Installation
Operation
Maintenance

Trane FreeCool FCAA
Free Cooling module

ENGY-SVX001A-GB

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General information

Foreword

This document is given as a manual of instructions to guide the user for good practice in the installation, start-up, operation, and maintenance of Trane FCAA free cooling modules.

They do not contain full service procedures necessary for the continued successful operation of this equipment. The services of a qualified technician should be employed through the medium of a maintenance contract with a reputable service company. Read this manual thoroughly before unit start-up.

Warnings and cautions

Warnings and Cautions appear at appropriate sections throughout this manual. Your personal safety and the proper operation of this machine require that you follow them carefully. The manufacturer assumes no liability for installations or servicing performed by unqualified personnel.

WARNING! : Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION! : Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices or for equipment or property-damage- only accidents.

Safety recommendations

To avoid death, injury, equipment or property damage, the following recommendations should be observed during maintenance and service visits:

1. Use appropriate Personal Protective Equipment for the task to be done

2. Disconnect the main power supply before any servicing or repair on the unit.

WARNING! Some electricity supplies remain live even when the main power supply is disconnected for anti-freeze protection. See the part Power supply for more information.

3. Service work should be carried out only by qualified and experienced personnel.

Reception

On arrival, inspect the unit before signing the delivery note.

Reception in France only:

In case of visible damage: The consignee (or the site representative) must specify any damage on the delivery note, legibly sign and date the delivery note, and the truck driver must countersign it. The consignee (or the site representative) must notify Trane Epinal Operations - Claims team and send a copy of the delivery note. The customer (or the site representative) should send a registered letter to the last carrier within 3 days of delivery.

Note: for deliveries in France, even concealed damage must be looked for at delivery and immediately treated as visible damage.

Reception in all countries except France:

In case of concealed damage: The consignee (or the site representative) must send a registered letter to the last carrier within 7 days of delivery, claiming for the described damage. A copy of this letter must be sent to Trane Epinal Operations – Claims team.

Warranty

Warranty is based on the general terms and conditions of the manufacturer. The warranty is void if the equipment is repaired or modified without the written approval of the manufacturer, if the operating limits are exceeded or if the control system or the electrical wiring is modified. Damage due to misuse, lack of maintenance or failure to comply with the manufacturer's instructions or recommendations is not covered by the warranty obligation. If the user does not conform to the rules of this manual, it may entail cancellation of warranty and liabilities by the manufacturer.

Maintenance contract

It is strongly recommended that you sign a maintenance contract with your local TRANE Service agency.
This contract provides regular maintenance of your installation by a specialist in our equipment. Regular maintenance ensures that any malfunction is detected and corrected in good time and minimizes the possibility that serious damage will occur. Finally, regular maintenance ensures the maximum operating life of your equipment.

We would remind you that failure to respect these installation and maintenance instructions may result in immediate cancellation of the warranty.

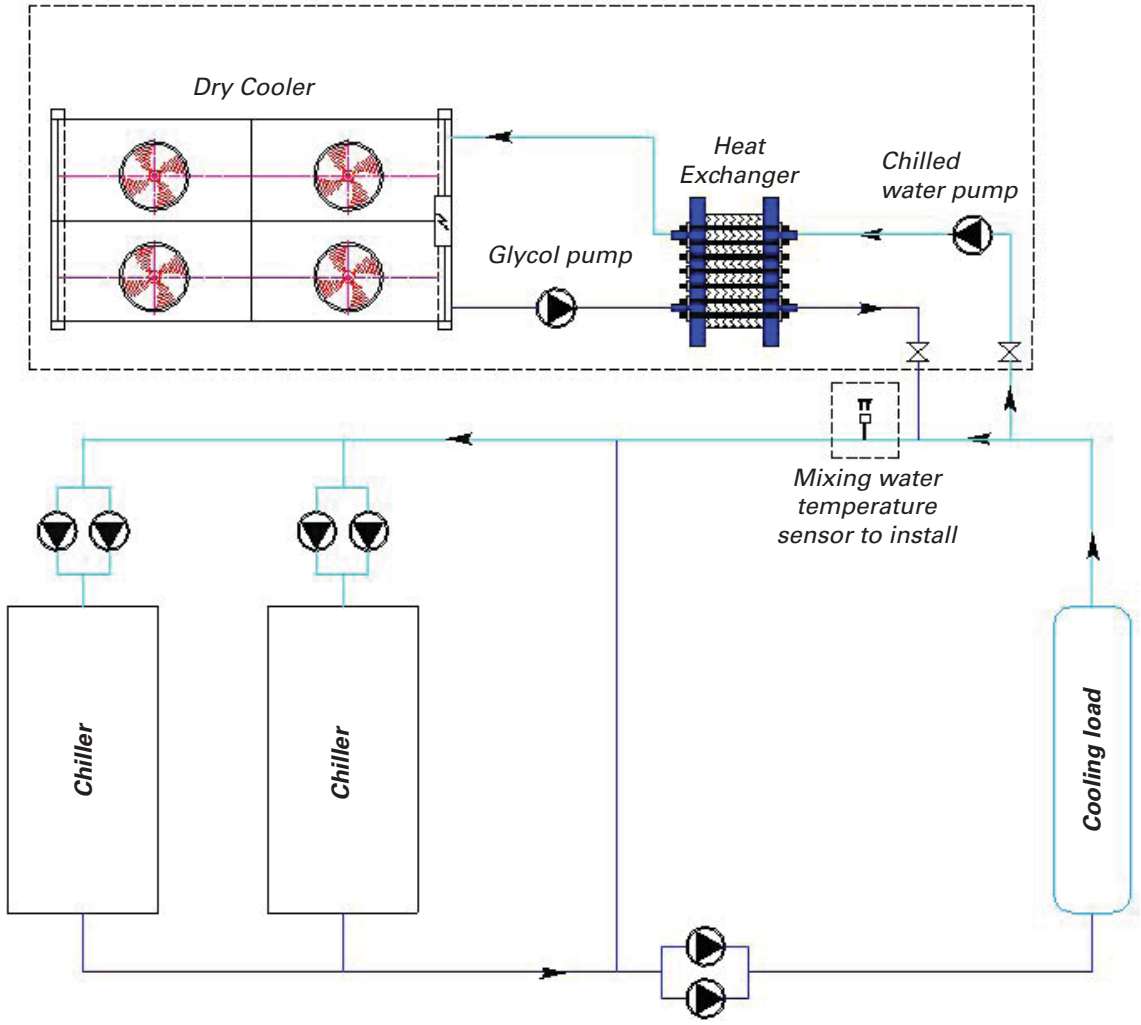
Overview

Trane FCAA free cooling units are designed to cool down chilled water directly using outside air whenever possible and viable.

