AERMEC
La prima per il clima

ENGLISH

TECHNICAL MANUAL

Water-cooled chillers with two-stage centrifugal compressor

TW 110

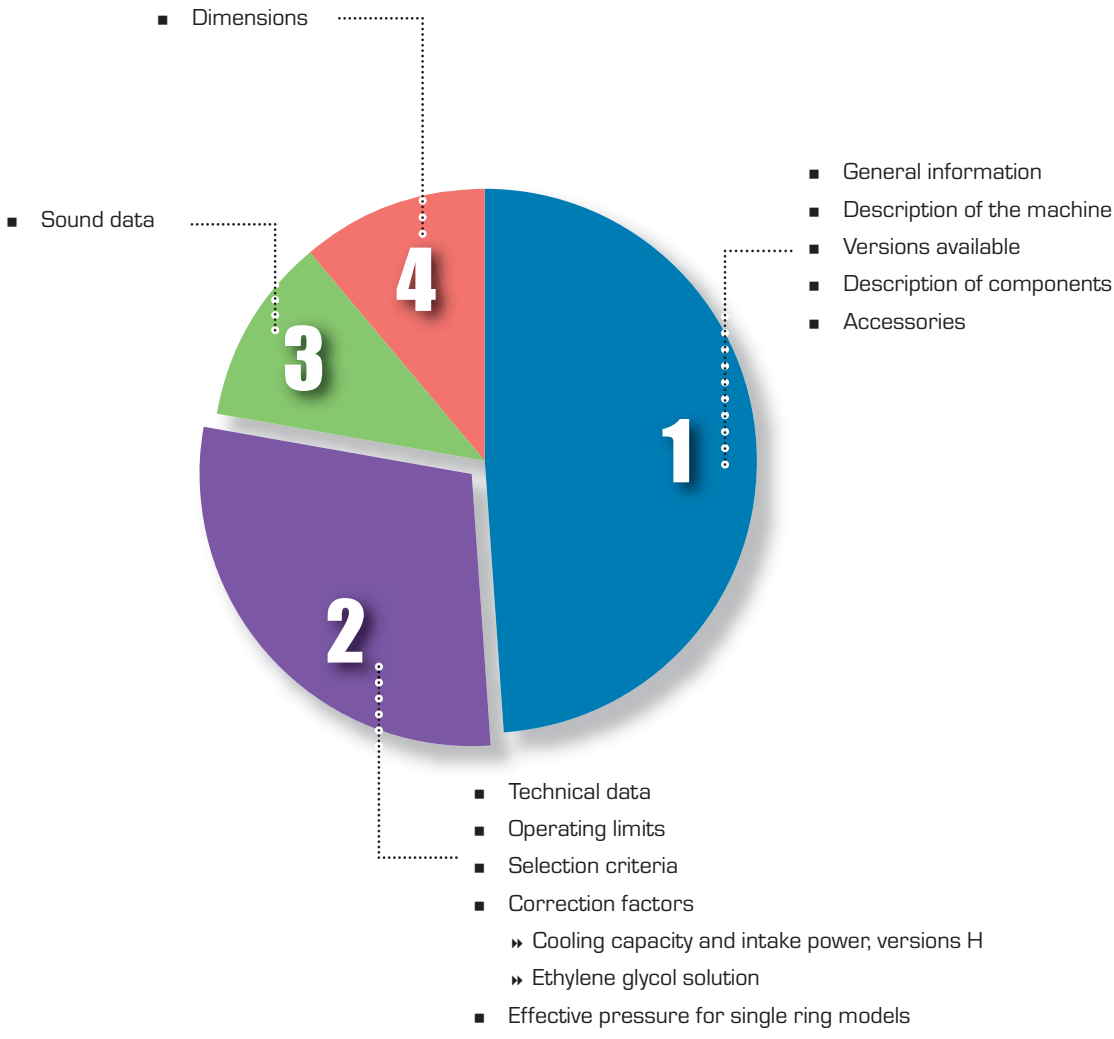
R134a

CE

AERMEC
COMPANY QUALITY SYSTEM
ICIM
ISO 9001 - Cert. n° 0128/4
CISQ IQNet
AERMEC S.P.A.

ITWPW. 0601 6230110

This manual contains:



ENGLISH

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Dear Customer,
Thank you for choosing an AERMEC product. It is the fruit of many years of experience and special design studies and it has been made of the highest grade materials and with cutting edge technology.
In addition, all our products bear the EC mark indicating that they meet the requirements of the European Machine Directive regarding safety. The standard of quality is permanently being monitored and AERMEC products are therefore a synonym of Safety, Quality and Reliability.
If you do not know where our nearest After-Sales Service Centre is, you can ask at the dealership where the device was purchased.

The data may undergo modifications considered necessary for the improvement of the product.

Thank you again.
AERMEC S.p.A

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TW110

MODEL:	
SERIAL NUMBER	

COMPLIANCE DECLARATION	We, the undersigned, declare on our own exclusive responsibility that the object in question, so defined:
Product identification	WATER / WATER is in compliance with:

1.	Directive 97/23/EC and has been subjected (with reference to Attachment II of the said directive) to the following compliance evaluation procedure: **module H** with checks made via inspections by the appointed body CEC via Pisacane 46 Legnano (MI) - Itally, identity number 1131;

2.	Designed, produced and marketed in observance of the following technical specifications: Harmonised standards:	
	- EN 378:	Refrigerating system and heat pumps - Safety and environmental requirements;
	- EN 12735:	Copper and copper alloys - Seamless, round copper tubes for air conditioning and refrigeration;
	- UNI 1285-68:	Calculation of the strength of metal pipes subject to internal pressure;

3.	Designed, produced and marketed in observance of the following EC directives:	
	98/37/EC:	Machine Directive
	2006/95/CE	LVD

Bevilacqua	26/03/2007	

Marketing Director
Signature

General standards

• This manual and the electrical layouts supplied with the unit must be kept in a dry place for any future consultation, and for the entire working life of the machine.

This manual has been drawn up with the aim of supporting the correct installation of the unit and providing all the indications for the correct use and maintenance of the device. Before proceeding with the installation, please read all the information in the manual carefully, as well as the procedures necessary for the correct installation and use of the unit.

