38RBS 039-160

Air-Cooled Condensing Units

Nominal cooling capacity 40-160 kW

50 Hz

PRO-DIALOG

For the operation of the control please refer to the
Pro-Dialog+ Control manual for the 38RBS 039-160 series

Installation, operation and maintenance instructions

ISO9001·ISO14001

Quality and Environment
Management Systems
Approval

CONTENTS

The cover photograph is for illustrative purposes only and is not part of any offer for sale or contract.

1 - INTRODUCTION

Prior to the initial start-up of the 38RBS units, the people involved should be thoroughly familiar with these instructions and the specific project data for the installation site.

38RBS units are designed to provide a very high level of safety and reliability making installation, start-up, operation and maintenance easier and more secure. They will provide safe and reliable service when operated within their application range.

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 e.g. 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 - Check equipment received

- Inspect the unit for damage or missing parts. If damage is detected, or if shipment is incomplete, immediately file a claim with the shipping company.
- Confirm that the unit received is the one ordered. Compare the name plate data with the order.
- The name plate is attached to the unit in two locations:
  - on the outside on one of the unit sides
  - on the control box door on the inside.
- 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
  - Refrigerant used
  - Nitrogen 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
- Check that all accessories ordered for on-site installation have been delivered, and 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".

1.2 - 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.

38RBS units are supplied without a safety valve on the refrigerant circuit. During the installation it is obligatory:

- ***to check the applicable refrigerant regulations and safety standards (e.g. PED, EN378 for the European Community).***
- ***if a fire risk exists, protect not only the added capacities (e.g. direct-expansion coil), but also take the compressor surface into consideration. The compressors are considered as vessels that can hold liquid refrigerant. Take care with option 92B (suction and liquid line valves), as these valves do not isolate the safety valves from the different vessels that this option must protect.***

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 accessory*	Damage limitation accessory** in case of an external fire
Refrigerant side		
High-pressure switch	x	
External relief valve***		x
Rupture disk		x
Fuse plug		x
Heat transfer fluid side		
External relief valve****	x	x

* Classified for protection in normal service situations.
** Classified for protection in abnormal service situations.
*** The instantaneous over-pressure limited to 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.
**** The classification of these safety valves must be made by the personnel that completes the whole hydronic installation.

The external safety 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.

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

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

Accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation or explosions.

Inhalation of high concentrations of vapour is harmful and may cause heart irregularities, unconsciousness, or death. Vapour is heavier than air and reduces the amount of oxygen available for breathing. These products cause eye and skin irritation. Decomposition products can be hazardous.

1.3 - 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.

Do not introduce high static and dynamic pressure compared with the existing operating pressures - either service or test pressures - in the refrigerant circuit, e.g. by limiting the elevation of the condensers or evaporators.

1.4 - Maintenance safety considerations

Engineers working on the electric or refrigeration components must be authorized, trained and fully qualified to do so (e.g. electricians trained and qualified in accordance with IEC 60364 Classification BA4).

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.

38RBS 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 operations). The unit must be switched off while this is done.

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.

During any handling, maintenance and service operations the engineers working on the unit must be equipped with safety gloves, glasses, shoes and protective clothing.

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 and secure the machine upstream with a padlock.

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

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

If any work is carried out in the fan area, specifically if the grilles or casings have to be removed, cut the power supply to the fans to prevent their operation. It is also recommended to block the rotation of the blades during any intervention.

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.

OPERATING CHECKS:

- ***IMPORTANT INFORMATION REGARDING THE REFRIGERANT USED:***
  This product contains fluorinated greenhouse gas covered by the Kyoto protocol.
  Refrigerant type: R-410A
  Global Warming Potential (GWP): 1975

ATTENTION

- ***Attach the label supplied that shows the refrigerant used to the side used for topping up and/or recovery.***
- ***On the label clearly indicate the topped up refrigerant quantity in indelible ink.***
- ***Prevent the release of fluorinated gas from the unit. Ensure that fluorinated gas is never released to the atmosphere during installation, maintenance or disposal. If a leak of fluorinated gas is detected, stop the leak and repair it as quickly as possible.***
- ***Only a qualified service technician is allowed to access this product and to correct the fault.***
- ***Any handling of fluorinated gas contained in this product (e.g. moving the product or topping up the gas) must comply with EC regulation no. 842/2006 about certain fluorinated greenhouse gases and any other applicable local legislation.***
- ***Contact your local dealer if you have any questions.***
- ***Periodic inspections for refrigerant leaks may be required depending on European or local legislation. Please contact your local dealer for more information.***
- ***During the life-time of the system, inspection and tests must be carried out in accordance with national regulations.***

Protection device checks:

- ***If no national regulations exist, check the protection devices on site in accordance with standard EN378: once a year for the high-pressure switches, every five years for external safety valves.***

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, transfer the refrigerant to bottles specifically provided for this purpose 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.

1.5 - 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 authorized 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.

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 the unit. Traces of vapour should be displaced with dry nitrogen. Refrigerant in contact with an open flame can produce 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.

Never apply an open flame (blowlamp) or overheated steam (high-pressure cleaner) to the refrigerant circuit. 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 safety 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.

Periodically inspect all valves, fittings and pipes of the refrigerant circuit 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.

Always ensure you are using the correct refrigerant type before recharging the unit.

Charging any refrigerant other than the original charge type (R-410A) will impair machine operation and can even lead to a destruction of the compressors. The compressors operate with R-410A and are charged with a synthetic polyol-ester oil.

Before any intervention on the refrigerant circuit, the complete refrigerant charge must be recovered.

2 - MOVING AND SITING THE UNIT

2.1 - Moving

See chapter 1.2 - "Installation safety considerations".

2.2 - Siting 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 siting 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 2 mm in both axes).
- if the installation is sensitive to vibration and/or noise transmission, the unit is disconnected from the support structure by inserting anti-vibration mounts (elastomeric mounts or springs) that have been sized by an expert.
- 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 38RBS 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.

2.3 - 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.

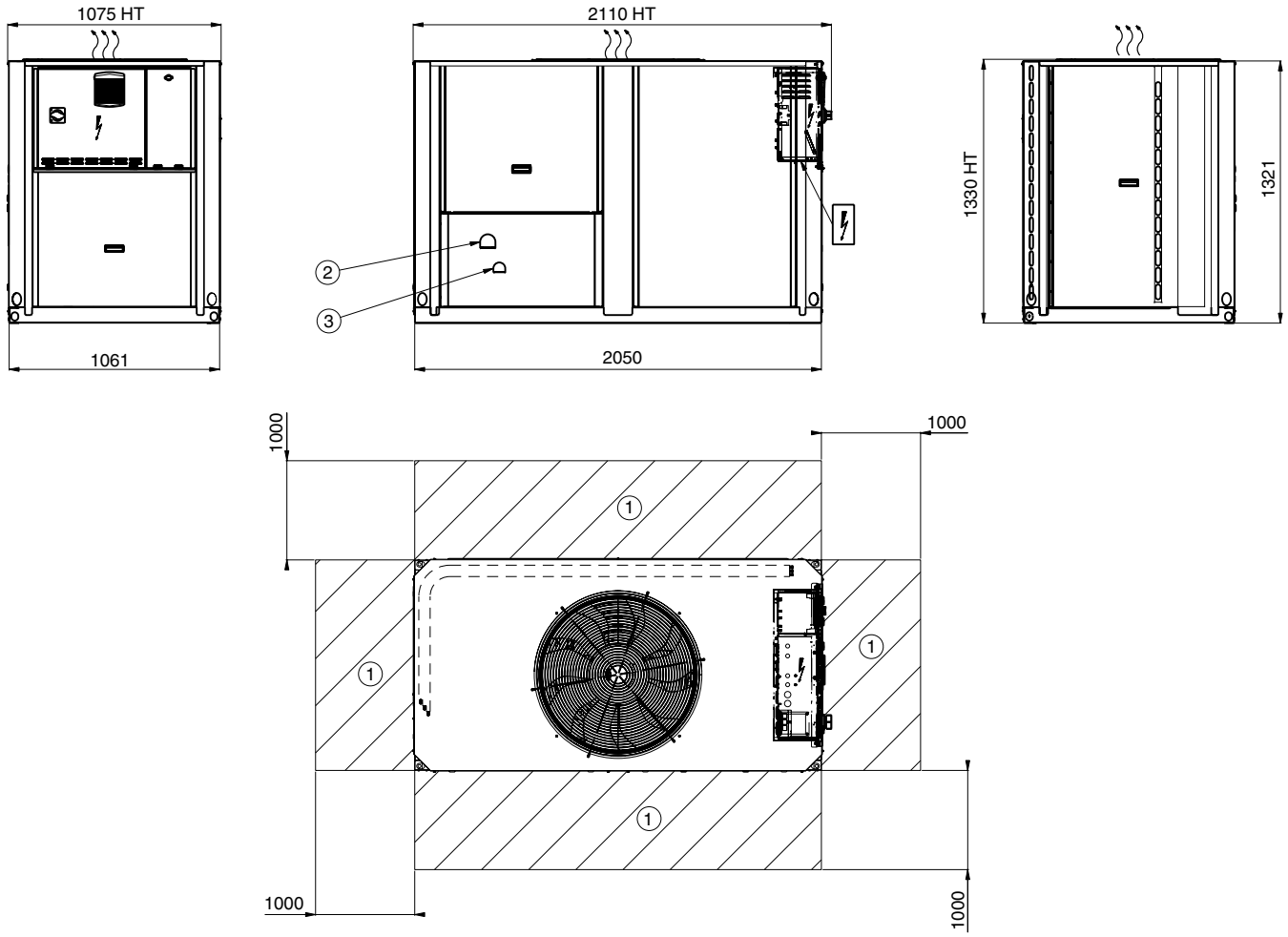
For these checks national regulations must be followed. If the national regulation does not specify any details, refer to standard EN 378-2 as follows:

