Installation Guide

Inverter Scroll Refrigerating Unit
CDU-S (CDU-R02A1A & CDU-R02A1B)
CDU-M (CDU-R04A1A & CDU-R04A1B)
CDU-L (CDU-R06A2A & R06A2B)

IMPORTANT
Please keep this document.

Thank you for choosing a SANDEN refrigerating unit.

This installation guide is intended for installers, repair technicians and daily operators working with the equipment. It provides essential information to complete the required installation work, in order to ensure the equipment's optimum and safe operation.

After completing the installation, please provide users with instructions for use and safety guidelines to be followed.

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Version History

Version	Date	Contents	Author
1.01	26/10/2014	Revision of the table of contents Correction of typing errors Addition of the refrigeration power diagram Modification of wiring diagrams Replacement of parts	
1.02	01/02/2016	English translation	
1.03	04/08/2016	Update	
1.04	14/03/2017	Update	

1. Introduction

- This product is a condensing unit for refrigerating applications, intended for the European market.
- This installation manual is part of the product. It must be given to the installer and kept by the user.
- Carefully read the written warnings in the booklet. It contains important information about safety and product handling. Keep this manual handy.
- The installation must be performed by a qualified person only in accordance with the standards and the instructions of the manufacturer.
- It should not be used for other applications
- To avoid any interference liable to hinder the correct operation of the equipment's electronic board, any receiver devices (e.g. radio) must be located at least 3 meters away from the condensing unit.

2. Safety guidelines

This section contains instructions that are rated as "WARNING" or "IMPORTANT".

Failure to follow these instructions or incorrect use of the equipment may result in serious physical injury or death.

To ensure all staff's utmost security, please follow all the safety guidelines provided herein.

2.1 Meaning of symbols

WARNING. Serious danger liable to cause serious physical injury or death in the event where these guidelines are not followed.

IMPORTANT. Risk of physical injury or damage to the equipment.

Prohibited use

Observation

Mandatory grounding

2.2 To the attention of installers and operators

Please read this entire manual carefully before proceeding to install the condensing unit.
All handling operation must be performed by certified professionals.

WARNING

- The installation must be performed by certified professionals.
  Specific certification is required to perform electrical work. Please ensure that your electrician has all required clearances.
- During the installation, carefully follow the indications provided in this installation guide.
  Any installation work not performed in compliance with the service manual's instructions may result in water leaks, electric shocks or fire.
- Ensure that the condensing unit is installed on a resilient and stable surface that is capable of bearing its weight. Incorrect or incomplete installation work may cause the equipment to collapse, causing serious physical injury.
- When installing the equipment indoors, please take all measures required to ensure that the maximum concentration of refrigerant in the air never exceeds the limit allowed by applicable law, even in the event of a refrigerant leak.
  Refrigerant fluid leaking inside a confined room may result in suffocation if the maximum threshold is exceeded. This level must therefore never be exceeded.
- All electrical work must be performed in compliance with all applicable laws, as well as state of the art regulations.
  Incorrect electrical connections or an installation on an unsuitable electrical circuit may result in electric shocks or fire.
- Before any intervention, make sure that no gas remains in the piping.
- When using a burner, protect from overheating every components, such as the oil return tube located in the lower section of the compressor, the soundproofing cover and other components.
- Prior to installation, remove any flammable items from the worksite. These could cause a fire. Also, make sure that the worksite is equipped with a fire extinguisher.
- Leakage tests must be performed.
- Ensure that service valves are opened to avoid any damage caused by high-pressure.
- Wearing gloves is recommended during installation and maintenance of the condensing unit. Direct contact of the refrigerant with the user's skin may result in burns.
- This condensing unit exclusively uses R744 (CO_2) refrigerant, which is natural, non-toxic and non-flammable. When installing or repairing the equipment or performing any other intervention, never add any substance other than R744.
- Do not alter the settings of safety and protective devices. Incorrect settings may result in an explosion or fire.
- Do not use the condensing unit without first installing its cover and protective devices. Any contact with electrical parts exposes users to a risk of electric shocks.
- Do not remove the protective mesh from the air outlet. Never insert fingers or any objects into the air outlet or the air intake.

- If the condensing unit does not stop after being shut off, immediately shut off its main power supply. Failure to comply with this instruction may result in electric shocks, fire or an explosion. In this event, immediately contact the reseller or the manufacturer's after-sales service.
- In the event of a refrigerant leak, immediately shut off the equipment, shut off the main power supply, and contact the reseller or the manufacturer's after-sales service.
- In the event of any abnormal situation (e.g. smell of burning material, etc.), shut off the condensing unit and the main power supply.
- If the equipment's protective device is triggered repeatedly, or if you are unsure of how to operate the circuit breaker, immediately shut off the main power supply.
- A short-circuit or a power surge may result in electric shocks, fire or an explosion.
- Ensure good ventilation. A refrigerant leak can lead to oxygen deprivation.
- Always ensure that refrigerating cycles occur within the specified range.

3. Inverter condensing unit

3.1 Presentation

An inverter-type condensing unit features a regulator ensuring power modulation.

Among other types of variable power refrigerating systems, multiple-compressor systems feature a large number of compressors that deliver variable power according to the number of operating compressors. The inverter technology varies the compressor's rotation speed to control the unit's power. The objective, however, remains unchanged: to vary the condensing unit's cooling power according to the load.

With an inverter-type condensing unit, the load is defined by variations in the compressor's suction pressure. When the suction pressure increases, the device detects a higher load, and the inverter then increases its cooling power. Contrary to the power variation feature in a multiple-compressor system, the modulation of the inverter's rotation speed offers a more gradual power variation. The evaporator can then control each solenoid valve effectively and individually.

3.2 Configuration

3.2.a Configuring the operating frequency according to the setpoint

The suction pressure measured by the sensor when the equipment is started is displayed on the condensing unit's control panel. It is compared to the preset starting standard pressure, then sent to the inverter in order to adjust the operating frequency. The inverter then produces the required frequency in order to regulate the rotation speed.

3.2.b Inverter system

The inverter system refers to the conversion of continuous voltage into adjustable-frequency alternating current. It may also include a converter producing continuous voltage from the mains power.

4. Scroll-type compressor condensing units

The condensing unit is equipped with a scroll-type compressor. Its conditions of use and maintenance differ from traditional reciprocating systems.

These features will be detailed in each the following sections, but users are requested not to undertake any installation work and not to operate the equipment before familiarizing themselves with the required basic concepts.

1. **The scroll-type compressor cannot be reversed.**
   In traditional reciprocating systems, the direction of rotation is irrelevant. However, in scroll-type systems, only one direction of rotation is possible.
2. **During operation, the compressor can reach high temperatures.**
   The device's temperature rises when it operates, and remains high for some time after it has been shut off. Please be very careful when proceeding to the device's maintenance.

5. About the refrigerant (R744)

5.1 Specifications

- The R744 code signals that carbon dioxide (CO_2) is used as a refrigerant.
- Contrary to the carbon dioxide gas used in beverages, R744 carbon dioxide used as a refrigerant features extremely low levels of impurity and humidity.
- R744 refrigerant is obtained by reusing gases released during the purification of oil and ammonia.

IMPORTANT

♦ Do not use carbon dioxide gas intended for the production of carbonated beverages as a refrigerant. This may cause a malfunction.

Notes concerning carbon dioxide

- R744 is non toxic. However, prolonged presence in a closed room where the gas concentration exceeds 5% may have adverse effects on the human body. Ensure that the room is well ventilated when handling the refrigerant. Pressure inside the circuit is high. When evacuating the system, pay attention to the direction of the refrigerant jets.
- Carbon dioxide may cause the following symptoms.
  - **4%: redness in the face, headaches, dizziness, tinnitus**
  - **6%: shortness of breath, sensation of heat, chills, vomiting**
  - **7-8%: pulmonary congestion, difficulty breathing**
  - **10%: impairment of consciousness, respiratory arrest and risk of death**
- Observations regarding ventilation

  R744 is heavier than air; efficient ventilation at ground level is therefore required. Adequate ventilation is required in confined spaces, where the refrigerant can easily accumulate.

5.2 Precautions required when handling R744 refrigerant (CO_2)

Operation	R744 (CO_2) specifications	Notes regarding construction
Refrigerating circuit clean and dry, free of leakage	1 Special precautions must be taken to ensure the absence of any impurities in the refrigerating circuit (dust, oxidation, traces of fluids).	1 Protect the piping and ensure that it remains free of dust and moisture. 2 Always apply nitrogen during the brazing process. 3 Brush after brazing.
	The refrigerant is under high pressure. High pressure specification: 12 MPa Low pressure specification: 8 MPa	1 A confirmation is required to define the relation between the piping size and the refrigerant used for the thickness of the refrigerating circuit. 2 This product does not allow reuse of existing piping. 3 The HFC filler tube may not be reused. Use high-pressure piping suited to R744 (CO_2). 4 The charging cylinder may not be reused.
↓		
Leakage test		Air-tightness pressure High and low pressure: 8 MPa Add pressure to the pressure stated above → Wait approx. 12 hours without operating the equipment → No pressure drop → OK
↓		
Vacuum drying	The refrigerant fluid and condensing unit oil's hygroscopicity is high. Vacuum drying must be performed to minimize the acid degradation of the oil and the formation of hydrates. Compound containing hydration water	Evacuation must be performed when necessary. Evacuate to 0.1 MPa or less, especially if there is a risk of condensation inside of the piping, then perform a strict inspection. Use a high speed exhaust flow rate setting on the vacuum pump. A conventional exhaust flow rate of 20-30 l/min. always requires some time.
↓		
Introducing the refrigerant	Introduce the refrigerant fluid.	1 Always introduce the refrigerant in its liquid state, through the low-pressure circuit. 2 Do not use a HFC charging cylinder. 3 Thoroughly flush all lines after performing brazing work.
↓		
Using the existing piping	The condensing unit uses PAG machine oil. A kind of sludge will be produced if it is mixed with mineral oils used with HFCs, among other applications.	1 Evacuation can be performed with the usual equipment used for HFC systems. However, the equipment used to charge and discharge R744 must be specific to this refrigerant. 2 Never use existing piping as a replacement (always use new items).

○: Conventional (HFC) or compatible product ■: Special R744 (CO_2) refrigerant

Instruments and tools		Compatible with conventional products (HFC)		Reasons for incompatibility with HFCs and notes (⊙ Strict compliance must be ensured during sealing work)	Use
		HFC	CO_2		
Refrige-ration circuit	Tube cutter	○	○	Use material "O".	Cutting refrigerant piping Deburring
	Flaring tool	○	–	Flaring cannot be performed.	Flaring the refrigerant fluid tubes
	Output length adjustment gauge	○	–	Flaring cannot be performed.	Accurately gauging jutting copper tubes during flaring work
	Tube-bending machine	○	○	Use material "O".	Bending refrigerant fluid lines
	Bulging tool	○	○	Use material "O".	Expanding refrigerant fluid line piping
	Torque wrench	○	–	Flaring cannot be performed.	Tightening the flared nut
	Brazing	○	○	Use material "O".	Brazing the refrigerating circuit
	Nitrogen gas	○	○	Strict prevention of contamination (application of nitrogen during the brazing process)	Air-tightness test during brazing process
	Flaring, partial coating oil	○	○	Flaring cannot be performed.	Application on flaring surface
Refrigerant evacuation and charge	Refrigerant cylinder	○	■	Features a color stripe revealing the type of refrigerant used. R744 (CO_2) is green (charging port built into refrigerant cylinder)	Refrigerant charge
	Vacuum pump	○	○	⊙ Non-conventional products may be used, but when stopping the vacuum pump, a check valve adapter must be installed to prevent any refrigerant fluid from flowing back into the piping.	Refrigerant fluid charge
	Vacuum pump, vacuum drying adapter (with check valve)	○	○		Vacuum drying
	Manifold valve	○	■	A vacuum pump suited to HFCs can be used. It can however not be used for charging or evacuating the refrigerant.	Evacuation Refrigerant charge, Pressure test
	Charging cylinder	○	–	Do not use the charging cylinder.	Refrigerant fluid charge
	Refrigerant fluid charging scale	○	○	Using a refrigerant fluid charging scale	Refrigerant fluid filling equipment
	Refrigerant gas leak detector	○	■	On the contrary, unavailability of the detection method based on the refrigerant gas (HFC) leak detector, conventional product	Gas leak test
	Regulator	–	■	Use the high-pressure regulator at a 20 MPa setting, in compliance with the resistance specification.	Refrigerant charge Pressure test
	Filling tube	○	■	Use the high-pressure flexible charge at a 20 MPa setting, in compliance with the resistance specification.	Refrigerant fluid charge

6. Instructions regarding the inverter scroll condensing unit

6.1 Do not install a phase advance condenser

As the inverter can switch to an advanced phase, adding a phase condenser would only negatively affect the power factor and may result in damage to the equipment.

