embraco

Commercial Cooling Solutions

Installation Instructions

embraco
PLUG N' COOL

NATURAL
REFRIGERANTS

embraco
PLUG N' COOL

Summary

1 General Information

This manual contains data and information necessary to guide users of Plug n'Cool sealed refrigeration systems during installation, handling, maintenance and disposal. **Its reading and observance are obligatory**, especially because Plug n'Cool type sealed refrigeration systems contain flammable fluid R-290 (propane).

The settings presented in this manual may be slightly different due to constructional or application characteristics. In such cases, the recommendations will be presented in a generic way to safeguard the applicability of this document. Pictures and drawings should be considered for reference only.

This manual must be delivered in printed form and in electronic format to the owners of the final products. We suggest that the printed copy be stored in a place that is easily accessible to the person responsible for the operation of the product and protected from the action of external agents that may cause its deterioration throughout the product life cycle.

Embraco understands that the location of the Plug n'Cool units follow all safety and hygiene standards and procedures and that the technical teams responsible for installation, handling, maintenance and disposal have an adequate level of training sufficient to interpret the information in this manual.

⚠ WARNING

This safety warning symbol indicates the possibility of damage to health or risk to life if the guidelines described herein are not followed.

Whenever this symbol is indicated, the potential risk related to such will also be available.

2 Product Description

Embraco's Plug n'Cool units are a new product line specially designed to support a refrigeration system with its best efficiency and the lowest environmental impact. All units are preloaded with R-290 (propane), a natural and efficient refrigerant, with loads below 150 grams per circuit. As propane is flammable, only specialized technicians can perform maintenance on these units.

Plug n'Cool units are complete cooling systems, which integrate the condenser unit (high pressure and temperature side), evaporator unit (low pressure side and temperatures) and ventilation systems. Units can be equipped with one or two independent cooling circuits and removal of heat from the high temperature side occurs by forced air or water flow, depending on the version. In the version with the removal of heat from the water-cooled condenser, the water pumping mechanism, interconnections and the external heat exchange system are not an integral part of this product.

Table 1 we have the product envelop and application.

Table 1 - Plug n' Cool Product Description

Model	SKU	Voltage	Application	Cooling	Cabinet Temperature	Defrosting Type
EPCA SFMFT413U	515200049	208-240V / 50-60Hz	Chilled products, meat, beers	Air	-5 ~ 5°C	Hot Gas with sensor in the Evaporator

The unit controller is not included. In addition to the other parameters deemed necessary, it is recommended to set the time cycling, temperature cycling (set point and hysteresis), defrosting time and conclusion of defrosting by temperature.

The units are designed to provide maximum energy efficiency, including the use of electronic motors (ECM's) on fans, Fullmotion technology compressors and R-290 (propane) refrigerant, which is class A3 flammability - high flammability and low toxicity (Table 2) - as specified in EN0378-1:2008.

Plug n' Cool has all the basic elements of a cooling system, the variations of the components of each version, main dimensions, safe operation area, main application and performance data are described in chapter 2.3 - Product Presentation.

Table 2 - Refrigerant safety classification

Flammability		Toxicity	
		Low Toxicity	High Toxicity
	Without flame propagation	A1	B1
	Low flammability	A2	B2
	High flammability	A3	B3

2.1 Reference Standards

Plug n'Cool units have been built with reference to the security requirements specified in the following standards:

- *EN378-1: Refrigerating systems and heat pumps. Safety and environmental requirements. Basic requirements, definitions, classification and selection criteria*
- *IEC 60335-1: 2010 Household and similar electrical appliances – Safety – Part 1: General requirements;*
- *EN 378-2, Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation.*
- *EN60079-15:2010 - Explosive atmospheres - Part 15: Equipment protection by type of protection 'n'*

2.2 Training of Technical Teams

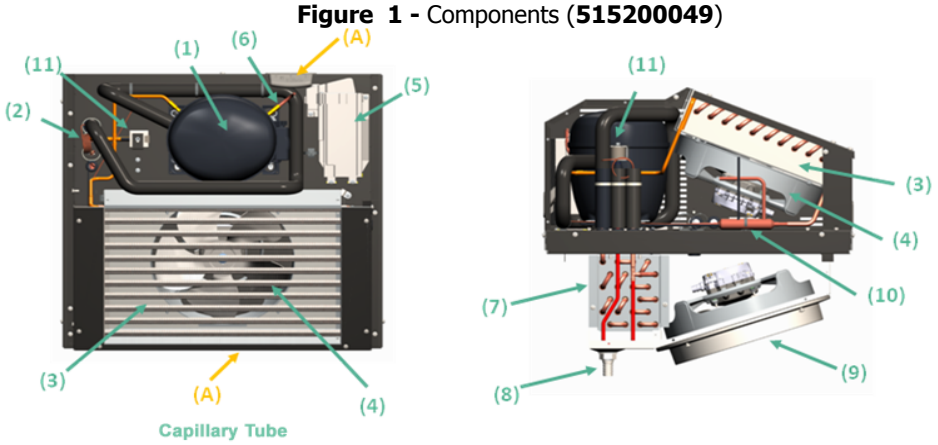
Embraco recommends that technical support, installation, maintenance, operation and dismantling teams of systems containing flammable fluids receive appropriate training. Seek technical support from the cabinet manufacturer for specific details and information.