- Be careful to adhere to the instructions in this manual and observe the safety regulations currently in place.
- The device must be installed in compliance with the local legislation currently in force in the country of destination.
- Non-authorised tampering with the equipment, whether electrical or mechanical, will make **THE WARRANTY VOID and exclude any liability on the part of the company**.
- Check the electrical characteristics shown on the registration plate (fig.01) before making the electrical connections. Read the instructions in the specific section about electrical connections.
- If the unit needs to be repaired, in all cases contact a specialised AERMEC After-Sales Centre and only use OEM spare parts.
- The manufacturer furthermore declines any liability for any injury to persons or damage to things resulting from the failure to comply with the information in this manual.
- Permitted uses: this series of chillers is suitable for producing warm/cold water to use in hydronic systems designed for heating/air conditioning. Any use other than that permitted, or outside the operating limits mentioned in this manual, is forbidden if not previously agreed with the company. The warranty does not include payment for damage due to wrong installation of the unit by the installer.
- The warranty does not include payment for damage due to the improper use of the unit by the user.
- The manufacturer does not consider itself liable for accidents to the user or the installer due to the incorrect installation or improper use of the unit.
- The device must be installed in such a way that maintenance and/or repair operations can be carried out. The warranty of the device does not in any case cover costs incurred as a result of motorised ladders, scaffolding or any other lifting systems made necessary to carry out the operations under warranty.

The warranty is not valid when:

- the services and the repairs have been carried out by non-authorised personnel or companies;
- the unit has been repaired or modified in the past with non-OEM spare parts;
- the unit has not been subject to adequate maintenance;
- the instructions described in this manual have not been followed;
- non-authorised modifications have been made.

N.B.:

The manufacturer reserves the right at all times to make any modification for the improvement of its product, and is not obliged to add these modification to machines of previous manufacture that have already been delivered or are being built.

The warranty conditions are anyway subject to the general sales conditions at the moment the contract is finalised.

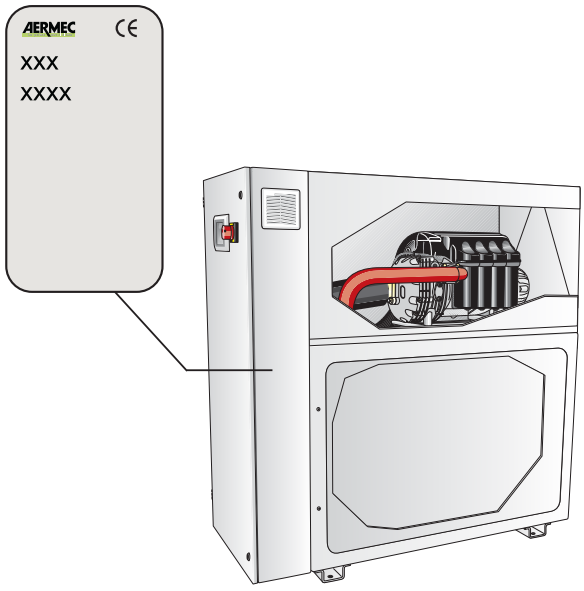


Fig.01

Description and choice of unit

The unit TW 110 is a water-based modular chiller for home and technological use.
The unit must only be installed indoors; it has a protection rating of IP20. These units are fitted with plate-type exchangers, optimised to work with gas R134a as both evaporators and condensers, hence allowing extremely reduced bulk. In addition, the layout of the components has been designed so that it is possible to combine two or more units in the minimum technical clearances. The compressor is of the two-stage centrifugal type; the number of rotations can be regulated by means of the inverter, for the optimum control of the cooling capacity. It works without oil, in the absence of mechanical friction, thanks to the bearings with magnetic levitation, and there is a system for the reduction of the starting current (just 6A). The flow of refrigerant gas is modulated by an electronic thermostatic valve, on the basis of the refrigerating load. A microprocessor controls and manages all the working parameters of the unit. Via an LCD touchscreen display assembled on the front panel of the unit, it is possible to pilot the machine and intervene on its main working parameters easily and quickly, thanks to the intuitive graphic menus.

FIELDS OF USE

The TW 110 can produce refrigerated water down to 5°C; for lower temperatures, contact the company.
The machine can work with water from a well or an evaporating tower. The application with dry-cooler is only possible if the operating limits are not exceeded (maximum temperature of condenser output = 45°C), so this application is allowed in temperate climates (maximum temperature of outside air 32°C).

Description of components

• Refrigerating circuit

Compressor
Of the two-stage, centrifugal type with the possibility to regulate the number of rotations by means of the inverter for the optimum control of the cooling capacity. It works without oil, in the absence of mechanical friction, thanks to the bearings with magnetic levitation.

CONDENSER
Of the plate type, in stainless steel AISI 316, optimised to work with the refrigerant gas R134a. It is externally insulated with closed cell material to reduce the heating dispersion, and also has a protection against ultraviolet rays, made of embossed aluminium sheet.

EVAPORATOR
Of the plate type, in stainless steel AISI 316, optimised to work with the refrigerant gas R134a. It is externally insulated with closed cell material to reduce the heating dispersion, and also has a protection against ultraviolet rays, made of embossed aluminium sheet.

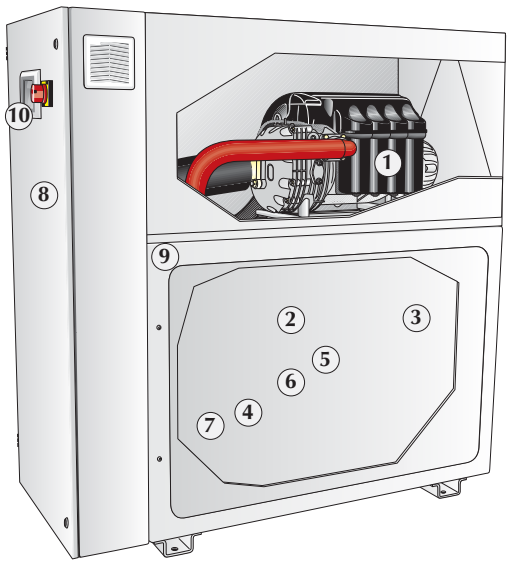
Filter-drier
Able to hold back impurities and any traces of humidity that may be present in the refrigerating circuit.

TAP
Allows you to intercept the refrigerant in the event of extraordinary maintenance.

Sight glass
For checking the refrigerating gas load and any humidity in the refrigerating circuit.

ELECTRONIC THERMOSTATIC VALVE

The valve modulates the flow of gas to the evaporator, on the basis of the refrigerating load, in order to guarantee an adequate level of overheating of the suction gas. The valve closes when the compressor turns off, preventing the flow of refrigerant gas towards the evaporator.



