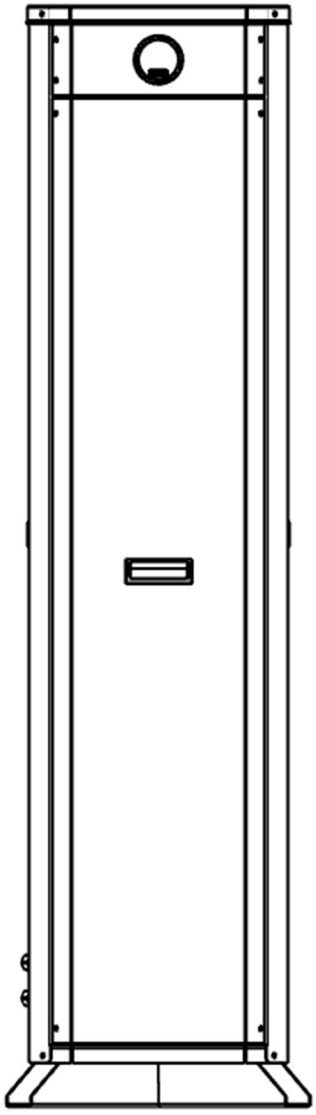
Panasonic®

Operation and Maintenance Manual
External Receiver Module

Model No.

CZ-CO2-R24L80-E
CZ-CO2-R24L80-H

CZ-CO2-R24L90-E
CZ-CO2-R24L90-H



Original manual
25.09 Rev.01-EN

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Overview of Symbols

Below is a summary of the pictograms used in this document. They refer to operating recommendations, technical information, and safety guidelines. They indicate potential hazards for the user and the device, as well as possible consequences resulting from failure to follow the instructions.



- Indicates possibility of death or serious injury



- Risk of electric shock
- Indicates possibility of minor injury or damage to properties.



- Risk of explosion.
- Risk of hand injury.
- Risk of fire.



- Risk of entrapment
- Risk of collision.
- Risk of falling load.



- Risk of burn – contact with hot surfaces, steam, or flame may cause skin burns.
- Risk of frostbite – contact with extremely cold surfaces or substances (e.g., liquid CO_2) may damage tissue.



- Protective clothing must be worn



- Recommended action



- Grounding – electric shock
- Additional grounding required



- Electrical and electronic equipment, including refrigeration systems, must be disposed of in accordance with Directive 2012/19/EU (WEEE).

General safety notes



All works related to the refrigeration plant should be performed by duly qualified personnel. Persons performing assembly, service, maintenance, dismantling, and leakage tests should have appropriate authorizations required in the country of installation of the unit, in the scope of performed works.



It is particularly important that all employees responsible for operation and service works related to the cycle and refrigerant have received an adequate training in the operation of supercritical refrigeration systems using carbon dioxide as a refrigerant.



The unit is designed to work under electrical voltage. It can be used only by employees with proper qualifications. Exercise extreme caution when conducting service work.



Note: After opening the door, the electrical components can be accessed directly. Danger of electric shock.



Personnel performing assembly and service works must be equipped with personal protection equipment, such as protective gloves, safety glasses, helmet, appropriate clothing, etc.



The operation/servicing of the refrigeration system requires the use of components (refrigeration pressure gauges, flexible hoses, etc.) designed to work with supercritical carbon dioxide as a refrigerant. Using components that are unsuitable may lead to their rupture, and as a consequence, may cause injury or, in extreme cases, death.



Carbon dioxide is an asphyxiant gas. It should be checked whether the system requires the use of carbon dioxide detectors and mechanical emergency ventilation. For this purpose, follow the guidelines in European standards EN 378-1 and EN 378-3.

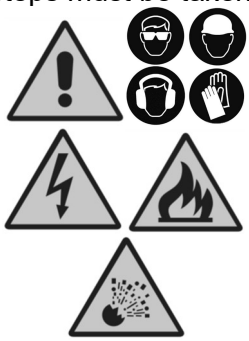
The unit should be installed in a well-ventilated place.



Prior to dispatch, the unit is filled with nitrogen at a pressure of 10 bar. Before starting the assembly work, check if the unit is still filled with gas by connecting the pressure gauge to the service valves of the unit. If overpressure is detected, discharge the gas into the atmosphere. In the absence of overpressure, check that the unit has not been damaged and unsealed during transport. See chapter 5.6 *Leak-tightness test.*

Procedure in case of injuries and emergencies

In the event of injuries or an accident during installation or maintenance work, the following steps must be taken:



- Secure the area of the incident – do not attempt to operate the device if there is a risk of leakage, electric shock, fire, or explosion.
- Provide first aid to the injured person in a safe location.
- Immediately call emergency services (tel. 112) or the appropriate local authority, clearly informing them about the nature of the incident and the potential hazard.
- Use protective equipment in accordance with EN 378-3 standards.

Terms and definitions

Strength test pressure — Symbol: **PT** — pressure used during strength pressure testing of the refrigeration system and/or any of its parts.

Maximum allowable pressure— Symbol: **PS** — maximum permissible pressure specified by the manufacturer. This is the limit value of the working pressure that must not be exceeded in the system both during its operation and idle time.

Receiver – liquid receiver of refrigerant.

Section — a well-defined part of the system giving the possibility of be cut off, for which the following parameters will be common: maximum permissible pressure, minimum permissible temperature, maximum permissible temperature and safety devices.

Tampering with the unit



It is forbidden to interfere with the cooling system, electrical system or software of the unit without the consent of the manufacturer. It is forbidden to upload settings or firmware from other units (other OCU models or the same model but with a different firmware). Any change to the default settings may result in incorrect operation of the unit and its damage, for which the manufacturer is not responsible. Make changes responsibly, and if in doubt, contact the manufacturer for default settings or more information.