Embraco supports cabinet manufacturers and provides relevant information so their technical teams can be trained to operate with these applications.

2.3 Presentation of the Product

SFMFT413U (SKU: 515200049)

Figure 1 - Components (**515200049**)



(1) Compressor
(2) Capillary Tube
(3) Condenser
(4) Condenser Fan
(5) Inverter
(6) Process Tube
(7) Evaporator
(8) Water drain outlet
(9) Evaporator fan
(10) Drier Filter
(11) Hot gas defrost solenoid valve
(A) Transport handles

Figure 2 - Critical Dimensions (**515200049**)

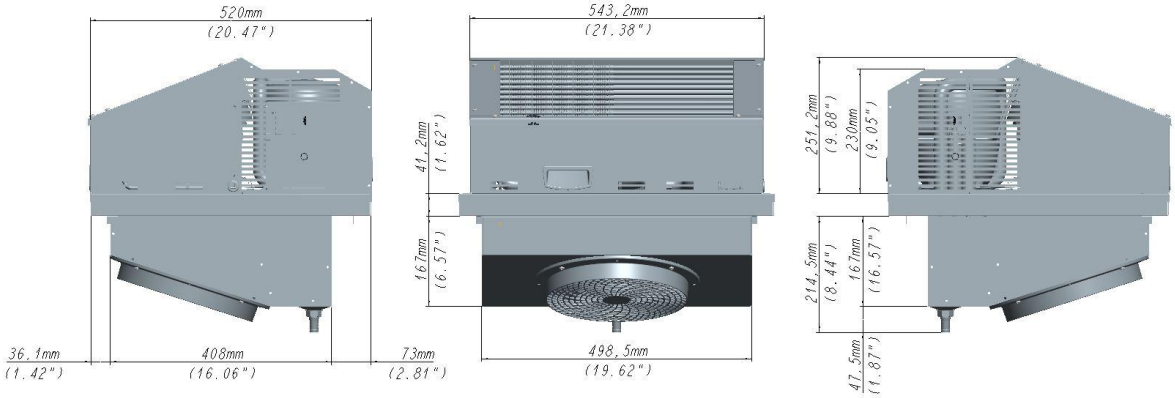


Table 3 - Additional Plug n' Cool Information (515200049)

Refrigerant Load:	130g (4,586oz)
Refrigerant:	Propane (R-290)
Product weight:	26 kg (57lbs)
HP:	¾
Voltage/ frequency	220 V / 60 Hz
Main Application:	Average temperature (reach ins)
Condenser type:	Air cooled
Defrosting:	Hot gas
Mounting Configuration:	Ceiling mounting (top mounted)

Table 4 - Plug n' Cool Performance Data (515200049)

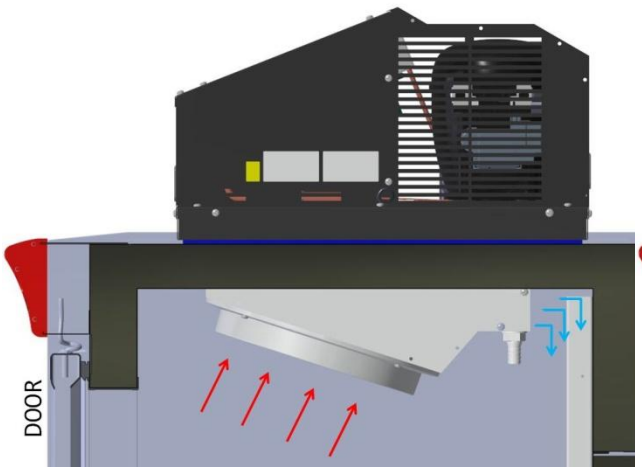
Capacity (BTU/h) - EER (BTU/Wh) - Consumption (BTU/h) Capacity (W) - Efficiency (W/W) - Consumption (W)		Ambient Temp. (°C)
		25
Cabinet Temp. (°C)	-5	3176 BRU/h – 4.74 BTU/Wh – 2283 BTU/h 930.8 W – 1.39 W/W – 669 W
	0	3415 BTU/h – 4.77 BTU/Wh – 2439 BTU/h 1000.8 W – 1.40 W/W – 714.8 W
	5	3551 BTU/h – 4.80 BTU/Wh – 2518.5 BTU/h 1040.7 W – 1.41 W/W – 738.1 W
Capacity (BTU/h) - EER (BTU/Wh) - Consumption (BTU/h) Capacity (W) - Efficiency (W/W) - Consumption (W)		Ambient Temp. (°C)
		35
Cabinet Temp. (°C)	-5	3002 BTU/h – 4.06 BTU/Wh – 2522.6 BTU/h 879.8 W - 1.19 W/W - 739.3 W
	0	3137 BTU/h – 4.07 BTU/Wh – 2636.2 BTU/h 919.4 W – 1.19 W/W – 772.6 W
	5	3271 BTU/h – 4.08 BTU/Wh – 2748.5 BTU/h 958.6 W – 1.19 W/W – 805.5 W

