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Installation, Operation and Maintenance Manual D-EIMAC01802-23_09EN

Air Cooled Chiller with Scroll Compressors

EWAT~B-C

EWFT~B-C



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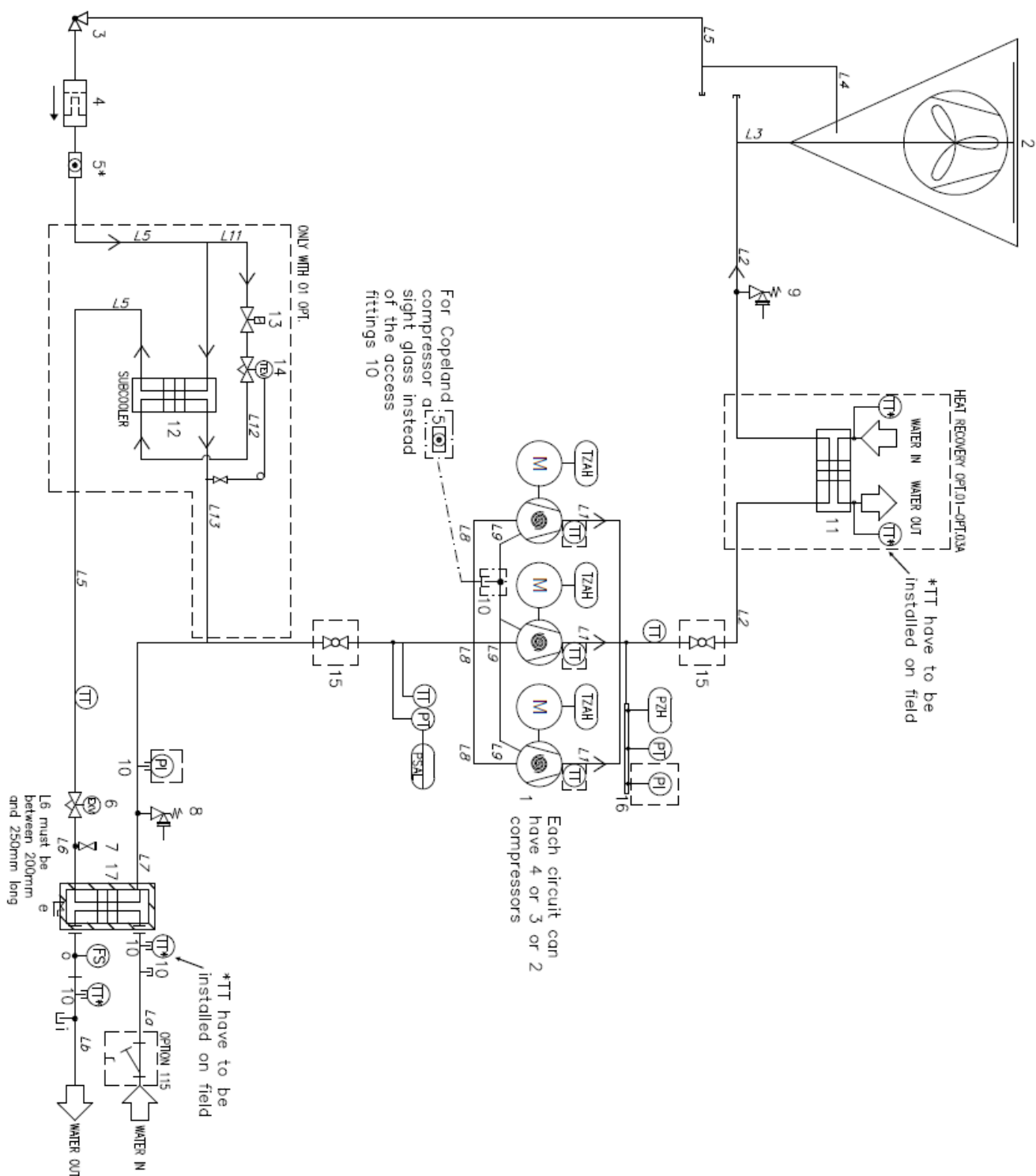


Fig. 1 – Refrigerant circuit diagram (P&ID) standard single circuit unit

LEGEND	
ID	DESCRIPTION
1	SCROLL COMPRESSOR (TANDEM CONF.)
2	MICROCHANNEL COIL CONDENSER
3	ANGLE VALVE
4	DRIER FILTER
5	MOISTURE SIGHT GLASS (only for model with ETS12C expansion valve)
6	ELECTRONIC EXPANSION VALVE
7	RECEIVER VALVE (1/4" SAE FLARE)
8	PRESSURE RELIEF VALVE LP 25,5 barg 3/8"
9	PRESSURE RELIEF VALVE HP 45 barg 3/4"
10	ACCESS FITTINGS 1/4"
11	HEAT EXCHANGER (BPHE) HEAT RECOVERY OPTIONAL
12	HEAT EXCHANGER (BPHE) SUBCOOLER OPTIONAL
13	SOLENOID VALVE
14	THERMOSTATIC EXPANSION VALVE
15	BALL VALVE (OPTIONAL)
16	MANIFOLD WITH ACCESS FITTING
17	EVAPORATOR
e	BPHE Electric heater
i	DRAIN 1/4" NPT
o	FLOWSWITCH FITTING 1/2" G or 1"G
L1	DISCHARGE COMPRESSOR COLLECTOR
L2	DISCHARGE LINE
L3	DISCHARGE LINE/CONDENSER COIL
L4	CONDENSER COIL/LIQUID LINE
L5	LIQUID LINE
L6	ELECTRONIC EXPANSION VALVE/EVAPORATOR
L7	SUCTION LINE
L8	SUCTION COMPRESSOR COLLECTOR
L9	OIL COMPRESSOR
L11	SUBCOOLER (L5→14)
L12	SUBCOOLER (L14→SUBCOOLER)
L13	SUBCOOLER (SUBCOOLER→SUCTION)
La	WATER IN CONNECTION
Lb	WATER OUT CONNECTION
PT	PRESSURE TRANSDUCER
PZH	HIGH PRESSURE SWITCH 42 bar
TZAH	HIGH TEMPERATURE SWITCH (MOTOR THERMISTOR)
PSAL	LOW PRESSURE LIMITER (CONTROLLER FUNCTION)
TT	TEMPERATURE SENSOR (*to be installed on field)
TS	TEMPERATURE SWITCH
PI	PRESSURE GAUGE (OPTIONAL)
FS	FLOW SWITCH (OPTIONAL)

Water inlet and outlet are indicative. Please refer to the machine dimensional diagrams for exact water connections.

The series is composed by mono (one circuit) and dual (two circuits) chiller.

Each circuit can be with 4 or 3 or 2 compressors.

Only one circuit is reported.

Temperature sensors must be installed on shipped loose Water In/Water Out pipe connections: please refer to machine dimensional diagrams for the installation.

HYDRONIC FREECOOLING

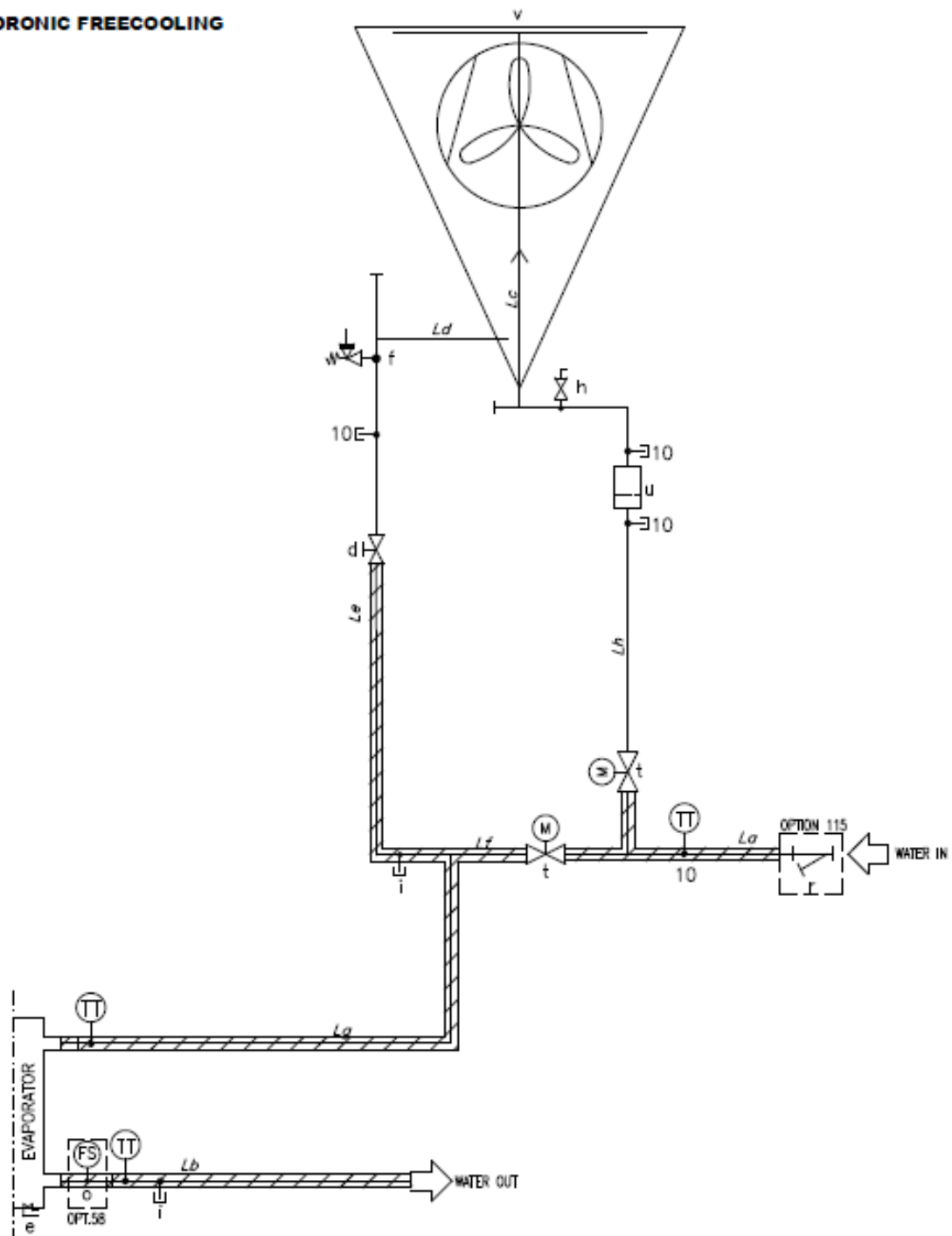
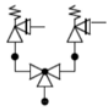


Fig. 3 –Hydronic freecooling system (P&ID)

LEGEND	
ID	DESCRIPTION
10	ACCESS FITTING 1/4" NPT
d	VALVE
f	SAFETY VALVE 10 BAR 1/2" MF
h	AIR VENT 3/8" NPT /TBC)
i	DRAIN 1/4" NPT
r	WATER FILTER
t	TWO WAY VALVE MOTORIZED
u	FILTER
v	FREECOOLING COIL
o	FLOWSWITCH FITTING 1/2" or 1"G
La	WATER IN LINE
Lh	WATER IN MANIFOLD
Lc	WATER IN COIL
Ld	WATER OUT COIL (FLEXIBLE)
Le	WATR OUT MANIFOLD
Lf	FREECOOLING COIL BYPASS
Lg	EVAPORATOR WATER IN
Lb	EVAPORATOR WATER OUT
TT	TEMPERATURE SENSOR
e	ELECTRIC HEATER

Water inlet and outlet are indicative. Please refer to the machine dimensional diagrams for exact water connections.
The series is composed by mono (one circuit) and dual (two circuits) chiller.

REFRIGERANT	PED/PER GROUP	LINE	PS [bar]	TS [°C]
R32	1	HIGH PRESSURE GAS	45	+10/+130
		HIGH PRESSURE LIQ	45	-10/+65
		LOW PRESSURE [Opt. 227]	25,5	-30/+50 [-29/+50]
WATER CIRCUITS		WATER IN/OUT	10	-15/+40



Safety valves can be provided with a changeover device as optional.

1 INTRODUCTION

This manual is an important supporting document for qualified personnel, but it is not intended to replace such personnel.



**READ THIS MANUAL CAREFULLY BEFORE INSTALLING AND STARTING UP THE UNIT.
IMPROPER INSTALLATION COULD RESULT IN ELECTRIC SHOCK, SHORT-CIRCUIT, LEAKS, FIRE
OR OTHER DAMAGE TO THE EQUIPMENT OR INJURE TO PEOPLE.**



**THE UNIT MUST BE INSTALLED BY A PROFESSIONAL OPERATOR/TECHNICIAN
UNIT STARTUP HAS TO BE PERFORMED BY AUTHORIZED AND TRAINED PROFESSIONAL
ALL ACTIVITIES HAVE TO BE PERFORMED ACCORDING TO LOCAL LAWS AND REGULATION.**



**UNIT INSTALLATION AND START UP IS ABOSOLUTELY FORBIDDEN IF ALL INSTRUCTION
CONTAINED IN THIS MANUAL ARE NOT CLEAR.
IF CASE OF DOUBT CONTACT THE MANUFACTURER REPRESENTATIVE FOR ADVICE AND
INFORMATION.**

1.1 Precautions against residual risks

1. Install the unit according to the instructions set out in this manual
2. Regularly carry out all the maintenance operations foreseen in this manual
3. Wear protective equipment (safety gloves, safety glasses, safety helmet, etc.) Suited to the work in hand; do not wear clothes or accessories that can get caught or sucked in by flows of air; tie back long hair before entering the unit
4. Before opening the machine panelling make sure that it is firmly hinged to the machine
5. The fins on heat exchangers and the edges of metal components and panels can cause cuts
6. Do not remove the guards from mobile components while the unit is operating
7. Make sure that mobile component guards are fitted correctly before restarting the unit
8. The surfaces of the machine and pipes can get very hot or cold and cause the risk of scalding
9. Never exceed the maximum pressure limit (PS) of the water circuit of the unit.
10. Before removing parts on the pressurised water circuits, close the section of the piping concerned and drain the fluid gradually to stabilise the pressure at the atmospheric level
11. Do not use your hands to check possible refrigerant leaks
12. Disable the unit from the mains using the main switch before opening the control panel
13. Check that the unit has been grounded correctly before starting it
14. Install the machine in a suitable area
15. Do not use cables with inadequate sections nor extension cord connections, even for very short periods or emergencies
16. For units with power correction capacitors, wait 5 minutes after removing the electric power supply before accessing the inside of the switch board
17. The unit contains pressurised refrigerant gas: the pressurised equipment must not be touched except during maintenance, which must be entrusted to qualified and authorised personnel
18. Connect the utilities to the unit following the indications set out in this manual and on the panelling of the unit itself
19. To avoid an environmental risk, make sure that any leaking fluid is collected in suitable devices in accordance with local regulations.
20. If a part needs to be dismantled, make sure it is correctly re-assembled before starting the unit
21. When the rules in force require the installation of fire-fighting systems near the machine, check that these are suitable for extinguishing fires on electrical equipment and on the lubricating oil of the compressor and the refrigerant, as specified on the safety data sheets of these fluids
22. When the unit is equipped with devices for venting overpressure (safety valves): when these valves are triggered, the refrigerant gas is released at a high temperature and speed; prevent the release of gas from harming people or objects and, if necessary, discharge the gas according to the provisions of EN 378-3 and the local regulations in force.
23. Keep all the safety devices in good working order and check them periodically according to the regulations in force
24. Keep all lubricants in suitably marked containers
25. Do not store inflammable liquids near the unit
26. Solder or braze only empty pipes after removing all traces of lubricant oil; do not use flames or other heat sources close to pipes containing refrigerant fluid
27. Do not use naked flames near the unit
28. The machinery must be installed in structures protected against atmospheric discharge according to the applicable laws and technical standards
29. Do not bend or hit pipes containing pressurised fluids
30. It is not permitted to walk or rest other objects on the machines
31. The user is responsible for overall evaluation of the risk of fire in the place of installation (for example, calculation of the fire load)
32. During transport, always secure the unit to the bed floor of the vehicle to prevent it from moving about and overturning
33. The machine must be transported according to the regulations in force considering the characteristics of the fluids in the machine and the description of these on the safety data sheet

34. Inappropriate transport can cause damage to the machine and even leaking of the refrigerant fluid. Before start-up, the machine must be checked for leaks and repaired accordingly.
35. The accidental discharge of refrigerant in a closed area can cause a lack of oxygen and, therefore, the risk of asphyxiation: install the machinery in a well-ventilated environment according to EN 378-3 and the local regulations in force.
36. The installation must comply with the requirements of EN 378-3 and the local regulations in force; in the case of installations indoors, good ventilation must be guaranteed and refrigerant detectors must be fitted when necessary.

1.2 General description

The unit you bought is an “air cooled chiller”, a machine aimed to cool water (or water-glycol mixture) within the limits described in the following manual. The operation of the unit is based on compression, vapor condensation and subsequent evaporation, according to the inverse Carnot cycle. The main components are:

- A scroll compressor to rise the refrigerant vapour pressure from evaporation pressure to condensation pressure
- A condenser, where high pressure vapour condensate rejecting heat removed from the chilled water in the atmosphere thanks to an air-cooled heat exchanger
- An expansion valve allowing to reduce the pressure of condensed liquid from condensation pressure to evaporation pressure
- An evaporator (BPHE, or DX S&T), where the low-pressure liquid refrigerant evaporates to cool the water

The range of chillers called EWFT_B is equipped with hydronic free-cooling system. When the free-cooling mode is active, water flows through dedicated MCH coils before entering inside the evaporator.

All units are fully assembled in the factory and tested before shipping. The EWAT_B / EWFT_B range consists of models with a single refrigerant circuit (from 250 to 370 kW) and models with a double refrigerant circuit (from 180 to 1000 kW).

The machine uses R32 refrigerant fluid suitable for the entire field of application of the machine.

The controller is pre-wired, set up and tested at the factory. Only normal field connections such as piping, electrical connections and pump interlocks are required, simplifying installation and increasing reliability. All safety and operation control systems are installed at the factory in the control panel.

The instructions in this manual are applicable to all models in this series unless otherwise specified.

1.3 Information about the refrigerant

This product contains R32 refrigerant that has a minimal environmental impact, thanks to its low value of Global Warming Potential (GWP). According to ISO 817, R32 refrigerant is classified as A2L, which is slightly flammable, since the flame propagation rate is low, and non-toxic.

