Carrier

United Technologies

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

Unit with low-noise option

Air-Cooled Liquid Chillers

30RB 604-804

Nominal cooling capacity 607-774 kW / 50 Hz

AQUASNAP®

Original document

CONTENTS

CONTENTS

Prior to the initial start-up of the 30RB units, the people involved should be thoroughly familiar with these instructions and with the technical characteristics of the installation site.

30RB chillers are designed to provide a very high safety and reliability level making installation, start-up, operation and maintenance easier and more secure. They will provide safe and reliable service if used within their application range.

They are designed for an operating life of 15 years by assuming a 75% utilisation factor; that is approximately 100,000 operating hours.

The procedures in this manual are arranged in the sequence required for machine installation, start-up, operation and maintenance.

Be sure you understand and follow the procedures and safety precautions contained in the instructions supplied with the machine, as well as those listed in this guide, such as: protective clothing such as gloves, safety glasses, safety shoes and appropriate tools, and suitable qualifications (electrical, air conditioning, local legislation).

To find out, if these products comply with European directives (machine safety, low voltage, electromagnetic compatibility, equipment under pressure etc.) check the declarations of conformity for these products.

1.1 - Installation safety considerations

After the unit has been received, and before it is started up, it must be inspected for damage. Check that the refrigerant circuits are intact, especially that no components or pipes have shifted or been damaged (e.g. following a shock). If in doubt, carry out a leak tightness check. If damage is detected upon receipt, immediately file a claim with the shipping company.

Do not remove the skid or the packaging until the unit is in its final position. These units can be moved with a fork lift truck, as long as the forks are positioned in the right place and direction on the unit.

The units can also be lifted with slings, using only the designated lifting points marked on the unit (labels on the chassis and a label with all unit handling instructions are attached to the unit).

Use slings with the correct capacity, and always follow the lifting instructions on the certified drawings supplied for the unit.

Safety is only guaranteed, if these instructions are carefully followed. If this is not the case, there is a risk of material deterioration and injuries to personnel.

DO NOT COVER ANY PROTECTION DEVICES.

This applies to fuse plugs and relief valves (if used) in the refrigerant or heat transfer medium circuits. Check if the original protection plugs are still present at the valve outlets. These plugs are generally made of plastic and should not be used. If they are still present, please remove them. Install devices at the valve outlets or drain piping that prevent the penetration of foreign bodies (dust, building debris, etc.) and atmospheric agents (water can form rust or ice). These devices, as well as the drain piping, must not impair operation and not lead to a pressure drop that is higher than 10% of the control pressure.

Classification and control

In accordance with the Pressure Equipment Directive and national usage monitoring regulations in the European Union the protection devices for these machines are classified as follows:

	Safety accessories(1)	Over pressure protection in case of an external fire(2)
Refrigerant side		
High-pressure switch	x	
External relief valve(3)		x
Rupture disk		x
Fuse plug		x
Heat transfer fluid side		
External relief valve	(4)	(4)

(1) Classified for protection in normal service situations.
(2) Classified for protection in abnormal service situations. These accessories are sized for fires with a thermal flow of 10kW/m². No combustible matter should be placed within 6.5m of the unit.
(3) The instantaneous over-pressure limitation of 10% of the operating pressure does not apply to this abnormal service situation.
The control pressure can be higher than the service pressure. In this case either the design temperature or the high-pressure switch ensures that the service pressure is not exceeded in normal service situations.
(4) The selection of these discharge valves must be made by the personnel responsible for completing the hydraulic installation.

Do not remove these valves and fuses, even if the fire risk is under control for a particular installation. There is no guarantee that the accessories are re-installed if the installation is changed or for transport with a gas charge. When the unit is subjected to fire, safety devices prevent rupture due to over-pressure by releasing the refrigerant. The fluid may then be decomposed into toxic residues when subjected to the flame:

- ***Stay away from the unit.***
- ***Set up warnings and recommendations for personnel in charge to stop the fire.***
- ***Fire extinguishers appropriate to the system and the refrigerant type must be easily accessible.***

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

The external relief valves must always be connected to drain pipes for units installed in a closed room. Refer to the installation regulations, for example those of European standard EN 378 and EN 13136.

These pipes must be installed in a way that ensures that people and property are not exposed to refrigerant leaks. As the fluids can be diffused in the air, ensure that the outlet is far away from any building air intake, or that they are discharged in a quantity that is appropriate for a suitably absorbing environment.

Relief valves must be checked periodically. See paragraph "Repair safety considerations".

Provide a drain in the drain pipe, close to each relief valves, to avoid an accumulation of condensate or rain water.

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

1.2 - Equipment and components under pressure

These products incorporate equipment or components under pressure, manufactured by Carrier or other manufacturers. We recommend that you consult your appropriate national trade association or the owner of the equipment or components under pressure (declaration, re-qualification, retesting, etc.). The characteristics of this equipment/these components are given on the nameplate or in the required documentation, supplied with the products.

These units comply with the European Pressure Equipment Directive.

The units are intended to be stored and operate in an environment where the ambient temperature must not be less than the lowest allowable temperature indicated on the nameplate.

1.3 - Maintenance safety considerations

Carrier recommends the following drafting for a logbook (the table below should not be considered as reference and does not involve Carrier responsibility):

Intervention		Name of the commissioning engineer	Applicable national regulations	Verification Organism
Date	Nature (1)			

(1) Maintenance, repairs, regular verifications (EN 378), leakage, etc.

Engineers working on the electric or refrigeration components must be authorized, trained and fully qualified to do so.

All refrigerant circuit work must be carried out by a trained person, fully qualified to work on these units. He must have been trained and be familiar with the equipment and the installation. All welding operations must be carried out by qualified specialists.

Aquasnap Puron units use high-pressure R-410A refrigerant (the unit operating pressure is above 40 bar, the pressure at 35°C air temperature is 50% higher than for R-22). Special equipment must be used when working on the refrigerant circuit (pressure gauge, charge transfer, etc.).

Any manipulation (opening or closing) of a shut-off valve must be carried out by a qualified and authorised engineer, observing applicable standards (e.g. during draining operarations). The unit must be switched off during all operations.

NOTE: The unit must never be left shut down with the liquid line valve closed, as liquid refrigerant can be trapped between this valve and the expansion device and lead to the risk of a pressure increase. This valve is situated on the liquid line before the filter drier box.

Equip the engineers that work on the unit as follows:

Personal protection equipment (PPE) (1)	Operations		
	Handling	Maintenance, service	Welding or brazing(2)
Protective gloves, eye protection, safety shoe, protective clothing.	X	X	X
Ear protection.		X	X
Filtering respirator.			X

(1) We recommend to follow the instructions in EN 378-3.
(2) Performed in the presence of A1 refrigerant according to EN 378-1.

Never work on a unit that is still energized. Never work on any of the electrical components, until the general power supply to the unit has been cut.

If any maintenance operations are carried out on the unit, lock the power supply circuit in the open position ahead of the machine.

If the work is interrupted, always ensure that all circuits are still deenergised before resuming the work.

ATTENTION: Even if the unit has been switched off, the power circuit remains energised, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details. Attach appropriate safety labels.

It is recommended to install an indicating device to show if part of the refrigerant has leaked from the valve. The presence of oil at the outlet orifice is a useful indicator that refrigerant has leaked. Keep this orifice clean to ensure that any leaks are obvious. The calibration of a valve that has leaked is generally lower than its original calibration. The new calibration may affect the operating range. To avoid nuisance tripping or leaks, replace or re-calibrate the valve.

ATTENTION: In case of utilisation of service valves, do not forget to remount protection in order to avoid leakages.

Important information regarding the refrigerant used:

This product contains fluorinated greenhouse gas covered by the Kyoto protocol.

Fluid type: R410A

Global Warming Potential (GWP): 2088

CAUTION:

1. **Any intervention on the refrigerant circuit of this product should be performed in accordance with the applicable legislation. In the EU, the regulation is called F-Gas, N°517/2014.**
2. **Ensure that the refrigerant is never released to the atmosphere during installation, maintenance or equipment disposal.**
3. **The deliberate gas release into the atmosphere is not allowed.**
4. **If a refrigerant leak is detected, ensure that it is stopped and repaired as quickly as possible.**
5. **Only a qualified and certified personnel can perform installation operations, maintenance, refrigerant circuit leak test as well as the equipment disposal and the refrigerant recovering.**
6. **The gas recovery for recycling, regeneration or destruction is at customer charge.**
7. **Periodic leak tests have to be carried out by the customer or by third parties. The EU regulation set the periodicity here after:**

System WITHOUT leakage detection		No Check	12 Months	6 Months	3 Months
System WITH leakage detection		No Check	24 Months	12 Months	6 Months
Refrigerant charge/ circuit (CO_2 equivalent)		< 5 Tons	5 ≤ Charge < 50 Tons	50 ≤ Charge < 500 Tons	Charge > 500 Tons(1)
Refrigerant charge/ Circuit (kg)	R134A (GWP 1430)	Charge < 3.5 kg	3.5 ≤ Charge < 34.9 kg	34.9 ≤ Charge < 349.7 kg	Charge > 349.7 kg
	R407C (GWP 1774)	Charge < 2.8 kg	2.8 ≤ Charge < 28.2 kg	28.2 ≤ Charge < 281.9 kg	Charge > 281.9 kg
	R410A (GWP 2088)	Charge < 2.4 kg	2.4 ≤ Charge < 23.9 kg	23.9 ≤ Charge < 239.5 kg	Charge > 239.5 kg
	HFO's: R1234ze	No requirement			

(1) From 01/01/2017, units must be equipped with a leakage detection system.

8. **A logbook must be established for equipments subject to periodic leak tests. It should contain the quantity and the type of fluid present within the installation (added and recovered), the quantity of recycled fluid, regenerated or destroyed, the date and output of the leak test, the designation of the operator and its belonging company, etc.**
9. **Contact your local dealer or installer if you have any questions.**

The company or organisation that conducts a pressure switch test shall establish and implement a detailed procedure to fix:

- Safety measures
- Measuring equipment calibration
- Validating operation of protective devices
- Test protocols
- Recommissioning of the equipment.

Consult Carrier Service for this type of test. Carrier mentions here only the principle of a test without removing the pressure switch:

- Verify and and record the set-points of pressure switches and relief devices (valves and possible rupture discs)
- Be ready to switch-off the main disconnect switch of the power supply if the pressure switch does not trigger (avoid over-pressure or excess gas in case of valves on the high-pressure side with the recovery condensers)
- Connect a pressure gauge protected against pulsations (filled with oil with maximum pointer if mechanical), preferably calibrated (the values displayed on the user interface may be inaccurate in an instant reading because of the scanning delay applied in the control)
- Complete an HP Test as provided by the software (refer to the Control IOM for details).

If the machine operates in a corrosive environment, inspect the protection devices more frequently.

Regularly carry out leak tests and immediately repair any leaks. Ensure regularly that the vibration levels remain acceptable and close to those at the initial unit start-up.

Before opening a refrigerant circuit, purge and consult the pressure gauges.

Change the refrigerant after an equipment failure, following a procedure such as the one described in NF E29-795 or carry out a refrigerant analysis in a specialist laboratory.

If the refrigerant circuit remains open for longer than a day after an intervention (such as a component replacement), the openings must be plugged and the circuit must be charged with nitrogen (inertia principle). The objective is to prevent penetration of atmospheric humidity and the resulting corrosion on the internal walls and on non-protected steel surfaces.

1.4 - Repair safety considerations

All installation parts must be maintained by the personnel in charge, in order to avoid deterioration and injury. Faults and leaks must be repaired immediately. The authorised technician must have the responsibility to repair the fault immediately. After each repair of the unit, check the operation of the protection devices and create a report of the parameter operation at 100%.
Comply with the regulations and recommendations in unit and HVAC installation safety standards, such as: EN 378, ISO 5149, etc.

RISK OF EXPLOSION 

Never use air or a gas containing oxygen during leak tests to purge lines or to pressurise a machine. Pressurised air mixtures or gases containing oxygen can be the cause of an explosion. Oxygen reacts violently with oil and grease.

Only use dry nitrogen for leak tests, possibly with an appropriate tracer gas.

If the recommendations above are not observed, this can have serious or even fatal consequences and damage the installation.

Never exceed the specified maximum operating pressures. Verify the allowable maximum high- and low-side test pressures by checking the instructions in this manual and the pressures given on the unit name plate.

Do not unweld or flamecut the refrigerant lines or any refrigerant circuit component until all refrigerant (liquid and vapour) as well as the oil have been removed from chiller. Traces of vapour should be displaced with dry nitrogen. Refrigerant in contact with an open flame produces toxic gases.

The necessary protection equipment must be available, and appropriate fire extinguishers for the system and the refrigerant type used must be within easy reach.

Do not siphon refrigerant.

Avoid spilling liquid refrigerant on skin or splashing it into the eyes. Use safety goggles and safety gloves. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, immediately and abundantly flush the eyes with water and consult a doctor.

The accidental releases of the refrigerant, due to small leaks or significant discharges following the rupture of a pipe or an unexpected release from a relief valve, can cause frostbites and burns to personnel exposed. Do not ignore such injuries. Installers, owners and especially service engineers for these units must:

- ***Seek medical attention before treating such injuries.***
- ***Have access to a first-aid kit, especially for treating eye injuries.***

We recommend to apply standard EN 378-3 Annex 3.

Never apply an open flame or live steam to a refrigerant container. Dangerous overpressure can result.

During refrigerant removal and storage operations follow applicable regulations. These regulations, permitting conditioning and recovery of halogenated hydrocarbons under optimum quality conditions for the products and optimum safety conditions for people, property and the environment are described in standard NF E29-795.

Refer to the certified dimensional drawings for the units.

It is dangerous and illegal to re-use disposable (non-returnable) cylinders or attempt to refill them. When cylinders are empty, evacuate the remaining gas pressure, and move them to a designated place for recovery. Do not incinerate.

Do not attempt to remove refrigerant circuit components or fittings, while the machine is under pressure or while it is running. Be sure pressure is at 0 kPa and that the unit has been shut-down and de-energised before removing components or opening a circuit.

Do not attempt to repair or recondition any safety devices when corrosion or build-up of foreign material (rust, dirt, scale, etc.) is found within the valve body or mechanism. If necessary, replace the device. Do not install relief valves in series or backwards.

ATTENTION: No part of the unit must be used as a walkway, rack or support. Periodically check and repair or if necessary replace any component or piping that shows signs of damage.