Foundation of the unit

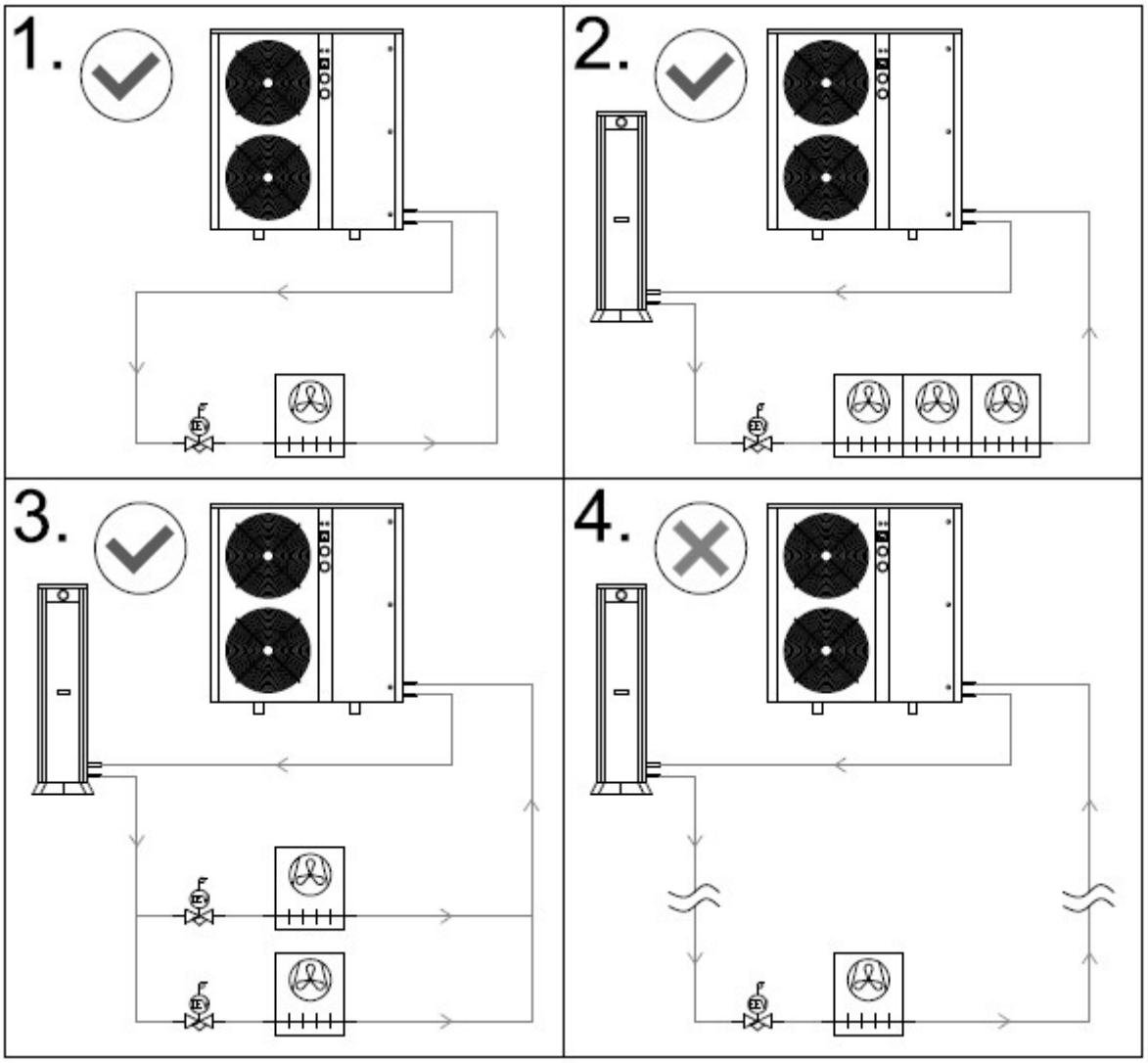
Detailed description of requirements concerning the foundation can be found in chapter 2.3 Place of assembly – main rules related to installation.

1. Unit description

The External Receiver Module (“external receiver”) are prepared as an optional stand-off addition for:

- OCU-CRC150A08 and OCU-CRC060A08 condensing units – version 24L PS = 80 bar (“-80”)
- OCU-CRC210M08 condensing unit – version 24L PS = 90 bar ("-90”)

External Receiver Module is useful for larger, more extensive systems with higher than standard refrigerant charging demand thanks to its capability to accumulate additional volume of refrigerant. it allows to work only with installations with evaporators with larger required charge (2.) or with larger summary quantity of evaporators in installation (3.). The unit does not extend the permissible maximum distance between condensing unit and evaporators (4.) – please look at the diagram below.



It does not have any negative impact on physical properties of the liquid refrigerant accumulated in or flowing through the unit. The unit is connected on the liquid line, in series - between condensing unit and evaporators.

