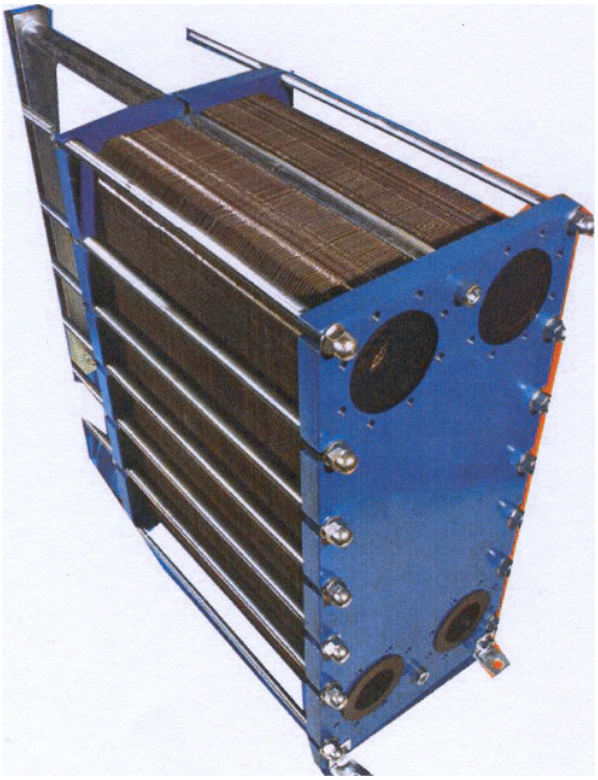
PLATE HEAT EXCHANGER



USER AND MAINTENANCE MANUAL

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1 - Introduction.

This User and maintenance manual is a valid guide where the user may find important technical information relative to the correct installation, start-up and maintenance of the Certikin Commercial plate heat exchanger.

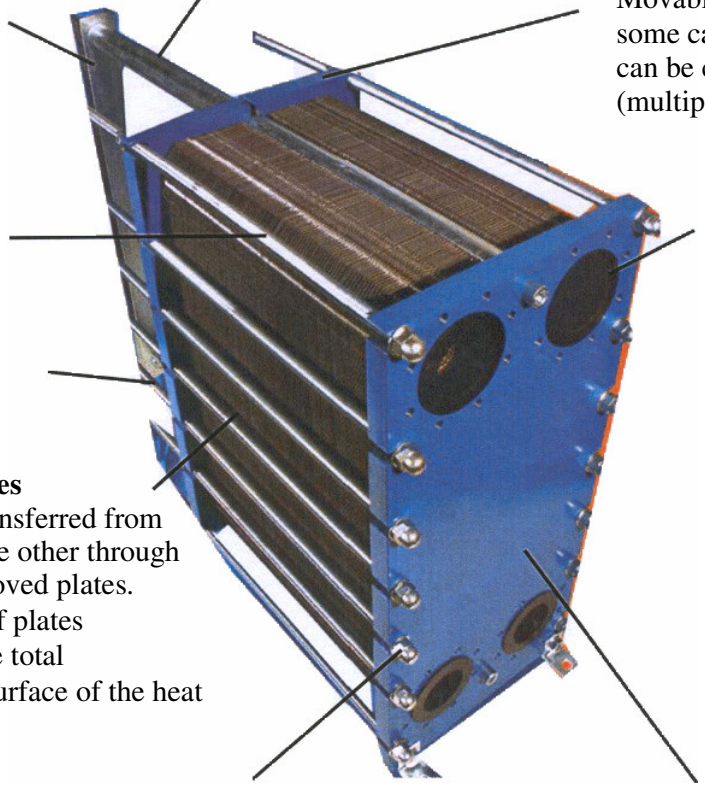
Certikin declines all legal responsibility in case of damages derived from incorrect installation, or as a result of use or maintenance conditions not foreseen in this manual.

Any changes that imply variations of fluid-dynamic and thermodynamic conditions will previously be agreed with Certikin.

The user should not exceed the maximum working pressure, including during the execution of the internal tests.

2 - Product description.

The plate heat exchanger is a device that permits recovery of the heat contained in a fluid being transferred to another fluid.
Both fluids never touch each other because they are separated by metallic sheets.
These sheets, which are called plates, are very fine and grooved to enable the diffusion of the greatest amount of heat through each surface unit.
The plate heat exchanger has been made to guarantee a heat interchange with the highest security.
The plate heat exchangers with nuts have the following elements:



Support rod*
It supports the grooved plates and the pressure plate

Support column

Pressure plate
Movable steel plate. In some cases, the tubes can be connected to it (multipass)

Tightening bolts

Connections*
The holes in the frame plate allow fluids to enter into the heat exchanger

Guide bar

Grooved plates
The heat is transferred from one fluid to the other through these fine grooved plates. The number of plates determines the total transference surface of the heat

Tightening nuts **Fixed plate**

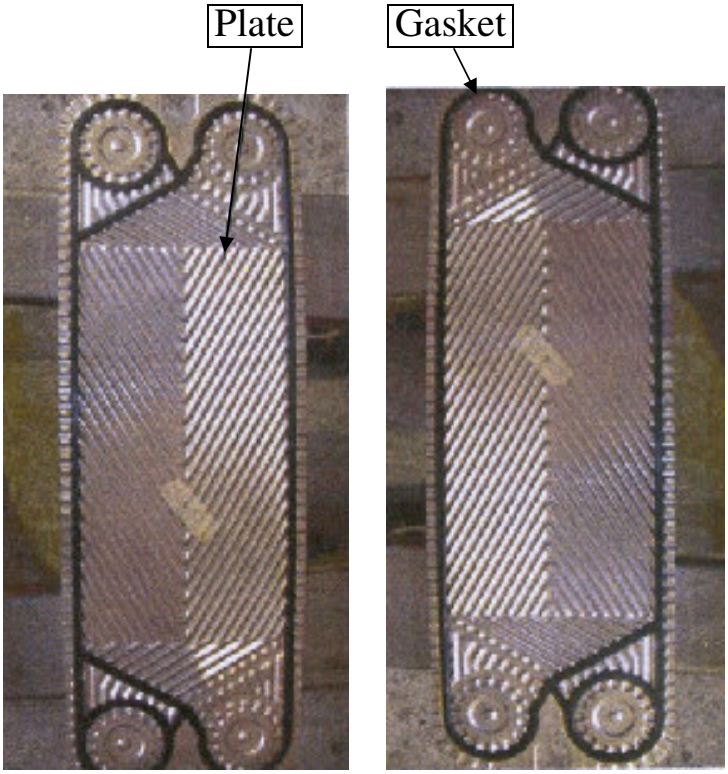
2.1 – Plates.

The plates are the main components of a heat exchanger. These plates represent the thermal interchange surface between the fluids.
The number and form of the plates depend on the thermodynamic characteristics needed by the user; when superposed they form the so called “plate pack”.
Each plate of the heat exchangers has been individually moulded, with no joined or welded pieces.

The plates can be obtained from any pressable material. The materials are chosen according to its conditions of use.
Certikin provides plate heat exchangers made up of different materials; being the most used:
Stainless steel (AISI 304,316)
Titanium
Titanium-Palladium
Nickel
Hastelloy

Each plate displays fish bone-type grooves in its central part; the plates are placed alternately with its fish bone-type grooves facing downwards or upwards (the plates with identical design but turned 180º).

These groves form the sliding channel for the fluids that leave through the holes made on the sides.

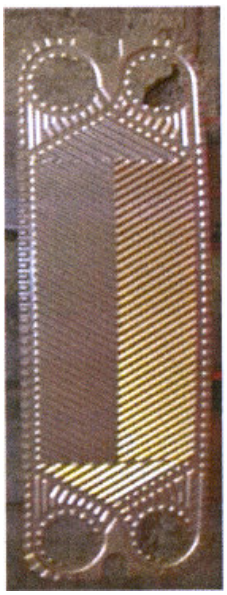


The geometry of the so formed channel forces a turbulent movement in the fluid to eliminate stagnant areas and therefore the dirt.