These units are added on the chiller plant level, preferably in a sidestream configuration like represented below.

They can operate stand-alone, independently of the chillers, but can be controlled together with the chillers through dedicated hardwired connections in the unit controller.

Figure 1 - Schematic view of the Free Cooling unit with heat exchanger and its integration in a typical chiller plant



Packaged contents

Trane FCAA units are composed of the following parts:

- A dry cooler, mounted on metal sheet beams.
- An hydraulic and electric module, including a plate heat exchanger, pump(s), hydraulic accessories and piping, an electrical panel with the power supply and controls.
- One water temperature sensor, to be installed on the cooling system at the mixing point (see Figure 1).

Overview

General data

Table 1- General data. Free cooling modules FCAA

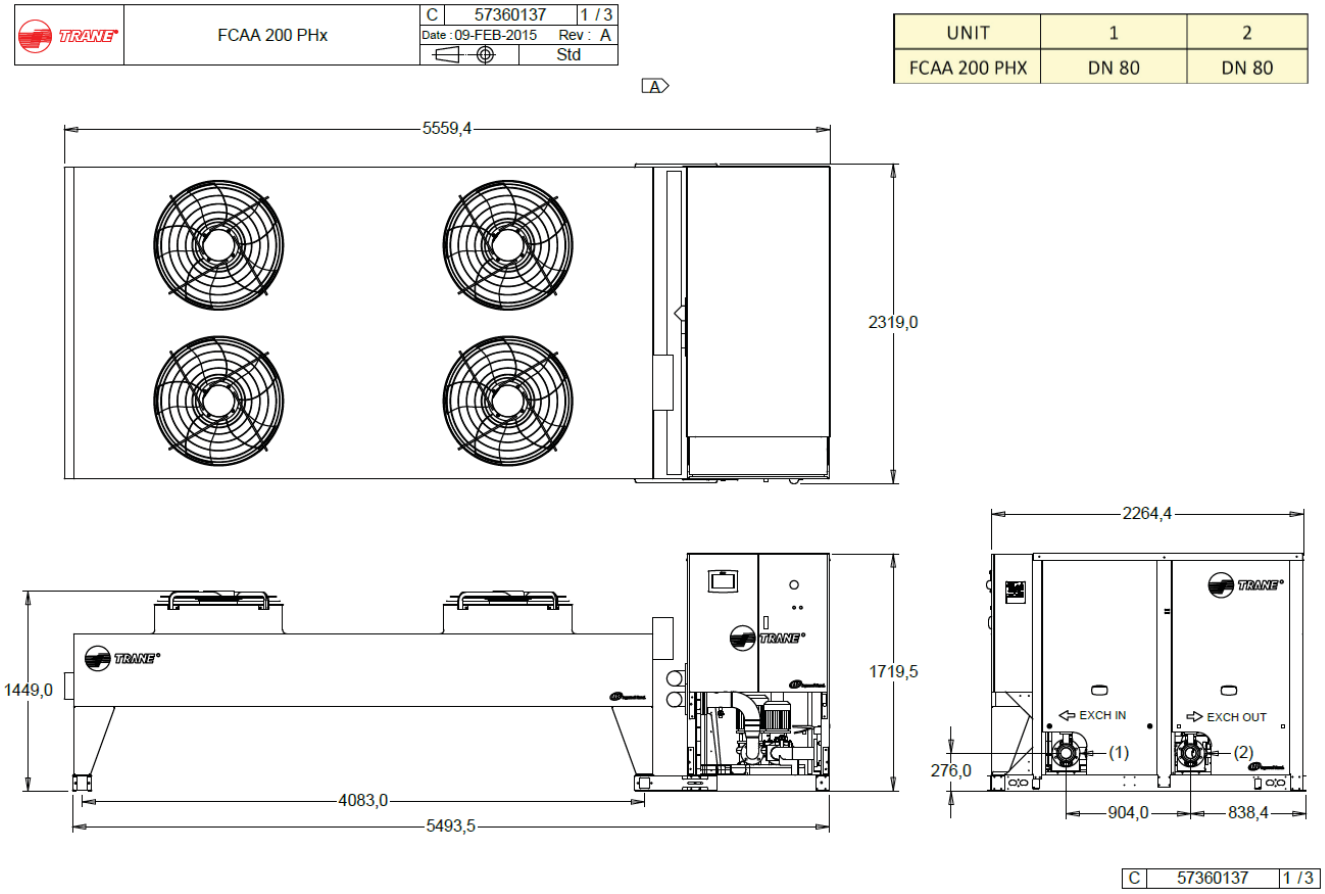
		FCAA 200 PHx	FCAA 200 Hx
Performances			
Cooling Capacity	(kW)	220	
Total Power input	(kW)	12	
Sound Power Level	(dBA)	82	
Hydraulic characteristics			
Heat exchanger pressure drop – secondary side	(kPa)	64.9	
Available head – secondary side	(kPa)	46	-
Unit pressure drop – secondary side	(kPa)	-	91
Power supply			
Main Power supply		400/3/50	
Nominal Amps	(A)	28	22
Start-up Amps	(A)	32	26
Max supply cable size (1) (Copper wire)	(mm^2)	16	
Dry Cooler			
Type		Flat bed	
Number of fans		4	
Starting Current per fan	(A)	4.55	
Full Load Current per fan	(A)	3.5	
Power input per fan	(kW)	1.75	
Hydraulic pressure drop	(kPa)	71	
Primary pump			
Max. current	(A)	7.7	
Rated power	(kW)	4.0	
Speed	(min-1)	2900	
Required NPSH	(m)	4.34	
Secondary pump			
Max. current	(A)	6.1	-
Rated power	(kW)	3.0	-
Speed	(min-1)	2900	-
Required NPSH	(m)	4.30	-
Piping			
Type		Steel	
Connection hydraulic module / dry cooler		Flanges DN100	
Connection cooling system		Flanges DN80	
Water strainer size (secondary side)		DN80	
Dimensions			
Height	(mm)	1800	
Length	(mm)	5546	
Width	(mm)	2260	
Operating Weight			
Dry Cooler module	(kg)	1200	
Hydraulic module	(kg)	900	
Shipping Weight			
Dry Cooler module	(kg)	1060	
Hydraulic module	(kg)	780	

