



Installation, Operation and Maintenance Manual

D – KIMWC00311-09EN



Water-cooled screw chillers

EWWD380-C11BJYNN

50Hz – Refrigerant: R-134a

Original Instructions

▲ IMPORTANT

This Manual is a technical aid and does not represent a binding offer for McQuay. McQuay has drawn up this Manual to the best of its knowledge. The content cannot be held as explicitly or implicitly guaranteed as complete, precise or reliable. All data and specifications contained herein may be modified without notice. The data communicated at the moment of the order shall hold firm. McQuay shall assume no liability whatsoever for any direct or indirect damage, in the widest sense of the term, ensuing from or connected with the use and/or interpretation of this Manual. The entire content is protected by McQuay copyright.

▲ WARNING

Before starting the installation of the unit, please read this manual carefully. Starting up the unit is absolutely forbidden if all instructions contained in this manual are not clear.

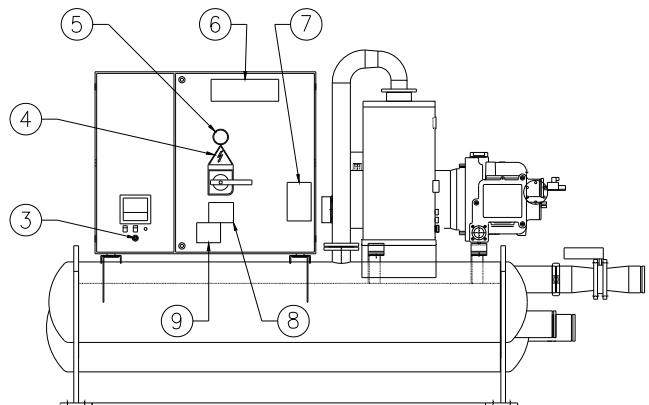
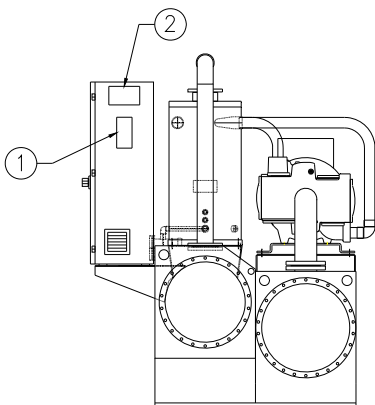
Key to symbols

▲ Important note: failure to respect the instruction can damage the unit or compromise operation

⚠ Note regarding safety in general or respect of laws and regulations

⚡ Note regarding electrical safety

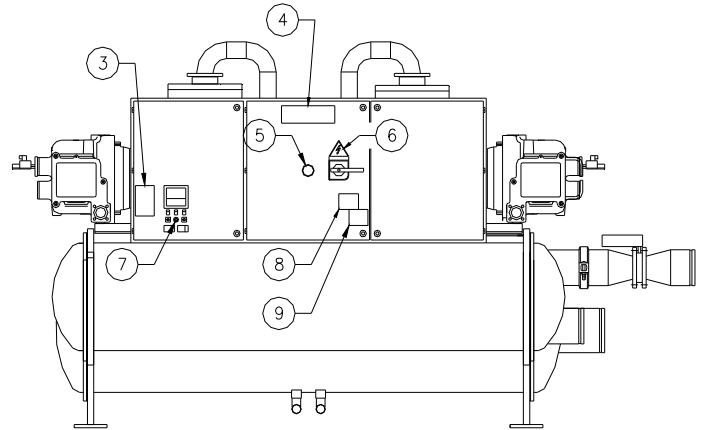
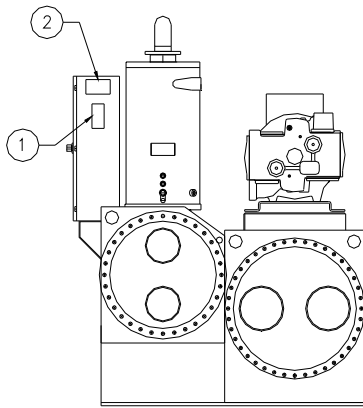
Description of the labels applied to the electrical panel



Single compressor unit

Label Identification

1 – Unit nameplate data	6 – Manufacturer's logo
2 – Lifting instructions	7 – Non flammable gas symbol
3 – Emergency stop	8 – Hazardous Voltage warning
4 – Electrical hazard symbol	9 – Cable tightening warning
5 – Gas type	



Two compressors unit

Label Identification

1 – Unit nameplate data	6 – Electrical hazard symbol
2 – Lifting instructions	7 – Emergency stop
3 – Non flammable gas symbol	8 – Hazardous Voltage warning
4 – Manufacturer's logo	9 – Cable tightening warning
5 – Gas type	

General information

▲ ATTENTION

The units described in the present manual represent a high value investment, maximum care should be taken to ensure correct installation and appropriate working conditions. Installation and maintenance must be performed by qualified and specifically trained personnel only. Correct maintenance of the unit is indispensable for its safety and reliability. Manufacturer's service centres are the only having adequate technical skill for maintenance.

▲ ATTENTION

This manual provides information about the features and standard procedure for the complete series.

All units are delivered from the factory complete with wiring diagrams and dimensional drawings including size and weight for each model.

WIRING DIAGRAMS AND DIMENSIONAL DRAWINGS MUST BE CONSIDERED ESSENTIAL DOCUMENTS OF THIS MANUAL

In case of any discrepancy between this manual and the equipment's document please refer to the wiring diagram and dimensional drawings.

General description

The chillers are completely assembled and factory tested before shipment.

Each unit with 1 circuit has one compressor connected to one evaporator and one condenser. The units with 2 circuits are equipped with 2 compressors operating in parallel on a single evaporator and condenser.

The chillers use refrigerant R-134a to reduce the size and weight of the package compared to negative pressure refrigerants, and since R-134a operates at a positive pressure over the entire operation range, no purge system is required.

The controls are pre-wired, adjusted and tested. Only normal field connections such as piping, electrical and interlocks, etc. are required, thereby simplifying installation and increasing reliability.

Most necessary equipment protection and operating controls are factory installed in the control panel.

The manual contents are applicable to all models of the series unless specifically referenced otherwise.

Application

Units must be initially started at the job site by a factory trained Daikin service technician. Failure to follow this start-up procedure can affect the equipment warranty.

The standard limited warranty on this equipment covers parts that prove defective in material or workmanship. Warranty does not cover materials that are subject to natural consumption.

Cooling towers used with the chillers have to be selected according to 24°C ÷ 32°C as maximum condenser inlet water temperature values.

Installation

Storage

If the chillers have to be stored prior to installation, the following warnings have to be observed.

Store the chillers inside, at ambient temperatures lower than 50°C.

Keep the chillers far from heat sources.

Do not expose the chillers to direct sun light.

Receiving and handling

The unit should be inspected immediately after receipt for possible damage.

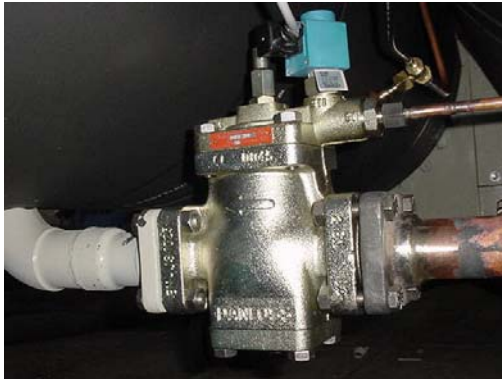
The chillers are shipped ex-factory and all claims for handling and shipping damage are the responsibility of the consignee.

Neoprene vibration pads are shipped loose. Check that these items have been delivered with the unit.

Extreme care must be used when rigging the equipment to prevent damage to the control panels or refrigerant piping.

The unit can be lifted by fastening the rigging hooks to the four corners of the unit where the rigging eyes are located. Spreader bars must be used between the rigging lines to prevent damage to the control panels, piping and motor terminal boxes.

Figure 1 - Main components



△ ATTENTION

For unit water connections and wiring, refer to dimensional drawing and wiring diagram.

Location and mounting

The unit must be mounted on a level concrete or steel base and must be located to provide service clearance (3200 mm) at one end of the unit for possible removal of evaporator tubes and/or condenser tubes. Evaporator and condenser tubes are rolled into the tube sheets to permit replacement if necessary. Clearance at all other points, including the top, is 1 meter.

Make sure that the floor or structural support is adequate to support the full operating weight of the complete unit.

Vibration pads

The shipped-loose neoprene vibration pads should be located under the corners of the unit (unless the job specifications state otherwise). They are installed to be flush with the sides and outside edge of the feet. For vibration-damping installation, refer to dimensional drawing of the unit. If no screws are used for fixing the unit to the floor, install anti-slip rubber between the floor and the vibration pads.

△ ATTENTION

Before to deliver the units, refrigerant and oil valves are closed, to insulate the two fluids during the transport. The valves have to be kept closed till start-up, that has to be performed by Daikin technicians.

Water piping

Evaporator and condenser water piping

All evaporators and condensers come standard with groove-type nozzles for Victaulic couplings (also suitable for welding), or optional flange connections. The installing contractor must provide matching mechanical connections of the size and type required.

Important notes on welding

If welding is to be performed on the mechanical or flange connections:

1. Remove the solid-state temperature sensor and thermostat bulbs from the wells to prevent damage to those components.
2. Properly ground the unit or severe damage to the unit controller can occur.