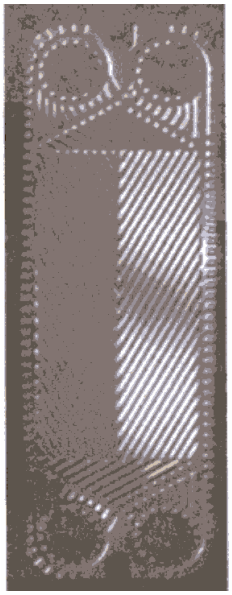
Certikin provides, from model 3601 onwards and for all higher models, plates with two different types of angles for the fish bone.
A B
The **A** type configuration (high performance) provides a high thermal exchange coefficient. This grooved design has an angle that maximises the fluid turbulences inside the channel, generating a high pressure drop (high pressure losses).
Configuration **B** (low performance) displays a higher skid able grooved design in order to diminish turbulences and therefore the pressure drops (low pressure losses). A low thermal efficiency corresponds to lower values of turbulence.
It is possible to combine "high performance" plates (**A** type) with "low performance" plates (**B** type), allowing **M** type mixed grooving. This high constructive flexibility enables Certikin to exactly satisfy the specifications required by the client (thermal interchange, pressure drops).

The plates always have four holes on the sides, but the final plate which has no holes.

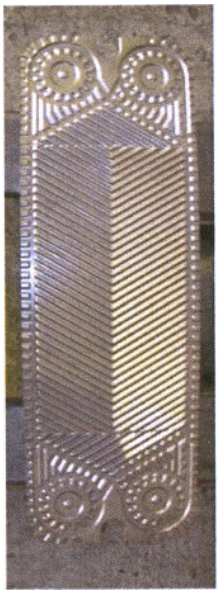
Special plates have been enabled for Multipass circuits.



A – Alto rendimiento



B – Bajo rendimiento



Placa inicial con junta

2.2 – Gaskets.

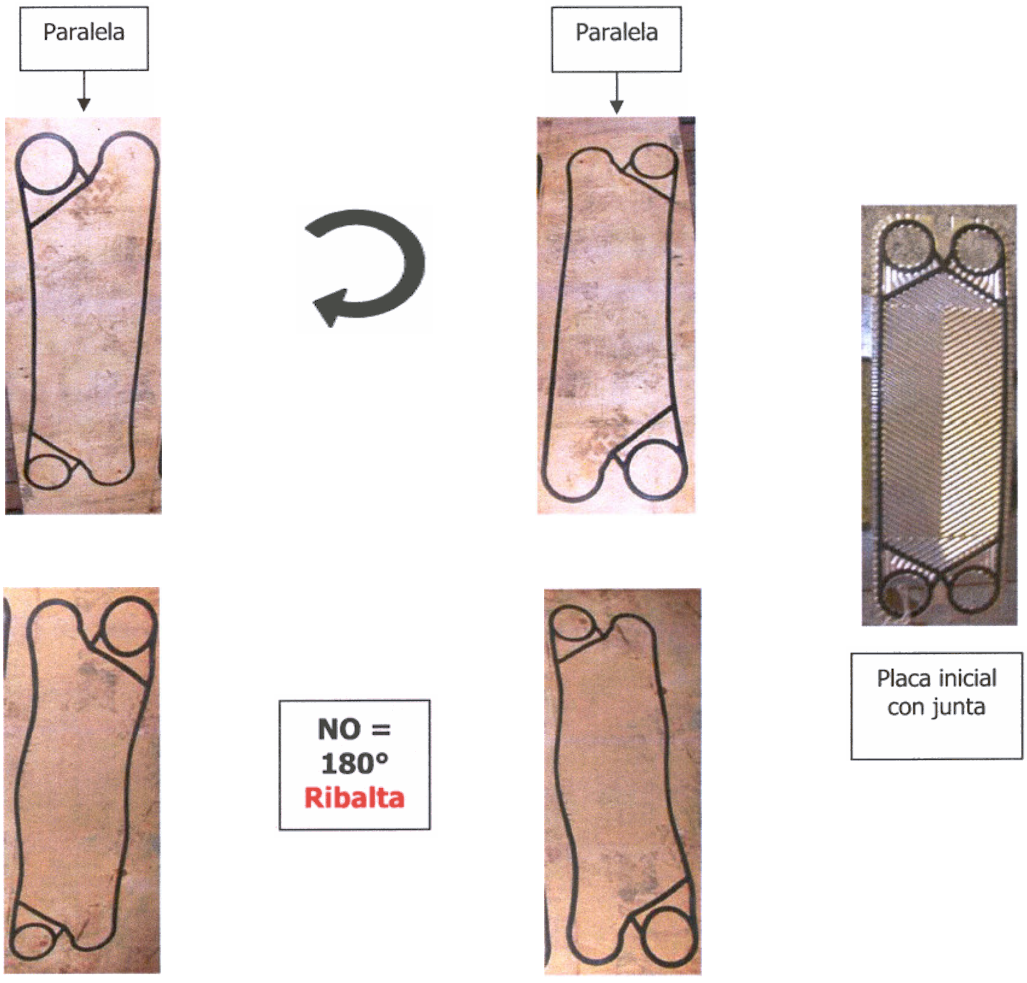
The grooved plates have grooves along its perimeter where the gaskets are placed.
They perform three main functions:
- contain the fluids in the perimeter area of the plate;
- divert fluids alternatively inside the exchanger;
- distinguish between parallel and crossed flow.

A fluid that enters the primary circuit finds the entrance to the channel open between two plates, finding the second channel closed. On the contrary in the secondary circuit, the fluid finds the first step closed while it finds the second one open.

Certikin provides two types of gaskets up to model 3601: parallel and cross.

The initial gaskets are made up of four holes.
The gaskets can be glued to the plates.
The main components of the heat exchangers submissive wearing down are the rubber gaskets.

Each gasket has a unique inner elasticity. This elasticity depends on the temperature and working pressure, besides the force with which it is compressed during its tightening to the plate pack.



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Unsuitable temperatures and pressures deteriorate the gasket elasticity, risking fractures. Therefore the parts made with rubber need greater attention.

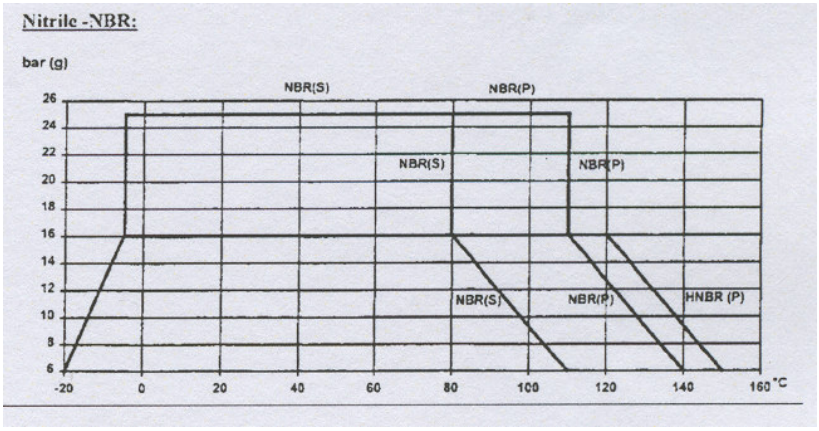
The gasket design has been studied to reduce the possibility of both fluids touching each other. In the only point where gaskets separate both fluids, a security chamber has been added that communicates with the outside which, in addition to preventing the mixture of fluids, allows the possible loss to go outside under low pressure.

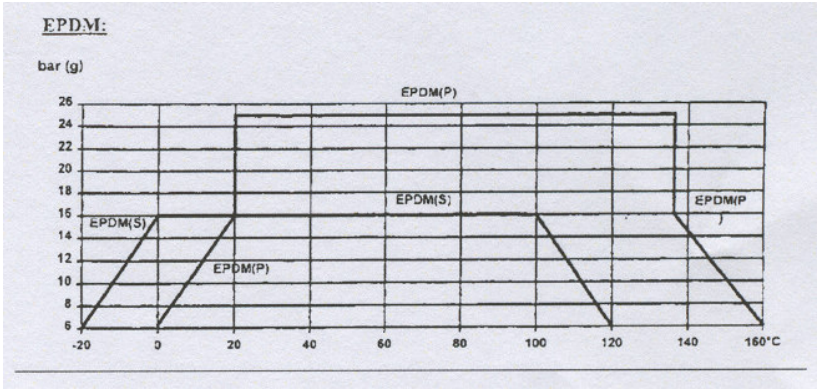
All gaskets and glue are of non-toxic material.