6.2 Precautions to avoid electromagnetic interferences

The inverter system produces interference on the power line, which may affect neighboring equipment.
The following precautions help minimize this interference.

1. **Install the condensing unit and power supply over 3 meters away from any receiving device.**
2. **The condensing unit must imperatively be grounded.**
   - **The earth ground is exclusively intended for use by the condensing unit, and should never be shared with other electric machines or transformers.**
   - **To offer protection against electric shocks, avoid combining earth grounds and/or power supply lines connected to multiple pieces of equipment.**
   - **Grounding work must be performed in compliance with «Category D» requirements (resistance not exceeding 100 Ω).**
   - **The earth ground must be located as close as possible to the condensing unit.**
3. **Do not share the condensing unit's power supply line with other pieces of equipment.**
4. **In the event where the equipment is installed near a piece of equipment producing electromagnetic waves, position the equipment in such a way that the electromagnetic wave-producing device is not facing the condensing unit's electrical enclosure.**

6.3 Handling precautions

Once wiring work is complete, use an Megohmeter (Megger DC500V type) and ensure that at least 1 MΩ is measured between the terminals of all electrical components and the ground.
However, take care not to measure the electronic circuit section's insulation resistance (continuous current circuit).
High voltage may be present even after shutting off the condensing unit's power supply, which momentarily retains a residual charge (approximately 1 minute).
Do not touch any electrical components for some time, as this is dangerous.

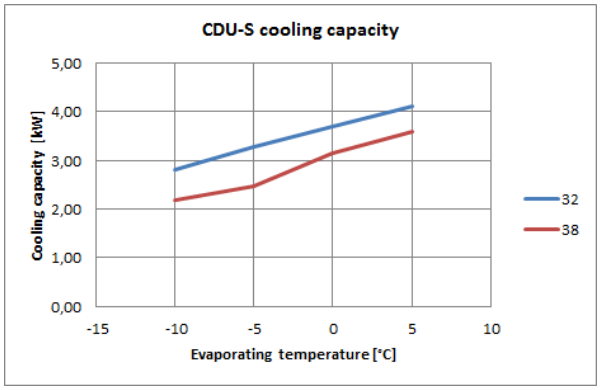
6.4 Other information

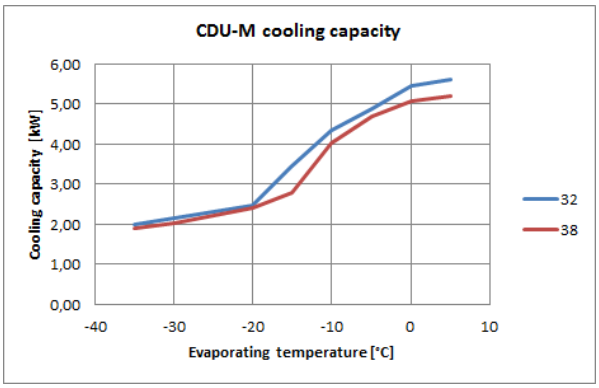
The noise produced by the equipment may vary during the course of its use. This is due to changes in the compressor's operating frequency, and does not signal a malfunction.

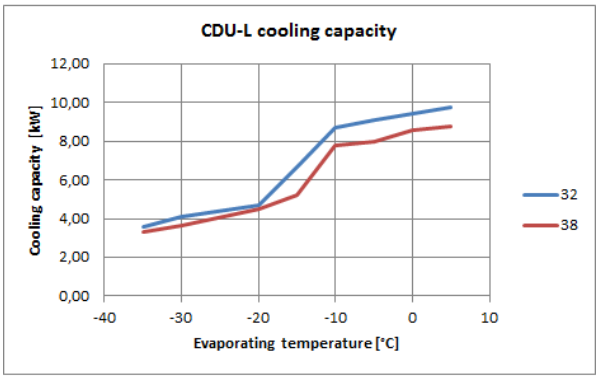
7. Product specifications

7.1 Performance

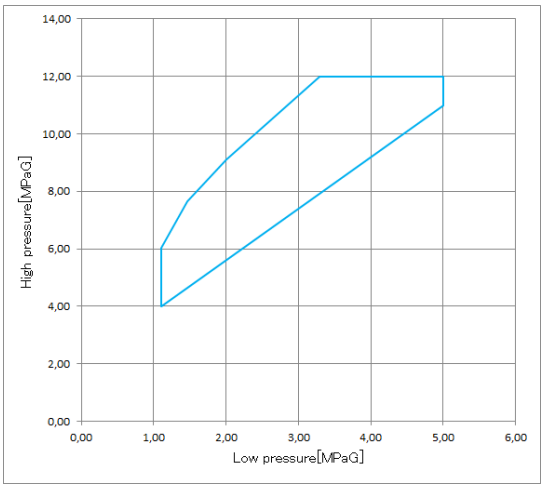
- Performance test conditions
- Compressor speed at 80 Hz
- Superheat temperature 5K