Do not step on refrigerant lines. The lines can break under the weight and release refrigerant, causing personal injury.

Do not climb on a machine. Use a platform, or staging to work at higher levels.

Use mechanical lifting equipment (crane, hoist, winch, etc.) to lift or move heavy components. For lighter components, use lifting equipment when there is a risk of slipping or losing your balance.

Use only original replacement parts for any repair or component replacement. Consult the list of replacement parts that corresponds to the specification of the original equipment.

Do not drain water circuits containing industrial brines, without informing the technical service department at the installation site or a competent body first.

Close the entering and leaving water shutoff valves and purge the unit hydraulic circuit, before working on the components installed on the circuit (screen filter, pump, water flow switch, etc.).Periodically inspect all valves, fittings and pipes of the refrigerant and hydraulic circuits to ensure that they do not show any corrosion or any signs of leaks.

It is recommended to wear ear defenders, when working near the unit and the unit is in operation.

2.1 - Check equipment received

- Check that the unit has not been damaged during transport and that no parts are missing. If the unit has been damaged or the shipment is incomplete, send a claim to the shipping company.
- Compare the name plate data with the order. The name plate is attached in two places to the unit:
  - On one of the unit sides on the outside
  - On the control box door on the inside.
- The unit name plate must include the following information:
  - Model number - size
  - CE marking
  - Serial number
  - Year of manufacture and pressure and leak tightness test date
  - Fluid being transported
  - Refrigerant used
  - Refrigerant charge per circuit
  - PS: Min./max. allowable pressure (high and low pressure side)
  - TS: Min./max. allowable temperature (high and low pressure side)
  - Pressure switch cut-out pressure
  - Unit leak test pressure
  - Voltage, frequency, number of phases
  - Maximum current drawn
  - Maximum power input
  - Unit net weight
- Confirm that all accessories ordered for on-site installation have been delivered, are complete and undamaged.

The unit must be checked periodically, if necessary removing the insulation (thermal, acoustic), during its whole operating life to ensure that no shocks (handling accessories, tools, etc.) have damaged it. If necessary, the damaged parts must be repaired or replaced. See also chapter “Maintenance”.

2.2 - Moving and siting the unit

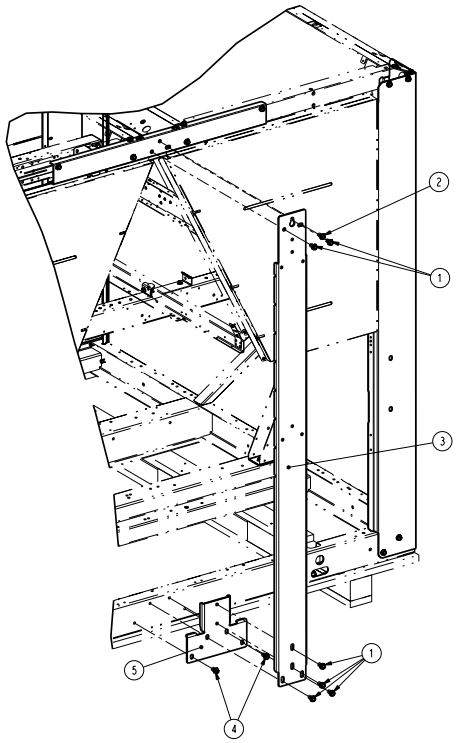
2.2.1 - Moving

See chapter 1.1 “Installation safety considerations”.

In some cases vertical supports are added for the transport and handling of the unit. These supports must be removed for access or connection, if required.

IMPORTANT: Follow the disassembly sequence shown in the disassembly instruction notes.

- Screw off item: 1
- Loosen screw item: 2
- Raise and remove frame post item: 3
- Screw off item: 4 and remove reinforcement plate item: 5



Keep the vertical supports after commissioning the units and re-insert them when the unit is moved.

2.2.2 - Placing the unit

The machine must be installed in a place that is not accessible to the public or protected against access by non-authorised persons.

In case of extra-high units the machine environment must permit easy access for maintenance operations.

Always refer to the chapter “Dimensions and clearances” to confirm that there is adequate space for all connections and service operations. For the centre of gravity coordinates, the position of the unit mounting holes, and the weight distribution points, refer to the certified dimensional drawing supplied with the unit.

Typical applications of these units do not require earthquake resistance. Earthquake resistance has not been verified.

CAUTION: Only use slings at the designated lifting points which are marked on the unit.

Before placing the unit check that:

- The permitted loading at the site is adequate or that appropriate strenghtening measures have been taken.
- The unit is installed level on an even surface (maximum tolerance is 5 mm in both axes).
- There is adequate space above the unit for air flow and to ensure access to the components (see dimensional drawings).
- The number of support points is adequate and that they are in the right places.
- The location is not subject to flooding.
- For outdoor installations, where heavy snowfall is likely and long periods of sub-zero temperatures are normal, provision has to be made to prevent snow accumulating by raising the unit above the height of drifts normally experienced. Baffles may be necessary to deflect strong winds. They must not restrict air flow into the unit.

CAUTION: Before lifting the unit, check that all casing panels are securely fixed in place. Lift and set down the unit with great care. Tilting and jarring can damage the unit and impair

unit operation.

If 30RB units are hoisted with rigging, it is advisable to protect coils against crushing while a unit is being moved. Use struts or a lifting beam to spread the slings above the unit. Do not tilt a unit more than 15°.

WARNING: Never push or lever on any of the enclosure panels of the unit. Only the base of the unit frame is designed to withstand such stresses.

2.2.3 - Checks before system start-up

Before the start-up of the refrigeration system, the complete installation, including the refrigeration system must be verified against the installation drawings, dimensional drawings, system piping and instrumentation diagrams and the wiring diagrams.

During the installation test national regulations must be followed. If the national regulation does not specify any details, refer to standard EN 378 as follows:

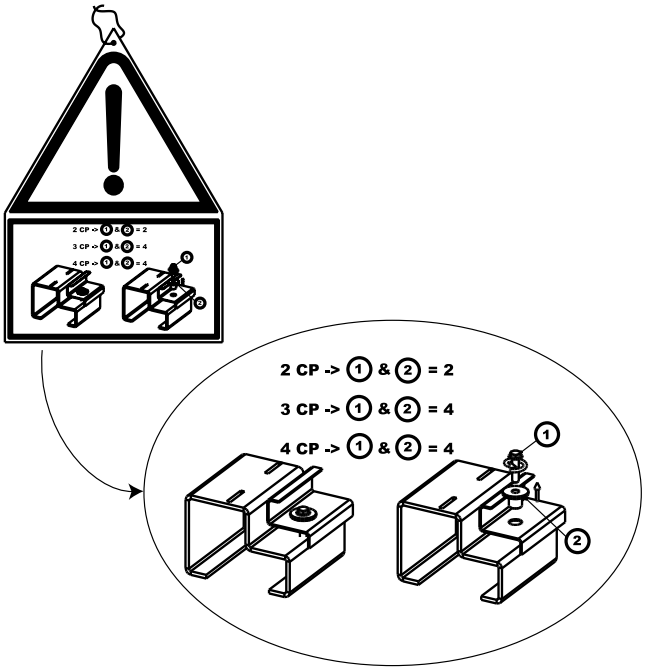
External visual installation checks:

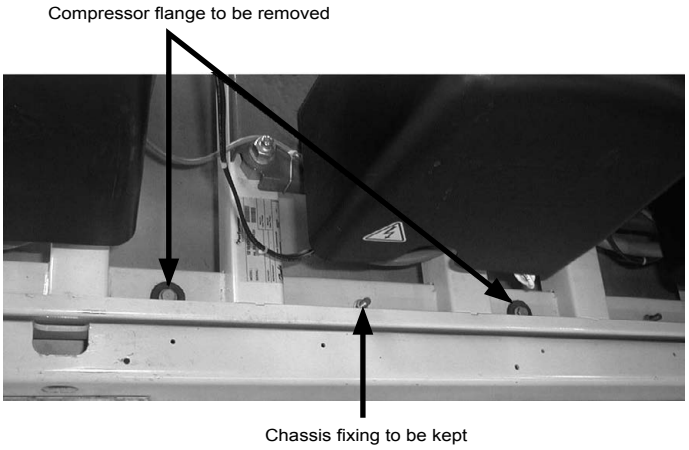
- Ensure that the machine is charged with refrigerant, Verify on the unit nameplate that the 'fluid transported' is R410A and is not nitrogen.
- Compare the complete installation with the refrigeration system and power circuit diagrams.
- Check that all components comply with the design specifications.
- Check that all protection documents and equipment provided by the manufacturer (dimensional drawings, P&ID, declarations etc.) to comply with the regulations are present.
- Verify that the environmental safety and protection and devices and arrangements provided by the manufacturer to comply with the regulations are in place.
- Verify that all documents for pressure containers, certifi-cates, name plates, files, instruction manuals provided by the manufacturer to comply with the regulations are present.
- Verify the free passage of access and safety routes.
- Verify the instructions and directives to prevent the deliberate removal of refrigerant gases.
- Verify the installation of connections.
- Verify the supports and fixing elements (materials, routing and connection).
- Verify the quality of welds and other joints.
- Check the protection against mechanical damage.
- Check the protection against heat.
- Check the protection of moving parts.
- Verify the accessibility for maintenance or repair and to check the piping.
- Verify the status of the valves.
- Verify the quality of the thermal insulation.

IMPORTANT: The compressor assemblies are "floating" on rubber blocks between the unit chassis and the sub-assembly chassis (they are not visible). To protect the piping during transport, a flange is installed in the factory.

This flange must be removed on site.

The flange is identified by red rings. A label attached to the compressor sub-assembly warns the installer.

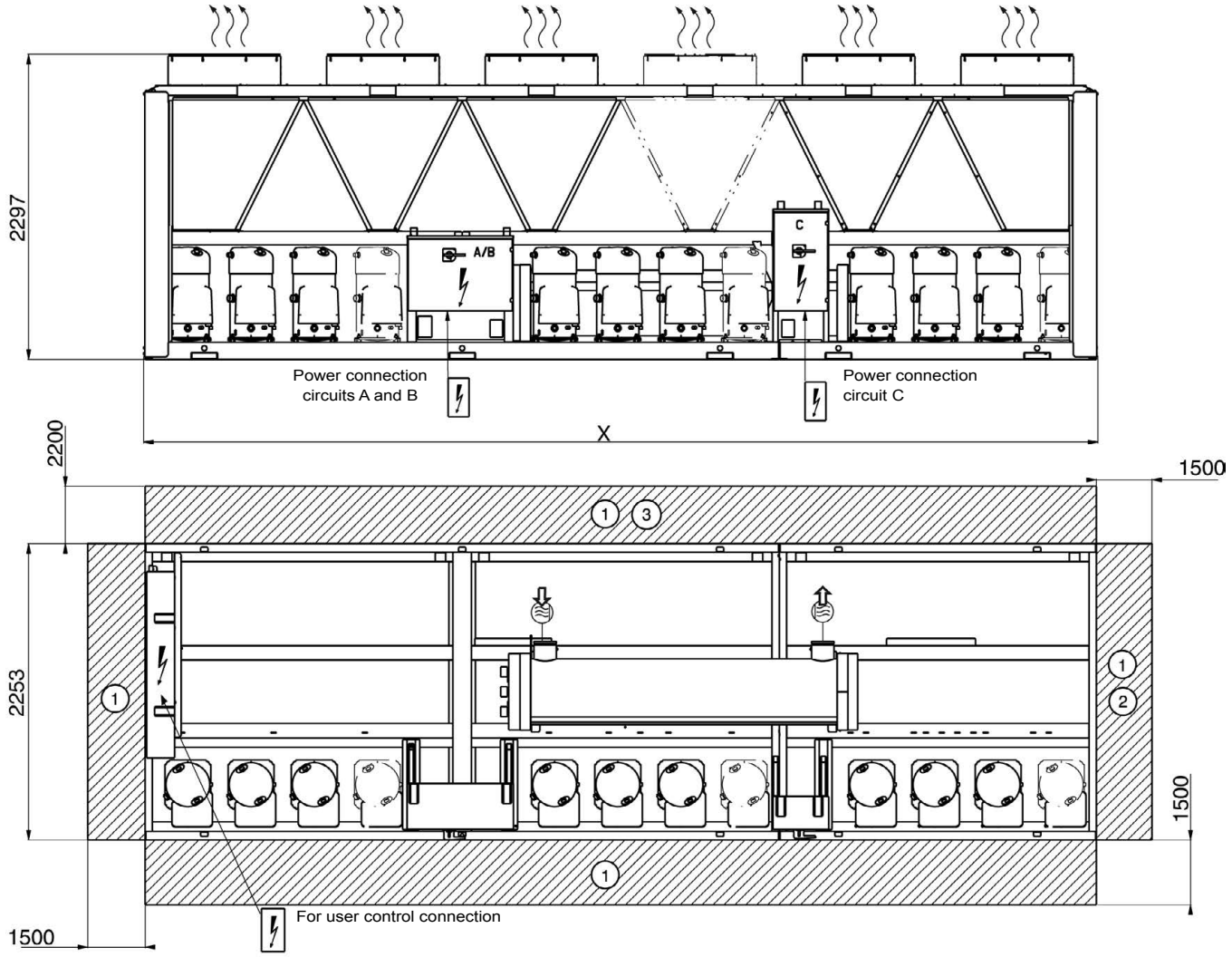




3 - DIMENSIONS, CLEARANCES

For the heat reclaim condenser option, please refer to the relevant chapter.

3.1 - 30RB 604-804



30RB	X
604-674	5992
734-804	7186

Legend
All dimensions are given in mm.

① Clearances required for maintenance and air flow
② Clearances recommended for evaporator tube removal
③ Clearances recommended for heat exchanger removal
Water inlet
Water outlet
Air outlet – do not obstruct
Control box

NOTE: Non-contractual drawings.

When designing an installation, refer to the certified dimensional drawings, available on request.

For the positioning of the fixing points, weight distribution points and centre of gravity coordinates please refer to the dimensional drawings.

3.2 - Multiple chiller installation

It is recommended to install multiple chillers in a single row, arranged as shown in the example below, to avoid recycling of warm air from one unit to another.