Certikin provides NBR, EPDM prx and FPM gaskets. The choice of the material depends mainly on the temperature and working pressure, in addition to the fluids that are used.

In the graph below the maximum gasket resistance is shown in relation to temperature.

The maximum temperatures shown in the graph are of course values that can be diminished by Certikin according to the exchanger in use. The maximum pressure and the operating temperatures are shown on the name plate.





The following table shows the different compatibilities of the Certikin gaskets with the different types of fluids normally used.

	Junta en Nitrilo	Junta en EPDM prx	Junta en FPM
Acetato di etile		■	
Acidi grassi		■	
Acido acetico		■	
Acido cloridrico 2%		■	
Acido cloridrico 3%		■	
Acido cloridrico 8%		■	
Acido solforico 20%		■	
Acqua demineralizzata	■	■	
Acqua di mare	■	■	
Acqua glicolata	■	■	■
Acqua igienico sanitaria	■	■	■
Acqua minerale		■	
Acqua sporca	■	(	(
Acqua termale	(	(	
Alcoli etilici		(	(
Ammoniaca soluzione		(	
Benzine	(		(
Cloruro di sodio 6%	(	(	(
Colla	(	(	(
Etanolo 60%		(	(
Flemme alcoliche		(	
Formaldeide 25% - 50%		(	
Formaldeide 7% fredda		(	
Gasolio	(		(
Glicole etilenico	(	(	(
Glucosio	(	(	(
Ipoclorito di sodio			(
Kerosene	(		(
Latte	(	(	
Miele	(		
Miscela di gelato	(		
Miscela lievito	(		
Mosto vino	(	(	
Olio di oliva	(		(
Olio di semi	(		(
Olio di tempra	(		(
Olio diatermico			(
Olio idraulico	■		■
Olio minerale	■		■
Olio sintetico	■		■
Petrolio	■		■
Saccarosio	■		
Salamoia		■	
Sciroppo neutro	■		
Soda caustica 20%		■	
Solfito di ammonio		■	
Solvente		■	■
Succo di frutta	■	■	
Tricoroetilene			■
Vapore 3 bar max	■	■	
Vino	■	■	

2.3 – Frame.

Certikin provides a frame made up of two steel plates of different thickness (depending on the model) connected to a variable number of 8.8 steel tie bars. These, formed of threaded bars, nuts and washers, keep the plate pack together. The pressure plate and the fixed plate differ for the outlet and inlet holes for the fluids. Normally there are 4 holes in the fixed plate, although certain circuits (see chap. 5) may also require others in the pressure plate (multipass mode).

The frame can be provided in two different materials:
- AISI304;
- Varnished common steel.

Certikin uses two different types of support rods for the frames, being their design:
- A round form;
- An IPE form.

The choice of the type of support rod is made according to the model of exchanger used.

2.4 – Connections.

The connections are the devices needed to connect the exchanger to the installation.
The connections can be attached to the **fixed plate** or to the **pressure plate**. The positions of the connections used or the type of selected circuit are specially shown in the Appendix A of this User and maintenance manual.

The LF-4F connections are usually enumerated consecutively and anticlockwise on the **fixed plate. In the pressure plate (multi-pass mode, see chap. 5)** the connections lL-4L have been enumerated consecutively and clockwise.

The choice of the connection type is made depending on the design conditions and the model of exchanger used.

Certikin provides two different types of connections:
1. Connections formed by GAS-type socket sleeves made up of carbon steel (AISI 316 Ls);
2. Connections with bridles, with threaded holes to tighten the bridle directly into the plate. The interior of the hole has been covered with a sleeve of the same material used for the gaskets.
3. Nylon 6 or Polypropylene connections.

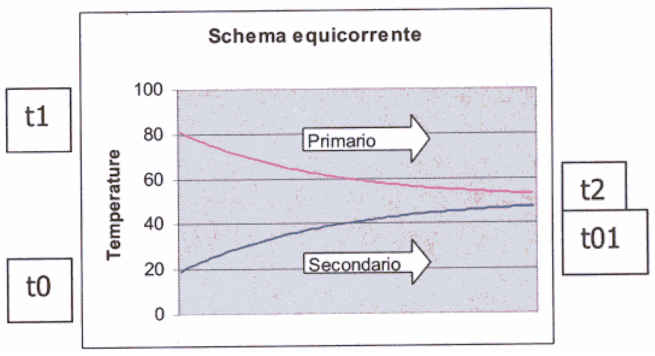
3 – Principles of operation.

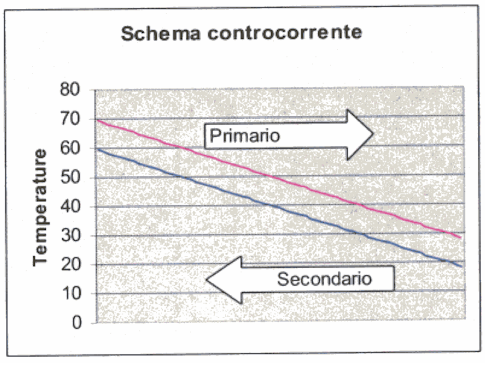
The heat transmission between two bodies takes place in three different ways:
- by irradiation;
- by conduction;
- by convection.

The principles of operation of plate exchangers are based on convection and conduction.
Consider two fluids contained in two coaxial tubes circulating throughout these. Let us suppose that the fluid contained in the inner tube has a greater temperature than the one in the outer tube. Let us consider, first of all, the case when both fluids flow in the same direction. The formula: Q=KS (ta-TV) is not valid, since it is valid only when the temperatures ta and tb are constant. In this case, however, the temperature of the heating fluid (A) is tl at the inlet and t2 at the outlet; so therefore will be tl>t2. The temperature of the heated fluid will be t0 at the inlet and t0l at the outlet, and should be t0<t0l. The previous formula will be considered roughly valid considering the average temperatures of the heating fluid and the heated fluid.
Therefore, it will be:

Q=KS ((tl +t2)/2) - (tOl +tO)/2)

In the case of direct circulation (in parallel), the heat exchange is very active in the first section of the tube, where the temperature difference between the heating fluid and the heated fluid is high, while it will be scarcely active at the end of the tube where the difference between these temperatures is smaller.





In order to solve this problem, the fluids are directed in opposite directions (counter-current flow) to maintain the temperature jump between both fluids sensibly high at all times, standardising the heat interchange between the fluids.
This is the principle according to which all plate heat exchangers always present a counter-current flow.
The plate heat exchanger is made up of a variable number of grooved metallic plates so that the fluids between which the heat transference takes place can flow through. These plates form channels that allow the **alternation of the fluids in counter-current.**
The fluids are always separated by two gaskets for security reasons.
The central part of the plates shows a fish bone-type grooving alternatively facing each other.
The gaskets perform two functions: containing the fluids in the perimeter of the plate and alternatively diverting the fluids into the exchanger.
The fluid that enters the primary circuit finds the entrance to the channel between the first two plates open, while it finds the second one closed.
On the contrary, in the secondary circuit the fluid finds the first step closed, while it finds the second one open.
Thus two fine layers of liquid separated by a metallic sheet are formed. The heat exchange takes place in optimal conditions. The grooved plate favours the fluid turbulence and prevents the plates suffering pressure differentials.

There are two main types of circuits:
- figure A Individual (1-1);
- figure B Multi-pass (2-2/3-3/4 - 4).

The first type of circuit is indicated in figure **A**, wherein both primary and secondary circuits flow through the fixed plate; the fluid in this type of circuit crosses the exchanger and returns after having reached the pressure plate.
The second type of circuit is in figure **B**, in where the presence of an intermediate plate generates another passage, as if two or more exchangers were connected in series.
This type of flow requires connections in the movable plate.

Attention: the different types of circuits used do not have any influence on the external dimensions of the exchanger. They are important, however, for the type of connections needed.

4 – Storage.