Water pressure gauge connection taps and gauges could be provided in the field piping at the inlet and outlet connections of both vessels for measuring the water pressure drops. The pressure drops and flow rates for the various evaporators and condensers are job specific and the original job documentation can be consulted for this information. Refer to the nameplate on the vessel shell for identification.

Be sure that water inlet and outlet connections match certified drawings and stenciled nozzle markings. The condenser is connected with the coolest water entering at the bottom to maximize subcooling.

Note: When common piping is used for both heating and cooling modes, care must be taken to provide that water flowing through the evaporator cannot exceed the maximum value which can cause the discharge of refrigerant through the relief valve or damage to controls.

The piping must be supported to eliminate weight and strain on the fittings and connections. Piping must also be adequately insulated. A cleanable water strainer must be installed in both water inlet lines. Sufficient shutoff valves must be installed to permit draining the water from the evaporator or condenser without draining the complete system.

⚠ WARNING

To avoid tubes damages on heat exchangers tubes, cleanable water strainer must be installed in both water inlet lines. Strainer mesh size has to be 1mm.

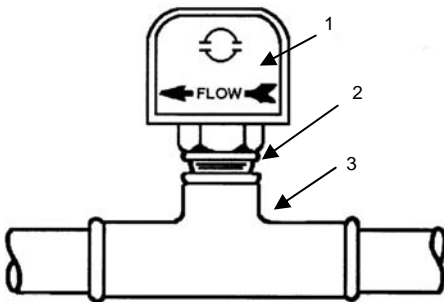
Flow switch

A water flow switch must be mounted in the evaporator inlet water line to signal the presence of adequate water flow to the vessel before the unit can start. It also serves to shut down the unit in the event that water flow is interrupted, thus preventing the evaporator from freeze-up, but the flow switch operation cannot be used as unit control.

A flow switch is available as standard. It is a "paddle" type switch and adaptable to any pipe size from 1 inch to 8 inches.

Installation should be as shown in figure 2.

Figure 2 - Flow switch mounting



- 1 Flow direction marked on switch
- 2 1 inch (25mm) NPT flow switch connection
- 3 Tee

Electrical connections must be made to terminals 5 and 23 of M1 terminal board for the evaporator, to terminals 5 and 8 for the condenser. Flow switch contact quality must be suitable for 24 VAC, low current (16mA). Flow switch wire must be in separate conduit from any high voltage conductors (115 VAC and higher).

⚠ WARNING

Freeze notice: neither the evaporator nor the condenser is self-draining; both must be blown out to help avoid damage from freezing.

The piping should also include thermometers at the inlet and outlet connections and air vents at the high points.

The water heads can be interchanged (end for end) so that the water connections can be made at either end of the unit. If this is done, new head gaskets must be used and control sensors relocated.

In cases where the water pump noise can be objectionable, vibration isolation sections are recommended at both the inlet and outlet of the pump. In most cases, it will not be necessary to provide vibration eliminator sections in the condenser inlet and outlet water lines. But they can be required where noise and vibration are critical.

Cooling tower

If cooling tower is used, a balancing valve is recommended. Some form of temperature control is also required if cooling tower water should be very cold. Unit microprocessor includes the control for cooling tower fans. Therefore it is suggested to make the relevant wiring connections.

Water treatment

Before every start-up, clean and flush the cooling water circuit. Make sure tower blow-down or bleed-off is operating. It should be recognized that atmospheric air contains many contaminants that increase the need for proper water treatment. The use of untreated water can result in corrosion, erosion, sliming, scaling or algae formation. Daikin assumes no responsibility for the results of untreated or improperly treated water.

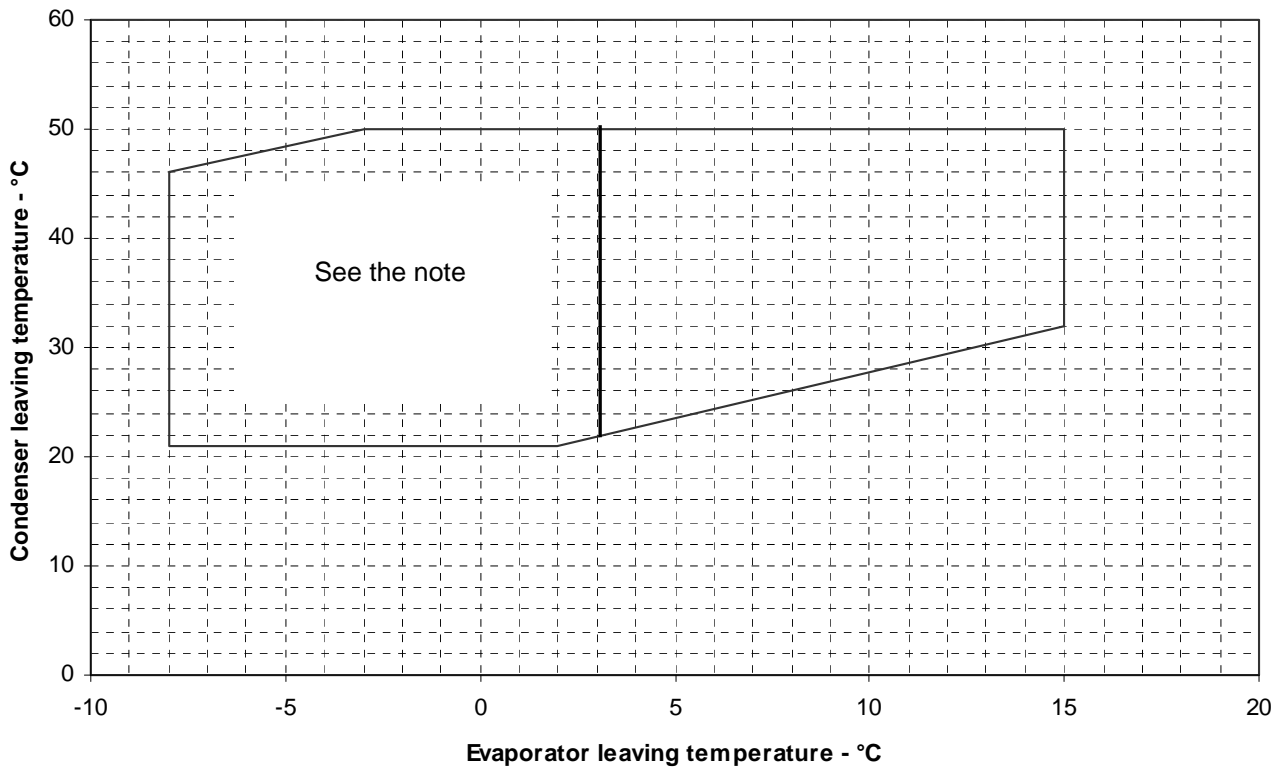
Glycol solution

WARNING

Use exclusively glycol for industrial applications. Do not use antifreeze for automotive applications (this kind of antifreeze contains inhibitors that cause the evaporator tubes plating). Type and managing of the glycol have to be according to rules in force.

Temperature and water flow limits

Operating Range



Operating range	Operating range
Condenser leaving temperature (°C)	Condenser outlet temperature (°C)
Evaporator leaving temperature (°C)	Evaporator outlet temperature (°C)
See the note	See the note

Note: The use of glycol is necessary for evaporator outlet water temperature below +3°C.

Flow rates below the minimum values shown in the evaporator and condenser pressure drop curves, may cause freeze-up problems, scaling and poor control. Flow rates above the maximum values shown in the evaporator and condenser pressure drop curves will result in unacceptable pressure drops, excessive erosion and tube vibrations potential cause of tubes failure.

Evaporator freeze protection

1. If the unit will not operate during the winter, drain and flush the evaporator and chilled water piping with glycol. Drain and vent connections are provided on the evaporator.
2. Insulate the water pipes, especially the chilled water side.

Note: Freeze damages are not considered warranty failures. Daikin declines any liability.

Condenser protection and design considerations

When the unit is not operating, the condenser temperature and the liquid refrigerant line can go down the room temperature if the cooling fluid comes from lake, river or bed water and the water valves have a blow-by. This problem occurs when cold water circulates inside the condenser and the unit is off waiting to be loaded. Under these conditions:

3. Shut-off the condenser water pump when the compressor is off.
4. Verify the liquid line solenoid valve is operating properly.

Chilled water temperature sensor

The chiller is equipped with a microprocessor. Be careful when working around the unit to avoid damaging cables and sensors. Check the cables before running the unit. Avoid rubbing the cables on the frame or other components. Verify the cables are firmly anchored. If the temperature sensor is removed from the well for servicing, do not wipe off the heat conducting compound supplied in the well and place the sensor correctly.

Safety valves

Each system will be equipped with a safety valve on condenser and evaporator in order to release the refrigerant charge in case of faulty operation. Most codes require that relief valves be vented to the outside, and this is a desirable practice for all installations.

IMPORTANT

To prevent injuries for R134a inhalation, avoid releasing the refrigerant in the atmosphere or inside. The relief valves have to be vented to the outside, according to the rules in force in the country of the installation. The installer is responsible for sizing the bleeder pipes and connecting the relief valves to them.

Electrical connections

Wire size must be in accordance with the nameplate data and the rules in force.

McQuay Italia S.p.A. assumes no responsibility for the results of improperly electrical connections.

CAUTION

**Connections to terminals must be made with copper lugs and copper wire.
Qualified and licensed electricians must perform wiring. Shock hazard exists.**

Power wiring to compressors must be in proper phase sequence. For this reason, phase monitor is supplied as standard.