Legenda:

1	Compressore
2	Evaporatore
3	Condensatore
4	Valvola termostatica elettronica
5	Filtro deidratatore
6	Rubinetto del liquido
7	Valvola solenoide
8	Quadro elettrico
9	Struttura portante
10	Visualizzatore LCD

• Safety and control components

PRESSURE SWITCH
Located on the upper side of the refrigerating circuit, it stops the working of the compressor in the event of anomalous work pressures.

Refrigerating circuit safety valve
Calibrated at 22 bar (Hp) 16.5 bar (Lp), it intervenes by discharging the refrigerant in the event of anomalous overpressures.

• Frame

Load-bearing structure
Made of hot galvanised sheet iron, of a suitable thickness, varnished with polyurethane powders to guarantee a high level of protection against atmospheric agents.

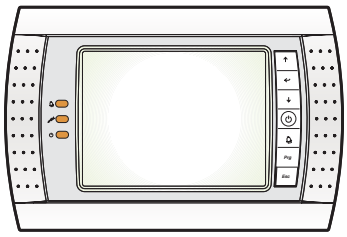
SOUNDPROOFING CASING
Made of galvanised sheet iron, of a suitable thickness, internally insulated with sound-absorbent material.

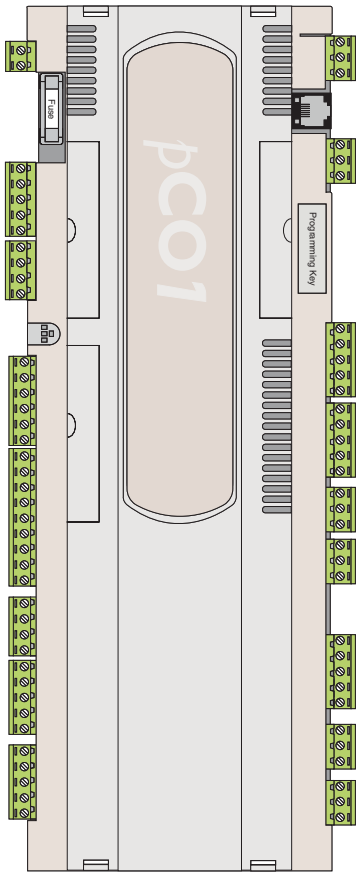
• Electrical components

ELECTRICAL PANEL
For protection and control, in compliance with the Standards:
- EN 60335-2-40
- EN 60204-1
- EN 61000-6-2
- EN 61000-6-4

Complete with command keyboard, it includes the microprocessor card that regulates the temperature of the evaporator output water, calculates the working hours, start/stop, reset, permanent memory of the alarms and relative visualisation, automatic restart after a drop in voltage, visualisation of the machine status, alarm management, visualisation of the main operating parameters (temperature of exchanger for input and output water, work pressure, overheating and under-cooling, discharge temperature, number of effective rotations of the compressor) setting of work set, working with local or remote control, compressor timer management, daily/weekly programming. In addition, the electric panel is complete with door-blocking magnetho-thermal switch, compressor power supply meter, miniature circuit breaker protection of the auxiliary circuit,

sinusoidal filter and reactance.





Microprocessor	
Remote on/off with external contact without voltage	●
Multilingual menu	●
Phase sequence control	●
Cumulative block failure signalling	●
Alarm log function	●
Daily/weekly programming	●
Inlet/outlet water temperature display	●
Compressor/circuit fault display	●
General machine alarm display	●
Proportional regulation on the temperature of the inlet water	●
Programmable timer function	●
Function with double setpoint linked to the programmable timer	●
Fan regulation	●
Pump-down at stop	●
Functioning without keyboard on the machine	●
Availability of the protocol specifications	●
Can be interfaced with the Modbus protocol	●
Pump control	●
Second pump control	●
Management of available resources from external contact	●
Double setpoint from external contact	●
Setpoint variation from external 0-10V signal	●
Clockwise rotation + FIFO compressors	●
Management of compressor working hours	●

Technical data

TW 110	Ver.	U.M.	TW110
Cooling capacity	°	kW	285
Input power	°	kW	56.4
Evaporator water flow rate (7°C)	°	l/h	49020
Condenser water flow rate (30°)	°	l/h	58720
Evaporator pressure drop	°	kPa	30
Condenser pressure drop	°	kPa	51

Energy indices

EER	°	W/W	5.10
ESEER [1]	°	W/W	7.90

Electrical data

Power supply	°		3~ 400V -50Hz
Nominal input current	400 V	A	88
Maximum current	400 V	A	134
Starting current	400 V	A	6

Compressors

Type	°		Two-stage centrifugal
Quantity	°	no.	1

Evaporator

Quantity	°	n°	1
Connections	IN	diam	3" victaulic
	OUT	diam	3" victaulic

Condenser

Quantity	°	no.	1
Connections	IN	diam	3" victaulic
	OUT	diam	3" victaulic

Sound data

Sound power	°	dB(A)	77
Sound pressure [2]	°	dB(A)	49

Dimensions

Height	°	mm	1710
Width	°	mm	805
Length	°	mm	1653
Weight	°	kg	960

Cooling:

evaporator input temperature 12°C
evaporator output temperature 7°C
condenser input temperature 30°C
condenser output temperature 35°C

(1) = European Seasonal Energy Efficiency Ratio (EECCAC)
(2) = In free field, at a distance of 10 metres with directivity factor Q=2;