(1) The maximum size of power supply cable that can be connected on the electrical panel. The actual size of cable shall be determined by the installation company.

Dimensions

The dimensions of the unit are shown on the drawing below. The full submittal is available as a separate file.

Figure 2 - Dimensions of FCAA 200 PHx / Hx unit



UNIT	1	2
FCAA 200 PHX	DN 80	DN 80

Installation

Installation instructions

Foundations

No special foundations are required, provided the supporting surface is flat and level, and can withstand the weight of the unit.

Before installing the unit in its final location, appropriate load calculations should be completed, taking into consideration functional unit load. This is to ensure its operating platform will withstand the units distributed weight. It is the responsibility of the installer to ensure that the relevant national building legislations are met and the operating surface is suitable to withstand the supplied unit.

Isolating rubber pads

Ten pads are supplied as standard with the unit (55x150 mm). They should be placed between the supporting floor and the unit to isolate from the ground. Trane does not recommend installing spring isolators.

Figure 3 - Location of the isolation rubber pads

Water drain hole

Install a drain hole wide enough to drain away water from the unit in the event of shut-down, purge or repair.

Clearance

Respect recommended clearance around the unit to allow maintenance operation to take place without obstruction. For minimum clearance, consult the following drawings and table.

For efficient operation, the unit needs airflow to be unrestricted and inlet air to be at ambient temperature.

Adjacent building styles, plant and prevailing winds can often cause air currents which, in turn can create down draughts, consequently forcing the discharge air back down into the air intake stream causing high air entering temperatures and subsequent loss of performance. Other adjacent plant, either requiring an air supply or dissipating air will affect the air flow onto the unit. To achieve unrestricted air at ambient temperature, it is necessary to avoid hazards such as:

- Local wind conditions causing warm outlet air to be mixed with the cool inlet.
- Inlet air entraining warm exhaust air from other equipment.
- Solar heat absorption from surrounding surfaces increasing the local ambient.
- Vertical coils should be shaded from the sun.

Adding effects together, a 5 K temperature increase in inlet air temperature over and above ambient may be reached at the installation site. This obviously has a serious effect on the performance. Sound pressure levels away from the unit will be affected by its surrounding objects/obstructions such as solid walls resulting in higher than specified levels of sound pressure.

Figure 4 - Avoid obstructions within 2 x diameter of the fan outlet

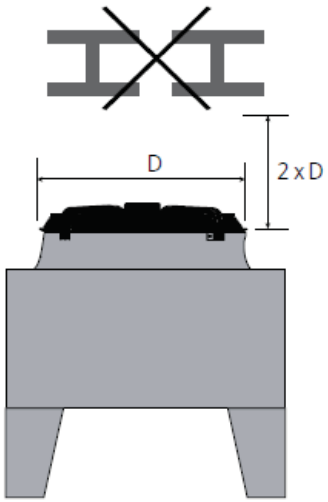


Figure 5 - Recommended clearance dimensions for units installation to avoid inlet or outlet restrictions objects such as walls.

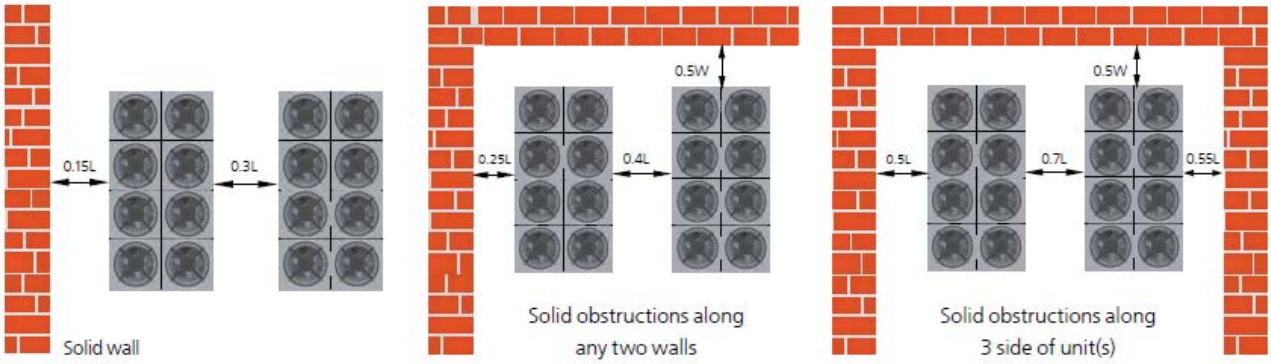


Figure 6 - Recommended clearance around the hydraulic module

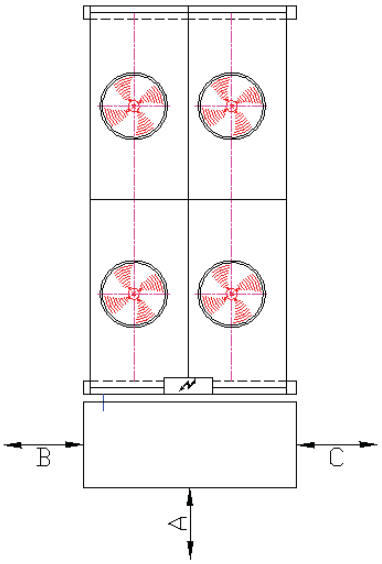


Table 2 - Clearances

Model	Fan diameter D (mm)	L (mm)	W (mm)	A (mm)	B (mm)	C (mm)
FCAA 200 PHx / Hx	910	4523	2260	1000	1000	500