The unit can be manufactured in housing or without (v. “-ECO”)

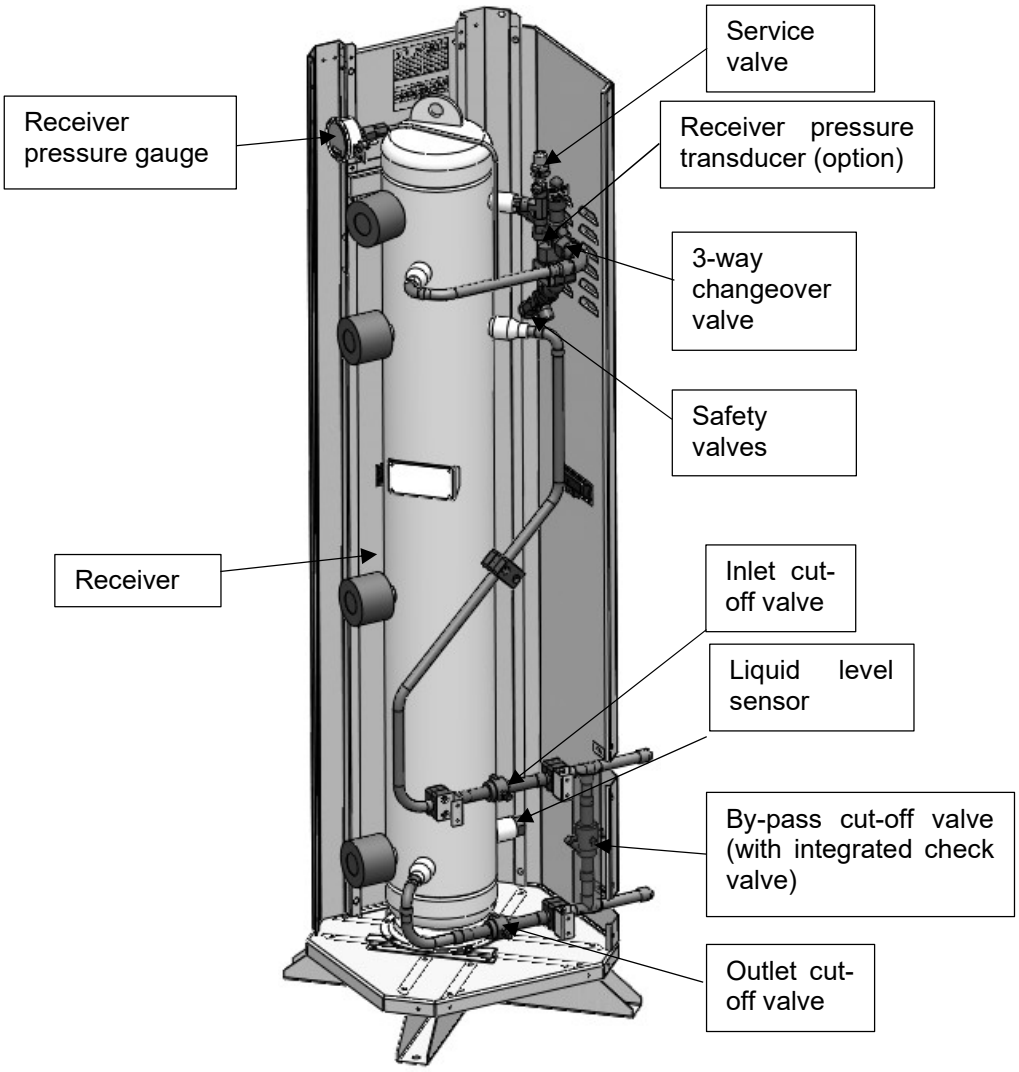


Figure 1.1 The main components of the unit

1.1. Type code description

CZ - CO2 - R24L 80* - E*

E = ECO (non-housed)
H = Housed

80 = Maximum allowable pressure 80 bar
90 = Maximum allowable pressure 90 bar

R24L = Receiver volume

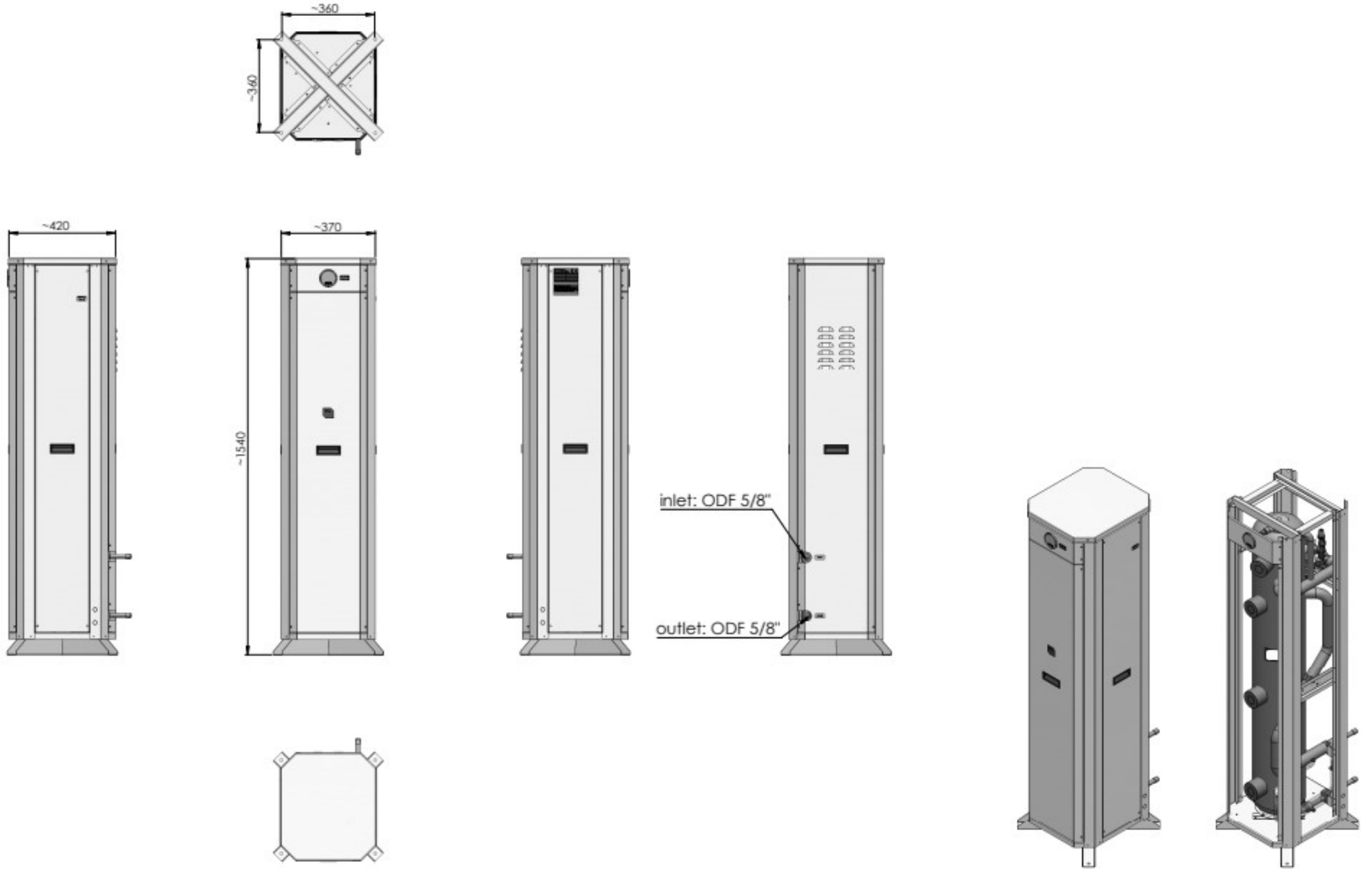
CO2 = R744

CZ = Accessory provided by factory

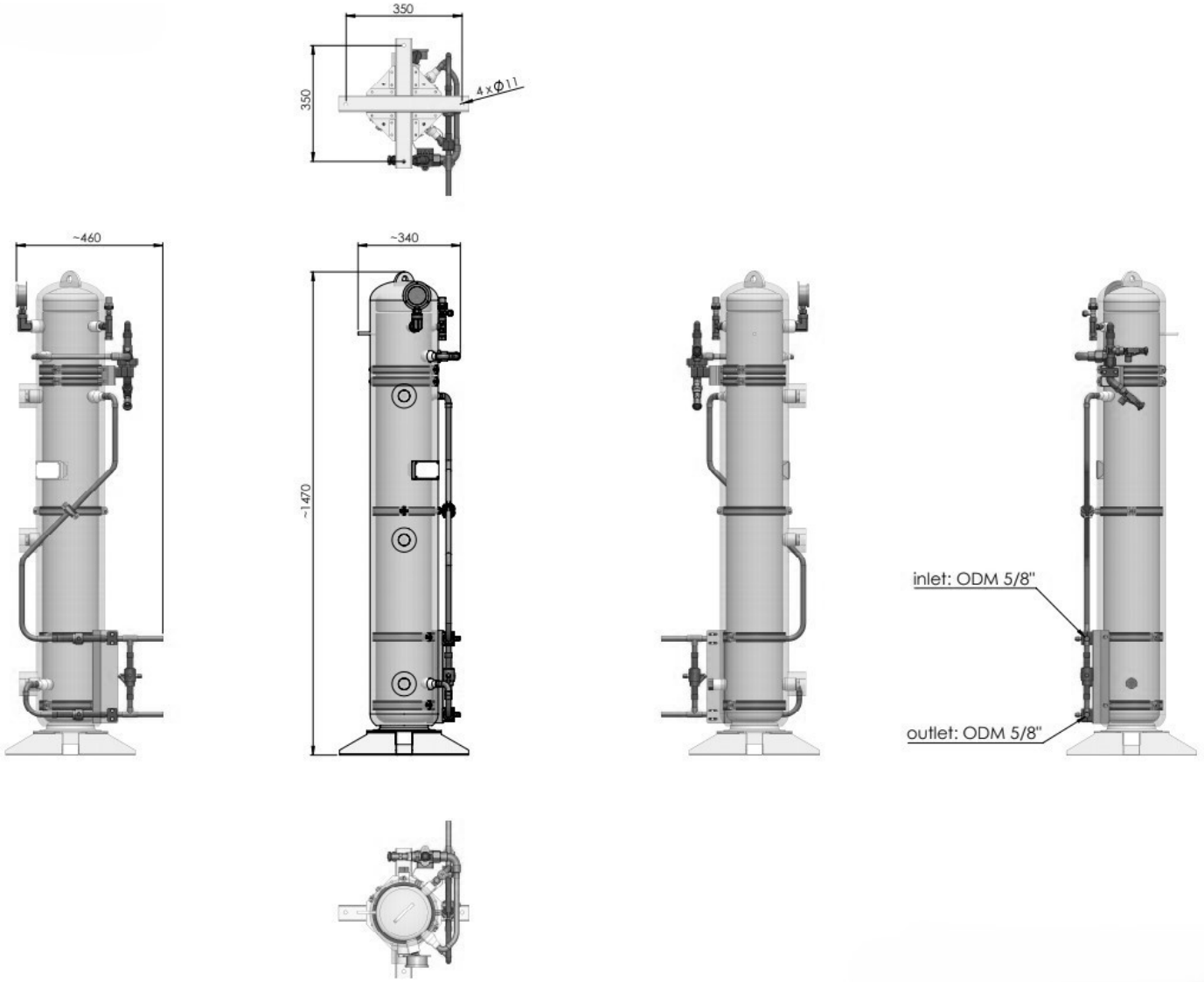
*possible option

1.2. Drawing

CZ-CO2-R24L80-H



CZ-CO2-R24L80-E



1.3. Technical data

MODEL	CZ-CO2-R24L80-E*	CZ-CO2-R24L90-E*
Refrigerant	R744 (CO2)	R744 (CO2)
Max. ambient temperature	43 °C	43 °C
Min. ambient temperature	-20 °C	-20 °C
Max. relative humidity	70 %	70 %
Pressures for unit:		
Max. pressure liquid line	PS=80 bar, PT=88 bar	PS=90 bar, PT=99 bar
Safety valve set for liquid line	80 bar	90 bar
PED category	III	III
Equipment:		
Liquid receiver	24,0 L SG + SV	24,0 L SG + SV
Pressure transducer	Option	Option
Min. liquid level sensor	Option	Option
Connections:		
Liquid line	CuFe2P 5/8"	CuFe2P 5/8"
Dimensions and Weight:		
Length	370 mm / 350mm*	370 mm / 350mm*
Height	1540 mm / 1470 mm*	1540 mm / 1470 mm*
Width	420 mm / 460 mm*	420 mm / 460 mm*
Weight	80 kg / 60 kg*	80 kg / 60 kg*