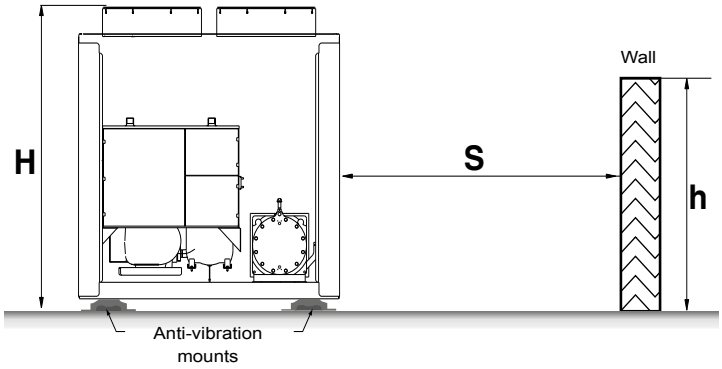
If the situation at the site does not permit this arrangement, contact your Carrier distributor to estimate the space required between units.

3.3 - Distance to the wall

To ensure correct operation for most cases:

If h < H (2.3 m), minimum S = 3 m

If h > H or S < 3 m, contact your Carrier distributor.



4 - PHYSICAL DATA - 30RB

4.1 - 30RB 604-804 units

30RB		604	674	734	804
Operating weight(1)					
Unit with option 15	kg	4626	4864	5342	5583
Standard unit(2)	kg	4410	4630	5090	5313
Sound levels					
Unit with option 15LS (very low noise level)					
Sound power level 10-12 W(3)	dB(A)	89	89	89	90
Sound pressure level 10 m distance(4)	dB(A)	56	57	57	57
Unit with option 15 (low noise level)					
Sound power level 10-12 W(3)	dB(A)	93	93	94	94
Sound pressure level 10 m distance(4)	dB(A)	61	61	61	62
Base unit without option 15					
Sound power level 10-12 W(3)	dB(A)	95	95	96	96
Sound pressure level 10 m distance(4)	dB(A)	63	63	63	64
Compressors		Hermetic scroll, 48.3 r/s			
Circuit A		3	3	4	4
Circuit B		3	3	4	4
Circuit C		3	4	3	4
No. of control stages		9	10	11	12
Refrigerant		R-410A			
Circuit A	kg	22	22	26	26
	$teqCO_2$	45	45	54	54
Circuit B	kg	22	22	28	28
	$teqCO_2$	46	45	58	58
Circuit C	kg	24	28	24	31
	$teqCO_2$	49	58	50	65
Control		Pro-Dialog Plus			
Minimum capacity	%	11	10	9	8
Condensers		All aluminium micro-channel heat exchanger (MCHE)			
Fans		Axial Flying Bird 4 with rotating shroud			
Quantity		9	10	11	12
Total air flow	l/s	40623	45139	49653	54167
Speed	r/s	16	16	16	16
Evaporator		Direct expansion, shell-and-tube			
Water volume	l	284	284	284	284
Max. water-side operating pressure without hydraulic module	kPa	1000	1000	1000	1000
Water connections without hydraulic module		Victaulic			
Diameter	inch	6	6	6	6
Outside tube diameter	mm	168,3	168,3	168,3	168,3
Chassis paint colour		Colour code: RAL 7035			

(1) Weight shown is a guideline only. To find out the unit refrigerant charge, please refer to the unit nameplate.
(2) Standard unit = base unit without option 15.
(3) in dB ref=10^{-12}W, (A) weighting. Declared dualnumber noise emission values in accordance with ISO 4871 (with an associated uncertainty of +/-3dB(A)). Measured in accordance with ISO 9614-1 and certified by Eurovent.
(4) in dB ref 20µPa, (A) weighting. Declared dualnumber noise emission values in accordance with ISO 4871 (with an associated uncertainty of +/-3dB(A)). For information, calculated from the sound power level Lw(A).

5 - ELECTRICAL DATA - 30RB

5.1 - 30RB 604-804 units

30RB		604	674	734	804
Power circuit					
Nominal power supply	V-ph-Hz	400-3-50			
Voltage range	V	360-440			
Control circuit supply		24 V, via internal transformer			
Nominal unit current draw(1)					
Circuits A + B (one supply)	A	237	237	316	316
Circuit C (separate supply)	A	118	158	118	158
Maximum unit power input(2)					
Circuits A + B (one supply)	kW	194	194	259	259
Circuit C (separate supply)	kW	97	129	97	129
Cosine phi, unit at max. capacity(2)		0,88	0,88	0,88	0,88
Maximum unit current draw (Un-10%)(3)					
Circuits A + B (one supply)	A	340	340	454	454
Circuit C (separate supply)	A	170	227	170	227
Maximum unit current draw(4)					
Circuits A + B (one supply)	A	314	314	419	419
Circuit C (separate supply)	A	157	209	157	209
Maximum start-up current, standard unit (Un)(5)					
Circuits A + B	A	525	525	629	629
Circuit C	A	368	420	368	420

(1) Standardised Eurovent conditions: evaporator entering/leaving water temperature 12°C/7°C, outside air temperature 35°C, evaporator fouling factor 0.18 x 10-4 (m2K)/W.
(2) Power input, compressors and fans, at the unit operating limits (saturated suction temperature 10°C, saturated condensing temperature 65°C) and nominal voltage of 400 V (data given on the unit nameplate).
(3) Maximum unit operating current at maximum unit power input and 360 V.
(4) Maximum unit operating current at maximum unit power input and 400 V (values given on the unit nameplate).
(5) Maximum instantaneous start-up current at operating limit values (maximum operating current of the smallest compressor(s) + fan current + locked rotor current of the largest compressor).

5.2 - Short-circuit stability current

Short-circuit stability current (TN system)(1)

30RB		604	674	734	804
Unit without main disconnect					
With fuses upstream - maximum fuse values assigned (gL/gG)					
Circuits A and B	A	630/500	630/500	630/500	630/500
Circuit C	A	400	400	400	400
With fuses upstream - admissible rms current value (gL/gG)					
Circuits A and B	kA	70	70	60/70	60/70
Circuit C	kA	60	60	60	60
Unit with optional main disconnect without fuse					
Short-time assigned current Icw(2) (1s) rms value/peak Ipk(6)					
Circuits A and B	kA/kA	13/26	13/26	15/30	15/30
Circuit C	kA/kA	13/26	13/26	13/26	13/26
With fuses upstream - maximum fuse values assigned (gL/gG)					
Circuits A and B	A	400	400	630	630
Circuit C	A	400	400	400	400
With fuses upstream - conditional short-circuit assigned current Icc/Icf†					
Circuits A and B	kA	50	50	50	50
Circuit C	kA	50	50	50	50
Unit with optional main disconnect with fuses					
Short-circuit stability current Icc/Icf† increased with fuses - maximum fuse values assigned (gL/gG)					
Circuits A and B	kA	400	400	630	630
Circuit C	kA	250	250	250	250
Short-circuit stability current Icc/Icf† increased with fuses - admissible rms current value (gL/gG)					
Circuits A and B	kA	50	50	50	50
Circuit C	kA	50	50	50	50

(1) Type of system earthing
(2) Icw: assigned short-time current
(3) Ipk: assigned current, admissible peak
† Icc/Icf: assigned conditional short-circuit current

IT system: The short-circuit holding current values given above for the TN system are not valid for IT; modifications are required.

5.3 - Compressor usage and electrical data

Compressor	I Nom	I Max (Un)	I Max (Un-10%)	LRA (Un)	Cosine Phi (max.)	Circuit	604	674	734	804
00PPG000471003A	38	51	56	260	0,86	A	3	3	4	4
						B	3	3	4	4
						C	3	4	3	4

Legend
I Nom Nominal current draw at Eurovent conditions (see definition of conditions under nominal unit current draw), A
I Max Maximum operating current at 360 V, A
LRA Locked rotor current, A

5.4 - Electric power user reserve

Control circuit power reserve:

The TC transformer with all possible options connected makes 1A available for 24 V, 50 Hz.

For the same TC transformer the 230 V, 50 Hz circuit with connection ribbon only permits supply to the battery chargers for portable computers, 0.8 A at 230 V maximum.

IMPORTANT: Only connect doubly-insulated class II apparatus to these ribbons.

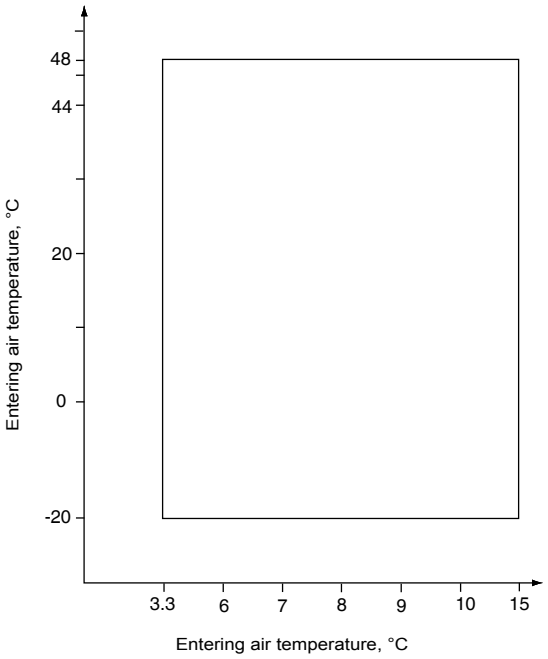
6.1 - Unit operating range

30RB 604-804 units

Evaporator		Minimum	Maximum
Entering water temperature at start-up	°C	6,8(1)	40
Leaving water temperature during operation	°C	3,3	15(2)
Condenser		**Minimum**	**Maximum**
Outdoor ambient operating temperature			
Standard unit	°C	-20	48
Available static pressure			
Standard unit (outdoor installation)	Pa	0	0

(1) For application requiring operation at less than 8 or 6.8°C respectively, contact Carrier for unit selection using the Carrier electronic catalog.
(2) For an application, requiring operation up to +15°C leaving water temperature, contact Carrier for the selection of the unit.

Operating range 30RB 604-804 units



Notes
1. Evaporator ΔT = 5 K
2. The evaporator is protected against frost down to -20°C.

Legend
Standard unit operating at full load.

In addition to options 28 and 28B-28C the unit must either be equipped with the evaporator frost protection option (for units without hydraulic module option) or the evaporator or the water loop must be protected by the installer by adding a frost protection solution.

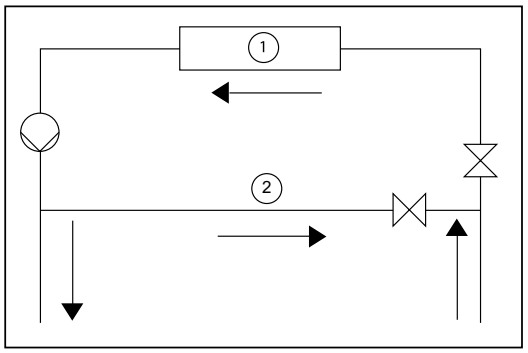
ATTENTION:

If the outside temperature is below -10°C and the unit has been switched off for more than 4 hours, it is necessary to wait two hours after the unit has been switched on again to allow the frequency converter to warm up.

6.2 - Minimum chilled water flow

The minimum chilled water flow is shown in the table on the next page. If the system flow is less than this, the evaporator flow can be recirculated, as shown in the diagram.

For minimum chilled water flow rate

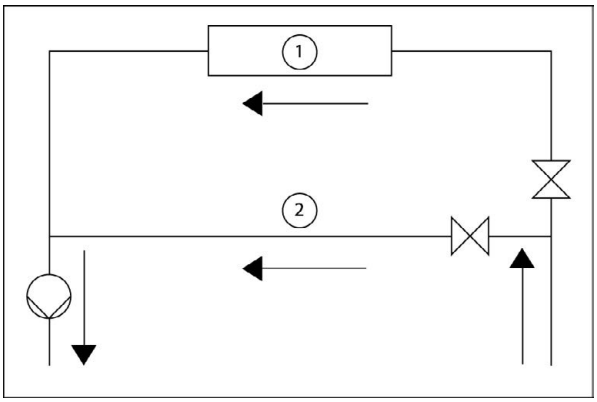


Legend
1 Evaporator
2 Recirculation

6.3 - Maximum chilled water flow

The maximum chilled water flow is shown in the table on the next page. If the system flow exceeds the maximum value, it can be bypassed as shown in the diagram.

For maximum chilled water flow rate



Legend
1 Evaporator
2 Bypass

6.4 - Variable flow evaporator

Variable evaporator flow can be used in standard chillers. The flow rate must be higher than the minimum flow given in the table of permissible flow rates and must not vary by more than 10% per minute. If the flow rate changes more rapidly, the system should contain a minimum of 6.5 litres of water per kW instead of 2.5 l/kW. It is possible to use a dedicated terminal to connect the pump drive (0/10V signal). Please refer to 30RB / 30RQ Prodialog control manual.

6.5 - Minimum system water volume

Whichever the system, the water loop minimum capacity is given by the formula:

Capacity = Cap (kW) x N Litres

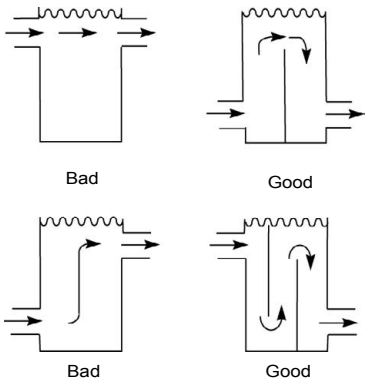
Application	N
Normal air conditioning	2.5
Process type cooling	6.5

Where Cap is the nominal system cooling capacity (kW) at the nominal operating conditions of the installation.

This volume is necessary for stable operation.

It can be necessary to add a buffer water tank to the circuit in order to achieve the required volume. The tank must itself be internally baffled in order to ensure proper mixing of the liquid (water or brine). Refer to the examples below.