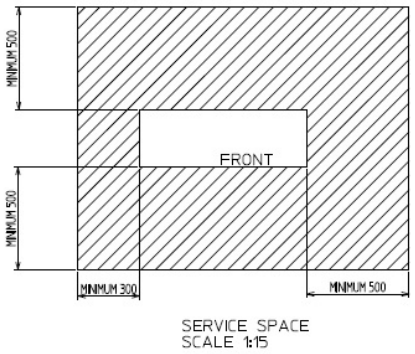


7.2 Compressor pressure range

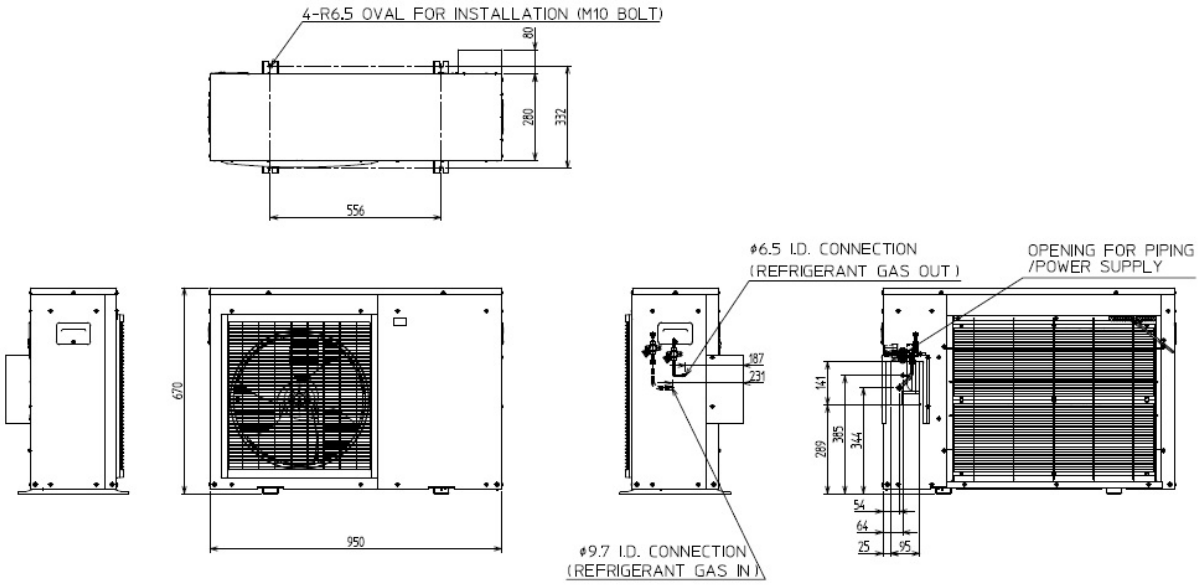


7.3 CDU Dimensions

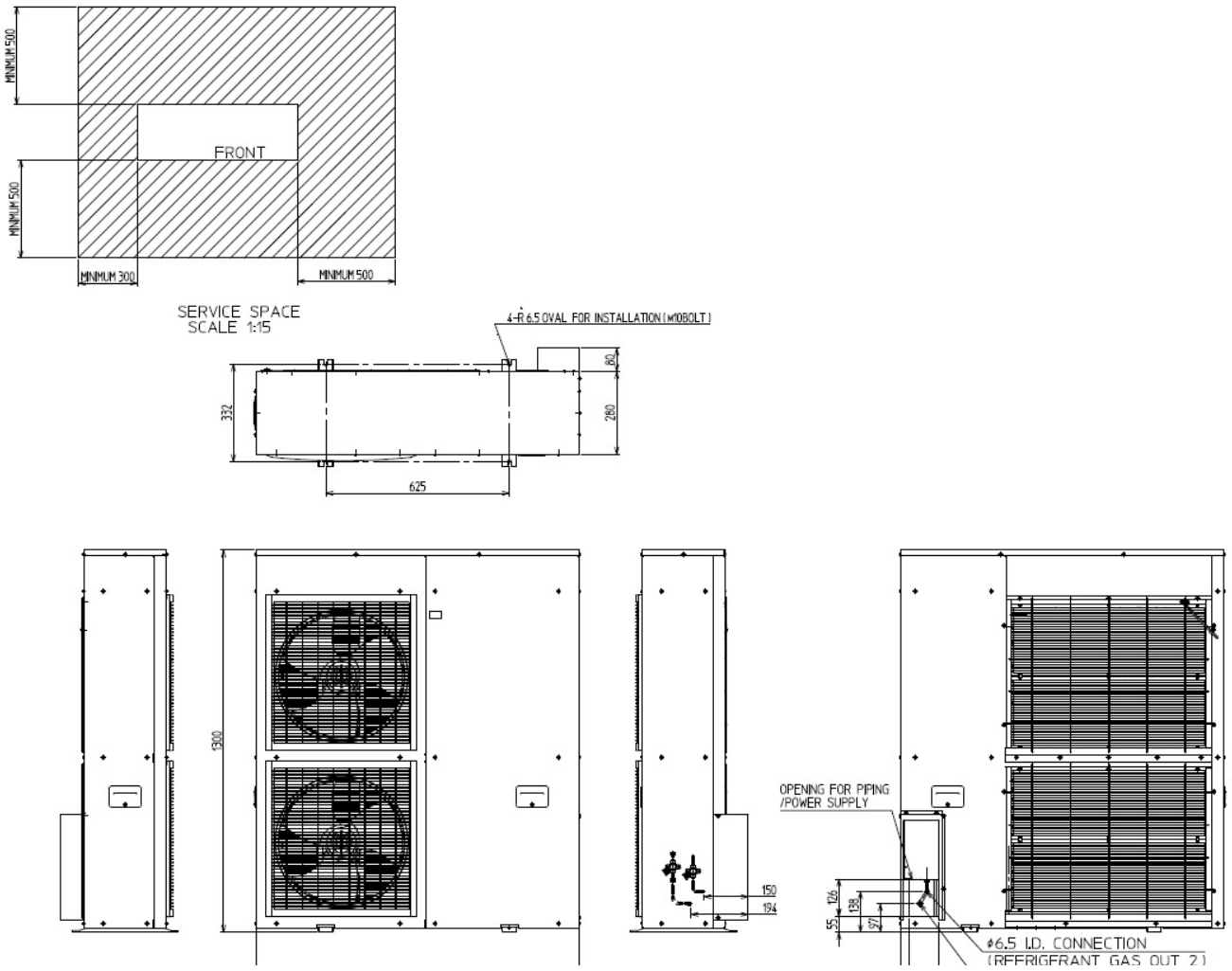
1. CDU-S dimensions



SERVICE SPACE
SCALE 1:15

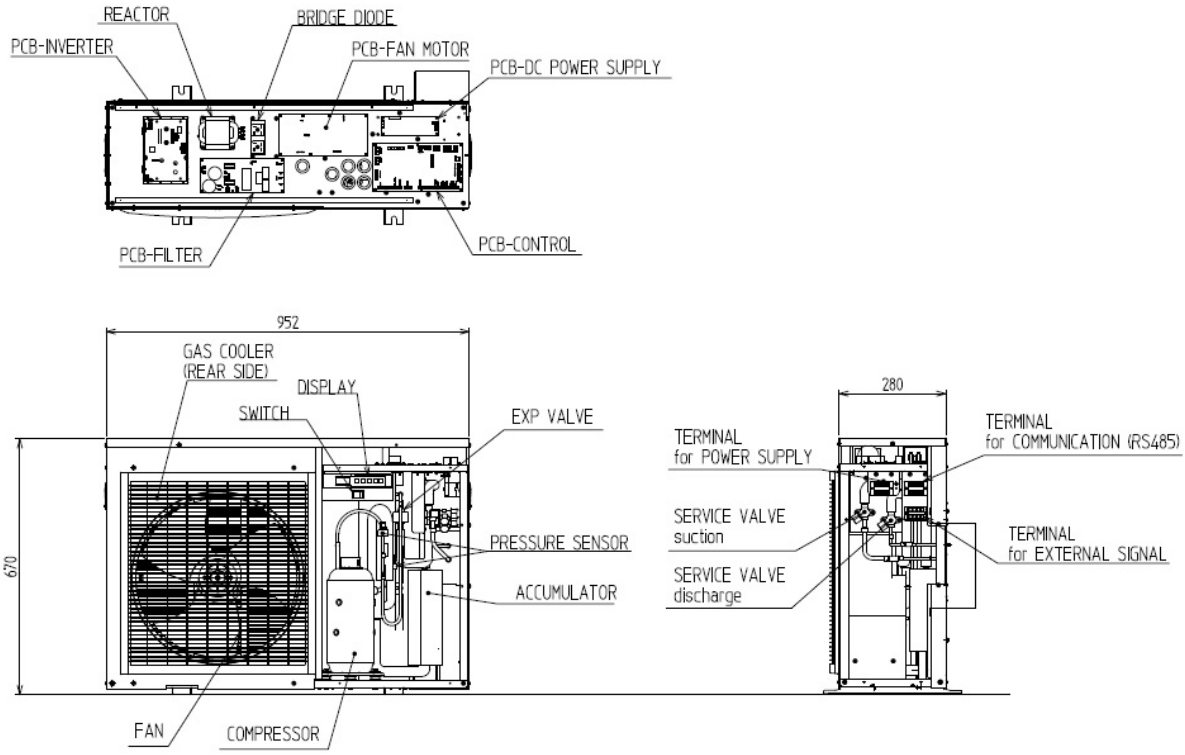


2. CDU-M & CDU-L dimensions

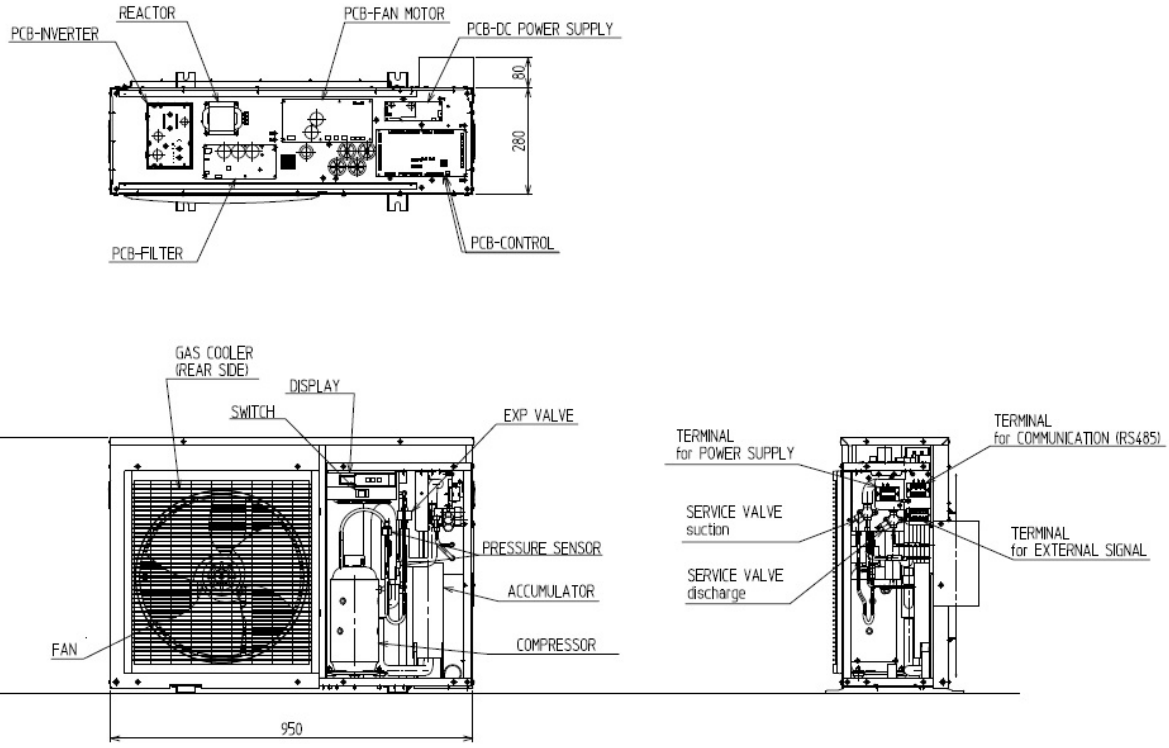


7.4 Structure Diagram

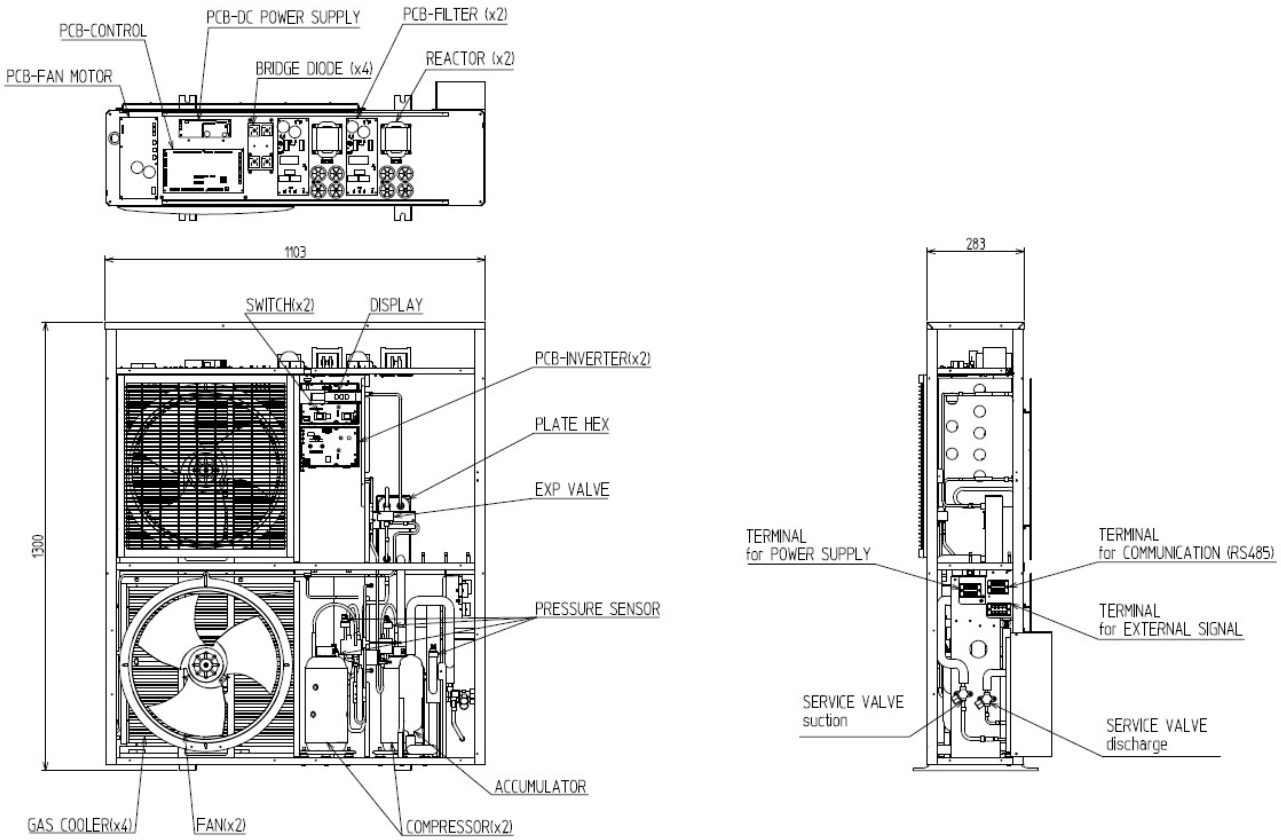
1. CDU-S 3-phase 230V



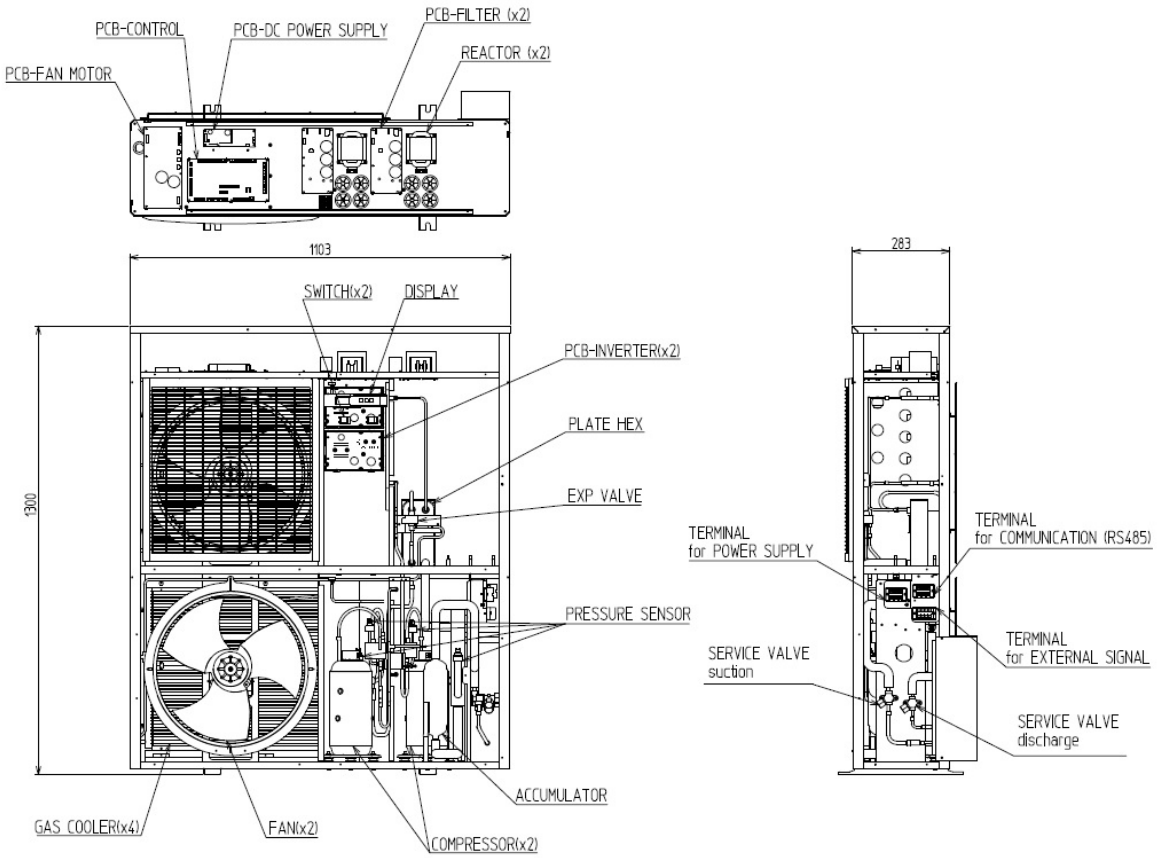
2. CDU-S single phase 230V



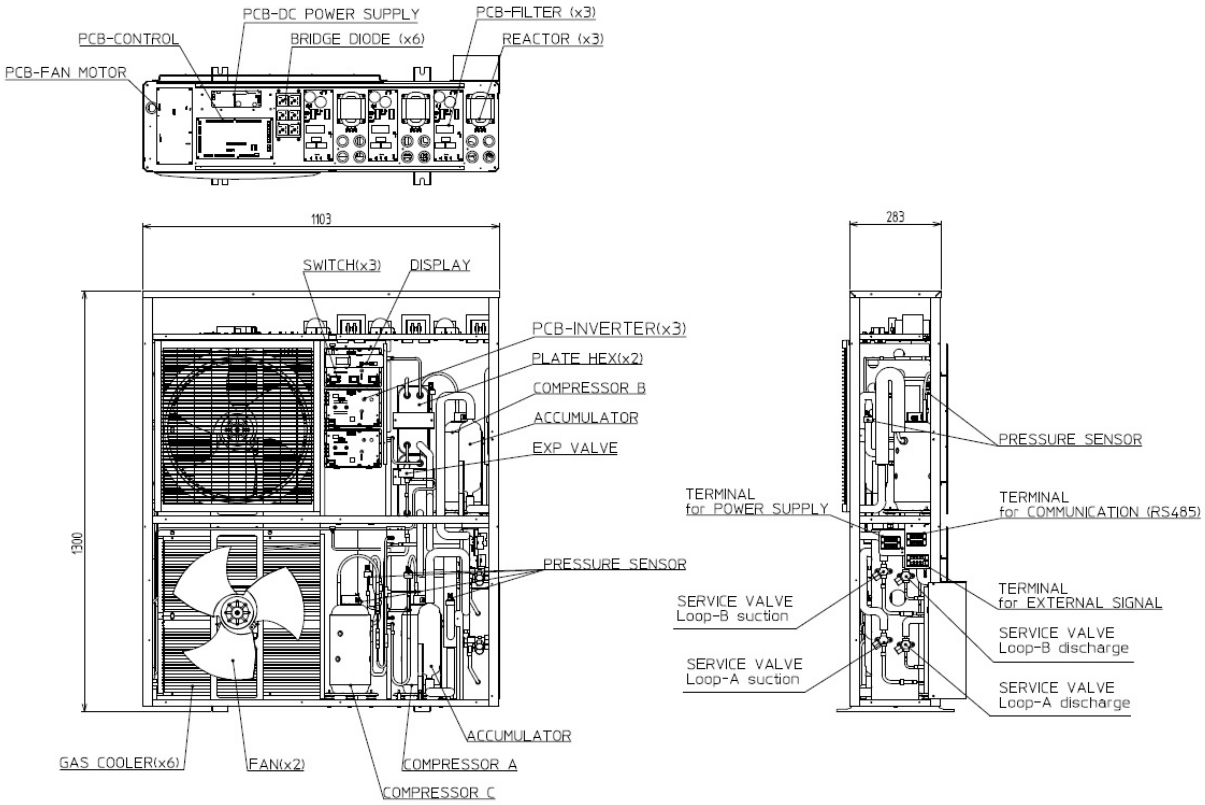
3. CDU-M 3 phase 230V



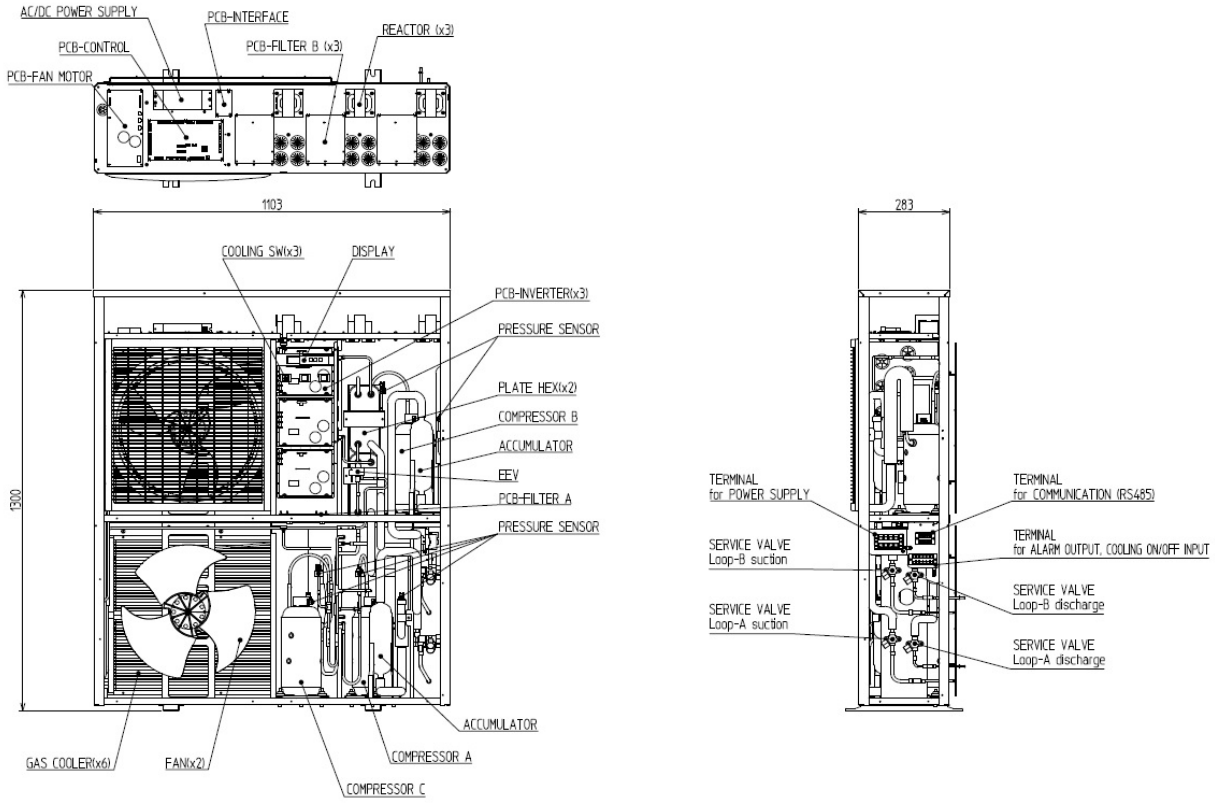
4. CDU-M single phase 230V



5. CDU-L 3-phase 230V



6. CDU-L 3-phase 400V



8. Functional range

The condensing unit's functional range is provided in the table below.

Item	Unit	Specification
Refrigerant	–	R744
Evaporating operation temperature (CDU-S)	°C	-10 to +5
Evaporating operation temperature (CDU-M & CDU-L)		-35 to +5
Suction pressure	MPa	0.9 to 4.0
Gas suction temperature	°C	< 40
Discharge temperature	°C	< 120
Ambient operation temperature	°C	-25 to +43
Power supply	–	depending of the model - See § 12.1.6

WARNING

- Fully insulate the condensing unit's refrigerating circuit (approximately 50 mm of insulation are required).
  - **Avoid all contact between the suction tubes and discharge tubes in order to prevent any unwanted heat exchanges.**
  - **Also place insulation on the discharge tubes if the evaporation temperature is below 0°C.**
- Never use the equipment in a corrosive atmosphere.

9. Installation precautions

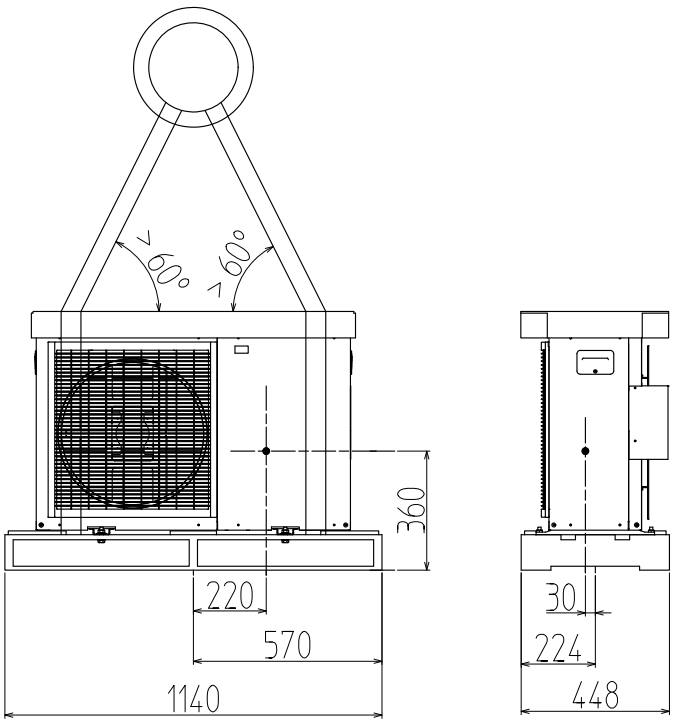