R32 refrigerant can burn slowly when all the following conditions are present:

- The concentration is between the lower and upper flammability limit (LFL & UFL)
- T Wind velocity < propagation of flame velocity
- Energy of the ignition source > Minimum ignition energy

But pose no risk under the normal usage conditions for air-conditioning equipment and work environment.

Physical characteristics of R32 refrigerant

Safety class (ISO 817)	A2L
PED Group	1
Practical limit (kg/m³)	0.061
ATEL/ ODL (kg/m³)	0.30
LFL (kg/m³) @ 60 °C	0.307
Vapour density @25 °C, 101.3 kPa (kg/m³)	2.13
Molecular mass	52.0
Boiling point (° C)	-52
GWP (100 yr ITH)	675
GWP (ARS 100 yr ITH)	677
Autoignition temperature (° C)	648

1.4 Usage

EWAT_B units are designed and built for cooling buildings or industrial processes. The first commissioning on the final plant must be carried out by Daikin technicians, specifically trained for this purpose. Failure to follow this start-up procedure affects the warranty of the supply.

The standard guarantee of this equipment covers parts with proven defects in materials or workmanship. Materials subject to natural consumption are not covered by warranty.

1.5 Installation information

The chiller has to be installed in open air or machinery room (location classification III).

To ensure location classification III a mechanical vent on the secondary circuit(s) has to be installed.

Local building codes and safety standards shall be followed; in absence of local codes and standards refer to EN 378-3:2016 as a guide.

In paragraph "Additional guidelines for safe use of R32" there are provided additional information that should be added to the requirements of safety standards and building codes.

Additional guidelines for safe use of R32 for equipment located in the open air

Refrigerating systems sited in the open air shall be positioned to avoid leaked refrigerant flowing into a building or otherwise endangering people and property.

The refrigerant shall not be able to flow into any ventilation fresh air opening, doorway, trap door or similar opening in the event of a leak. Where a shelter is provided for refrigerating equipment sited in the open air it shall have natural or forced ventilation.

For refrigeration systems installed outside in a location where a release of refrigerant can stagnate e.g. below ground, then the installation shall comply with the requirements for gas detection and ventilation of machinery rooms.

Additional guidelines for safe use of R32 for equipment located in a machinery room

When a machinery room is chosen for the location of the refrigerating equipment it shall be located in accordance with local and national regulations. The following requirements (according to EN 378-3:2016) can be used for the assessment.

- A risk analysis based on the safety principle for a refrigeration system (as determined by the manufacturer and including the charge and safety classification of the used refrigerant) should be conducted to determine if it is necessary to install the chiller in a separate refrigeration machinery room.
- Machinery rooms should not be used as occupied spaces. The building owner or user shall ensure that access is permitted only by qualified and trained personnel doing the necessary maintenance to the machinery room or general plant.
- Machinery rooms shall not be used for storage with the exception of tools, spare parts and compressor oil for the installed equipment. Any refrigerants, or flammable or toxic materials shall be stored as required by national regulations.
- Open (naked) flames shall not be permitted in machinery rooms, except for welding, brazing or similar activity and then only provided the refrigerant concentration is monitored and adequate ventilation is ensured. Such open flames shall not be left unattended.
- A remote switching (emergency type) for stopping the refrigerating system shall be provided outside the room (near the door). A similar acting switch shall be located at a suitable location inside the room.
- All piping and ducting passing through floors, ceiling and walls of machinery room shall be sealed.
- Hot surfaces shall not exceed a temperature of 80 % of the auto-ignition temperature (in °C) or 100 K less than the auto-ignition temperature of the refrigerant, whichever is lower.

Refrigerant	Self-ignition temperature	Maximum surface temperature
R32	648 °C	548 °C

- Machinery rooms shall have doors opening outward and sufficient in number to ensure freedom for persons to escape in an emergency; the doors shall be tight fitting, self-closing and so designed that they can be opened from inside (anti-panic system).
- Special machinery rooms where the refrigerant charge is above the practical limit for the volume of the room shall have a door that either opens directly to the outside air or through a dedicated vestibule equipped with self-closing, tight-fitting doors.
- The ventilation of machinery rooms shall be sufficient both for normal operating conditions and emergencies.
- Ventilation for normal operating conditions shall be in accordance with national regulations.
- The emergency mechanical ventilation system shall be activated by a detector(s), located in the machinery room.
 - This ventilation system must be:
 - independent of any other ventilation system on the site
 - provided with two independent emergency controls one located outside the machinery room, and the other inside
 - The emergency exhaust ventilation fan shall:
 - be either in the air flow with the motor outside the airflow, or rated for hazardous areas (according to the assessment)
 - be located to avoid pressurization of the exhaust ductwork in the machinery room
 - not cause sparks to occur if it contacts the duct material.
 - Airflow of the emergency mechanical ventilation shall be at least:

$$V = 0,014 \times m^{2/3}$$

where

V is the air flow rate in m³/s;

m is the mass of refrigerant charge, in kg, in the refrigerating system with the largest charge, any part of which is located in the machinery room;

0.014 It is a conversion factor.

- Mechanical ventilation shall be operated continuously or shall be switched on by the detector.

- Detector shall automatically activate an alarm, start mechanical ventilation and stop the system when it triggers.
- The location of detectors shall be chosen in relation to the refrigerant and they shall be located where the refrigerant from the leak will concentrate.
- The positioning of the detector shall be done with due consideration of local airflow patterns, accounting for location sources of ventilation and louvers. Consideration shall also be given to the possibility of mechanical damage or contamination.
- At least one detector shall be installed in each machinery room or the occupied space being considered and/or at the lowest underground room for refrigerants heavier than air and at the highest point for refrigerants lighter than air.
- Detectors shall be continuously monitored for functioning. In the case of a detector failure, the emergency sequence should be activated as if refrigerant had been detected.
- The pre-set value for the refrigerant detector at 30 °C or 0 °C, whichever is more critical, shall be set to 25 % of the LFL. The detector shall continue to activate at higher concentrations.

Refrigerant	LFL	Threshold level	
R32	0.307 kg/m ³	0.07675 kg/m ³	36000 ppm

- All electrical equipment (not only the refrigerating system) shall be selected to be suitable for use in the zones identified in the risk assessment. Electrical equipment shall be deemed to comply with the requirements if the electrical supply is isolated when the refrigerant concentration reaches 25 % of the lower flammable limit or less.
- Machinery rooms or special machinery rooms shall be **clearly marked** as such on the entrances to the room, together with warning notices indicating that unauthorized persons shall not enter and that smoking, naked light or flames are prohibited. The notices shall also state that, in the event of an emergency, only authorized persons conversant with emergency procedures shall decide whether to enter the machinery room. Additionally, warning notices shall be displayed prohibiting unauthorized operation of the system.
- The owner / operator shall keep an updated logbook of the refrigerating system.



The optional leak detector supplied by DAE with the chiller should be used exclusively to check refrigerant leakage from the chiller itself

1.6 Transport limits

To determine the maximum load supported by the unit, the main acceleration values and the VDI 2700 coefficients have been considered:

Feature	Description
Type of road	Paved public roads (urban, suburban, motorways)
Fund conditions	Dry, standard conditions (not snow/ice)
Type of vehicle	Standard trucks / lorries / industrial vehicles
Typical speed	Around 70-80 km/h on suburban roads or motorways
Manoeuvres considered	Abrupt braking, sudden changes of direction, sharp bends

Direction / Type of manoeuvre	Basic value for road vehicles (VDI BASE LINE)	DAIKIN STANDARD value for on-road vehicles	Comments / special cases / main routes
Forward (frontal acceleration)	0,8 g	2 g	for hard braking; often 1.0 g is also found in stricter regulations or combined
Transverse (lateral)	0,5 g	1,5 g	crosswinds, bends, abrupt changes of direction
Verticale	up to 1.0 g (peaks)	2 g	due to potholes, roughness of the road surface, uphill/downhill; it is less frequently used as a constant base but as a peak value

According to the formula below:

$$a_{tot} = \sqrt{a_{forward}^2 + a_{lateral}^2 + a_{vertical}^2}$$

the maximum acceleration value is:

$$a_{tot} = \mathbf{3,2g}$$

2 RECEIVING THE UNIT

Inspect the unit immediately after delivery. Make sure that the machine is intact in all its parts and that there are no deformations due to impacts. All components described in the delivery note must be inspected and checked. Should any damage occur upon receipt of the machine, do not remove the damaged material and immediately make a written complaint to the transport company, requesting the inspection of the unit; do not repair until inspection by the transport company representative is carried out. Immediately report the damage to the manufacturer representative, a set of photographs is helpful in recognizing responsibility.

The restitution of the machine is intended as ex-factory Daikin Applied Europe S.p.A.

Daikin Applied Europe S.p.A. declines all responsibility for any damage that the machine may suffer during transport to the destination.

Use extreme caution when handling the unit to prevent damage to components.

Before installing the unit, check that the model and power supply voltage shown on the nameplate are correct.

Responsibility for any damage after acceptance of the unit cannot be attributed to the manufacturer.

3 OPERATING LIMITS

3.1 Storage

If it is necessary to store the unit before installation, it is necessary to observe some precautions:

- do not remove the protective plastic.
- protect the unit from dust, bad weather and any rodents.
- do not expose the unit to direct sunlight.
- do not use heat sources and / or open flames near the machine.

Although the unit is covered with a heat-shrink plastic sheet, it is not intended for long-term storage and must be removed and replaced by tarpaulins or the like, more suitable for a longer period.

Environmental conditions must be within the following limits:

- Minimum ambient temperature : -20 °C
- Maximum ambient temperature : +40 °C
- Maximum R.H. : 95% not condensing.

Storage at a temperature below the minimum can cause damage to the components, instead at a temperature above the maximum causes the opening of the safety valves, with consequent loss of refrigerant. Storage in a humid atmosphere may damage electrical components.

3.2 Operation limits

Operation out of the mentioned limits may damage the unit. In case of any doubt contact the manufacturer representative. To ensure correct operation of the unit, the value of the water flow in the evaporator must be within the declared range for that unit. A water flow rate much lower than the nominal value shown at the unit selection point can cause problems with freezing, fouling and poor control. A water flow much higher than the nominal value shown at the unit selection point results in an unacceptable loss of load and excessive erosion and vibration of the tubes which can cause them to break; **refer to the Chiller Selection Software (CSS) for the correct range of each unit.** For units with freecooling option, the freecooling mode can be active only when the ambient air temperature is at least 0÷10 °C lower than the outlet water temperature.

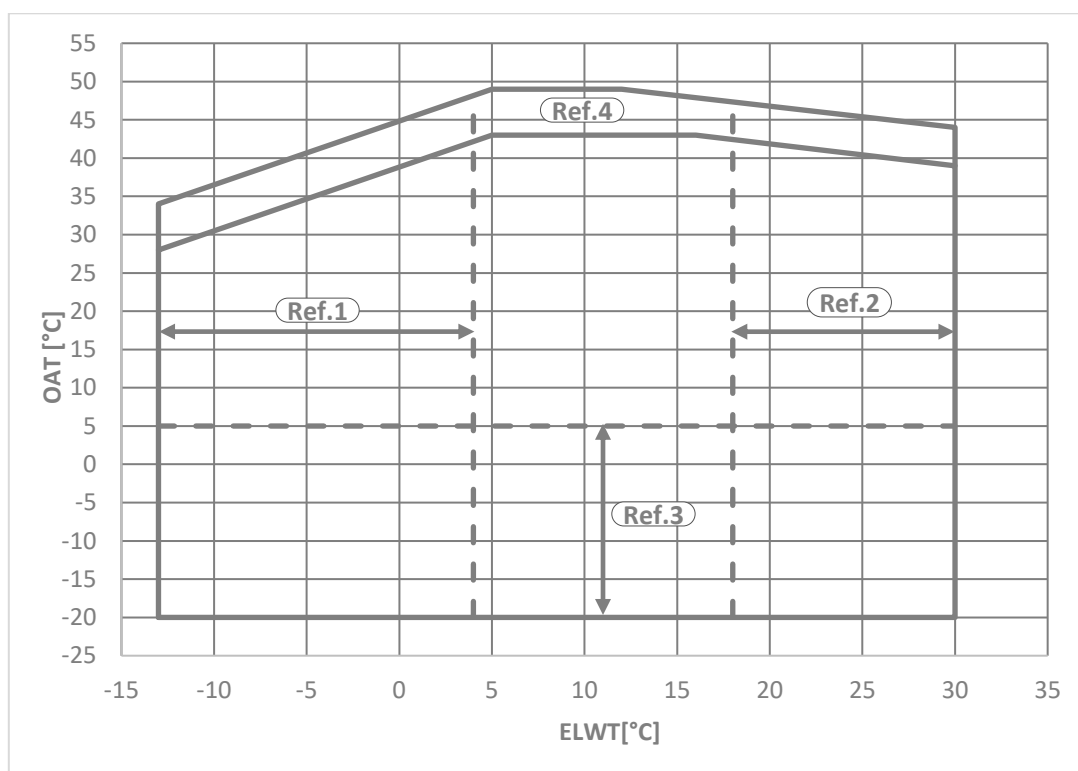


Fig. 4 – EWAT-B-C Silver Operational limits

OAT	Outside ambient air temperature
ELWT	Evaporator leaving water temperature
Ref 1	Operation with ELWT < 4 °C requires option 08 (brine) and glycol
Ref 2	Operation with ELWT > 18 °C requires option 187 (high evaporator leaving water temperature)
Ref 3	Operation at outside ambient air temperature < 5 °C requires option 229 (fan speed modulation) or option 42 (Speedtrol)
Ref 4	Operation requires option 142 (High ambient temperature kit)



The charts shown above constitute a guideline on operating limits in the range.

Refer to the CSS selection software for the actual operating limits in the working conditions for each model.

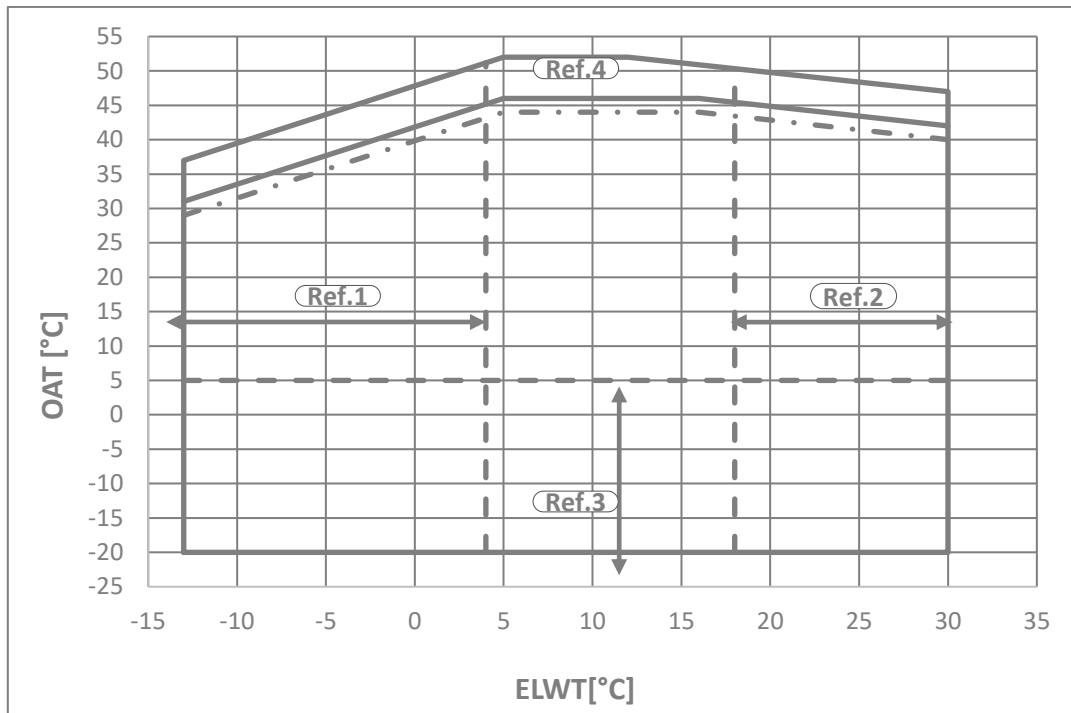


Fig. 5 – EWAT-B-C Gold Operational limits

OAT	Outside ambient air temperature
ELWT	Evaporator leaving water temperature
Ref 1	Operation with ELWT < 4 °C requires option 08 (brine) and glycol
Ref 2	Operation with ELWT > 18 °C requires option 187 (high evaporator leaving water temperature)
Ref 3	Operation at outside ambient air temperature < 5 °C requires option 229 (fan speed modulation) or option 42 (Speedtrol)
Ref 4	Operation requires option 142 (High ambient temperature kit)
- - - - -	Reduced noise unit operation limit



The charts shown above constitute a guideline on operating limits in the range. Refer to the CSS selection software for the actual operating limits in the working conditions for each model.