Connection to a buffer tank



6.6 - Evaporator flow rate

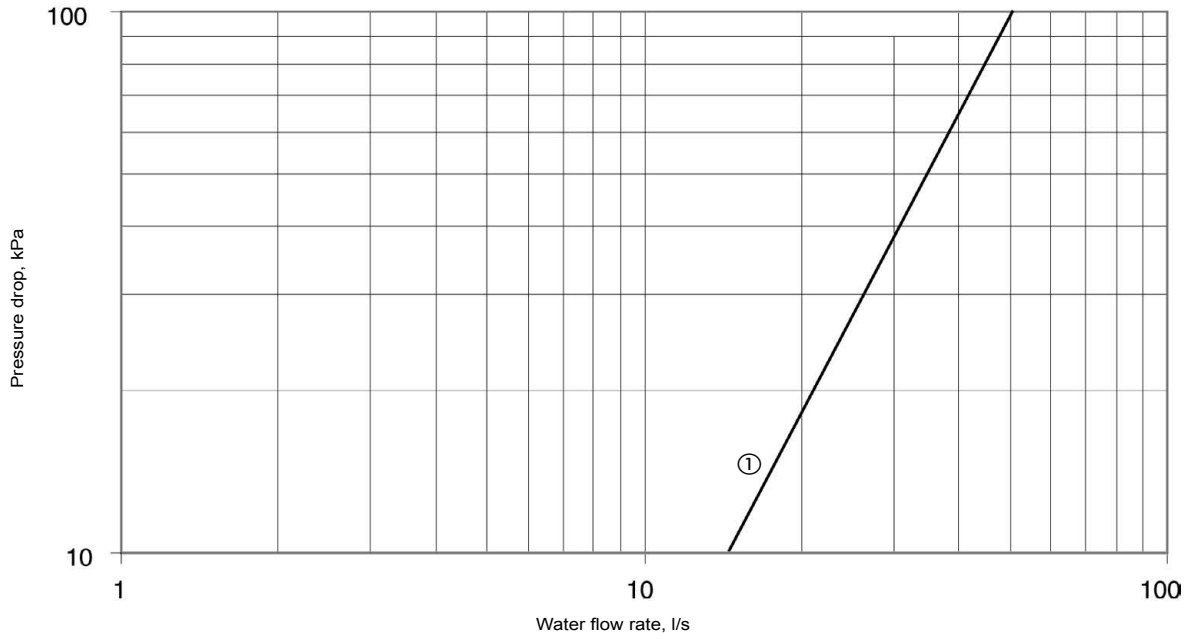
30RB 604-804

30RB	Minimum flow rate. l/s	Maximum flow rate. l/s
604	7,9	50,6
674	8,7	50,6
734	9,6	50,6
804	10,3	50,6

* The maximum flow rate corresponds to a pressure loss of 100 kPa (heat exchanger without hydraulic module).

6.7 - Pressure drop curves for the evaporator and standard entering/leaving water piping

30RB 604-804 units



1 30RB 604-804

Note: If the Carrier instructions (power and water connections and installation) are not oberved, the Carrier warranty becomes invalid.

7 - ELECTRICAL CONNECTION

Please refer to the certified dimensional drawings, supplied with the unit.

7.1 - Power supply

The power supply must conform to the specification on the chiller nameplate. The supply voltage must be within the range specified in the electrical data table. For connections refer to the wiring diagrams and certified dimensional drawings.

WARNING: Operation of the chiller with an improper supply voltage or excessive phase imbalance constitutes abuse which will invalidate the Carrier warranty. If the phase imbalance exceeds 2% for voltage, or 10% for current, contact your local electricity supply at once and ensure that the chiller is not switched on until corrective measures have been taken.

7.2 - Voltage phase imbalance (%)

$$\frac{100 \times \text{max. deviation from average voltage}}{\text{Average voltage}}$$

Example:

On a 400 V - 3 ph - 50 Hz supply, the individual phase voltages were measured to be:

AB = 406 V ; BC = 399 V; AC = 394 V

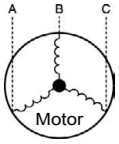
Average voltage = (406 + 399 + 394)/3 = 1199/3
= 399.7 say 400 V

Calculate the maximum deviation from the 400 V average:

(AB) = 406 - 400 = 6

(BC) = 400 - 399 = 1

(CA) = 400 - 394 = 6



The maximum deviation from the average is 6 V. The greatest percentage deviation is:

100 x 6/400 = 1.5 %

This is less than the permissible 2% and therefore acceptable.

7.3 - Power connection/disconnect switch

30RB	Connection points	Disconnect switch without fuse (opt. 70)	Disconnect switch with fuse (opt. 70D)
Standard unit			
604-804	2(1)	-	
Option 70			
604-804	2(1)	X	
Option 70D			
604-804	2(1)		X

(1) 2 connection points: one for circuits A and B and one for circuit C

7.4 - Recommended wire sections

Wire sizing is the responsibility of the installer, and depends on the characteristics and regulations applicable to each installation site. The following is only to be used as a guide-line, and does not make Carrier in any way liable. After wire sizing has been completed, using the certified dimen-sional drawing, the installer must ensure easy connection and define any modifications necessary on site.

The connections provided as standard for the field-supplied power entry cables to the general disconnect/isolator switch are designed for the number and type of wires, listed in the table on the next page.

Electrical data notes for 30RB units:

- 30RB 604-804 units have two connection points upstream of the main disconnect switches.
- The control box includes:
  - One main disconnect switch
  - Starter and motor protection devices for each compressor, the fans) and the pump
  - Control devices
- **Field connections:**

All connections to the system and the electrical installations must be in full accordance with all applicable local codes.

- The Carrier 30RB units are designed and built to ensure conformance with these codes. The recommendations of European standard EN 60 204-1 (corresponds to IEC 60204-1) (machine safety - electrical machine components - part 1: general regulations) are specifically taken into account, when designing the electrical equipment.

Notes:

- Generally the recommendations of International Electrotechnical Commission document IEC 60364 are accepted as compliance with the requirements of the installation directives. Conformance with EN 60204 is the best means of ensuring compliance with the Machines Directive § 1.5.1.
- Annex B of EN 60204-1 describes the electrical characteristics used for the operation of the machines.

- Operating conditions of 30RB units are described below:

1. Physical environment*

The classification of environment is specified in standard EN 60364:

- Outdoor installation*,
- Ambient temperature range: minimum temperature -20°C to +48°C**,
- Altitude: AC1 of 2000 m or less,
- Presence of hard solid: Class AE3 (no significant dust present)*,
- Presence of corrosive and polluting substances, class AF1 (negligible),
- Competence of persons: BA4 (Persons wise).

2. Compatibility for low-frequency conducted disturbances according to class 2 levels per IEC61000-2-4 standard:

- Power supply frequency variation: +- 2Hz
- Phase imbalance : 2%
- Total Voltage Harmonic Distortion (THDV): 8%

3. The neutral (N) line must not be connected directly to the unit (if necessary use a transformer).
4. Overcurrent protection of the power supply conductors is not provided with the unit.
5. The factory-installed disconnect switch(es)/circuit breaker(s) is (are) of a type suitable for power interruption in accordance with EN 60947-3 (corresponds to IEC 60947-3).
6. The units are designed for connection to TN networks (IEC 60364). In IT networks, if noise filters are integrated into the variable frequency drive(s), this will render the units unsuitable for their intended purpose. In addition, the equipment characteristics in case of insulation failure are modified. Provide a local earth; consult competent local organisations to complete the electrical installation. 30RB units are designed to use for domestic / residential and industrial environments in accordance with standard EN61800 - 3 electric power variable speed drives:

- part 3: EMC requirements and specific test methods for the following classifications: Use in the first and second environments**.
- Category C2 applicable in the first environment, to stationary devices designed to be installed and commissioned by a professional.

Warning: In a residential environment, this product may cause radio interference in which case additional mitigation measures could be required.

Leakage currents: If protection by monitoring the leakage currents is necessary to ensure the safety of the installation, the presence of additional leakage currents introduced by the use of variable frequency drive(s) in the unit must be considered. In particular, the reinforced immunity protection types and a control value not lower than 150 mA are recommended when selecting differential protective devices.

Note: If particular aspects of an actual installation do not conform to the conditions described above, or if there are other conditions which should be considered, always contact your local Carrier representative.

* The required protection level for this class is IP43BW (according to reference document IEC 60529). All 30RB units are protected to IP44CW and fulfil this protection condition.

** - Example of installations of the first environment: Commercial and residential buildings.
- Example of installations of the second environment: industrial zones, technical rooms powered from a dedicated transformer.

The calculations are based on the maximum machine current (see electrical data tables).

For the accessory system the following standardised instal-lation methods are used, in accordance with IEC 60364, table 52C: No. 17: suspended aerial lines, and No. 61: buried conduit with a derating coefficient of 20.

The calculation is based on PVC or XLPE insulated cables with copper or aluminium core. The maximum temperature is 48°C. The given wire length limits the voltage drop to < 5%.

IMPORTANT: Before connection of the main power cables (L1 - L2 - L3) on the terminal block, it is imperative to check the correct order of the 3 phases before proceeding to the connection on then terminal block or the main disconnect/ isolator switch.

7.4.1 - Power cable entry

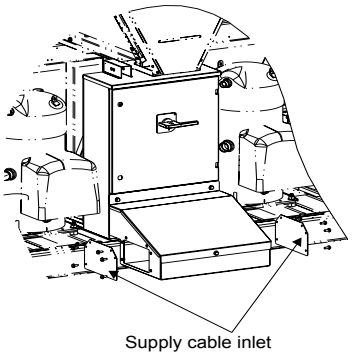
The power cables can enter the 30RB control box from below or from the unit side.

- Unit raised from the ground (e.g. installation on support rails): It is recommended to enter the power cables from below the control box. A removable aluminium plate below the control box allows introduction of the cables.
- Unit placed on the ground (e.g. on a concrete base): It is recommended to enter the power cables from the control box side. An aluminium plate on the control box face allows introduction of the cables. It is important to check that the power cable bend radius is compatible with the connection space available in the control box. Refer to the certified dimensional drawing for the unit.

7.4.2 - Connection extension box

This accessory permits stripping the power cables before they enter the control box, and must be used when the cable bend radius is not compatible with the connection space available in the control box. The accessory connection extension box ensures mechanical protection of the stripped cable, before it enters the control box. It must be used in the following cases:

- Unit placed on the ground and use of power cables with protective metallic armour.
- Unit placed on the ground and use of power cables with a section > 250 mm².



7.5 - Field control wiring

IMPORTANT: Field connection of interface circuits may lead to safety risks: Any control box modification must maintain equipment conformity with local regulations. Precautions must be taken to prevent accidental electrical contact between circuits supplied by different sources:

- **The routing selection and/or conductor insulation characteristics must ensure dual electric insulation.**
- **In case of accidental disconnection, conductor fixing between different conductors and/or in the control box prevents any contact between the conductor ends and an active energised part.**

Refer to the 30RB Pro-Dialog Plus Controls IOM and the certified wiring diagram supplied with the unit for the field control wiring of the following features:

- Customer interlock (safety chain)
- Evaporator pump interlock (mandatory)
- Remote on/off switch
- Remote heat/cool switch
- Demand limit external switch 1
- Remote dual set point
- Alarm, alert and operation report
- Evaporator pump control
- Heat reclaim condenser pump control (option)
- Setpoint reset via outside air temperature sensor reset (0-10 V)
- Various interlocks on the Energy Management Module (EMM) board (accessory or option)

Table of minimum and maximum wire sections (per phase) for connection to 30RB units

30RB	Max. connectable section per phase			Min. wire section per phase			Max. wire section per phase				
	Section, mm²			Section, mm²			Max length, m	Wire type	Section, mm²	Max. length, m	Wire type
	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C					
604	2 x 240	2 x 240	2 x 185	1 x 185	1 x 185	1 x 70	190/155	XLPE Copper	2 x 185/2 x 95	430/325	XLPE Cu/XLPE Al
674	2 x 240	2 x 240	2 x 185	1 x 185	1 x 185	1 x 95	190/178	XLPE Copper	2 x 185/2 x 150	430/375	XLPE Cu/XLPE Al
734	3 x 240	3 x 240	2 x 185	2 x 95	2 x 95	1 x 70	190/155	XLPE Copper	3 x 185/2 x 95	490/325	XLPE Cu/XLPE Al
804	3 x 240	3 x 240	2 x 185	2 x 95	2 x 95	1 x 95	190/178	XLPE Copper	3 x 185/2 x 150	490/375	XLPE Cu/XLPE Al

7.6 - Power supply

After the unit has been commissioned, the power supply must only be disconnected for quick maintenance operations (one day maximum). For longer maintenance operations or when the unit is taken out of service and stored (e.g. during the winter or if the unit does not need to generate cooling) the power supply must be maintained to ensure supply to the compressor oil crankcase heaters.

8 - WATER CONNECTIONS

For dimensions and position of the water inlet and outlet connections refer to the certified dimensional drawings supplied with the unit. The water pipes must not transmit any radial or axial force to the heat exchangers nor any vibration.

The water supply must be analysed and appropriate filtering, treatment, control devices, isolation and bleed valves and circuits built in, to prevent corrosion (example: tube surface protection damage in case of impurities in the fluid), fouling and deterioration of the pump fittings.

Before any start-up verify that the heat exchange fluid is compatible with the materials and the water circuit coating. Where additives or other fluids than those recommended by Carrier are used, ensure that these are not considered as a gas, and that they are class 2, as defined in directive 2014/33/EU.

Carrier recommendations on heat exchange fluids:

- No NH^{4+} ammonium ions in the water, they are very detrimental for copper. This is one of the most important factors for the operating life of copper piping. A content of several tenths of mg/l will badly corrode the copper over time. If required, use sacrificial anodes.
- Cl^- Chloride ions are also detrimental for copper with a risk of perforations by corrosion by puncture. Keep at a level below 125 mg/l.
- SO_4^{2-} sulphate ions can cause perforating corrosion, if their content is above 30 mg/l.
- No fluoride ions (<0.1 mg/l).
- No Fe^{2+} and Fe^{3+} ions with non negligible levels of dissolved oxygen must be present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.
- Dissolved silica: silica is an acid element of water and can also lead to corrosion risks. Content < 1 mg/l.
- Water hardness: >0.5 mmol/l. Values between 1.0 and 2.5 mmol/l are recommended. This will facilitate scale deposit that can limit corrosion of copper. Values that are too high can cause piping blockage over time. A total alkalimetric titre (TAC) below 100 mg/l is desirable.
- Dissolved oxygen: Avoid any sudden change in water oxygenation conditions. It is as detrimental to deoxyge-nate the water by mixing it with inert gas as it is to over- oxygenate it by mixing it with pure oxygen. The distur-bance of oxygenation conditions encourages destabilisa-tion of copper hydroxides and enlargement of particles.
- Electric conductivity 10-600µS/cm
- pH: Ideal case pH neutral at 20-25°C (7.5<pH<9).

ATTENTION: Filling, completing and draining the water circuit charge must be done by qualified personnel, using the air purges and materials that are suitable for the products.