*Tests at 4,500 rpm

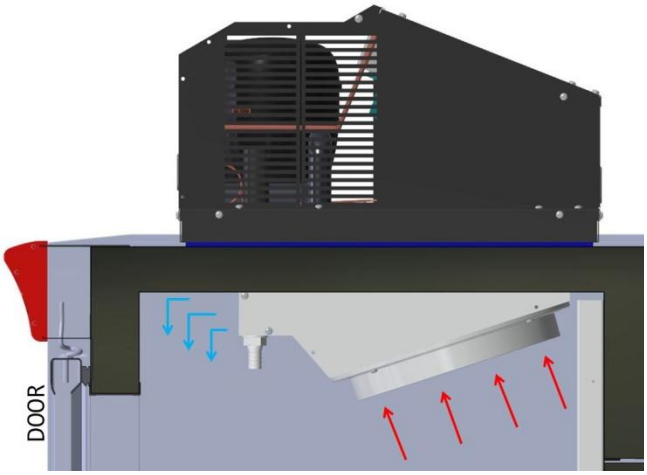
2.4 Airflow views

Figure 3 - SFMFT413U air flow options

(a) Rear airflow



(b) Front airflow

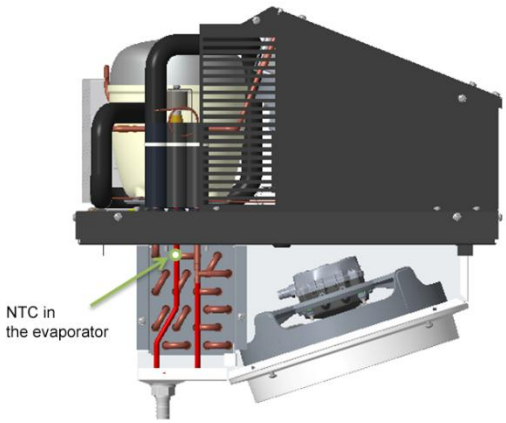


2.5 Thermocouple Locations

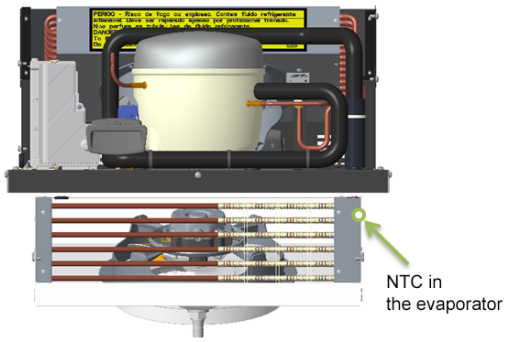
The Plug 'n Cool include thermocouples for defrost end. The manufacturer shall verify if the location is correct for its application and install additional ones if needed.

Figure 4 - NTC position

(A) NTC position in the evaporator (side view)



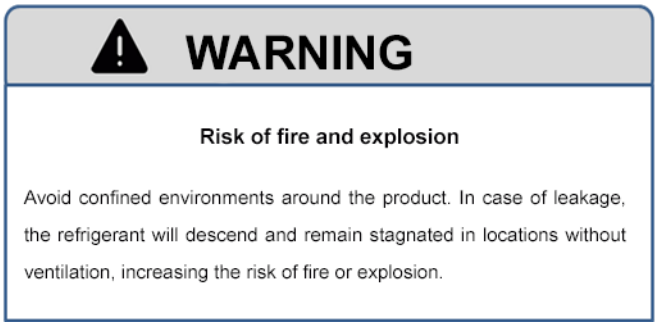
(B) NTC position in the evaporator (rear view).



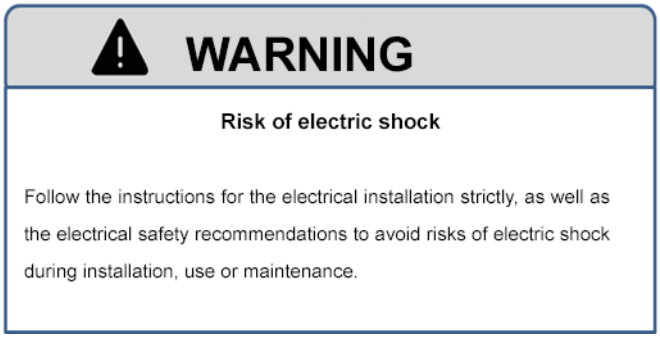
3 Installation

To avoid risk of fire, electric shock or injury, observe the following precautions:

- Follow the installation instructions carefully to ensure your own safety as well as the users of the product.
- Read all instructions before beginning the installation and operation of the product.
- This product has been developed exclusively for light commercial use in ambient temperature range between 15 and 35 °C.
- Handling of the product by untrained persons is not permitted.
- Do not install or store the product in a place subject to rain, even if it is in its original packaging.
- Do not exchange any component of this product or make any repairs that are not explicitly recommended in this manual.
- Always use Personal Protective Equipment (PPE), proper tools and equipment.