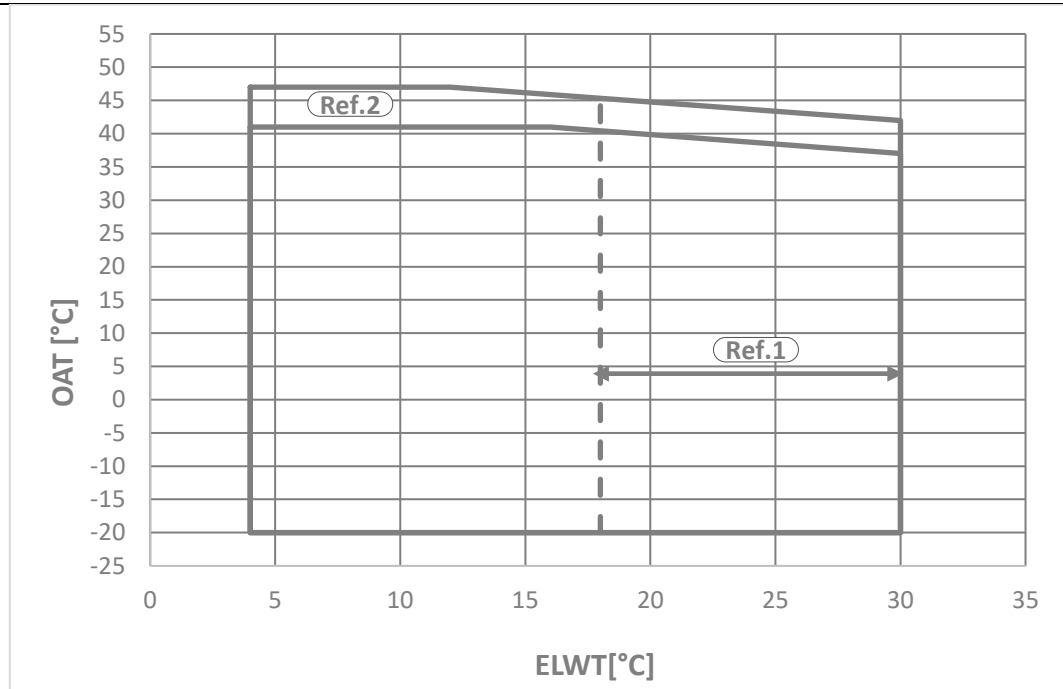


Fig. 6 – EWFT-B-C Silver Operational limits

OAT	Outside ambient air temperature
ELWT	Evaporator leaving water temperature
Ref 1	Operation with ELWT > 18 °C requires option 187 (high evaporator leaving water temperature)
Ref 2	Operation requires option 142 (High ambient temperature kit)



The charts shown above constitute a guideline on operating limits in the range.
Refer to the CSS selection software for the actual operating limits in the working conditions for each model.

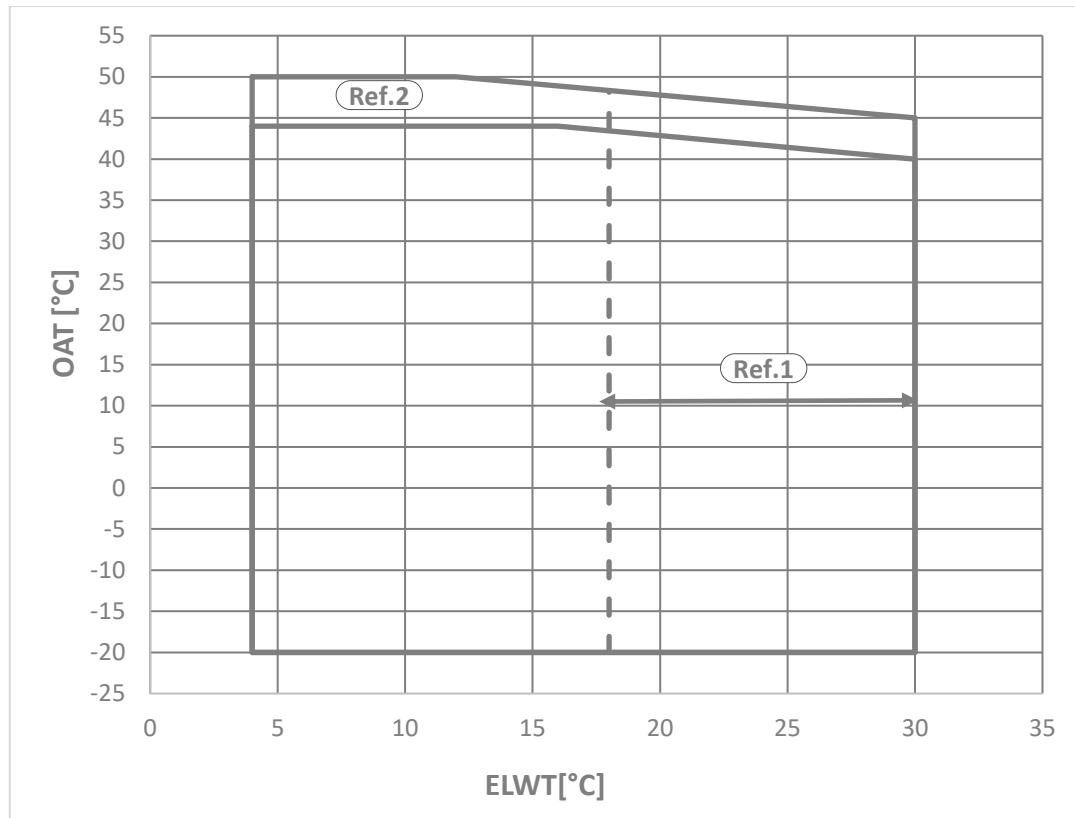


Fig. 7 – EWFT-B-C Gold Operational limits

OAT	Outside ambient air temperature
ELWT	Evaporator leaving water temperature
Ref 1	Operation with ELWT > 18 °C requires option 187 (high evaporator leaving water temperature)
Ref 2	Operation requires option 142 (High ambient temperature kit)



The charts shown above constitute a guideline on operating limits in the range.
Refer to the CSS selection software for the actual operating limits in the working conditions for each model.

Table 1 – Evaporator - Fouling factor

A	B	C	D
0.0176	1.000	1.000	1.000
0.0440	0.978	0.986	0.992
0.0880	0.957	0.974	0.973
0.1320	0.938	0.962	0.975

Legend:

A = Fouling factor ($\text{m}^2 \text{ } ^\circ\text{C} / \text{kW}$)
B = Correction factor of the cooling capacity
C = Correction factor of the absorbed power
D = EER correction factor

Table 2 – Air heat exchanger - Altitude correction factor

A	0	300	600	900	1200	1500	1800
B	1013	977	942	908	875	843	812
C	1.000	0.993	0.986	0.979	0.973	0.967	0.960
D	1.000	1.005	1.009	1.015	1.021	1.026	1.031

Legend:

A = Altitude above sea level (m)

B = Barometric pressure (mbar)

C = Correction factor of the cooling capacity

D = Correction factor of the absorbed power

- The maximum operating altitude is 2000 m above sea level.

- Contact the factory if the unit is to be installed at altitudes between 1000 and 2000 m above sea level.

Table 3 – Minimum percentage of glycol for the low air ambient temperature

	AAT(2)	-3	-8	-15	-20
A(1)		10%	20%	30%	40%
	AAT(2)	-3	-7	-12	-20
B(1)		10%	20%	30%	40%

Legend:**AAT** = Ambient air temperature (°C) (2)**A** = Ethylene glycol (%) (1)**B** = Propylene glycol (%) (1)**(1)** Minimum percentage of glycol to prevent freezing of the water circuit at the indicated ambient air temperature**(2)** Ambient air temperature that exceeds the operating limits of the unit.

Protection of the water circuit is necessary in the winter season, even with the unit not in operation.

4 MECHANICAL INSTALLATION

4.1 Safety

The unit must be firmly secured to the soil.

It is essential to observe the following instructions:

- The unit can only be lifted using the lifting points marked in red fixed to its base.
- It is forbidden to access the electrical components without having opened the unit main switch and switched off the power supply.
- It is forbidden to access the electrical components without using an insulating platform. Do not access the electrical components if water and/or moisture are present.
- Sharp edges and the surface of the condenser section could cause injury. Avoid direct contact and use adequate protection device
- Switch off power supply, by opening the main switch, before servicing the cooling fans and/or compressors. Failure to observe this rule could result in serious personal injury.
- Do not introduce solid objects into the water pipes while the unit is connected to the system.
- A mechanical filter must be installed on the water pipe connected to the heat exchanger inlet.
- The unit is supplied with safety valves, that are installed both on the high-pressure and on the low-pressure sides of the refrigerant circuit.

It is absolutely forbidden to remove all protections of moving parts.

In case of sudden stop of the unit, follow the instructions on the **Control Panel Operating Manual** which is part of the onboard documentation delivered to the end user.

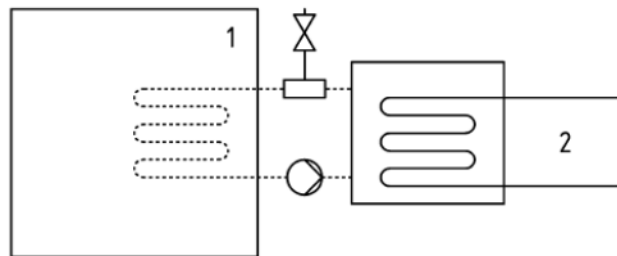
- It is strongly recommended to perform installation and maintenance with other people.



Avoid installing the chiller in areas that could be dangerous during maintenance operations, such as platforms without parapets or railings or areas not complying with the clearance requirements around the chiller

DAE units can be installed without charge restrictions into machinery rooms or in open air (location class.III).

According to EN 378-1, a mechanical vent on the secondary circuit(s) has to be installed: to ensure location classification III the system shall be classified as an "indirect vented closed system".



Indirect vented closed system

Key

- 1) Occupied Space
- 2) Refrigerant containing part(s)

Machinery rooms shall not be considered occupied space (except as defined in part 3, 5.1: machinery room used as a maintenance workspace shall be considered occupied spaces under access category c).

All precautions concerning handling of refrigerant must be observed in accordance with local regulations.

4.1.1 Safety devices

In accordance with the Pressure Equipment Directive the following protection devices are used:

- High pressure switch → safety accessory.
- External relief valve (refrigerant side) → over pressure protection.
- External relief valve (heat transfer fluid side) → **The selection of these relief valves must be made by the personnel responsible for completing the hydraulic circuit(s).**

All factory-installed relief valves are lead-sealed to prevent any calibration change.

If the relief valves are installed on a changeover valve, this is equipped with a relief valve on both outlets. Only one of the two relief valves is operating, the other one is isolated. Never leave the changeover valve in the intermediate position.

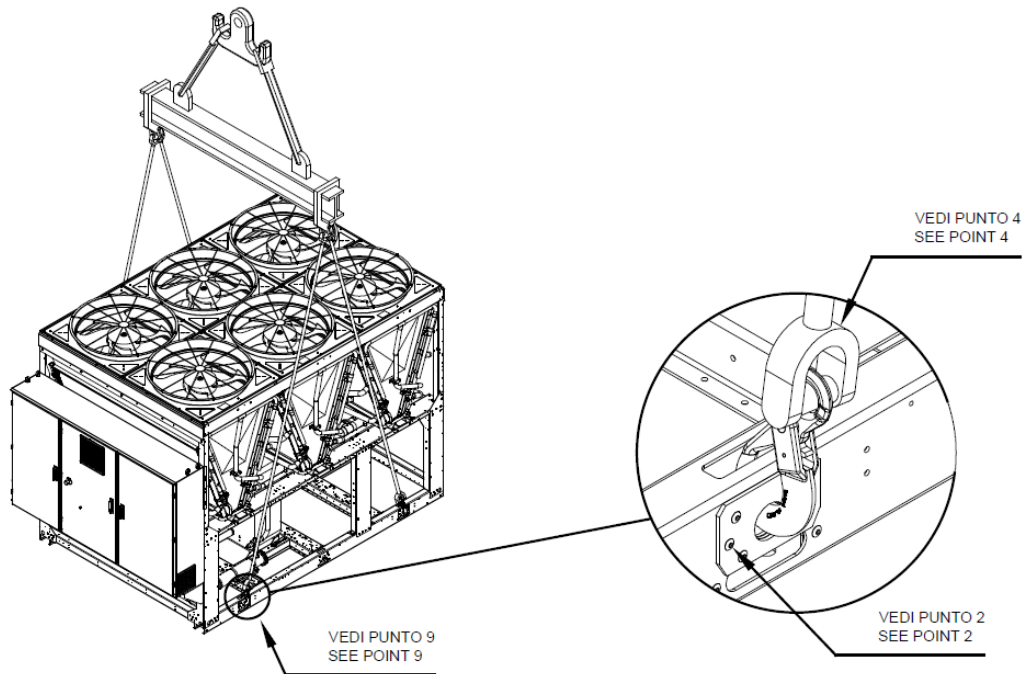
If a relief valve is removed for checking or replacement please ensure that there is always an active relief valve on each of the changeover valves installed in the unit.

4.2 Handling and lifting

Avoid bumping and/or jolting during loading/unloading unit from the truck and moving it. Do not push or pull the unit from any part other than the base frame. Secure the unit inside the truck to prevent it from moving and causing damages. Do not allow any part of the unit to fall during transportation or loading/unloading. All units of the series are supplied with lifting points marked in red. Only these points may be used for lifting the unit, as shown in the following figure.

Use spacing bars to prevent damage to the condensation bank. Position these above the fan grills at a distance of at least 2.5 meters.

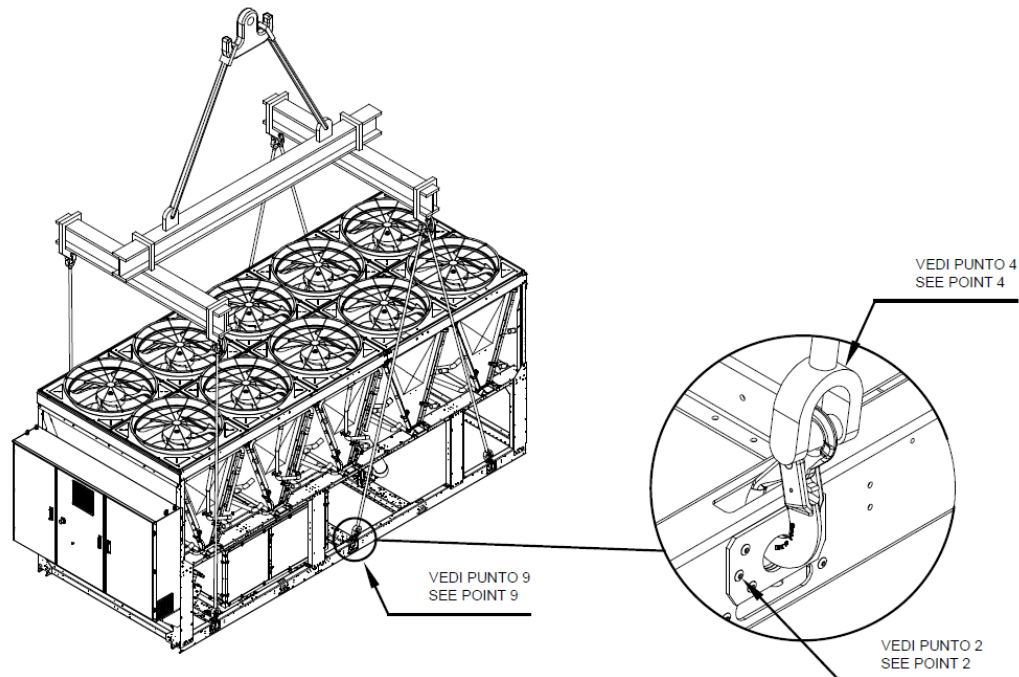
During the handling of the machine, it is mandatory to provide all the devices necessary to guarantee personal safety.



Unit with 4 lifting points

The drawing shows only the 6 fans version.

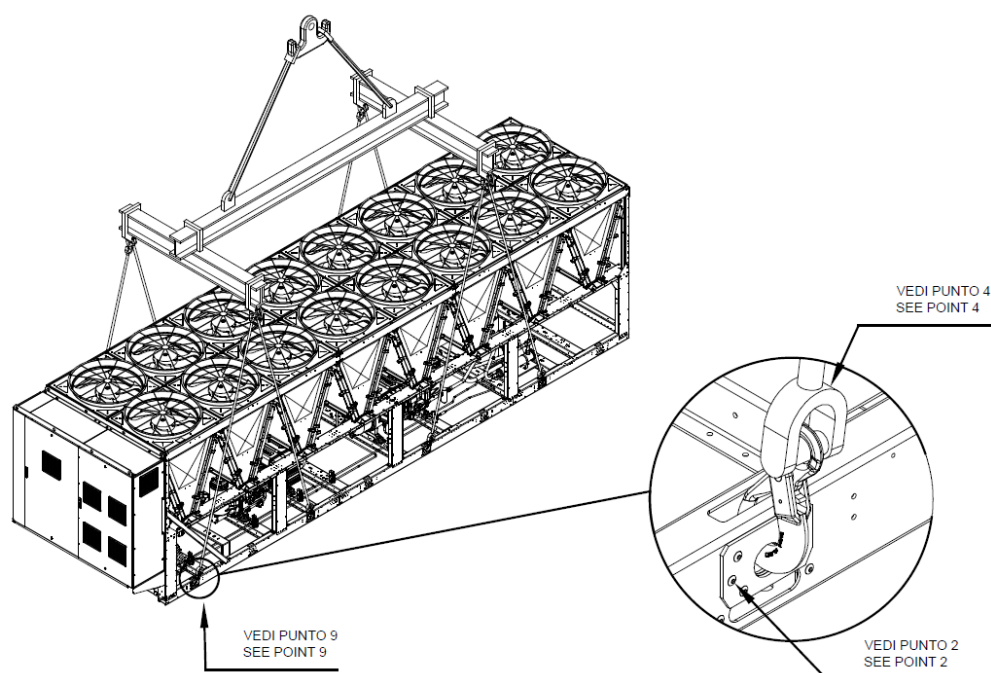
The lifting mode is the same regardless of the number of fans



Unit with 6 lifting points

The drawing shows only the 10 fans version.

The lifting mode is the same regardless of the number of fans.



Unit with 8 lifting points

The drawing shows only the 16 fans version.

The lifting mode is the same regardless of the number of fans.

Fig. 8 – Lifting instructions



Consult the dimensional drawing for the hydraulic and electrical connection of the units.

The overall dimensions of the machine, as well as the weights described in this manual, are purely indicative.

The contractual dimensional drawing and the related electrical scheme are delivered to the customer when ordering.

The equipment, ropes, lifting accessories and handling procedures must comply with local regulations and current regulations.

Use only lifting hooks with locking device that meet the following hook characteristics. The hooks must be securely fixed before handling.

The lifting ropes, hooks and spacing bars must be strong enough to support the unit safely. Please check the unit weight on the unit nameplate.

The installer has the responsibility to ensure the selection and correct use of the lifting equipment. However, it is advisable to use ropes with a minimum vertical capacity equal to the total weight of the machine.

The machine must be lifted with the utmost attention and care following lifting label instructions; lift the unit very slowly, keeping it perfectly level.

4.2.1 Safety hook

The characteristics of the hook to be used for lifting the units are as follows (a hook with the same characteristics can also be used).