Charging and removing heat exchange fluids should be done with devices that must be included on the water circuit by the installer. Never use the unit heat exchangers to add heat exchange fluid.

8.1 - Operating precautions and recommendations

Before the system start-up verify that the water circuits are connected to the appropriate heat exchangers. The water circuit should be designed to have the least number of elbows and horizontal pipe runs at different levels. Below the main points to be checked for the connection:

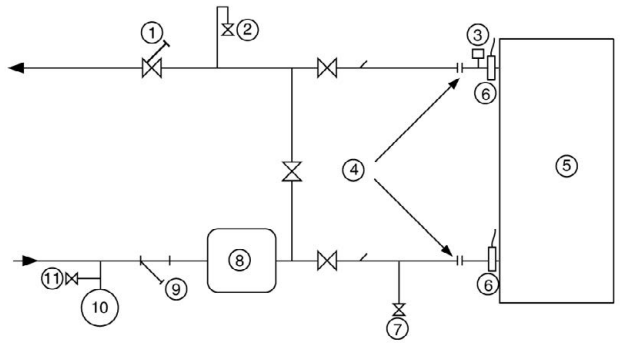
- Observe the water inlet and outlet connections shown on the unit.
- Install manual or automatic air purge valves at all high points in the circuit.
- Use a pressure reducer to maintain pressure in the circuit(s) and install a relief valve as well as an expansion tank.
- Install thermometers in both the entering and leaving water connections.
- Install drain connections at all low points to allow the whole circuit to be drained.
- Install stop valves close to the entering and leaving water connections.
- Use flexible connections to reduce the transmission of vibrations.
- Insulate the pipework, after testing for leaks, to prevent heat transmission and condensation.
- Cover the insulation with a vapour barrier. If the water piping outside the unit passes through an area where the ambient temperature is likely to fall below 0°C, it must be protected against frost (defrost solution or electric heaters).
- The use of different metals on hydraulic piping could generate eletrolytic pairs and consequently corrosion. Verify then, the need to install sacrificial anodes.

NOTE: A screen filter must be installed in units without hydraulic module. This must be installed in the water inlet piping upstream of the pressure gauge and close to the unit heat exchanger. It must be located in a position that is easily accessible for removal and cleaning. The mesh size of the filter must be 1.2 mm.

If the filter is missing, the plate heat exchanger or the shell-and-tube evaporator can quickly become fouled during the first start-up, as it will perform the filter function, and correct unit operation will be affected (reduced water flow rate due to the increased pressure drop).

8.2 - Hydraulic connections

Typical water circuit diagram - without hydraulic module



Legend

1 Control valve
2 Air vent
3 Flow switch for the evaporator (supplied)
4 Flexible connection
5 Heat exchanger
6 Temperature sensor (supplied)
7 Drain
8 Buffer tank (if needed)
9 Filter (mesh size: 1.2 mm = 20 mesh)
10 Expansion tank
11 Fill valve

8.3 - Flow control

All units are equipped with a factory-set flow switch. The unit must be interlocked with the chilled-water pump.

Terminals 34 and 35 are provided for field installation of the chilled water pump interlock (auxiliary contact for pump operation to be wired on site).

8.4 - Frost protection

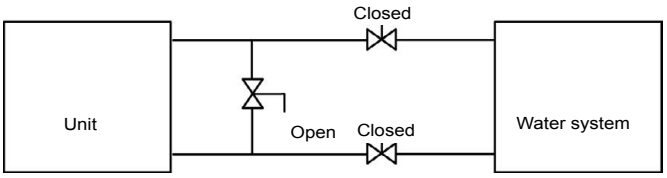
The standard unit does not include any particular frost protection when it has shut down. It is therefore essential to check that there is no risk of the water in the hydraulic circuit freezing during winter temperature conditions. If this may be the case it is essential to add an appropriate anti-freeze solution to protect the hydraulic circuit down to the minimum temperature minus 10 K.

Another solution consists of draining the hydraulic circuits exposed to temperatures below 0°C (must be used for units with plate heat exchangers). If the unit is not used for an extended period, protect it by circulating a protective solution. Please consult a specialist.

A third solution is to order the 'evaporator frost protection' option (factory-installed - an electric heater on the evaporator).

The heat exchanger temperature sensors are part of its frost protection: if piping trace heaters are used, ensure that the external heaters do not affect the measurement of these sensors.

Winter position



List of options for periods when the units are in standby mode	
Ambient unit temperature range	**30RB 604-804 standard units**
> 0°C to 46°C	-
-10°C to 0°C	Option 41 or Appropriate frost protection solution (e.g. glycol) or Drain the water circuits
-20°C to 0°C	

ATTENTION: If the recommendations above are not followed, any resulting frost damage is not covered by the guarantee.

The frost protection and electric heater solutions can be combined. If protection by electric heater is used, do not switch off the power supply to the unit.

IMPORTANT: The main unit disconnect switch, the auxiliary heater protection switch as well as the control circuit switch must always remain closed (to locate the components, please refer to the wiring diagram).

IMPORTANT: Depending on the climatic conditions in your area you must do the following when you shut the unit down in winter:

- **Add ethylene glycol with an adequate concentration to protect the installation up to a temperature of 10 K below the lowest temperature likely to occur at the installation site.**
- **If the unit is not used for an extended period, it is recommended to drain it, and as a safety precaution add ethylene glycol to the heat exchanger, using the water entering purge valve connection.**
- **At the start of the next season, refill the unit with water and add an inhibitor.**
- **For the installation of auxiliary equipment, the instal-ler must comply with basic regulations, especially for minimum and maximum flow rates, which must be between the values listed in the operating limit table (application data).**
- **If any heat transfer circuit is emptied for longer than a month, the complete circuit must be placed under nitrogen charge to avoid any risk of corrosion by differential aeration. If the heat transfer fluid does not comply with Carrier recommendations, nitrogen must be charged immediately.**

8.5 - Operation of two units in master/slave mode

For this type of operation the 'Twinning' option must be ordered.

The units supplied are then equipped with an additional sensor connected to the electronic board and located in the control box.

This sensor must be used when master/slave assembly control at the water outlet is used (it is not required for entering water control).

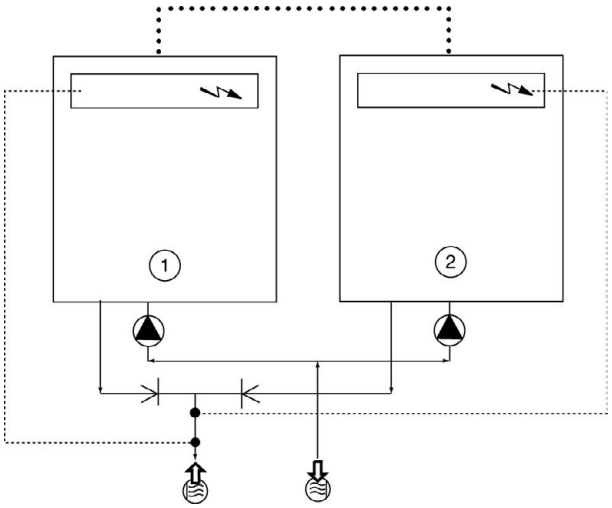
The customer must connect the two units via a communi-cation bus (0.75 mm^2, twisted and shielded). Consult the 30RB Pro-Dialog Plus control manual for the connection addresses.

Master/slave operation is only possible, when the units are installed in parallel. It is not possible, if the units are installed in series.

All parameters, required for the master/slave function must be configured using the Service Configuration menu. All remote controls of the master/slave assembly (start/stop, set point, load shedding etc.) are controlled by the unit configured as master and must only be applied to the master unit.

Each unit controls its own water pump. If there is only one common pump, in cases with variable flow, isolation valves must be installed on each unit. They will be activated at the opening and closing by the control of each unit (in this case the valves are controlled using the dedicated water pump outputs). See the 30RB Pro-Dialog Plus Control IOM for a more detailed explanation.

30RB with configuration: Leaving water control



Legend

1	Master unit
2	Slave unit
	Control boxes of the master and slave units
	Water inlet
	Water outlet
	Customer water pumps
	Additional sensors for leaving water control, to be connected to channel 1 of the slave boards of each master and slave unit
	CCN communication bus
	Connection of two additional sensors

9 - NOMINAL SYSTEM WATER FLOW CONTROL

The water circulation pumps of the 30RB units have to be sized to allow the hydraulic modules to cover all possible configurations based on the specific installation conditions, i.e. for various temperature differences between the entering and the leaving water (ΔT) at full load, which can vary between 3 and 10 K.

This required difference between the entering and leaving water temperature determines the nominal system flow rate. It is necessary to know the nominal system flow rate to allow its control via a manual valve either provided in the water leaving piping of the module (item 9 in the typical hydraulic circuit diagram) or to be installed as shown in the same diagram (chapter 8.2).

With the pressure loss generated by the control valve in the hydraulic system, the valve can impose the system pressure/flow curve on the pump pressure/flow curve, to obtain the desired operating point. The pressure drop reading in the heat exchanger and its internal piping is used to control and adjust the nominal system flow rate.

Use this specification for the unit selection to know the system operating conditions and to deduce the nominal air flow as well as the pressure drop of the heat exchanger and its internal piping at the specified conditions. If this information is not available at the system start-up, contact the technical service department responsible for the installation to get it.

These characteristics can be obtained from the technical literature using the unit performance tables for a ΔT of 5 K at the evaporator or with the Electronic Catalogue selection program for all ΔT conditions other than 5 K in the range of 3 to 10 K.

9.1 - Water flow control procedure

As the total system pressure drop is not known exactly at the start-up, the water flow rate must be adjusted with the control valve to obtain the specific flow rate for this application.

Proceed as follows:

Open the valve fully.

Start-up the pump using the forced start command (refer to the controls manual) and let the pump run for two consecutive hours to clean the hydraulic circuit of the system (presence of solid contaminants).

Read the filter pressure drop by taking the difference of the readings of the pressure gauge connected to the filter inlet and outlet, a pressure gauge after filter inlet and outlet (see typical hydraulic circuit diagrams), and comparing this value after two hours of operation.

If the pressure drop has increased, this indicates that the screen filter must be removed and cleaned, as the hydraulic circuit contains solid particles. In this case close the shutoff valves at the water inlet and outlet and remove the screen filter after emptying the hydraulic section of the unit.

Renew, if necessary, to ensure that the filter is not contami-nated. Purge the air from the circuit using the purge valves in the hydraulic circuit and the system (see typical hydraulic circuit diagram).

When the circuit is cleaned, read the pressures at the pressure gauge (entering water pressure - leaving water pressure), expressed in bar and convert this value to kPa (multiply by 100) to find out the pressure drop of the heat exchanger and its internal piping.

Compare the value obtained with the theoretical selection value.

It is essential to carry out systematic filter cleaning at the initial start-up, as well as after any modification in the hydraulic circuit.

ATTENTION: It is essential to keep the pressure gauge purge valve open after measuring the pressure (risk of freezing during winter).

If the pressure drop measured is higher than the value specified the flow rate in the evaporator (and thus in the system) is too high. The pump supplies an excessive flow rate based on the global pressure drop of the application. In this case close the control valve one turn and read the new pressure difference.

Proceed by successively closing the control valve until you obtain the specific pressure drop that corresponds to the nominal flow rate at the required unit operating point.

If the system has an excessive pressure drop in relation to the available static pressure provided by the pump, the resulting water flow rate will de reduced and the difference between entering and leaving water temperature of the hydraulic module will be increased.

To reduce the pressure drops of the hydraulic system, it is necessary:

- To reduce the individual pressure drops as much as possible (bends, level changes, accessories, etc.)
- To use a correctly sized piping diameter.
- To avoid hydraulic system extensions, wherever possible.

10 - MAJOR SYSTEM COMPONENTS

10.1 - Compressors

30RB units use hermetic scroll compressors. Each compressor is equipped with a crankcase oil heater, as standard, complete with a safety device that prevents compressor start-up if there is a fault at the heater.

Each compressor sub-function is equipped with:

- Anti-vibration mountings between the unit chassis and the chassis of the compressor sub-function.
- Suction piping equipped with openings (not visible) to ensure an even oil level between all compressors.
- A pressure safety switch at the discharge line of each circuit.

10.2 - Lubricant

The compressors installed in these units have an oil charge of 6.9 l to ensure their correct operation.

The oil level check must be done with the unit switched off, when then suction and discharge pressures are equalised. The level must be full (higher than or equal to 3/4 of the sight-glass) after two hours shut-down. If this is not the case, there is an oil leak in the circuit. Search and repair the leak, then recharge oil, so that it reaches a high sight glass level, when the unit is recharged with refrigerant. The refrigerant dissolved in the oil raises the level - do not add any more oil.

ATTENTION: Too much oil in the circuit can cause a unit defect.

NOTE: Use only oils which have been approved for the compressors. Never use oils which have been exposed to air.

CAUTION: R-22 oils are absolutely not compatible with R-410A oils and vice versa.

10.3 - Condensers

The 30RB coils are micro-channel condensers made entirely of aluminium. For some options (see chapter 11.7 - Other options and accessories) optional coils with internally grooved copper tubes with aluminium fins are also available.

10.4 - Fans

Each fan motor assembly is equipped with a high-performance impeller made from recyclable composite material.

The motors are three-phase, with lifetime lubricated bearings and class F insulation (IP55 level).

According to the Regulation No. 327/2011 implementing Directive 2009/125/EC with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW.

		30RB 604-804
Fan overall efficiency	%	41
Measurement Category		A
Efficiency Category		Static
Target Efficiency grade N(2013)		N(2015) 40
Efficiency grade at optimum efficiency point		45,7
Variable frequency drive		Yes upstream of the motor
Year of manufacture		See label on unit
Fan Manufacturer		Simonin
Motor manufacturer		Leroy Somer
Fan PN		00PSG000000100A
Motor PN		00PPG000494700A
Motor nominal power	kW	1,84
Flow rate	m^3/s	4,15
Pressure at optimum energy efficiency	Pa	170
Rated speed	rpm	950
specific ratio		1,002
Relevant information for dysassembling, recycling or disposal at end of life		See service manual
Relevant information to minimize impact on the environment		See service manual

According to the Regulation No. 640/2009 and amendment 4/2014 implementing Directive 2005/32/EC with regard to ecodesign requirements for electric motors.

