

USER AND MAINTENANCE MANUAL FOR FINNED BLOCK HEAT EXCHANGER

Heat exchanger according to Directive 2014/68/EU Art. 4.3 and Cat.I

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1. INTRODUCTION

The finned-block heat exchanger is used to transfer thermal capacity between a fluid flowing inside tubes (single-phase or two-phase) and a secondary fluid flowing outside tubes (air).

The fluid flowing inside tubes could be water, ethylene glycol, propylene glycol or a refrigerant, according to the project.

The finned block heat exchanger is usually part of a heat pump or air conditioning system.

1.1 DISCLAIMER

Failure to read and follow instructions and warnings in this document may result in damage or injury of which Sierra cannot be considered responsible.

These instructions do not claim to cover all details and to provide for every possible contingency met in connection with installation, operation, or maintenance.

1.2 SCOPE

The manual must be used for:

- Safe use of the product;
- Safe handling, packing and unpacking;
- Correct installation;
- Function and limits;
- Safe maintenance;
- Recycling and out of service.

1.3 HOW TO READ AND STORE THIS MANUAL

It is strictly recommended to read this manual before the use of the product.

This manual is available for users, maintainers and air-conditioning system manufactures.

1.4 RANGE OF APPLICATION

The heat exchanger is manufactured according to the specification of the customer. The used material and characteristic of the product are adjusted to the case of application. The limits of application with regard to pressure and temperature, which are indicated on the drawing accepted by the customer, has to be observed.

 **It is possible that Sierra Spa will make corrections and changes without notice.**

2 GENERAL INFORMATION

2.1 ACCEPTANCE

At the receiving, the heat exchanger must have no sign of any tampering or damage, it must be provided with plugs and pre-charged, if requested.

Before using the heat exchanger, check that the delivered equipment is what you have ordered, verifying the correctness of the nameplate (if present).

2.2 SAFETY STANDARD

The heat exchanger is manufactured according European law and regulation, including:

Directive 2006/42/CE

Directive PED 2014/68/UE

EN 378-1:2021

3 DESCRIPTION

3.1 FUNCTION

The finned block heat exchanger operates with two different fluids: the fluid which flows inside the tubes could be water, anti-freeze liquids or refrigerant, the fluid which flows externally is air.

It is not allowed the use of refrigerants different from the project.

Pay attention to flammable refrigerant, a special project is needed for them.

Respect strictly the inlet and outlet refrigerant or water connection defined by the project.

The project capacity is reached only if the air direction is respected.

3.2 MAIN COMPONENTS

Heat exchanger parts:

- 1) Hairpin plate (usually made in galvanized steel, aluminium, peraluman)
- 2) Return bend plate (usually made in galvanized steel, aluminium, peraluman)
- 3) Top plate (usually made in galvanized steel, aluminium, peraluman)
- 4) Bottom plate (usually made in galvanized steel, aluminium, peraluman)
- 5) Inlet header assembly (use only for inlet) (copper)
- 6) Outlet header assembly (use only for outlet) (copper)
- 7) Hairpin (copper)
- 8) Return bend (copper)
- 9) Fins (aluminium)
- 10) Label (indicative position)