Voltage unbalance

Extreme voltage unbalance in a three-phase system is the cause of increase in motor temperature. The voltage unbalance between phases must not exceed 2%, according to the following calculation.

$$\text{unbalance \%} = \frac{(V_x - V_{AVG}) \times 100}{V_{AVG}}$$

V_x = phase with the maximum unbalance

VAVG = average voltage

i.e. the three phases are 383V, 386V e 392V, the average is:

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

therefore unbalance % is:

$$\frac{(392-387) \times 100}{387} = 1,29\% \text{ less then the maximum allowed (2\%)}$$

Control circuit

McQuay PFS unit's circuit control is supplied with 110 Vac power.

Move the ON/OFF switch controller (Q0) to the "off" position every time unit operation is not required.

Inside the controller are installed connecting terminals for the water flow lock. See the wiring diagram to operate the correct connection on the field. The purpose of the water flow interlocked switch is avoiding the compressor operation till the evaporator and condenser pumps are able to grant the correct water flow. The flow switch or the differential pressure switch is an accessory supplied by McQuay Italia upon request however necessary to be installed on the unit.

It is recommended to let the microprocessor controlling the pumps for a better plant system.

In case of external control on the pumps use the following procedure.

Evaporator water pump:

- start-up the pump 2 minutes before turn on the unit;
- switch off the pump 5 minutes after turn off the unit.

Condenser water pump:

- start the pump 30 seconds before turn on the unit;
- switch on the pump 1 minute after the last compressor is off.

When the unit is not operating the condenser pump must be always off.

Circuit control test

All PFS units are factory tested. Both the control and power circuits are carefully inspected before delivering.

Operation

Operator responsibilities

It is important that the operator become familiar with the equipment and the system before attempting to operate the chiller. In addition to reading this manual, the operator should study the operation manual for the controller and the wiring diagram furnished with the unit before starting, operating, or shutting it down.

During the initial startup of the chiller the McQuay technician will be available to answer any questions and instruct in the proper operating procedures.

It is recommended that the operator maintain an operating log for each individual chiller unit. In addition, a separate maintenance log should be kept of the periodic maintenance and servicing activities.

This McQuay chiller represents a substantial investment and deserves the attention and care normally given to keep this equipment in good working order. If the operator encounters abnormal or unusual operating conditions, it is recommended that a McQuay service technician be consulted.

Safety

The machine must be firmly secured to the ground.

It is essential to observe the following instructions:

- The machine must be raised only by the lifting points. Only these points can support the whole weight of the unit.
- Do not allow unauthorised and/or unqualified personnel to access the machine.
- It is forbidden to access the electrical components without having opened the machine's general disconnecting 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.

- All operations on the refrigerant circuit and on components under pressure must be carried out by qualified personnel only.
- Replacement of a compressor or addition of lubricating oil must be carried out by qualified personnel only.
- Sharp edges can cause wounds. Avoid direct contact.
- Avoid introducing solid bodies into the water pipes while the machine is connected to the system.
- A mechanical filter must be installed on the water pipe connected to the heat exchanger inlet.
- The machine is supplied with safety valves, that are installed on both the high and the low pressure sides of the refrigerant circuit.

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 with this manual.

It is 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
- move the injured person in a warm place far from the unit and in rest position
- contact immediately emergency rescue personnel of the building or if the Health Emergency Service
- wait without leaving the injured person alone until the rescue operators come
- give all necessary information to the the rescue operators

WARNING

It 's absolutely forbidden to remove all the protections of the moving parts of the unit

Nomenclature

	EWW	D	C11	BJ	YN	N	****
Machine type							
ERA: Air-cooled condensing unit							
EWW: Water-cooled packaged water chiller							
EWL: Remote condenser water chiller							
EWA: Air-cooled chiller, cooling only							
EWY: Air-cooled chiller, heat pump							
EWC: Air-cooled chiller, cooling only with centrifugal fan							
EWT: Air-cooled chiller, cooling only with heat recovery							
Refrigerant							
D: R-134a							
P: R-407C							
Q: R-410A							
Capacity class in kW (cooling)							
Always a 3-digit code							
Cap < 50 kW: not rounded: example: 37 kW => 037							
50 < Cap < 999 kW: rounded 0/5: 536 kW => 535							
Cap > 999 kW use C symbol (C=100): example: 2578 kW => C26							
Model series							
first character : letter A, B,...: major modification							
second character : letter A,B,... : minor modification DENV							
letter J-W... : minor modification New Series							
Voltage							
V1: ~ / 220 - 240 V / 50 Hz							
V3: 1~ / 230 V / 50 Hz							
T1: 3~ / 230 V / 50 Hz							
W1: 3N~ / 400 V / 50 Hz							
Y1: 3~ / 380-415 V / 50 Hz							
YN: 3~ / 400 V / 50 Hz							
Hydraulic module/Heat recovery version/ Pump & electrical options (Consult Selection software)							
N: No Hydraulic components							
M: Modular							
A-V: Combination of specific options							
Option code (Consult Selection software)							
****: 4 digits							
Option regarding efficiency version, sound version							
/H: High ambient version							
/A: High efficiency version							
/Q: Extra low noise version							
/Z: High efficiency and Extra low noise version							

Sound pressure level EWWD-BJYNN

Unit size	Sound pressure level at 1 m from the unit in free field (ref. factor 2×10^{-5})								
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	dBA
380	63,5	70,5	80,0	74,5	74,0	68,5	60,5	50,5	78,0
460	64,5	71,5	81,0	75,5	75,0	69,5	61,5	51,5	79,0
550	65,5	72,5	82,0	76,5	76,0	70,5	62,5	52,5	80,0
750	66,5	73,5	83,0	77,5	77,0	71,5	63,5	53,5	81,0
850	67,0	74,0	83,5	78,0	77,5	72,0	64,0	54,0	81,5
900	67,5	74,5	84,0	78,5	78,0	72,5	64,5	54,5	82,0
C10	68,0	75,0	84,5	79,0	78,5	73,0	65,0	55,0	82,5
C11	68,5	75,5	85,0	79,5	79,0	73,5	65,5	55,5	83,0

Note: Average sound pressure level rated in accordance with ISO 3744, free field semispherical conditions.

Unit description

The unit is equipped with a Fr4 series single screw compressor and includes a flooded shell-and-tube evaporator with the refrigerant out of the high efficiency tubes and the water inside them, a shell-and-tube condenser operating with the refrigerant out the high efficiency tubes and the cooling water inside them.

The single semi-hermetic screw compressor uses the suction gas coming from the evaporator to chill the motor and to allow an excellent operation of the unit in all working load conditions.

Besides the normal lubrication of the moving parts, the oil injection system allows the sealing of the screw granting the gas compression.

The refrigerant circuit also installs a rotating valve with a mechanical pilot system that controls the refrigerant level inside the heat exchangers even during the PUMP-DOWN operation.

All the described components are managed by an innovative microprocessor control system able to monitor all operating parameters to optimise the process.

A self-diagnostic system helps the operator detect alarm and failure cause.

Refrigerant cycle description

The low temperature refrigerant gas coming from the evaporator to the compressor cools the electric motor. Then it is compressed and during this process the refrigerant is mixed with the oil coming from the separator. The high-pressure oil/ refrigerant mixture is introduced into the centrifuge-type high-efficiency oil separator. The oil settles down at the separator end plate and is forced by the pressure difference back to the compressor while the refrigerant separated from the oil is delivered to the condenser.

The refrigerant is equally distributed on all tube bundle surface inside the condenser. On its way across the heat exchanger's tubes, the refrigerant de-superheats and starts to condense. De-superheating and condensing heat is taken off by condensing water, consequently increasing the water temperature.

Liquid condensed at saturation temperature crosses the subcooling section still yielding heat, which increases the cycle efficiency. The subcooled liquid crosses the rolling gear which starts an expansion process resulting in a pressure drop and flashing of part of the refrigerant.

The result is a low-pressure and low-temperature liquid and gas mixture that is conveyed to the evaporator.

After being evenly distributed along the tube bundle, the liquid-gas refrigerant exchanges heat with the water to be cooled, thus reducing the water temperature while it gets completely vaporised.

The refrigerant leaves the evaporator in gas condition and is drawn by the compressor again to start a new cycle.

Evaporator

The evaporator is flooded shell-and-tube type, with the refrigerant outside the tubes and the water through the inside. Normally, no maintenance or service operation is required. When it is necessary to replace a tube it is easy to remove the old one.

Condenser

The condenser is shell-and-tube type, with the refrigerant outside the tubes and the water through the inside. The condenser tubes are externally finned and expanded on the tube plate. All units have a built-in subcooler in the condenser, also equipped with a safety valve. If required, it is possible to remove and replace the tubes.

Expansion valve

The expansion valve is directly commanded by a refrigerant level sensor placed on the condenser. The expansion valve controls the level of liquid refrigerant that floods the whole built-in sub-cooling section of the shell-and-tube condenser for proper operation of the system.

A microprocessor-controlled solenoid valve is fitted in the expansion valve body. It allows the automatic control of pump-down function and the valve opening during the shutdown period.

The correct positioning of the liquid sensor and appropriate refrigerant charge (ex-factory) allows an efficient and reliable unit operation.

Clear refrigerant sight glasses are located on the condenser and evaporator shells to verify immediately the adequate charge.

Refrigerant level sensor

The level sensor includes a floating element that detects the refrigerant level inside the condenser, commanding the expansion valve that, in turn, controls the refrigerant flow.