External visual installation checks:

- 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, certificates, 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 and of the vapour barriers.
- Ensure that the ventilation in the machine room is sufficient.
- Check the refrigerant detectors.

3 - DIMENSIONS, CLEARANCES

3.1 - 38RBS 039-080



Legend:
All dimensions are given in mm

(1) Required space for maintenance

(2) Refrigerant inlet

(3) Refrigerant outlet

Power wiring connection

Power supply

Air outlet, do not obstruct

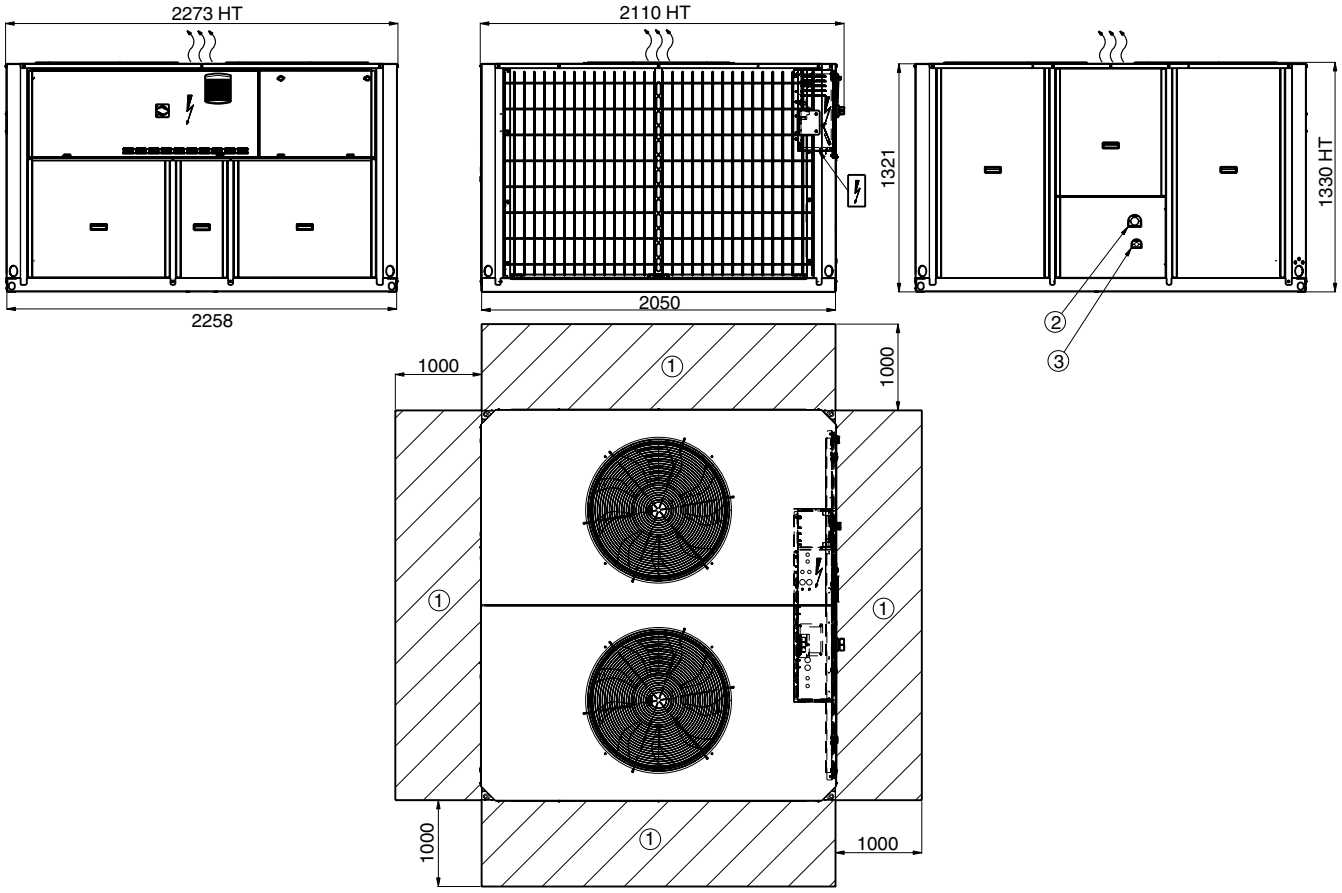
NOTES:

A Non-certified drawings.
Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation. For the location of fixing points, weight distribution and coordinates of the centre of gravity refer to the certified dimensional drawings.

B In multiple-unit installations (maximum four units), the side clearance between the units should be increased from 1000 to 2000 mm.

C The height of the solid surface must not exceed 2 m.

3.2 - 38RBS 090-120



Legend:
All dimensions are given in mm

(1) Required space for maintenance

(2) Refrigerant inlet

(3) Refrigerant outlet

Power wiring connection

Power supply

Air outlet, do not obstruct

NOTES:

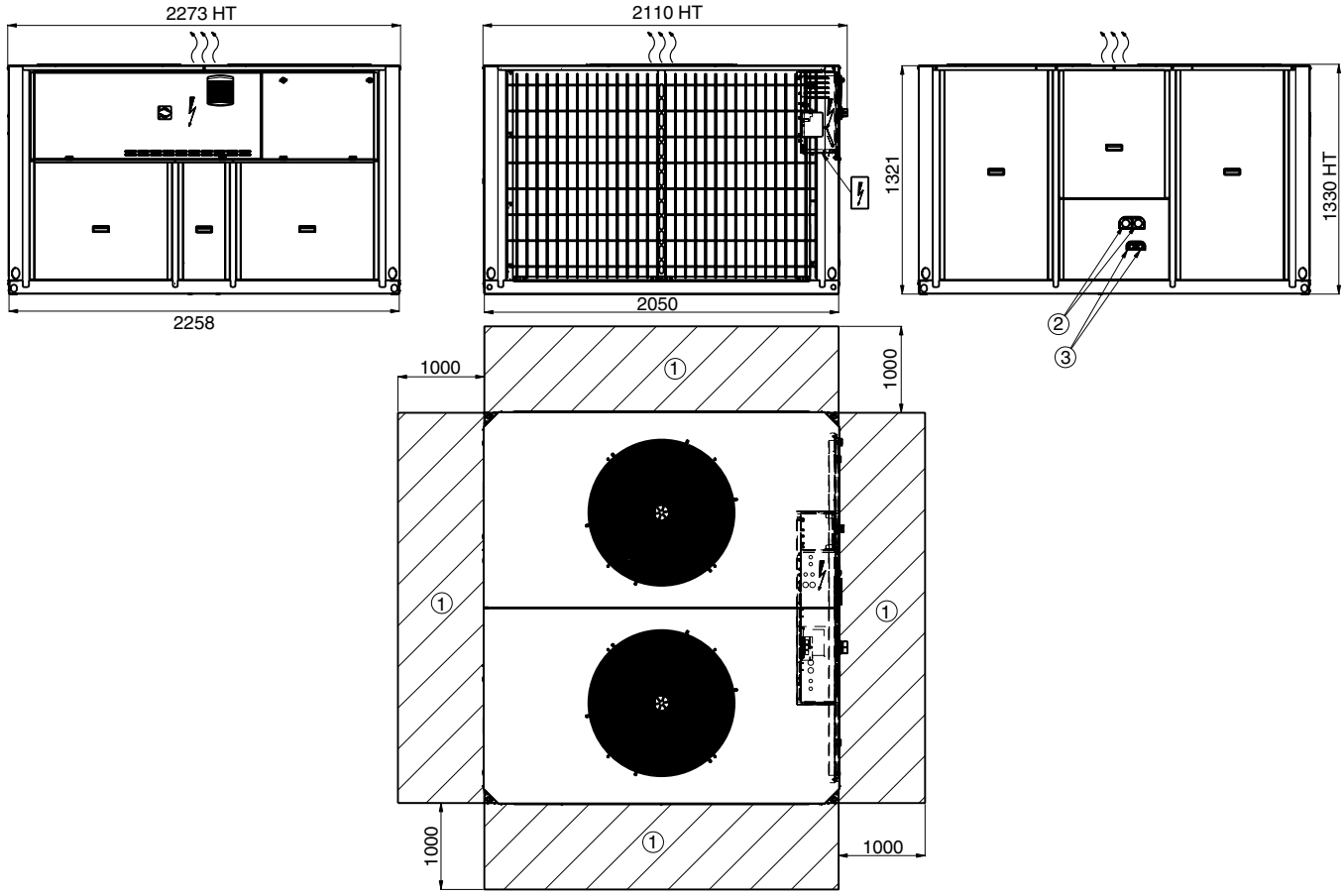
A Non-certified drawings.
Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation.

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

B In multiple-unit installations (maximum four units), the side clearance between the units should be increased from 1000 to 2000 mm.

C The height of the solid surface must not exceed 2 m.

3.3 - 38RBS 140-160



Legend:
All dimensions are given in mm

(1) Required space for maintenance

(2) Refrigerant inlet

(3) Refrigerant outlet

Power wiring connection

Power supply

Air outlet, do not obstruct

NOTES:

A Non-certified drawings.
Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation.

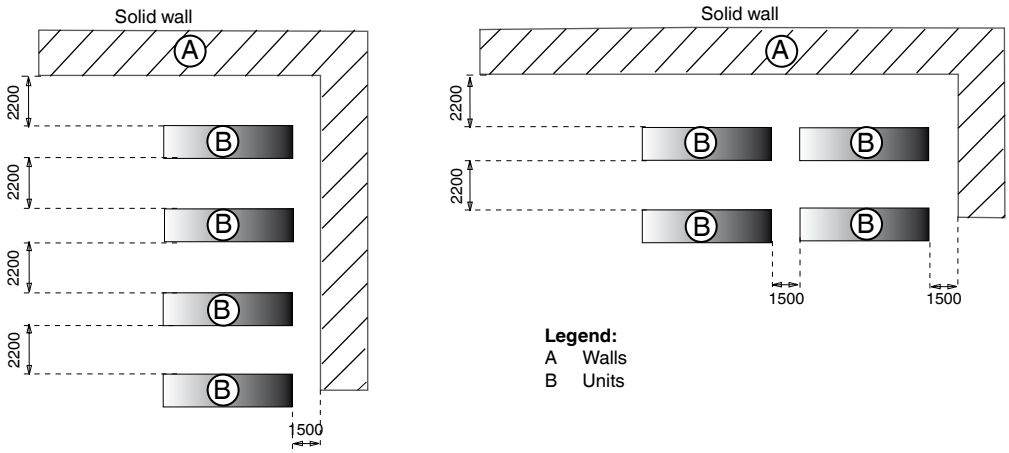
For the location of fixing points, weight distribution and coordinates of the centre of gravity refer to the certified dimensional drawings.

B In multiple-unit installations (maximum four units), the side clearance between the units should be increased from 1000 to 2000 mm.

C The height of the solid surface must not exceed 2 m.

Multiple unit installation

NOTE: If the walls are higher than 2 m, contact the factory.



Legend:
A Walls
B Units

4 - PHYSICAL DATA

38RBS		039	045	050	060	070	080	090	100	120	140	160
Operating weight ex factory*												
Standard unit	kg	399	408	425	445	435	456	698	701	719	796	842
Sound levels												
Standard unit												
Sound power level 10^{-12} W**	dB(A)	80	81	81	81	87	87	84	84	84	90	90
Sound pressure level at 10 m***	dB(A)	49	49	49	49	55	55	52	52	52	58	58
Unit with option 15LS (very low sound level)												
Sound power level 10^{-12} W**	dB(A)	79	80	80	80	80	80	83	83	83	83	83
Sound pressure level at 10 m***	dB(A)	48	48	48	48	48	48	51	51	51	51	51
Compressors		Hermetic scroll compressor 48.3 r/s										
Circuit A		2	2	2	2	2	2	3	3	3	2	2
Circuit B		-	-	-	-	-	-	-	-	-	2	2
Number of capacity stages		2	2	2	2	2	2	3	3	3	4	4
Refrigerant		R410A										
Control		Pro-Dialog+										
Minimum capacity	%	50	50	50	50	50	50	33	33	33	25	25
Capacity split, circuits A/B	%	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	50/50	50/50
Condensers		Grooved copper tubes, aluminium fins										
Fans		Axial Flying Bird 4 fans with rotating shroud										
Quantity		1	1	1	1	1	1	2	2	2	2	2
Total air flow (high speed)	l/s	3800	3800	3800	3800	5300	5300	7600	7600	7600	10600	10600
Speed	r/s	12	12	12	12	16	16	12	12	12	16	16
Refrigerant connections												
Suction line diameter	in	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
Liquid line diameter	in	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8
Chassis paint colour		Colour code: RAL 7035										

* Weight shown is a guideline only. To find out the unit refrigerant charge, please refer to the unit nameplate.
** In accordance with ISO 9614-1. The values have been rounded and are for information only and not contractually binding
*** For information, calculated from the sound power level Lw(A)

5 - ELECTRICAL DATA

38RBS		039	045	050	060	070	080	090	100	120	140	160
Power circuit												
Nominal power supply	V-ph-Hz	400-3-50										
Voltage range	V	360-440										
Control circuit supply		24 V, via internal transformer										
Maximum start-up current (Un)*												
Standard unit	A	114.2	132.4	141.3	143.7	170.4	209.4	169.4	196.4	240.4	226.2	275.2
Unit with electronic starter option	A	74.7	86.5	93.8	96.2	114.4	139.8	-	-	-	-	-
Unit power factor at maximum capacity**		0.83	0.81	0.81	0.83	0.81	0.78	0.83	0.81	0.79	0.81	0.78
Maximum unit power input**	kW	19.5	22.3	24.5	27.9	31.2	35.8	42.3	45.6	52.5	62.4	71.6
Nominal unit current draw***	A	26.2	30.4	34.6	37.6	44.2	53.8	57.8	64.4	78.8	88.4	107.6
Maximum unit current draw (Un)****	A	35.6	40.0	43.8	48.6	55.8	65.8	74.3	81.8	96.8	11.6	131.6
Maximum unit current draw (Un-10%)†	A	38.0	49.0	51.2	57.8	73.2	79.8	88.1	107.9	117.9	146.4	159.6
Customer-side unit power reserve	kW	Customer reserve at the 24 V control power circuit										
Short-circuit stability and protection		See table 5.1 "Short-circuit stability current" below										

* 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).
** Power input, compressors and fans, at the unit operating limits (saturated suction temperature 15°C, saturated condensing temperature 65°C) and nominal voltage of 400 V (data given on the unit nameplate).
*** Nominal conditions: suction temperature 5°C, outside air temperature 35°C.
**** Maximum unit operating current at maximum unit power input and 400 V (values given on the unit nameplate).
† Maximum unit operating current at maximum unit power input and 360 V.