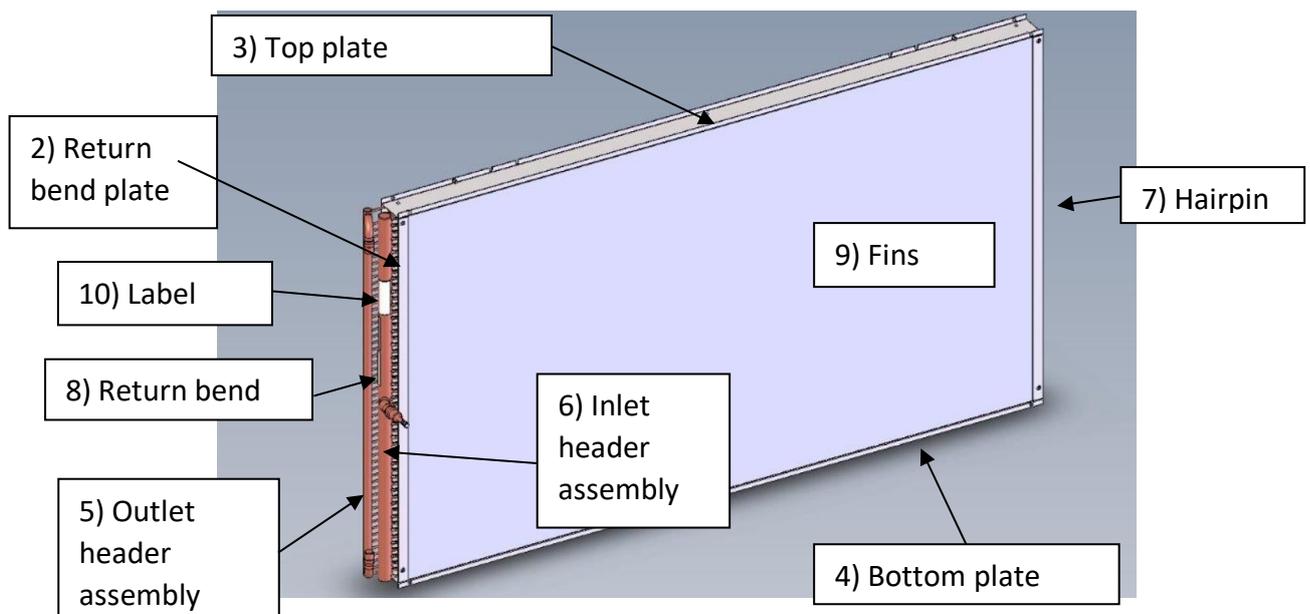


Figure 1 - Heat exchanger main components.

The heat exchanger is identified from the labels on the external packaging and on the heat exchanger itself (usually on the frame or on the headers).

Figure 1 is used only as an example and does not represent the real configuration, which can be different.

 The heat exchangers are produced according to the drawing available to the producer.

ATTENTION: any alteration and removal of the label is forbidden

4 SAFETY

4.1 GENERAL REMARKS

All the staff involved must have thorough knowledge of the operations and any danger that may arise when the installation operations are carried out. The installer must be aware of all the injury risks, of the personal protection equipment and accident prevention guidelines prescribed by national and international laws and regulations.

Before starting any operations, read these instructions carefully and carry out the safety checks to avoid all risks.

The alteration or substitution of components not authorized by the manufacturer is forbidden. Sierra S.p.A. declines all responsibilities in case of not authorized modifications.

It is necessary to check periodically the integrity and functioning of the heat exchanger.

Qualified staff must install the heat exchanger and do any maintenance or fixing operation. Incorrect fixing or maintenance can cause dangers for the user.

! *The product warranty does not cover additional cost for ladder track, scaffold or other elevation system that might be necessary to do reparations covered by the warranty.*

4.2 UTILIZATION

Use only refrigerants that are compatible with the design value of PS and with the heat exchanger materials.

It is forbidden to use the heat exchanger in systems operating with ammonia or other fluids that in case of leak may cause damages to people, environment or objects.

The heat exchangers manufactured by Sierra S.p.A. comply with Directive 2014/68/EU.

Sierra S.p.A. is not liable for direct or indirect damages deriving from wrong installation, operation, maintenance or unsuited use.

Respect the following safety remarks:

- Use the heat exchanger only in systems compliant with the design refrigerant.
- The heat exchanger must be handled with caution and only by qualified personnel.
- If the heat exchangers work with a flammable refrigerant, all the system must be suitable for this use (ATEX equipment must be evaluated).

The fluid to use is defined in the specific project.

The use of the heat exchanger is defined in this manual; other uses are not authorized by the manufacturer.

It must be avoided:

- The use the heat exchanger in environments with copper corrosive substances (like environments rich in ammonia, chlorine, etc.)

- The use of the heat exchanger in polluted industrial environment
- The use of the heat exchanger in marine environment (high salinity)
- The exposure to dynamic loads (like vibrations) which might cause fatigue failure.
- Collisions and unsuitable transportation that could compromise the integrity of the heat exchanger
- The overheating of joints during brazing.



The finned block heat-exchanger could have cutting-edge. Please use protection glove.

The heat exchanger is a pressure equipment and its PED category is determined according to Directive 2014/68/EU.

In case that the heat exchanger is PED I category, a PED label will be applied on it. Please check all the information contained in the label.

4.2.1 Fluids

<i>Operation type</i>	<i>Primary fluid (inside tubes)</i>	<i>Secondary fluid (outside tubes)</i>
Operation with hot or chilled water	Water Ethylene glycol Propylene glycol	Air
Evaporator	R134a R410A R407C R1234ze R1234yf R454C R454B R452C R32 R290 R744(CO2) and other refrigerants compatible with tubes material and thickness. The use of NH3 (ammonia) is forbidden.	Air
Condenser		
Reversible		
Other operation type	To check with Sierra Technical Department.	To check with Sierra Technical Department.