- Install the display unit to ensure adequate ventilation around the product. As it is a denser coolant than air, propane tends to accumulate in the lower part of the cabinet, so its installation should prevent the formation of gas pockets (confined spaces);



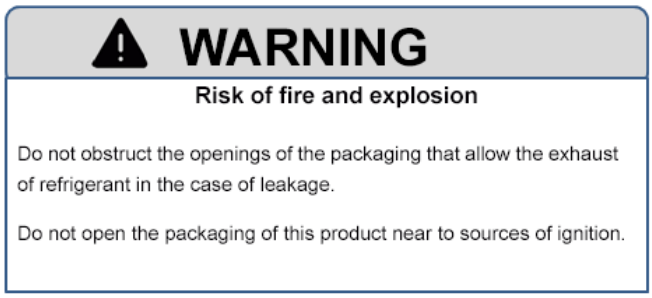
- Follow the installation instructions, especially regarding the supply voltage, forms of electrical connection, grounding, application of electric safety devices (circuit breakers) and water drain connections from the defrosting process;

There should be no equipment near the Plug n' Cool units that generate sparks in their normal operation, such as: relays, contactors, switches, circuit breakers, pressure switches,

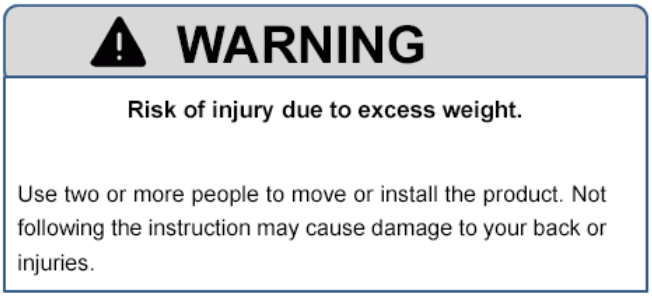
motors etc. These components increase the risk of ignition in the event of leakage of refrigerant from the refrigeration system.

3.1 Product Storage, Transportation, Unpacking and Handling.

It is recommended that refrigeration units be transported independently from the cabinet in which they will be installed. If this is not possible, ensure that the cooling unit is secured to the cabinet.



- Due to its flammable fluid, the packaging of the Plug n' Cool units has holes in its base that allow the natural exhaust of the gas in case of leakage. Do not block these holes;
- Do not store in confined places, always use ventilated areas;
- Do not store or open the product packaging near sources of ignition;
- Always transport the product in its original packaging.



- This product is heavy, depending on the model it should be handled by two people or with the support of specific equipment for heavy machinery operations.
- Do not drop the product.

Cooling systems containing flammable fluid above 100g (3.52 oz) cannot be transported by air, in accordance with current regulations issued by the IATA - International Air Transport Association.

3.2 Mounting and Fixation

The mounting window allows the cold side of the cooling unit to be inserted into the cabinet. This window should be positioned in such a way as to allow the best distribution of the airflow in the cabinet. Laboratory tests are recommended for determining the position of the mounting window and the need for deflectors for the airflow.

The mounting cooling unit must be built into the insulation thereof, which requires an adapter with a ”⌐ “ shaped profile inside the mounting window. This option allows the Plug n'Cool insulation block to be inserted into the insulation of the cabinet.

Add devices that lock the system in the desired position (not included). Use couplings with rubber vibration attenuators or suchlike.

An overview of the "Plug n' Cool + cabinet" fitting is shown in Figure 5. The cooling unit may be built into the insulation of the box (Figure 6) or mounted on the cabinet (Figure 7).

Note: The adapter is not supplied with the Plug n 'Cool unit, so it must be developed by the cabinet manufacturer. In case of use of the adapter, insulate it with covers so that this metal part does not come in direct contact with the ambient air, as this will lead to condensation forming on the upper part of the cabinet.