*variant (v.”-ECO”)

2. Design recommendations

2.1. Security measures

Because carbon dioxide in high concentrations is an asphyxiant gas, the place of installation should be protected against the effects of its possible leakage to the environment. In order to select the required security measures appropriately, follow the instructions in European standard EN 378. In particular, pay attention to points below:

- Refrigerant leaks may cause the concentration of carbon dioxide to rise above the permissible level, hence carbon dioxide sensors should be installed near the system.
- Oxygen depletion sensors should not be used.
- The sensors should be mounted at a height of about 20–40 cm above the floor.
- Any leaks must be signaled with sound and light alerts.
- If it is necessary to install emergency ventilation in the part of the plant, it must be ensured that the air is removed from the lower part of the plant.
- Emergency ventilation should be supplied from a different source than detectors and carbon dioxide leak alarms.

2.2. Maximum allowable pressure

- The maximum allowable pressure of the unit is 80 bar (v. “L80”) or 90 bar (v. “L90”)
- The maximum allowable pressure of all components installed in the liquid line of the system should be at least 80 bar (for OCU-CRC150A08, OCU-CRC060A08 or 90 bar (for OCU-CRC210M08)
- To install the unit use the pipelines and components adapted to work with carbon dioxide as a refrigerant.
- All assembled components should have a declaration of conformity with the relevant directives adequately to the intended use of a given component (pressure, electric, machine, etc.).
- The maximum allowable pressure of other parts of the plant must be specified.

- The maximum permissible pressure of a given section is determined by the component with the lowest maximum allowable pressure (PS) in this section.
- Information on the maximum permissible pressure (PS) of a given component or pipeline is given by the manufacturer in the technical specification.

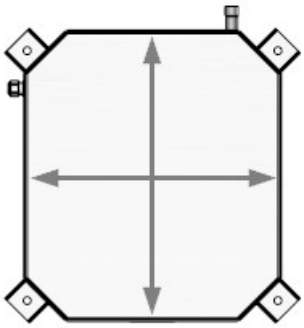
2.3. Place of assembly – main rules related to installation

- The external receiver is not an independently working unit and it can be used only in cooperation with OCU condensing unit (according to chapter 12.2. *Basic service tools recommended).*

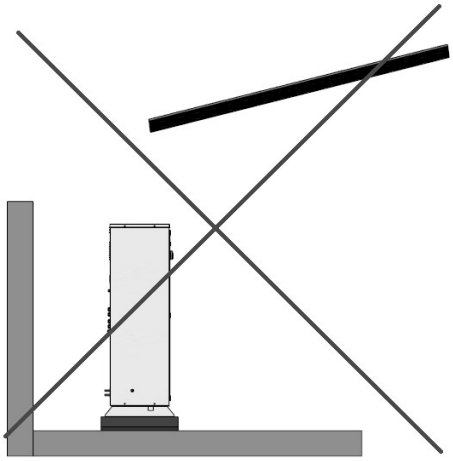


Figure 2.1 Example of the location of external receiver unit near the condensing unit

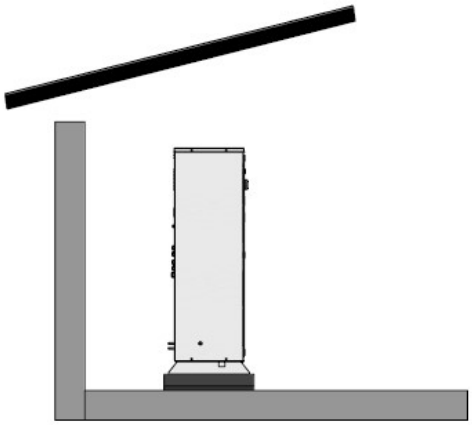
- The maximum length of the liquid pipe between external receiver unit and condensing unit (and therefore the distance between both units) cannot exceed 3 m.
- The maximum level difference between external receiver unit and condensing cannot exceed 0,1 m.
- The placing of the unit should not affect the air flow of the condensing unit.
- The ambient temperature in which the unit is operated must not exceed 43 °C. To reduce the risk of exceeding this temperature is recommended to put unit under a canopy or inside a room where free air flow can be ensure.
- The foundation must be horizontal, strong, stable and rigid enough to transfer the entire mass of the unit and eliminate vibrations and interferences.
- Each unit leg must be mounted rigid to the ground surface (without vibration isolators).
- The location of the unit must enable access for conducting service and maintenance works.
- Install the module in a place that will not restrict the service of the condensing unit.
- The unit must be leveled. Incorrect leveling of the unit will void the warranty.
- The units should be accessible only to duly qualified personnel.
- Due to the possibility of opening safety valves and the accompanying noise, it is recommended to install the units away from busy crossings, e.g. streets.
- Unit is designed to work in ambient temperature ranging from -20°C to 43°C. Do not allow the unit to operate outside the permissible operating range.
- Choice of location for unit installation should be done regarding potential nuisance for outsiders.
- Maximum allowable tilt in both planes is equal to 10 mm/m.