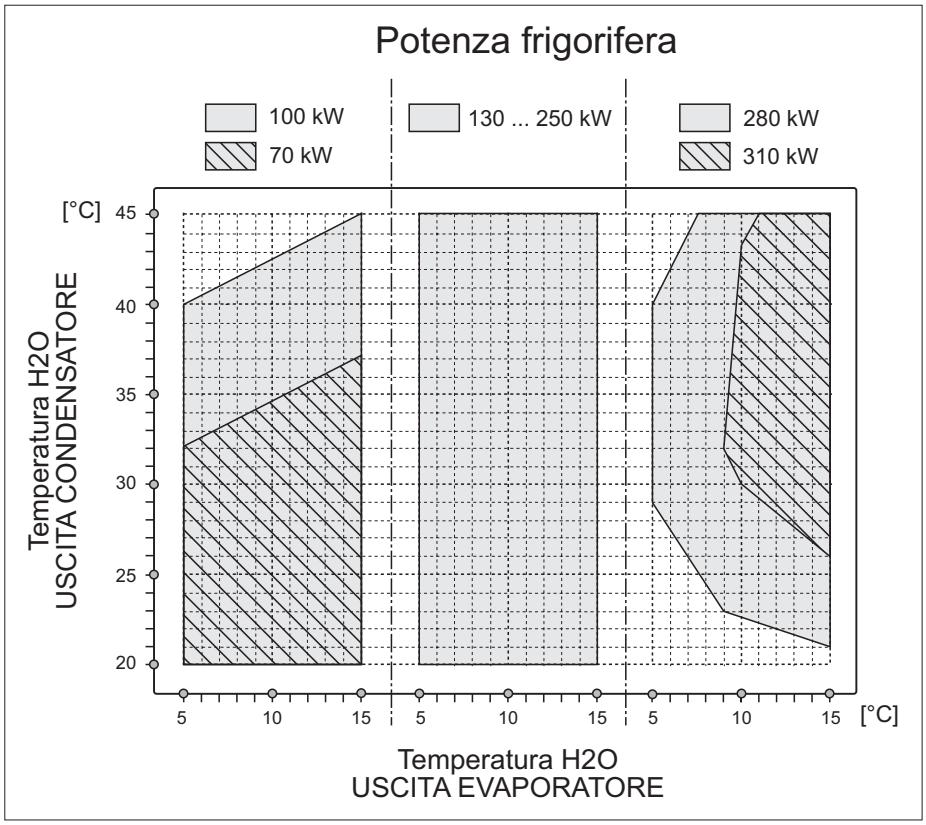
Selection criteria

Capacity variation

The operating limits of the TW110 vary on the basis not only of the temperature of the evaporator and condenser outlet water, but also the cooling capacity.
The centrifugal-type compressors, in fact, can work within a speed range defined by the minimum speed (surge speed) and the maximum speed (choke speed); this range varies according to the work pressures. The phenomenon of "surge", or pumping, is seen when the rotation speed is too low and not enough pressure is "generated" to push the gas towards the condenser, overcoming the dominating pressure via the non-return valve. As the cooling capacity is proportional to the rotation speed, so the lower the minimum cooling capacity, the lower the compression ratio.
A higher temperature of the evaporator outlet water and a lower temperature of the condenser outlet water therefore increase the compressor's capacity to choke, to a minimum of 70kW.
The "choke" phenomenon arises when the rotation speed is so high that the gas inside the compressor reaches the speed of sound. In these conditions, known as "critical flow", an increase in the number of rotations does not produce any increase in the cooling capacity. To heighten the cooling capacity, it is necessary to emerge from the critical flow, increasing the compression ratio. An increase in the suction pressure also allows you to augment the capacity, as the density of the suction gas is enhanced.
A higher temperature of the evaporator outlet water and a higher temperature of the condenser outlet water increase the compressor's capacity to augment the cooling capacity produced.
The compressor has a cooling capacity margin of about 10% compared with the nominal data that can be used in peak conditions, as long as the operating limits are respected.
The operating limits below 130kW and above 280kW are data for reasonable capacity values. For more details, consult the selection program. If you want to use the unit with a partial load, you are advised to check that the working temperatures are within the operating limits for the various load conditions.

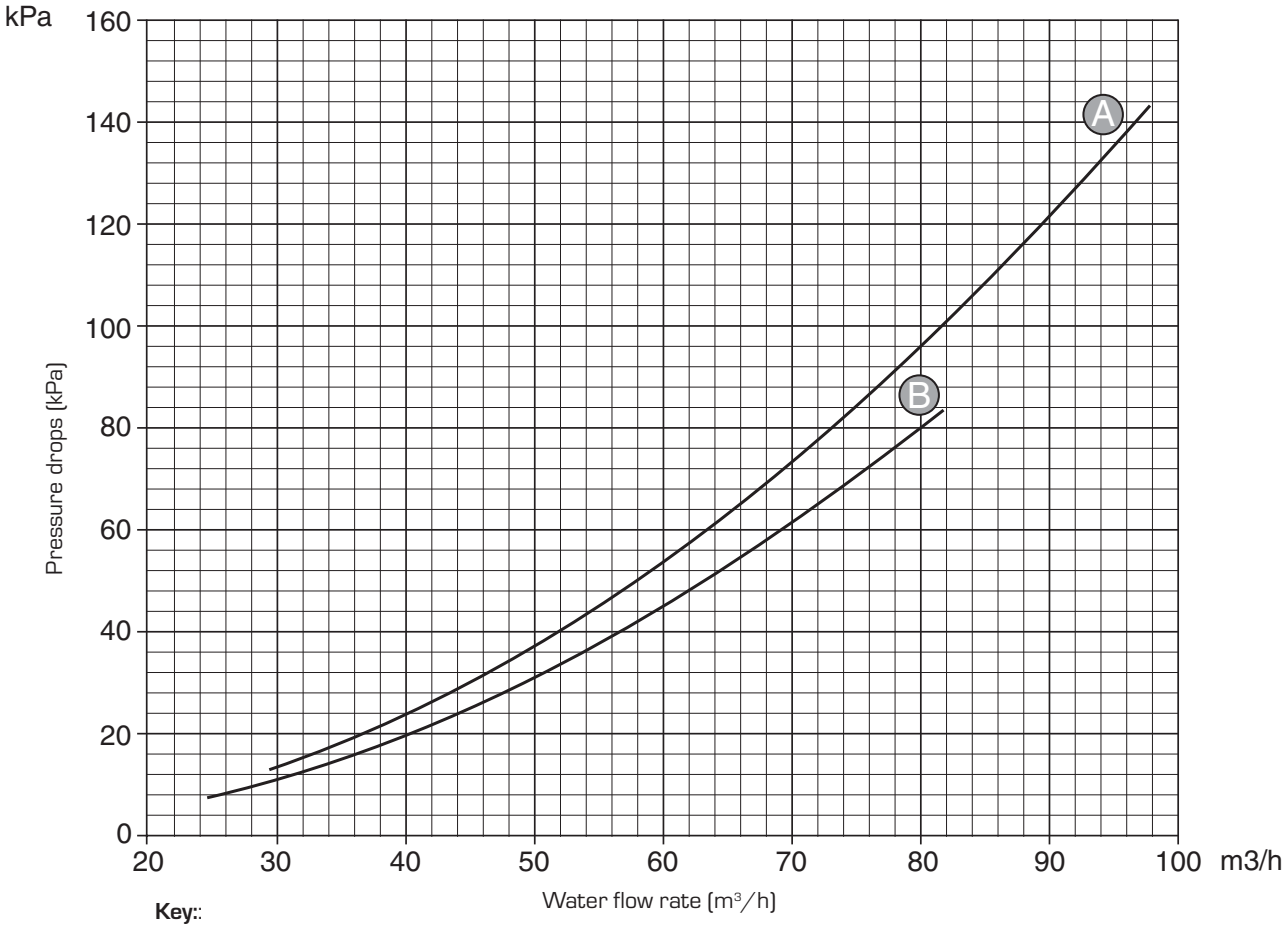
Operating limits

N.B:
For partial load performance and variations in water temperature, consult the Aermec selection program.