A regulating valve, installed on the sensor flange, allows the level to stabilise. This valve is adjusted during factory tests and normally does not require any further field tuning except for particularly unstable plants in which case qualified personnel must complete the adjustment.

Compressors

The compressor is driven by a special motor fitted at the end of the main driving shaft. It consists of two screwed cast iron elements: the main one includes all moving parts such as the main rotor and the two satellites, the second element includes the three-phase 2-pole electric motor.

The gas flows through the electric motor, cooling the windings before entering the suction ports. Sensors inside the windings constantly monitor the motor temperature, preventing from dangerous overheating. A terminal box including the connectors for thermistors and power wiring is located on top of the motor casing.

The compressor moving elements doing the compression include 3 rotating parts; there are no reciprocating or eccentric moving parts inside the compressor. Basic elements are the main rotor and two exactly opposed satellite rotors tightly meshing with the main one. A specially shaped synthetic material between the main rotor and the satellites provides tightness during the compression. The main shaft on which both the motor and the main rotor are fitted, is supported by 3 ball bearings. This system is balanced both statically and dynamically before the assembly. Two large covers are also fitted on the compressor sides for an easy access to the satellites, rotor, shaft and bearings without affecting the assembly tolerances.

Compression process

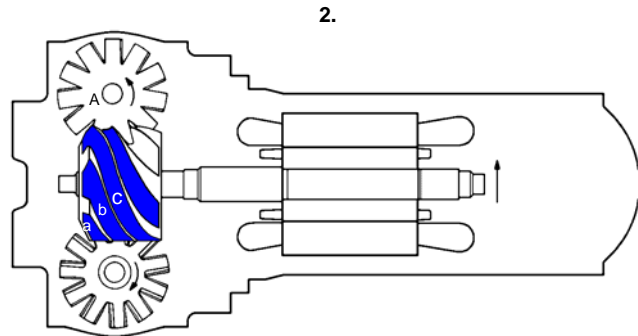
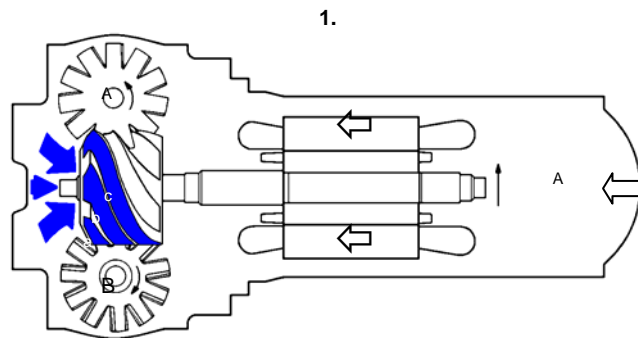
The refrigerant suction, compression and discharge process in the single-screw compressor is done on a continuous flow basis through each satellite. During this operation, the volume is progressively reduced and the refrigerant compressed. After the compression, the gas is discharged through properly designed ports. See figure 3 for suction, compression and discharge cycle.

1. and 2. Suction

Main rotor flutes 'a', 'b' and 'c' are in communication with the suction chamber, via the bevelled rotor end face, at one end, and are sealed by the teeth of star rotor A at the other end. As the main rotor turns, the effective length of the flutes increases with a corresponding increase in the volume open to the suction chamber: Diagram 1 clearly shows this process. As flute 'a' assumes the position of flutes 'b' and 'c' its volume increases, inducing suction vapour to enter the flute.

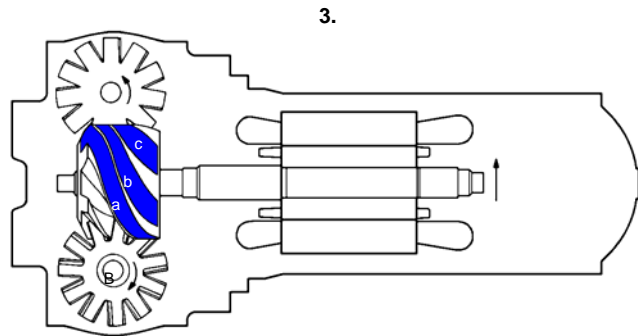
Upon further rotation of the main rotor, the flutes which have been open to the suction chamber engage with the teeth of the other star rotor. This coincides with each flute being progressively sealed by the main rotor. Once the flute volume is closed off from the suction chamber, the suction stage of the compression cycle is complete.

A Suction gas



3. Compression

As the main rotor turns, the volume of gas trapped within the flute is reduced as the length of the flute shortens and compression occurs.



4. Discharge

As the star rotor tooth approaches the end of a flute, the pressure of the trapped vapour reaches a maximum value occurring when the leading edge of the flute begins to overlap the triangular shaped discharge port.

Compression immediately ceases as the gas is delivered into the discharge manifold. The star rotor tooth continues to scavenge the flute until the flute volume is reduced to zero. This compression process is repeated for each flute/star tooth in turn.

While the compression process described above is occurring in the upper half of the compressor, there is an identical process taking place simultaneously in the lower half using star B, thus each main rotor flute is used twice per rotor revolution (one time for one tooth in each star rotor). The compression process may be likened to an assembly of six double-acting cylinders (the main rotor flutes) in which the star rotor teeth move as pistons (always in the same direction).

A Discharge gas

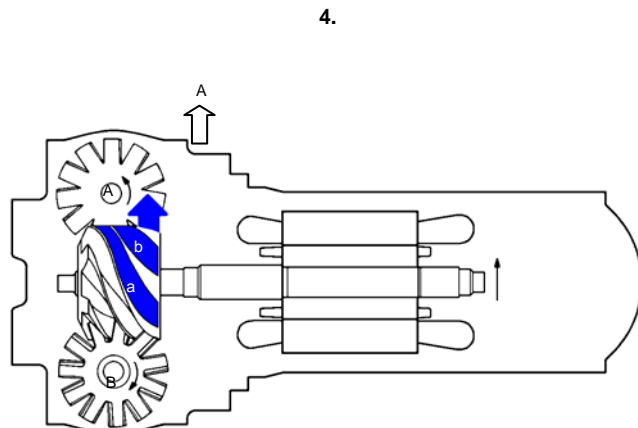


Figure 3 - Compression process

Capacity control

The compressors are provided with continuously variable capacity control as standard. This system allows unit load to be equal to plant demand. Stepless capacity control is permitted by a pair of sliding valves fitted in the compressor, one for each half of the symmetrical compression process. Each slide valve is housed in a semicircular slot in the wall of the annular ring which encloses the main rotor. As the slide valve travels axially from the full load position it uncovers a port, which vents part of the gas trapped in the main rotor flute back to the suction side before compression can begin. When the flute has passed beyond the port, compression commences with a reduced volume of gas. However, a simple bypass arrangement without any further refinement would produce an undesirable drop in the effective volume ratio which in turn causes under-compression and inefficient partial-load operation. To overcome this problem, the slide valve is shaped so that it delays the opening of the discharge port at the same time as the bypass slot is created.

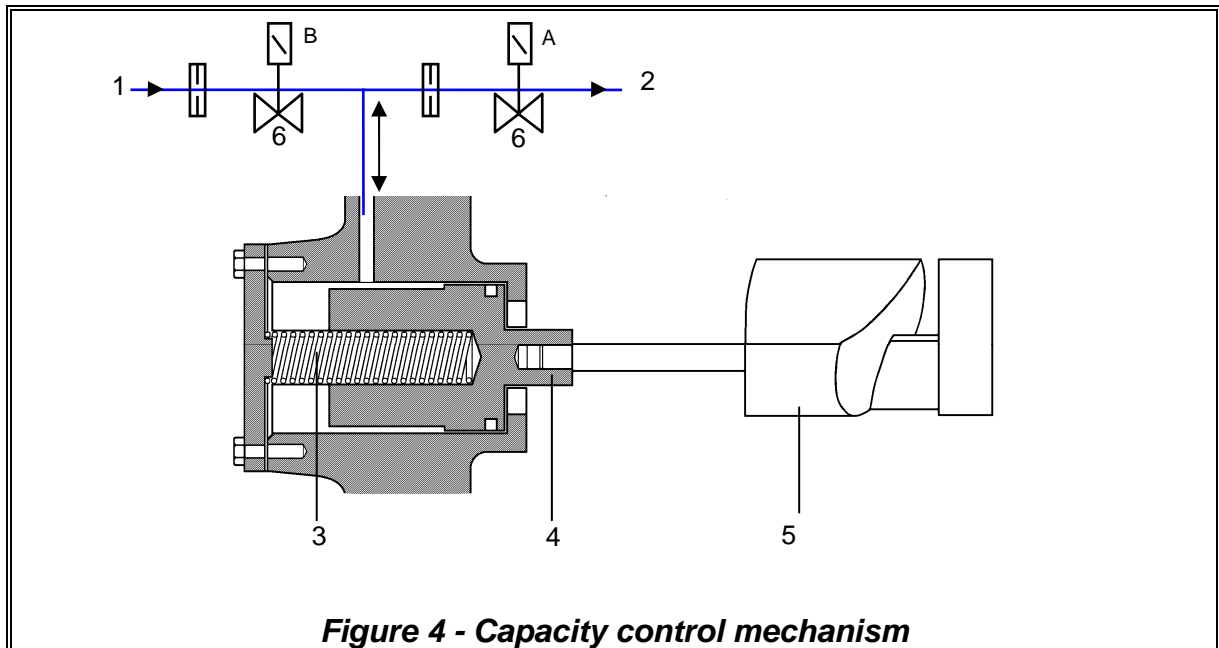
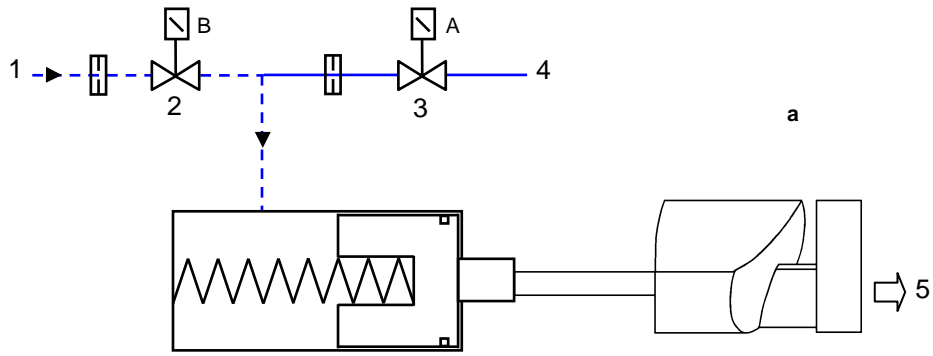
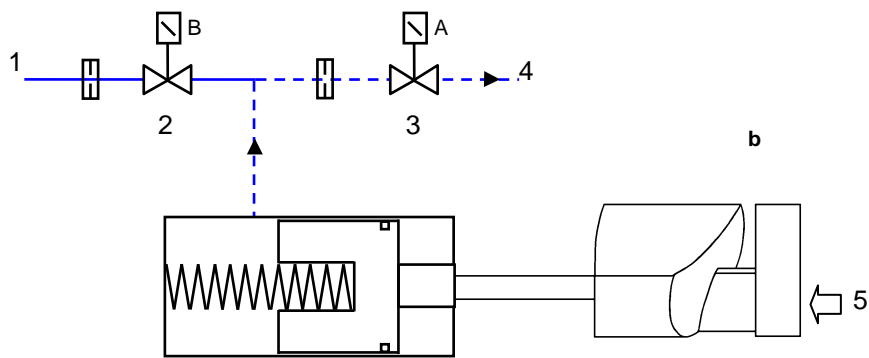