5.1 - Short-circuit stability current (TN system*) - standard unit (with main disconnect without fuse)

38RBS	039	045	050	060	070	080	090	100	120	140	160
Value with unspecified upstream protection											
Short-term current at 1 s - Icw - kA rms	3.36	3.36	3.36	3.36	3.36	3.36	5.62	5.62	5.62	5.62	5.62
Admissible peak current - Ipk - kA pk	20	20	20	20	20	15	20	20	15	20	15
Max. value with upstream protection (circuit breaker)											
Conditional short-circuit current Icc - kA rms	40	40	40	40	40	40	40	40	40	30	30
Schneider circuit breaker - Compact series	NS100H	NS100H	NS100H	NS100H	NS100H	NS100H	NS100H	NS160H	NS160H	NS250H	NS250H
Reference number**	29670	29670	29670	29670	29670	29670	29670	30670	30670	31671	31671

* Earthing system type
** If another current limitation protection system is used, its time-current and thermal constraint (I^2t) trip characteristics must be at least equivalent to those of the recommended Schneider circuit breaker. Contact your nearest Carrier office.
The short-circuit stability current values above are in accordance with the TN system.

5.2 - Compressor usage and electrical data for standard units

Compressor	I Nom	I Max (Un)	I Max (Un-10%)	LRA* A	LRA** A	Cosine phi max.	Circuit	039	045	050	060	070	080	090	100	120	140	160
ZP90	15.2	16.4	17.6	95.0	57.0	0.85	A	2	-	-	-	-	-	-	-	-	-	-
							B	-	-	-	-	-	-	-	-	-	-	-
ZP103	17.4	18.6	23.1	111.0	67.0	0.83	A	-	2	-	-	-	-	-	-	-	-	-
							B	-	-	-	-	-	-	-	-	-	-	-
ZP120	20.0	20.5	24.2	118.0	71.0	0.83	A	-	-	2	-	-	-	-	-	-	-	-
							B	-	-	-	-	-	-	-	-	-	-	-
ZP137	20.7	22.9	27.5	118.0	71.0	0.85	A	-	-	-	2	-	-	3	-	-	-	-
							B	-	-	-	-	-	-	-	-	-	-	-
ZP154	25.0	25.4	34.1	140.0	84.0	0.83	A	-	-	-	-	2	-	-	3	-	2	-
							B	-	-	-	-	-	-	-	-	-	2	-
ZP182	28.6	30.4	37.4	174.0	104.0	0.8	A	-	-	-	-	-	2	-	-	3	-	2
							B	-	-	-	-	-	-	-	-	-	-	2

I Nom Nominal current draw (see definition of conditions under nominal unit current draw), A
I Max Maximum operating current at 360 V, A
* Locked rotor current at nominal voltage, A
** Locked rotor current at nominal voltage, electronic starter, A

Electrical data and operating conditions notes:

- 38RBS 039-160 units have a single power connection point located immediately upstream of the main disconnect switch/circuit breaker.
- The control box includes the following standard features:
  - a main disconnect switch,
  - starter and motor protection devices for each compressor, the fans and the pump,
  - the 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 38RBS units are designed and built to ensure conformance with these codes. The recommendations of European standard EN 60204-1 (machine safety - electrical machine components - part 1: general regulations - corresponds to IEC 60204-1) are specifically taken into account, when designing the electrical equipment.

NOTES:

- Generally the recommendations of IEC 60364 are accepted as compliance with the requirements of the installation directives. Conformance with EN 60204-1 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.
- The operating environment for the 38RBS units is specified below:

1. Environment* - Environment as classified in EN 60721 (corresponds to IEC 60721):
   - outdoor installation*
   - ambient temperature range: -10°C to +48°C, class 4K4H
   - altitude: ≤ 2000 m
   - presence of hard solids, class 4S2 (no significant dust present)
   - presence of corrosive and polluting substances, class 4C2 (negligible)
2. Power supply frequency variation: ± 2 Hz.
3. The neutral (N) conductor 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 is of a type suitable for power interruption in accordance with EN 60947.
6. The units are designed for simplified connection on TN(s) networks (IEC 60364). For IT networks provide a local earth and consult competent local organisations to complete the electrical installation.
7. Derived currents: If protection by monitoring of derived currents is necessary to ensure the safety of the installation, the control of the cut-out value must take the presence of leak currents into consideration that result from the use of frequency converters in the unit. A value of at least 150 mA is recommended to control differential protection devices.

Caution: 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.

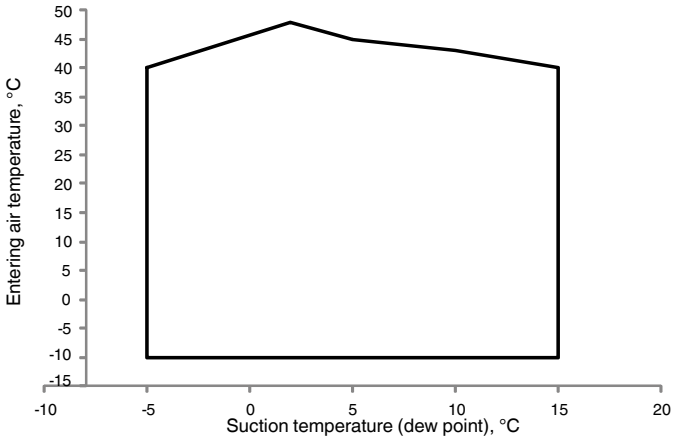
* The required protection level for this class is IP43BW (according to reference document IEC 60529). All 38RBS units are protected to IP44CW and fulfil this protection condition.

6 - APPLICATION DATA

6.1 - Operating range, standard unit

38RBS		Minimum	Maximum
Evaporator			
Suction temperature (dew point)	°C	-5	15
Condenser			
Entering air temperature***	°C	-10	48

* For transport and storage of the 38RBS units the minimum and maximum allowable temperatures are -20°C and +48°C. It is recommended that these temperatures are used for transport by container.



7 - ELECTRICAL CONNECTION

7.1 - Control box

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

7.2 - Power supply

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

WARNING: Operation of the unit 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 unit is not switched on until corrective measures have been taken.

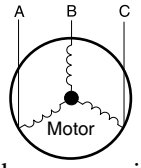
7.3 - Voltage phase imbalance (%)

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

Example: On a 400 V-3 ph-50 Hz supply, the individual phase voltages were measured: 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 is therefore acceptable.

7.4 - Recommended wire sections

Wire sizing is the responsibility of the installer, and depends on the characteristics and regulations for each installation site. The following should only be used as a guideline, and does not make Carrier in any way liable.

After wire sizing has been completed, using the certified dimensional drawing, the installer must ensure easy connection and define any modifications necessary on site. The standard connections 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 below.

The calculations are based on the maximum machine current (see electrical data tables), and standard installation practices, in accordance with IEC 60364, table 52C have been applied (38RBS units are installed outside):

- No. 17: suspended aerial lines,
- No. 61: buried conduit with a derating coefficient of 20.