Pressure drop

Exchanger pressure drops



Key::

A = Condenser

B = Evaporator

Ethylene glycol solution

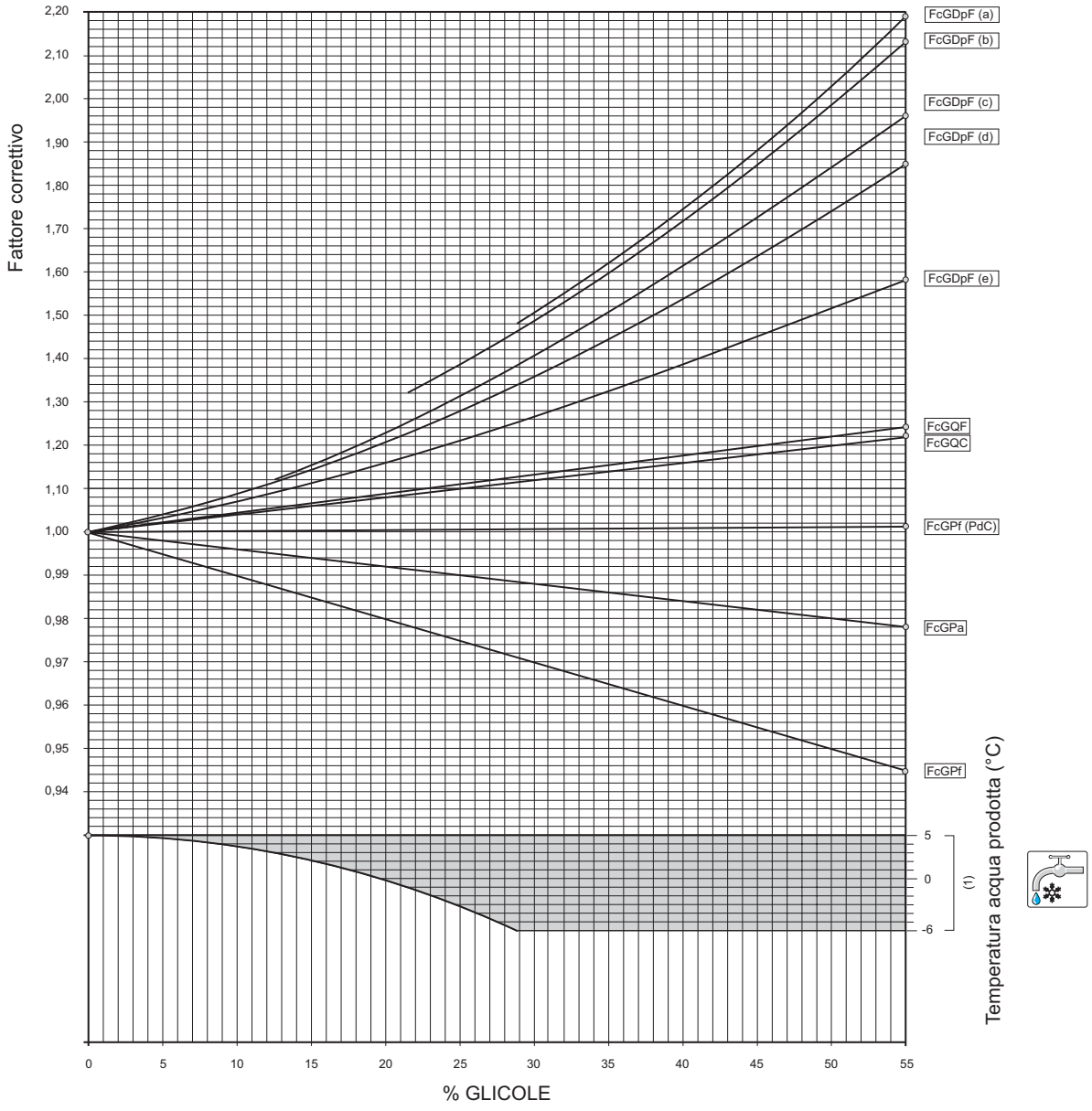


Fig.03

Key:

FcGPf = Correction factor of the cooling capacity

FcGPa = Input power correction factor.

FcGDpF (a) =(Evaporator) pressure drop correction factor (evaluated with an average temperature of -3.5°C)

FcGDpF (b) = Correction factor of the pressure drops (average temperature = 0.5°C)

FcGDpF (c) = Correction factor of the pressure drops (average temperature = 5.5°C)

FcGDpF (d) = Correction factor of the pressure drops (average temperature = 9.5°C)

FcGDpF (e) = Correction factor of the pressure drops (average temperature = 47.5°C)

FcGQF =Flow rate (evap) correction factor mean temperature = 9.5°C)

FcGQC =Flow rate (condenser) correction factor mean temperature = 47.5°C)

The water flow rate and pressure drop correction factors must be applied directly to the data obtained for operation without glycol.