Installation

Handling

The dry cooler and the hydraulic module are delivered separately and shall be lifted separately.

They shall be placed on their final destination place, with matching flanges.

CAUTION: The units must be lifted with the outmost care. Avoid shock load by lifting slowly and evenly.

To prevent any damage, position the lifting bar so that the slings do not touch the units.

Hydraulic module

A specific lifting method is recommended as follows:

1. 4 lifting points are built into the unit.
2. Slings and spreader bar to be provided by rigger and attached to the 4 lifting points.
3. Minimum rated lifting capacity (vertical) of each sling and spreader bar shall be no less than the tabulated unit shipping weight. Refer to Figures 1 and 2.

Figure 7 - Rigging the unit - FCAA (200) Hydraulic module

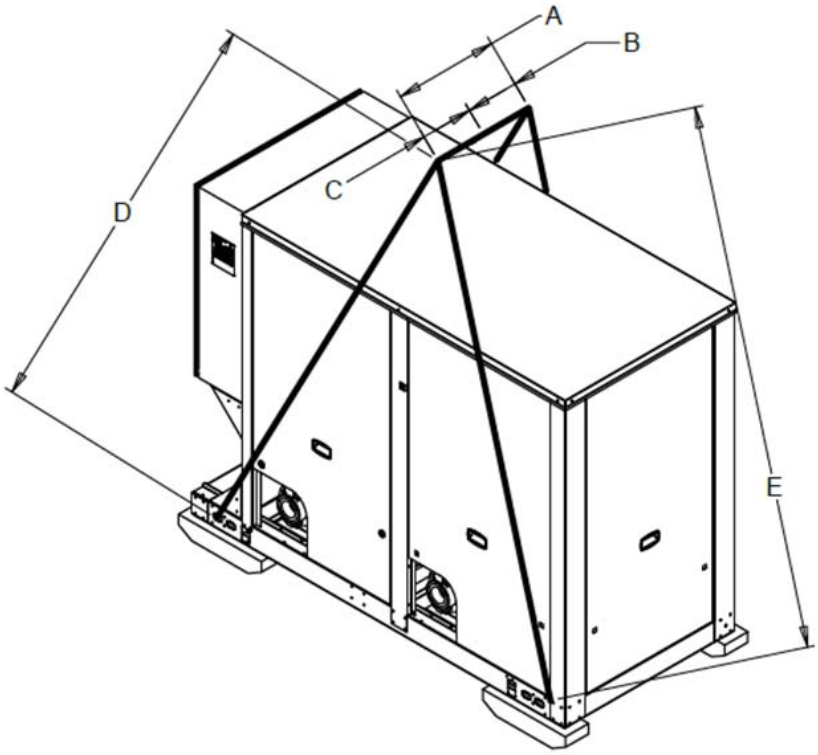


Table 3 - Dimensions of recommended slings and swing-bar for the hydraulic module

Model	Fan diameter D (mm)	L (mm)	W (mm)	A (mm)	B (mm)	C (mm)
FCAA 200 PHx / Hx	900	1100	550	550	2600	2500

Dry Cooler

The dry cooler has recommended points for use when fork or strop lifting which are clearly marked.