Code / Type	Load Capacity [kg]	e [mm]	h [mm]	a [mm]	b [mm]	d1 [mm]	d2 [mm]	g [mm]	s max. [mm]	weght [kg/pc]
LHW 10	4000	168	30	29	107	33	16	45	1	1.57

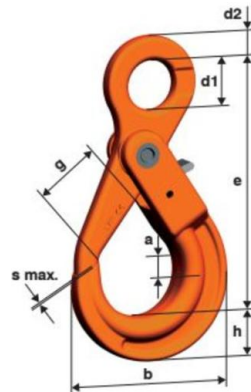


Fig. 9 – Lifting hook characteristics

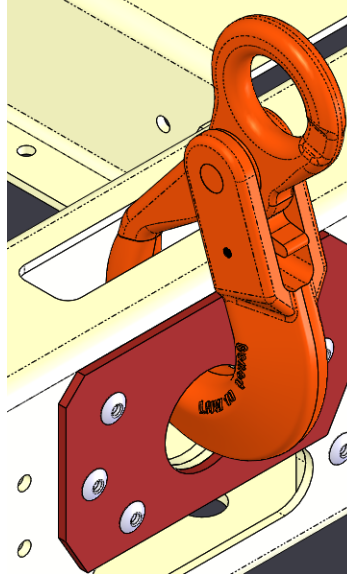


Fig. 10 – Lifting hook installation

4.2.2 Lifting shackles

In the absence of a suitable lifting hook, lifting shackles can be used.

WLL	Size	Dimençons										weght	
Load Capacity [t]	Inches	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]	f [mm]	g [mm]	G 4151 h [mm]	G 4153 h [mm]	j [mm]	G4151 [kg]	G4153 [kg]
8.5	1	25	28	59	25	43	85	154	137	150	25	2.08	2.46

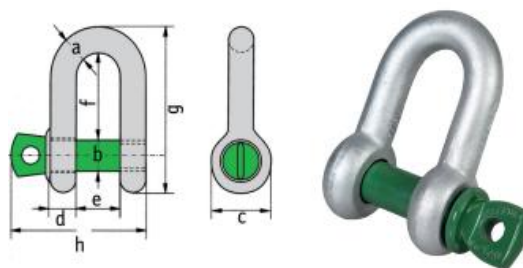


Fig. 11 – Lifting shackles characteristics

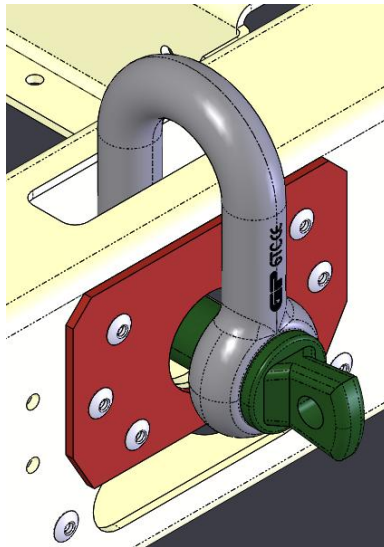


Fig. 12 – Lifting shackles installation

4.2.3 OPT.71 Container Kit

While lifting the unit, the optional plates (OPT 71) must be removed to guarantee the correct installation on the basement (see figure below).

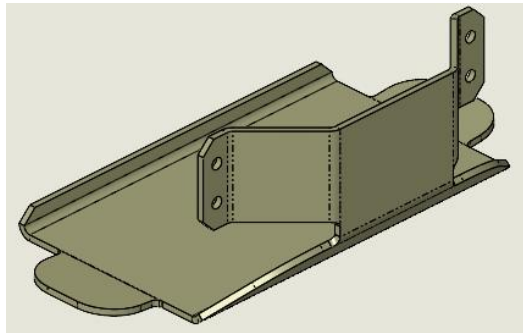


Fig. 13 –OPT 71 Plates

To remove the plates, unscrew the 4 M8 bolts used to connect the plate to the unit frame (see figure below). Repeat this operation on each connection plate.

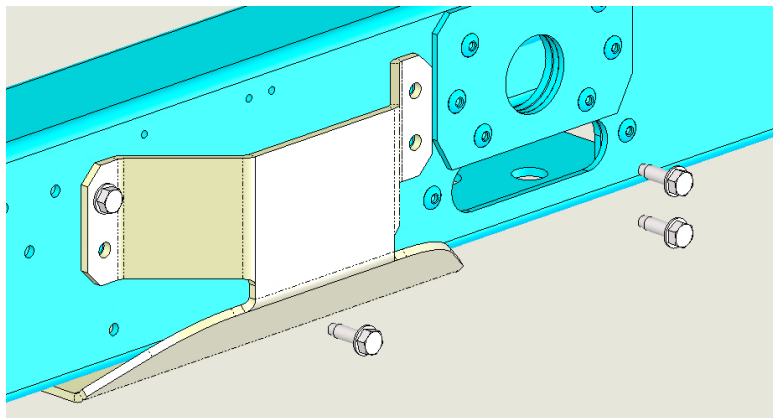


Fig. 14 – M8 bolts for plate-unit frame connection

4.3 Positioning and assembly

All units are designed for installation outdoors, i.e. on balconies or on the ground, provided that the installation area is free of obstacles that could reduce air flow to the condensers coil.

The unit must be installed on a robust and perfectly level foundation; should the unit be installed on balconies or roofs, it might be necessary to use weight distribution beams.

For installation on the ground, a strong concrete base, at least 250 mm thickness and wider than the unit must be provided. This base must be able to support the weight of the unit.

The unit must be installed above antivibration mounts (AVM), rubber or spring types. The unit frame must be perfectly levelled above the AVM.

Installation such as in the figure 3 must always be avoided. In case the AVM are not adjustable the flatness of the unit frame must be guaranteed by using metal plate spacers.

Before unit commissioning, the flatness must be verified by using a laser levelling device or other similar devices. The flatness shall not be over 5 mm for units within 7 m length and 10 mm for units over 7 m.

If the unit is installed in places that are easily accessible to people and animals, protection grids for the unit shall be installed.

To ensure best performance on the installation site, the following precautions and instructions must be followed:

- avoid air flow recirculation;
- make sure that there are no obstacles to hamper air flow;
- make sure to provide a strong and solid foundation to reduce noise and vibrations;
- avoid installation in particularly dusty environments, in order to reduce soiling of condensers coils;
- the water in the system must be particularly clean and all traces of oil and rust must be removed. A mechanical water filter must be installed on the unit inlet piping;
- avoid the refrigerant discharge from the safety valves at the installation site. If necessary, it is possible to connect them with exhaust pipes whose cross-section and length must comply with national laws and European directives.

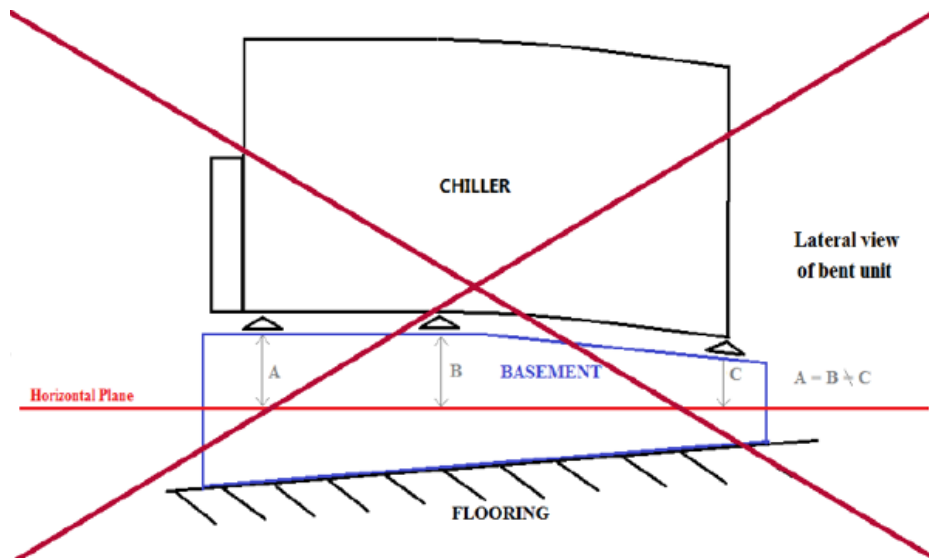


Fig. 15 – Unit levelling

4.4 Minimum space requirements

It is fundamental to respect minimum distances on all units to ensure optimum ventilation to the condenser coils.

When deciding where to position the unit and to ensure a proper air flow, the following factors must be taken into consideration:

- avoid any warm air recirculation
- avoid insufficient air supply to the air-cooled condenser

Both these conditions can cause an increase of condensing pressure, which leads to a reduction in energy efficiency and refrigerating capacity.

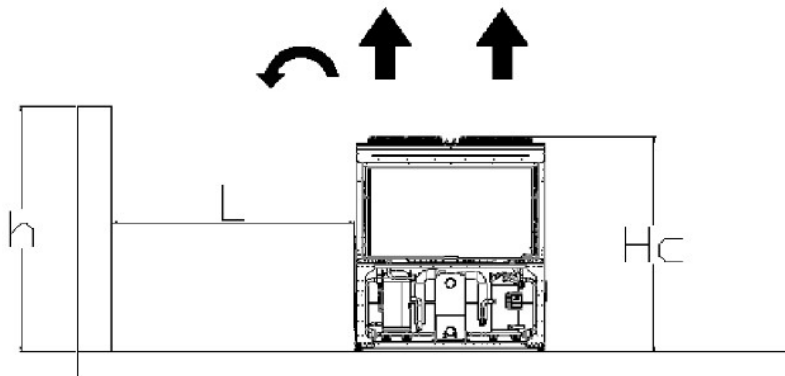
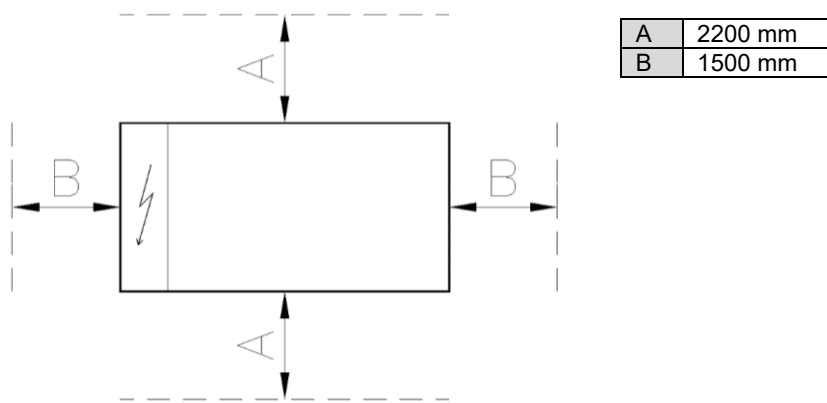
Any side of the unit must be accessible for post-installation maintenance operations. Figure below shows the minimum space required.

Vertical air discharge must not be obstructed for at least 5000mm.

In case of two chillers installed in free field, minimum recommended distance between them is 3600 mm; in case of two chillers in a row, minimum distance is 1500 mm. The pictures below show examples of recommended installations.

Should the unit be installed without observing the recommended minimum distances from walls and/or vertical obstacles, there could be a combination of warm air recirculation and/or insufficient supply to the air-cooled condenser which could cause a reduction of capacity and efficiency.

In any case, the microprocessor will allow the unit to adapt itself to new operating conditions and deliver the maximum available capacity under any given circumstances, even if the lateral distance is lower than recommended, unless the operating conditions should affect personnel safety or unit reliability.



If $h < H_c \rightarrow L \geq 3,0$ m (multi V) / $L \geq 1,8$ m (single V); if $h > H_c$ or L is lower than recommended contact your Daikin distributor to evaluate the various possible arrangements.

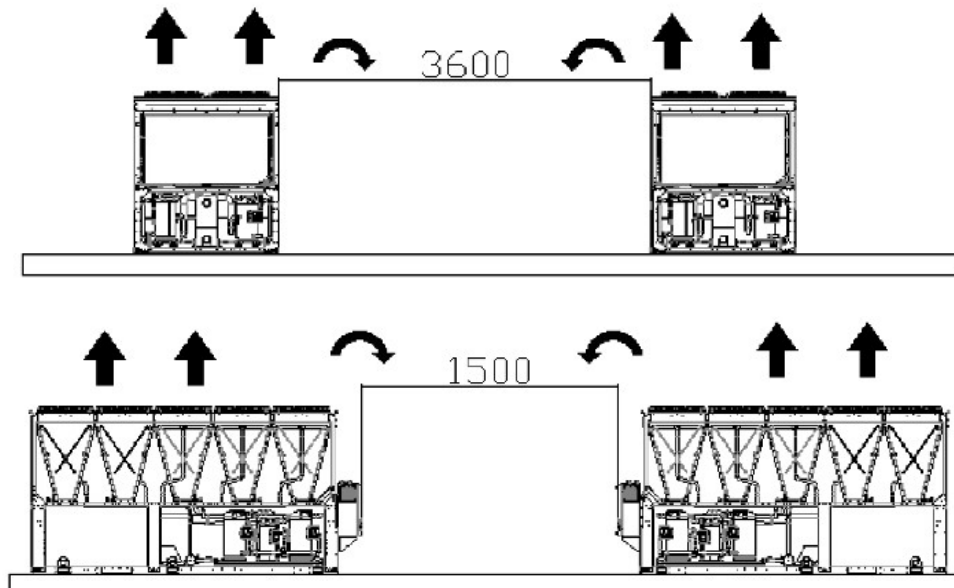


Fig. 16 – Minimum space requirements

The minimum distances, reported above, ensure functionality of the chiller in most applications. However, there are specific situations which include multiple chiller installation; in this case the following recommendations are to be followed:

Multiple chillers installed side by side in a free field with dominant wind

Considering an installation in areas with a dominant wind from a specific direction (as shown in the following fig.):

- Chiller N°1: is performing normally without any ambient over-temperature.
- Chiller N°2: is working in a warmed ambient. The chiller is working with air recirculating from Chiller 1 and recirculation from itself.
- Chiller N° 3: is working in an over-temperature ambient due to the recirculating air from the other two chillers.

To avoid the hot air recirculation due to dominant winds, the installation where all chillers are aligned to the dominant wind is preferred (see figure below).

Multiple chillers installed side by side in a compound

In case of compounds with walls of the same height of the chillers or higher, the installation is not recommended. Chiller 2 and chiller 3 work with sensible higher temperature due to the enhanced recirculation. In this case special precautions must be considered according to the specific installation (e.g.: louvered walls, install the unit on base frame in order to increase the height, ducts on the discharge of the fans, high lift fans, etc).

All the above cases are even more sensitive in case of design conditions close to the limits of the unit operating envelope.

NOTE: Daikin cannot be considered responsible in case of malfunctions generated by hot air recirculation or insufficient airflow as result of improper installation if the above recommendations are ignored.

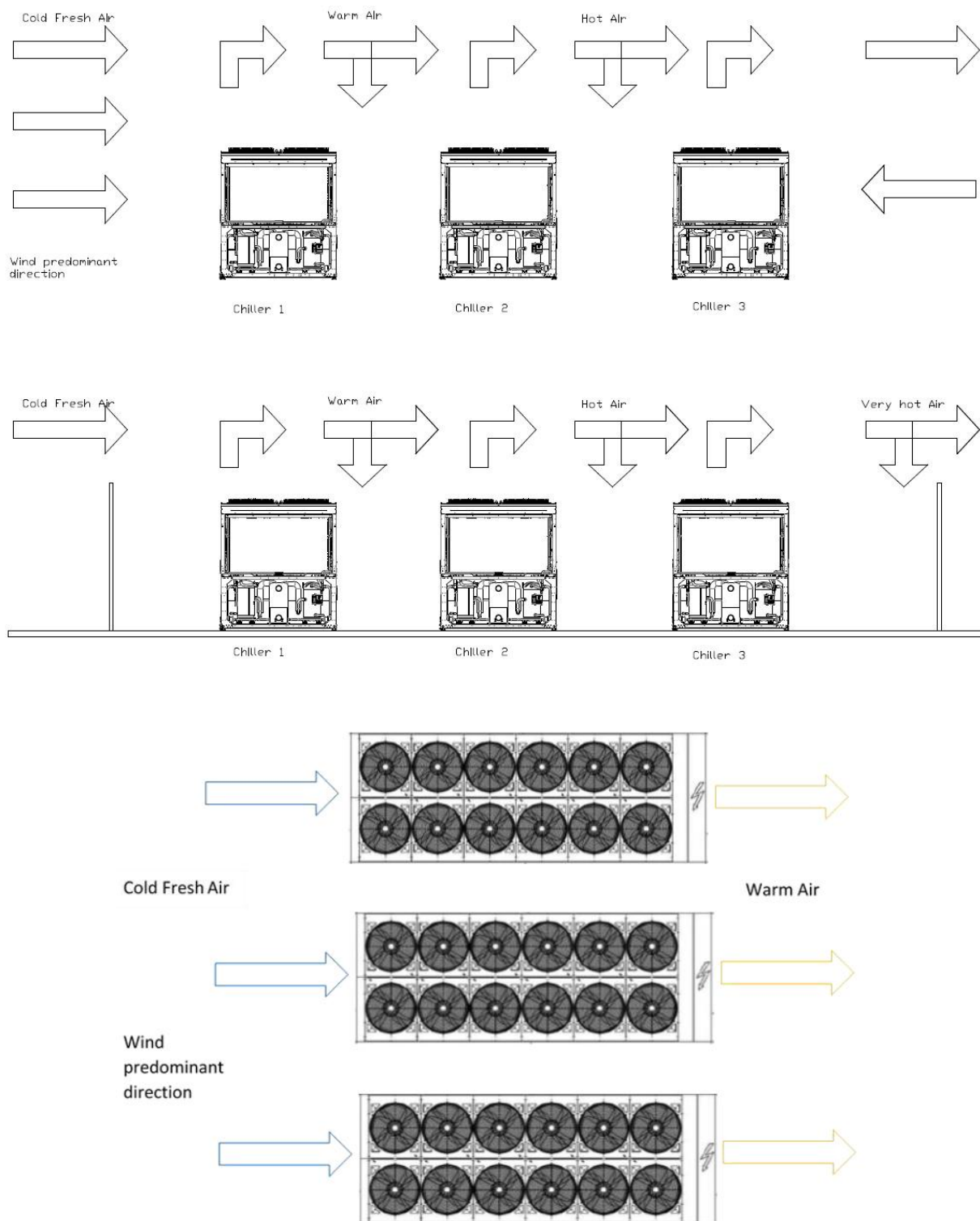


Fig. 17 – Multiple Chiller Installation

4.5 Installation of hydronic free-cooling piping shipped loose

EWFT-B-C free cooling units, particularly those with 4 and 6 fans, may have part of the hydronic circuit piping outside the unit footprint (see Fig.12). The piping outside the unit footprint is disassembled after production test and shipped loose (pre-assembled for quick installation) to avoid possible piping breakage and problems during transport of the unit. All components shipped separately must be assembled on site by the installer in accordance with the instructions below.