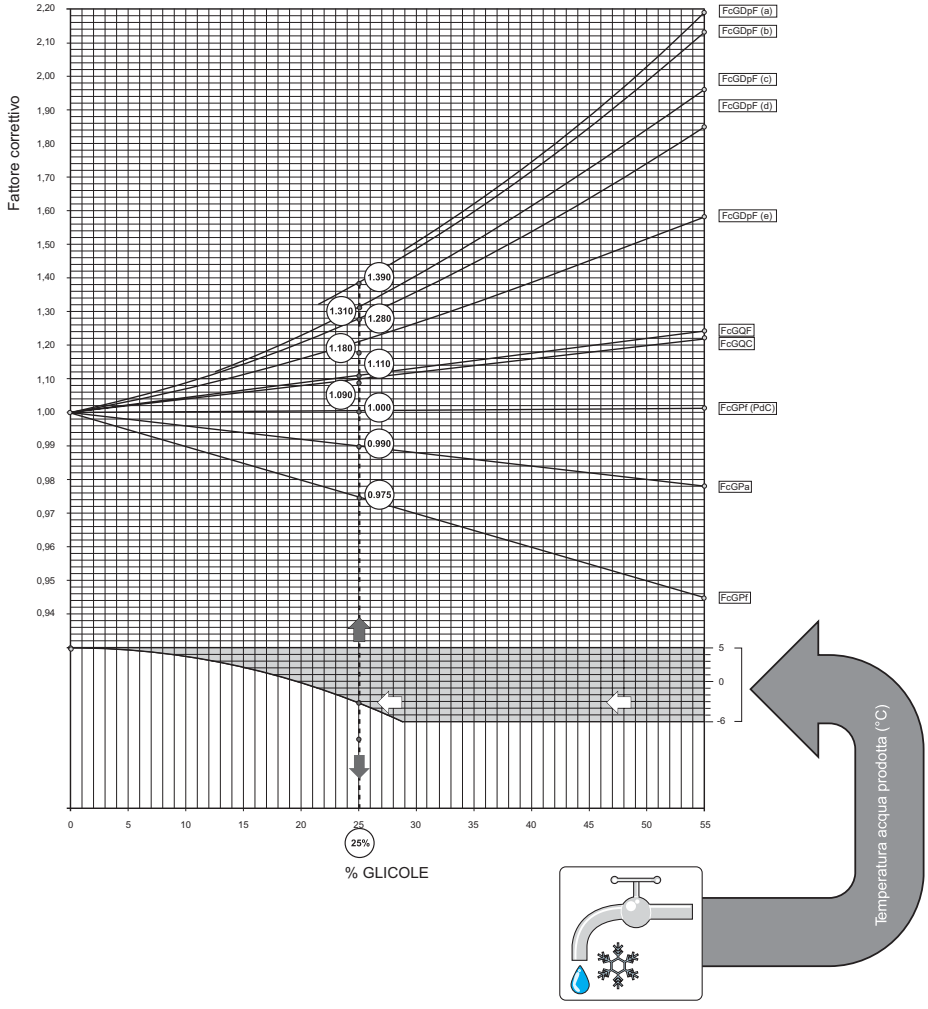
The correction factors of the cooling capacity and input power take account of the presence of glycol. The water flow rate and pressure drop correction factors must be applied directly to the data obtained for operation without glycol. The water flow rate correction factor is calculated in such a way as to have the same Δt that it would have in the absence of glycol. The pressure drop correction factor already takes account of the different flow rate deriving from the application of the water flow rate correction factor. By using the diagram opposite it possible to establish the percentage of glycol necessary; this percentage can be calculated by taking into consideration the following factor:

Water temperature

To find the coefficients, you must enter the diagram from the left side; from the intersection between the straight line representing water temperature, and the relative curves, you obtain a point through which the vertical line must pass, identifying both the percentage of glycols and the relative correction coefficients.

How to read glycol curves:
The curves shown in Figure 03 summarise a notable quantity of data, each represented by a specific curve. To use these curves correctly, it is necessary to make some initial considerations:

Fig. 03 A



Correction factors for Δt different from the rated value

N.B. for Δt different from 5°C, the table opposite is used to get the correction factors of both the cooling capacity and the input power and those of exchanger dirtying

	3	5	8	10
Cooling capacity correction factors	0.99	1	1.02	1.03
Cooling capacity correction factors	0.99	1	1.01	1.02

Fouling factors

	[K*m²]/[W]	0.00005	0.0001	0.0002
Cooling capacity correction factors		1	0.98	0.94
Cooling capacity correction factors		1	0.98	0.95

Fouling factors.

The performances shown by the table refer to conditions with clean exchangers, with a fouling factor = 1. For different fouling factor values, multiply the data of the performance tables by the coefficients shown.

Sound data

Key::
Nominal working conditions:
Evaporator water (in/out) 12/7°C
Condenser water (in/out) 30/35°C

	Tot. noise level			Octave band[Hz]						
	Pres.	Pow.		125	250	500	1000	2000	4000	8000
	10m	dB(A)	dB	Levels of sound power [dB]						
TW110	49.0	77.0	81.3	75.7	77.6	68.1	67.3	71.8	69.2	64.9

Sound power:
Aermec determines the value of the sound power on the basis of the measurements taken in compliance with the Standard UNI EN ISO 9614-2, and in accordance with the requirements of the EUROVENT certification.

Sound pressure:
Sound pressure in unrestricted range on reflecting plane (directivity factor Q=2), at a distance of 10 metres from the outer surface of the unit.

Calibrations of control parameters and protection devices

Control parameters

		min.	standard	max.
Water temperature set in cooling mode	°C	5	7	15

Protection device calibration

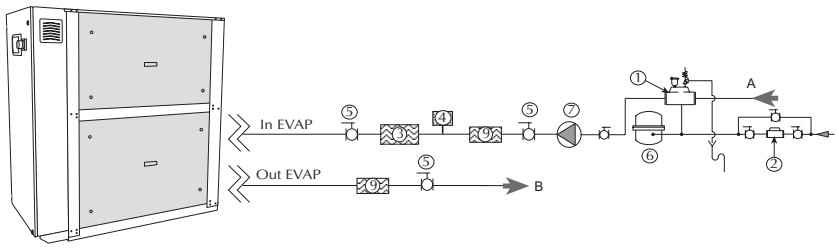
		TW 110
magnetho-thermal switch (400V)	A	160
Safety valve (high)	bar	17.5
Safety valve (low)	bar	17.5
Double high pressure switch (manual reset/manual reset with tool)	bar	16/16.5

Recommended external hydraulic circuit

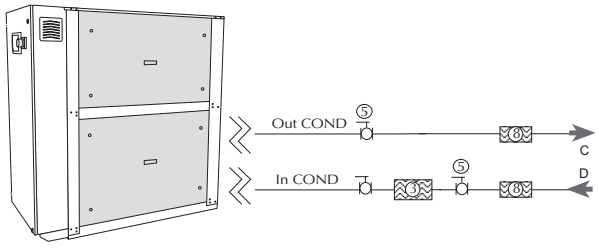
The figure below shows a schematisation of the hydraulic circuit of a TW110, to highlight some recommended or obligatory components. The flow rate of the water sent to the evaporator must be constant at all times. Each unit is equipped with a series of high pressure couplings.