		30RB 604-804
Option		Standard or Option 28
Motor type		Asynchrone
Number of poles		6
Nominal input frequency	Hz	50
Nominal voltage	V	400
Number of phases		3
Motor included in the application domain of the regulation 640/2009 and amendment 4/2014		NON
Sales leaflet for exemption		Article 2.1
Ambient air temperature for which the motor is specifically designed	°C	70

10.5 - Electronic expansion valve (EXV)

The EXV is equipped with a stepper motor (2785 to 3690 steps, depending on the model) that is controlled via the EXV board. It is also equipped with a sight-glass that permits verification of the mechanism movement and the presence of the liquid gasket.

10.6 - Moisture indicator

Located on the EXV, permits control of the unit charge and indicates moisture in the circuit. The presence of bubbles in the sight-glass indicates an insufficient charge or non-condensables in the system. The presence of moisture changes the colour of the indicator paper in the sight-glass.

10.7 - Filter drier

The role of the filter drier is to keep the circuit clean and moisture-free. The moisture indicator shows, when it is neces-sary to change the element. A difference in temperature between the filter inlet and outlet shows that the element is dirty.

10.8 - Evaporator

10.8.1 - 30RB 604-804

The evaporator is a shell-and-tube type with two or three refrigerant circuits. It has been tested and stamped in accor-dance with applicable pressure codes for a maximum operat-ing pressure of 2910 kPa refrigerant-side and 1000 kPa water-side. The seamless copper tubes are finned on the refrigerant side and expanded into the tube sheets. The water connection of the heat exchanger is a Victaulic connection.

The evaporator shell has a thermal insulation of 19 mm thick polyurethane foam, and is equipped with a water drain and purge. An option with an aluminium jacket is also available.

As an option the evaporator is available with frost protection (option 41: evaporator frost protection).

The products that may be added for thermal insulation of the containers during the water piping connection procedure must be chemically neutral in relation to the materials and coatings to which they are applied. This is also the case for the products originally supplied by Carrier.

NOTES: Monitoring during operation, re-qualification, re-testing and re-testing dispensation:

- **Follow the regulations on monitoring pressurised equipment.**
- **It is normally required that the user or operator sets up and maintains a monitoring and maintenance file.**
- **Follow the control programmes of EN 378, annexes A, B, C and D.**
- **If they exist follow local professional recommendations.**
- **Regularly inspect the condition of the coating (paint) to detect blistering resulting from corrosion. To do this, check a non-insulated section of the container or the rust formation at the insulation joints.**
- **Regularly check for possible presence of impurities (e.g. silica grains) in the heat exchange fluids. These impurities maybe the cause of the wear or corrosion by puncture.**
- **Filter the heat exchange fluid check and carry out internal inspections as described in EN 378, annex C.**
- **In case of re-testing take possible maximum pressure differences, as indicated in (2) above into consideration.**
- **The reports of periodical checks by the user or opera-tor must be included in the supervision and mainte-nance file.**

Repair

Any repair or modification, including the replacement of moving parts:

- **Must follow local regulations and be made by qualified operators and in accordance with qualified procedures, including changing the heat exchanger tubes**
- **Must be made in accordance with the instructions of the original manufacturer. Repair and modification that necessitate permanent assembly (soldering, welding, expanding etc.) must be made using the correct procedures and by qualified operators.**
- **An indication of any modification or repair must be shown in the monitoring and maintenance file.**

Recycling

The unit is wholly or partly recyclable. After use it contains refrigerant vapours and oil residue. It is coated by paint.

Operating life

This unit is designed for:

- **Prolonged storage of 15 years under nitrogen charge with a temperature difference of 20 K per day.**
- **452000 cycles (start-ups) with a maximum difference of 6 K between two neighbouring points in the container, based on 6 start-ups per hour over 15 years at a usage rate of 57%.**

Excess corrosion thickness

Gas side: 0 mm

Heat exchange fluid side: 1 mm for tubular plates in lightly alloyed steels, 0 mm for stainless steel plates or plates with copper-nickel or stainless steel protection.

10.9 - Refrigerant

30RB units operate with refrigerant R-410A.

10.10 - High-pressure safety switch

30RB units are equipped with high-pressure safety switches with automatic reset. These pressure switches are located at the discharge of each circuit.

10.11 - Variable frequency drive

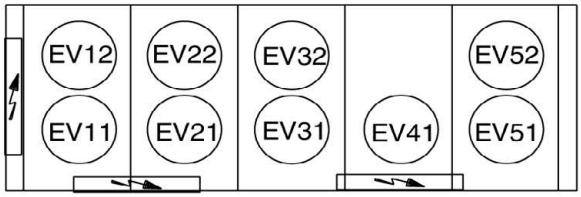
The units are equipped with variable frequency drives to control the fan speed within the fmin-fmax frequency range (standard, fmin=5 Hz and fmax=50 Hz).

All fans on the same refrigerating circuit are controlled by a single variable frequency drive. Fan speed is changed by generating a controlled waveform in which frequency and voltage are varied (Pulse Width Modulation).

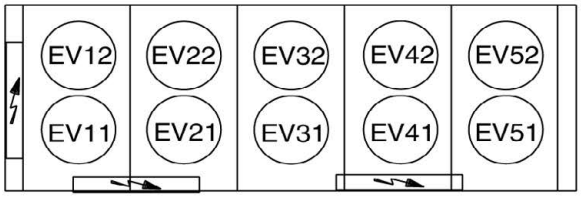
Fan start-up/shut-down and the working range frequency setpoint are controlled by the Controller through RS485 communication using the LEN Protocol.

10.12 - Fan arrangement

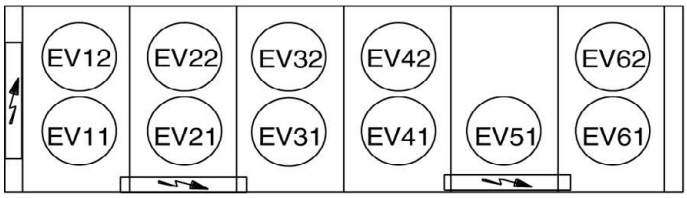
30RB 604



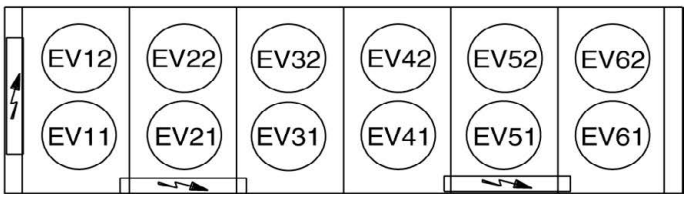
30RB 674



30RB 734



30RB 804



10.13 - Fan stages

Standard unit 30RB	Circuit	Variator
604	A	EV11 + EV12 + EV21
	B	EV31 + EV32 + EV22
	C	EV51 + EV41 + EV52
674	A	EV11 + EV12 + EV21
	B	EV31 + EV32 + EV22
	C	EV41 + EV51 + EV42 + EV52
734	A	EV11 + EV21 + EV12 + EV22
	B	EV31 + EV41 + EV32 + EV42
	C	EV61 + EV51 + EV62
804	A	EV11 + EV21 + EV12 + EV22
	B	EV31 + EV41 + EV32 + EV42
	C	EV51 + EV61 + EV52 + EV62

10.14 - Variable speed ventilation

The variable speed drives on the fans are used to optimise the efficiency of the unit depending on the conditions of use (air temperature, circuit capacity) and hence improve the seasonal efficiency (SEER).

All fans in the same refrigerant circuit are controlled by a single variable speed drive.

Therefore, they operate together at the same rotational speed.

All variable-speed fans are controlled by the unit controller.

Each variable-speed fan is equipped with its own variable speed drive.

The speed is controlled independently for each refrigerating circuit,

This rotation speed at full load or partial load for each circuit is controlled by an algorithm that continuously optimises the condensation temperature to obtain the best unit energy efficiency (EER) whatever the operating conditions.

10.15 - Fan motor electrical protection

The motors of a same circuit are electrically protected by the variable frequency drive in case of short-circuit, locked rotor or general overload.

Each variable frequency drive follows a variable current characteristic, based on the frequency from 5 to 50 Hz and the number of fans controlled.

In case of fan failure (e.g. motor disconnected) the variable frequency drive will detect this problem and an alert will be sent to the user interface.

Refer to the unit's control manual for the list of alarms.

11.1 - Partial heat reclaim using desuperheaters (option 49)

This option permits the production of free hot water using heat reclaim by desuperheating the compressor discharge gases. The option is available for the whole 30RB range.

A plate heat exchanger is installed in series with the air condenser coils on the compressor discharge line of each circuit.

The control configuration for the desuperheater option is factory assembled (see chapter 11.3.6 - Control configura-tion). The installer must protect the heat exchanger against frost.

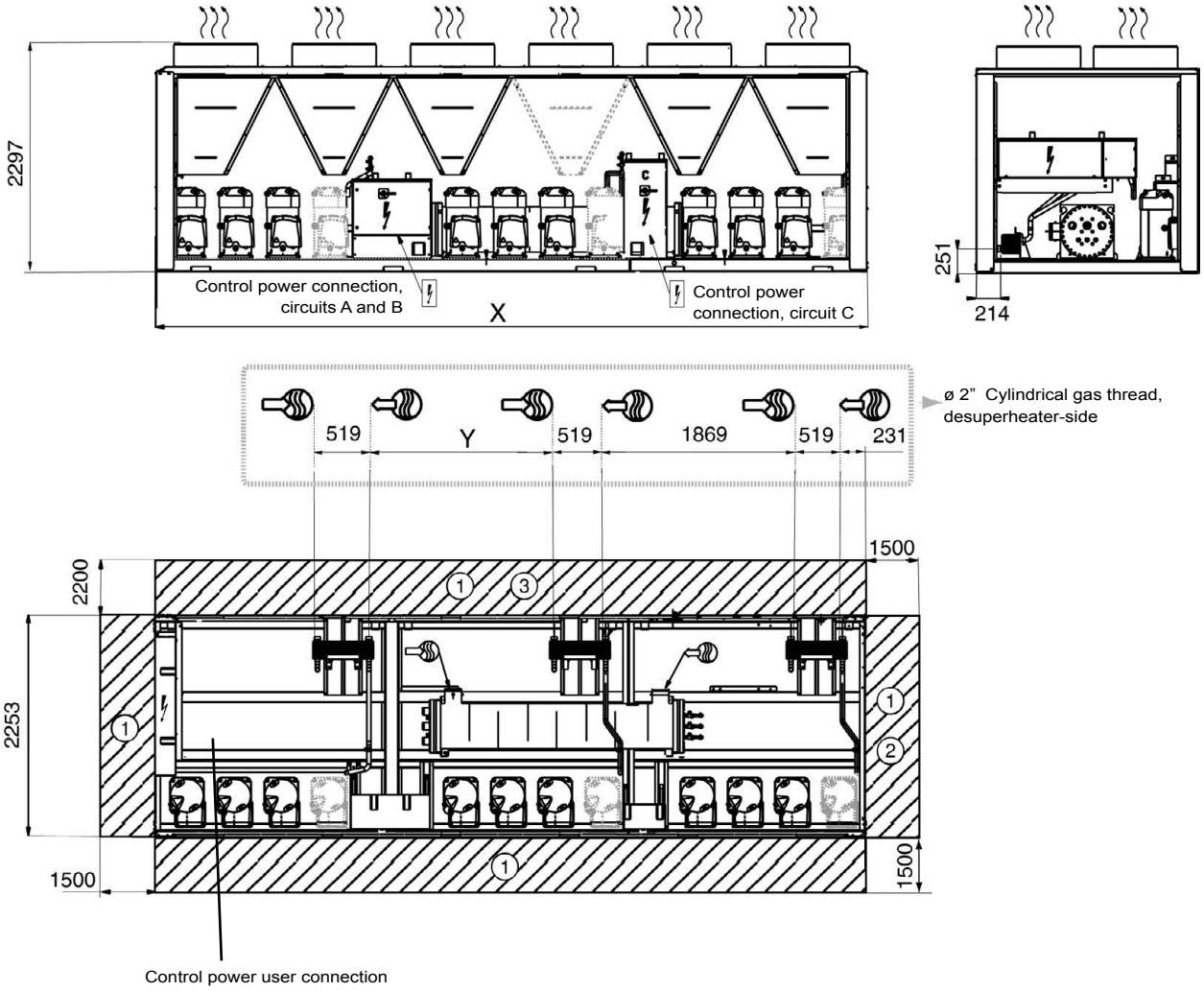
11.1.1 - Physical data, 30RB units with partial heat reclaim using desuperheaters (option 49)

30RB option 49		604	674	734	804
Operating weight(1)					
Standard unit(2)	kg	4544	4769	5234	5461
Unit with options(3)	kg	4760	5003	5486	5731
Desuperheater in circuits A/B/C					
Water volume circuit A	l	5,5	5,5	7,5	7,5
Water volume circuit B	l	5,5	5,5	7,5	7,5
Water volume circuit C	l	5,5	7,5	5,5	7,5
Max. water-side operating pressure	kPa	1000	1000	1000	1000
Water connections					
Connection	in	2	2	2	2
Outside diameter	mm	60,3	60,3	60,3	60,3

(1) Weights shown are a guideline only
(2) Standard unit (with MCHE coils) and desuperheater option
(3) Unit with option 15 + desuperheater

11.1.2 - Dimensional drawings for units equipped with the desuperheater option

30RB 604-804



30RB	X	Y
604-674	5992	1200
734-804	7186	1869

Legend
All dimensions are given in mm.

- ① Clearances required for maintenance and air flow
- ② Clearances recommended for evaporator tube removal
- ③ Clearances recommended for heat exchanger removal
- Water inlet, evaporator and desuperheater
- Water outlet, evaporator and desuperheater
- Air outlet – do not obstruct
- Control box
- Additional compressor(s), depending on the unit size

NOTE: Non-contractual drawings.

When designing an installation, refer to the certified dimensional drawings, available on request.

For the positioning of the fixing points, weight distribution and centre of gravity coordinates.

