditioning system, the number of people transported and the aggressiveness of the environment where the vehicle travels. This cleaning is the exclusive responsibility of the vehicle owner, he will bear all the burden of poor air quality offered to his passengers.

NOTE: ducts are components of the body.

DO NOT USE RECONDITIONED PARTS!
The use of reconditioned parts will decrease the efficiency of the air conditioning, overload the electrical system and may pause component damage and even cause a fire.

Preventive Maintenance Frequency Check List

WEEKLY	1 - Clean or change the return air filter.
MONTHLY	1 - Accomplish the weekly check list.
	2 - Clean the condenser capillary tube coil (Apply only water and neutral non-aggressive soup to cooper and aluminum). See note (*)
	3 - Check if the evaporator hatches are closed to avoid air intake into the equipment.
	4 - Test the equipment operation functions: cool / fan (high and low speed) / heat / dry (air renewing) modes.
TRIMESTRAL	1 - Accomplish the monthly check list.
	2 - Activate the heating system, if any.
	3 - Measure the exhaust suction pressure, temperature and suction line condition.
	4 - Measure the condenser and evaporator fan flow consumption (check their air outflow).
SEMESTER	1 - Accomplish the trimestral check list.
	2 - Clean the evaporator capillary tube coil. (Apply only water and neutral non-aggressive soup to cooper and aluminum). See note (*)
	3 - Clean the heating system heaters, if any. (Apply only water and neutral non-aggressive soup to cooper and aluminum). See note (*)
	4 - Clean the evaporator drain.
	5 - Look carefully, if there is any leakage at coupling spots: oil leakage, refrigerant leakage.
	6 - Check if there are any loose, free, damaged, broken, worn parts, rusty, melting, cracked or bad fractioning to the bus body.
YEARLY	1 - Accomplish the semester check list.
	2 - Check the opening and closing pressures of high and low pressure switches.
	3 - Clean the air conditioning body getting rid of any dust/scrap at components. See note (*)

IMPORTANT: If you do not accomplish the preventive maintenance check list as above, it implies to total or partial loss of warranty coverage.
The actions of preventive maintenance written in this manual have been based on normal conditions. Just in case of environment contaminated and bad weather conditions, then you must do the maintenance more frequent.
NOTE (*) : when cleaning using water, protect electrical and electronic components to prevent damage.

IMPORTANT: the vehicle owner must do preventive maintenance actions.
If you do not do the preventive maintenance as described in this chapter, it implies you lose partially or full warranty coverage.

ATTENTION: Just in case a problem happens in the refrigeration system, then it must be repaired in an authorized shop or qualified professional.
If a third party installs the equipment, SPHEROS DO BRASIL - S/A, guarantees only the product, not the installation of it.

The following items are in charge of the OEM Plant (Bus Body Builder).

- **Driver´s evaporator:**
Problems with any driver´s air conditioning component, leakage, bad working or operation.
IMPORTANT: lclean the return filter of the driver´s air conditioning, at least, once a week.

- **Tubes, hoses, drains and wiring harness:**
Bad attachment. Leakage at connections and welding points. Damages due to frictioning / chassis and components frictioning or bad installed.

- **Gas Charge Process:**
Leakage test procedure. Vacuum process and refrigerant gas charge.

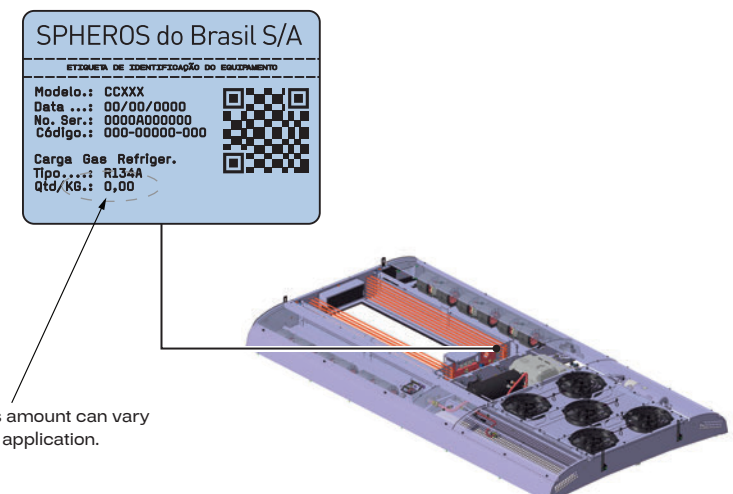
Note: in case the installation is bad, SPHEROS Agent Authorized Service Net will have to call the OEM Plant first, then get an authorization to do the service, print and issue the Invoice of repairs.