Obligatory components of the hydraulic circuit:
- the installation of a flow switch (not supplied) at the evaporator input is obligatory; the guarantee will otherwise become invalid.
- it is obligatory to assemble a mechanical filter (not supplied) in the hydraulic circuits, at the input of each plate exchanger; the guarantee will otherwise become invalid.
The filter must have filtering holes with a diameter no greater than one millimetre, it must be kept clean, so it is necessary to check its clean state after the installation of the unit, and check it periodically.
- It is obligatory to assemble the high pressure flexible couplings (not supplied) in the hydraulic circuits, at the input and output of the exchangers, as shown in the figure below, in order to protect the machine from any tube vibrations (the machine itself does not emit vibrations). WARNING: the hydraulic tubes coupled with the machine must be of a suitable size for the effective water capacity requested by the system when operating as a chiller.

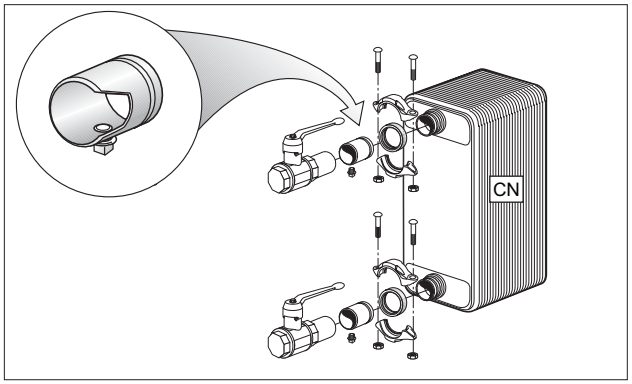
Hydraulic circuit EVAPORATOR

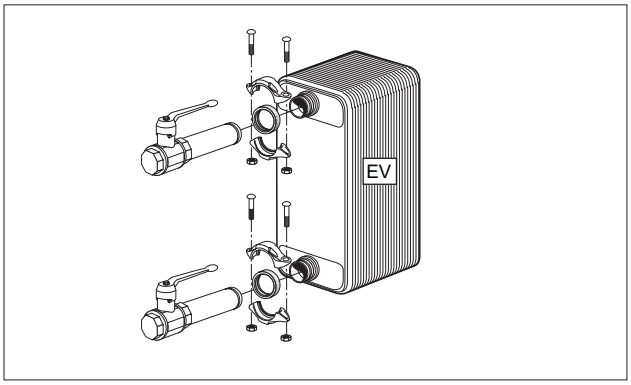


Hydraulic circuit CONDENSER



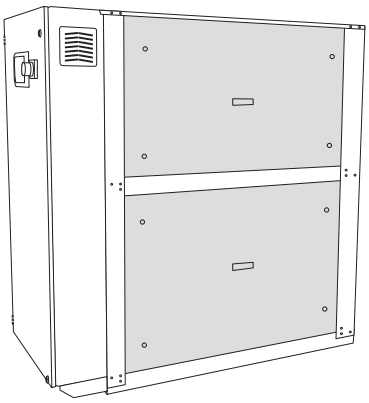
KEY
1 - Safety valve;
2 - Automatic power supply with pressure gauge;
3 - Water filter;
4 - Flow switch;
5 - Manual interception valves;
6 - Accumulation tank;
7 - Expansion tank;
8 - Pumping unit;
9 - High pressure flexible couplings, to avoid the transmission of vibrations to the unit TW 110
EV1 - Evaporator;
CN1 - Condenser;
A,D- Water inlet;
B,C - Water outlet;

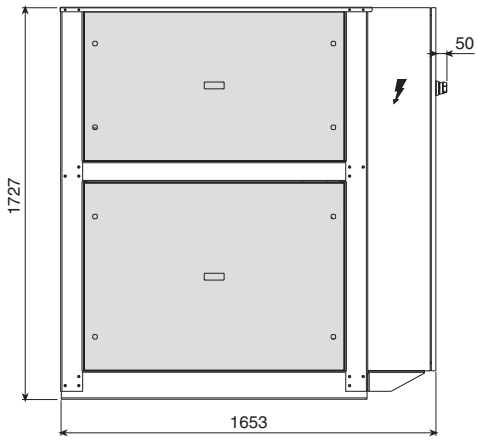


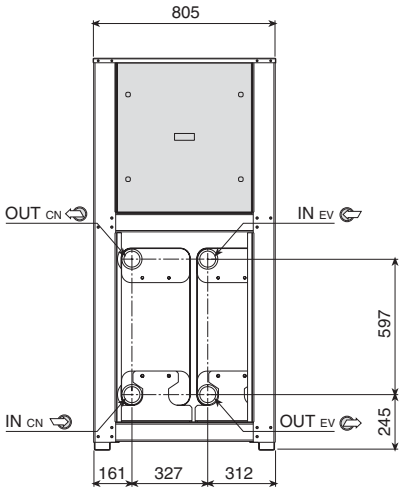


N.B. in the grooved couplings (supplied with the condenser), there is a connection for the cleaning of the exchanger.

Size data







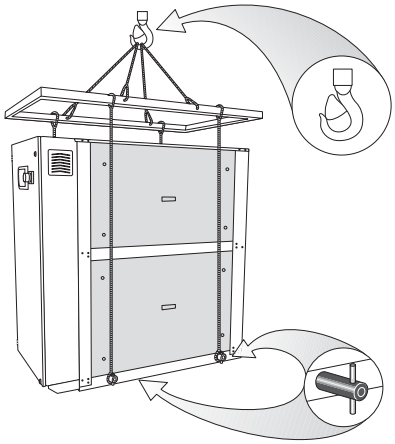
Remember that, if you use a number of units connected side by side, the clearances necessary for installation, use and/or technical interventions must take into account the minimum technical clearances required for these units; the data relating to the minimum technical clearances are included in the appropriate section of this manual.

Handling the unit

Before handling the unit, make sure that it has not been damaged during the transport and make sure that the equipment to be used for lifting and positioning has a suitable capacity (see weights table) and respects current safety regulations. Particular attention must be paid to all the loading, unloading and lifting operations so as to avoid hazardous situations for people, and damage to the structure and operational parts of the machine. The weights and the axes of the unit's centre of mass are indicated in the table. The holes in the base, to be used for lifting, are indicated with yellow adhesives showing a black arrow. The blades, which are adequately scaled, must protrude from the base unit for a sufficient length so that the lifting straps can be tautened upwards without them encountering any interference. Make sure that the straps have been approved to support the weight of the unit. Ensure that they are properly fixed to the upper frame and to the lifting blades. The safety closure must ensure that the straps do not work loose of their housing. The lifting frame must have the hooking point positioned vertically to the centre of mass (see handling figure). During the lifting process, you are advised to assemble the anti-vibration mounting (if included), fixing it to the holes on the base, according to the assembly layout supplied with the accessories.
Under no circumstance must anybody or anything stop under the unit, even briefly.