Figure 5 - SFMFT413U mounting diagram

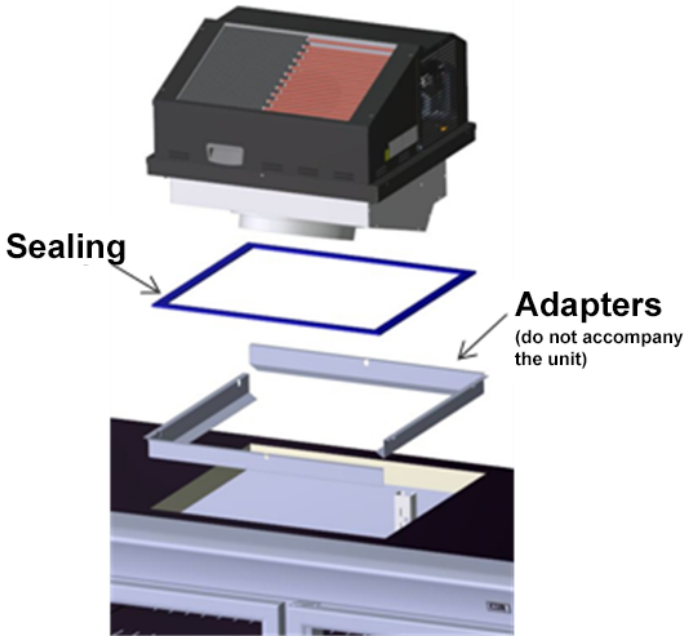


Figure 6 - Dimensions of the mounting window with adapter

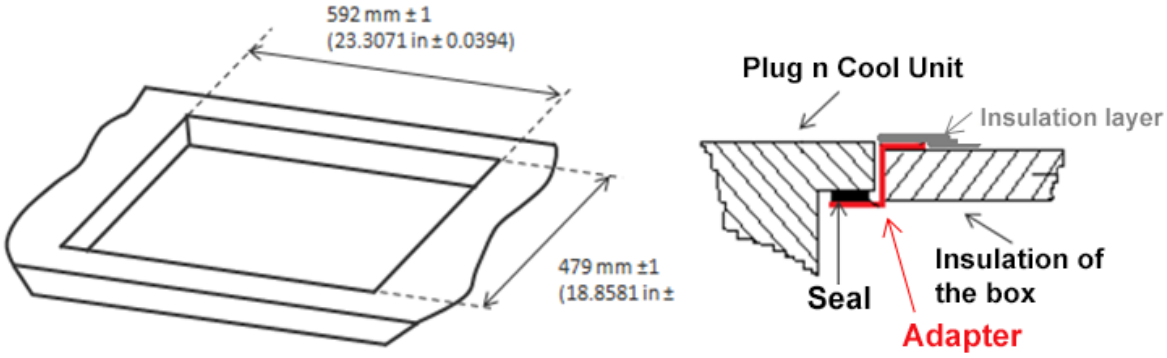
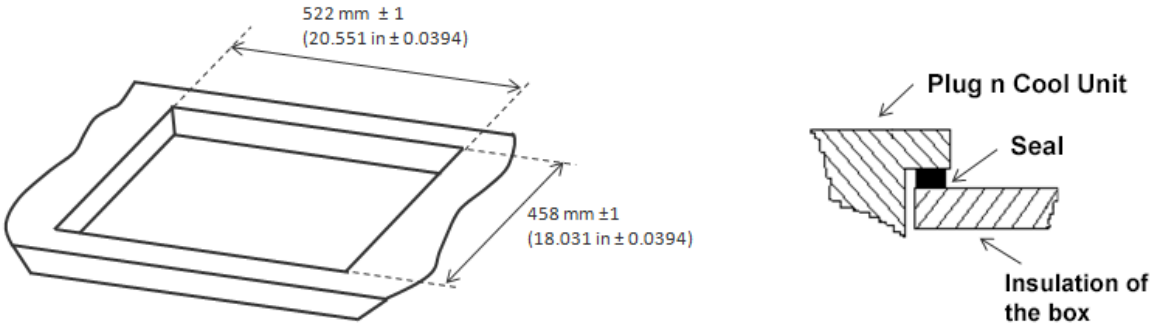


Figure 7 - Dimensions of the assembly window without adapter



3.3 Installation of thermo-acoustic insulation

Mount the thermo-acoustic insulator on the interface surface between the cabinet and the Plug n'Cool unit, with the adhesive part facing the cabinet's ceiling, all around the mounting window, preventing the presence of gaps.

3.4 Wastewater connection (condensation water)

Plug n'Cool units have a drain for water from the defrosting cycle. In order for the system to operate properly, it must be leveled (maximum allowable variation: 3°) and the drain connected to a wastewater line. The gauge for the connection of the drain hose to the product is given in Table 5.

Table 5 - Wastewater connection

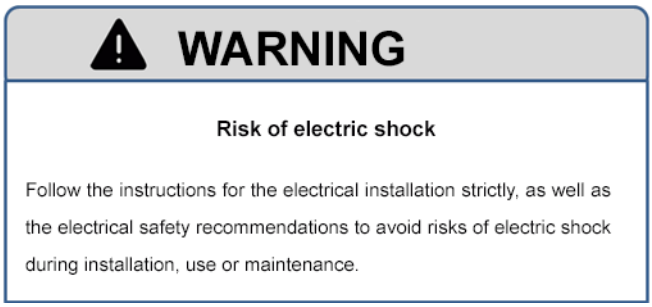
Model	SKU	Connection
EPCA SFMFT413U	515200049	15,8750 mm (5/8 in)

Ensure that the drain has a siphon to prevent the return of odors and the entry of insects into the cabinet.

During certification tests for the use of your cabinet, evaluate the need for the inclusion of a drain resistor. This component is not provided by Embraco.

3.5 Electrical Connection

This equipment must be installed in a properly protected electrical circuit by means of a residual current circuit breaker (DR) of at max. 30mA of leakage current. For two phase circuits, apply a residual bipolar current circuit breaker to protect both phases. The recommendation for the electrical wiring gauge is 16 AWG (1 mm²) for all units, or top section. Grounding the entire system is a mandatory requirement. Limits of current (Ampere) and voltage range by Plug n'Cool system (Table 6).