Figure 8 - Rigging the unit - FCAA (200) Dry Cooler

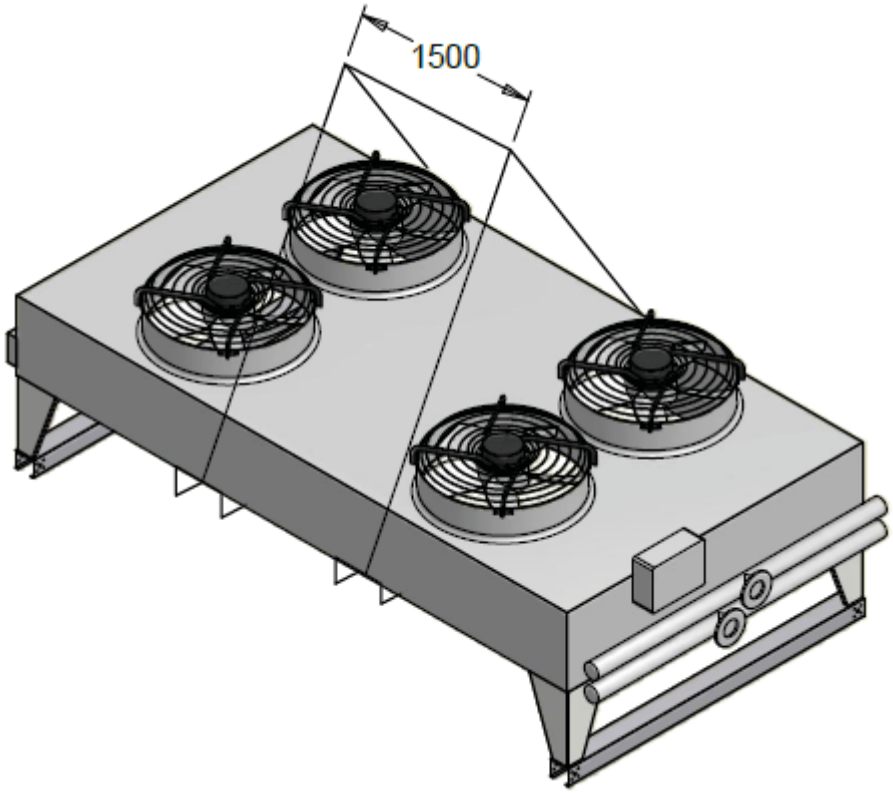


Table 4 – Weight of dry cooler

Model	Maximum weight (kg)	Spreader (mm)
FCAA 200 PHx / Hx	1060	1500

Installation

Hydraulic flow charts

Figure 9 - Hydraulic flow chart of FCAA PHx units

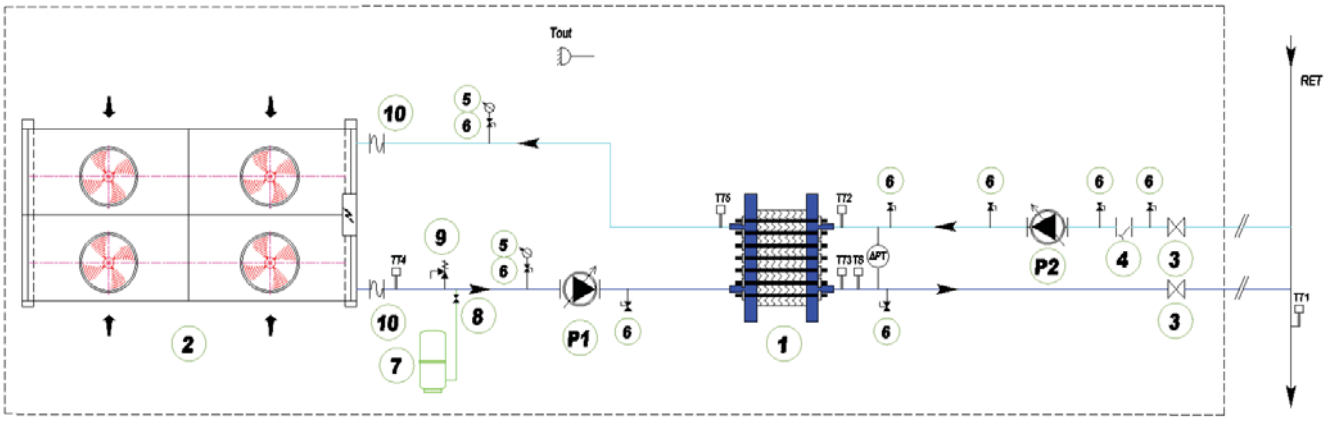
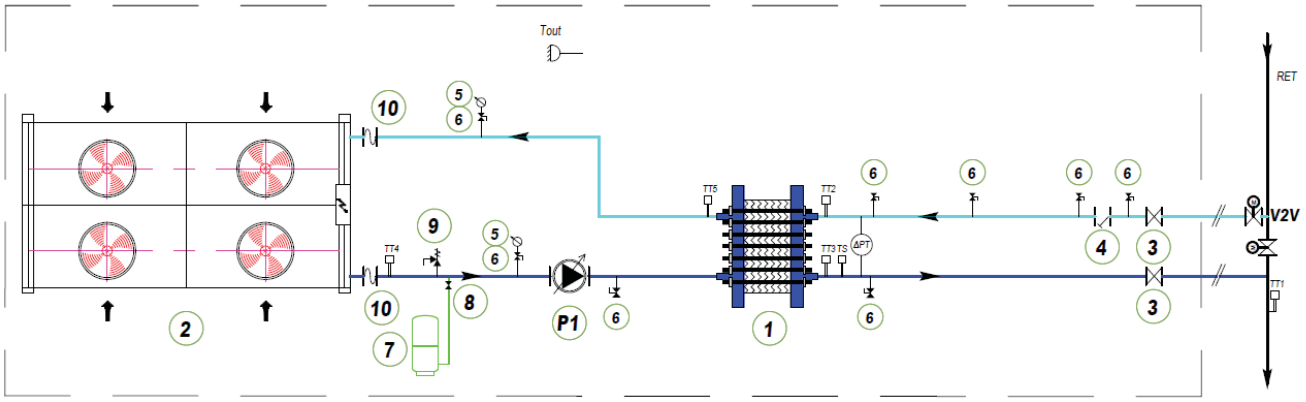


Figure 10 - Hydraulic flow chart of FCAA Hx units



1	Gasketed Plate Heat Exchanger
2	Dry Cooler
3	Butterfly valve
4	Strainer
5	Manometer
6	Ball valve
7	Expansion vessel
8	Ball valve
9	Safety valve
10	Bellow
P1, P2	Single head pump
ΔPT	Differential pressure transmitter
TT1-5	Immersion temperature sensor
Tout	Outside air temperature sensor
TS	Thermostat
RET	System chilled water return
V2V	Motorized, on-off 2-way valves (out of scope)

Water treatment

Untreated or insufficiently treated water used in this unit may cause scale, slime or algae to accumulate or cause erosion and corrosion.

As Trane does not know the components used in the hydraulic network and the quality of the water used, we recommend the services of a qualified water treatment specialist.

Trane will not accept any liability for damage caused by the use of untreated or improperly treated water or from the use of saline or brackish water. If water treatment is required, contact your local Trane sales office.

Assembly of the unit

Water connections

The dry cooler and the hydraulic module shall be connected at their flanges. Necessary bolts and screws are supplied with the unit.