The calculation is based on PVC or XLPE insulated cables with copper core. A maximum outside temperature of 46°C is taken into consideration. The given wire length limits the voltage drop to < 5% (length L in metres - see table below).

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 the main disconnect/isolator switch.

Power cable entry
The power cables can enter the 30RB control box from below or from the side of the unit, at the bottom of the angle iron. Pre-punched holes facilitate the entry. Refer to the certified dimensional drawing for the unit.

A removable aluminium plate below the control box allows introduction of the cables.

7.5 - 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 heaters (compressor oil crankcase heaters, unit frost protection).

7.6 - 24 V user power reserve

After all possible options have been connected, the transformer ensures the availability of a usable 24 VA or 1 A power reserve for the control circuit on site.

Table of minimum and maximum wire sections (per phase) for connection to 38RBS units

38RBS	Disconnect switch	Connectable wire					
	Max. connectable section	Min. calculated wire section			Max. calculated wire section		
	Section, mm²	Section, mm²	Max. length, m	Wire type	Section, mm²	Max. length, m	Wire type
039	1 x 95	1 x 16	165	XLPE Cu	1 x 25	300	PVC Cu
045	1 x 95	1 x 16	165	XLPE Cu	1 x 25	300	PVC Cu
050	1 x 95	1 x 16	165	XLPE Cu	1 x 25	300	PVC Cu
060	1 x 95	1 x 16	210	XLPE Cu	1 x 25	305	PVC Cu
070	1 x 95	1 x 25	220	XLPE Cu	1 x 35	350	PVC Cu
080	1 x 95	1 x 25	220	XLPE Cu	1 x 50	380	PVC Cu
090	1 x 95	1 x 35	220	XLPE Cu	1 x 50	380	PVC Cu
100	1 x 95	1 x 35	280	XLPE Cu	1 x 70	410	PVC Cu
120	1 x 95	1 x 50	280	XLPE Cu	1 x 95	410	PVC Cu
140	1 x 185	1 x 70	305	XLPE Cu	1 x 120	465	PVC Cu
160	1 x 185	1 x 95	320	XLPE Cu	1 x 150	465	PVC Cu

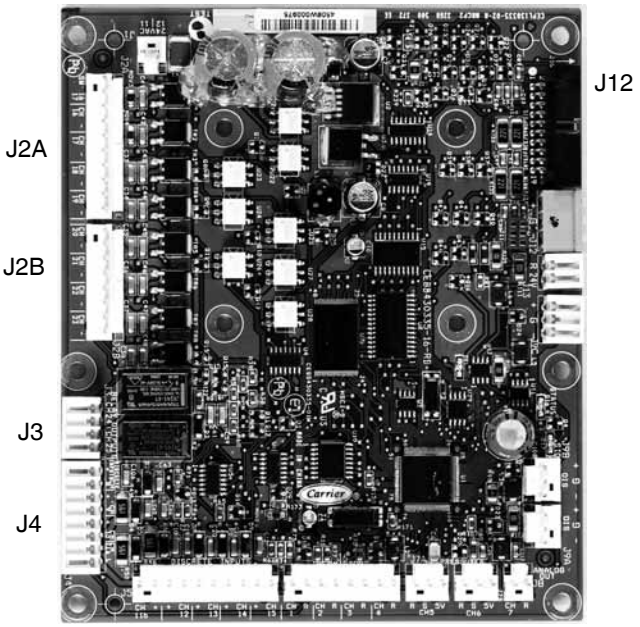
Note: Power supply cable section (see the wiring diagrams supplied with the unit)

8 − 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.***
- ***Conductor fixing between different conductors and/or inside the control box must prevent accidental disconnection and uncontrolled conductor displacement, where ends could touch an active energised part.***

NRCP2-BASE control board



8.1 - Solenoid valves

The solenoid valves are supplied with the unit, and attached to one of the fan posts. They must be connected to channels 21 and 22, located at connector J2B of the main board (and to connector J2B of the additional board of units 38RBS 140-160).

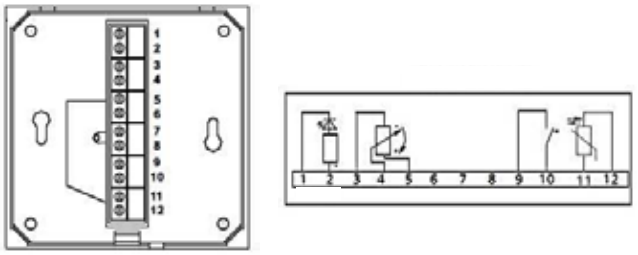
8.2 - Option 278

Option 278 (capacity control by temperature sensors) includes:

- an outside temperature sensor
  - Sensor NTC 10 K: channel 01 of the main board
  - Potentiometer for setpoint offset: channel 01 of the additional board
  - Presence button: channel 08 located at connector J4 of the additional board
  - LED indicating the indoor fan status: channel 23 located at connector J2B of the main board
- a supply air sensor to be installed on the air handling unit: channel 04 of the additional board.

Connection of the presence button and of the LED is not absolutely required. These sensors are supplied with the unit, in the control box.

Outside temperature sensor terminal board



Legend:

1-2	LED
4-5	Potentiometer
9-10	Presence button
11-12	NTC 10 K sensor

9 − REFRIGERANT PIPING

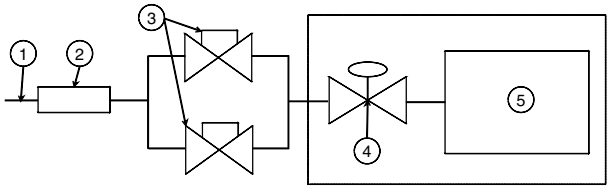
9.1 - Thermal expansion valve TXV (not supplied)

- The thermal expansion valve (TXV) must be suitable for R410A and have a maximum operating pressure that is lower than or equal to 15°C. It must be equalised with the outside pressure.
- Special attention must be given to the selection of the thermal expansion valve. It must be suitable for the evaporator capacity to have a stable system performance. Base the selection of the thermal expansion valve on:
  - the evaporating temperature,
  - the difference between the condensing and the evaporating pressure,
  - the pressure drop in the liquid line (piping, filter drier, solenoid valves etc.). If the evaporator is positioned higher than the condensing unit, the pressure drop generated by the liquid pressure head must also be taken into consideration. Use the supplier's selection tables to determine the exact expansion valve capacity.
- The expansion valve bulb must be correctly attached to a suitable pipe located after the coil collector (suction piping). It must be thermally insulated.
- The preferred position of the TXV is in a vertical section.
- Generally observe the TXV supplier's installation guidelines.
- The expansion valve must be installed as shown in the diagrams of chapter 9.2.

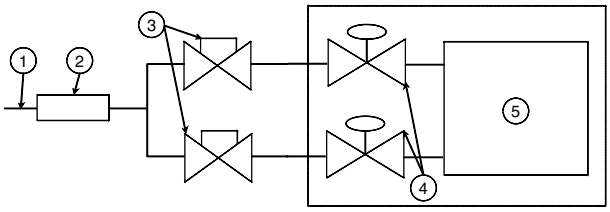
9.2 - Solenoid valves

- The solenoid valves are used:
  - to permit evacuation of the unit at shut-down,
  - to deactivate a part of the evaporator to ensure oil return in split evaporators.
- The solenoid valves must be installed as shown in the diagrams below. For a single evaporator two solenoid valves must be installed in parallel. This installation permits their correct operation within the application range.

Single evaporator (per circuit)



Single split evaporator (per circuit)



Legend:
1. 38RBS liquid line
2. Filter drier (supplied, not installed)
3. Solenoid valve (supplied, not installed)
4. Thermal expansion valve TXV
5. Evaporator

▭ Supplied by customer

- It is important to pay attention to the installation of the solenoid valve and especially:
  - the installation direction (indicated by the arrow on the valve body),
  - its protection during welding - excessive temperatures can damage the mechanism and the valve may lose its leaktightness,
  - in general follow the manufacturer's installation instructions.