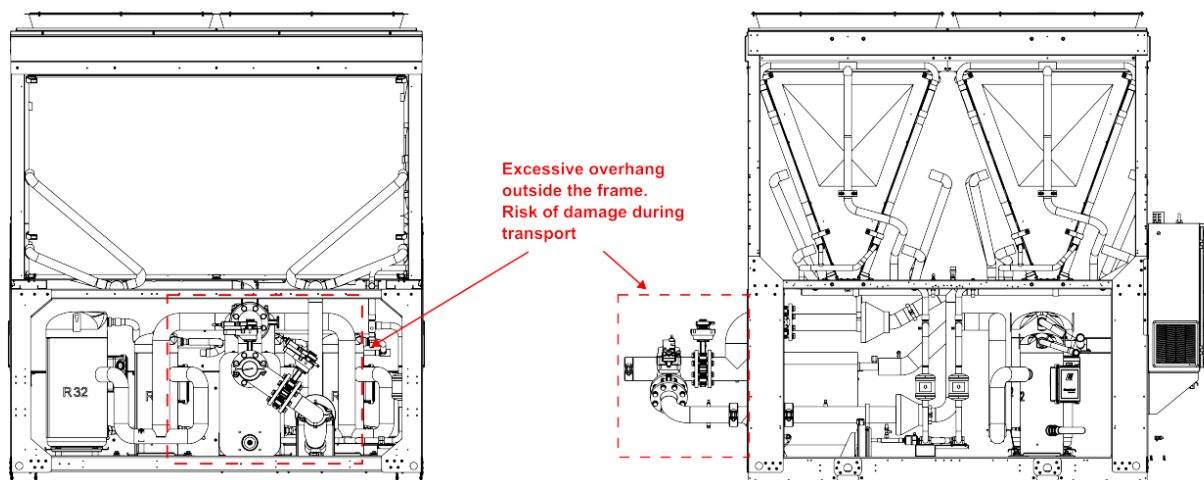


Fig. 18 – Piping outside the footprint of free-cooling units.

4.5.1 Pipe installation details and instructions

In the cases specified above, a list of the components shipped with the unit is given (see Fig. 13):

- Water inlet connection pipe.
- Automatic check valve #1 with motor protection.
- T connection between BPHE (point **b**) and manual check valve **d**.
- Automatic check valve #2 with motor protection.
- Connection pipe from check valve #2 to water filter (point **a**).

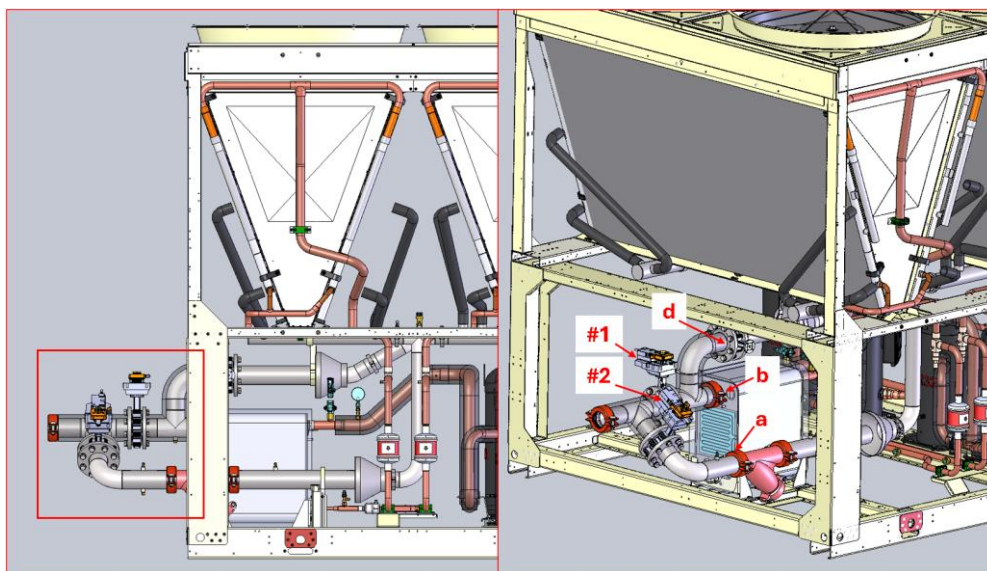


Fig. 19 – Details of the piping installation.



Hydronic circuit of free-cooling units are pressurized with dry air at 2 bar before shipment and may be still pressurized when the unit arrives on site. Please beware and make sure to depressurize the free-cooling circuit before starting the installation procedure.

All of the above parts are pre-assembled and shipped separately from the unit. To install the shipped loose parts the installer must:

- Relieve the pressure inside the free-cooling section using venting valve of the MCH coils.
- Remove caps where present.
- Install the assembly by connecting it to the unit at points **a** (Victaulic connection to water filter), **b** (Victaulic connection to BPHE) and to the check valve flange **d**.

4.6 Noise and sound protection

The unit is a source of noise mainly due to rotation of compressors and fans.

The noise level for each model size is listed in sales documentation.

If the unit is correctly installed, operated and maintained, the noise emission level does not require any special protection device to operate continuously close to the unit without any risk.

In cases where the installation is subject to compliance with special sound requirements, it may be necessary to use additional noise attenuation devices, it is necessary to isolate the unit from its base with extreme care, correctly applying the anti-vibration elements (supplied as optional). Flexible joints must be installed on the water connections, as well.

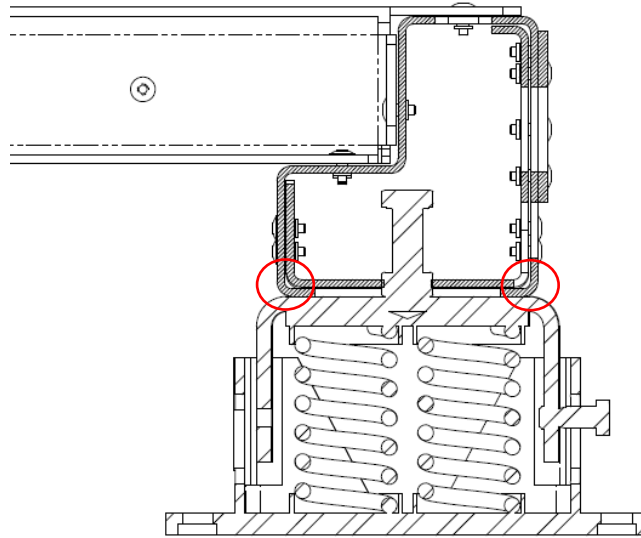


Fig. 20 – Mounting anti-vibration elements (supplied as optional)



In case of anti-vibration elements provided by a different supplier, the load of the chiller on the anti-vibration element must be discharged on the external part of the frame and not on the internal plate (see picture above).

4.6.1 Installation of anti-vibration dampers

The anti-vibration mounts must be fitted to the unit in accordance with the following instructions:

1. Insert the M16 bolt and nut into the central hole of the frame at the lifting point (Fig. 19).

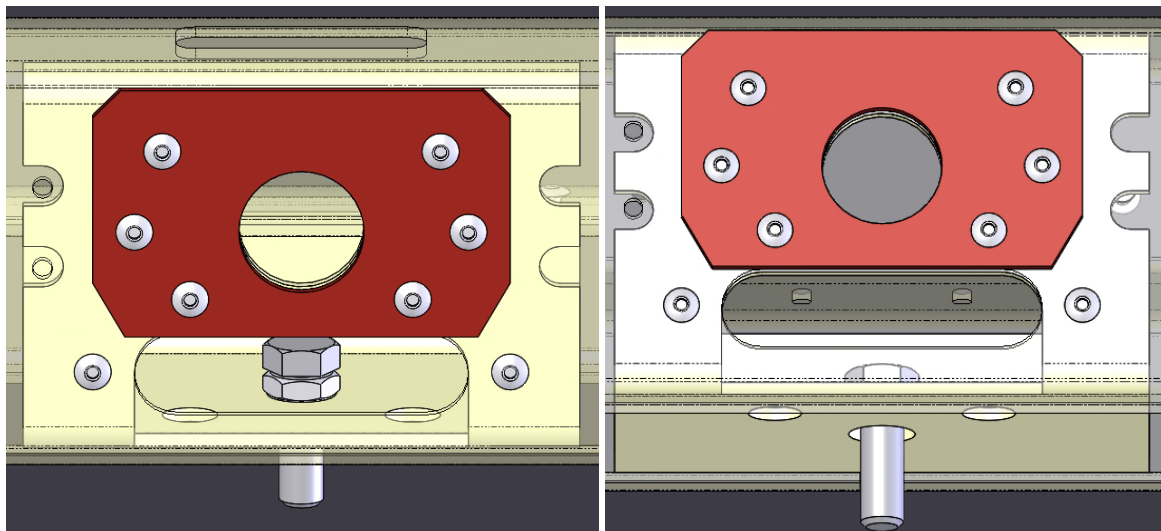


Fig. 21 – Detail of anti-vibration damper fixing screw

2. Fix the damper with the screw: hold the screw and turn the damper anticlockwise.

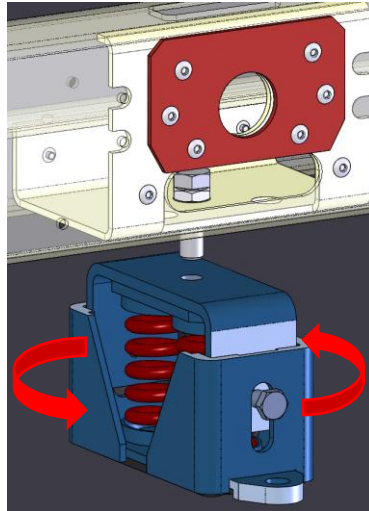


Fig. 22 – Detail of the anti-vibration damper installation.

3. Adjustment: Finish tightening the vibration damper with the nut.

For both single and double spring dumpers, the final position of the anti-vibration damper must be perpendicular to the frame (as shown below).

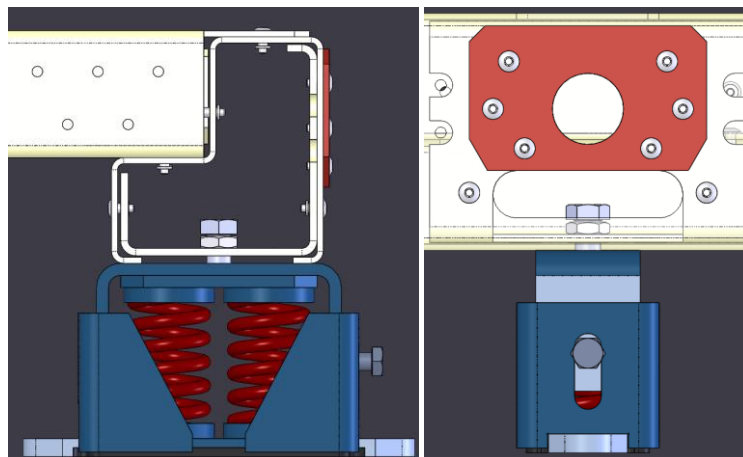


Fig. 23 – Final position of anti-vibration damper.



Anti-vibration dampers shall be fixed to the floor in accordance with the installation requirements.

4.7 Water circuit for the connection of the unit

4.7.1 Water piping

Piping must be designed with the lowest number of elbows and the lowest number of vertical changes of direction. In this way, installation costs are reduced considerably, and system performance is improved.

The water system must have:

1. Anti-vibration mountings to reduce transmission of vibrations to the structures.
2. Isolating valves to isolate the unit from the water system during maintenance.
3. To protect the chiller, the evaporator/evaporators must be protected against freezing by continuous monitoring of the water flow in the evaporator/evaporators by a flow switch. In most cases, on site, the flow switch is set to generate an alarm only when the water pump turns off and the water flow drops to zero. It is recommended to adjust the flow switch to produce a "Water Leakage Alarm" when the water flow reaches 50% of the nominal value; in this case the evaporator/evaporators is/are protected against freezing and the flow switch can detect the clogging of the water filter.
4. Manual or automatic air venting device at the system highest point and drain device at the system lowest point.
5. Neither the evaporator nor the heat recovery device must be positioned at the system's highest point.
6. A suitable device that can maintain the water system under pressure (expansion tank, etc.).
7. Water temperature and pressure indicators to assist the operator during service and maintenance.
8. A filter or device that can remove particles from the fluid. The use of a filter extends the life of the evaporator and pump and helps to keep the water system in a better condition. **The water filter must be installed as close as possible to the chiller.** If the water filter is installed in another part of the water system, the Installer must guarantee the cleaning

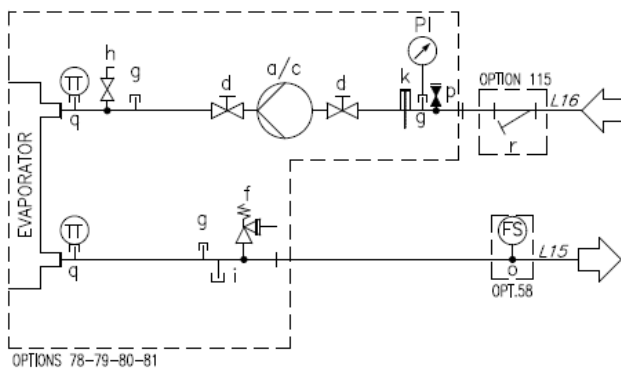
of the water pipes between the water filter and the evaporator. If the unit is provided with hydronic freecooling system, an **additional** filter is installed by factory on the water pipe before the MCH coils to prevent clogging, however a water filter at the head of the circuit is always mandatory.

Recommended maximum opening for strainer mesh is:

- 1.0 mm (BPHE)
- 0.87 mm (DX S&T)
- 1.2 mm (Flooded)

- Evaporator with an electrical heater controlled by the unit logic that ensures protection against water freezing at water temperatures lower than antifreeze setpoint.
All the other water piping/devices outside the unit must therefore be protected against freezing.
- The heat recovery device must be emptied of water during the winter season, unless an ethylene glycol mixture in appropriate percentage is added to the water circuit.
- If case of unit substitution, the entire water system must be emptied and cleaned before the new unit is installed. Regular tests and proper chemical treatment of water are recommended before starting up the new unit.
- If glycol is added to the water system as anti-freeze protection, pay attention to the fact that suction pressure will be lower, the unit performance will be lower and water pressure drops will be greater. All unit-protection systems, such as anti-freeze, and low-pressure protection will have to be readjusted.
- Before insulating water piping, check that there are no leaks. The complete hydraulic circuit must be insulated to prevent condensation and reduced refrigeration capacity. Protect the water pipes from frost during winter (using for example a glycol solution or a heating cable).
- Check that the water pressure does not exceed the design pressure of the water side heat exchangers. Install a safety valve on the water pipe downstream of the evaporator.
- (max. operating pressure 10 bar)

SINGLE / TWIN PUMP



SINGLE / TWIN PUMP + TANK

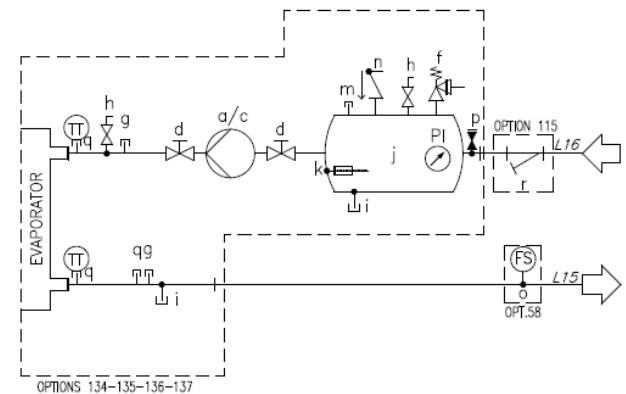


Fig. 24 – Hydraulic diagram (opt. 78-79-80-81/134-135-136-137)

Legend

a	Single Pump	n	Check valve
c	Twin pump	m	Plugged fitting
d	Valve	o	Flow switch fitting ½ "G or 1"G
e	Check Valve	p	Automatic filling valve fitting
f	Safety Valve	q	Plugged fitting
g	Plugged fitting	r	Water filter
h	Air vent	TT	Temperature sensor
i	drain	PI	Pressure gauge
j	Tank	FS	Flowswitch
k	Electrical heater		

4.7.2 Installing the flow switch



The flow switch shall be installed by qualified personnel only and according to local regulations and good engineering practices.

Correct installation of the flow switch is essential to ensure safe and reliable operation of the unit. It is required to:

- Protect the heat exchanger against freezing and overheating conditions;
- Prevent compressor operation in the absence of water circulation;
- Ensure proper unit control logic and effective alarm management;
- Guarantee stable and reliable unit operation under all operating conditions.

Incorrect installation may result in:

- Nuisance alarms;
- Unstable unit operation;
- Delayed flow detection;
- Failure of the safety function.

The flow switch can be installed either on the inlet or outlet water piping, Installation in the outlet water piping is recommended.

The manufacturer offers, as optional, a flow switch that has been selected for this purpose.

This paddle-type flow switch is suitable for heavy-duty outdoor applications (IP67) and pipe diameters in the range of 1" to 8".

The flow switch is supplied with a clean contact that must be electrically connected to the terminals shown in the wiring diagram.

4.7.2.1 Flow Switch mechanical installation procedure

Installation Position

Install the flow switch on a straight pipe section of the water line. To ensure correct operation:

- install the device with the arrow on the body aligned with the water flow direction;
- install the switch on the top side of the pipe whenever possible;
- For optimum flow switch performance, a straight pipe length of at least $10 \times DN$, (or the minimum distance specified in the flow switch manufacturer's documentation) is recommended upstream and downstream of elbows, valves, reducers, pumps, or other hydraulic disturbances. Where these installation requirements cannot be met, consult the unit manufacturer to assess the suitability of the installation and verify correct flow switch operation under the specific application conditions.
- ensure that the paddle can move freely inside the pipe without touching the pipe wall or any internal obstruction.
- For vertical pipe installation, upward flow direction is recommended.