Figure 4 - Capacity control mechanism

- 1 Oil supply
- 2 Oil vent
- 3 Spring
- 4 Piston
- 5 Slide
- 6 NC (normally closed)



Oil Pressure + Spring Force > Suction/Discharge Differential Pressure = Slide and Piston Move Towards Unload



Suction/Discharge Differential Pressure > Spring Force = Slide and Piston Move Towards Load

a Compressor unloading

- 1 Oil supply
- 2 Energised (open)
- 3 De-energised (closed)
- 4 Oil vent
- 5 Unload

b Compressor loading

- 1 Oil supply
- 2 De-energised (closed)
- 3 Energised (open)
- 4 Oil vent
- 5 Load

CAPACITY CONTROL ACTION	SOLENOID VALVE A	SOLENOID VALVE B
Load compressor Oil is vented from the capacity control cylinder. The action of the suction/discharge differential pressure on the slide/piston assembly overcomes the force of the unloading spring and moves the slide valve towards the maximum load position.	Energised (open)	De-energised (close)
Unload compressor High pressure oil is admitted to the capacity control cylinder. Oil pressure supplements the force of the spring acting on the unload side of the piston. The combined force is sufficient to overcome the action of the suction/discharge differential pressure and move the slide valve towards the minimum load position.	De-energised (close)	Energised (open)
Hold slide valve position The slide valve is hydraulically locked at the desired load position.	De-energised (close)	
¹ Start-up 		
1 Start requested 2 Compressor starts (loading inhibited) 3 Compressor permitted to load 4 Compressor stopped 5 60 seconds 6 Solenoid valve B energised (open) 7 Solenoid valve B de-energised (open) 8 Solenoid valve B energised (open) until compressor required to load 9 Time		

Figure 5 - Continuously variable capacity control

Oil system control

Each screw compressor is connected to a tank (oil separator) that separates and collects the oil carried by the discharge gas.

The discharge gas pressure pushes the oil into the compressor where, after passing through a high capacity filter, is conveyed to the main injection port for compression sealing and lubrication of all moving parts.

During the compression, the oil mixes with the discharge gas before being conveyed again into the oil separator to re-start the cycle.

The oil flow is granted by the pressure difference created between the condenser and the evaporator. This difference depends on the cooling water and evaporator water temperatures. During the start-up it is vital to establish the appropriate temperature difference quickly by checking the right cooling water temperature.

In order to achieve the correct pressure difference, the units install a regulating valve on the condenser outlet. That valve, monitored by an analogical signal released by the microprocessor installed in the electrical panel, is modulated depending on the unit compression ratio. The head of cooling water pump at zero flow rate should not exceed the maximum working pressure of condenser and plant water side.

After the oil filter, a pressure transducer is installed on the compressor for continuous monitoring of the oil pressure and transmitting the pressure values to the microprocessor. Oil pressure control prevents the compressor from a possible malfunction.

A flow switch is also installed on the oil piping to shut down the compressor in case of oil leak in the system.

Units already include the correct oil charge. Once the system is started, it is not necessary to fill additional oil, except for repair jobs or when a big quantity of oil has been removed from the system.

 **WARNING**

It is dangerous for the unit to execute a wrong maintenance on the lubricating system, including to over charge of oil or to use oil or oil filter different from the original ones. This operation must be performed only by qualified personnel. Please contact your local Daikin Service Centre.

Lubricating oils

Besides lubricating the bearing and other moving parts, the oil has the equally important task of granting the seal during the compression, improving the efficiency. The amount of oil injected is therefore well in excess of that required for lubrication alone.

Lubricating oil approved by Daikin is mentioned on the compressor label.

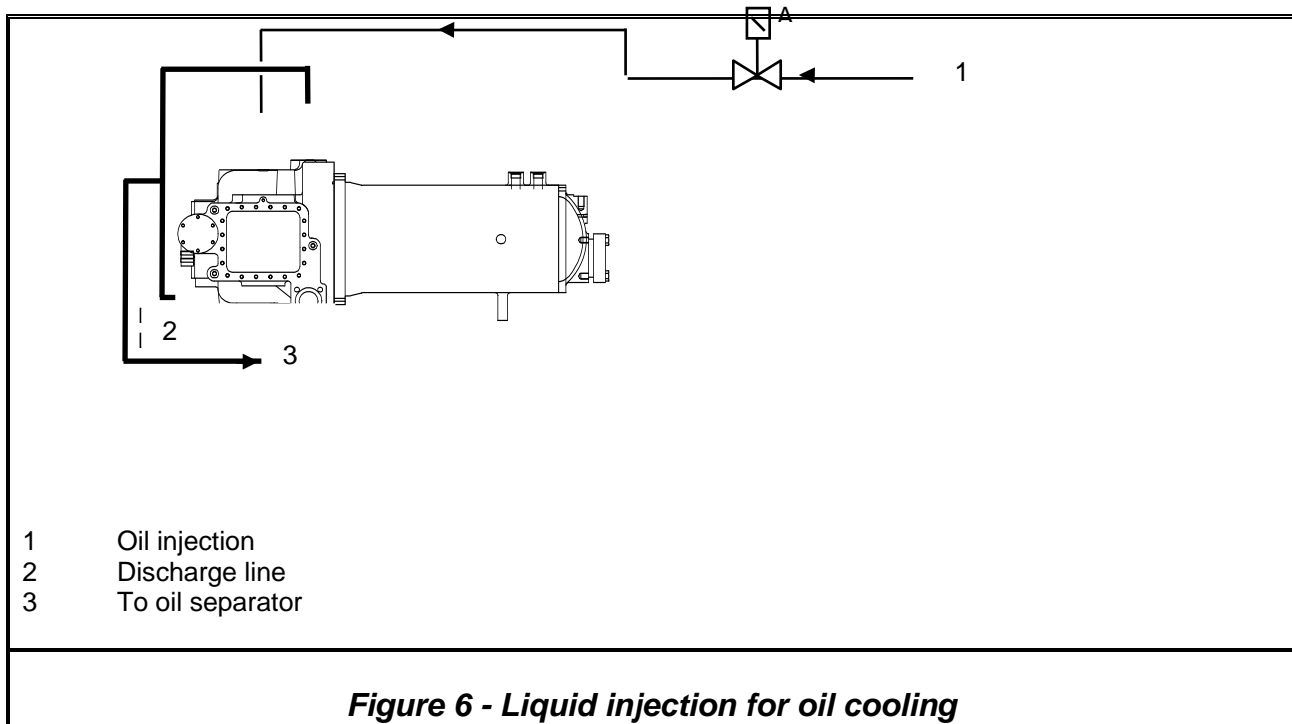
Liquid injection

The units do not require any device for cooling the discharge gas or the oil as far as the nominal operating range (7°C evaporator water outlet temperature, 35°C condenser water outlet temperature) is maintained.

When the operating conditions exceed the standard values (condenser water outlet temperature higher than 40°C), the compressor requires the oil cooling kit defined as “liquid injection”.

That system, supplied as standard on heat pump and heat recovery versions, is directly controlled by the unit microprocessor according to the separator oil temperature. Figure 6 shows the liquid injection circuit.