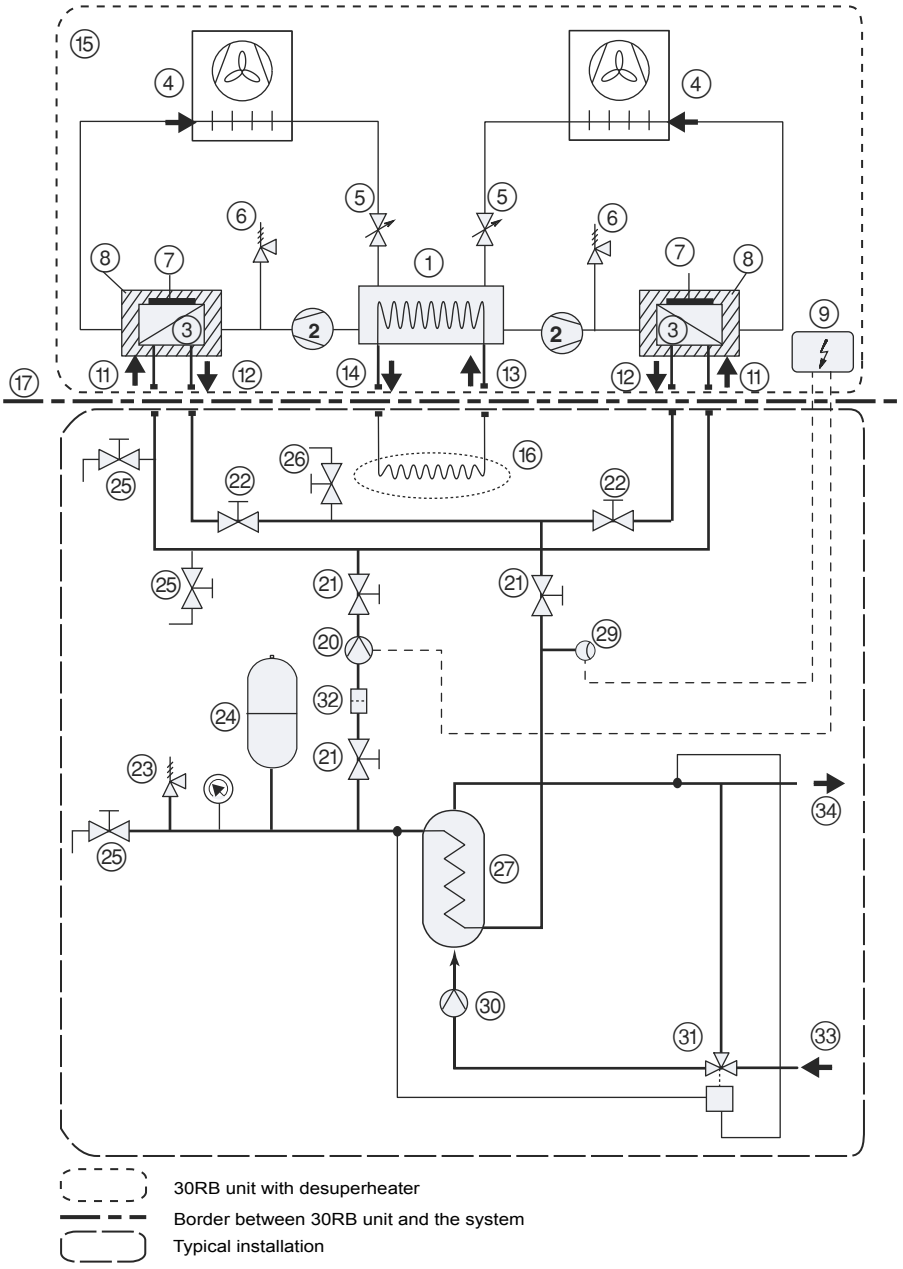
11.1.3 - Installation and operation of the heat reclaim with desuperheater option

The 30RB units with the desuperheater option (No. 49) are supplied with one heat exchanger per refrigerant circuit.

During the unit installation the heat reclaim plate heat exchangers must be insulated and frost protected, if required.

Please refer to the typical installation diagram below for the main components and functions of the 30RB units with the desuperheater option.

Typical installation diagram of units with the desuperheater option



Legend

30RB unit components

1 Evaporator
2 Compressor
3 Desuperheater (plate heat exchanger)
4 Air condenser (coils)
5 Expansion valve (EXV)
6 Damage limitation accessory in case of a fire (relief valve)
7 Electric heater to protect the desuperheater against frost (not supplied)
8 Desuperheater insulation (not supplied)
9 Unit control box
10 NA
11 Desuperheater water inlet
12 Desuperheater water outlet
13 Evaporator water inlet
14 Evaporator water outlet
15 Unit with desuperheater option without hydraulic module
16 System heat load
17 Border between the 30RB unit and the typical installation

Installation components (installation example)

20 Pump (hydraulic circuit of the desuperheater loop)
21 Shut-off valve
22 Desuperheater water flow balancing and control valve
23 Damage limitation accessory in case of a fire (relief valve)
24 Expansion tank
25 Charge or drain valve
26 Air purge
27 Heat exchange coil or plate heat exchanger
28 Pressure gauge
29 Flow switch
30 Pump (sanitary hot water circuit)
31 Three-way valve + controller
32 Filter to protect the pump and the desuperheaters
33 District water supply
34 Sanitary hot water outlet

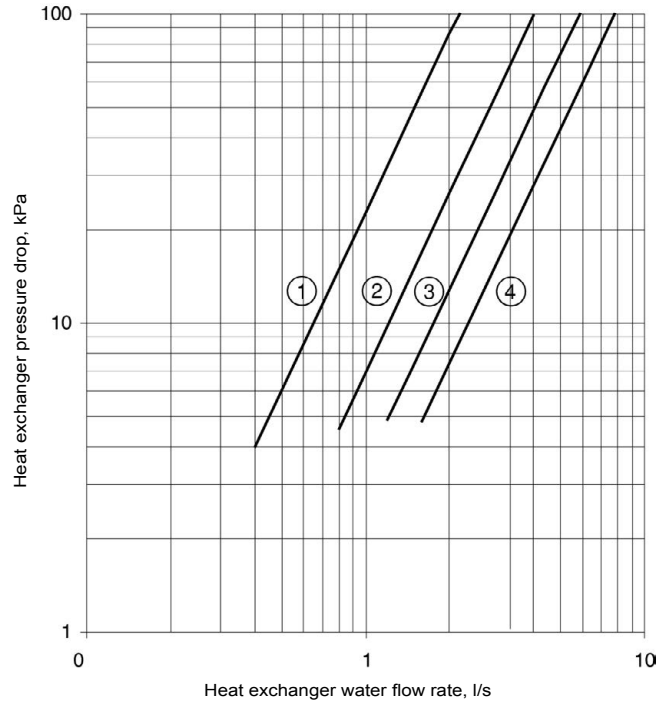
11.1.4 - Installation

The water supply of each desuperheater is arranged in parallel. The water connections on the desuperheater water inlets and outlets must not cause any mechanical local constraint at the heat exchangers. If necessary, install flexible connection sleeves.

Install water flow control and balancing valves at the heat exchanger outlet. Water flow control and balancing can be done by reading the pressure drop in the heat exchangers. This must be identical on all of them with the total water flow rate given by the “Electronic catalogue” selection program.

Refer to the pressure drop curves below to control the balancing valves before starting up the installation. The water flow control of each desuperheater can de refined when the unit operates at full load by trying to obtain leaving water temperatures that are absolutely identical for each circuit.

Desuperheater
(plate heat exchanger pressure drop curves)



1 Circuit with one compressor
2 Circuit with two compressors
3 Circuit with three compressors
4 Circuit with four compressors

Operation of the pump (see typical diagram - item 20 of chapter 11.3.3) of the desuperheater water circuit can be linked to the start-up of the first unit compressor. This requires the installation of an additional electronic board in the control box: option 156, Energy Management Module.

Output No. 25 of the additional board of this option allows control of the pump operation - the pump will start up when the unit starts. A flow switch (item 29) can be installed to generate an alarm if there is a problem with the pump.

The volume of the desuperheater circuit water loop must be as low as possible so that the temperature can increase rapidly when the unit is started up. The minimum entering water temperature at the desuperheater is 25°C. This may require the use of a three-way valve (item 31), with a control-ler and the sensor controlling the minimum required entering water temperature.

The desuperheater water loop must include a relief valve and an expansion tank. When selecting these, consider the water loop volume and the maximum temperature (120°C) when pump operation is stopped (item 20).

11.1.5 - Operating range

Desuperheater		Minimum	Maximum
Entering water temperature at start-up	°C	25(1)	75
Leaving water temperature during operation	°C	30	80
Air condenser		**Minimum**	**Maximum**
Outside operating temperature	°C	0(2)	46

(1) The entering water temperature at start-up must not be lower than 25°C. For installations with a lower temperature a three-way valve is necessary.
(2) The minimum outside temperature is 0°C; -20°C with the winter operation option.

11.3.6 - Control configuration with the desuperheater option

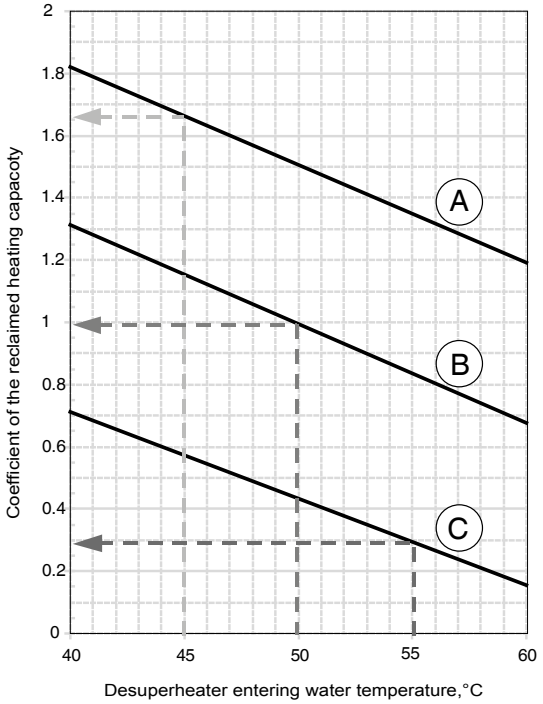
This configuration allows the user to enter a setpoint that is relative to the minimum condensing temperature (default = 30°C) to increase the heating capacity reclaimed at the desuperheaters, if required. The percentage of the reclaimed heating capacity compared with the total capacity rejected by the condenser increases in proportion to the saturated condensing temperature.

For the setpoint control of the minimum saturated condensing temperature refer to the Pro-Dialog control manual.

Other parameters directly affecting the effective capacity reclaimed at the desuperheater are principally:

- The unit load rates, that decide whether the unit operates at full load (100%) or part load (depending on the number of compressors per unit circuit).
- The water entering temperature in the desuperheater as well as the condenser entering air temperature. See the curve below.

Coefficient of the heating capacity reclaimed at the desuperheater based on the entering water temperature at the desuperheater and the condenser entering air temperature



A Entering air temperature = 45 °C
B Entering air temperature = 35 °C
C Entering air temperature = 20 °C

Nominal conditions corresponding to coefficient = 1
Evaporator entering/leaving temperature = 12/7°C
Desuperheater entering/leaving temperature = 50/60°C
Condenser entering air temperature = 35°C (curve B).

11.2 - Other options

Options	No.	Description	Advantages	Use
Low noise level	15	Aesthetic and sound absorbing compressor enclosure	Noise level reduction	30RB 604-804
Very low noise level	15LS	Aesthetic and sound absorbing compressor enclosure associated with low-speed fans	Noise level reduction for sensible site	30RB 604-804
Grilles and enclosure panels	23	Metal grilles on the 4 unit sides, plus side enclosure panels at each end of each coil	Improves aesthetics, protection against intrusion to the unit interior, coil and piping protection against impacts.	30RB 604-804
Enclosure panels	23A	Side enclosure panels at each end of each coil	Improves aesthetics, coil and piping protection against impacts.	30RB 604-804
Water exchange frost protection	41	Electric heater on the water exchanger and the water piping	Water exchanger module frost protection between 0°C and -20°C outside air temperature	30RB 604-804
Partial heat recovery	49	Unit equipped with one desuperheater on each refrigerant circuit	Production of free high-temperature hot-water simultaneously with chilled water production (or hot water for Heat pump)	30RB 604-804
Master/slave operation	58	Unit equipped with supplementary water outlet temperature sensor kit (to be field installed) allowing master/slave operation of two units connected in parallel	Optimised operation of two units connected in parrallel operation with operating time equalisation	30RB 604-804
Main disconnect switch without fuse	70	Factory-installed main electric disconnect switch in the control box	Ease-of-installation and compliance with local electrical regulations	30RB 604-804
Fuses on main disconnect switch	70D	Factory installed additional fuses, one per each phase, to protect main switch and associated cables from over-current flow (Note: frequency drives and electronic boards are protected as standard by dedicated fuses. Option 70D recommended when compliant protection devices on field not present)	No need for separate fuse box. Save time and money on site installation and avoid additional space requirement	30RB 604-804
Shell and tubes evaporator with aluminum jacket	88	Evaporator covered with an aluminum sheet for thermal insulation protection	Improved resistance to aggressive climate conditions	30RB 604-804
Compressor suction valve	92	Valve set for the compressor suction side to isolate it in the refrigerant circuit	Simplified service and maintenance	30RB 604-804
J-Bus gateway	148B	Bi-directional communication board complying with JBus protocol	Connects the unit by communication bus to a building management system	30RB 604-804
BacNet gateway	148C	Bi-directional communication board complying with BacNet protocol	Easy connection by communication bus to a building management system	30RB 604-804
Lon gateway	148D	Bi-directional communication board complying with Lon Talk protocol	Connects the unit by communication bus to a building management system	30RB 604-804
Energy Management Module	156	EMM Control board with additional inputs/outputs. See Energy Management Module option chapter	Extended remote control capabilities (Set-point reset, ice storage end, demand limits, boiler on/off command...)	30RB 604-804
Dual relief valves on 3-way valve	194	Three-way valve upstream of dual relief valves on the shell and tubes evaporator	Valve replacement and inspection facilitated without refrigerant loss. Comforms to European standard EN378/BGVD4	30RB 604-805
Compliance with Australian regulations	200	Unit approved to Australian code	Conformance with Australian regulations	30RB 604-804
Enviro-Shield anti-corrosion protection	262	Coating by conversion process which modifies the surface of the aluminum producing a coating that is integral to the coil. Complete immersion in a bath to ensure 100% coverage. No heat transfer variation, tested 4000 hours salt spray per ASTM B117	Improved corrosion resistance, recommended for use in moderately corrosive environments	30RB 604-804
Super Enviro-Shield anti-corrosion protection	263	Extremely durable and flexible epoxy polymer coating applied on micro channel heat exchangers by electro coating process, final UV protective topcoat. Minimal heat transfer variation, tested 6000 hours constant neutral salt spray per ASTM B117, superior impact resistance per ASTM D2794	Improved corrosion resistance, recommended for use in extremely corrosive environments	30RB 604-804
Welded evaporator connection kit	266	Victaulic piping connections with welded joints	Easy installation	30RB 604-804
230V electrical plug	284	230V AC power supply source provided with plug socket and transformer (180 VA, 0,8 Amps)	Permits connection of a laptop or an electrical device during unit commissioning or servicing	30RB 604-804

12 - STANDARD MAINTENANCE

Air conditioning equipment must be maintained by profes-sional technicians, whilst routine checks can be carried out locally by specialised technicians. See the standard EN 378-4.