Before installation, verify the correct paddle configuration according to the unit model, pipe size and minimum water flow rate. The required number of paddles and the corresponding paddle size shall be determined according to the flow switch manufacturer's data sheet, using the hydraulic data provided in the table below..

The flow switch must be set up to intervene when the water flow of the BPHE reaches the minimum value of the flow acceptable (see the table below..).

Table 4 – Acceptable water flow limits

BPHE Model	Pipe Diameter DN (inch)	Minimum evap. water flow (l/s)
ACK240EQ AH 170 MONO	DN80 (3")	5.6
ACK240EQ AH 202 MONO	DN80 (3")	6
ACK240DQ AH 102 DUAL	DN80 (3")	4.1
ACK240DQ AH 146 DUAL	DN80 (3")	5.2
ACK240DQ AH 202 DUAL	DN80 (3")	6
ACK240DQ AH 262 DUAL	DN80 (3")	6.5
ACK540DQ AH 210 DUAL	DN125 (5")	16.2
ACK540DQ AH 270 DUAL	DN125 (5")	20
ACK540DQ AH 318 DUAL	DN125 (5")	22.6
DX S&T Model	Pipe Diameter DN (inch)	Minimum evap. water flow (l/s)
EV.U.50190099/09.D R32	DN200 (8")	13.4
EV.U.50191212/07.D R32		
EV.U.50191212/07.D R32		
EV.U.50191212/07.D R32		

If multiple paddles are used, install the smaller paddles behind the largest paddle to increase stiffness and improve stability during operation.

Thread Preparation

Before installing the flow switch:

1. Clean the threaded connection and remove dirt, oil or metal particles.
2. Apply PTFE tape (Teflon tape) on the male thread only. Use enough PTFE tape to cover the entire thread and prevent water leaks.
3. Apply the tape in the tightening direction.

Flow Switch Installation

1. Verify that the hydraulic circuit is depressurized and empty in the installation area.
2. Insert the paddle assembly into the pipe branch carefully to avoid bending or damaging the paddle.
3. Thread the male fitting into the female connection until hand-tight engagement is achieved. At this stage, the joint should already be partially sealed, with no leakage or only minimal leakage.
4. Using an appropriate wrench, tighten the fitting by an additional 1.5 to a maximum of 3 turns beyond the hand-tight position, until the flow direction arrow is correctly aligned with the direction of fluid flow.
5. After installation, adjust the flow switch setpoint using the adjustment screw so that switch actuation occurs at the minimum water flow rate specified for the unit in Table 4.

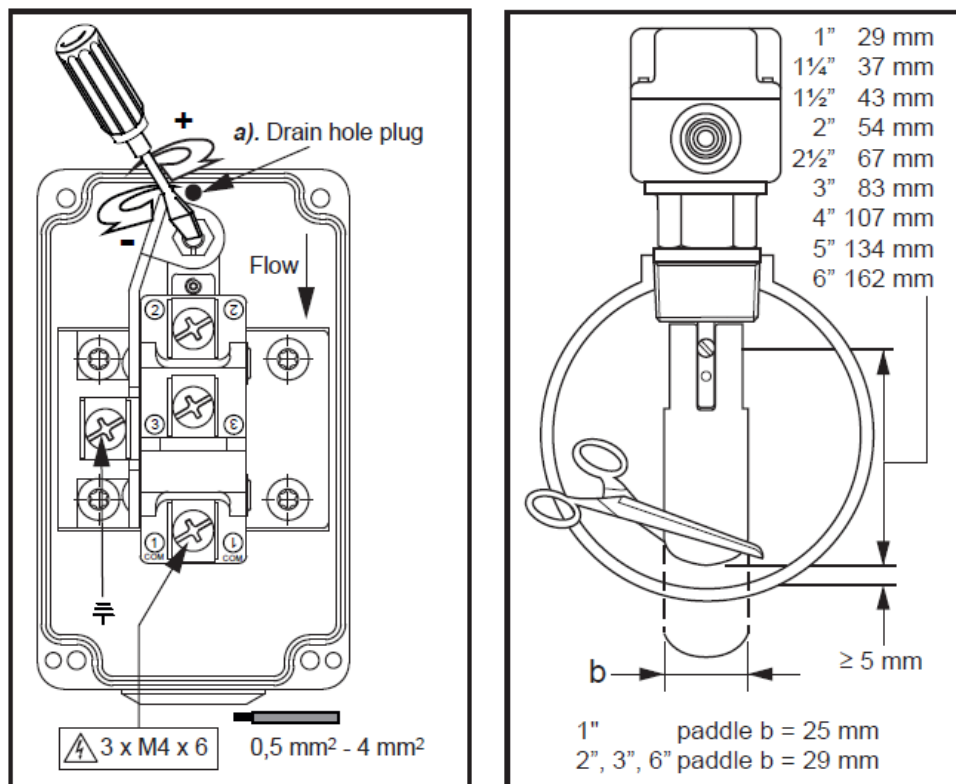


Fig. 25 – Flow switch adjustment (model F61TB-9100 – Johnson Controls)

Orientation Requirements

The flow switch can be installed with limited angular inclination, provided that:

- the enclosure remains above the pipe centerline;
- the paddle movement is not obstructed.

Maximum recommended inclination:

- **120° from vertical top position.**

Electrical Connection



Electrical wiring shall be performed only by qualified personnel according to local electrical regulations.

Before wiring:

- disconnect the power supply;
- verify absence of voltage.

Use suitable cable glands and ensure proper sealing degree according to the application environment.

Additional Installation Recommendations

- Do not install the flow switch close to pump discharge.
- Do not install the device in areas subject to vibration or water hammer.
- Avoid installation in partially filled pipes or in points where air accumulation may occur.
- Ensure that the hydraulic circuit is protected against freezing conditions.



The flow switch is an operating and safety device and must never be bypassed during normal operation.

4.7.3 Heat recovery

Units may be optionally equipped with heat recovery system.

This system is made by a water-cooled heat exchanger located on the compressors discharge pipe and a dedicated management of condensing pressure.

To guarantee compressor operation within its envelope, units with heat recovery cannot operate with water temperature of the heat recovery water lower than 20°C.

It is a responsibility of plant designer and chiller installer to guarantee the respect of this value (e.g. using recirculating bypass valve).

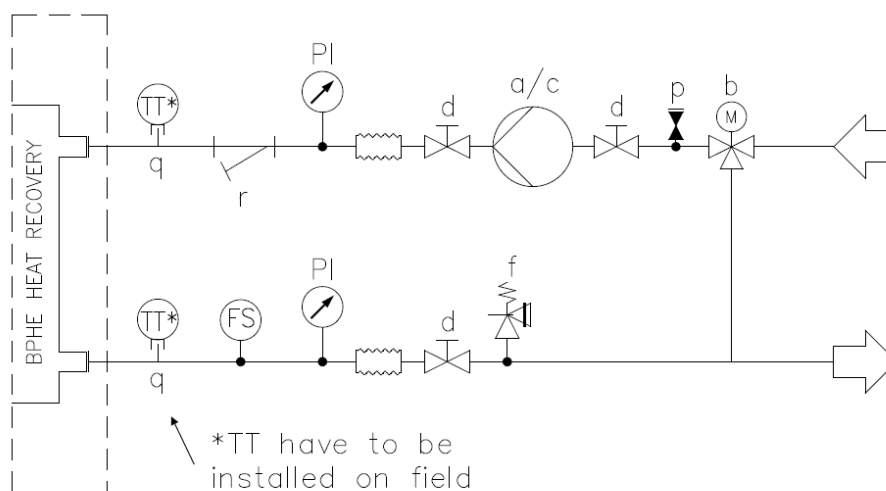


Fig. 26 - Water piping connection for Heat Recovery Exchangers (Maximum pressure 20 bar)

LEGEND

TT	Temperature sensor (to be installed on piping as close as possible to BPHE heat recovery)
PI	Pressure gauge
FS	Flowswitch
a	Single Pump
c	Twin pump
d	Valve
f	Safety valve
b	Three-way valve
p	Automatic filling valve fitting
r	Water filter

4.8 Water treatment

Before putting the unit into operation, clean the water circuit.

The evaporator must not be exposed to flushing velocities or debris released during flushing. It is recommended that a suitably sized bypass and valve arrangement is installed to allow flushing of the piping system. The bypass can be used during maintenance to isolate the heat exchanger without disrupting flow to other units.

Any damage due to the presence of foreign bodies or debris in the evaporator will not be covered by warranty.

Dirt, scales, corrosion debris and other material can accumulate inside the heat exchanger and reduce its heat exchanging capacity. Pressure drop can increase as well, thus reducing water flow. Proper water treatment therefore reduces the risk of corrosion, erosion, scaling, etc. The most appropriate water treatment must be determined locally, according to the type of system and water characteristics.

The manufacturer is not responsible for damage to or malfunctioning of equipment caused by failure to treat water or by improperly treated water.

Table 5 – Acceptable water quality limits

DAE Water quality requirements	Shell&tube + Flooded	BPHE
pH (25°C)	6.8 – 8.4	7.5-9.0
Electrical conductivity (25°C)	< 2000 µS/cm	<500 µS/cm
Chloride ion	< 150 mg Cl ⁻ /l	
Chlorine molecular	< 5 mg Cl ₂ /l	<1.0mg Cl ₂ /l
Sulphate ion (SO ₄ ⁻⁻ /l)	< 100 mg SO ₄ ⁻⁻ /l	<100 mg SO ₄ ⁻⁻ /l
Alkalinity	< 200 mg CaCO ₃ /l	<100 mg CaCO ₃ /l
Total Hardness	130-300 mg CaCO ₃ /l	80-150 mg CaCO ₃ /l
Iron	< 5.0 mg Fe/l	
Copper	< 1.0 mg Cu/l	-
Ammonium ion (NH ₃)	< 1.0 mg NH ₄ ⁺ /l	<0.5mg NH ₄ ⁺ /l
Silica	50 mg SiO ₂ /l	
Dissolved Oxygen	< 8 mg/l	
Total dissolved solids	< 1500 mg/l	
Hydrogen carbonate (HCO ⁻⁻⁻)		60-200 mg HCO ₃ /l
(HCO ⁻⁻⁻)/(SO ₄ ⁻⁻)		>0.5
(Ca+Mg)/(HCO ⁻⁻⁻)		>1.6

4.9 Hydronic Freecooling System

4.9.1 Introduction

Free cooling units have additional coils used to pre-cool the glycol mixture using ambient air when the latter has a temperature lower than that of the return mixture. If the external temperature is low enough to dissipate the entire thermal load, compressors automatically turn off and the mixture temperature is controlled by fan speed regulation. If the mixture temperature is too high, compressors will run as long as necessary.

In the free cooling hydraulic circuit, two motorized two-ways valves are installed. They work in opposition: when one is open, the other is closed.

Free cooling operation can be enabled by QFC switch installed in the control section of the electrical panel. Once the free cooling function is enabled, the unit controller automatically manages the operation of the two valves. The system controls, also, fans operation in order to maximize the free cooling effect.

System changeover is controlled by embedded unit controller, depending on operating conditions and unit setpoint. Between mechanical and freecooling operation the water side pressure drops are different, consequently the chiller water flow could be different. Evaluate that the minimum and maximum water flow, between the two operations, are inside the water flow limits (see product manual).



**Some units have components that extend beyond the unit footprint.
For transport reasons these components are shipped separately and must be assembled on site.
Please refer to section 4.5 for more information.**

Free cooling glycol free (or closed loop) version is available as a special option (option 231) by contacting the factory. For this option, additional components are installed on the unit:

- Glycol free units P&ID is reported below:

[illegible]

D-EIMAC01802-23 09EN - 35/55

LEGEND	
ID	DESCRIPTION
a	INVERTER DRIVEN PUMP
10	ACCESS FITTING ¼" NPT
q1	PLUGGED FITTING ¼" NPT – 6mm
q2	PLUGGED FITTING ¼" NPT – 4mm
c	RECEIVER VALVE 1"
d	VALVE
f	SAFETY VALVE 6 BAR 253056 ¾" F
h	AIR VENT 3/8" NPT
i	DRAIN 1/4" NPT
r	WATER FILTER
t	TWO WAY VALVE MOTORIZED
u	FILTER
v	FREECOOLING COIL
o	FLOWSWITCH FITTING 1/2" or 1"G according to ST_0603
m	EXPANSION VESSEL
e	ELECTRIC HEATER
FS	FLOWSWITCH
TT	TEMPERATURE SENSOR

LEGEND – LINE LIST		
ID	LINE (from / to)	THERMAL INSULATION
L1	WATER IN LINE	YES (19 mm)
L2	EVAPORATOR WATER IN LINE	YES (19 mm)
L3	EVAPORATOR WATER OUT LINE	YES (19 mm)
L4	BPHE WATER IN LINE	YES (19 mm)
L5	BPHE WATER OUT LINE	YES (19 mm)
L6	FREE COOLING WATER IN	NO
L7	FREE COOLING MANIFOLD IN	NO
L8	FREE COOLING MANIFOLD OUT	NO
L9	FREE COOLING WATER OUT	NO

Water inlet and outlet are indicative. Please refer to the machine dimensional diagrams for exact water connections.

DESIGN CONDITION	LINE	PS [bar]	TS [°C]
CLOSED LOOP	L6; L7; L8; L9	6	-10/+30
EVAPORATOR WATER IN/OUT	L1; L2; L3; L4; L5	10	+4/+30

Table 15 - Legend Closed loop Hydronic Free cooling P&ID

4.9.3 Coolant quality requirements



The minimum mandatory content of glycol is 25% (ethylene or propylenic).

For operation at less than -10°C the percentage of glycol must be determined by the installer.

The use of other substances different from ethylene or propylenic glycol shall be approved by the factory.

For operation below +4°C the use of glycol is mandatory.

Use only pre-made mixtures. The manufacturer cannot be considered responsible if a water-glycol mixture is created on site.

There are three main reasons for this suggested minimum advised content of glycol:

1. Corrosion protection
2. PH buffering increasing
3. Inhibition of the proliferation of most bacteria and fungi

In alternative to water+glycol to ensure the long operating life of microchannel free cooling coil, the following conditions for coolant shall be respected:

Table 6 – Free cooling application coolant quality requirements for MCH coils

Coolant quality requirements	Value
Ph (25 °C)	7.5 ÷ 8.5
Ammonium ion [mg NH ⁴⁺ / l]	< 2
Chloride ion [mg Cl ⁻ / l] (water temp. < 65°C)	< 10
Sulphate ions [mg SO ₄ ²⁻ / l]	< 30
Fluoride ions [mg F ⁻ / l]	< 0.1
Fe ²⁺ and Fe ³⁺ ions (if dissolved oxygen present >5mg/l) [mg / l]	0
Fe ²⁺ and Fe ³⁺ ions (if dissolved oxygen present <5mg/l) [mg / l]	< 5
Zn ions (ethylene glycol solution application)	0
Silica [mg SiO ₂ / l]	< 1
Total Hardness [mg CaCO ₃ / l]	100 ÷ 250
Total alkalimetric title (TAC) [mg / l]	< 100
Electrical conductivity [mS/m] (25 °C)	20 ÷ 60
Specific resistance [Ohm / m]	> 30

Notes:

- Dissolved oxygen: any sudden change in water oxygenation conditions is not expected.
- The addition of corrosion inhibitor is necessary for ensured coil protection, e.g. those based on monopropylene glycol or sodium molybdate.
- Maximum opening for strainer mesh shall be 1 mm

The most appropriate water treatment must be determined locally, according to the type of system and water characteristics.

The manufacturer is not responsible for damage to or malfunctioning of equipment caused by failure to treat water or by improperly treated water.

4.9.4 First operations at unit commissioning start

Free cooling section is pressurized before shipping up with up to 2 bar of dry air. To do so, it was necessary to disable free cooling by PLC and close manually the valve "d" (see. Fig. 3); valve "1" will close automatically when disabling free cooling.

When commissioning the unit (both standard and closed loop free-cooling unit), it is necessary to:

- Open valve "d"
- Enable free cooling operation from PLC (for further details please refer to the Operating Manual).
- After coolant (water + glycol) charge operation, it is necessary to vent the unit. Use venting valve installed on top of MCH coil to do this operation.



***Please, note that closed loop free cooling units are shipped without glycol content. Glycol charging operations must be done on site using valve indicated with „c” in the P&ID. Glycol content is communicated by the factory at order entry.
Use only pre-made mixtures. The manufacturer cannot be considered responsible if a water-glycol mixture is created on site.***

The expansion tank installed on the unit is pre-charged to 1.5 barg. If necessary, it's possible to charge the expansion tank with nitrogen using the valve on the top.

When the unit is shipped, perform a visual inspection of the expansion vessel focusing on the connection part between the metal support and the vessel itself.

In case of glycol free units, during glycol pump operations, it is important to always keep a minimum water side pressure of 250 kPa to avoid cavitation.

4.9.5 Free cooling purge valve related

The purge valves located at four corners of the free cooling MCH are used for air purging and water purging. The below instruction is defined to protect the purge valve from deformation and/or failure.

After dismounting the cap, please refer to the below to reinstall the cap:

- Check and clean the screw if there is dust and debris on screw's surface
- Check the rubber o-ring in the cap and make sure that it is in the cap and in the right position
- Screw the purge valve with one circle by hand and make sure the screw match is well.
- Clockwise screw the purge valve with torque wrench. Make sure the torque should be applied around the screw axis. The eccentric torque might damage the screw.
- Operation torque:
 - o The recommended torque value to install the cap is 5 Nm



The purge valves are protrusions from the coil.

Pay attention to not let the purge valve be impacted during transportation and installation process.

4.9.6 Operations in case of failure

In case of free cooling coil breakage,

1. Empty the unit
2. Close valve 1 and valve "d" (see Fig. 3)
3. Isolate the failed coil/coils which need to be replaced
4. Close the coil so to avoid air entrance inside it and any trace of humidity
5. Pressurize all coils with nitrogen at 1-2 barg



Please note that free cooling MCH coil cannot be exposed to open air for too long due to possible humidity entrance.

DAE cannot be considered accountable for any failure of flexible hoses which connect free cooling coils to stainless steel main manifolds. Following the correct maintenance may extend components life as much as possible.