At normal operating condition and when the compressor is off, the solenoid valve (A), that controls the liquid injection, should be off. If the oil temperature exceeds the setpoint value set in the microprocessor, the solenoid valve (A) energises to inject liquid refrigerant into the dedicated port. The oil temperature gradually decreases down to the setpoint minus the control differential, and then the microprocessor de-energises the solenoid valve (A). The liquid injection may activate during plant starting and/or during unloading conditions.



Oil recovery system

Each compressor includes a system to recover the oil accumulated inside the evaporator during the normal operation.

This system consists of a jet pump able to collect continuously all the oil from the evaporator preventing from the accumulation due to the low speed refrigerant gas.

The high-pressure discharge gas feeds the jet pump that creates a depression, which allows the suction of the oil refrigerant mixture from the evaporator into the compressor to re-establish the oil level inside the lubrication system.

A sight glass on the oil recovery piping allows to check the oil-gas mixture flow to the compressor. If flow is insufficient or if the unit continuously stops on "Low Oil Level" alarm, verify the correct operation of the corresponding circuit.

Verify that:

1. The oil recovery system shutoff valves are open
2. The solenoid valve installed on the Jet Pump feed is working properly.

Heating elements

The compressor and the oil separator are provided with resistances for heating the compressor and the oil in the separator in order to prevent the migration and the condensation of the refrigerant during unit shutdown.

The auxiliary circuit should be energised for at least 12 hours prior to starting the compressor. The compressor and oil temperatures should be sufficiently high before starting the system, to minimise lubrication problems and liquid blow risk. The microprocessor monitors the oil temperature directly and inhibits the compressor starting if the oil temperature is not 5°C higher, at least, than the evaporating saturation temperature. In that condition the compressor status will be: "Off: Oil Heating". For granting the good operation of the heating resistances, regularly verify their power input.

Controller

The unit controller has been designed to perform, step by step, compressors starting, load modulation, compressor protection and unload sequencing before stopping.

The controller can be used to modify unit setpoints and to check control parameters. To optimise unit operation, it is recommended to become familiar with the system.



Figure 7 - Controller panel

Control section - main features:

- Full routine operation at condition of:
 - High thermal load
 - High evaporator inlet water temperature (start-up)
 - Critical heat exchange
- Display of evaporator inlet/outlet water temperature
- Display of condensing/evaporating temperature and pressure
- Modulation of chilled water outlet temperature. Temperature tolerance $\pm 0.2^{\circ}\text{C}$
- Display of number of starts and running hours of each compressor
- Display of safety devices status
- Equalization of starts number and running hours for the compressors
- Optimised management of compressors load
- Management of cooling tower fans according to condensing pressure
- Automatic re-start in case of power failure
- Demand limit
- Soft load
- AOT reset
- Current limitation

Safety for each refrigerant circuit

High pressure (pressure switch)
Compressor overload
High discharge temperature of the compressor
Star / Delta transition failure
High differential oil pressure
No oil flow

System safety

Phase monitor
Freeze protection
Low pressure (pressure switch)
Evaporator flow switch

Regulation type

Proportional + integral + derivative modulation with input from the evaporator water sensor ($T = \pm 0.2^{\circ}\text{C}$)

Controller terminal

The controller terminal has following features:

- 4-line by 20-character backlit liquid crystal display
- Remote keypad capabilities (connection by RJ11 jack)
- "Clear language display
- Key-pad consisting of 15 keys
- Multilanguage
- No volatile memory for data storage
- General faults alarm LED
- 4-level password access to modify settings
- Service report displaying running hours and general conditions

Compressors rotation

The units automatically alternate the starting sequence of compressors for balancing starts number and running hours.

On "automatic mode", the compressor with the lowest number of starts is activated the first. If both compressors are running, the one with more running hours will stop first.

High condensation pressure control

The microprocessor is provided with a transducer for monitoring the condensation pressure. Although the main task of the high pressure transducer is to maintain the correct condensation pressure control (by monitoring the cooling towers when connected), the transducer also sends a signal to the microprocessor to stop the compressor when the discharge pressure is over the maximum limit. When the unit is off due to high condensation pressure, the microprocessor should be reset manually.

Mechanical high pressure switch

The high pressure switch is a single pole switch that opens when the pressure exceeds the limit. When the switch opens, the control relay is disconnected and the compressor shuts down.

The pressure switch is installed on the oil separator.

To reset the pressure switch, push the blue button and reset the alarm on the microprocessor.

Compressor motor protection

The compressors are protected against motor overheating by thermistors installed on each motor winding. The three thermistors, mounted in series, are connected to a device identified as MP1 and MP2 in the wiring diagram. The "compressor thermal relay" alarm can be reset manually on the keypad.

Repeated occurrence of this alarm during normal operation may indicate a potential problem with the compressor motor or excessive suction superheating due to low refrigerant charge. The overload relays (optional) are reset manually; both the relays and the microprocessor must be reset.

Phase monitor

The phase monitor provides protection against phase loss and phase reversal. Whenever any of these conditions occurs, a contact opens disabling the start-up or disconnecting the system.

WARNING

A wrong phase sequence may seriously damage the compressor.

When energising the unit, the phase monitor relay closes and the microprocessor enables the compressors for operation. If the output relay does not close, the microprocessor releases the "Phase Monitor" alarm. In that case perform the following tests:

1. Using an external phase tester, verify that R/S/T phase sequence is correct. A correct rotation is required for compressor operation. If phase sequence correction is required, turn off the unit and invert two phases on the main power supply line.
2. Turn on the unit. The phase monitor relay should now close.
3. If the alarm is still on, verify phase voltage with a voltmeter.

Supervisory program

The units can be monitored locally or via modem by the supervisory program that runs on PC under Windows 2000-XP.

The supervisory program is the best solution:

- To centralise all the information in just one local and/or remote PC
- To check all the parameters of the connected units
- To be kept updated about the alarms by modems or printers
- Data record for temperature, pressure and humidity
- Printouts of alarms, parameters and graphs
- To control several plants, located in different geographical areas, from a central station

The supervisory program allows:

- Display and modification of the microprocessors parameters
- Protection of the main parameters by multiple password levels
- Recording of data and graphics
- Display, print-out and record of the alarms

Maintenance

Pressure / Temperature

Pressure / Temperature for R-134a							
°C	bar	°C	bar	°C	bar	°C	bar
-14	0,71	12	3,43	38	8,63	64	17,47
-12	0,85	14	3,73	40	9,17	66	18,34
-10	1,01	16	4,04	42	9,72	68	19,24
-8	1,17	18	4,37	44	10,30	70	20,17
-6	1,34	20	4,72	46	10,90	72	21,13
-4	1,53	22	5,08	48	11,53	74	22,13
-2	1,72	24	5,46	50	12,18	76	23,16
0	1,93	26	5,85	52	13,85	78	24,23
2	2,15	28	6,27	54	13,56	80	25,33
4	2,38	30	6,70	56	14,28	82	26,48
6	2,62	32	7,15	58	15,04	84	27,66
8	2,88	34	7,63	60	15,82	86	28,88
10	3,15	36	8,12	62	16,63	88	30,14

Ordinary maintenance

Check on condenser performance

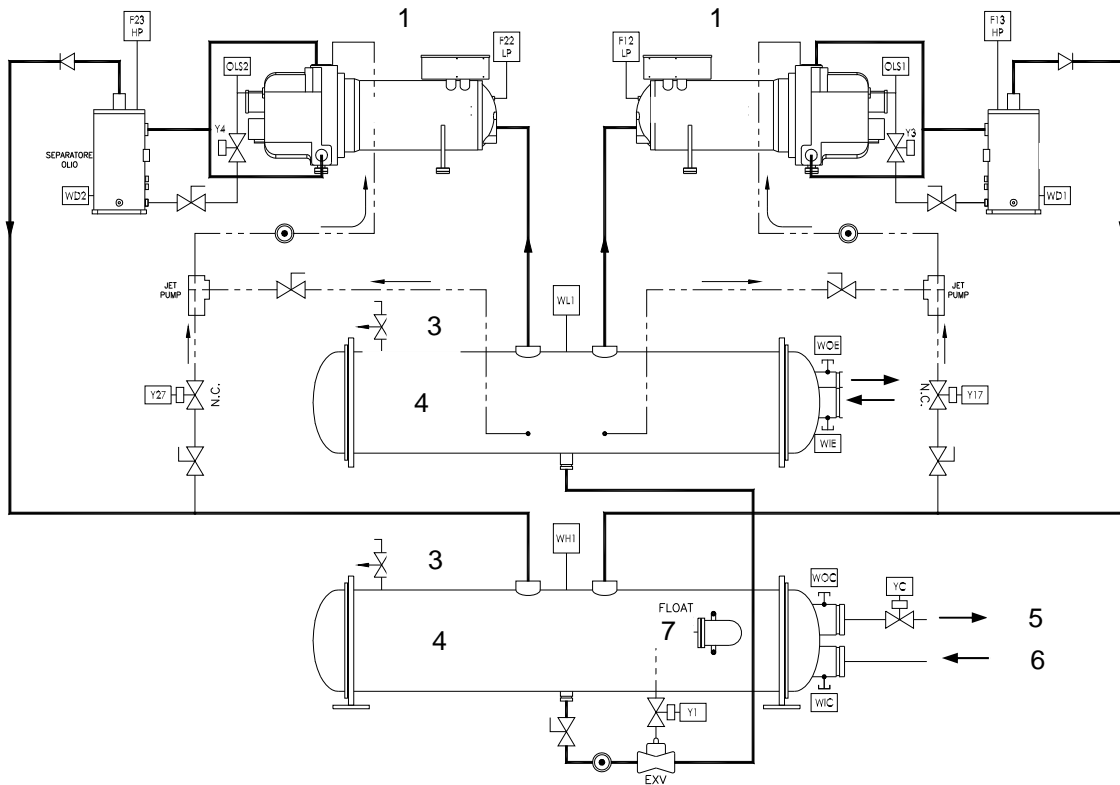
It is important to program periodic cleaning of copper piping to prevent from performance failure. This check can be done by verifying on the microprocessor that the difference between the condensing temperature and the condenser water outlet temperature does not exceed 5°C. In case of a higher deviation, it is recommended to clean the condenser.