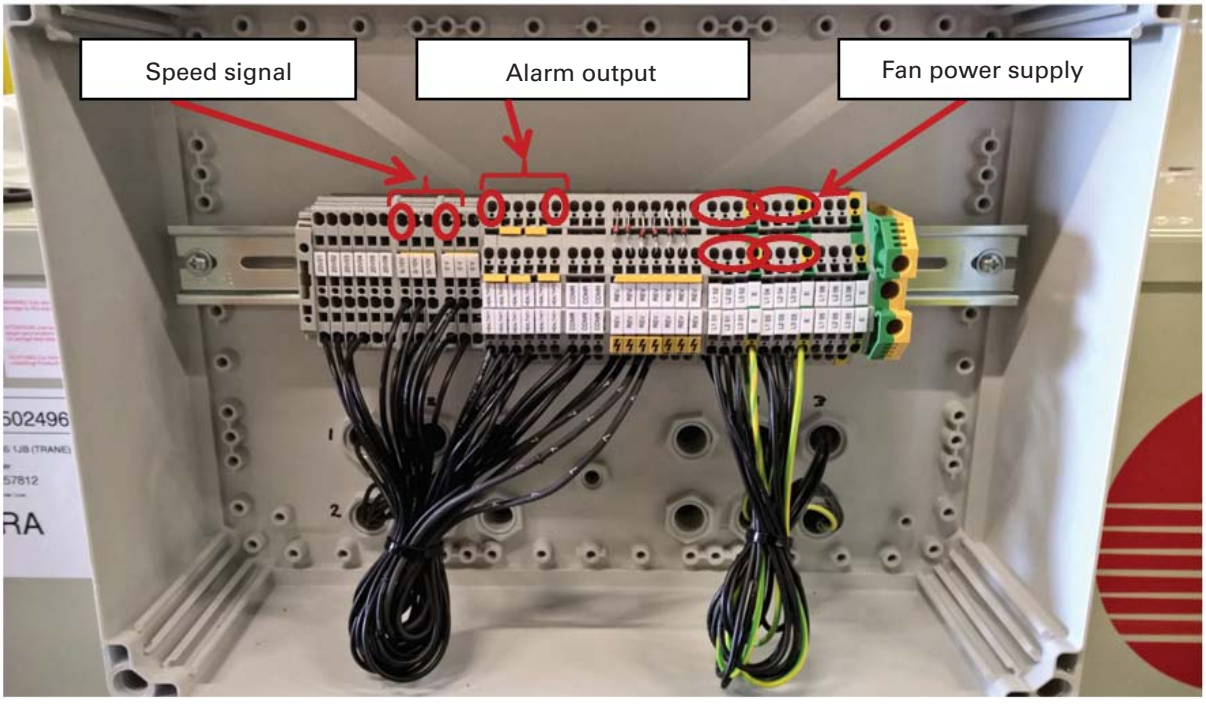
Figure 11 - Hydraulic connection of hydraulic module with dry cooler

Electrical connection

The cables for the dry cooler power supply and control are prewired on the hydraulic module, and need to be connected to the dry cooler – see Figure 9:

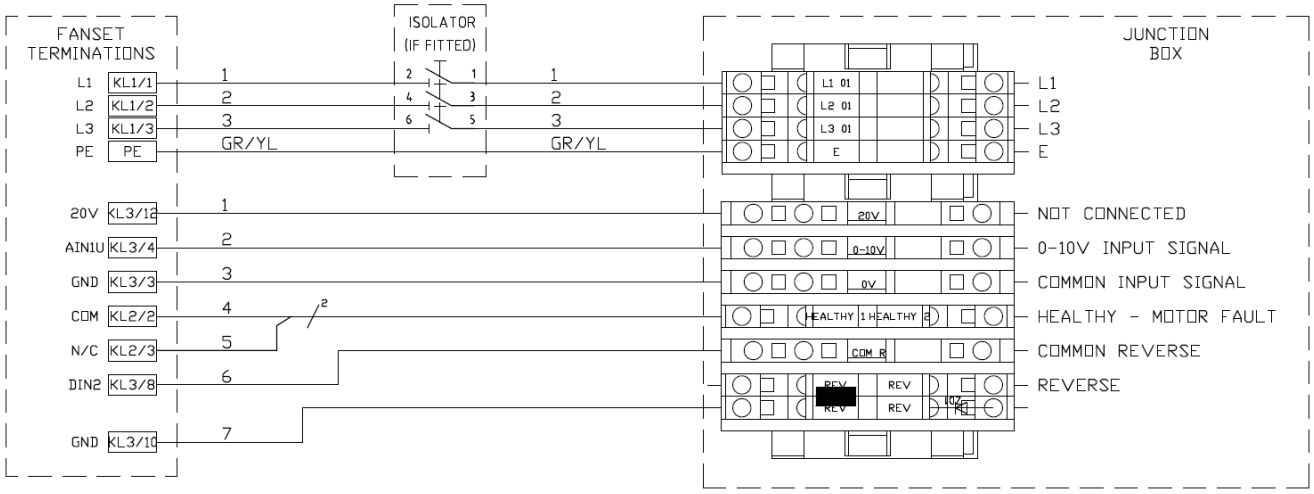
- 1 power supply cable (L1-L2-L3-E) per fan
- 1 speed signal 0-10V input to connect onto “0-10V” and “0V”
- 1 alarm output to connect onto “Healthy1”/”Healthy2”

Figure 12 - Dry cooler junction box and cables to connect



Installation

Figure 13 - Wiring diagram of the dry cooler junction box – for each fan



Hydraulic connection to the cooling system

Before making any connections, make sure the labeling for entering and leaving water corresponds to the submittals.

The hydraulic connection between the main cooling system and the FCAA unit should be performed in the same diameter as the connection flanges or larger, in order to limit pressure drop. The maximum available pressure drop is indicated on the selection sheet.

Bellows are recommended in order to limit the transmission of vibrations from the unit to the cooling installation.

The pipes shall be trace heated and insulated in order to avoid any freezing in the pipes during a stop of the installation at low ambient conditions.

If required additional isolation valves can be installed close to the main system connection provided pipe lengths are adequate.