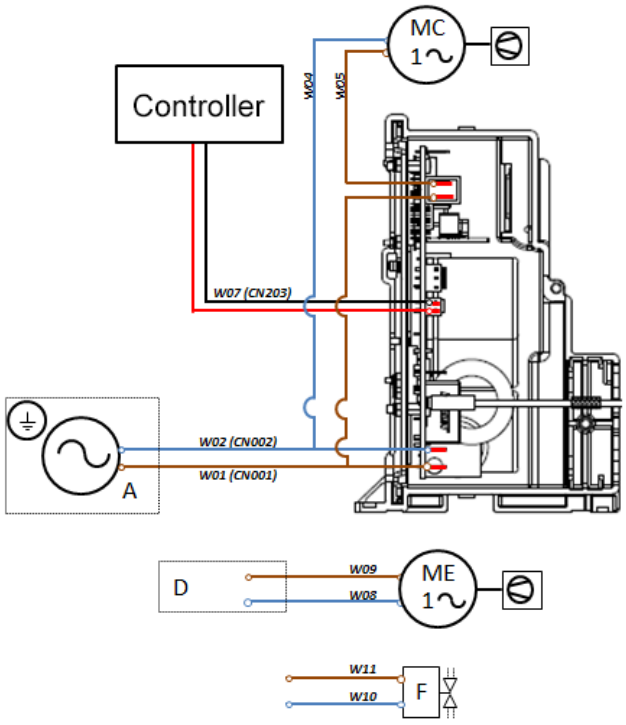


- Do not carry out maintenance or handling of the equipment while energized. Always turn off the power before accessing the equipment. For details on the components, such as connectors, request the drawings from Embraco.

Table 6 - Plug n' Cool Electrical Data

SKU	Input voltage / Frequency / Phase	Max Fuse (A)	Min Cir Amp (A)
515200049	208-240V / 50-60Hz / 1ph	11.51	8.22

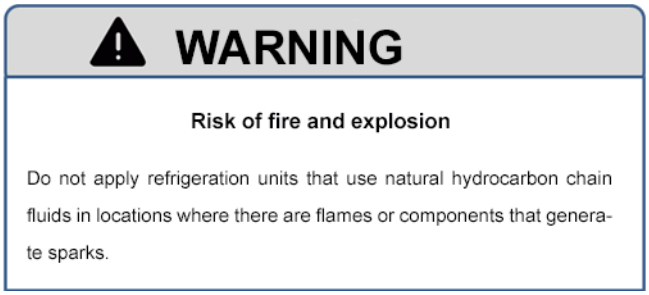
Electrical scheme SFMFT413U (SKU: 515200049)



***W01:** Phase (brown), connected to CN001 inverter*
***W02:** Neutral (blue), connected to CN002 inverter*
***W04:** Neutral connector (blue) in the condenser*
***W05:** Phase connector (brown) in the condenser fanfanportport*
***W07:** Frequency sign al, connected to CN203 inverter port*
***W08:** Neutral connection (blue) in the evaporator fan*
***W09:** Neutral connection (blue) in the evaporator fan*
***W10:** Neutral connection (blue) in the defrost coil*
***W11:** Phase connection (brown) in the defrost coil*
***Controller:** frequency signal – JST (VHR-2N-W-GE1)*
***A:** Power supply 30140N5 with grounding*
***MC:** Condenser fan*
D: Quick connection of the evaporator motor to be connected to the controller. The controller is not supplied with the unit.
***ME:** Evaporator fan*
F: Solenoid for hot gas defrost (without connector) – to be connected to the controller. The controller is not supplied with the unit.

4 Operation, maintenance and disposal.

This equipment is designed for light commercial use and is designed to be installed in horizontal walls only (top mounting of refrigerated cabinets). It must operate solely and exclusively with the refrigerant for which it was designed, which is propane (R-290).



- This product is designed to operate in locations without a potentially explosive atmosphere.

This product must be protected against adverse weather. It is recommended to turn on the product and left empty for at least 1 hour before being filled with the final products, which must already be cooled beforehand. In case of shutdown, wait 5 minutes before turning the appliance back on.

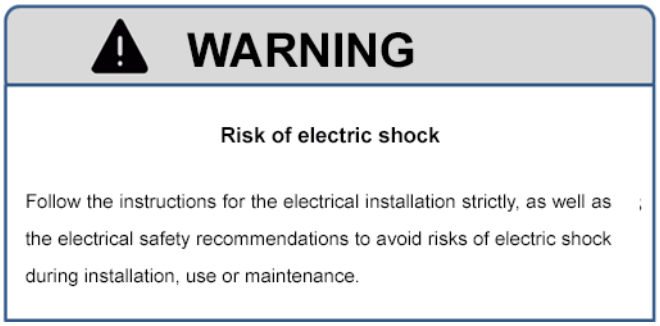
Fire extinguishers near the place of installation of this product are recommended. In order to reduce the risk of flame propagation, the product must remain free of combustible materials such as plastics, paper, oil, solvents and rags.

4.1 Cleaning

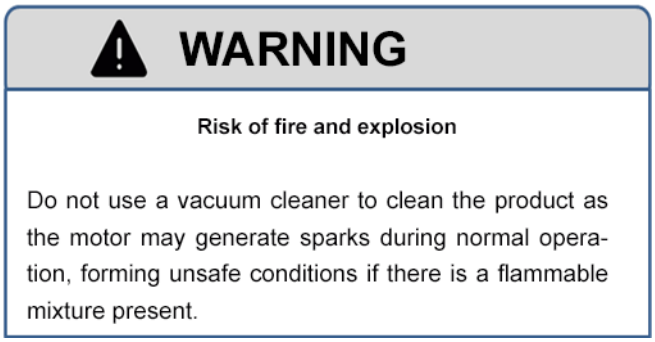
Maintain a periodic cleaning program for your equipment. Initially, we recommend evaluating the operating conditions every three (3) months. Based on the conditions observed, evaluate the possibility of extending or reducing the period for cleaning and maintenance.