Certikin provides the plate heat exchanger preassembled, ready for installation. If the exchanger remains stored and not working for a period of time longer than a month, Certikin advises to follow these precautionary measures to prevent any possible damage or wear on the exchanger parts:
- keep the exchanger inside (temperatures min. 5º, max. 40º).
- do not leave anything in the premises where the exchanger is kept:
* Ozone generators (i.e. electrical motors, arc welders, etc.) because ozone is an aggressive chemical agent for the gaskets that could be permanently damaged.
* Organic or chemical dissolvent.
If the exchanger is kept outdoors, check that it is correctly protected against the action of atmospheric agents.

5 – Precautionary measures for lifting.

Certikin usually provides the exchanger preassembled on a wood protection base (pallet), to which it is secured by means of a plastic tape. This wood protection facilitates its handling and transport using a fork-lift.
The procedure you should follow to handle it is the following:

1. Remove all packing material (nails and plastic tape);
2. Calculate with the aid of the name plate the empty weight of the exchanger in order to use appropriate lift systems;
3. Set the lift sling around the top tightening nuts, along the tie bars, as indicated on the side; use a rope sling for this operation, never a steel one;

Caution: never fix the lift sling to the steel connections.

4. As the securing elements are not in the gravitational centre, raise the equipment slowly. The exchanger will tend to turn by itself;
5. Lower the heat exchanger to its horizontal position and set it on the floor.

6 - Installation.

Correct installation is essential; errors in this phase may jeopardise the final result causing gasket fractures and suspensions, misalignments in the pipes, etc.
It is requested that the following points are read carefully and followed.

6.1 - Initial controls.

6.1.1 – Product control.

Certikin advises to carry out a thorough checking of the equipment before starting with the installation and immediately communicate any possible omissions or damages in the materials provided.

6.1.2 - Tightness.

The plates equipped with gaskets and provided in a pack are pressed by a frame so that tightness is guaranteed in the compressed gaskets.
The frame is closed with tie bars with nuts. The space between two plates is different depending on the exchanger models and the number of plates.
Certikin asks the end user to verify its tightness, indicated in the name plate or the Appendix A of the User and maintenance manual. A smaller space would damage the plates while a greater one would not assure the exchanger tightness with the result of fluid leaks.
Attention: the verification of the tightness level is essential when the connections are in place in the pressure plate.

6.1.3 - Installation placing requirements.

Exchangers are usually mounted in an upright position; the name plate of each model contains the pressures and nominal temperatures. During operation, these pressures and temperatures should never be exceeded to prevent possible damages to the exchanger.

6.1.3.1 - Base.

Install the unit on a base which must be strong enough to support the frame.
Warning: Certikin provides the exchanger net weight and its capacity in litres.
Certikin advises to install a purge container underneath the exchanger in some particular applications (naval facilities, or when highly corrosive fluids are used), similar in volume to the exchanger. The container overflow pipe must be larger than 50 [mm] (2").

6.1.3.2 - Clamping.

Certikin, for 3601 and superior models, provides, fixed to the frame, support legs of sufficient strength to support the exchanger and to fix it to the base.
Attention: welds are made to fix the exchanger; the exchanger should not be grounded to avoid the occurrence of voltaic arcs between the plates.

6.1.3.3 - Minimum space requirements around the exchanger.

It is necessary to leave enough free space at both sides of the exchanger (as shown in the figure). This makes access to the plate exchanger easier and allows routine maintenance operations (extraction and insertion of the plates and opening of the exchanger).
If it is foreseen that the surface of the heat exchanger overheats or cools down too much, it should be isolated.

6.2 - Requirements for the connections and network.

Layout of the network

In order to address the problem correctly, it is necessary to know the exact location and potential of each user, in addition to the pressure values and the inlet and outlet temperatures in each user. Also to determine the preliminary layout, the preferred flows, the forced or prevented steps should be known, in addition to the topographical levels of the highest points.

The booster pumps of the exchanger must be equipped with regulating valves. If the pumps work to greater pressures than those the exchanger can guarantee it is necessary to install safety valves, which should be airtight.

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Certikin indicates in an attachment to this manual the type of connection that will be implemented according to the circuit established during the design phase (see Appendix A). If you want to verify the type of connection used, spill some fluid or blow over one of the connections in order to verify the output.
All the piping connected to the exchanger must be equipped with interception valves to facilitate their disassembling and to guaranty its security.

Warning:
- The safety valves must be installed according to the regulations currently in force in the area of pressure equipment (PED).

In the hot circuit, the regulation valve must be installed in the feed pipe, between the pump and the interception valve.

Certikin also advises the installation of a drain valve in both feeding tubes, so that the exchanger can be stopped and opened without causing any problems to the adjoining equipment.

The assembly of the connections in order to clean between the valves and the exchanger often seems very useful. For example, it is possible to carry out a chemical washing (CIP see p. 30) without disassembling or opening the exchanger.
Certikin advises to follow the following precautionary measures:

Warning:
- The thermal tensions or expansions in the connections or in the exchanger should not be discharged.

The movable plate should never be attached to a fixed point. The thermal stress generated may cause leakages.

- Before connecting any conduit, check there are no impurities in the system.
- During the connection, check the tubes do not produce any stress in the plate heat exchanger.
- Do not connect the tubes in the connections in a rough way. There are welds that could be damaged, causing future leakages.
- To prevent water hammers, do not use chop throttle valves. Water hammering is a brief pressure spike that can be verified during the operation or shutdown of a hydraulic system, which produces the formation of a compression wave that crosses the tube at the speed of sound. It can cause serious damage to the equipment (for example, the gaskets could jump out of their housing resulting in fluid leakages).
If inhibiting agents are used, Certikin advises to check they do not interact with the materials of the gaskets, plates and connection elements.

Multi-pass unit, (with connections on the fixed plate and the pressure plate).

It is important that the plate pack is tightened to its correct measure (check the design in the Appendix A) before connecting the tube.

Warning. In order to facilitate the disconnection of the plate heat exchanger, it is necessary to connect a right-angled bend to the connection in the pressure plate, oriented vertically or laterally, and to place another flange located just outside of the profile of the heat exchanger; this solution is necessary to enable the pressure plate to slide up to the support in case of maintenance operations.

7 - Start up.

Certikin determines the proportions and designs their exchangers for a specific use.
The limits of temperature and the fluids at issue have been indicated in the plate. Any alteration of its characteristics could harm its operation.

Before the start up, if it is necessary to resize the installation, please get in touch with our technical department or reseller. It is possible to increase or diminish the capacity of thermal interchange or the pressure drop by means of an increase or diminution of the surface of thermal interchange (increase or diminution of the number of plates.)

Start up procedure.
1. Before carrying out the start up, control the tightening level verifying its conformity to the data shown in the name plate or in the Appendix A;
N.B. Test pressure. The user should not exceed the maximum working pressure, not even during the execution of the internal tests.
2. Check the valves between the pump and the exchanger are **closed;**
3. If there are valves at the outlet, verify that they are completely **open;**
4. Open the drain valve necessary to evacuate the air. The air can cause bubbles that reduce the potential of thermal interchange and increase the risk of plate corrosion;
5. Start up the pumps; if the system includes several pumps, make sure which one should be open first;
6. Open the valves at the inlet **slowly**, so that the pressure increases gradually in the exchanger to prevent thus **water hammering**;
7. When the exchanger operation has become stabilised, check leakages as a result of an incorrect fixation of the plate pack or the presence of defective gaskets do not take place.

It is possible to start up the circuits individually.
Warning: in case of pressure differentials between both circuits superior to 50%, it is advised to open simultaneously both systems to prevent high pressure decompensations.

8 – Operation.

Operation check:
- The temperatures and pressures of the exchanger are within the limits indicated in the name plate provided by Certikin.
When exceeding the threshold temperature, leakages due to the fracture of the gaskets may take place.
- The support column, the support rod and the guide bar are clean and lubricated.
- The tie bars must be lubricated with molybdenum disulphide (Molikote) or something equivalent, especially in the section used for the opening and closing of the exchanger.

Warning: the flow control should be carried out slowly to protect the system against thermal and pressure shocks.

The client will be able to carry out pressure tests up to the **maximum working pressure**. To this aim, calibrated pressure gauges should be used. The test pressure shown in the name plate can only be reached in the factory.