9.1 Handling the condensing unit

When raising the condensing unit, always observe the following safety precautions:

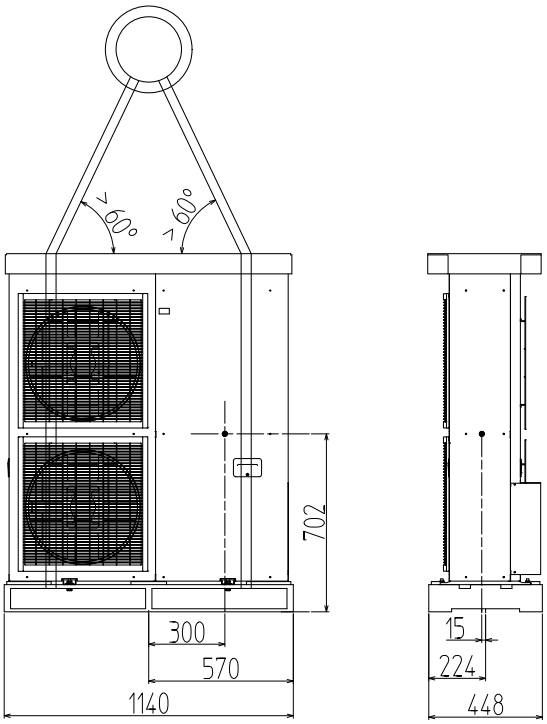
1. **Protect any parts that are in contact with hoisting ropes, e.g. with cardboard.**
2. **Do not pass beneath the condensing unit when it is raised.**
3. **Weight:**

CDU-S : Product weight: 57 kg	Total weight including packaging: 65 kg
CDU-M : Product weight: 107kg	Total weight including packaging: 117 kg
CDU-L : Product weight: 135 kg	Total weight including packaging: 145 kg

4. **This product's weight is not evenly distributed.**
   In particular, take care to avoid any shocks and sudden movements when transporting and raising the equipment.



CDU-S

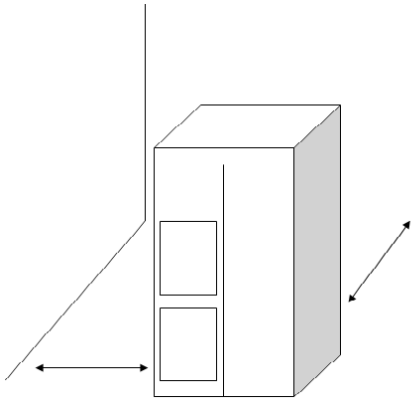


CDU-L & CDU-M

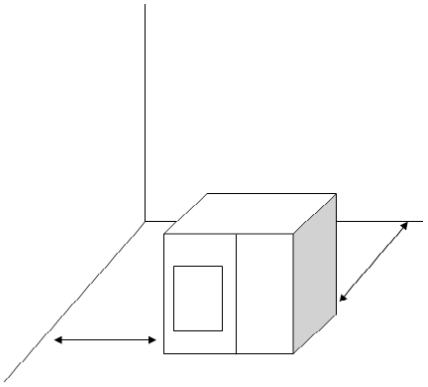
9.2 Choosing the condensing unit's installation location

Please consider the following criteria when choosing an installation location.

1. **If the air suction and discharge ports are too small, the air flow will be insufficient to ensure the condensing unit's correct performance, which may cause it to fail.**
   In addition, sufficient space must be provided around the unit to facilitate its maintenance and inspection. Please provide the following free space around the equipment.



CDU-L /CDU-M



CDU-S

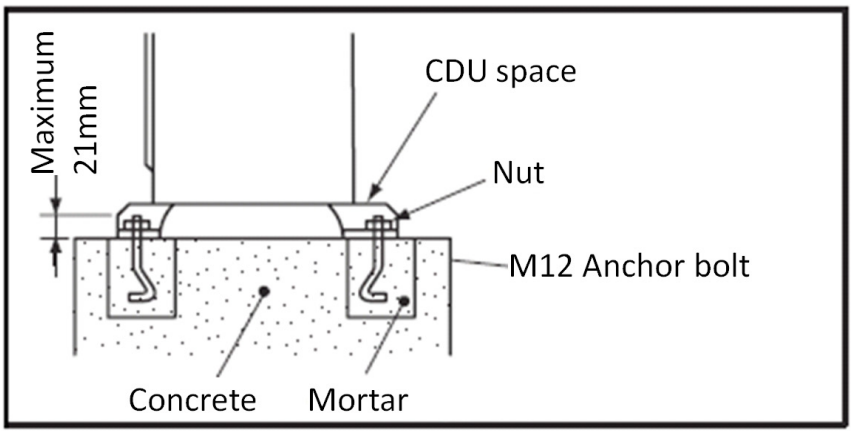
Installation conditions
• Provide space above the equipment to allow it to be opened. • Provide at least 300 mm of free space on the right-hand side. • Provide at least 500 mm of free space on the left-hand side and the front and back.