Identification Tag

It is very important, when you need to ask for spare parts or after sales parts, and similar ones, customer must identify the model of the air conditioning, telling the series number, model and manufacturing date.

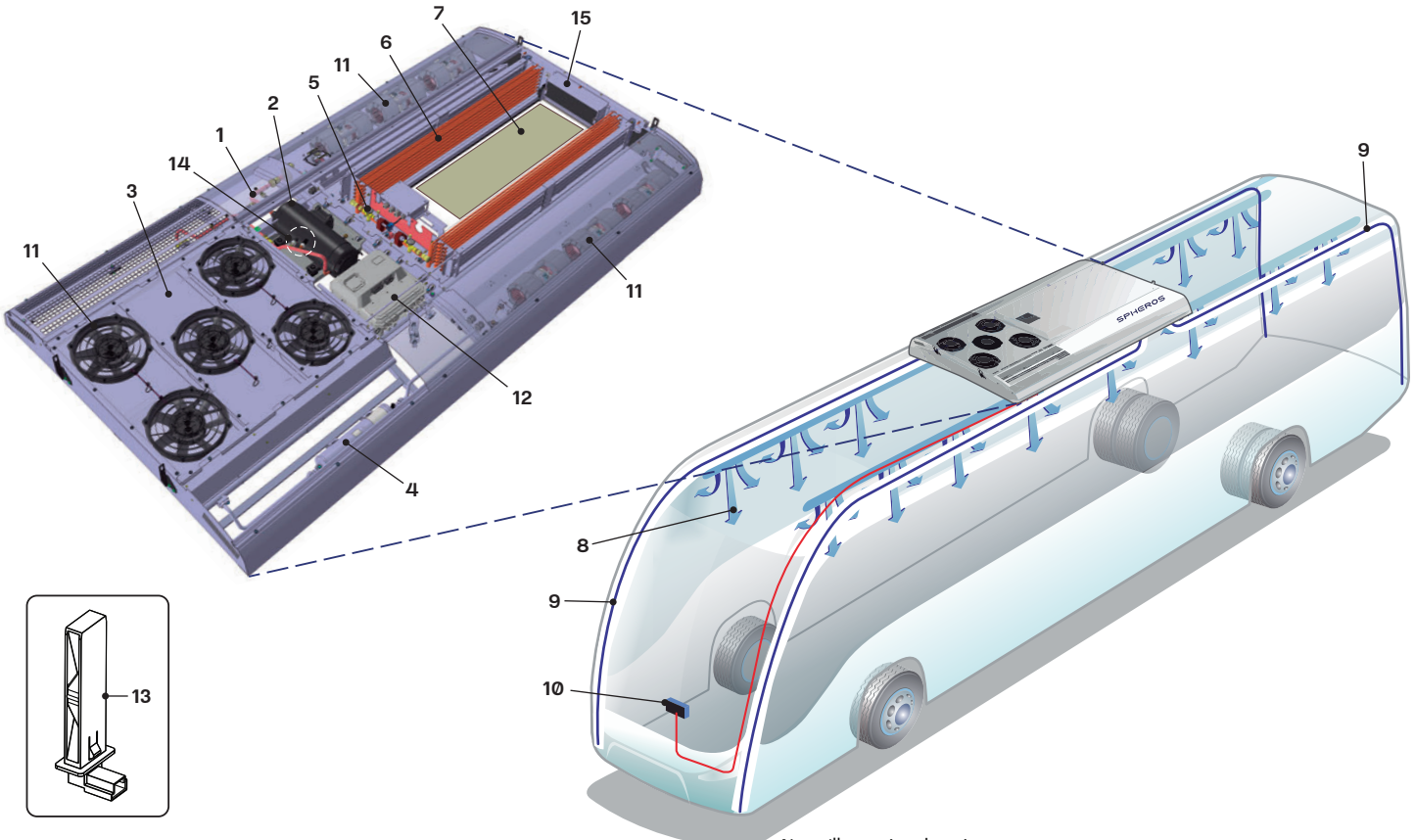
This information can be found in the Air Conditioning Warranty Certificate and ID tag.