- The unit should be placed away from heat sources.
- Limitation of excessive exposure to sunlight
  - Mounting the unit on the north or east side is recommended.
  - If it is not possible to mount the unit on the north or east side, it is recommended to install the unit under a roof.
  - Installation on large-area roof slopes, in particular those covered with materials that strongly absorb solar radiation (e.g. black felt) is not recommended.
- Slope of the roof has to ensure correct operation of the unit, especially during snowfall.

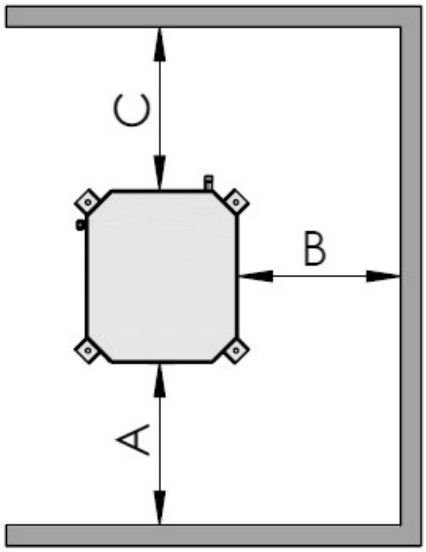


Incorrect placement in relation to the roof may result in the formation of snowdrifts near the unit



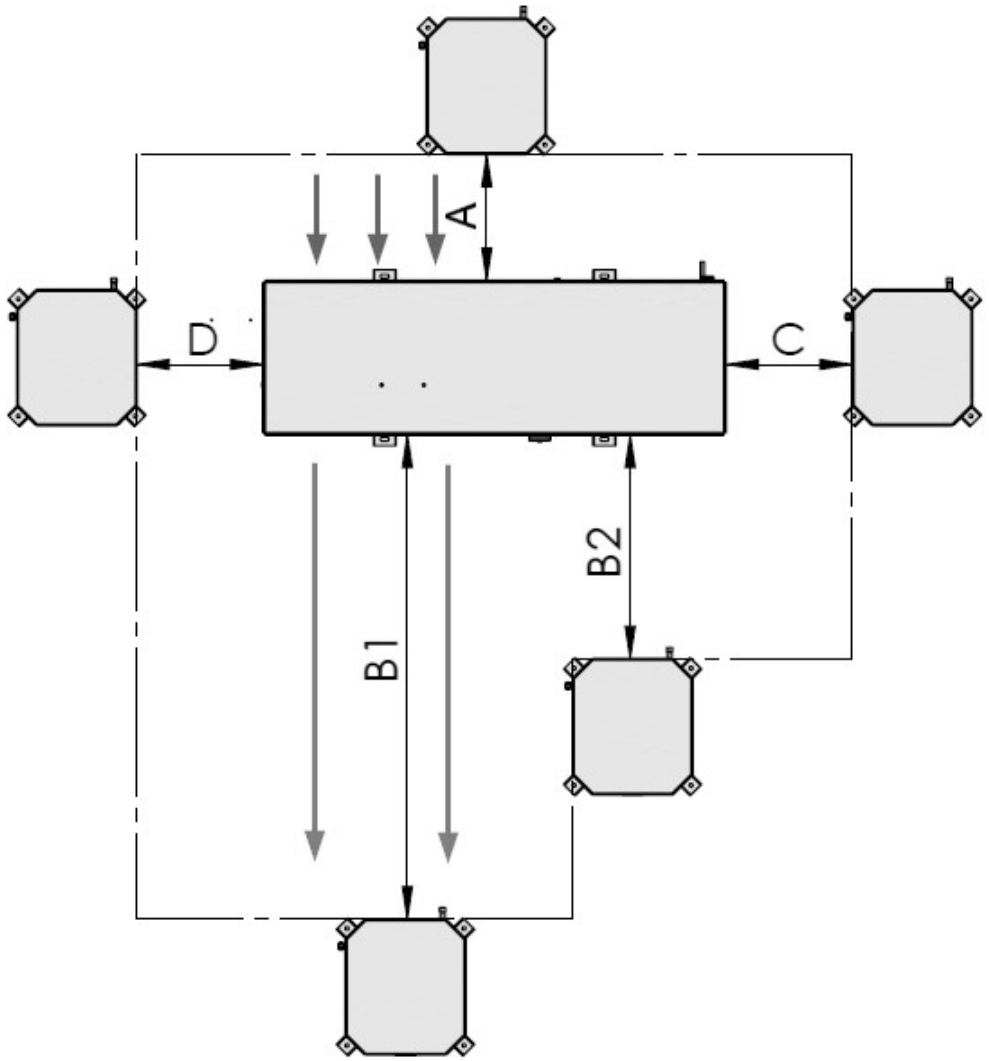
The roof protects the unit against the accumulation of snowdrifts

2.4. Required distances from walls or partitions



Dimension	Value
A	Min. 400 mm
B	Min. 400 mm
C	Min. 400 mm
Each time when determining the location of montage, the service space for the unit should be taken into account for the purpose of repair and inspection.	

2.5. Required distances from condensing unit

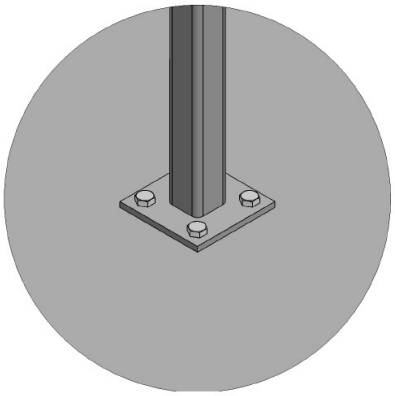


Dimension	Value
A	Min. 400 mm, Max. 3000 mm
B1	Min. 1500 mm, Max. 2000 mm
B2	Min. 400 mm, Max. 2000 mm
C	Min. 400 mm, Max. 3000 mm
D	Min. 400 mm, Max. 2000 mm
• Each time when determining the location of montage, the service space for the units should be taken into account for the purpose of repair and inspection. • The placing of the unit should not affect the air flow of the condensing unit • The maximum level difference between external receiver unit and condensing unit cannot exceed 0,1 m.	