FCAA units without secondary pump:

For these units, the customer's main cooling system pump(s) need to deliver the necessary pressure to overcome the pressure drop on the secondary side of the unit, which is mentioned in Table 1.

A motorized on/off three-way valve or two two-way valves (not included) shall be installed at the connection with the main cooling system. These valves shall be able to receive opening and closing signals from the unit controller, and deliver back status information.

Winter freeze protection

The unit is delivered with the following systems to protect the secondary side from freezing during negative ambient air temperatures. Ensure that these systems are in operating mode:

- Start chilled water secondary pump when the water temperature is close to the freezing point.
- Insulation and electrical trace heating on the secondary piping and heat exchanger, triggered by a mechanical thermostat on the heat exchanger secondary outlet.

The outdoor piping connections between the free cooling unit and the main cooling system should be protected in a similar manner from freezing by the installer.

Temperature sensor installation and connection

An immersion water temperature sensor is supplied with the unit. It shall be installed on the customer's main cooling system, after the mixing point with the free cooling unit supply, preferably about one meter after this point; see Figure 1.

The immersion sensor is delivered with a thermowell that shall be installed into the main pipe. It has the following characteristics:

- Length: 4" / 100 mm
- Thread: ½" BSPP External
- Material: Brass

The sensor is equipped with a Plastic Enclosure (IP-54).

The sensor shall be connected to the electrical panel, to the terminals foreseen for the item "TT1" (see the electrical schematic).

Recommended wire: 0.33 to 0.82 mm^2 section, stranded, tinned-copper, shielded, twisted-pair.

Power supply

400V / 50Hz / 3ph power supply cables shall be provided to the FCAA electrical panel.

The maximum current data is indicated on the unit nameplate.

The maximum cable size is indicated in Table 1 - General data Free cooling modules FCAA.

WARNING ! The trace heating system remains active even if the main disconnect switch is off. Cables that remain live are marked as such in the electrical panel. The trace heating cables mounted on the pipes and plate heat exchanger also remain live.

CAUTION:

1. The greatest care should be taken when cutting through passages and installing electric wiring. Under no circumstances should chips of metal or cuttings of copper or isolating material fall into the starter panel or electric components. Relays, contactors, terminals and control wiring should be covered and protected before power supplies are connected.

2. Install power supply cabling as shown in wiring diagram. Adequate cable glands should be chosen, ensuring no foreign bodies enter the electrical housing or components.

CAUTION:

1. Cabling must comply with local standards. The type and location of fuses must also comply with standards. As a safety measure, fuses should be visibly installed, close to the unit.

2. Only copper wiring should be used. Using aluminum wires can produce galvanic corrosion and possibly lead to superheat and failure of connection points. If aluminum cables are used, specific connectors must be applied.

CAUTION: The cabinet power supply should be protected. Cabinet requirements are indicated on the nameplate.

CAUTION: Units must not be linked to the neutral wiring of the installation. Units are compatible with the following neutral operating conditions:

TNS	IT	TNC	TT
Standard	Special	Special	Special

Control connection

The following hardwired inputs can be connected:

- Temperature setpoint (Tseti): 0-10V signal. Use to control the setpoint for the System Mixing Water Temperature (TT1) from an external source.
- External validation (ExVal): binary signal (N.B.: a bridge must be placed when this input is not used – the unit is delivered with bridging). Use to enable/disable the free cooling unit from an external source.

The following hardwired outputs can be connected:

- Alarm relay (KA4): general alarm report.
- Running status (KA9): enable/disable status of free cooling unit. Reports whether at least a pump or the dry cooler is operating.
- Full Free Cooling capacity (KA5): maximum free cooling capacity is reached; the pumps and fans are running at maximum speed. This output can be used to enable/disable chillers.

The following hardwired inputs/outputs must be connected for FCAA units without secondary pump:

- Inputs: System return 2-way valve open status (XV On), System return 2-way valve closed status (XV Off),
- Outputs: Valve 1 Free cooling line (3L1) and Valve 2 Bypass Line (3L2).

Recommended wires: 0.33 to 0.82 mm^2 section, stranded, tinned-copper, shielded, twisted-pair.

Operating range

The minimum outside air temperature for the FCAA units is -15°C.

Preparation for start-up

Carry out all of the listed operations so that the unit is correctly installed and ready to operate. The installer must check all the following points before calling in the Trane Servicing Department to put the equipment into service:

- Check position of the unit.
- Check unit is level.
- Check type and position of the rubber pads.
- Check clearance required for maintenance (Refer to certified drawings).
- Check both modules are well connected to each other, hydraulically and electrically.
- Primary and secondary circuits ready to operate, filled respectively with glycol solution and water, pressure test carried out and air purged and checked for leak test.

CAUTION: It is prohibited to start the water pumps when the water loop is not filled with water. Doing so can severely damage the mechanical seal of the pump.

Installation

- Primary and secondary water circuits must be rinsed.
- The strainer must be cleaned after 2 hours of pumps operation.
- Check chilled water pumps interconnection to control panel.
- Ensure that the isolation resistance of all power supply terminals to ground complies with standards and regulations in force.
- Check that unit voltage and frequency supplied match rated input voltage and frequency.
- Check that all electrical connections are clean and sound.
- Check that main power supply switch is sound.
- Check Ethylene glycol or Propylene glycol concentration in the primary water circuit.
- Check chilled water pressure drop through heat exchanger are in accordance with the Trane order write-up.
- On start-up of each motor in the system, check the direction of rotation and operation of all the components they drive. Checking the direction of rotation of the pumps: Switch on briefly and check whether the direction of rotation corresponds to the arrow on the motor (fan cover or flange). If the direction of rotation is incorrect, proceed as follows: Swap two phases on the motor terminal board (e.g. phase L1 for phase L2).
- To avoid cavitation noises and damage, a minimum intake pressure must be guaranteed at the suction port of the pump. This minimum intake pressure depends on the operation situation and the duty point of the pump, and must be defined accordingly. The main parameters for defining the minimum intake pressure are the required NPSH (Net Positive Suction Head) of the pump at its duty point and the vapor pressure of the fluid.
- Bleed the pumps by loosening the venting screw.
- Check that there is sufficient demand for cooling on the day of start-up (around 50% of nominal load).