Application information regarding to: series and bus body model, series and chassis model are very important to identify which parts the equipment carries.
In order to identify the bus body and chassis, you need to check the bus body builder manual.



The refrigerant gas amount can vary according to application.

Operating the Air Conditioner



Note: Illustrative drawing.

MECHANIC SYSTEM

1 Refrigerant Fluid

It is inside the air conditioning equipment, inside the system. It works absorbing the heat from the interior / room of the vehicle, at the evaporator, and then it goes to the condenser where the heat is thrown to the outside. SPHEROS DO BRASIL - S/A, products apply refrigerant R134a, according to the Protection Environmental Law.

2 Compressor

When it is working, the compressor sucks the refrigerant fluid from evaporator at gaseous state and under low pressure, compressing it, so temperature and pressure increase, then the compressor puts it into the condenser.

3 Condenser

Its main goal is dissipate the heat out, which was absorbed by the refrigerant fluid along the refrigeration system.
At the condenser, the overheat refrigerant fluid is sent to outside losing its force, changing from gaseous state to liquid state.

4 Accumulator Liquid Tank

Its purpose is to retain impurities and / or moisture that may be in the system preventing them from reaching the expansion valve.

5 Expansion Thermostatic Valve

Valve hinders the refrigerant inlet that comes from de condenser at high pressure and its goal is adjust the refrigerant gas flow that passed by the evaporator looking for making the pressure steady and temperature at the capillary tubes output.

MECHANIC SYSTEM

6 Evaporators

Now at evaporators, the refrigerant fluid, at low pressure, turns from liquid to gaseous state, absorbing the interior heat of the vehicle in this process.

7 Air Filter

Air return filter retains impurities from air avoiding any block of dirt at evaporator capillary tubes and coil.

8 Air Circulation

Air being cooled by the evaporator, then it follows to the bus interior through fans.

9 Drain

It is a way to get the condensed moisture from evaporator tubes from the condensed tray to putting out.

ELECTRIC SYSTEM

10 Controller

It is installed in the instrument panel, it offers to the driver to set-point of temperature, to see by display the interior temperature, offering full climatic control inside de bus.
Set-point: it is the temperature the driver wishes to set inside the vehicle for passengers.

11 Electronic Fan

Electronic fans differ from conventional fans because their speed varies according to the compressor rotation, thus allowing a better temperature adjustment.

ELECTRIC SYSTEM

12 Frequency Inverter

The frequency inverter has the purpose of transforming DC voltage into 380VAC three-phase, thus varying the frequency of rotation of the compressor.

13 Temperature Sensor

The interior temperature is measured by the temperature sensor placed at the air return spot.

14 Pressure Switches

Pressure sensors are devices that read pressure and convert it into an electrical signal.

15 Air Refrechment

This permits the entry of the exernal in order to expel unwanted odors and impurities from the vehicle.

1.1- SCB2000 Controller Operation

This product aims to control the temperature of SD (Single Deck) vehicles. The intelligence of the system and charge activation is done by Smart ECU in conjunction with the relay board, while the panel is used for user interface only.

SCB2000 Controller

1.2- Description of the Control Panel

Below is a description of each of the keys with their respective functions.