Expansion valve and level control

The units are equipped with an expansion valve directly controlled by a level sensor installed on the condenser. This system should not normally require maintenance, since it was set during the final factory test. The expansion valve is activated by a solenoid valve managed by the microprocessor. This valve performs the evaporator pump-down during unit shutdown. In case of unit shutdown under low pressure condition, check the solenoid valve operation. A regulating valve, which was set at the factory, is installed on the level controller. However, an adjustment might be required in plants with severe unbalance. Closing this valve increases the time the expansion valve takes to close completely, thus making the level control response slower, while opening the valve speeds up the process. It is recommended not to vary the valve position unless strictly required.

Refrigerant circuit

The refrigerant circuit maintenance consists of recording all operating conditions and ensuring the correct oil and refrigerant quantity. (See maintenance program and the operating data at the end of this bulletin). During each inspection, the following data should be recorded: oil pressure, suction pressure, discharge pressure, condenser water temperature, evaporator water temperature. Changes in sub-cooling and/or discharge superheating could be due to low refrigerant charge. The correct discharge superheating value at full load should be between 8°C and 15°C for R134a refrigerant, and the sub-cooling should be between 3.5°C and 6.0°C (at full load).



- 1 Compressor
- 2 Oil separator
- 3 Safety valve
- 4 Evaporator
- 5 Water outlet
- 6 Water inlet
- 7 Float valve

Figure 8 - Typical refrigerant circuit

F12 – 22 LP	LOW PRESSURE SWITCH
F13 – 23 HP	HIGH PRESSURE SWITCH
OLS1 – 2	OIL LEVEL READOUT
Y1	LIQUID SOLENOID VALVE
Y3 – 4	OIL INJECTION SOLENOID VALVE
Y17 – 27	JET PUMP SOLENOID VALVE
YC	CONDENSATION CONTROL VALVE
WH1	HIGH PRESSURE TRANSDUCER (0÷30 bar)
WL1	LOW PRESSURE TRANSDUCER (-0,5÷7 bar)
WD1 – 2	DISCHARGE SENSOR
WOC	CONDENSER WATER OUTLET TEMPERATURE SENSOR
WIC	CONDENSER WATER INLET TEMPERATURE SENSOR
WOE	EVAPORATOR WATER OUTLET TEMPERATURE SENSOR
WIE	EVAPORATOR WATER INLET TEMPERATURE SENSOR

Refrigerant charge

PFS B units are designed to operate with R134a refrigerant. DO NOT USE any other refrigerant other than R134a.

WARNING

Ensure the correct water flow inside the evaporator and condenser while adding or removing the refrigerant to prevent from tubes freezing.
Freezing damages invalidates the warranty conditions.

Qualified personnel using correct material must perform refrigerant removing and drain operation. Inappropriate maintenance could lead to refrigerant or pressure loss. Do not discharge the refrigerant or the lubricant oil into the environment. Always use a proper recovery system.

WARNING

DO NOT OVERCHARGE THE SYSTEM

Excessive refrigerant charge increases the gas level in the evaporator contributing to the oil migration into the evaporator, which may trigger alarm for lack of oil into the compressor.

All units are shipped factory charged with a full operating charge of refrigerant. However if a unit must be recharged at the jobsite following are recommendations to apply. PSF B units are more sensitive to overcharging therefore it is preferable a slightly undercharge of refrigerant. The optimum charge allows the unit to run with a correct refrigerant flow at all operating conditions.

Check on refrigerant charge

To verify if the unit is operating with the correct refrigerant charge the following checks must be executed.

1. Run the unit at maximum operating load.
2. Check the evaporator leaving water temperature to be between 6÷8°C.
3. Check the condenser entering water temperature to be between 25 and 32°C.
4. Under the above mentioned conditions verify the following items.
 - a) The discharge superheating to be between 8 and 15°C
 - b) The sub-cooling to be between 4 and 6°C
 - c) The difference between leaving water temperature and evaporating temperature to be in 0,5÷4°C range.
 - d) The difference between condensing temperature and condenser leaving water temperature to be in 0,2÷3°C range.
 - e) The evaporator refrigerant level slightly laps last tubes row by checking the sight glass installed on each evaporator for a visual inspection.
 - f) The condenser refrigerant level to be included between the condensing and the sub-cooling sections by checking the sight glass installed on each condenser for a visual inspection.
5. Verify the sight glass on the liquid piping to be fully charged.

If one of the above parameters exceeds the limits, unit may require an additional refrigerant charge.

Note: As the unit changes the load, the sub-cooling will vary, but should become stable shortly; however it should never go below 3°C. The sub-cooling will vary somewhat with evaporator and condenser leaving water temperatures.

A refrigerant leak could be such small to have little effect on the circuit or could be such severe to cause the unit to shut down for operation of safety protections.

Procedure to charge a moderately uncharged PFS B unit.

1. Connect the refrigerant tank to the service-filling valve located on the evaporator.
2. Open the refrigerant cylinder and charge the unit weighing the gas – or – charge the unit during the compressor/s operation until the evaporating pressure allows the compressors running at full load.
3. With compressors running at 100%, add the refrigerant checking the evaporator gas level does not exceed the last tubes row.

WARNING

If during the unit operation there is an excessive formation of foam inside the evaporator, check the oil recovery system. An excessive oil dilution into the evaporator could be determined by a too rich refrigerant charge.

Electrical System

Maintenance of the electrical system involves the general requirement of keeping contacts clean and connections tight and checking on specific items as follows:

1. The compressor current draw should be checked and compared to nameplate value. Normally, the actual current will be lower, since the nameplate rating represents full load operation.
2. Inspection must verify that the oil heaters are operative. The heaters can be checked by ammeter reading. They should be energised whenever power is available to the control circuit and the compressor is inoperative. When the compressor runs, the heaters are de-energised.
3. At least once a quarter, all equipment protection controls except compressor overloads and high pressure switches should be made to operate and their operating points checked. A control can shift its operating point as it ages, and this must be detected so the controls can be adjusted or replaced. Pump interlocks and flow switches should be checked to be sure they interrupt the control circuit when tripped. Thermal relays and high pressure switches have to be checked separately at the test bench.
4. Absorbed current for electrical heaters in the compressor is about 4,1 A, while it is about 1,4 A for the oil separator.
5. The contactors in the motor starter should be inspected and cleaned quarterly. Tighten all terminal connections.
6. The compressor motor resistance to ground should be checked and logged semi-annually. This log will track insulation deterioration. A reading of 50 M Ω or less indicates a possible insulation defect or moisture and must be further checked.

WARNING

Never Megger a motor while in a vacuum. Severe motor damage can result.

Cleaning and Preserving

A common cause of service calls and equipment malfunction is dirt. This can be prevented with normal maintenance. The system components most subject to dirt are:

1. Permanent or cleanable filters in the air handling equipment must be cleaned in accordance with the manufacturer's instructions; throwaway filters should be replaced. The frequency of this service will vary with each installation.
2. Remove and clean strainers in chilled water system and condenser water system at every inspection.

Seasonal Servicing

Prior to shutdown periods and before starting up again, the following service procedures must be completed.

Annual Shutdown

1. Where the chiller can be subject to freezing temperatures, the condenser and chiller must be drained of all water. Dry air blown through the condenser will aid in forcing all water out. Removal of condenser heads is also recommended. The condenser and evaporator are not self-draining and tubes must be blown out. Water permitted to remain in the piping and vessels can rupture these parts if subjected to freezing temperature.

Forced circulation of antifreeze through the water circuits is one method of avoiding freeze up.

2. Take measures to prevent the shutoff valve in the water supply line from being accidentally turned on.
3. If a cooling tower is used, and if the water pump will be exposed to freezing temperatures, be sure to remove the pump drain plug and leave it out so any water that can accumulate will drain away.
4. Open the compressor disconnect switch, and remove the fuses. Set the manual I/O switch to the O position.
5. Check for corrosion and clean and paint rusted surfaces.
6. Clean and flush water tower for all units operating on a water tower. Make sure tower blowdown or bleed-off is operating. Set up and use a good maintenance program to prevent "liming up" of both tower and condenser. It should be recognized that atmospheric air contains many contaminants that increase the need for proper water treatment. The use of untreated water can result in corrosion, erosion, sliming, scaling or algae formation. It is recommended that the service of a reliable water treatment company be used.
7. Remove condenser heads at least once a year to inspect the condenser tubes and clean if required.

 **WARNING**

McQuay International assumes no responsibility for the results of untreated or improperly treated water.

Annual Startup

This is a good time to check all the motor winding resistance to ground. Semi-annual checking and recording of this resistance will provide a record of any deterioration of the winding insulation. All new units have well over 100 M Ω resistance between any motor terminal and ground.