Damages in the event of exposure to pressures higher than working pressure are not covered by the guarantee.
If you wish to carry out a test to 15 bar, it will be necessary to request an exchanger with a working pressure higher than 15 bar.

Always contact Certikin to obtain data regarding:
- The new dimensions of the plate pack, if you want to change the number of plates;
- The choice of the gasket material if the working temperatures and pressures have permanently changed or if you use a different fluid in the heat exchanger.

9 - Stopping.

The stopping procedure is the following:
1 Closes the valves slowly paying attention pressure spikes or water hammers do not take place;
2 If the system includes several pumps, make sure which one should be switched off first;
3 Close the outlet valve, if included;
4 Repeat points 1-2-3 for the other circuit;
5 Take control of the purge valve to take the pressure to atmospheric level and eventually drain it.

10 – Shutdown.

In case of a long inactivity period of the exchanger (longer than a month), Certikin has foreseen the process to put the equipment out-of-service. This step is especially taken when there is a risk of fluid freezing or when the used fluids are particularly aggressive.
The necessary operations for the process are similar to those of the previous point:
1 Close the inlet valve of the circuit slowly with higher pressure;
2 Close the outlet valve, if included;
3 Open the purge valve and take the pressure in the exchanger to atmospheric level;
4 Repeat operations 1-2-3-4 for the other circuit;
5 Loosen the tie bars to reduce the pressure in the gaskets; leave also the plates in contact in such a way it is enough to avoid the entrance of impurities;
6 The tie bars should be lubricated with molybdenum disulfide (Molikote) or equivalent grease.

11 – Maintenance.

WARNING: When the equipment is going to be shutdown during long periods of time, it is advised to retire the equipment from the premises or to ventilate the room where it is located periodically. This is due to the humid and chlorinated atmosphere to which the equipment is exposed, which causes the accelerated deterioration of its electronic components. The guarantee does not cover those cases when the product may be damaged due to a prolonged exposure to a humid and chlorinated atmosphere.

11.1 - Opening the heat exchanger.

Before carrying out the sequence to open the heat exchanger, Certikin advises to perform the following operations:
1 Clean and lubricate the support rod;
2 Clean the bolts and the threaded section of the tie bars;

3 Lubricate the sliding parts;
4 Draw a diagonal coloured line on the side of the plate pack to verify the order of assembly of the plates is correct;
5 Measure and write down the tightening level.

After having conducted these preliminary operations, the opening operations start:
1 Close the inlet valve of the circuit slowly with higher pressure;
2 Close the outlet valve, if included;
3 Repeat operations 1-2-3 for the other circuit;
4 Open the purge valve and take the pressure in the exchanger to atmospheric level;
Warning: the exchanger can only be opened when the temperature has dropped below 50º Celsius and the container is no longer under pressure.
5 Disconnect all connections of the fixed and movable plates;
Warning: in the case of multiple circuit exchangers (multi-pass), immediately move the connections of the movable plate away.
6 Fully loosen the bolts and take away the upper and lower tie bars of the exchanger;
7 Loosen the nuts in alternate order;
Warning: pay attention so that the movable plate is parallel to the fixed plate.
Only move away the tie bars when you are able to manually unscrew the bolts because the plate pack is totally free and is not compressed.
8 When all tie bars have been extracted, move the pressure plate up to the support column.
Now it is possible to get to the individual plates;
9 If the plates must be enumerated, start the numeration before disassembling.

11.2 - Disassembling the plates.

It is advisable to use gloves to handle the plates since the edges of the plates are very sharp.
The plates have been mounted in different ways according to the model used. Certikin provides two systems to secure the plates:

- Rounded support rod
- IPE support rod

According to the general plan (Appendix A).
When dismounting the plates (regardless of the form of the support rod), you should proceed following these steps:
1. Slip the pressure plate up to the support column;
2. Incline the plate in longitudinal direction to loosen its lower section, embedded in the guide bar;
3. Turn the plate around the support rod and take it out.

Warning: if two or more plates remain in contact, it is necessary to separate them carefully to remove the gasket from its housing. The glue that keeps the gasket attached to the plate loses strength when exposed to high working temperatures.

11.3 - Cleaning the plates.

Inside the exchanger a series of channels between plates have been foreseen. Its prolonged use may cause the formation of deposits (limestone, for example, if the fluid used is water) and incrustations. These deposits are very small due to the little amount of fluid in the channels and to the deposit limited adherence capacity to the surface of the sheet. In case of a sensible reduction of the exchanger performance, this will be probably the cause. In certain applications in which the fluid gets particularly dirty or contains solid particles greater than one millimetre, Certikin advises to use a filter in the feeding network.

Warning: always ask your detergent supplier or Certikin about the compatibility of the agent used to do the cleaning and about the application method (temperature and length of treatment).
Warning: soda and nitric acid can seriously damage the steel plate exchanger; the effect of corrosion depends on the temperature and average pH of the concentration.

The plates can be cleaned in two different ways:

1 - Cleaning the exchanger without opening (Cleaning-In-Place -CIP).

This process is based on the principle of not disarming the plate exchanger. Instead it flushes it with detergent liquid and generates an action which combines mechanical (dynamic fluid turbulence) and chemical elements to remove the incrustations.

The dirt inside the exchanger can often be related to a too low fluid speed in the channels. Where possible, you may try to increase the flow if the exchanger presents an elevated reduction of power or pressure drops.

If the CIP cleaning is not sufficient, with crystallizations or obstinate dirt it is often needed a mechanical-chemistry combined action (manual cleaning).

2 - Manual cleaning.

Warning: protect your eyes and other body parts adequately against the risk of contact with the used solutions. Use glasses, gloves and suitable clothing to protect yourself against contact with acids. Steam can also damage your health, so you should not work in closed or poorly ventilated atmospheres.

Warning: pay attention not to damage the gasket during the manual cleaning.
Warning: never use brushes or iron tools to clean the plates.

The plates can be cleaned manually; the operation can be carried out without disassembling the frame plates or extracting them from their housing.
In the first case, after opening the exchanger, place the first plate by the side of the movable plate, extract the deposits with a smooth brush and running water; rinse with abundant water using a high pressure flexible tube.
In the second case, extract one plate at a time, place it on a work surface and apply the detergent with a smooth brush. Let it work for the necessary time depending on the agent used and rinse with water, using a high pressure flexible tube.

Warning: after cleaning, always rinse the plates with plenty of water.

Certikin provides a general indication of the detergents that should be depending on the main polluting agents:
- In the case of oil, asphalt or grease residues, use a gasoline-based paraffinic dissolvent (kerosene, for example).

- In the case of organic deposits that contain proteins, they may be disposed of with an alkaline solution, 2% caustic soda at 50 ºC. For particularly persistent dirt, leave it to soak several hours.
- The limestone deposits are cleaned with acid solutions (max. concentration of 4%, max. temperature 60°C); for example, some types of commercialised products are:

1) Nitric acid for calcium carbonates.
2) Sulphamic acid for calcium sulphide (metallic oxides).
3) Citric acid for silicates like clay.
4) Phosphoric acid for silicates like alumina.

Warning: hydrochloric or sulphuric acid can not be used.
Warning: soda and nitric acid can seriously damage the steel plate exchanger; the effect of corrosion depends on the temperature and average pH of the concentration.
Warning: do not use the following agents: Ketones, Esters, and Halogenated and Aromatic Hydrocarbons.
Warning: after cleaning, rinse the plates with plenty of water.

If the plates are not equipped with holes they can be recycled.
In this phase, it is useful to change the gaskets. The gaskets are made of materials subject to wear and they are not covered by the guarantee. It is not possible to anticipate their duration since it depends on the use they go through. Moreover, their duration is strongly affected by temperatures and pressures.

11.4 - Changing the gaskets.

The change of gaskets must be performed with maximum attention and care to prevent damage to the plates.
It is necessary to carry out these operations:

Disposal of the old gaskets.
This operation can be done in different ways; one possibility is the following: with a hot air gun warm up the back of the plate until is easy to remove the gasket.
Warning: follow the instructions carefully; see the gun manual for more information on the dangers related to the use of the pistol.