4.10 Operating stability and minimum water content in the system

For the correct functioning of the machine, it is important to guarantee a minimum water content inside the system, avoiding an excessive number of compressor start-ups and stops. In fact, every time the compressor starts working, an excessive amount of oil from the compressor enters the refrigerant circuit and at the same time there is an increase in the temperature of the compressor stator, generated by the inrush current of the starting. To avoid damage to the compressors, the control system allows no more than 10 starts per hour. The plant where the unit is installed must therefore ensure that the overall water content allows constant operation of the unit and consequently also greater environmental comfort.

The minimum water content per unit can be calculated with a certain approximation using the following formula must be calculated considering the following specifications:

$$M [l] = m \left[\frac{l}{kW} \right] * CC [kW]$$

where:

M = minimum water content per unit, expressed in litres [l];

CC = cooling capacity (Cooling Capacity), expressed in kilowatt [kW];

m = specific water content [l/kW].

Model	m
EWATxxxB-XXC1	5 l/kW
EWATxxxB-XXC2 [opt 227]	2.5 l/kW 5 l/kW
EWFTxxxB-XXC1	5 l/kW
EWFTxxxB-XXC2	2.5 l/kW

Note: The calculation formula described above considers several factors such as the compressor stop time and the permissible temperature difference between turning off and restarting the last compressor. In this regard, the minimum calculated water content refers to the operation of the machine in a normal air conditioning system. If greater stability of operation is required, it is recommended to double the calculated water content. For the most accurate determination of the amount of water, it is advisable to contact the system designer. In very simple systems, it may be necessary to insert in the hydraulic circuit an inertial storage tank that allows to reach the minimum volume of water required. The insertion of this component must guarantee the correct mixing of the water and therefore it is advisable to choose a tank that has inside of the diaphragms dedicated for this purpose.



The calculation formula described above must be considered only for a single unit, in case of a plant of multiple units, the calculation must be done by the system designer

4.11 Anti-freeze protection for evaporator and recovery exchangers

All evaporators are supplied with a thermal controlled anti-freeze electrical heater, which provides adequate anti-freeze protection at temperatures lower than antifreeze setpoint.

However, unless the heat exchangers are completely empty and cleaned with anti-freeze solution, additional methods should also be used against freezing.

Two or more of below protection methods should be considered when designing the system as a whole:

- continuous water flow circulation inside piping and exchangers
- addition of an appropriate amount of glycol inside the water circuit
- additional heat insulation and heating of exposed piping
- if the unit does not work during the winter season, emptying and cleaning of the heat exchanger.

It is the responsibility of the installer and/or of local maintenance personnel to ensure that described anti-freeze methods are used. Make sure that appropriate anti-freeze protection is always maintained. Failing to follow the instructions above could result in unit damage.



Damage caused by freezing is excluded from the warranty, therefore Daikin Applied Europe S.p.A declines all responsibility

5 ELECTRICAL INSTALLATION

5.1 General specifications

Refer to the specific wiring diagram for the unit you have bought. Should the wiring diagram not be on the unit, or should it have been lost, please contact your manufacturer representative, who will send you a copy.

In case of discrepancies between wiring diagram and electrical panel/cables, please contact the manufacturer representative.



All electrical connections to the unit must be carried out in compliance with laws and regulations in force.

All installation, management and maintenance activities must be carried out by qualified personnel. There is a risk of electric shock.

This unit includes non-linear loads such as inverters, which have a natural current leakage to earth. If an Earth Leakage Detector is installed upstream the unit, a type B device with a minimum threshold of 300 mA must be used.



Before any installation and connection works, the unit must be switched off and secured. Since this unit includes inverters, the intermediate circuit of the capacitors remains charged with high voltage for a short period of time after being switched off.

Do not operate to the unit before 20 minutes after the unit has been switched off.

Electrical equipment can operate correctly in the intended ambient air temperature. For very hot environments and for cold environments, additional measures are recommended (contact the manufacturer representative).

The electrical equipment can operate correctly when the relative humidity does not exceed 50 % at a maximum temperature of +40 °C. Higher relative humidities are permitted at lower temperatures (for example 90% at 20 °C). Harmful effects of occasional condensation shall be avoided by design of the equipment or, where necessary, by additional measures (contact the manufacturer representative).

This product complies with EMC standards for industrial environments. Therefore, it is not intended for use in residential areas, e.g. installations where the product is connected to a low voltage public distribution system. Should this product need to be connected to a low voltage public distribution system, specific additional measures will have to be taken to avoid interference with other sensitive equipment.

5.2 Electrical supply

The electrical equipment can operate correctly with the conditions specified below:

Voltage	Steady state voltage: 0,9 to 1,1 of nominal voltage
Frequency	0,99 to 1,01 of nominal frequency continuously 0,98 to 1,02 short time
Armonics	Harmonic distortion not exceeding 10 % of the total r.m.s. voltage between live conductors for the sum of the 2nd through to the 5 th harmonic. An additional 2 % of the total r.m.s. voltage between live conductors for the sum of the 6th through to the 30th harmonic is permissible.
Voltage unbalance	Neither the voltage of the negative sequence component nor the voltage of the zero sequence component in three-phase supplies exceeding 3 % of the positive sequence component
Voltage interruption	Supply interrupted or at zero voltage for not more than 3 ms at any random time in the supply cycle with more than 1 s between successive interruptions.
Voltage dips	Voltage dips not exceeding 20% of the peak voltage of the supply for more than one cycle with more than 1 s between successive dips.

5.3 Electric connections

Provide an electrical circuit to connect the unit. It must be connected to the copper cables with an adequate section relative to the plate absorption values and according to the current electrical standards.

Daikin Applied Europe S.p.A. declines all responsibility for an inadequate electrical connection.



The connections to the terminals must be made with copper terminals and cables, otherwise overheating or corrosion may occur at the connection points with the risk of damaging the unit. The electrical connection must be carried out by qualified personnel, in compliance with the laws in force. There is a risk of electric shock.

The power supply to the unit must be set up in such a way that it can be switched on or off independently from that of other system components and other equipment in general, by means of a general switch.

The electrical connection of the panel must be carried out maintaining the correct sequence of the phases. Refer to the specific wiring diagram for the unit you have bought. Should the wiring diagram not be on the unit, or should it have been lost, please contact your manufacturer representative, who will send you a copy. In case of discrepancy between wiring diagram and electrical panel/cables, please contact the manufacturer representative.



Do not apply torque, tension or weight to the main switch terminals. Power line cables must be supported by appropriate systems.

To avoid interference, all control wires must be connected separately from the power cables. To do this, use several electrical passage ducts.

Simultaneous single and three-phase loads and phase unbalance can cause ground losses of up to 150 mA during normal unit operation. If the unit includes devices that generate higher harmonics, such as an inverter or phase cut, ground losses can increase to much higher values, about 2 A.

The protections for the power supply system must be designed according to the values mentioned above. A fuse must be present on each phase and, where provided for by the national laws of the country of installation, a leak detector to earth. This product complies with EMC (Electromagnetic Compatibility) standards for industrial environments. Therefore, it is not intended for use in residential areas, e.g. installations where the product is connected to a low voltage public distribution system. Should this product need to be connected to a low voltage public distribution system, specific additional measures will have to be taken to avoid interference with other sensitive equipment.



Before any electrical connection work to the compressor motor and / or the fans, make sure that the system is switched off and the main switch of the unit is open. Failure to observe this rule could result in serious personal injury.

5.4 Cable requirements

The cables connected to the circuit breaker must respect the insulation distance in the air and the surface isolation distance between the active conductors and the earth, according to IEC 61439-1 table 1 and 2, and to the local national laws. The cables connected to the main switch must be tightened using a pair of keys and respecting the unified clamping values, relative to the quality of the screws of the washers and nuts used.

Connect the earth conductor (yellow / green) to the PE ground terminal.

The equipotential protection conductor (earth conductor) must have a section according to table 1 of EN 60204-1 Point 5.2, shown below.

Table 7. - Table 1 of EN60204-1 Point 5.2

Section of the copper phase conductors feeding the equipment $S [mm^2]$	Minimum cross-section of the external copper protection conductor $S_p [mm^2]$
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	$S/2$

In any case, the equipotential protection conductor (earth conductor) must have a cross section of at least 10 mm², in accordance with point 8.2.8 of the same standard.

5.5 Phase unbalance

In a three-phase system, the excessive imbalance between the phases is the cause of the engine overheating. The maximum permitted voltage unbalance is 3%, calculated as follows:

$$Sbilanciamento \% = \frac{(Vx - Vm) * 100}{Vm}$$

where:

Vx = phase with greater unbalance

Vm = average of the tensions

Example: the three phases measure 383, 386 and 392 V respectively. The average is:

$$\frac{383 + 386 + 392}{3} = 387 \text{ V}$$

The unbalance percentage is:

$$\frac{(392 - 387) * 100}{387} = \mathbf{1.29 \%}$$

less than the maximum allowed (3%).

5.6 Electrical panel label description

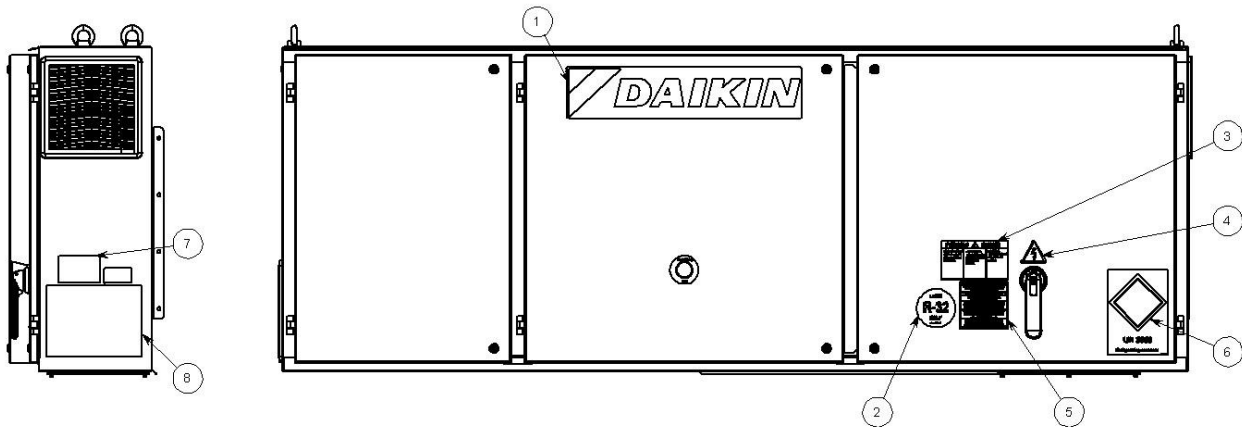


Fig. 28 – Description of labels applied on the electrical panel small

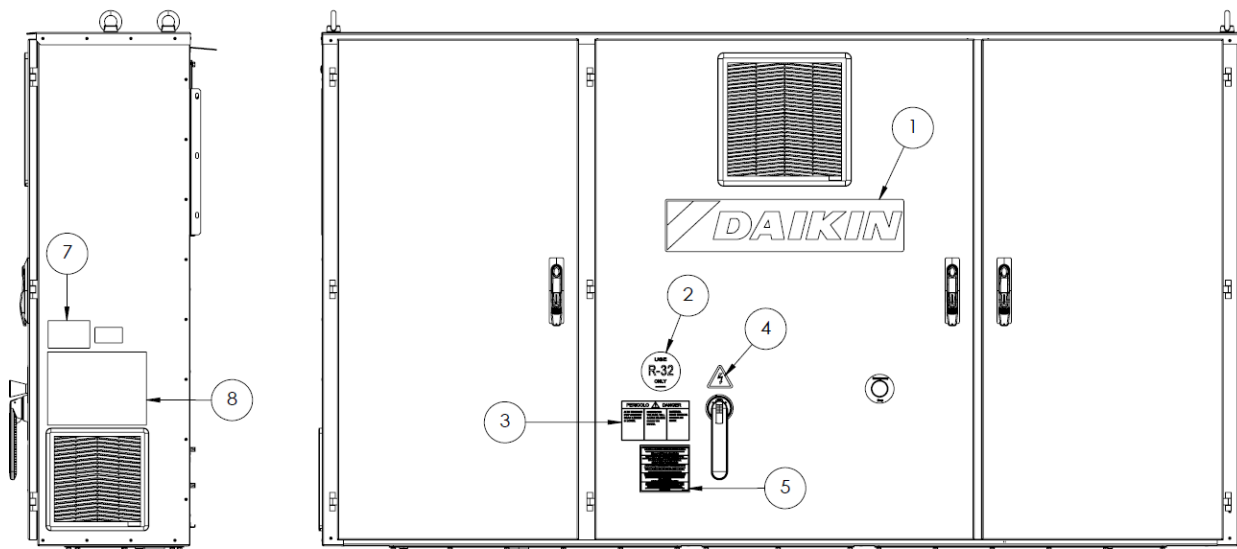


Fig. 29 – Description of labels applied on the electrical panel medium.

Label Identification

1 – Manufacturer logo	5 – Cable tightening warning
2 – Gas type	6 – Unit nameplate data
3 – Hazardous Voltage warning	7 – Lifting instruction
4 – Electrical hazard symbol	

6 OPERATOR'S RESPONSIBILITIES

It is essential that the operator is appropriately trained and becomes familiar with the system before operating the unit. In addition to reading this manual, the operator must study the microprocessor operating manual and the wiring diagram to understand start-up sequence, operation, shutdown sequence and operation of all the safety devices.

During the unit initial start-up phase, a technician authorized by the manufacturer is available to answer any questions and to give instructions as to the correct operating procedures.

The operator must keep a record of operating data for every installed unit. Another registration must also be kept for all the periodic maintenance and assistance activities.

If the operator notes abnormal or unusual operating conditions, he is advised to consult the technical service authorized by the manufacturer.



If the unit is switched off, the compressor heating resistors cannot be used. Once the unit is reconnected to the mains, leave the compressor heating resistors charged for at least 12 hours before restarting the unit.

Failure to observe this rule may cause damage to the compressors due to excessive accumulation of liquid inside them.

This unit represents a substantial investment and deserves the attention and care to keep this equipment in good working order.

However, during operation and maintenance it is essential to observe the following instructions:

- do not allow unauthorized and / or unqualified personnel to access the unit.
- it is forbidden to access the electrical components without having opened the unit main switch and switched off the power supply.
- it is forbidden to access the electrical components without using an insulating platform. Do not access the electrical components if water and/or moisture are present.
- verify that all operations on the refrigerant circuit and on the components under pressure are carried out exclusively by qualified personnel.
- the replacement of the compressors must be carried out exclusively by qualified personnel.
- sharp edges and the surface of the condenser section could cause injury. Avoid direct contact and use adequate protection device.
- do not introduce solid objects into the water pipes while the unit is connected to the system.
- it is absolutely forbidden to remove all protections of moving parts.

In case of sudden stop of the unit, follow the instructions on the Control Panel Operating Manual which is part of the on-board documentation delivered to the end user.

It is strongly recommended to perform installation and maintenance with other people.

In case of accidental injury or unease, it is necessary to:

- keep calm.
- press the alarm button if present in the installation site.
- contact immediately emergency rescue personnel of the building or the Health Emergency Service.
- wait for the operators to arrive without leaving the injured person alone.
- give all necessary information to the rescue operators.



Avoid installing the chiller in areas that could be dangerous during maintenance operations, such as platforms without parapets or railings or areas not complying with the clearance requirements around the chiller.

7 MAINTENANCE

Personnel working on the electrical or the refrigeration components must be authorized, trained and fully qualified. Maintenance and repair requiring the assistance of other skilled personnel should be carried out under the supervision of the person competent in the use of flammable refrigerants. Any person conducting servicing or maintenance on a system or associated parts of the equipment should be competent according to EN 13313.

Persons working on refrigerating systems with flammable refrigerants should have competence in safety aspects of flammable refrigerant handling supported by evidence of appropriate training.

Always protect the operating personnel with personal protective equipment appropriate for the tasks to be performed. Common individual devices are helmet, goggles, gloves, caps, safety shoes. Additional individual and group protective equipment should be adopted after an adequate analysis of the specific risks in relevance, according to the activities to be performed.

electrical components	Never work on any electrical components, until the general supply to the unit has been cut using the disconnect switch(es) in the control box. The frequency variators used are equipped with capacitor batteries with a discharge time of 20 minutes; after disconnecting power wait 20 minutes before opening the control box.
refrigerating system	The following precautions should be taken before working on the refrigerant circuit: — obtain permit for hot work (if required) — ensure that no flammable materials are stored in the work area and that no ignition sources are present anywhere in the work area — ensure that suitable fire extinguishing equipment is available — ensure that the work area is properly ventilated before working on the refrigerant circuit or before welding, brazing or soldering work — ensure that the leak detection equipment being used is non-sparking, adequately sealed or intrinsically safe — ensure that all maintenance staff have been instructed. The following procedure should be followed before working on the refrigerant circuit: - remove refrigerant (specify the residual pressure) - purge circuit with inert gas (e.g. nitrogen) - evacuate to a pressure of 0,3 (abs.) bar (or 0,03 MPa) - purge again with inert gas (e.g. nitrogen) - open the circuit. The area should be checked with an appropriate refrigerant detector prior to and during any hot work to make the technician aware of a potentially flammable atmosphere. If compressors or compressor oils are to be removed, it should be ensured that it has been evacuated to an acceptable level to ensure that there is no flammable refrigerant remaining within the lubricant. Only refrigerant recovery equipment designed for use with flammable refrigerants should be employed. If the national rules or regulations permit the refrigerant to be drained, this should be done safely, using a hose, for example, through which the refrigerant is discharged into the outside atmosphere in a safe area. It should be ensured that an inflammable explosive refrigerant concentration cannot occur in the vicinity of an ignition source or penetrate a building under any circumstance. In the case of refrigerating systems with an indirect system, the heat-transfer fluid should be checked for the possible presence of refrigerant. After any repair work, the safety devices, for example refrigerant detectors and mechanical ventilation systems, should be checked and the results recorded. It should be ensured that any missing or illegible label on components of the refrigerant circuit is replaced. Sources of ignition should not be used when searching for a refrigerant leak.