9.3 - Piping installation

On all units, relieve the pressure of the holding charge before opening the circuit.
- Open the service valves, if used (option 92B: suction and liquid line).
- Remove the protective cap from the Schrader port in the liquid line valve and press on the valve depressor to release the holding charge (nitrogen).
- Unsolder the plugs and prepare the pipes for connection.
- Complete the liquid line valve connections between the moisture indicator and the evaporator.
- Complete the low-pressure suction line connections between the compressor and the evaporator. Do this with nitrogen or another inert gas flowing through the pipework to prevent oxidation of the copper.

IMPORTANT: Pipe flange collars are provided at the unit outlet. These must be correctly tightened to prevent vibration and possible pipe breaks.

The piping between condensing unit and evaporator must be correctly supported based on its size and the operating weight.

9.4 - Evaporator coil selection

38RBS 039-080
The circuit of these units includes two compressors, operating in parallel.

38RBS 090-120
The circuit of these units includes three compressors, operating in parallel.

38RBS 140-160
The two circuits of these units include two compressors each, operating in parallel.

Oil return
It is important to position the coil collector pipe as low as possible. To ensure oil return to the compressors at low load, it may be necessary to split the evaporator coil into two independent circuits.

The tables below give the minimum evaporator coil capacity per circuit needed to prevent oil return problems. Table 1 applies to a liquid line temperature of 30°C and a pipe diameter in the coil of 1/2". For a different liquid line temperature and/or a different diameter multiply the value in table 1 with the coefficients in tables 2 and 3. Multiply the value found by the number of coil circuits to calculate the minimum capacity required to ensure oil return.

Example: for a part-load condition:
- Evaporating temperature (saturated) = -5°C
- Liquid temperature = 40°C
- Coil pipe diameter = 1/2"
- Number of circuits in the coil = 15

The minimum capacity required to ensure oil return is:
0.825 x 0.91 x 1 x 15 = 11.26 kW

If the unit capacity (at these liquid temperature and evaporating temperature conditions) is lower than this value, it will be necessary to split the evaporator coil into two separate circuits.

Table 1 - Minimum capacity to ensure oil return in a coil circuit

Evaporating temperature (dew point)	°C	-5	0	5	10	15
Cooling capacity (minimum load)*	kW	0.825	0.978	1.15	1.36	1.58

* Capacity for an operating condition with a liquid temperature of 30°C and a pipe diameter of 1/2".

Table 2 - Correction coefficient based on the liquid line temperature

Liquid line temperature	°C	30	40	50	60
Coefficient	-	1	0.91	0.81	0.69

Table 3 - Correction coefficient based on the pipe diameter

Evaporator coil pipe diameter	in	3/8	1/2	5/8
Coefficient		0.5	1	1.67

10 - REFRIGERANT PIPE SIZING WITH REFRIGERANT

10.1 - General and pipe sizing limits

Pipe sizing limits

38RBS		Maximum
Linear length (suction - liquid)	m	30
Height difference	m	16

The pipes must be as short as possible and have as few changes as possible (bends etc.) to minimise pressure losses. If there may be a risk of poor operation, adequate measures (design, position, protection) must be taken to prevent this.

Refrigerant pipe sizing must be carried out, taking account of the following constraints:
Oil return to the compressor for the majority of applications must be ensured. Oil return is ensured by entrainment. A minimum refrigerant velocity is required to ensure entrainment. This velocity depends on the pipe diameter, refrigerant and oil temperature (these are treated as being the same in most cases).

A reduction of the pipe diameter permits an increase of the refrigerant velocity. The problem of a minimum entrainment velocity does not exist for the pipes that carry liquid refrigerant as the oil is fully miscible here.

The compressor suction line (pipes linking the evaporator outlet with the compressor inlet) pressure drops must be limited to avoid system performance losses (the compressor power input increases, and the cooling capacity decreases).

The pressure drop in the liquid line (linking the condenser outlet to the expansion device) must not result in a change in phase. The estimate of these pressure drops must include those for the possible accessories, such as solenoid valves, filters, dehumidifier etc.

10.2 - Pipe sizing

The following procedure can be used for pipe sizing:
- Measure the length (in metres) of the piping under consideration.
- Add 50% to take account of special characteristics.
- Read the pipe size from from tables 4 and 5 below.
- Calculate the equivalent lengths for parts included in the piping under consideration (such as valves, filters, connections). The equivalent lengths are normally available from the component supplier. Add these lengths to the length calculated in step 3.
- Repeat steps 4 and 5, if necessary.

10.3 - Suction pipe sizing

This sizing is the most critical. A distillation process takes place in the evaporator, during which the refrigerant evaporates until it reaches a balance point. It exists in two phases: the vapour phase that only contains refrigerant, and the liquid phase, that is a mix of liquid refrigerant and oil.

The content of refrigerant in this mixture depends on the pressure. The liquid mixture can only be returned to the compressor by entrainment, initiated by the vapour velocity.

Table 4 “Suction piping” shows the different pipe diameters based on the unit size and the equivalent circuit length. These recommended diameters allow oil return within the application range.

IMPORTANT: Siphon traps must be inserted in the vertical riser pipes:
- ***at the bottom of the piping,***
- ***every 3 m of vertical length,***
- ***at the top of the piping (counter-siphon).***

The trap must be correctly sized to ensure that not too much of the liquid refrigerant/oil mixture is trapped. The horizontal pipes must have a slight slope (30 mm/m) between evaporator and condensing unit in the direction of the compressors.

Table 4 - Suction piping (inches)*

38RBS	039	045	050	060	070	080	090	100	120	140 (per circuit)	160 (per circuit)
Equivalent length											
0-10 m	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-1/8	1-1/8
10-20 m	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-3/8	1-3/8
20-30 m	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-3/8
30-40 m	1-1/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
40- 50 m	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
50-60 m	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
60-70 m	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
70 m and above	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8

* Recommended diameters to ensure oil return in the application range.

Table 5 - Liquid line piping (inches)*

38RBS	039	045	050	060	070	080	090	100	120	140 (per circuit)	160 (per circuit)
Equivalent length											
0-10 m	1/2	1/2	1/2	1/2	5/8	5/8	5/8	5/8	5/8	5/8	5/8
10-20 m	1/2	5/8	5/8	5/8	5/8	5/8	3/4	3/4	3/4	5/8	5/8
20-30 m	5/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4	7/8	3/4	3/4
30-40 m	5/8	5/8	5/8	3/4	3/4	3/4	3/4	7/8	7/8	3/4	3/4
40- 50 m	5/8	5/8	5/8	3/4	3/4	3/4	7/8	7/8	7/8	3/4	3/4
50-60 m	5/8	5/8	3/4	3/4	3/4	7/8	7/8	7/8	7/8	3/4	7/8
60 m and above	5/8	3/4	3/4	3/4	3/4	7/8	7/8	7/8	7/8	3/4	7/8

* Recommended diameters to prevent migration problems.

Equivalent length of the filter drier and solenoid valves (standard units and units with option 92B)

38RBS		039	045	050	060	070	080	090	100	120	140 (per circuit)	160 (per circuit)
Equivalent length of the filter drier and solenoid valves												
1/2" diameter	m	9.0	9.0	2.3	2.3	-	-	-	-	-	-	-
5/8" diameter	m	32.5	32.5	8.5	8.5	8.5	5.7	7.0	7.0	4.2	8.5	5.7
3/4" diameter	m	-	83.0	19.5	19.5	19.5	14.0	16.0	16.0	10.5	19.5	14.0
7/8" diameter	m	-	-	-	-	-	30.0	36.0	36.0	22.0	-	30.0

10.4 - Liquid line sizing

38RBS compressors are supplied with an oil that is fully miscible with refrigerant R410A in the liquid phase, and low refrigerant velocities in the liquid lines are not a problem.

Table 5 “Liquid line piping” shows the different pipe diameters based on unit size and equivalent circuit length. These recommended diameters prevent refrigerant migration problems.

To determine the equivalent liquid line length the pressure drop generated by the filter drier and the solenoid valves must be take into consideration. The table above gives the equivalent length for each unit, based on the diameter used.