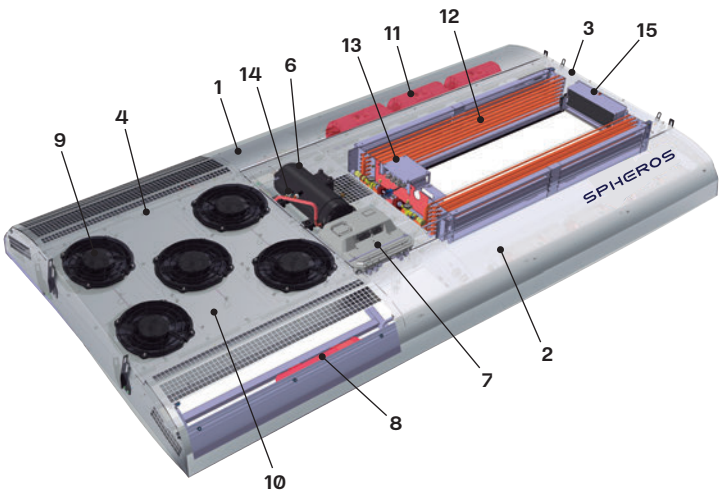
1- ON/OFF_____Turns the product ON / OFF.
2- AC_____Indicates that the compressor is ready for operation.
3- Increment of the set-point_____Defines the desired temperature in the room.
4- Decrease of the set-point _____Defines the desired temperature in the room.
5- Auto_____Activates the automatic fan speed and air renewal mode.
6- VENT_____Manual speed control of the evaporator fans.
7- Re-Heat_____Turns on / off the passenger window defroster.
8- Air recirculation _____Turns on / off air recirculation on the bus.

2- Technical Data Sheet

Component	Characteristics	CC356-E
AIR CONDITIONING	Cooling Capacity Evaporator: 40^{0} C @ 46% UR Condenser: 35 ^{0}C	110.000 BTU/h (32kW)
	Heating Capacity	41.000 BTU/h (12kW)
	Air Renewal	25%
	Evaporator Air flow (free blowing)	6.600 m^{3}/h
	Condenser Air flow (free blowing)	13.500 m ^{3}/h
DIMENSIONS	L x W x H (mm)	3270 x 1700 x 280
	Weight	Refrigeration - 235 Kg Refrigeration and Heating - 250 Kg
	Ceiling Radius (mm)	10.000
ELECTRIC	Current Consumption 750 Vdc Maximum Rotation (100%)	Refrigeration - 17,0 A Heating - 16,5 A
	Integrated Converter	Included
COMPRESSOR	Refrigerant Gas	R407C
	Tension	380 Vac Three Phase

3- Equipment Components

NOTE: visit www.spheros.com to consult the complet parts catalog.



Item	Code	Description
01	See NOTE	Right Side Cover
02	See NOTE	Left Side Cover
03	See NOTE	Evaporator Cover
04	See NOTE	Condenser Cover
05	See NOTE	SCB2000 Controller
06	See NOTE	380V Hermetic Compressor
07	See NOTE	Frequency Inverter and Converter 24Vdc
08	See NOTE	Accumulator Liquid Tank
09	See NOTE	Condenser Fan
10	See NOTE	Condenser Coil
11	See NOTE	Evaporator Blowers
12	See NOTE	Evaporator Coil
13	See NOTE	Heating System Controller (PTC-CU)
14	See NOTE	Pressure Sensors
15	See NOTE	Air Renewall Set

06 - Hermetic Compressor 380V:
No oil is added.
Winding resistance 1,7 Ohms.
R407c Refrigerant.

07 - Frequency Inverter and Converter 24Vdc:
Do not invert the output phases for the U-V-W motor.
Does not need preventive maintenance.
Maximum altitude: 3,000 meters.

4- Definitions and Main Information

High Voltage - 480 to 880 VDC

ATTENTION: before any maintenance, disconnect the High Voltage and wait 20 minutes for electrical discharge.

- High Voltage fuses under the responsibility of the chassis/body.
- High Voltage input cable in the ceiling device under the responsibility of the chassis/body.
- Do not invert the phases in the connection between the Inverter and the Compressor.
- Minimum section for the Protective Conductor of 25mm^2.
- Grounding Points CPE1 to CPE4 must be directly connected to the body structure to ensure electromagnetic compatibility.