Simple preventive maintenance will allow you to get the best performance from your HVAC unit:

- Improved cooling performance
- Reduced power consumption
- Prevention of accidental component failure
- Prevention of major time-consuming and costly work
- Protection of the environment

There are five maintenance levels for HVAC units, as defined by the AFNOR X60-010 standard.

12.1 - Level 1 maintenance (see note opposite)

Simple procedure can be carried out by the user:

- Visual inspection for oil traces (sign of a refrigerant leak)
- Air heat exchanger (condenser) cleaning - see chapter 'Condenser coil - level 1'
- Check for removed protection devices, and badly closed doors/covers
- Check the unit alarm report when the unit does not work (see report in the 30RB Pro-Dialog Plus control manual)
- Verification of the charge in the liquid line sight glass
- Verify that the temperature difference between the heat exchanger inlet and outlet is correct.
- General visual inspection for any signs of deterioration.

12.2 - Level 2 maintenance (see note opposite)

This level requires specific know-how in the electrical, hydraulic and mechanical fields. It is possible that these skills are available locally: existence of a maintenance service, industrial site, specialised subcontractor.

In these cases, the following maintenance operations are recommended.

Carry out all level 1 operations, then:

- At least once a year tighten the power circuit electrical connections (see table with tightening torques opposite).
- Check the expansion tank for signs of excessive corro-sion or gas pressure loss and replace it, if necessary.
- Check and retighten all control/command connections, if required (see table with tightening torques opposite).
- Remove the dust and clean the interior of the control boxes, if required.
- Check the presence and the condition of the electrical protection devices.
- Check the correct operation of all heaters.
- Replace the fuses every 3 years or every 15000 hours (age-hardening).
- Check the water connections.
- Purge the water circuit (see chapter 'Water flow control procedure').
- Clean the water filter (see chapter 'Water flow control procedure').
- Fully clean the condensers with a low-pressure jet and a bio-degradable cleaner (counter-current cleaning - see chapter 'Condenser coil - level 2).
- Check the unit operating parameters and compare them with previous values.
- Keep and maintain a maintenance sheet, attached to each HVAC unit.

All these operations require strict observation of adequate safety measures: individual protection garments, compliance with all industry regulations, compliance with applicable local regulations and using common sense.

12.3 - Level 3 (or higher) maintenance (see note below)

The maintenance at this level requires specific skills/approval/tools and know-how and only the manufacturer, his repre-sentative or authorised agent are permitted to carry out these operations. These maintenance operations concern for example:

- A major component replacement (compressor, evaporator)
- Any intervention on the refrigerant circuit (handling refrigerant)
- Changing of parameters set at the factory (application change)
- Removal or dismantling of the HVAC unit
- Any intervention due to a missed established maintenance operation
- Any intervention covered by the warranty.

NOTE: Any deviation or non-observation of these maintenance criteria will render the guarantee conditions for the HVAC unit nul and void, and the manufacturer, Carrier France, will no longer be responsible.

12.4 - Tightening torques for the main electrical connections

Component	Designation in the unit	Value (N·m)
M12 screw on bus bar, customer connection		80
Soldered screw PE, customer connection		80
Tunnel terminal screw, fuse holder	Fu-	3-3.5
Tunnel terminal screw, compressor contactor	KM1-->KM12	3-4.5
Brass screw M6, compressor earth	EC-	5
Screw M6, compressor connection	EC-	5
Tunnel terminal screw, disconnects	QM-	0.8-1.2
Screw M6, earth power distribution		10

12.5 - Tightening torques for the main bolts and screws

Screw type	Used for	Value (N·m)
Metal screw D=4.8	Condensing module, housing supports	4.2
Screw H M8	Condensing module, compressor fixing	18
Taptite screw M10	Condensing module, chassis - structure fixing	30
Taptite screw M6	Piping support, cowling	7
Screw H M8	Piping clip	12
Screw H M6	Piping clip	10
Nut H M10	Compressor chassis	30
Nut M8	Plate heat exchanger fixing (30RB 162-262)	12

12.6 - Condenser coil

We recommend, that finned coils are inspected regularly to check the degree of fouling. This depends on the environment where the unit is installed, and will be worse in urban and industrial installations and near trees that shed their leaves.

For coil cleaning, two maintenance levels are used, based on the AFNOR X60-010 standard:

Recommendations for maintenance and cleaning of round tube plate fin (RTPF) condenser coils:

- Regular cleaning of the coil surface is essential for correct unit operation. Eliminating contamination and removal of harmful residue will increase the operating life of the coils and the unit.

- The maintenance and cleaning procedures below are part of the regular maintenance and will prolong the life of the coils.

Removal of fibres that obstruct the surfaces:

Fibres and dirt collected on the coil surface must be removed with a vacuum cleaner. If you do not have a vacuum cleaner, a soft brush with non-metallic bristles can be used instead. In all cases cleaning must be done in the direction of the fins, as the coil surface is easily damaged. The fins bend easily and damage the protective coating of the coil, if cleaning is done at right angles to the fins. Clean against the air flow direction.

NOTE: Using a water jet from a spray hose on a polluted surface will result in fibres and dirt becoming trapped in the coil, making cleaning more difficult. All fibres and dirt must be removed from the surface, before using a low-speed rinsing jet.

Periodical cleaning with clean water:

For coils installed in a coastal or industrial environment periodical cleaning by rinsing with water is beneficial. It is however essential that rinsing is done with a low-speed water jet to avoid damaging the fins. Monthly cleaning as described below is recommended.

ATTENTION

- **Chemical cleaning agents, water containing bleach, acidic or basic cleaning agents must never be used to clean the coil exterior or interior. These cleaning agents may be difficult to rinse off and can accelerate corro-sion at the joint between tube and fins, where two different materials come into contact.**
- **High-speed water from a high-pressure cleaner, spray hose or compressed air cleaner must never be used for coil cleaning. The force of the water or air jet will bend the fins and increase the air-side pressure drop. This can result in reduced performance or nuisance shutdowns of the unit.**

Recommendations for maintenance and cleaning of MCHE (microchannel) condenser coils:

- Regular cleaning of the coil surface is essential for correct unit operation. Eliminating contamination and removal of harmful residue will increase the operating life of the coils and the unit.
- The maintenance and cleaning procedures below are part of the regular maintenance and will prolong the life of the coils.
- Remove foreign objects and debris attached to the coil surface or wedged between the chassis and the supports.
- Provide personal protection equipment including safety glasses and/or a face mask, waterproof clothing and safety gloves. It is recommended to wear clothing that covers the whole body.
- Clean and brush with a soft a soft Nylon, PolyPro® or Tynex® brush all the connection to remove any loose corrosion and debris with tap water at low pressure.

WARNING: Never use pressurised water without a large diffuser. Do not use high-pressure cleaners for Cu/Cu and Cu/Al coils! High pressure cleaners are only permitted for MCHE coils (maximum permitted pressure 62 bar).

Concentrated and/or rotating water jets are strictly forbidden. Never use a fluid with a temperature above 45°C to clean the air heat exchangers.

Correct and frequent cleaning (approximately every three months) will prevent 2/3 of the corrosion problems.

Protect the control box during cleaning operations.

12.7 - Evaporator maintenance

Check that:

- The insulating foam is intact and securely in place.
- The cooler heaters are operating, secure and correctly positioned.
- The water-side connections are clean and show no sign of leakage.

12.8 - Characteristics of R-410A

See the table below.

Saturated temperatures based on the relative pressure (in kPa)			
Saturated Temp. °C	Relative pressure, kPa	Saturated Temp. °C	Relative pressure, kPa
-20	297	25	1552
-19	312	26	1596
-18	328	27	1641
-17	345	28	1687
-16	361	29	1734
-15	379	30	1781
-14	397	31	1830
-13	415	32	1880
-12	434	33	1930
-11	453	34	1981
-10	473	35	2034
-9	493	36	2087
-8	514	37	2142
-7	535	38	2197
-6	557	39	2253
-5	579	40	2311
-4	602	41	2369
-3	626	42	2429
-2	650	43	2490
-1	674	44	2551
0	700	45	2614
1	726	46	2678
2	752	47	2744
3	779	48	2810
4	807	49	2878
5	835	50	2947
6	864	51	3017
7	894	52	3088
8	924	53	3161
9	956	54	3234
10	987	55	3310
11	1020	56	3386
12	1053	57	3464
13	1087	58	3543
14	1121	59	3624
15	1156	60	3706
16	1192	61	3789
17	1229	62	3874
18	1267	63	3961
19	1305	64	4049
20	1344	65	4138
21	1384	66	4229
22	1425	67	4322
23	1467	68	4416
24	1509	69	4512
		70	4610

Aquasnap Puron units use high-pressure R-410A refrigerant (the unit operating pressure is above 40 bar, the pressure at 35°C air temperature is 50% higher than for R-22). Special equipment must be used when working on the refrigerant circuit (pressure gauge, charge transfer, etc.).

12 - STANDARD MAINTENANCE

Preliminary information

Job name: .....
Location: .....
Installing contractor: .....
Distributor: .....
Start-up preformed by: ..... Date: .....

Equipment

Model 30RB: S/N

Compressors

Circuit A	Circuit B	Circuit C
1. Model #	1. Model #	1. Model # .....
S/N	S/N	S/N .....
2. Model #	2. Model #	2. Model # .....
S/N	S/N	S/N .....
3. Model #	3. Model #	3. Model # .....
S/N	S/N	S/N .....
4. Model #	4. Model #	4. Model # .....
S/N	S/N	S/N .....

Air handling equipment

Manufacturer .....
Model # ..... S/N .....

Additional air handling units and accessories.....
.....

Preliminary equipment check

Is there any shipping damage? ..... If so, where? .....
.....
Will this damage prevent unit start-up? .....

☐ Unit is level in its installation
☐ Power supply agrees with the unit name plate
☐ Electrical circuit wiring has been sized and installed properly
☐ Unit ground wire has been connected
☐ Electrical circuit protection has been sized and installed properly
☐ All terminals are tight
☐ All cables and thermistors have been inspected for crossed wires
☐ All plug assemblies are tight

Check air handling systems
☐ All air handlers are operating
☐ All chilled water valves are open
☐ All fluid piping is connected properly
☐ All air has been vented from the system
☐ Chilled water pump is operating with the correct rotation. CWP amperage: Rated:..... Actual .....

12 - STANDARD MAINTENANCE

Unit start-up

☐ Chilled water pump starter has been properly interlocked with the chiller
☐ Oil level is correct
☐ Unit has been leak checked (including fittings)
☐ Locate, repair, and report any refrigerant leaks
.....
.....
.....

Check voltage imbalance: AB..... AC ..... BC.....
Average voltage = ... (see installation instructions)
Maximum deviation = ... (see installation instructions)
Voltage imbalance = ...(see installation instructions)

☐ Voltage imbalance is less than 2%

WARNING: Do not start chiller if voltage imbalance is greater than 2%. Contact local power company for assistance.

☐ All incoming power voltage is within rated voltage range

Check evaporator water loop
Water loop volume = ... (litres)
Calculated volume = ... (litres)
2.5 litres/nominal kW capacity for air conditioning
6.5 litres/nominal kW capacity for process cooling

☐ Proper loop volume established
☐ Proper loop corrosion inhibitor included ..... litres of .....
☐ Proper loop freeze protection included (if required) ..... litres of .....
☐ Water piping includes electric tape heater up to the evaporator
☐ Return water piping is equipped with a screen filter with a mesh size of 1.2 mm

Check pressure drop across the evaporator

Entering evaporator = ... (kPa)
Leaving evaporator = ... (kPa)
Pressure drop (entering - leaving) = ... (kPa)
WARNING: Plot the pressure drop on the evaporator flow/pressure drop curve to determine the flow rate in l/s at the nominal operating conditions for the installation.
If necessary use the control valve to impose the flow rate on the nominal value.

☐ Flow rate from the pressure drop curve, l/s = ...
☐ Nominal flow rate, l/s = ...
☐ The flow rate in l/s is higher than the minimum unit flow rate
☐ The flow rate in l/s corresponds to the specification of ..... (l/s)

12 - STANDARD MAINTENANCE

Carry out the QUICK TEST function (see 30RB/RQ Pro-Dialog Plus Control manual):

Check and log on to the user menu configuration

Load sequence selection.....
Capacity ramp loading selection.....
Start-up delay .....
Burner section .....
Pump control .....
Set-point reset mode .....
Night-time capacity setback.....

Re-enter the set-points (see Controls section)

To start up the chiller

WARNING: Be sure that all service valves are open, and that the pump is on before attempting to start this machine. Once all checks have been made, start the unit in the "LOCAL ON" position.

Unit starts and operates properly

Temperatures and pressures

WARNING: Once the machine has been operating for a while and the temperatures and pressures have stabilized, record the following:

Evaporator entering water .....
Evaporator leaving water.....
Ambient temperature .....
Circuit A suction pressure .....
Circuit B suction pressure.....
Circuit C suction pressure .....
Circuit A discharge pressure.....
Circuit B discharge pressure .....
Circuit C discharge pressure .....
Circuit A suction temperature .....
Circuit B suction temperature .....
Circuit C suction temperature.....
Circuit A discharge temperature .....
Circuit B discharge temperature.....
Circuit C discharge temperature.....
Circuit A liquid line temperature.....
Circuit B liquid line temperature.....
Circuit C liquid line temperature .....

NOTES:

.....
.....
.....

CARRIER participates in the ECP programme for LCP/HP
Check ongoing validity of certificate:
www.eurovent-certification.com

Quality and Environment
Management Systems
Approval

Carrier
United Technologies

Order No: 10232, 05.2018 - Supersedes order No: 10232, 11.2017. Manufactured by: Carrier SCS, Montluel, France.
Manufacturer reserves the right to change any product specifications without notice. Printed in the European Union.