 **Caution is required for the use of flammable or mildly flammable refrigerants, in order to avoid fire hazard.**



Pay attention that all the refrigerants could have choking hazard if an accidental leakage occurs, because they limit the oxygen percentage.

4.2.1.1 Remarks on the use of water

Water inside tubes could freeze at low temperatures and cause heat exchanger failure.

Heat exchangers that are not in operation should be emptied and blown dry whenever there is a risk of freezing.

Sierra does not guarantee a perfect drainage of water. Some residual of water could remain in the tubes.

To avoid damage due to freezing, water must include an anti-freeze agent when operating conditions are below 5 °C.

4.2.1.2 Remarks on the use of CO₂ (R744)

The use of the finned heat exchanger with CO₂ has some risk because of the high pressure (up to 140 bar, please control the heat exchanger specification), the high/low temperature and asphyxia.

- **Choking hazard**



Pay attention to the CO₂ exposure effects if an accidental leakage occurs.

Carbon dioxide (CO₂) is a toxic gas at high concentration, as well as an asphyxiant gas (due to reduction in oxygen). Irritation of the eyes, nose and throat occurs only at high concentrations. The concentration thresholds for health effects are outlined in the table.

Health effects of respiratory exposure to carbon dioxide

(Baxter, 2000; Faivre-Pierret and Le Guern, 1983 and refs therein; NIOSH, 1981).

Exposure limits (% in air)	Health Effects
2-3	Unnoticed at rest, but on exertion there may be marked shortness of breath
3	Breathing becomes noticeably deeper and more frequent at rest
3-5	Breathing rhythm accelerates. Repeated exposure provokes headaches
5	Breathing becomes extremely laboured, headaches, sweating and bounding pulse
7.5	Rapid breathing, increased heart rate, headaches, sweating, dizziness, shortness of breath, muscular weakness, loss of mental abilities, drowsiness, and ringing in the ears
8-15	Headache, vertigo, vomiting, loss of consciousness and possibly death if the patient is not immediately given oxygen
10	Respiratory distress develops rapidly with loss of consciousness in 10-15 minutes
15	Lethal concentration, exposure to levels above this are intolerable
25+	Convulsions occur and rapid loss of consciousness ensues after a few breaths. Death will occur if level is maintained.

- **Explosion, high or low temperature hazard**



The CO₂ has a very high working pressure (up to 140 bar). During the refrigerant cycle, the temperature could be very high (100 °C or more) or very low (-20 °C or less). It is very important to avoid risks in case of accidental explosion or leak. Protection or safety control to prevent injury against people, animal or things are recommended.

Because of high pressure and high or low temperature, it is strictly recommended to avoid vibration, shock or any kind of collisions in general.

Contact with solid or liquid R744 will cause freeze burns and should be avoided. Suitable gloves and goggles should always be worn when working with R744.



**Please, check the project conditions (PS and TS) before installations.
PS and TS are reported on the drawing.**

- **Dry ice formation**

Dry ice could form when a system which is below CO₂ triple point (4.2 bar, -56 °C) is charged. When the dry ice in the system absorbs heat from the surroundings, it turns into gas and this results in a significant pressure increase.

4.2.1.3 *Remarks on the use of flammable or mildly flammable refrigerant*

- **Fire hazard**



Some refrigerant could be flammable or mildly flammable. Please, check the refrigerant Safety Data Sheet.

The manufacturer must install the heat exchanger in order to prevent fire hazard also in case of leakage or accidental breaking.

4.2.2 Periodical checks

The legislative decree no.329/04 regulates the start-up and the frequency of mandatory inspections. See mandatory inspection and their frequency in the table below.

The user is responsible for the periodical checks. The frequency may change depending on the type of plant and on the working conditions (see D.M. 329/04)

	Frequency	
	Periodical	If necessary
Check the integrity of the product after delivering.		X
Check the integrity of the product in case of accidental collisions, earthquakes or other natural disaster.		X
Check that no permanent deformation occurred on the heat exchanger after the charging of the system.	At the start-up	
Check there are no leakages that may be due to wrong transportation or installation.	At the start-up	
Check there are no leakages (check the charge of the system)	Every 1 year	X
Check the effective working conditions in compliance with producer indications and/or start-up declaration		X
Check the functioning of safety accessories	Follow the machine manufacturer indications	
Check the functioning of measurement instruments.	Follow the machine manufacturer indications	
External viewing inspection for corrosion, erosion, contamination and damage. External viewing inspection of joints and headers.	Every 1 year	X
Pneumatic test pressure with clean dry air or inert gas, as specified on the nameplate.		X
Evaporation/Condensation temperature measurement.		X
Superheating/subcooling measurement		X
Fins cleaning (if necessary)	Every 1 year	X

Table 1- Periodical maintenance.