Wire colors according to IEC 60757		
ABREV.	English	Português
BN	BROWN	Marrom
RD	RED	Vermelho
BU	BLUE	Azul
OG	ORANGE	Laranja
BK	BLACK	Preto
YE	YELLOW	Amarelo
GN	GREEN	Verde
VT	VIOLETT	Violeta
GY	GRAY	Cinza
WH	WHITE	Branco
PK	PINK	Rosa
TQ	TURQUOISE	Turquesa

Definitions	
ICN	Connector Controller Interface
ISV	Vehicle Interface Connector
IC	Connector Body Interface
B10M	24V - M10 Positive Terminal
B8M	24V - M8 Negative Terminal
RB	Relay Base
IPTC	Connector Heating System Interface
STD	Duct Temperature Sensor
STE	External Temperature Sensor
STR	Return Temperature Sensor
RAR	Air Renewal
FB	Fuse Base
VR	Radial Fan
CD	Condenser Interface Connector
CAN	Communication with Frequency Inverter
VA	Axis Fans
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
PSL	Low Pressure Switch
PSH	High Pressure Switch
CTS	Compressor Temperature Sensor
FI	Frequency Inverter Connectors
CPTC	PTC Connector
CPE	Protective Conductor Connection

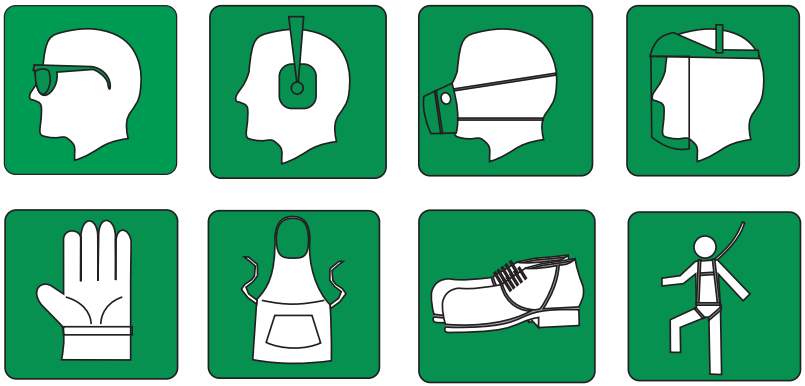
5- Security Alerts

Air conditioning systems offers chemic, mechanic and electric risks.

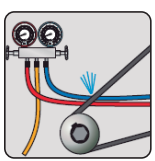
It is mandatory to wear IPE (Individual Protection Equipment), picture 1 to protect yourself from refrigerant gas, refrigerant oil, battery acid, waste launched, engine high temperature and noise.

Other Care:
- Ladders and platforms: they can slip or break;
- Whenever working at a height greater than 1.5m use proper PPE for working at height (belt, helmet, etc.;
- Cooling oil can cause skin and eye irritation, use the appropriate PPE (gloves and goggles);
- Check that all screws are adequate and torqued correct.

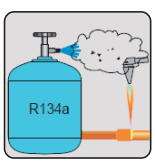
Personal Protection:



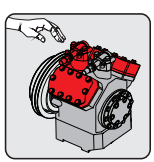
High Pressure:
The refrigerant in liquid state and high pressure causes a potential risk. When the refrigerant is sprayed to natural air, it can cause serious injuries to eyes and skin.



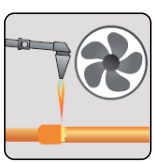
Hoses:
Check if manometer hoses are in good conditions, when holding them; stay far from belts, pulleys and hot surfaces.



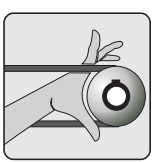
Toxic Gases:
The refrigerant gas along with flame becomes into toxic gases and can cause very serious breathing illness. Take special care in closed places, if gases scape somehow (leakage) and then it can cause no toxygen in the air.



Hot Surface:
The compressor discharges, exhaust pipes and other engine components can be extremely hot.



Welding:
Welding must be done carefully; it causes burns and spray toxic gases out. Provide ventilated places to do it.



Rotation Components:
The fans, pulleys and belts are not visible under certain conditions. Special care must be taken when putting your hands near them.

6- Product Discard

Concerned about sustainability at SPHEROS DO BRASIL - S/A guides its customers and its authorized service network to discard products in an environmentally sound and safe manner.

Proper disposal of the product or components at the end of their useful life will contribute with the preservation and pollutinon reduction of the environment, creating economic growth through the Reverse Logistics Program.

According to Law 12,305 / 2010, the environmentally adequate destination of components (parts, oil, refrigerant) is required.

It is the responsibility of all to ensure that products and components are sent to appropriate treatment to companies approved by the environmental agencies.

For more information about our Reverse Logistics Program, please see our website: **www.spheros.com**

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