Special attention must be paid to the liquid line sizing when the expansion device ist positioned higher than the condenser. If the liquid refrigerant head is very high, it may even be necessary to increase the subcooling to prevent a phase change in the liquid line. This can be done e.g. by a liquid-vapour heat exchanger or an additional coil.

11 - START-UP

11.1 - Preliminary checks

Never be tempted to start the unit without reading fully, and understanding, the operating instructions and without having carried out the following pre-start checks:

- Check the air handling units and all other equipment connected to the unit.
- Refer to the manufacturer’s instructions.
- Refer to the wiring diagram supplied with the unit.
- Ensure that there are no refrigerant leaks.
- Confirm that all pipe securing bands are tight.
- Confirm the the electrical connections are secure.

11.2 - Actual start-up

IMPORTANT:

- ***Commissioning and start-up of the unit must be supervised by a qualified refrigeration engineer.***
- ***All setpoint adjustments and control tests must be carried out before the unit is started up.***
- ***Please refer to the 38RBS control manual.***

The unit should be started up in Local ON mode.

Ensure that all safety devices are operational, especially that the high pressure switches are switched on and that the alarms are acknowledged.

Set the room thermostat to a temperature value that is lower than the room temperature in order to do a start-up test. If the compressor does not start, set the thermostat to a lower value.

11.3 - Refrigerant charge adjustment

IMPORTANT: It is imperative to empty the nitrogen holding charge from the system and evacuate the system before beginning to charge refrigerant into the unit. Never charge refrigerant into the low-pressure side of the system. During charging of refrigerant ensure that the indoor fan is operating.

With all fans operating, adjust the refrigerant charge. Measure the pressure at the liquid line service valve. If possible, measure the liquid line temperature as close as possible to the service valve.

Add charge until the refrigerant passing through the sight glass is ‘clear’: the refrigerant is now only liquid. When the liquid line temperature is measured, it should now be possible to calculate an actual subcooling value between 4 and 8 K, based on the liquid line pressure drops (filter drier, solenoid valves, special components and possible liquid head).

The actual subcooling is equal to the saturated temperature at the bubble point, minus the liquid line temperature measured. If the actual subcooling value is higher than 8 K, (unit outlet) an excess charge is possible. This excess charge translates to an excessive condensing pressure and increases the compressor power input.

The refrigerant charge must not exceed the values below:

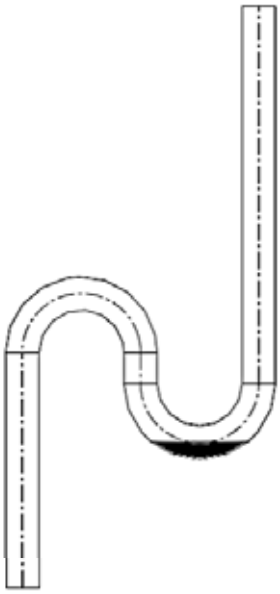
38RBS	Max. refrigerant charge, kg	38RBS	Max. refrigerant charge, kg
039	14.3	**090**	30.6
045	16.9	**100**	31.6
050	20.4	**120**	36.6
060	22.9	**140**	42.4
070	21.2	**160**	55.2
080	27.1		

If adding charge does not result in a clear sight glass and the condensing pressure rises above the acceptable values, ensure that the filter drier is not blocked and that one of the solenoid valves is not partially closed.

11.4 - Oil charge adjustment

If a suction riser is used, the oil charge must be adjusted. Add the equivalent volume to half of the lower part of each siphon trap (see figure below), when the unit is empty.

Oil volume for a siphon trap



12 - MAJOR SYSTEM COMPONENTS

12.1 - Compressors

38RBS units use hermetic scroll compressors. Each compressor is equipped with a crankcase oil heater, as standard. Each compressor sub-function is equipped with:

- Anti-vibration mountings between the unit chassis and the chassis of the compressor sub-function.
- A single pressure safety switch at the discharge.

12.2 - Lubricant

The compressors installed in these units have a specific oil charge, indicated on the name plate of each compressor.

The oil level check must be done with the unit switched off, when then suction and discharge pressures are equalised. The oil level must be visible and above the middle of the sight-glass in the oil equalisation line. 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 level between the middle and three quarters of the sight-glass (unit in vacuum).

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.

12.3 - Condensers

38RBS coils are condensers with internally grooved copper tubes with aluminium fins.

12.4 - Fans

The fans are axial Flying Bird fans with rotating shroud and made of composite recyclable material. The motors are three-phase, with permanently lubricated bearings and insulation class F.

12.5 - Moisture indicator

Located on the liquid line, 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.

12.6 - Filter drier

This is a one-piece, brazed filter drier, located in the liquid line. The role of the filter drier is to keep the circuit clean and moisture-free. The moisture indicator shows when it is necessary to change the filter drier. A difference in temperature between the filter inlet and outlet shows that the element is dirty.

NOTES - Monitoring during operation:

- ***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.***
- ***If there are no regulations or to complement them follow the control programmes of EN 378.***
- ***If they exist follow local professional recommendations.***
- ***Regularly check for possible presence of impurities (e.g. silicon grains) in the heat exchange fluids. These impurities maybe the cause of the wear or corrosion by puncture.***
- ***The reports of periodical checks by the user or operator must be included in the supervision and maintenance file.***

12.7 - Refrigerant

38RBS units operate with refrigerant R-410A.

12.8 - High-pressure safety switch

38RBS units are equipped with automatically reset safety pressure switches on the high-pressure side. Refer to the controls manual for the alarm acknowledgements).

13 - OPTIONS

Options	No.	Description	Advantages	Use
Condenser with anti-corrosion post-treatment	2B	Coils with factory-applied Blygold Polual treatment	Improved corrosion resistance, recommended for urban, industrial and rural environments	38RBS 039-160
Condenser with pre-treated fins	3A	Fins made of pre-treated aluminium (polyurethane and epoxy)	Improved corrosion resistance, recommended for marine environments	38RBS 039-160
Very low noise level	15LS	Acoustic compressor enclosure and low-speed fans	Noise emission reduction at reduced fan speed	38RBS 039-160
Soft starter	25	Electronic compressor starter	Reduced compressor start-up current	38RBS 039-080
Winter operation	28	Fan speed control by frequency variator	Stable unit operation, when the air temperature is between -10°C and -20°C	38RBS 039-160
Suction and liquid line valves	92B	Ball valves on the suction and liquid line	Unit isolation from the rest of the refrigerant circuit	38RBS 039-160
JBus gateway	148B	Two-directional communications board, complies with JBus protocol	Easy connection by communication bus to a building management system	38RBS 039-160
Bacnet gateway	148C	Two-directional communications board, complies with Bacnet protocol	Easy connection by communication bus to a building management system	38RBS 039-160
LonTalk gateway	148D	Two-directional communications board, complies with LonTalk protocol	Easy connection by communication bus to a building management system	38RBS 039-160
Remote Pro-Dialog+ user interface	275	Pro-Dialog+ user interface for remote installation	Remote control of the unit and its operating parameters	38RBS 039-160
Replaceable filter drier	277	Filter drier with cartridge to replace hermetic filter	Easy filter replacement without emptying the refrigerant circuit	38RBS 039-160
Temperature sensor kit	278	Room temperature sensor with adjustable set-point and supply air sensor for installation in the air handling unit for capacity control	Optimisation of the unit capacity control, based on the usage conditions	38RBS 039-160

14 - STANDARD MAINTENANCE

Air conditioning equipment must be maintained by professional technicians, whilst routine checks can be carried out locally by specialised technicians.

All refrigerant charging, removal and draining operations must be carried out by a qualified technician and with the correct material for the unit. Any inappropriate handling can lead to uncontrolled fluid or pressure leaks.

WARNING: Before doing any work on the unit ensure that the power is switched off. If a refrigerant circuit is opened, it must be evacuated, recharged and tested for leaks. Before any work on a refrigerant circuit, remove the complete refrigerant charge from the unit with a charge recovery unit.