2. **Install the equipment in a dry and well-ventilated location, where air is not recycled.**
3. **Place the equipment in a location sheltered from direct sunlight, heat sources and cold wind. If exposing the equipment to direct sunlight is unavoidable, protect the device with a porch roof.**
4. **Choose a location where the noise produced by the condensing unit will not disturb any close neighbors. The noisiest components are located on sides and at the back of the unit.**
5. **The air outlet must not be directed towards house windows or plantations.**
6. **Place the equipment on a solid, smooth surface.**
7. **Place the equipment in a location where dust and debris do not risk being sucked into the evaporator fins.**
8. **In regions where significant snowfalls occur, always place the equipment under a roof, a shelter or a snow-proof porch roof.**

9. **Choose a location that is protected from strong headwinds that could reverse the direction of the condensing unit's ventilation fans. In locations where no protective buildings are available and the condensing unit may be exposed to gusts of wind, place the equipment in such a way that the air outlet is not exposed to strong winds.**
10. **Avoid installations located closed to the sea**
11. **Using the equipment in these conditions may cause it to fail. Equipment used in such conditions must therefore be subjected to specific maintenance.**
12. **In the event where the equipment is installed near a device producing electromagnetic waves, the condensing unit's electrical enclosure must be relocated or shielded from the electromagnetic field.**
13. **To avoid any interference, the condensing unit must be installed at a minimum distance of 3 m from any device producing or receiving electromagnetic waves (e.g. radio).**

9.2.a Installation work

Attaching the unit using anchor bolts



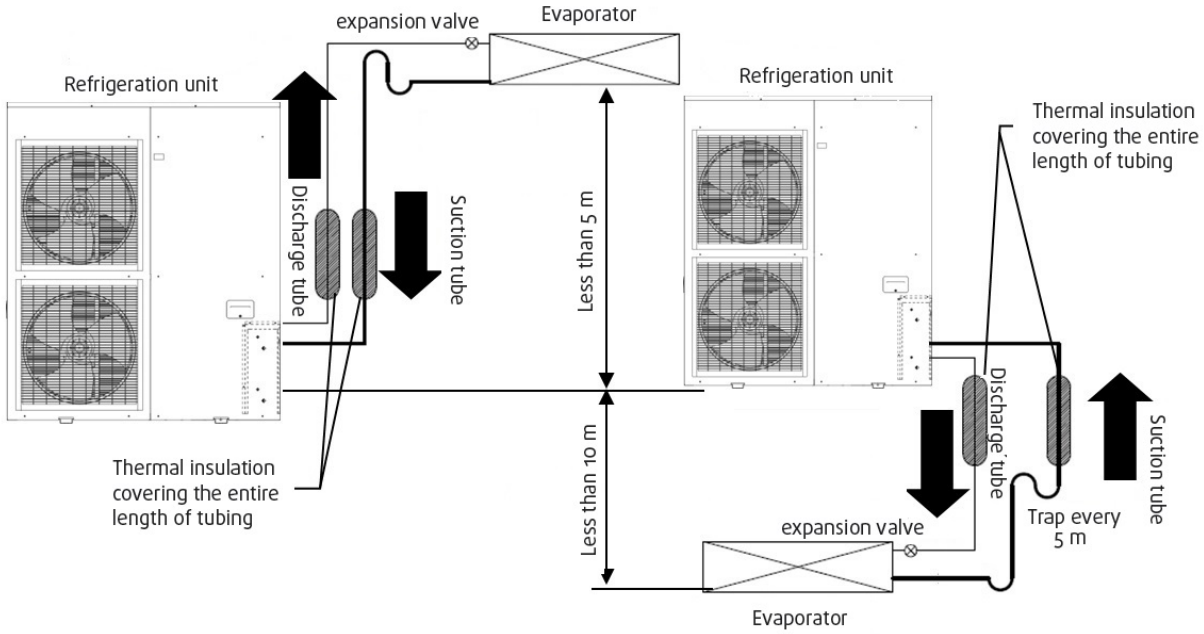
Securely attach the condensing unit and perform any foundation work required to avoid the unit from tilting, producing harmful noise levels and collapsing in the event of gusts of wind or earthquakes.

10. Installation

The quality of the refrigerating connections strongly affects the equipment's performance and lifecycle. It can also prevent operating problems. For this reason, the following recommendations must be observed when working on the equipment's piping.

10.1 Evaporator recommandation

1. **Evaporator maximum volume**
   Medium Temperature application : <15 liters
   Low Temperature application : <5 liters
2. **Distance to respect between the condensing unit and the evaporator :**



10.2 Piping recommendations

1. Piping selection

Use copper refrigerant piping, compliant with European standard

Select the piping material and thickness (table below) according to the maximum working pressure (MWP) of the installation

CDU connection	Diameter	Material	Thickness [mm]	MWP [bar]
Discharge pipe only	1/4" (6,35mm)	Hard copper	1	245
Both (discharge and suction pipe)	3/8" (9,52mm)	K65	0.65	120
		Hard copper	1	155

2. Piping instruction

Use clean copper piping, free from contaminating material deposits such as sulfur, oxidizing materials, waste, metal shavings or moisture.

Always cut the piping with a tube cutter, and remove any dust using nitrogen or pressurized air before connecting the tube. Avoid using tools that produce large quantities of dust, e.g. saws or grinders.

Warning:

- **Prevent any contamination and unwanted introduction of foreign bodies (dust, water, sand, earth, etc.) in the tube during installation work.**
- **In rainy weather, avoid performing tube connection work outdoors.**

3. Brazing

Brazing work must be performed by competent and certified professionals, in order to avoid gas leaks or equipment operation problems.

Always apply nitrogen when performing brazing tasks to connect the piping.

Use following brazing materials : Copro Phosphore BCuP2 to BCuP6

Be careful to entirely remove the flow after the brazing process.

When it leaves the factory, the condensing unit contains nitrogen.

To prevent contamination by moisture or foreign bodies, do not open the condensing unit before completing the piping connection work.

Condensing unit pipe interface
Discharge pipe: 6.35 mm (1/4")
Suction pipe: 9.53 mm (3/8")

4. Piping length

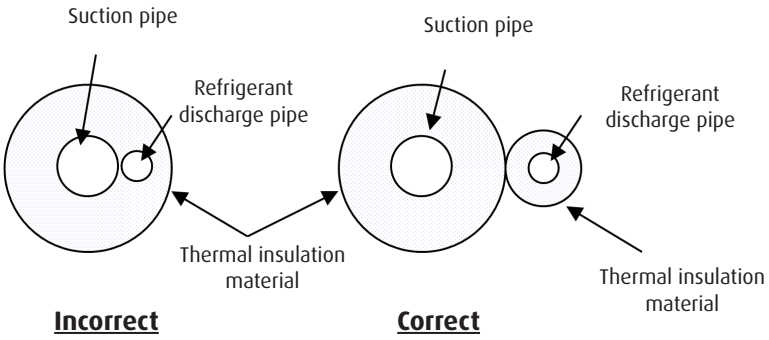
Medium Temperature application : < 30m (risk of capacity drop & poor lubrication if > 30m)

Low Temperature application : < 20m (risk of capacity drop & poor lubrication if > 20m)

5. Piping insulation

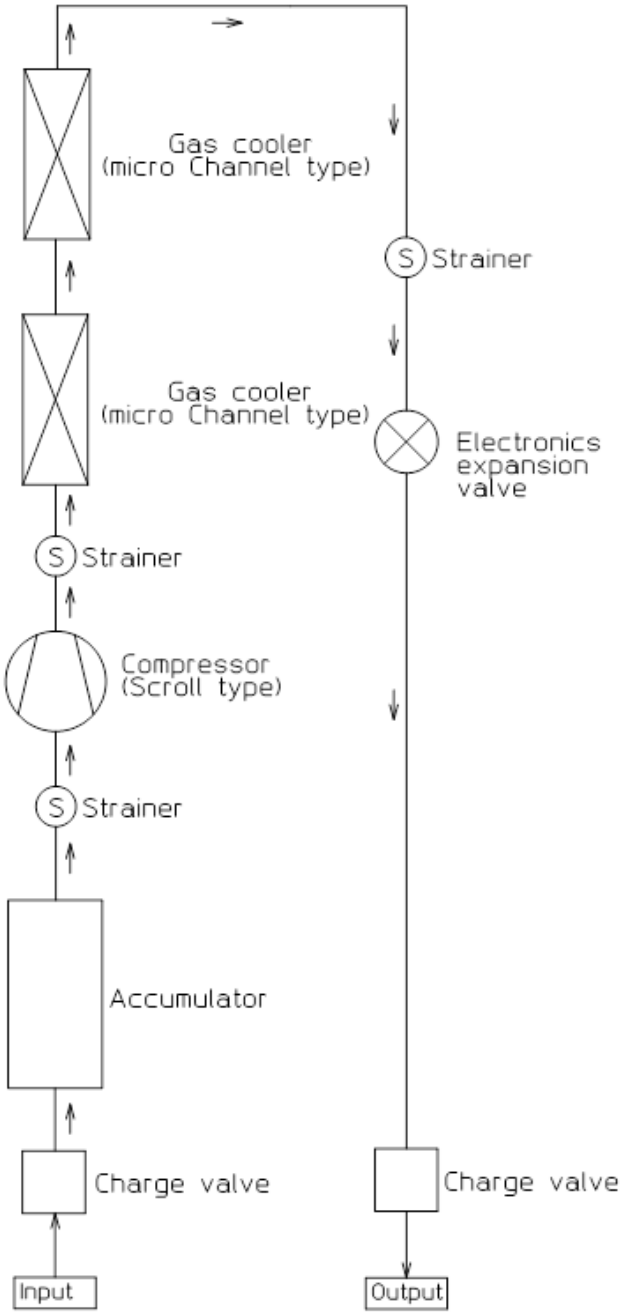
Insulation material thickness : 50mm

Insulate piping with the following instruction:

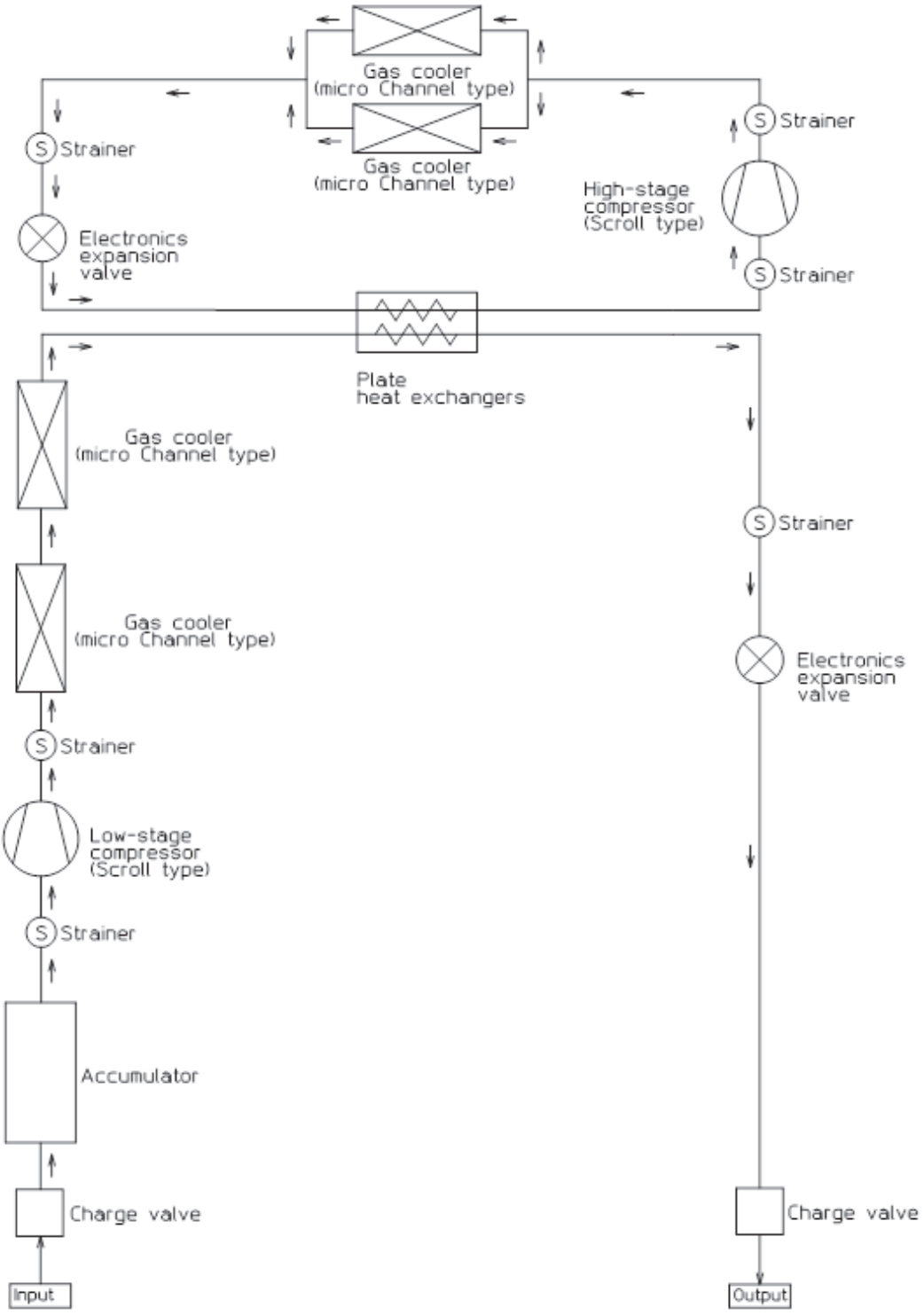


10.3 Refrigerating circuit diagram

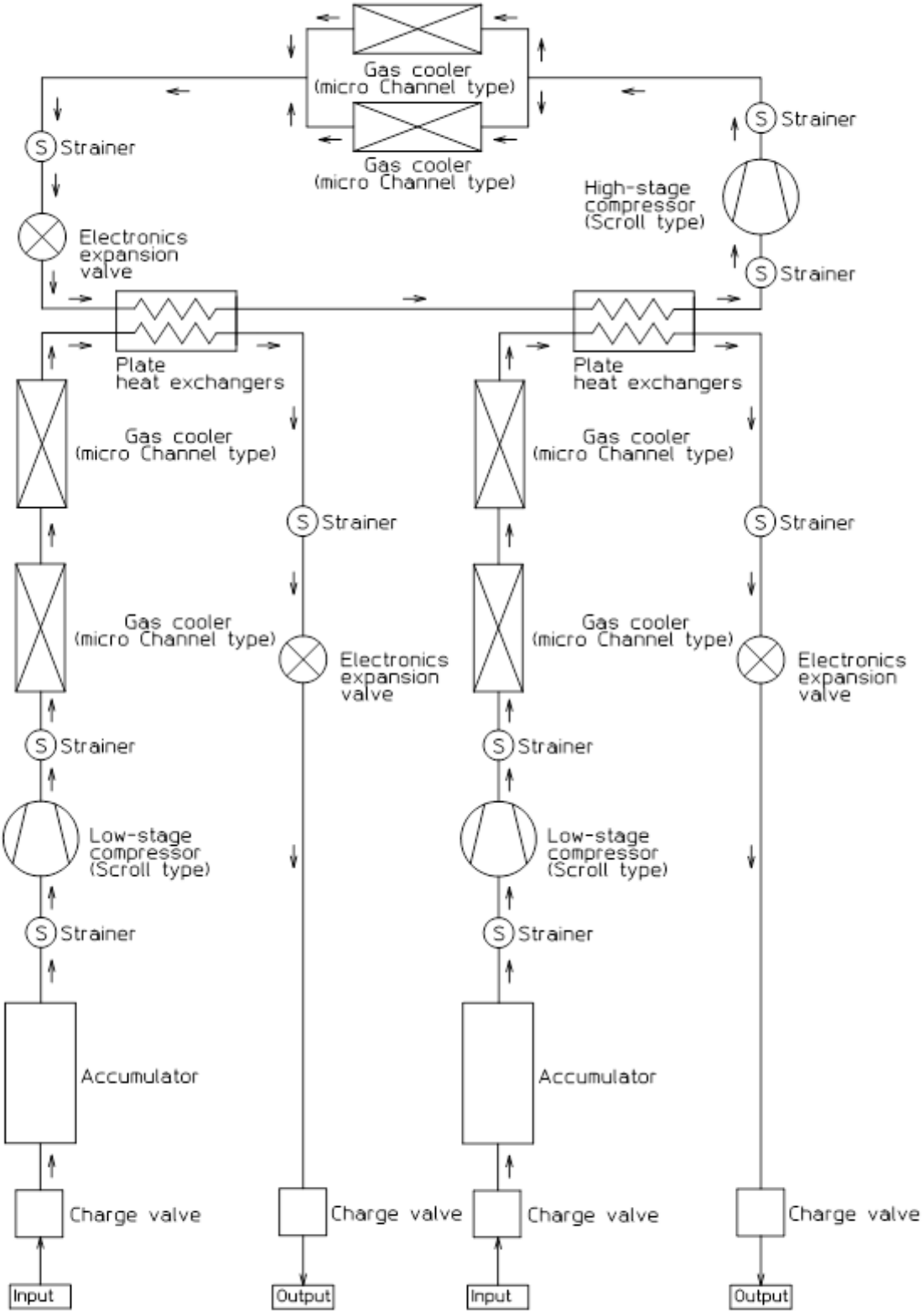
1. CDU-S



2. CDU-M


Gas cooler
(micro Channel type)
Gas cooler
(micro Channel type)
Strainer
Electronics
expansion
valve
High-stage
compressor
(Scroll type)
Strainer
Strainer
Plate
heat exchangers
Gas cooler
(micro Channel type)
Gas cooler
(micro Channel type)
Strainer
Low-stage
compressor
(Scroll type)
Strainer
Accumulator
Charge valve
Input
Strainer
Electronics
expansion
valve
Charge valve
Output

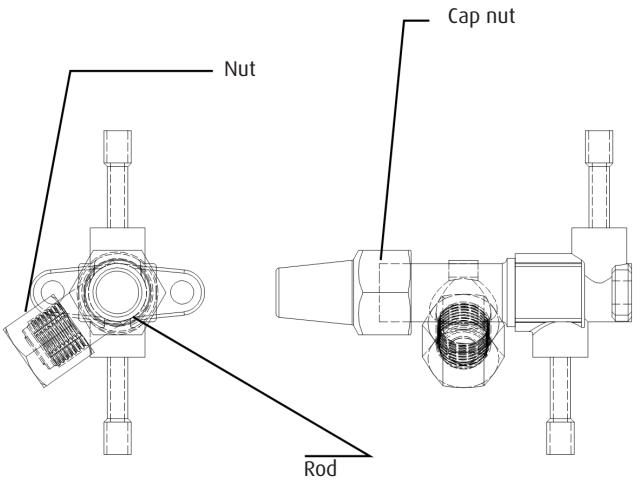
3. CDU-L

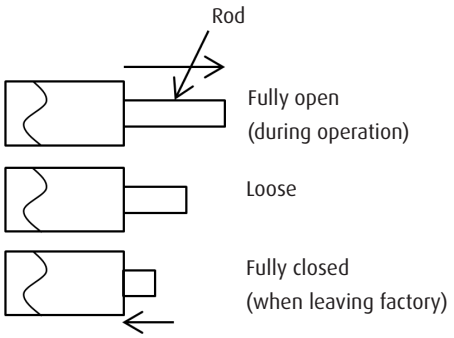

Gas cooler
(micro Channel type)
Gas cooler
(micro Channel type)
Strainer
Electronics
expansion
valve
Plate
heat exchangers
Gas cooler
(micro Channel type)
Gas cooler
(micro Channel type)
Strainer
Low-stage
compressor
(Scroll type)
Strainer
Accumulator
Charge valve
Input
Strainer
Electronics
expansion
valve
Output
High-stage
compressor
(Scroll type)
Strainer
Plate
heat exchangers
Gas cooler
(micro Channel type)
Gas cooler
(micro Channel type)
Strainer
Low-stage
compressor
(Scroll type)
Strainer
Accumulator
Charge valve
Input
Strainer
Electronics
expansion
valve
Charge valve
Output

11. Leakage test and refrigerant charging process

11.1 Leakage test

1. **Before performing thermal insulation , proceed to a leakage test on the complete installation.**
2. **Check functions of the service valves**





Steps to be performed prior to the leakage test and evacuation

1. Remove the nut.
2. Remove the cap nut.
3. Loosen the rod in the open state.
4. Connect the check valve (M16 x 1.5), then perform the leakage test and evacuate the refrigerant.
5. The evacuation process is performed when fully opened (step 3).
6. Fill the circuit with refrigerant.

Service valve (mm)	Nut (Nm)	Rod (Nm)	Cap nut (Nm)
High-pressure port : 6.35 mm (1/4")	12 to 14	13 to 17	25 to 35
Low-pressure port : 9.53 mm (3/8")			

Leakage test method

1. **Charge nitrogen through the low-pressure service valve, then perform a leakage test at 6 MPa (below relieve valve opening pressure).**
   If a leak is suspected, search for a leak using a foamy solution, then perform any required repairs.

IMPORTANT

- When performing the leakage test, the expansion valve must be fully opened by the controller or an additionnal magnet instead of the coil.
- The condensing unit's high and low-pressure values will be displayed on the control panel.
  - **If no voltage is applied, the pressure values are not displayed.**
  - **To check these values, install a gauge manifold on the service valve on the high and low-pressure side.**
    (Please refer to product specifications for information regarding the service valve's position.)

11.2 Vacuuming

1. **Vacuum the complete installation through the service valve (both high and low-pressure).**
2. **The expansion valve must be fully opened by the controller or an additionnal magnet instead of the coil.**
3. **After completing work, close the service valve's rod by applying 13 to 17 Nm torque, in order to avoid any gas leaks.**

Notes

1. **Vacuum the circuit, leaving enough time (2-3 hours) after the vacuum pressure reaches -0.1 MPa.**
   This operation is very important whenever there is a risk of condensation forming on the piping walls.
2. **Use a vacuum pump with a high speed exhaust flow rate.**
   Frequently used conventional vacuum pumps (small-sized, with a 20 to 30 l/min. exhaust flow rate) require a lot of time.
3. **Use a vacuum pump adapter to ensure that the mineral oil inside of vacuum pump does not flow back into the refrigerating circuit.**
4. **Use a R744 specific manifold valve.**

11.3 CO_2 charge process

After vacuuming, charge the refrigerant as follows.

1. **Inspect the refrigerant fluid cylinder.**
   The type of refrigerant used is R744 with quality level of 9.3 (pure CO_2).
2. **Add an expansion device on the cylinder to control the pressure**
3. **Connect the cylinder to the low pressure service valve.**
4. **Drain the hose**
5. **Weigh the refrigerant cylinder (by inspecting the cylinder's initial weight).**
6. **Start the refrigerating charge with R744 in gas state until 7 bar**
7. **Switch the R744 cylinder in liquide state to finish the charge until the right amount.**

Refrigerant quantity is linked to piping length and evaporator volume
The recommended filling quantity is ± 5 g below or over the defined refrigerant quantity.

Important
♦ Use charging valve and refrigerating hose suited to R744.

12. Electrical wiring

12.1 Wiring power capacity

1. **Install an earth ground.**
   "Category D" earth ground, with a resistance to earth not exceeding 100 Ω.
2. **Install a ground fault differential circuit breaker.**
   High-bandwidth type: switching delay below 0.2 seconds.
3. **The allowable voltage for the condensing unit is shown in the diagram to the right.**
   Electrical wiring must be sized in accordance with the electrical equipment's technical standards and applicable electrical safety regulations, thus ensuring compliance with the allowable voltage range. Please refer to the following electrical specifications table.
4. **Refer to the table below for torque values applicable to the electrical wiring's terminal block screws and the operating circuit's wiring.**

Tightening Torque	
Screw size	Torque (N m)
M4	1.0 to 1.3
M5	2.0 to 2.5
M6	4.0 to 5.0
M8	9.0 to 11.0
M10	18.0 to 23.0

5. **Electrical specifications**

Model		CDU-L		CDU-M		CDU-S	
Reference		CDU-R06A2A	CDU-R06A2B	CDU-R04A1A	CDU-R04A1B	CDU-R02A1A	CDU-R02A1B
Rated power(kW)		5.4		3.6		1.8	
Power supply		AC 3 phases 230V 50/60Hz	AC 3 phases 400V 50/60Hz	AC 3 phases 230V 50/60Hz	AC Single phase 230V 50/60Hz	AC 3 phases 230V 50/60Hz	AC Single phase 230V 50/60Hz
Electrical Specifications	Consumption (kW)	5.4	5.5	2.4	2.4	1.9	1.9
	Rated current (A)	14.9	8,5	6.5	10.7	5.1	8.4
Electrical power (kVA)		6.9		4.2		2.2	
Ground fault circuit breaker	Rated current (A)	20	10	10	12	10	12
(GFCB)	Sensitivity (mA)	30					

Notes

1. **Electrical specifications are provided for an air temperature of 32°C at the entrance of the gas cooler, an evaporation temperature of -5°C and a nominal operating frequency.**

   Values may increase during the peak of summer and/or according to voltage fluctuations. Suitable differential circuit breaker and wiring must therefore imperatively be used.

2. **Install a high-sensitivity differential circuit breaker (with a switching delay lower than 0.2 seconds) with a specific current sensitivity.**

   To avoid any malfunction due to current leakage, select a model that is compatible with the inverter mode.

   During installation work, ensure that the equipment is correctly grounded ("Category D" grounding).