2.6. Unit positioning

Aspects listed below must be considered regarding to unit placement:

- The unit must be place on stable surface.
- Each unit leg must be mounted rigid to the ground surface (without vibration isolators).
- In case of considerable tilt the unit must be installed on dedicated frame or support.
- In case of placement the unit on a frame, it is necessary to attach the frame to the stable surface and the unit to the frame.



- Fixing the unit to the stable surface is required.
- Unit could be installed in few combinations, including ground, roof and wall.

2.7. Unit support

Positioning of the unit with adequate frame design is recommended. If there is no such a possibility unit could be positioned with elements placed between unit and frame/support/ground. Positioning the unit with a threaded rod, nuts and washers are not recommended. While positioning support on the full surface, the rigid base leveling feet should be provided. M10 bolts are used to fix base leveling feet to the unit.



Figure 2.2 Example of rigid base level feet GN-23-80-M10-D0 from Elesa+Ganter

2.8. Pipelines arrangement

A. General requirements

- Before proceeding with pipeline assembly, take into account any design recommendations.
- It is recommended to wrap the pipelines only after performing a leak test of the plant.
- In the case of long pipelines, special attention should be paid to thermal expansion. The coefficient of thermal expansion for CuFe2P (K65) is 0.0176 mm/m K.
- Required distances between supports for pipelines depend on pipe size, according to the table below:

Outer pipe diameter (d)	Maximum distance between supports
d ≤ 1/2”	1 meter
1/2” < d ≤ 7/8”	2 meters

- When the evaporator is located higher than the condensing unit, about 0.5% slope of the suction line towards the unit is required.
- When the evaporator is located lower than the condensing unit, about 0.5% slope of suction line towards the unit and use of oil traps is required.
- Insulation of suction and liquid pipeline with proper pipe covering is required. Protection against external factors and weather conditions must be considered, including birds and UV protection.

B. Vibration absorbers

It is recommended to arrange connection pipe as below to reduce pipeline vibration (more information is available in dedicated manual of OCU condensing unit in chapter 12.2. *Basic service tools recommended*).

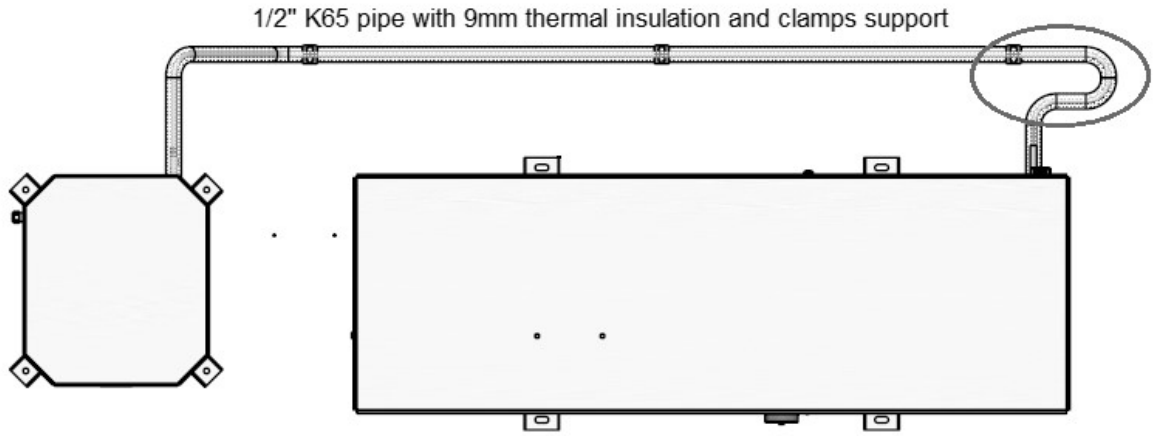


Figure 2.3 Vibration absorber on the pipeline

2.9. Pipelines

- All connectors and fittings should also be made out of CuFe2P.
- To connect individual components of the system, use adhesives recommended by manufacturers of installed components.
- The sections of the liquid line in which the liquid can be cut off should be protected against unplanned, excessive pressure increase (e.g. with a by-pass line or a safety valve).
- Evaporators and suction line fragments that can be cut off should be protected against unplanned, excessive pressure increase (e.g. with a by-pass line or a safety valve).
- In case of installation of additional valves (or other elements cutting off the flow of the medium) on the liquid line, it is necessary to install additional safety valves or bypasses protecting against pressure increase in the closed volume of the installation.
- Pipelines must be brazed with the nitrogen flow to avoid oxidation.

- The inlet connection of the external receiver unit has to be connected to the liquid outlet of the condensing unit.
- The outlet connection of the external receiver has to be connected to the liquid line leading to the evaporators.
- The installer should select a proper piping diameter to ensure both acceptable pressure drops and oil return. Wrong piping diameters can cause compressor damage.