Start-up

Follow the instructions below to correctly start-up the unit.

Installation and unit inspection

- Ensure that all the operations above (start-up preparation) are followed.
- Ensure the isolation valves are in service positions.
- Ensure that the unit is not damaged.
- Ensure that sensors are properly installed in their thermowells and submerged in heat conducting product.
- Reset all manually set control devices.
- Check setting of the safety pressure valve.

Electrical power wiring

- Check electrical terminals tightening of the motors and in the control panel.
- Check the isolation of the motors, using a 500V DC megohmeter which meets the manufacturer's specifications (minimum value 2 megohms).
- Check the direction of the rotation using phase meter.

CAUTION: Improper power phasing may result in equipment damage due to reverse rotation.

- Set-up fan-motors overload relays.

Electrical control wiring

- Check all the electrical terminals are tight.
- Check and set-up the Tracer UC600 control module.

Operating parameters statement

- Switch on main power supply.
- Check there is no cavitation when the water pump(s) starts.

After unit start up, keep in operation for at least 15 minutes, to ensure pressures are stabilized. Then check:

- voltage
- compressors currents
- leaving and return chilled water temperature
- leaving and return glycol water temperature
- heat exchanger pressure drop
- ambient air temperature

Operating parameters

- Chilled water pressure drop through heat exchanger or unit available pressure. It must be in accordance with Trane order write-up.
- Dry cooler approach: difference between dry cooler leaving temperature and outdoor air temperature. Normal value on standard unit should be 6°C at full load.
- Heat exchanger approach: difference between primary (dry cooler) inlet and secondary (cooling system) outlet water temperatures of the heat exchanger. Normal value on standard unit should be 2°C.

Final check

When the unit is operating correctly:

- Check that the unit is clean and clear of any debris, tools, etc.
- Ensure all valves are in operating position.
- Close electrical panel doors and check panel fixation.

CAUTION

For the warranty to apply, any start-up carried out directly by the customer must be recorded in a detailed report, which must be sent as soon as possible to your local Trane office.

- Do not start-up a motor with insulation resistance below 2 megohms.
- Phase imbalance should not be greater than 2%.
- The voltage supplied to motors should be within 5% of the rated voltage on the compressor nameplate.

WARNING!

The chilled water circuit may be under pressure. Bring down this pressure before opening up the system to rinse out or fill up the water circuit. Failure to comply may cause accidental injury to maintenance personnel. If a cleaning solution is used in the chilled water circuit, the chiller must be isolated from the water circuit to avoid all damage risks of the chiller and evaporator water pipes.

Operation

Control and unit operation

The control is done through the Tracer UC600 control module.

- Check the pump(s) operate(s).
- Start up the unit as described in the FreeCool User Guide. The unit will operate correctly when there is sufficient water flow.

Weekly start up

- Check the pump(s) operate(s).
- Start up the unit as described in the FreeCool User Guide.

Temporary shutdown during winter

- If the unit needs to be shut down for a short period of time, stop the unit as described in the FreeCool User Guide.
- Do not disconnect the main power switch, except if the unit is drained.
  WARNING! The trace heating system remains active even if the main disconnect switch is off. Cables that remain live are marked as such in the electrical panel. The trace heating cables mounted on the pipes and plate heat exchanger also remain live.
- Trane does not recommend draining the unit to avoid increased tube corrosion.
- Ensure that all safety precautions are taken to prevent frost damages during negative ambient temperature:
  - The pump(s) will operate depending on the measured temperatures.
  - The trace heating will be activated if the temperature measured in the chilled water leaving the heat exchanger is below its setpoint (units with heat exchanger).

Seasonal shutdown (summer)

- The unit does not need to be isolated during summer months or high ambient conditions, it will operate only if the required conditions are met.
- The short cycling of pumps and fans every few days during inactivity is included within the controls logic, to avoid seizing.
- If it is required to stop the unit, follow the procedure as outlined in the FreeCool User Guide.
- Before start-up and during low ambient conditions check the glycol concentration in the primary loop.

Any repairs to the free cooling unit should be undertaken by qualified personnel and in accordance with relevant national regulations, specifically with regards to fluid handling and brazing.

If any advice or guidance is required with regards to failure or repairs of Trane supplied products, please contact your local representative. Regular attention should be paid to the system operating requirements to ensure that the operating parameters are within the products/system specifications.

Every month, check:

- Coil condition, i.e clogging.

Every 12 months check:

- Security of fixings, especially fan motor mountings.
- Fluid pipework for damage and leaks.
- Motors rotate freely.
- Electrical connections for security of attachment. Check all external surfaces annually for any corrosion or peeling. Clean any affected area thoroughly with a wire brush, apply a coat of zinc primer and retouch with a suitable finishing paint.
- Only original spare parts should be used if replacing failed components.

Dry Cooler coil cleaning

It is essential that the heat exchanger coil is kept clean to maintain the designed heat transfer rate. General debris such as leaves, paper, dust and pollen can be removed using a brush, with compressed air blowing against direction of air flow (Max pressure 3bar) or an industrial vacuum cleaner.

The fin should be brushed in the longitudinal direction of the fins with a soft brush.

Heavier greasy soiling must be removed using a high-pressure water/steam jet washer (Max pressure 3bar) against direction of airflow, at a distance of 300 to 400 mm using a neutral cleaning agent if required.

The jet of the cleaner should be held vertical to the fin bank to avoid fin damage.

Any cleaning fluids should be suitable for use on both tube and fin materials. Incorrect use of fluids could be corrosive towards heat exchanger materials.

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ENGY-SVX001A-GB March 2015

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