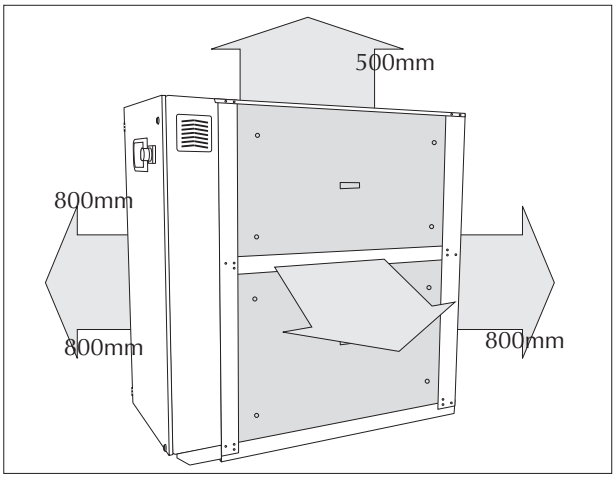
Remember that there are various solutions for the lifting and handling of the unit; the only limit set is the capacity of the equipment used for these operations; for further information regarding weights and the centre of mass of the machine, consult the appropriate section of this manual.

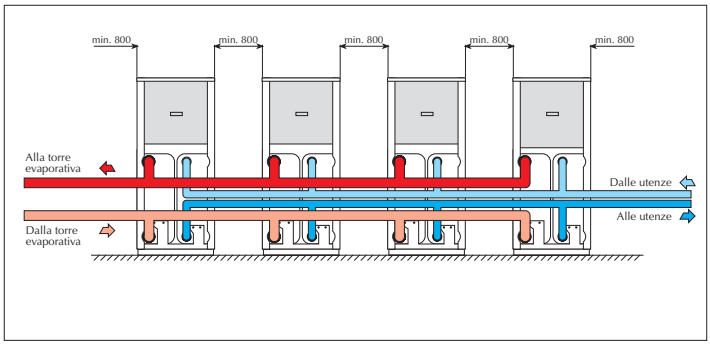
The material necessary for the handling of the machine is not supplied.

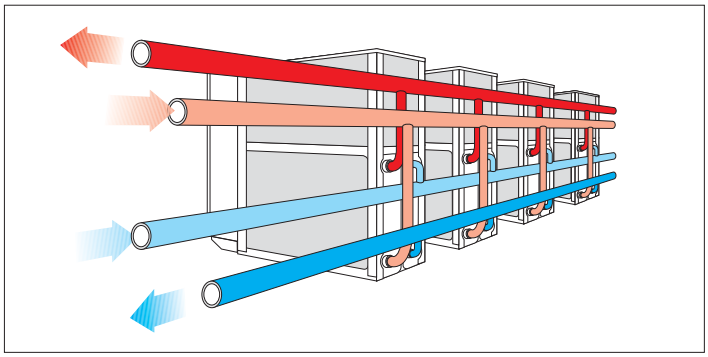


Minimum technical clearances

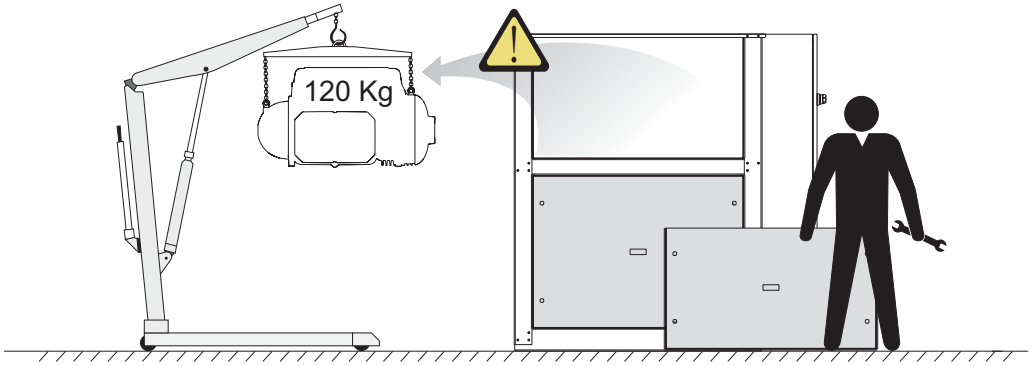
Before handling the unit, make sure that it has not been damaged during the transport and make sure that the equipment to be used for lifting and positioning has a suitable capacity (see weights table) and respects current safety regulations. Particular attention must be paid to all the loading, unloading and lifting operations so as to avoid hazardous situations for people, and damage to the structure and operational parts of the machine. The weights and the axes of the unit's centre of mass are indicated in the table. The holes in the base, to be used for lifting, are indicated with yellow adhesives showing a black arrow. The blades, which are adequately scaled, must protrude from the base unit for a sufficient length so that the lifting straps can be tautened upwards without them encountering any interference. Make sure that the straps have been approved to support the weight of the unit. Ensure that they are properly fixed to the upper frame and to the lifting blades. The safety closure must ensure that the straps do not work loose of their housing. The lifting frame must have the hooking point positioned vertically to the centre of mass (see handling figure). During the lifting process, you are advised to assemble the anti-vibration mounting (if included), fixing it to the holes on the base, according to the assembly layout supplied with the accessories. Under no circumstance must anybody or anything stop under the unit, even briefly. Remember that there are various solutions for the lifting and handling of the unit; the only limit set is the capacity of the equipment used for the lifting/handling operations; for further information regarding weights and the centre of mass of the machine, consult the appropriate section of this manual.







The device is designed and built to guarantee the maximum safety in the immediate surroundings. The accidental opening of the electric panel while the machine is working leads to the intervention of the mechanical interblock, which disconnects the voltage from the unit.
The machines of the TW110 range are indoor machines (protection rating IP20) and must be installed with the necessary technical clearances (see "Minimum technical clearances"). The respect of these clearances is essential in order to permit the routine and extraordinary maintenance interventions. The technical clearances necessary for the installation (electrical and hydraulic connections) are correlated to the individual situation. For the proper functioning of the unit, it must be installed on a perfectly flat surface. Ensure that the resting surface is able to support the weight of the machine.



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