5 INSTALLATION

5.1 HANDLING AND TRANSPORTATION

Do not lift or move the heat exchanger from headers, distributor, hairpins or return bends. Some heat exchanger is supplied with appropriate lifting points in order to make the handling easier, use always the lifting points if present.

Any instruction or warning signs attached to the heat exchanger or the packaging must be followed. Avoid shocks or continuous vibrations during transport.

Handle the heat exchanger with gloves to protect from sharp edges.

5.2 STORAGE

Do not store the heat exchanger outdoor or exposed to atmospheric agents, unless a packaging suitable for this is agreed.

Do not stack the heat exchangers unless explicitly indicated this is allowed. Place the heat exchangers on an even surface.

5.3 INSTALLATION

Do not perform on pressure equipment additional brazing other than the designed brazing. Do not overheat the joints during the brazing operation necessary to connect to the machine. Check that no permanent deformations occurred on the heat exchanger after the charging process of the machine.

6 CLEANING

The heat exchanger must be cleaned when necessary.

When the fins are dirty because of dust, leaves, etc., it may occur:

- Reduced heat capacity
- High electrical power absorption
- Overheating
- Increase of condensing temperature
- Decrease of evaporating temperature
- Block of the machine due to the intervention of the maximum or minimum pressure switch.

Dust can be removed with a paintbrush or a vacuum cleaner.

It is possible to clean the heat exchanger also with pressurized water provided that the following precautions are used:

- Maximum water pressure 120 bar
- Keep at least a distance of 1 meter from the fins
- Keep the jet perpendicular to the fins as shown in Figure 2.
- Pay specific attention if fins are louvered or hydrophilic.
- During the cleaning operation, check that no damages appear.

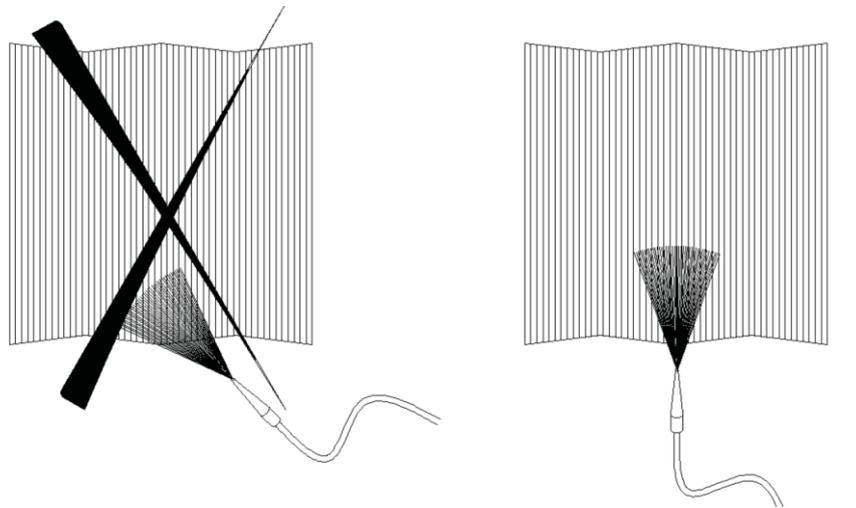


Figure 2 – Water flow direction during cleaning operation.

The use of cleaning products is not recommended, above all for heat exchangers with hydrophilic fins, since these products could damage the hydrophilic layer. If strictly necessary, eventually use neutral pH cleaning products and rinse with low pressure water at ambient temperature.

7 DISPOSAL

The heat exchanger contains recyclable materials (copper, aluminum and steel), that can be recycled after disassembly.

At the end of its useful lifetime, get information about the laws in force in your country regarding recycling.

Heat exchangers are supplied with packaging subjected to recycle or to waste disposal.

Before decommissioning, the heat exchanger should be emptied from refrigerant fluids. Avoid any emissions in the environment. Any refrigerants and oil residuals must be properly managed according to applicable environmental regulations.