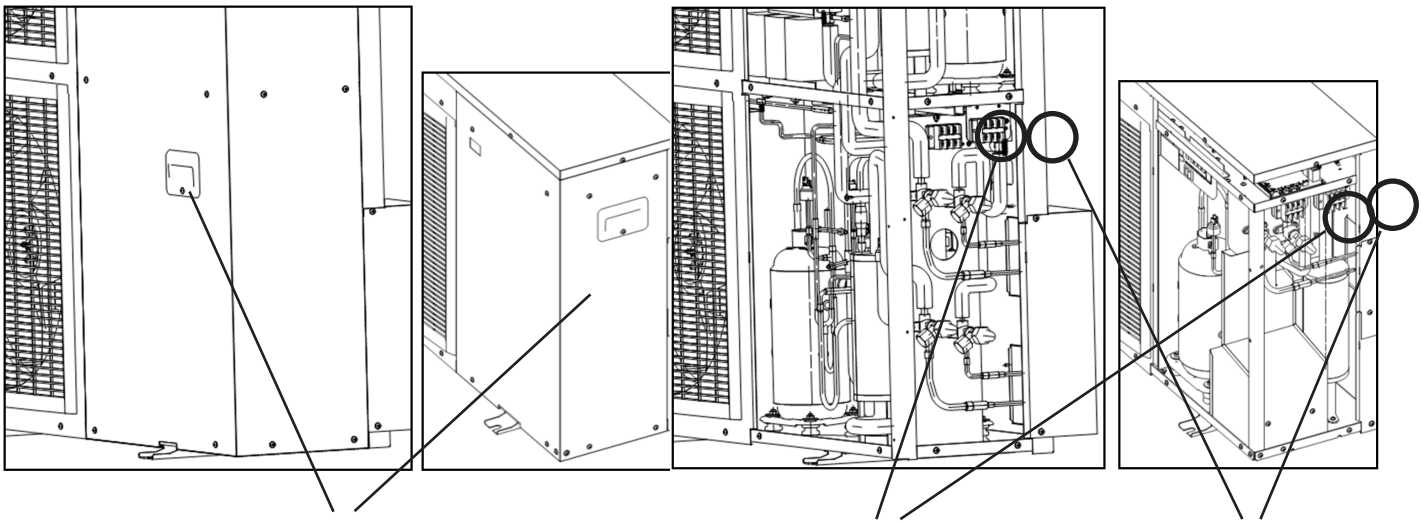
12.2 Electrical circuit connection wiring

Power supply circuit connection

The power supply connection wiring must be carried out according to the following procedure.

Untightened the bels and remove the right panel.

Connect the wiring to the terminal block.

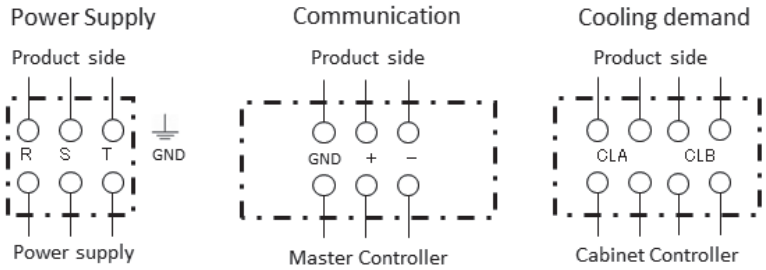


Remove the right panel.

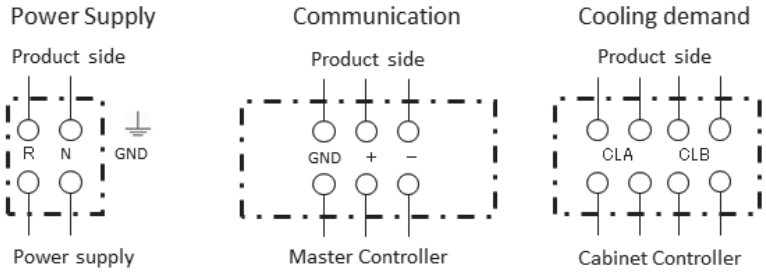
Power supply wire

Communication wires

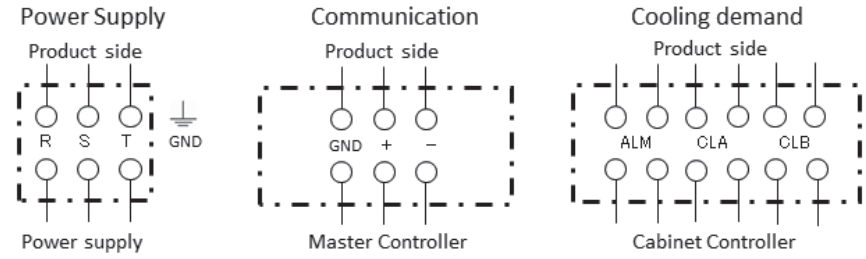
Triple Phase 230V Electrical connection (R02A1A/R04A1A/R06A2A)



Single Phase 230V Electrical connection (R02A1B/R04A1B)



Triple Phase 400V Electrical connection (R06A2B)



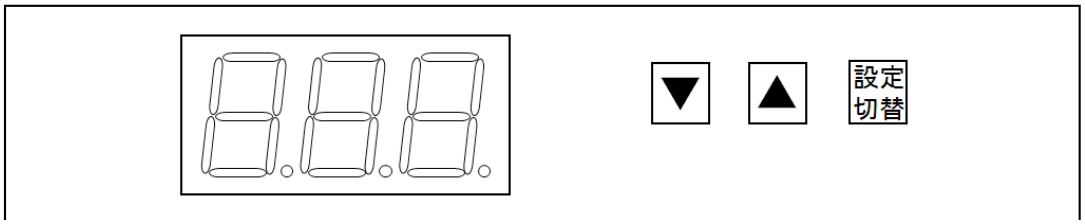
13. Condensing unit controls

13.1 List of controls

The condensing unit's controls are detailed in the following pages.

13.1.a Operational data display

Control and display panel



Enter

Name	Function
Configuration button 設定 切替	Scroll through configured values
▲ button	Edit settings (increase)
▼ button	Edit settings (reduce)

Exit

Name	Function
7-segment LED	Displays the normal low-pressure value. Displays the setting value in setting value adjustment mode, and displays each data point in RAM display mode.
	Flashes when sending or receiving communication data between the master unit and the slave unit (period after the first right-hand digit).

Scrolling through the control panel display

Each press on the setting adjustment button enables users to edit displayed items, as described below.

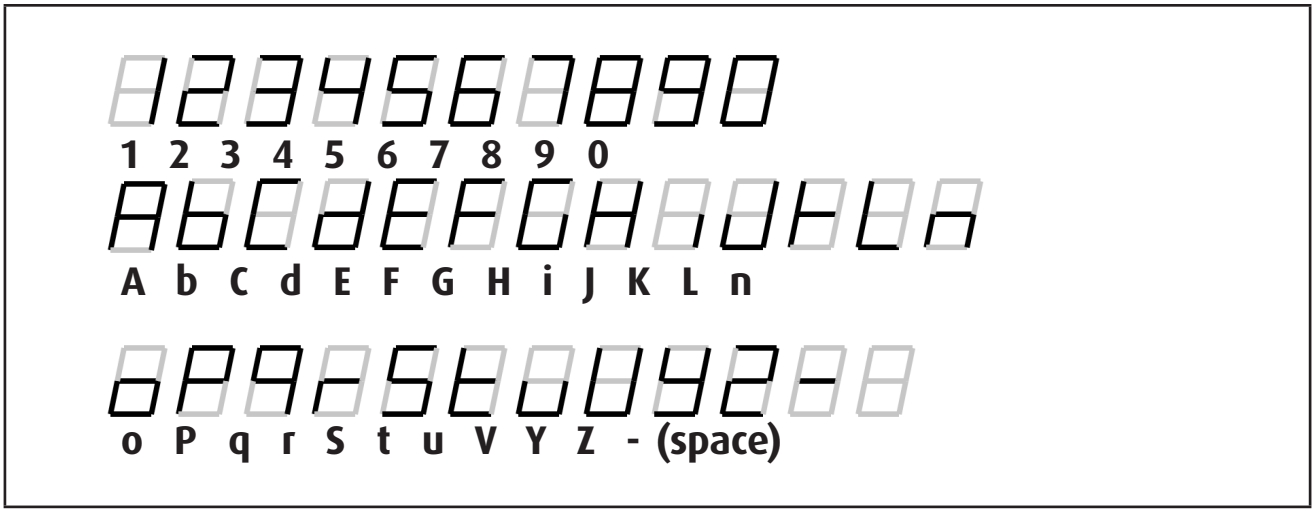
1 => 2=> 3 => · · · => 22 => 23 => 24 => 1 => · · ·

The 7-segment LEDs alternately flash the displayed item's symbols and the displayed value every 0.5 seconds.

Initializing the display

This display disappears and reverts to the normal display if the button is not pressed for 10 minutes, or after keeping the setting adjustment button pressed and held for 3 seconds.

The 7-segment LED display is operated as follows.



Data display

The control panel's 7-segment LEDs provide the following information.

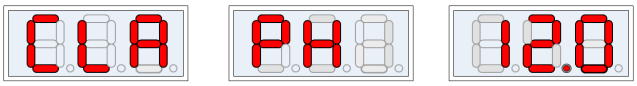
7-segment LED display					
Display of items		Display of content	Display format	Unit	Range
Normal display		Pressure sensor input (low-pressure side)	**.*	MPaG	0.8 à +9,8 MPaG
Displayed data		Display			
1	P H	Overheating (gas cooler outlet temperature and inlet temperature)	***	K	-99 to +99 °C
2	P s	Pressure sensor input (low-pressure side)	**.*	MPaG	-0.8 to +14.0 MPaG
3	P d	Pressure sensor input (high-pressure side)	**.*	MPaG	-0.8 to +14.0 MPaG
4	t d	Discharge temperature sensor input	***	°C	-6 to +156 °C
5	t i	Gas cooler inlet temperature sensor input	***	°C	-30 to +90 °C
6	T U	Gas cooler outlet temperature sensor input	***	°C	-30 to +90 °C
7	T R	Refrigerant electronic expansion valve	***	Pulse	0-990 pulses
8	C I	Inverter compressor motor operating speed	***	Hz	0 à 90Hz
9	T O L	Electronic enclosure temperature sensor input	***	°C	-20 to +106 °C
10	T A R	Ambient air temperature sensor input	***	°C	-20 to +106 °C
11	F F 1	Gas cooler fan rotation speed input (bottom)	***	rpm	0 to 255 rpm
12	F F 2	Gas cooler fan rotation speed input (top)	***	rpm	0 to 255 rpm
13	F U 1	Gas cooler fan output voltage (bottom)	*.**	V	0.00 to 5.00V
14	F U 2	Gas cooler fan output voltage (top)	*.**	V	0.00 to 5.00V
15	P S O	Target low pressure	**.*	MPaG	-0.8 to +14.0 MPaG
16	P D O	Target high pressure	**.*	MPaG	-0.8 to +14.0 MPaG
17	C O	Inverter compressor motor target frequency	***	Hz	0 à 90 Hz

13.1.b Control panel display mode

Input

1. **Press the configuration button in the normal display mode.**
2. **After entering the data display mode:**
   Displays the refrigerating circuit symbol for 0.5 seconds
   → Displays the displayed item's symbol for 0.5 seconds
   → Displays the current value for 1.0 second
   → Displays the refrigerating circuit symbol for 0.5 seconds
   ... Repeatedly displays these items.

[Refrigerating circuit] [Displayed item] [Current value]



0.5 s 0.5 s 1.0 s

For more information on the refrigerating circuit's symbols, please refer to the setting adjustment function below.

13.1.c Changing the display

- Press the configuration button
  Every time the button is pressed, the next display item is displayed. (Please refer to the display content list for information regarding the sequence of displayed items.)
  1 → 2 → 3 → ··· → 15 → 16 → 17 →1 → . . .
  The displayed item's symbol is displayed when the user presses the button.

- Press the ▼ or ▲ button
  Refrigerating circuit, displayed after each press on the button,
  [refrigerating circuit 1 (lower circuit A)] →
  [refrigerating circuit 2 (lower circuit B)] →
  [refrigerating circuit 3 (upper circuit C)] →
  [refrigerating circuit 1 (lower circuit A)] will be edited.
  Displays the item's symbol when the user presses the button.

13.1.d Exiting configuration

To exit the configuration mode:

- Press and hold the configuration button for 3 seconds.
- The button is not pressed for 10 minutes.

13.1.e Inverter compressor motor drive power

Refrigerating operation

Remote operation

This controls the inverter's rotation speed setpoint to allow the low-pressure value received from the central control to be achieved.

Local operation

The compressor's speed is controlled by the local operation function's low-pressure setpoint.