Simple preventive maintenance will ensure optimised performance of your HVAC unit:
- improve cooling performance
- reduce power consumption
- prevent accidental component failure
- prevent major time-consuming and costly interventions
- protect the environment

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

14.1 - Level 1 maintenance

See note in chapter 14.3. Simple procedures, can be carried out by the user on a weekly basis:
- 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 38RBS Pro-Dialog+ control manual),
- General visual inspection for any signs of deterioration,
- Verify the charge in the sight-glass,
- Check that the temperature difference between the heat exchanger inlet and outlet is correct.

14.2 - Level 2 maintenance

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

The frequency of this maintenance level can be monthly or annually depending on the verification type.

In these conditions, the following maintenance operations are recommended.

Carry out all level 1 operations, then:

Electrical checks
- At least once a year tighten the power circuit electrical connections (see table with tightening torques).
- Check and retighten all control/command connections, if required (see table with tightening torques).
- Remove the dust and clean the interior of the control boxes, if required.
- Check the status of the contactors, disconnect switches and capacitors.
- Check the presence and the condition of the electrical protection devices.
- Check the correct operation of all heaters.
- Check that no water has penetrated into the control box.

Mechanical checks
- Check the tightening of the fan tower, fans, compressor and control box fixing bolts.

Refrigerant circuit

- 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.
- Carry out an oil contamination test. Replace the oil, if necessary.
- Check the operation of the high-pressure switches. Replace them if there is a fault.
- Check the fouling of the filter drier. Replace it if necessary.
- 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.

14.3 - Level 3 (or higher) maintenance

The maintenance at this level requires specific skills/approval/ tools and know-how and only the manufacturer, his representative 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.

To reduce waste, the refrigerant and the oil must be transferred in accordance with applicable regulations, using methods that limit refrigerant leaks and pressure drops and with materials that are suitable for the products.

Any detected leaks must be repaired immediately.

The compressor oil that is recovered during maintenance contains refrigerant and must be treated accordingly.

Refrigerant under pressure must not be purged to the open air.

If a refrigerant circuit is opened, plug all openings, if the operation takes up to one day, or for longer periods charge the circuit with nitrogen.

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 SCS, will no longer be held responsible.

14.4 - Tightening torques for the main electrical connections

Component/screw type	Designation in the unit	Value (N·m)
Soldered screw (PE) customer connection		
M8	PE	14.5
Screw on switch inlet zones		
Switch - MG 28908	QS_	8
Switch - MG 28910		8
Switch - MG 28912		8
Switch - MG 31102		15
Tunnel terminal screw, compressor contactor		
Contactor LC1D12B7	KM*	1.7
Contactor LC1D18B7		1.7
Contactor LC1D25B7		2.5
Tunnel terminal screw, compressor circuit breaker		
Circuit breaker 25507	QM*	3.6
Circuit breaker 25508		
Circuit breaker 25509		
Tunnel terminal screw, control power transformer		
Transformer - 40958E	TC	0.6
Transformer - 40959E		
Transformer - 40888E		
Transformer - 40894E		
Compressor earth terminal in the power wiring control box		
M6	Gnd	5.5
Compressor earth connection		
M8	Gnd	2.83
Tunnel terminal screw, disconnect switch (fan, pump)		
Disconnect switch GV2ME08	QM_	1.7
Disconnect switch GV2ME10		
Disconnect switch GV2ME14		
Tunnel terminal screw, contactor (fan, pump)		
Contactor LC1K0610B7	KM	0.8 to 1.3
Contactor LC1K09004B7		
Contactor LC1K0910B7		
Contactor LC1K0901B7		

14.5 - Tightening torques for the main bolts and screws

Screw type	Used for	Torque (N·m)
Compressor strut	Compressor support	30
M10 nut	Compressor mounting	30
M16 nut	Compressor fixing	30
Oil nut	Oil equalisation line	75
Taptite screw M6	Fan support	7
Taptite screw M8	Fan motor fixing	13
H M8 screw	Fan scroll fixing	18
Metal screw	Sheet metal plates	4.2
H M6 screw	Stauff clamps	10
Earth screw	Compressor	2.8

14.6 - 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:

Level 1
- If the condensers are fouled, clean them gently in a vertical direction, using a brush.
- Only work on condensers with the fans switched off.
- For this type of operation switch off the HVAC unit if service considerations allow this.
- Clean condensers guarantee optimal operation of your HVAC unit. This cleaning is necessary when the condensers begin to become fouled. The frequency of cleaning depends on the season and location of the HVAC unit (ventilated, wooded, dusty area, etc.).

Level 2
The two cleaning products can be used for any of the following coil finishes: Cu/Cu, Cu/Al, Cu/Al with Polual, Blygold and/or Heresite protection.

Clean the coil, using appropriate products.
We recommend TOTALINE products for coil cleaning:
Part No. P902 DT 05EE: traditional cleaning method
Part No. P902 CL 05EE: cleaning and degreasing.

These products have a neutral pH value, do not contain phosphates, are not harmful to the human body, and can be disposed of through the public drainage system.

Depending on the degree of fouling both products can be used diluted or undiluted.

For normal maintenance routines we recommend using 1 kg of the concentrated product, diluted to 10%, to treat a coil surface of 2 m^2. This process can either be carried out using a high-pressure spray gun in the low-pressure position. With pressurised cleaning methods care should be taken not to damage the coil fins. The spraying of the coil must be done:
- in the direction of the fins
- in the opposite direction of the air flow direction
- with a large diffuser (25-30°)
- at a minimum distance of 300 mm from the coil.

It is not necessary to rinse the coil, as the products used are pH neutral. To ensure that the coil is perfectly clean, we recommend rinsing with a low water flow rate. The pH value of the water used should be between 7 and 8.

WARNING: Never use pressurised water without a large diffuser. Do not use high-pressure cleaners for Cu/Cu and Cu/Al coils. 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.

14.7 - Characteristics of R-410A

Saturated temperatures (°C) based on the relative pressure (in kPa)			
Saturated temperature, °C	Relative pressure, kPa	Saturated temperature, °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

38RBS 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.).

15 - START-UP CHECKLIST FOR 38RBS UNITS (USE FOR JOB FILE)

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

Equipment
Model 38RBS: ..... S/N .....

Compressors

Circuit A	**Circuit B**
1. Model No.	1. Model No. .....
Serial No.	Serial No. .....
2. Model No.	2. Model No. .....
Serial No.	Serial No. .....
3. Model No.	
Serial No.	

Air handling equipment
Manufacturer .....
Model No. ..... Serial No. .....

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 fluid piping is connected properly
☐ All air has been vented from the system

Unit start-up
☐ Oil level is correct
☐ Compressor crankcase heaters have been energised for 12 hours
☐ 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 unit if voltage imbalance is greater than 2%. Contact local power company for assistance.

☐ All incoming power voltage is within rated voltage range

Carry out the QUICK TEST function (for option 275 consult the 38RBS Pro-Dialog+ control manual):

Check and log on to the user menu configuration

Load sequence selection----------
Capacity ramp loading selection----------
Start-up delay ----------
Burner section ----------
Setpoint reset mode ----------
Night-time capacity setback ----------

Re-enter the setpoints (see controls section)

To start up the unit

WARNING: Be sure that all service valves are open, before attempting to start this machine. Once all checks have been made, start the unit by adjusting the thermostat to a temperature below the temperature in the room that needs to be air-conditioned.

Unit starts and operates properly

Temperatures and pressures

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

Room temperature .....
Evaporator entering air temperature.....
Evaporator leaving air temperature.....
Circuit A suction pressure .....
Circuit B suction pressure.....
Circuit A discharge pressure .....
Circuit B discharge pressure.....
Circuit A suction temperature .....
Circuit B suction temperature.....
Circuit A discharge temperature .....
Circuit B discharge temperature.....
Circuit A liquid line temperature .....
Circuit B liquid line temperature.....

NOTES:
.....
.....
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