7.1 Pressure / temperature table

Table 8 – Pressure / Temperature of the R32

°C	Bar	°C	Bar	°C	Bar	°C	Bar
-28	2.97	-2	7.62	24	16.45	50	31.41
-26	3.22	0	8.13	26	17.35	52	32.89
-24	3.48	2	8.67	28	18.30	54	34.42
-22	3.76	4	9.23	30	19.28	56	36.00
-20	4.06	6	9.81	32	20.29	58	37.64
-18	4.37	8	10.43	34	21.35	60	39.33
-16	4.71	10	11.07	36	22.45	62	41.09
-14	5.06	12	11.74	38	23.60	64	42.91
-12	5.43	14	12.45	40	24.78	66	44.79
-10	5.83	16	13.18	42	26.01	68	46.75
-8	6.24	18	13.95	44	27.29	70	48.77
-6	6.68	20	14.75	46	28.61	72	50.87
-4	7.14	22	15.58	48	29.99	74	53.05

7.2 Routine maintenance

This chiller must be maintained by qualified technicians. Before beginning any work on the system, the personnel shall assure that all security precautions have been taken.

Neglecting unit maintenance could degrade all parts of the units (coils, compressors, frames, pipes, etc.) with negative effect on performances and functionality.

There are two different levels of maintenance, which can be chosen according to the type of application (critical/noncritical) or to the installation environment (highly aggressive).

Examples of critical applications are process cooling, datacentre, etc.

Highly Aggressive Environments can be defined as the follows:

- Industrial environment (with possible concentration of fumes result of combustion and chemical process)
- Coastal environment
- Highly polluted urban environment
- Rural environment close to of animal excrement and fertilizers, and high concentration of exhaust gas from diesel generators
- Desert areas with risk of sandstorms
- Combinations of the above.

Table 7 lists all Maintenance activities for standard applications and standard environment.

Table 8 lists all Maintenance activities for critical applications or highly aggressive environment.

Unit exposed to a highly aggressive environment can face corrosion in a shorter time than ones installed on a standard environment. Corrosion causes a rapid rusting of the frame core, consequently, decreases unit structure life time. To avoid that, it is necessary to wash periodically the frame surfaces with water and suitable detergents.

In case of part of unit frame paint came off, it is important to stop its progressive deterioration by repainting the exposed parts using proper products. Please contact factory to get the required products specifications.

In case of just salt deposits are present, it is enough to rinse the parts with fresh water.

7.2.1 Microchannel Coils Maintenance

The operating environment of the units can affect life of MCH coils, both of condensing and of free cooling section. In order to maintain the efficiency of the unit over time and its duration, it is necessary to do a frequent cleaning of MCH coils.

As opposed to fin and tube heat exchangers, MCH coils are more likely to accumulate dirt on the surface. Dust, pollution, etc...can create obstructions between the fins of the coils. These obstructions can be removed by washing periodically under pressure.

The following maintenance and cleaning procedures are recommended as part of the routine maintenance activities. Before operating:

1. Disconnect the unit from power supply.
2. Wait for the fans to stop completely;
3. Make sure that the fan blades cannot move for any reason (for example: wind).
4. If present, remove the "V" shaped panels.
5. Before using a water jet on coils, remove bigger dirt, such as leaves and fibres, with a vacuum cleaner (preferably with a brush or other soft attachment rather than a metal tube), compressed air blown from the inside out (if possible), and/or a soft bristle (not wire!) brush. Do not impact or scrape the coil with the vacuum tube, air nozzle, etc.
6. Clean the **condenser coil** from the top, by removing fans grid.

7. Clean the surface of **free cooling coils**, if present, uniformly from top to bottom, by putting the jet in front of the coils with a right angle to the surface (90°).

Note: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibres and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibres must be completely removed prior to using low velocity clean water rinse.

8. Rinse. Do not use any chemicals (including those advertised as coil cleaners) to wash microchannel heat exchangers. They can cause corrosion. Rinse only. Hose the MCHE off gently, preferably from the inside out and top to bottom, running the water through every fin passage until it comes out clean. Microchannels fins are stronger than traditional tube & fin coil fins but still need to be handled with care.

It is possible to clean a coil with a high-pressure washer (max 62 barg) only if a flat shape of the water spray is used and direction of the spray is kept perpendicular to the fin edge. **If this direction is not respected the coil may be destroyed** if using a pressure washer so we do not recommend their use.

Note: A monthly clean water rinse is recommended for coils that are applied in coastal or industrial environments to help to remove chlorides, dirt and debris. When rinsing, keep water temperature below 55 °C. An elevated water temperature will reduce surface tension. Pressure shall not exceed 62 barg.

3. Quarterly cleaning is essential to extend the life of an E-coated coil and is required to maintain warranty coverage. Failure to clean an E-coated coil will void the warranty and may result in reduced efficiency and durability in the environment. For routine quarterly cleaning, first clean the coil with an approved coil cleaner. After cleaning the coils with the approved cleaning agent, use the approved chloride remover to remove soluble salts and revitalize the unit.

Note: Harsh chemicals, household bleach or acid cleaners should not be used to clean E-coated coils. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion and attack the E-coating. If there is dirt below the surface of the coil, use the recommended coil cleaners as described above.

Galvanic corrosion of the connection Copper/Aluminium can occur under the plastic protection; during the maintenance operations or periodic cleaning, check the aspect of the plastic protection of the Copper/Aluminium connection. If it is inflated, damaged, or took off contact the manufacturer representative for advice and information.

In case of free cooling MCH coil failure, stream the section before pressurizing it with nitrogen up to 1-2 barg to remove any trace of humidity.

7.2.2 Electrical maintenance



All electrical maintenance activities must be followed by qualified personnel. Make sure the system is switched off and the main switch of the unit open. Failure to observe this rule could result in serious personal injury. When the unit is turned off, but the disconnection switch is in the closed position, the unused circuits will still be active.

The maintenance of the electrical system consists of the application of some general rules as follows:

1. the current absorbed by the compressor must be compared to the rated value. Normally the value of the absorbed current is lower than the rated value that corresponds to the absorption of the full load compressor at the maximum operating conditions.
2. at least once every three months all the security checks must be made to verify their functionality. Each appliance, with aging, can change its point of operation and this must be monitored to adjust it or replace it. The pump interlocks and flow switches must be checked to make sure that they interrupt the control circuit if they intervene.

7.2.3 Service and limited warranty

All units are factory-tested and guaranteed for 12 months as of the first start-up or 18 months as of delivery.

These units have been developed and constructed according to high quality standards ensuring years of failure-free operation. **However, the unit requires maintenance even during the warranty period, from the time of installation and not just from the commissioning date.** We strongly advise stipulating a maintenance contract with a service authorized by the manufacturer to ensure efficient and problem-free service, thanks to the expertise and experience of our personnel.

It must be borne in mind that operating the unit in an inappropriate manner, beyond its operating limits or not performing proper maintenance according to this manual can void the warranty.

Observe the following points, to conform to warranty limits:

1. The unit cannot function beyond the specified limits.
2. The electrical power supply must be within the voltage limits and without voltage harmonics or sudden changes.
3. The three-phase power supply must not have an unbalance between phases exceeding 3%. The unit must stay turned off until the electrical problem has been solved.
4. No safety device, either mechanical, electrical, or electronic must be disabled or overridden.
5. The water used for filling the water circuit must be clean and suitably treated. A mechanical filter must be installed at the point closest to the evaporator inlet.
6. the value of the evaporator water flow must be included in the declared range for the unit considered, refer to the CSS selection software.

Table 9 – Standard Routine Maintenance Plan

List of Activities	Weekly	Monthly (Note 1)	Half Yearly	Annual/Seasonal (Note 2)
General:				
Reading of operating data (Note 3)	X			
Visual inspection of unit for any damage and/or loosening		X		
Verification of thermal insulation integrity				X
Clean and paint where necessary				X
Analysis of water (4)				X
Check of flow switch operation		X		
Electrical Installation:				
Verification of control sequence				X
Verify contactor wear – Replace if necessary				X
Verify that all electrical terminals are tight – Tighten if necessary				X
Clean inside the electrical control board				X
Visual inspection of components for any signs of overheating		X		
Verify operation of compressor and electrical resistance		X		
Measure compressor motor insulation using the Megger				X
Clean air intake filters of the electrical panel		X		
Verify operation of the ventilation system in the electrical panel				X
Refrigeration circuit:				
Check for any refrigerant leakage (leak test)		X		
Verify refrigerant flow using the liquid sight glass – Sight glass full	X			
Verify filter dryer pressure drop		X		
Analyse compressor vibrations				X
Analyse compressor oil acidity (Note 7)				X
Check the security valve (Note 5)		X		
Check and application of additional protective paint layer (Note 9)			X	
Condenser / Hydronic Freecooling section:				
Check the cleaning of condensing coils / hydronic freecooling coils and water heat exchangers (Note 6)				X
Verify that fans are well tightened				X
Verify the condenser coil fins / hydronic freecooling coils fins - Remove if necessary				X
Flexible hoses free cooling units check			X	
Flexible hoses clamps tightening for free cooling units.			X	
Tightening torque: 10 Nm				
Check the aspect of the plastic protection of the copper/aluminium connection		X		
Evaporator / Heat Recovery:				
Check the cleaning (Note 6)				X

Notes:

- Monthly activities include all the weekly ones.
- The annual (or early season) activities include all weekly and monthly activities.
- Daily reading of the operating values of the unit allows maintaining high observational standards.
- Check for any dissolved metals.
- Check that the cap and the seal have not been tampered with. Check that the drainage connection of the safety valves is not accidentally occluded by foreign objects, rust or ice. Check the manufacturing date on the safety valve and replace it, if necessary, in compliance with the national laws in force.
- Clean condenser banks with clean water and water heat exchangers with appropriate chemicals. Particles and fibers could clog up the exchangers, especially for water exchangers pay attention if water rich in calcium carbonate is used. An increase in pressure drops or a decrease in thermal efficiency means that the heat exchangers are clogged. In environments with a high concentration of air-borne particles, it might be necessary to clean the condenser bank more often.
- TAN (Total acid number): ≤ 0.10: No action
Between 0.10 and 0.19: Replace anti-acid filters and re-check after 1000 running hours. Continue to replace the filters until the TAN is below 0.10.
> 0.19: replace oil, oil filter and oil filter dryer. Verify at regular intervals.
- Units placed or stored in a Highly Aggressive Environment for long time without operation are still subject to those routine maintenance steps.
- The protective paint layer must be applied on: all brazing and joints of copper refrigerant pipes; drier filter plate; Rotalock valves and flanges of refrigerant circuit; all BPHE not insulated; anti-chattering capillars.

Table 10 – Routine Maintenance Plan for Critical Application and/or Highly Aggressive Environment

List of Activities (Note 8)	Weekly	Monthly (Note 1)	Half Yearly	Yearly/Seasonal (Note 2)
General:				
Reading of operating data (Note 3)	X			
Visual inspection of unit for any damage and/or loosening		X		
Verification of thermal insulation integrity				X
Cleaning		X		
Paint where necessary				X
Analysis of water (4)				X
Check of flow switch operation		X		
Electrical Installation:				
Verification of control sequence				X
Verify contactor wear – Replace if necessary				X
Verify that all electrical terminals are tight – Tighten if necessary				X
Clean inside the electrical control board		X		
Visual inspection of components for any signs of overheating		X		
Verify operation of compressor and electrical resistance		X		
Measure compressor motor insulation using the Megger				X
Clean air intake filters of the electrical panel		X		
Verify operation of all ventilation fans in the electrical panel				X
Refrigeration circuit:				
Check for any refrigerant leakage (leak test)		X		
Verify refrigerant flow using the liquid sight glass – Sight glass full	X			
Verify filter dryer pressure drop		X		
Analyse compressor vibrations				X
Analyse compressor oil acidity (Note 7)				X
Check the security valve (Note 5)		X		
Check and application of additional protective paint layer (Note 9)			X	
Condenser / Hydronic Freecooling section:				
Checking the cleaning of the air-cooler (Note 6)		X		
Check the cleaning of water heat exchangers (Note 6)				X
Quarterly clean condenser coils (E-coated only)				X
Verify that fans are well tightened				X
Verify the condenser coil fins / hydronic freecooling coils fins – Remove / Comb if necessary		X		
Check the aspect of the plastic protection of the copper/aluminium connection		X		
Flexible hoses free cooling units check			X	
Flexible hoses clamps tightening for free cooling units. Tightening torque: 10 Nm			X	
Evaporator / Heat Recovery:				
Check the cleaning (Note 6)				X

Notes:

- Monthly activities include all the weekly ones.
- The annual (or early season) activities include all weekly and monthly activities.
- Daily reading of the operating values of the unit allows maintaining high observational standards.
- Check for any dissolved metals.
- Check that the cap and the seal have not been tampered with. Check that the drainage connection of the safety valves is not accidentally occluded by foreign objects, rust, or ice. Check the manufacturing date on the safety valve and replace it, if necessary, in compliance with the national laws in force.
- Clean condenser banks with clean water and water heat exchangers with appropriate chemicals. Particles and fibers could clog up the exchangers, especially for water exchangers pay attention if water rich in calcium carbonate is used. An increase in pressure drops or a decrease in thermal efficiency means that the heat exchangers are clogged. In environments with a high concentration of air-borne particles, it might be necessary to clean the condenser bank more often.
- TAN (Total acid number): ≤ 0.10 : No action
Between 0.10 and 0.19: Replace anti-acid filters and re-check after 1000 running hours. Continue to replace the filters until the TAN is below 0.10.
>0.19: replace oil, oil filter and oil filter dryer. Verify at regular intervals.
- Units placed or stored in a Highly Aggressive Environment for long time without operation are still subject to those routine maintenance steps.
- The protective paint layer must be applied on: all brazing and joints of copper refrigerant pipes; drier filter plate; Rotalock valves and flanges of refrigerant circuit; all BPHE not insulated; anti-chattering capillars.

8 CHECKS FOR THE FIRST START-UP



The unit must be started for the first time ONLY by authorized DAIKIN personnel.

The unit must absolutely not be put into operation, even if for a very short period, without having first meticulously checking the following list in its entirety.

This general commissioning checklist can be used as a guideline and reporting template during the commissioning and hand-over to the user.

For more detailed commissioning instructions, please contact the local Daikin Service department or authorized representative of the manufacturer.

Table 11 – Checks to be performed before starting the unit

General	Yes	No	N/A
Check for external damage	☐	☐	☐
Open all isolation and / or shut-off valves	☐	☐	☐
Verify that the unit is pressurized with refrigerant in all of its parts before making the connection to the hydraulic circuit.	☐	☐	☐
Check the oil level in the compressors	☐	☐	☐
Control wells, thermometers, manometers, controls, etc. installed	☐	☐	☐
Availability of at least 25% of the machine load for testing and control settings	☐	☐	☐
Refrigerated water	Yes	No	N/A
Piping completion	☐	☐	☐
Install the water filter (even when not supplied) at the inlet of the exchangers.	☐	☐	☐
Install a flow switch	☐	☐	☐
Water circuit filling, air bleeding	☐	☐	☐
Pump installation, (rotation check), filter cleaning	☐	☐	☐
Operation of the controls (three-way valve, bypass valve, damper, etc.)	☐	☐	☐
Water circuit operation and flow balance	☐	☐	☐
Check that all water sensors are correctly fixed in the heat exchange	☐	☐	☐
Electrical circuit	Yes	No	N/A
Power cables connected to the electrical panel	☐	☐	☐
Starter and wired interlocking of the pump	☐	☐	☐
Electrical connection in compliance with local electrical regulations	☐	☐	☐
Install a main switch upstream of the unit, the main fuses and, where required by the national laws of the country of installation, a ground fault detector.	☐	☐	☐
Connect the pump contact(s) in series with the contact of the flow switch(es), so that the unit can operate only when the water pumps are running, and the water flow is sufficient.	☐	☐	☐
Provide the main voltage and check that it is within $\pm 10\%$ of the classification given on the nameplate.	☐	☐	☐

Note

This list must be completed and sent to the local Daikin Service office at least two weeks before the start date.

9 IMPORTANT INFORMATION ON THE REFRIGERANT USED

This product contains fluorinated greenhouse gases. Do not vent gases into the atmosphere.

Refrigerant type: R32
GWP Value (global warming potential): 675

9.1 Factory and Field charged units instructions.

The refrigerant system is charged with fluorinated greenhouse gases and the refrigerant charge is impressed on the plate, shown below, which is applied inside the electrical panel.

1. Fill in with indelible ink the refrigerant charge label supplied with the product as following instructions:
 - the refrigerant charge for each circuit (1; 2; 3) added during commissioning (on-site charging)
 - the total refrigerant charge (1 + 2 + 3)
 - calculate the greenhouse gas emission with the following formula:

$$GWP * total\ charge\ [kg]/1000$$

(Use the GWP value mentioned on the greenhouse gases label. This GWP value is based on the 4th IPCC Assessment Report.)

a		b		c	p	
Contains fluorinated greenhouse gases		CH-XXXXXXXX-KKKKXX				
m	R32	1	=	Factory charge	+ Field charge	d
n	GWP: 675	2	=			e
		3	=			e
		1 + 2 + 3	=			f
	Total refrigerant charge					g
	Factory + Field					h
	GWP x kg/1000					

- a Contains fluorinated greenhouse gases
- b Circuit number
- c Factory charge
- d Field charge
- e Refrigerant charge for each circuit (according to the number of circuits)
- f Total refrigerant charge
- g Total refrigerant charge (Factory + Field)
- h **Greenhouse gas emission** of the total refrigerant charge expressed
- m Refrigerant type
- n GWP = Global Warming Potential
- p Unit serial number



In Europe, the emission of greenhouse gases of the total refrigerant charge in the system (expressed in tonnes of equivalent CO₂) is used to determine the frequency of maintenance interventions. Follow the applicable legislation.

10 PERIODIC CHECKS AND COMMISSIONING OF PRESSURE EQUIPMENT

The units are included in category III and IV of the classification established by the European Directive 2014/68/EU (PED). For chillers belonging to these categories, some local regulations require a periodic inspection by an authorized person. Please check with your local requirements.

11 DISMISSION AND DISPOSAL

The unit is made of metal, plastic, and electronic parts. All these components must be disposed of in accordance with local disposal laws and if in scope with the national laws implementing the Directive 2012/19/EU (RAEE).

Lead batteries must be collected and sent to specific waste collection centres.

Avoid the escape of refrigerant gases into the environment by using suitable pressure vessels and tools for transferring the fluids under pressure. This operation must be carried out by competent personnel in refrigeration systems and in compliance with the laws in force in the country of installation.



12 DURATION

After this period the manufacturer advises to carry out a total control of the whole and above all the integrity check of the pressurized refrigeration circuits, as required by the laws in force in some European Community countries.

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