Starting and stopping conditions

1. The equipment may be started once all of the following conditions have been met.

- Power switch placed in ON position
  - **[low-pressure set value for restarting the inverter compressor] in ON mode, set to P08 or more**
  - **Even if [low pressure value to assess whether the inverter compressor is in ON mode] is lower than P08**
- ON mode is activated 3 minutes after the low-pressure limit cutout (operation is stopped). Evaluate the 3-minute delay when powering the device up.
- The inverter compressor's frequency complies with the stopping evaluation conditions.
- The ambient air temperature sensor is enabled and the ambient air temperature exceeds [operating temperature].
- 30 minutes have elapsed after stopping the compressor's shutoff [compressor forced SHUTDOWN time].
- Over 5 minutes have elapsed after the inverter's "motor shutoff factor" dropped from over "00" to "00".
- 5 minutes or more have elapsed after the high-pressure alarm was triggered by the high-pressure sensor.

2. Operation is stopped when one of the following conditions is met.

- The power switch is placed in the OFF position.
- SHUTDOWN (low-pressure cutoff) at [low-pressure value at which the cooling operation automatic holding feature is released] at A01, B01, C01 or less, for every low-pressure occurrence.
  - **Set delay (other than routine shutoff periods)**
    [Time elapsed following the electronic expansion valve shutoff request until the compressor's shutoff: decrease] (P24)
  - **Set delay (during a routine shutoff period)**
    [Time elapsed following the electronic expansion valve shutoff request until the compressor's shutoff: normal] (P23)
- The ambient air temperature sensor is enabled and the ambient air temperature exceeds [operating temperature] at A04, B04, C04 or less. Add
- Reception of an inverter "motor shutoff factor" other than "00".

- Detection of a high-pressure error by the high-pressure sensor. In this event, instant shutoff occurs as soon as a rotation value of 0 is indicated.

13.1.f Condenser fan drive power

Condenser fan operation and shutoff

Operating conditions

The condenser unit starts regulating the fan's operation in the following conditions:

- With delay P11 following the compressor motor's start
- When the compressor is started

Shutoff condition

The inverter's voltage regulation function is stopped in the following conditions:

- When the low-pressure value of each loop reaches the limits defined in parameters A01 B01 C01, the loop compressor stops after the delay defined by P11.
- The compressor stops after the delay defined by P11.

14. Condensing unit commissioning

To the attention of installers

1. **Check the parameters and the well functionning of the condensing unit**
2. **If the unit doesn't work after the commissioning, contact your supplier**
3. **Check that eletric cables are not defective**
4. **Check that the insulation resistance is >1M Ω**

14.1 Commissioning the condensing unit

1. **Before starting the condensing unit, perform all installation work on the refrigerated display side before powering up the equipment.**
2. **Place all the electrical enclosure's switches on «ON» (located on the front face of the condensing unit).**
3. **The compressor(s) and fan(s) start running.**
4. **Make sure that no vibrations or abnormal noises are present. If vibrations or abnormal noises are noted, shut off the group and locate the cause.**
5. **Once the equipment's operation has been stabilized, check the low-pressure equipment's operating pressure and temperature.**
6. **Check superheat conditions and adjust CO_2 amount if needed**
7. **Fulfill the comissionning data input §18**

15. Regular maintenance

To the attention of operators

15.1 Condensing unit maintenance and inspection

ATTENTION

- The maintenance and the inspection must be performed by certified professionals.
- Imperfect installation or electrical work (whether performed by yourself or by another person) may result in refrigerant leaks, electric shocks or fire.
- An improper maintenance can generate refrigerant leaks
- The refrigerant used is R744. The internal pressure is high. Do not replace R744 by freon gas, it would generate dysfonctionning.
- In case of refrigerant leaks, please ensure a good ventilation. Failure to comply with this rule may lead to oxygen deprivation.
- To ensure optimum operation of the condensing unit and to prevent any failures, regularly inspect the following items.
- Before removing the service cover to perform an inspection, confirm that the power supply has been shut off (STOP) on the condensing unit's control panel.

Condensing unit gas cooler

Checklist		Solutions
Gas cooler	Fins clogged with dust	Clean the fins
	Fan rotation	Fan operation
	Cooling air flow	Implement a system to avoid residual heat being sucked into the equipment
	Ambient air temperature	Maintain ambient air temperature between -15°C and +43°C
Compressor	Vibrations or abnormal noise during operation	Contact service.
Piping	Vibrations or abnormal noise during operation	Contact service.
Other equipment	Internal temperature increase	Clean the fins
	Dirt and dust inside the electrical enclosure	Clean the electrical components

Please pay attention to the following points before cleaning the gas cooler

- Shut off the main power supply before cleaning the equipment. Failure to follow this instruction may result in the fan motor sucking up dust and causing the equipment to fail.
- During regular inspections, clean the gas cooler using a vacuum cleaner or a soft non-metallic brush.
- In the event where the gas cooler is severely clogged with dirt, wash it with water.
- Wear thick gloves when cleaning the gas cooler. Direct contact between the skin and the gas cooler may result in burns.
- The gas cooler's fins are thin and can easily bend. Applying excessive pressure on the brush will drive the dirt towards the gas cooler's core and result in damage to the fins.
- Do not use compressed air to clean the gas cooler. Dust could become lodged inside the fins and cause the equipment to fail.
- Do not use detergent. Using certain cleaning products may result in damage to the condensing unit.
- Do not place any objects in front of the gas cooler. This could result in an accident.

15.2 If the safety device is triggered

To the attention of operators

If the condensing unit's safety device is triggered, please contact your supplier with the following information: ① the equipment model, ② the error code (list in the following page) and ③ the failure's status.

See the list of error codes §15.3

To the attention of maintenance technicians

- In the event where the safety device triggers a signal to stop the condensing unit, confirm that the conditions of use are followed (installation checklist in annex), and that all installation components are correctly sized according to the device's refrigerating capacity. All potential errors are listed in the following table (list of error codes §15.3)
- In case of repairing a gas leak, please vaccum the refrigerating circuit and braze with azote
- In case of product failure, please contact your supplier with the following information: ① the equipment model, ② the error code (list in the following page) and ③ the failure's status.

15.3 List of error codes

Error code	Error content
EEE	Microprocessor error
Err	EEPROM error
E01	Maximum discharge temperature triggered
E02	Maximum discharge pressure triggered
E10	Inverter compressor error
E16	Gas cooler (top) fan speed error
E17	Gas cooler (bottom) fan speed error
E20	High-pressure sensor error
E21	Low-pressure sensor error
E23	Ambient air temperature sensor error
E24	Discharge temperature sensor error
E26	Heat exchanger inlet temperature sensor error
E27	Heat exchanger outlet temperature sensor error
E40	Communications error with master controler (if using an external communication system)
E42	Inverter communications error
E50	EEV control error 1
E51	EEV control error 2
E70	Inverter control error 1
E71	Inverter control error 2
E10-HO4	Inverter overcurent error
E10-HO8	Inverter overcurent error
E10-HOA	Inverter overcurent error
E10- H20	Inverter overcurent error
E10-HOC	Heat sink high level temperature error
E10-H10	Inverter overload error
E10-H14	Inverter low input voltage error
E10-H18	Inverter high input voltage error
E10-H1C	Inverter controller communication error
E10-H24	Inverter voltage drop detection
E10-H28	Inverter voltage drop detection
E10-H3O	Inverter voltage drop detection
E10-H2C	Control PCB power supply error
E10-H38	Inverter phase shift error
E10-H40	Heat sink thermistor error
E10-H44	Converter overcurent error
E10-H46	Converter overcurent error
E10-H48	Converter overcurent error
E10-H4C	Converter overcurent error
E10-H5O	Compressor operation error
E10-H52	Compressor operation error
E10-H54	Compressor operation error
E10-H56	Compressor operation error

16. Warranty policy

Warranty duration : 1 year (parts and labor)

Exclusion of warranties

1. **Design error when selecting a model, accessories or configuration of the condensing unit.**
   - If your construction does not comply with the instructions and precautions provided in the instructions manual, or if you select a cooling load whose power is significantly lower or greater than the condensing unit's, we consider that incidents may occur.
   - Example: incorrect selection of an electronic expansion valve, installation error, expansion valve not fitted with a solenoid valve, use of a non-recommended refrigerant, etc.
2. **In the event where installation work was not correctly supervised.**
   - In the event of damage due to incorrect handling during the installation work.
   - If foreign bodies have been inserted during the installation work.
   - In the event where defective electrical wiring is used during installation work.
   - If no improvements have been made, in spite of shortcomings identified by authorized persons.
   - Accidents occurring during construction work in violation of various laws and regulations.
   - If the equipment produces vibrations or abnormal noises when started.
   - In the event of problems with the foundations, e.g. unstable chassis.
3. **In the event of an accident due to a local modification, additional work, relocation of specific products or incorrect use of specific products.**
4. **In the event of an accident occurring after installation in mobile equipment (e.g. road vehicle, railcar or ship)**

5. **In the event of an accident due to an inappropriate or unsuitable operating environment, or to lack of maintenance or inspections.**
   - In the event of an accident due to installation in an environment exposed to corrosive gases, oil or grease (including the machine's oil), salt (coastal regions) or sulfur gases (nearby hot water or thermal sources).
   - In the event of an accident in an installation location (insufficient air inlet or outlet, inadequate water pressure, presence of chemicals).
   - In the event of an accident due to incorrect configuration or incorrect settings (overheating expansion valve, pressure sensor low-pressure setting).
   - In the event of an accident due to incorrect use or incorrect handling (short operating cycles/service interruptions shorter than 5 minutes).
   - In the event of an accident due to poor maintenance (clogging of the fan exchanger, lack of cleanliness inspections or lack of cleaning, failure to inspect the refrigerant oil, unnoticed gas leak).
   - In the event of an accident due to incorrect repairs (use of incorrect parts or poor fitting, or use of the equipment with a missing part).
   - In the event of an accident due to a refrigerant overflow, lack of refrigerant fluid or oil in the condensing unit (failure to start, motor cooling fault, lubrication fault).
   - In the event of an accident due to poor de-icing.
   - In the event of an accident caused by external factors such as abnormal voltage, abnormal electromagnetic waves or intrusion of a foreign body.
   - If an inspection reveals that moist air is sucked into the system.
6. **In the event of an accident due to failure to observe evaporation temperature, ambient air temperature or the acceptable supply voltage range.**
7. **In the event of an accident due to external factors (including, but not limited to: fires, earthquakes, storms, floods, lightning, unusual weather conditions and other natural disasters, soot, ash and acid rain).**
8. **In the event of use in foreign countries.**
9. **In addition, the manufacturer may under no circumstance be held liable for or offer any coverage for accidents in the event of installation, use, handling, adjustments or maintenance that do not comply with common sense. No compensation will be granted for products such as cooling products. For this reason, in the event of secondary damage, after reviewing the alarm system's installation and filing a claim with our agency, please contact your insurance company.**

17. Annex

17.1 Installation and electrical work checklist

Destination: Inspection date: Inspector:

Model: Serial number: Production date:

Result: No issue reported: ✓ Improvements required: ✖

Classification	Inspections to perform	Result
Installation	Falling risks prevented with anchor bolts or other attachment systems?	
	300 mm space around the gas cooler's air intake surface (basic installation)?	
	500 mm space in front of the unit (basic installation)?	
	Height difference with cooler (charge side)?	
	with cooler located within 5 m distance	
	with cooler located within 10 m distance	
	Incorrect piping length with cooler located within 50 m distance (charge side)?	
Electrical wiring	Differential circuit breaker installed?	
	Suitable earth fault differential circuit breaker power rating?	
	Rated current: 50 A	
	Relative sensitivity 30 mA (switching delay: 0.1 seconds or less)	
	Ground wiring correctly connected?	
	Screws correctly tightened?	
	Power supply insulation (230V circuit), ground earth capacity 10 MΩ minimum	
	Suitable wiring power capacity?	
	Phase inversion, phase loss?	
	Power supply equal to 230 V ± 10%? [R-S / S-T / T-R = / / V]	
	Power supply phase imbalance lower than 2%?	
Piping	Valves stuck or cycle valves open?	
	Leakage checked using an air-tightness test. Are any leaks present?	
	Is the piping insulated?	
	Is sufficient evacuation ensured during the cycle?	
Refrigerant fluid	Quantity of refrigerant fluid introduced? [R744 refrigerant] [quantity: kg]	
	Refrigerant fluid leak?	

18. Comissionning data input

Input date	
Inspector	
Recipient (address, phone, email address)	
Equipment model	
Inspection date	
Serial number	
Production date	
Failure status	
Use	
Commissioning date	
Failure date	
Inspector's details (address, phone, fax, email address)	

Alarm code data confirmation
In the event of a failure, the condensing unit's front display panel flashes.
Note the values displayed after removing the front panel.

Code displayed:
Displayed data:
Cause of alarm: ( )

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