Cleaning of the gasket housing.
After having extracted the gasket, the remains of glue and eventually the filling parts should be cleaned of the housing before gluing a new one. Small pieces of rubber or glue can be left if they are flat. Wash the gasket housing even though does not contain any oil residues or other greasy substances, using pieces of cloth soaked in acetone or other dissolvent (ketone, methylethylene, etc.). **It is important to use chlorine-free dissolvent.**
Warning: dry the gasket housing carefully with a dry cloth.

Gluing the gasket.
When carrying out the gluing operation, check that the work chamber is ventilated enough and there are no naked flames.
Apply the glue with a fine and flat brush over the whole housing that is in contact with the gasket; leave it to dry briefly. In order to recognise where the old gaskets were placed, it is sufficient if you note the colour difference in the housing caused by the previous glue.

Now evenly insert the gasket with great care. It is extremely important that the gasket is placed flat and with no waves in its housing. After having let dry the glue for about 30 sec. (the time depends on the thickness and quantity of the diluted glue), the gasket is stuck on its corresponding housing. In order to facilitate the final gluing, it is advisable to put the plates under slight pressure, piling them up and leaving them thus 5 hours to allow the complete hardening of the glue. When the glue has fixed the gasket, it is advisable to cover it with talcum powder to prevent them stick to each other. The plates are now ready to be introduced in the exchanger.
Glue for gaskets.
Only some types of glue can be used to stick the gaskets on the plates; Certikin advises the use of the following materials:
- Bostik 1782;
- Pliobond 20/30 Synthetikleim;
- 3M EC 1099 Bond Spray 77.

Do not use other products since they may contain chlorine or other substances that may damage the plate. The glue should be diluted with acetone, in a maximum proportion of 1:1.

11.5 - Closing the heat exchanger.

Before assembling the exchanger, it is necessary to review all gaskets and the surfaces in contact with the gaskets.

The assembly procedure is the following:
1 Check all watertight surfaces are clean;
2 Clean the thread of the tie bars with a steel brush. Lubricate the thread of the tie bars with a grease film, Moilkote, for example, or an equivalent;
3 Insert the plate with the fish bone-type grooving in alternate direction and the gaskets oriented towards the fixed plate.
Warning: it is necessary to respect the initial order of the plates.
In order to identify the correct order of assembly, use the outside mark (diagonal band) that was drawn before disassembling the exchanger; as an alternative, check the Appendix A of the User and maintenance manual, where the type of flow is specified;
4 Press the plates one against the other. The fixation takes place in two phases, the pre-stressing and the true blocking:
- Hold both pairs of diagonal bolts in sequence (1-2 and 3-4) until the plate group do not measure 1.10 of the normal tightening level;
- Tighten the bolts (1-2 and 3-4) until reaching the tightening level shown on the name plate of the exchanger;
5 Finally hold the central pair of bolts, and then the lower and upper bolts.

The tightening level is the measurement of the distance between the interior of the two plates of the frame and can vary according to the tolerances in the thicknesses of the plates.

Warning: if the plates have correctly installed, the edges form a "beehive" design, corresponding with the upper bar. See the photo on the side.

12 – Safety devices.

According to appendix I of the EEC N. 97/23/EC directive of 29 May 1997, the following norms and safety measures have planned.
The risks derived of a heat exchanger are of two types:
» Mixture of fluids;
» Pressure.
The first one may be addressed in three ways:
- Separating the fluids by means of an AISI plate. This material guarantees enough resistance to corrosion. The cracks in the plate surfaces due to defects in the plate or manufacture are avoided by means of solutions.
They are identified during manufacture and eventually in the final pressure test;
- Using a perimeter gasket; the eventual lateral leakages cannot mix with another fluid because they go outside the exchanger;
- Having a special security chamber; a double gasket has been planned in the only spot where the gasket separates both fluids. The space between these two gaskets communicates with the outside.

The second one can be faced in three ways:
- The frame elements are calculated according to the DIN standards to be able to resist the stress pressures;
- A direct leakage in the perimeter can be solved with a continuous edge supporting the gasket;
- The weakest point in the plate is doubtlessly the security chamber, where a leakage does not spill directly to the outside. It only arrives through a chamber that performs the function of diminishing the power of the leakage thrust.

13 – Trouble shooting.

Outer leakages (gaskets).
With rubber gaskets, it may happen that when starting to work, in cold, the exchanger presents small leakages in the form of exudations or small drops.
These problems are solved when the discharge of the exchanger starts. Check the two plates remain always parallel during this phase. Otherwise, this could be the cause of the leakage. If parallelism has been verified, start to discharge the exchanger without descending below the tightening level. If this did not solve the problem, it will be necessary to change the plates or the corresponding gaskets.
Inner leakages (in the channels).
The corrosion can wear away the plate depth. The mixing of fluids is a true sign of this. In order to be able to visualise it, it is necessary to reduce the pressure on one side of the exchanger and then remove the lower pipe. Thus the interior of the exchanger conduit can be observed. Pressurize the other side of the exchanger (max. 6 bar) and you will be able observe where the leakage has taken place. Mark the defective plates and change them or dispose of them (always in pairs).
Temperatures are not achieved anymore.
If the outlet temperatures of exit were not the ones required, the plates may have been soiled and the interchange capacity may have diminished. In this case the exchanger must be cleaned in chemical or mechanical mode.

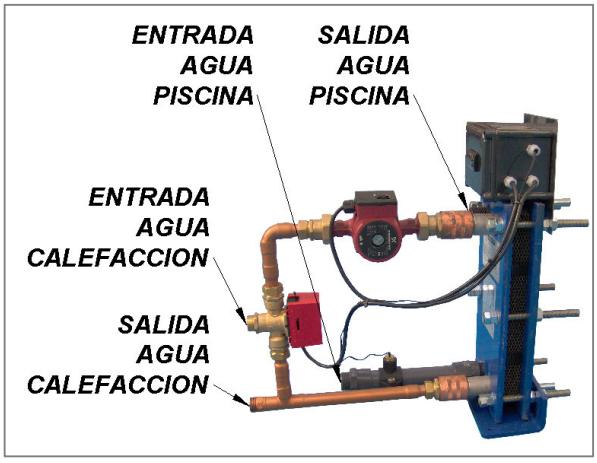
Different flows may also have been produced as a result of changes in the installation. This naturally has an influence in the outlet temperatures. All this can be easily controlled via the diminution of the flows, which should increase the temperature differentials.

Excessive pressure drops.

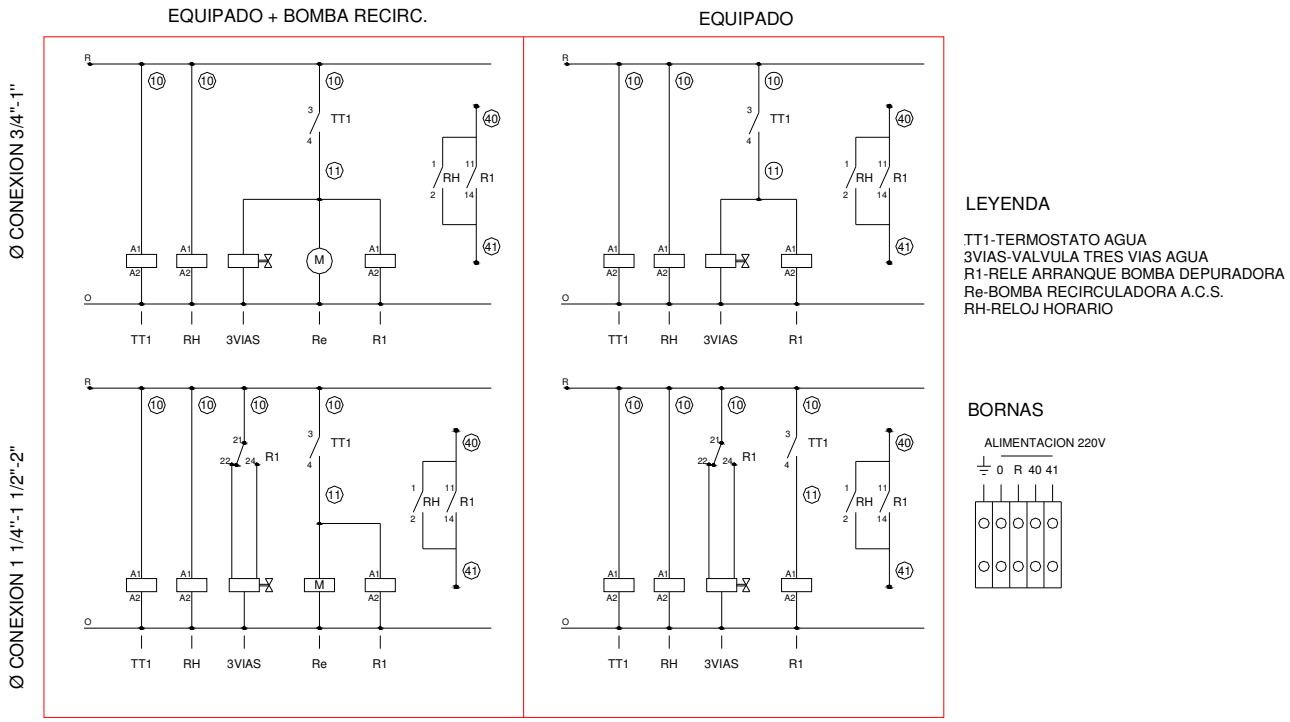
These leakages may be caused by an increase of the flow, dirt coming from the network, incrustations or some heavy piece of material that has been formed in the exchanger and that has clogged the conduit of the exchanger.