Clean the inside of your product using a sponge or cloth dampened in warm water with detergent or mild soap. Rinse thoroughly and dry with a clean and dry cloth.

Use only a duster to clean the outside (cooling system region).



- Turn off and disconnect the product from the power supply before starting cleaning.



- Do not use a vacuum cleaner or any other electrical appliance that is not designed to operate with flammable fluids, as they are susceptible to sparking during operation. In case of leakage, a flammable mixture may occur.

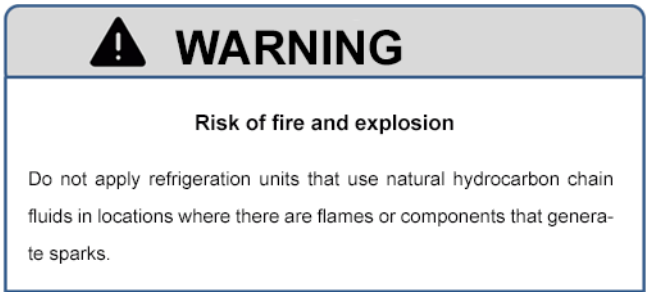
Avoid dust accumulation. Do not apply solvent, soap, alcohol, or chemicals that may chemically react with refrigerant system components. This product may become combustible under certain temperature and humidity conditions. After cleaning, plug the product into the outlet and let it operate for at least 1 hour before refueling.

4.2 Maintenance

Only qualified technicians familiar with the application of flammable coolant can perform work with Plug n'Cool units. These must strictly follow the working instructions:

- Maintain a periodic maintenance program for your equipment. Initially, we recommend evaluating the operating conditions every three (3) months. Based on the conditions observed, evaluate the possibility of extending or reducing the period for cleaning and maintenance;
- Every three (3) months, make a detailed inspection to identify refrigerant leaks. The presence of oil is an indicator of leakage;

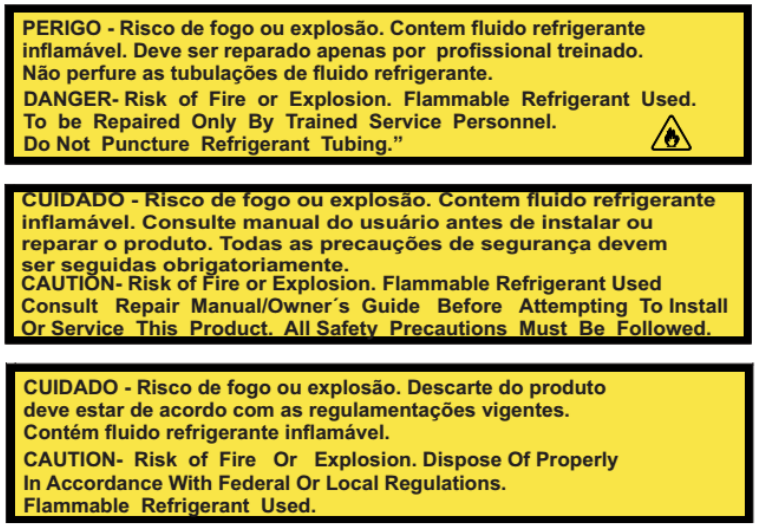
- In case of need to repair the product, determine a specific location to work with refrigeration systems that use flammable refrigerant. The work area must be free of ignition sources. Fire extinguishers must be present and easily accessible;
- Monitor the work area using a hydrocarbon detector (HC) located at a low level because HC's are heavier than air. The detector shall emit an audible and visual alarm before there is sufficient HC in the air to form a flammable mixture (approximately 2% HC by volume);
- When replacing or servicing electrical components in a system that uses a refrigerant with HC's, make sure that all components comply with IEC/EN60079-15. Starter devices and overload protectors need to be sealed and the fan motor cannot generate sparks (brushless);
- Remove coolant with a suitable gas collector for use with flammable fluids;
- Do not use a blowtorch to remove pipes. Cut them with a pipe cutter. Repair the unit and reduce the inspection interval to one (1) month until you are sure that reprocessing has been effective.



- Use appropriate tools and equipment;
- Only use tools and appliances certified for use in hazardous areas and use a bracelet to avoid antistatic electricity.

Transport the products in their original packaging or, if this is not possible, develop a package that allows the transport of the product within the safety requirements.

Pay attention to the safety instructions specified on the stickers placed inside the refrigeration unit and in its cover:



4.3 Disassembly and disposal

- After you have completed the cycle of using the Plug n'Cool units, define appropriate disposal of such;
- Do not reuse components, or restore the unit without an in-depth analysis of the conditions of use of each element;
- Use appropriate packaging (robust and ventilated) to transport the units from the installation site to the repair or dismantling area;
- Consider the possibility of returning the units to Embraco through the Nat Genius program;
- Never discard refrigeration systems in the trash container;
- Remove the refrigerant from the system safely;
- Dismantle the cooling system and the corresponding equipment;
- Separate materials according to their characteristics, encouraging recycling;
- Send refrigerant, oil and other materials to the appropriate collection stations.