1. The control circuit must be energised at all times, except during service. If the control circuit has been off and oil is cool, energise oil heaters and allow 24 hours for heater to remove refrigerant from the oil before starting.
2. Check and tighten all electrical connections.
3. Replace the drain plug in the cooling tower pump if it was removed at shutdown time the previous season.
4. Install fuses in main disconnect switch (if removed).
5. Reconnect water lines and turn on supply water. Flush condenser and check for leaks.

Repair of System

Pumping Down

If it becomes necessary to pump the system down, extreme care must be used to avoid damage to the evaporator from freezing. Always make sure that full water flow is maintained through the chiller and condenser while pumping down. To pump the system down, close all liquid line valves. With all liquid line valves closed and water flowing, start the compressor. Pump the unit down until the MicroTech II controller cuts out. Use a portable condensing unit to complete the pump down, condense the refrigerant, and pump it into the condenser.

A pressure regulating valve must always be used on the drum being used to build the system pressure. Also, do not exceed the test pressure given above. When the test pressure is reached disconnect the gas cylinder.

Pressure Testing

No pressure testing is necessary unless some damage was incurred during shipment. Damage can be determined upon a visual inspection of the exterior piping, checking that no breakage occurred or fittings loosened. Service gauges should show a positive pressure. If no pressure is evident on the gauges, a leak may have occurred, discharging the entire refrigerant charge. In this case, the unit must be leak tested to determine the location of the leak.

Leak Testing

In the case of loss of the entire refrigerant charge, the unit must be checked for leaks prior to charging the complete system. This can be done by charging enough refrigerant into the system to build the pressure up to approximately 70 kPa and adding sufficient dry nitrogen to bring the pressure up to a maximum of 850 kPa. Leak test with an electronic leak detector. Halide leak detectors do not function with R-134a. Water flow through the vessels must be maintained anytime refrigerant is added or removed from the system.

WARNING

Do not use oxygen or a mixture of R-22 and air to build up pressure as an explosion can occur causing serious personal injury.

To build up pressure, pressure regulating valve must be used. If pressure test is requested, disconnect the refrigerant cylinder before performing the test.

If any leaks are found in welded or brazed joints, or it is necessary to replace a gasket, relieve the test pressure in the system before proceeding. Brazing is required for copper joints.

After making any necessary repair, the system must be evacuated as described in the following section.

Evacuation

After it has been determined that there are no refrigerant leaks, the system must be evacuated using a vacuum pump with a capacity that will reduce the vacuum to at least 130Pa (\cong 1mmHg).

A mercury manometer, or an electronic or other type of micron gauge, must be connected at the farthest point from the vacuum pump. For readings below 130Pa, an electronic or other micron gauge must be used.

The triple evacuation method is recommended and is particularly helpful if the vacuum pump is unable to obtain the desired 130Pa of vacuum. The system is first evacuated to approximately 660Pa (\cong 5mmHg). Dry nitrogen is then added to the system to bring the pressure up to zero.

Then the system is once again evacuated to approximately 230Pa (\cong 2mmHg). This is repeated three times. The first pulldown will remove about 90% of the noncondensables, the second about 90% of that remaining from the first pulldown and, after the third, only 0,2% noncondensables will remain.

Charging the System

PFS B water chillers are leak tested at the factory and shipped with the correct charge of refrigerant as indicated on the unit nameplate. In the event the refrigerant charge was lost due to shipping damage, the system should be charged as follows after first repairing the leaks and evacuating the system.

1. Connect the refrigerant drum to the gauge port on the liquid line shutoff valve and purge the charging line between the refrigerant cylinder and the valve. Then open the valve to the mid-position.
2. Turn on both the cooling tower water pump and chilled water pump and allow water to circulate through the condenser and the chiller. (It will be necessary to manually switch on the condenser pump.)
3. If the system is under a vacuum, stand the refrigerant drum with the connection up, and open the drum and break the vacuum with refrigerant gas to a saturated pressure above freezing.
4. With a system gas pressure higher than the equivalent of a freezing temperature, invert the charging cylinder and elevate the drum above the condenser. With the drum in this position, valves open, water pumps operating, liquid refrigerant will flow into the condenser. Approximately 75% of the total requirement estimated for the unit can be charged in this manner.

- After 75% of the required charge has entered the condenser, reconnect the refrigerant drum and charging line to the service valve on the bottom of the evaporator. Again purge the connecting line, stand the drum with the connection up, and place the service valve in the open position.

IMPORTANT: At this point, the charging procedure should be interrupted and prestart checks made before attempting to complete refrigerant charge. The compressor must not be started at this time. (Preliminary check must first be completed.)

△ IMPORTANT

It is of utmost importance that all local, national, and international regulations concerning the handling and emission of refrigerants are observed.

Maintenance Schedule

	Monthly	Quarterly	Semi-Annually	Annually	As Required By Performance
I. Compressor					
A. Performance Evaluation (Log & Analysis) *	O				
B. Motor					
• Meg. Windings			X		
• Ampere Balance (within 10%)		X			
• Terminal Check (tight connections, porcelain clean)				X	
C. Lubrication System					
• Oil Lines Temperatures	O				
• Oil Solenoid Valve Operation		X			
• Oil Analysis				X	
• Oil Appearance (clear color, quantity)	O				
• Oil Filter Change					X
• Oil change if indicated by oil analysis					X
D. Unloading Operation					
• Compressor Loads:					
Record Motor Amps		X			
• Compressor Unloads:					
Record Motor Amps		X			
E. Internal Compressor Check					X
II. Controls					
A. Operating Controls					
• Check Settings and Operation			X		
• Check Unloading Setting and Operation			X		
• Verify Load Balance Operation			X		
B. Protective Controls					
• Test Operation of:					
Alarm Relay		X			
Pump Interlocks		X			
High and Low Pressure Cutouts		X			
High Discharge Temperature Cutout		X			
Oil Pump Pressure Differential Cutout		X			
III. Condenser					
A. Performance Evaluation	O				
B. Test Water Quality		X			
C. Clean Condenser Tubes				X	
E. Seasonal Protection					X
IV. Evaporator					
A. Performance Evaluation (Log Conditions And Analysis)	O				
B. Test Water Quality		X			
C. Clean Evaporator Tubes (as required)					X
E. Seasonal Protection					X
V. Expansion Valves					
A. Performance Evaluation		X			

Key: O = Performed by in-house personnel X = Performed by McQuay Service personnel

Maintenance Schedule, Cont.

	Monthly	Quarterly	Semi-Annually	Annually	As Required By Performance
VI. Compressor - Chiller Unit					
A. Performance Evaluation	O				
B. Leak Test:					
• Compressor Fittings and Terminal		X			
• Piping Fittings		X			
• Oil Pump Joints and Fittings		X			
• Vessel Relief Valves		X			
C. Vibration Isolation Test		X			
D. General Appearance:					
• Paint				X	
• Insulation				X	
VII. Starter					
A. Examine Contactors (hardware and operation)		X			
B. Verify Overload Setting and Trip		X			
C. Test Electrical Connections		X			
VIII. Optional Controls					
B. Liquid Injections Controls (verify operation)		X			

Key: O = Performed by in-house personnel X = Performed by McQuay Service personnel

CAUTION

Some compressors use power factory correction capacitors. Capacitors must be disconnected from the circuit to obtain a useful Megger reading. Failure to do so will produce a low reading. In handling electrical components, only fully qualified technicians must attempt service.

Prestart System Checklist

Chilled Water

- Piping complete
- Water system filled, vented
- Pumps installed, (rotation checked), strainers cleaned
- Controls (3-way, face and bypass dampers, bypass valves, etc.) operable
- Water system operated and flow balanced to meet unit design requirements

Condenser Water

- Cooling tower flushed, filled and vented
- Pumps installed, (rotation checked), strainers cleaned
- Controls (3-way, bypass valves, etc.) operable
- Water system operated and flow balanced to meet unit requirements

Electrical

- Power leads connected to the electrical panel
- Pump starters and interlock wired
- Cooling tower fans and controls wired
- Wiring complies with local codes
- Condenser pump starting relay installed and wired

Miscellaneous

- Relief valve piping complete
- Thermometer wells, thermometers, gauges, control wells, controls, etc., installed
- Minimum system load of 25% of machine capacity available for testing and adjusting controls

IMPORTANT

This checklist must be completed and sent to the local McQuay service location two weeks prior to start-up.

Obligatory routine checks and starting up apparatuses under pressure

The units are included in category IV of the classification according to European Directive PED 97/23/EC. For chillers belonging to this category, some local regulations require a periodic inspection by an authorized agency. Please check with your local requirements.

Important information regarding the refrigerant used

This product contains fluorinated greenhouse gases covered by the Kyoto Protocol. Do not vent gases into the atmosphere.

Refrigerant type: R134a
GWP(1) value: 1300

(1)GWP = global warming potential

The refrigerant quantity is indicated on the unit name plate. Periodical inspections for refrigerant leaks may be required depending on European or local legislation. Please contact your local dealer for more information.

Disposal

The unit is made of metal and plastic parts. All these parts must be disposed of in accordance with the local regulations in terms of disposal. Lead batteries must be collected and taken to specific refuse collection centres.



We reserve the right to make changes in design and construction at any time without notice, thus the cover picture is not binding.

Water-cooled screw chillers

EWWD380-C11BJYNN



Daikin units comply with the European regulations that guarantee the safety of the product.



Daikin Europe N.V. is participating in the EUROVENT Certification Programme. Products are as listed in the EUROVENT Directory of Certified Products.

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