In these cases you may try to invert the flow to observe if the opposite direction current manages to solve the problem, and then trying a chemical cleaning. Finally start a manual mechanical cleaning.

14 – Hydraulic connections.



15 – Wiring diagram.



LEYENDA

TT1-TERMOSTATO AGUA
3VIAS-VALVULA TRES VIAS AGUA
R1-RELE ARRANQUE BOMBA DEPURADORA
Re-BOMBA RECIRCULADORA A.C.S.
RH-RELOJ HORARIO

BORNAS

16 – Controller.

Gama de aparatos, diseñados para visualizar, controlar y regular generadores de frío (con desescarche manual y automático programable por paro de compresor) o de calor.

Índice

1- VERSIONES Y REFERENCIAS

MODELO	FUNCIÓN	RELÉ	ALIMENTACIÓN, 50/60 Hz
AKO-14031	Termómetro (P)	-	230 V ~ ±10%
AKO-14112	Termostato (P)	16(4) A , 250 V cos φ = 1, SPDT	12/24 V ≂ ±20%
AKO-14123	Termostato (P)	16(4) A , 250 V cos φ = 1, SPST	230 V ~ ±10%
AKO-14610	Termostato (M)	16(4) A , 250 V cos φ = 1, SPST	230 V ~ ±10%

NOTA: (P) = montaje en panel (M) = fijación mural

2- DATOS TÉCNICOS

Rango de temperatura: . . . . . (-59ºF a 99ºF) -50 ºC a 99 ºC
Resolución, ajuste y diferencial: . . . . . 1 ºC
Entrada para sonda NTC: **AKO-149XX**
Precisión termométrica: . . . . . ± 1 ºC
Tolerancia de la sonda a 25 ºC: . . . . . ± 0,4 ºC
Potencia máxima absorbida: . . . . . 3 VA
Temp. ambiente de trabajo: . . . . . 5 ºC a 50 ºC
Temp. ambiente de almacenaje: . . . . . -30 ºC a 70 ºC

Clasificación dispositivo de control: De montaje independiente, de característica de funcionamiento automático acción Tipo 1.B, para utilización en situación limpia, soporte lógico (software) clase A.

Aislamiento doble entre alimentación, circuito secundario y salida relé.

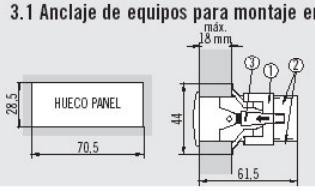
3- INSTALACIÓN

El termómetro o termostato debe ser instalado en un sitio protegido de las vibraciones, del agua y de los gases corrosivos, donde la temperatura ambiente no supere los valores reflejados en los datos técnicos.

Para que los controladores tengan un grado de protección IP65, deberá instalarse correctamente la junta entre el aparato y el perímetro del hueco del panel donde deba montarse.

Para que la lectura sea correcta, la sonda debe ubicarse en un sitio sin influencias térmicas ajenas a la temperatura que se desea medir o controlar.

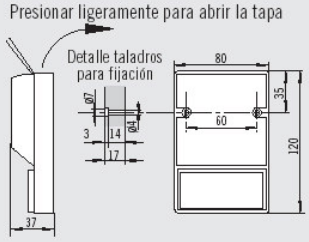
3.1 Anclaje de equipos para montaje en panel:



Para la fijación del aparato situar los anclajes **1** sobre las guías **2** en la posición de la figura. Desplazar el anclaje en el sentido de la flecha. Presionando la pestaña **3** puede desplazarse el anclaje en sentido contrario a la flecha.

3.2 Anclaje de equipos para fijación mural:

Presionar ligeramente para abrir la tapa



3.3 Conexionado:

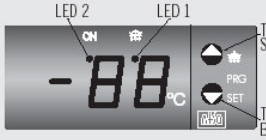
Véase esquema en la etiqueta de características de los aparatos.

La sonda y su cable **NUNCA** deben instalarse en una conducción junto con cables de potencia, control o alimentación.

El circuito de alimentación debe estar provisto de un interruptor para su desconexión de mínimo 2A, 230 V, situado cerca del aparato. El cable de alimentación será del tipo H05VV-F 2x0.5 mm² o H05V-K 2x0.5 mm².

Los cables para el conexionado del contacto del relé, deberán tener una sección de entre 1 mm² y 2.5 mm².

4- FUNCIONES DEL FRONTAL



Tecla SUBIR ◒

Pulsando durante 5 segundos se activa un desescarche manual de la duración que se haya programado. (Función para termostatos).

En programación, sube el valor que se está visualizando.

Tecla BAJAR ◓

Pulsando durante 5 segundos se visualiza la temperatura del PUNTO DE AJUSTE (Set Point). (Función para termostatos).

En programación, baja el valor que se está visualizando.

LED 1: Indicador de desescarche activado. (Función para termostatos)
LED 2: Indicador de relé activado. (Función para termostatos)
LED 2 intermitente: Fase de programación.

5- AJUSTE Y CONFIGURACIÓN

Sólo deben realizarse por personal que conozca el funcionamiento y las posibilidades del equipo donde se aplica.

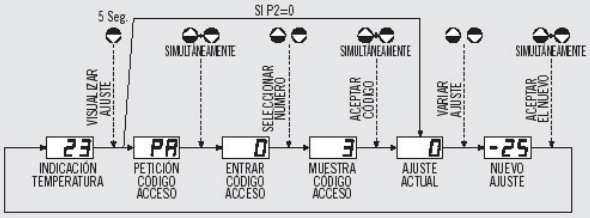
5.1 Ajuste de la temperatura

El valor de fábrica de AJUSTE DE TEMPERATURA (Set Point) por defecto es de 0 ºC.

- Pulse la tecla ◓ durante 5 segundos para VISUALIZAR AJUSTE. Aparece el valor del AJUSTE ACTUAL (Set Point) y se ilumina el LED "**2**" de forma intermitente.
- Pulse las teclas ◒ o ◓ para VARIAR AJUSTE (Set Point) al valor deseado.
- Pulse simultáneamente las teclas ◒ + ◓ para ACEPTAR EL NUEVO AJUSTE. La pantalla vuelve a INDICACION TEMPERATURA y el LED "**2**" deja de iluminar de forma intermitente.

En caso de aparecer **PA**, debe entrar el CÓDIGO ACCESO (Password) programado en el parámetro L5 para acceder al AJUSTE ACTUAL (Set Point)

- Pulse simultáneamente las teclas ◒ + ◓. La pantalla muestra **0** para ENTRAR CÓDIGO ACCESO.
- Pulse las teclas ◒ o ◓ para SELECCIONAR NÚMERO y MUESTRA CÓDIGO ACCESO (Password) programado.
- Pulse simultáneamente las teclas ◒ + ◓ para ACEPTAR CÓDIGO. Se visualiza el valor del AJUSTE ACTUAL (Set Point) que ya puede ser modificado.