4.4 In case of failures

Call the authorized service technician to determine if the problem is related to maintenance, failure of components (fans, water pumps etc.) or leakage of refrigerant. In the event that the problem is in the Plug n'Cool unit, the technician will turn off the equipment, remove it, and send it in appropriate packaging to a suitable location for analysis and maintenance. If available, request the installation of a replacement product for the system to operate normally during maintenance of failed equipment.

4.5 Improper use

Plug n'Cool refrigeration units are designed for food conservators. Because of their constructive features, which use capillary tubes as expansion devices, these units should not be used for rapid cooling of food. Thus, food must be pre-cooled before being added to the areas equipped with Plug n'Cool systems. Using Plug n'Cool units for operations other than those specified may cause damage to equipment, food, and persons.

4.6 Troubleshooting

Note: Only qualified personnel can perform the recommended analyzes.

Problem	Probable Cause	Solution
Product does not turn on	Lack of power	Check the supervisory system or the circuit breaker of the electrical installation; Also check that the plug is connected to the outlet.
	Very low voltage. Thermal protector of the compressor may activate	Check the electrical wiring impedance. Evaluate need to correct the voltage via a stabilizer.
	Wrong or damaged electrical connection	Check electrical connections and replace damaged components, such as electrical connectors and compressor capacitor. Follow the manufacturer's recommendations.
	Damaged power cable	Contact your supplier's Service Network.
Abnormal noise	Presence of loose elements in the refrigeration unit or on top of the cabinet	Check the installation location and eliminate loose parts by refitting them.
	Dirty and blocked heat exchangers, leading to activation of the thermal protector	Review preventive maintenance period to avoid blocking the condenser by dirt or particles. Check fault indication on the supervisory system.
	Fan motor with excessive wear or propeller in contact with external elements	Disconnect the propeller from the fan motor. Replace the motor if necessary.
Insufficient cooling	Dirty and blocked heat exchangers, leading to activation of the thermal protector	Review preventive maintenance period to avoid blocking the condenser by dirt or particles. Check fault indication on the supervisory system.
	Leakage	Call the authorized service center to replace the failed unit with a replacement unit. Ventilate the area before installing and connecting the new equipment. Open the cabinet doors for at least 5 minutes to eliminate the possibility of gas accumulation inside the cabinet.
	Evaporation of excessive ice in the evaporator	Review the defrosting logic to ensure the efficiency of the heat exchanger.
		Check that the defrosting water drain is not clogged.
External condensation	High ambient air humidity, normal in certain climates and times of the year	Install your product in a ventilated place. Dry it with a soft cloth.
	Poor sealing of the packing gasket	Replace the gasket with a new one.

For more information on the safe use of natural fluids, refer to the Brazilian HCFC Elimination Program (PBH), coordinated by the Ministry of the Environment (MMA), through the Ozone Layer Management Department connected to the Secretariat of Climate Change and Environmental Quality.

5 Legal Statements

All products, product specifications and information are subject to change without notice, so the customer should always check the latest updates made on the Embraco website (www.embraco.com) or with the information channels of the manufacturers of the cabinets, catalogs or technical information/manual before using them.

The information provided herein is correct in accordance with Embraco's knowledge of the requirements that are generally required for Embraco products. It is the customer's responsibility to validate that a particular product is suitable for the use of a specific application with the properties described in the Embraco product specifications, based only on its testing and engineering processes. Embraco does not adapt its products for incorporation or use in the customer's applications.

The parameters provided in the data sheets and/or specifications may vary in different applications and performances. In this way, Embraco's opinion on all operating criteria, including typical criteria, cannot be intended to replace customer validation for each application by the customer's technical specialists.

Product specifications do not extend or otherwise modify Embraco's terms and conditions of purchase, including but not limited to the warranty expressed therein.

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EMBRACO LOCATIONS

Embraco around the world

United States (Sales Office)

1610 Satellite Boulevard, Suite B, Duluth, GA, - USA – 30097

Telephone: +1 678 804-1337 | Fax: +1 678 804-1338

Brazil (Compressor Factory) - Headquarter

Rui Barbosa, 1020 – Zip Code 91, 89219-901 - Joinville - SC - Brazil

Telephone: +55 47 3441-2333

Slovakia (Compressor Plant)

Odorinska Cesta, 2 - 052-01, Spisská Nová Ves - Slovakia

Telephone:+42 153 417-2291 / +42 153 417-2293 | Fax: +42 153 417-2299

Mexico (Compressor Factory)

Av. Industrias 501 Parque Industrial PIMSA Oriente Apodaca – Nuevo Leon – Mexico

Telephone: +52 81 4780-6700

China (Compressor factory)

29 Yuhua Road Area B of Beijing Tianzhu Airport Zona Industrial, 101312 - Beijing - China

Telephone: +86 10 8048-2255

Russia (Sales Office)

Odesskaya st., building 2A, office 13, Moscow 117638, Russia

Telephone: +7(495) 640 7050

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