5.2 Configuración de parámetros

Nivel 1 Parámetros

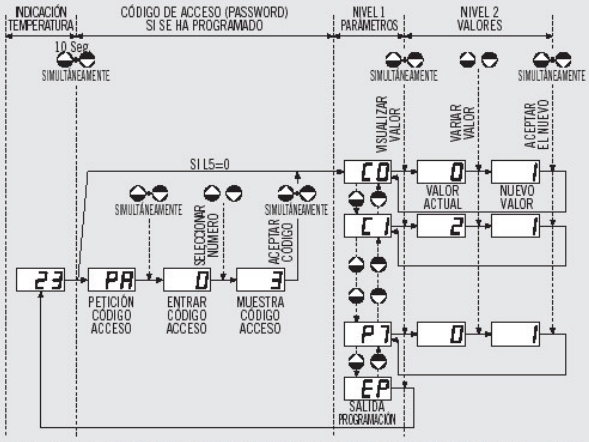
- Pulse simultáneamente las teclas ◒ + ◓ durante 10 segundos. El LED "**2**" se ilumina de forma intermitente, se ha entrado en programación de NIVEL 1 PARÁMETROS y en la pantalla aparece el primer parámetro "**C0**".
- Pulse la tecla ◒ para acceder al parámetro siguiente y la tecla ◓ para retroceder al parámetro anterior.
- Situados en el último parámetro LP y pulsando simultáneamente las teclas ◒ + ◓ el controlador vuelve a la situación de INDICACIÓN TEMPERATURA y el LED "**2**" deja de iluminar de forma intermitente.

En caso de aparecer **PA**, debe entrar el CÓDIGO ACCESO (Password) programado en el parámetro L5 para acceder a la programación de NIVEL 1 PARÁMETROS.

- Pulse simultáneamente las teclas ◒ + ◓. La pantalla muestra **0** para ENTRAR CÓDIGO ACCESO.
- Pulse las teclas ◒ o ◓ para SELECCIONAR NÚMERO y MUESTRA CÓDIGO ACCESO (Password) programado.
- Pulse simultáneamente las teclas ◒ + ◓ para ACEPTAR CÓDIGO. Se visualiza el primer parámetro "**C0**".

Nivel 2 Valores

- Para VISUALIZAR el VALOR ACTUAL de cualquier parámetro, sitúese en el que se desea y pulse simultáneamente las teclas ◒ + ◓. Una vez visualizado, si quiere VARIAR VALOR pulse las teclas ◒ o ◓.
- Pulse simultáneamente las teclas ◒ + ◓ para ACEPTAR EL NUEVO VALOR. La programación vuelve a NIVEL 1 PARÁMETROS.



NOTA: Si no se pulsa tecla alguna durante 25 segundos en cualquiera de los pasos anteriores, el controlador volverá automáticamente a la situación de INDICACIÓN DE TEMPERATURA, sin modificar el valor de los parámetros.

6- DESCRIPCIÓN DE PARÁMETROS Y MENSAJES

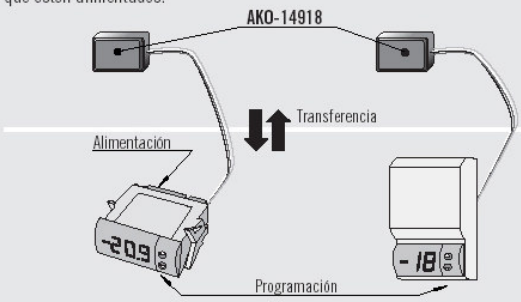
Los valores de la columna **Def.** vienen programados de fábrica.

AKO-14031							
AKO-14112, AKO-14123, AKO-14610							
	Control REFRIGERACIÓN	**Valores**	**Mín.**	**Def.**	**Máx.**		
C0	Calibración de la sonda (Offset)	(ºC)	-20	0	20	•	•
C1	Diferencial de la sonda (Hystéresis)	(ºC)	1	2	20	•	
C2	Bloqueo superior del punto de ajuste (No se podrá fijar por encima de este valor)	(ºC)	xx	99	99	•	
C3	Bloqueo inferior del punto de ajuste (No se podrá fijar por debajo de este valor)	(ºC)	-50	-50	xx	•	
C4	Tipo de retardo para protección del compresor 0=OFF/ON (Desde última desconexión) 1=ON (A la conexión)		0	0	1	•	
C5	Tiempo de retardo de la protección (Valor de la opción elegida en parámetro C4)	(min)	0	0	99	•	
C7	Tiempo del relé en ON en caso de sonda 1 averiada (Si C7=0 y C8≠0, relé siempre en OFF desconectado)	(min)	0	**0**	99	•	
C8	Tiempo del relé en OFF en caso de sonda 1 averiada (Si C8=0 y C7≠0, relé siempre en ON conectado)	(min)	0	**0**	99	•	
	Control DESESCARCHE	**Valores**	**Mín.**	**Def.**	**Máx.**		
d0	Frecuencia de desescarches (Tiempo entre 2 inicios)	(h)	0	1	99	•	
d1	Duración máxima del desescarche	(min)	0	0	99	•	
d2	Tipo de mensaje durante el desescarche: (0=Muestra la temperatura real) (1=Muestra la temperatura de inicio de desescarche) (2=Muestra el mensaje dF)		0	**0**	2	•	
d3	Duración máxima del mensaje (Tiempo añadido al final del desescarche)	(min)	0	**0**	99	•	
	Control ACCESO E INFORMACIÓN	**Valores**	**Mín.**	**Def.**	**Máx.**		
L5	Código de acceso (password) a parámetros e información		0	**0**	99	•	•
L6	Transferir parámetros: (0=Desactivado) (1=Enviar) (2=Recibir)		0	0	2	•	•
PU	Versión de programa (Información)					•	•
	ESTADO GENERAL	**Valores**	**Mín.**	**Def.**	**Máx.**		
P0	Tipo de funcionamiento: (0=Frío) (1=Calor)		0	**1**	1	•	
P1	Retardo de todas las funciones al recibir alimentación eléctrica	(min)	0	0	99	•	
P2	Asignación de código de acceso (password) al Punto de Ajuste: (0=Sin asignación) (1=Con asignación del código de acceso L5)		0	0	1	•	
P3	Parámetros iniciales (1=Si, configura en "Def." y sale de programación si P2=0)		0	0	1	•	
P5	Dirección para equipos con comunicación (No activada)		0	0	99		
P7	Modalidad de visualización de la temperatura: (0=Enteros en ºC) (2=Enteros en ºF)		0	0	2	•	•
EP	Salida de programación					•	•

7- TRANSFERENCIA DE PARÁMETROS

Servidor portátil

Servidor portátil **AKO-14918**, sin alimentación, que se le pueden copiar por transferencia, los parámetros programados en un controlador que esté alimentado. Los parámetros pueden transferirse de nuevo del servidor a otros controladores idénticos que estén alimentados.

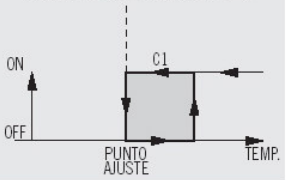


Servidor de sobremesa

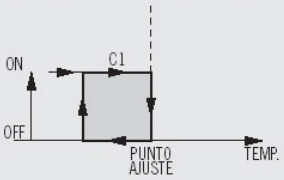
Para transferir parámetros, se dispone de otros servidores para controladores que deban ser programados todos iguales en gran cantidad sin alimentación eléctrica.

8- FUNCIONAMIENTO Y CONTROL DEL RELÉ

Funcionamiento para FRIO (P0=0)



Funcionamiento para CALOR (P0=1)



9- MANTENIMIENTO

Limpie la superficie del controlador con un paño suave, agua y jabón. No utilice detergentes abrasivos, gasolina, alcohol o disolventes.

10- ADVERTENCIAS

Utilizar el controlador no respetando las instrucciones del fabricante, puede alterar los requisitos de seguridad del aparato.

Para el funcionamiento correcto del aparato solamente deberán utilizarse sondas del tipo NTC de las suministradas por AKO.

Entre -40 ºC y +20 ºC, si se prolonga la sonda hasta 1.000 m con cable de mínimo 0,5 mm², la desviación máxima será de 0,25 ºC (Cable para prolongación de sondas ref. **AKO-15586**)