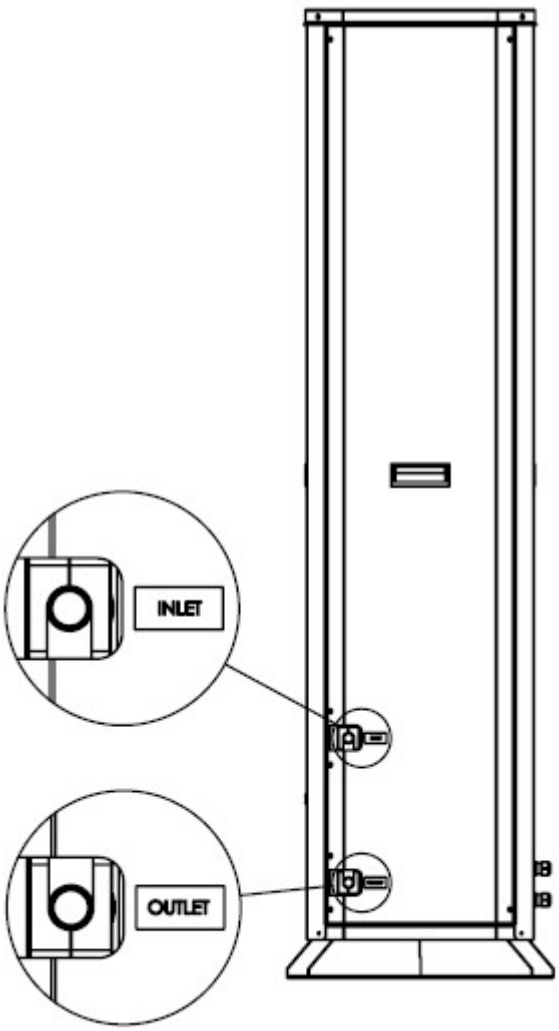


Figure 2.4 Location of inlet and outlet connections

3. Transport and storage



Warning: Danger of injury!



Block stacking is not allowed.



During transport and storage, unit should be transported exclusively on a palette.
Lifting by means of sling belts attached to palette is permissible.



Lifting and moving the unit should be performed using devices designed for this (forklift, crane, etc.). Machines used for lifting the unit must meet the requirements of Directive 2006/42/EC, have adequate load capacity and be approved for use.



Never go under a suspended unit.



Unless the unit is transported manually, maintain safe distance from the transported unit of at least 1.5 m.



Tilting the unit is not allowed. The unit must stand levelled.



Store the unit in shaded area in temperatures between -35°C and +50°C (without refrigerant).



The unit with package shall not be subjected to rain, corrosion environment or direct sunlight.



After unpacking, make a judgement whether the unit is undamaged and complete. Noticed discrepancies should be reported to supplier.



During transport and storage, the unit should be protected against humidity and dust (e.g. foil, carton).



Use of pipes, condenser collecting pipes or fittings to lift the unit is forbidden.

4. Assembly

4.1. Safety notes



Lift and move the unit using equipment designed for this purpose (forklift, crane, etc.).



The staff operating the hoisting equipment should have appropriate qualifications.



When moving the unit, the operator should use appropriate tools to protect the unit against shaking and damage.

4.2. Place of installation of the unit

Before installing the unit, read the information in chapter 2 Design recommendations
*variant (v.”-ECO”)

- Design recommendations
- After receiving the unit, check that:
  - It was not damaged during transport (each unit is packed),
  - There are no leaks in the unit (each unit is filled with dry nitrogen around at a pressure of approx. 10 bar),
  - The components of the unit have not been damaged,
  - The equipment matches the order.
- If the unit is installed in a seismic zone, the installer should follow all the required regulations.
- After installation, sufficient space should be left around the unit to allow performing maintenance works.

4.3. Location of service valve in the unit

The service valve is located inside the unit. It is protected by a brass nut protecting the process connection and a plastic cap that covers the Rotalock service key grip.

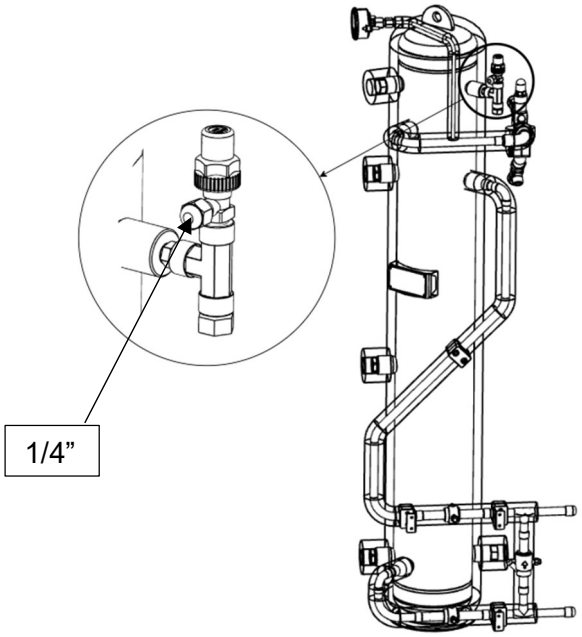


Figure 4.1 Location of service valve

5. The test of strength and leak-tightness

Before starting work, read the general safety notes.
After connecting the unit to the system, it is necessary to carry out a test of the strength of the system and then a leak test.

5.1. Safety notes



The personnel performing the strength test must have the appropriate permits and qualifications for conducting the test.



The personnel performing the strength test must be equipped with personal protective equipment, such as protective gloves, safety glasses, helmet, appropriate clothing, etc.



Do not use flammable, explosive, toxic or highly chemically active gases for the pressure test of the system (including oxygen — in contact with oil, the mixture may ignite or explode and cause injury or even death).



Use inert gases, such as dry nitrogen, for pressure testing.



The system must not be approached when the system pressure exceeds the maximum allowable system pressure (PS). Rupture of the system may cause injury.

5.2. Introductory information

- The delivered unit has passed the strength and leakage tests. There is no need to repeat the tests for the unit itself, provided there was no interference in the unit‘s cooling system.
- During the strength test, the safety valves on the receiver and on the suction line should be screwed out, and the stubs for their connection on the system should be plugged.
- After successful tests, the safety valves must be screwed into appropriate connections on the system.
- The strength and leak-tightness tests should be documented in the form of a test report. The report constitutes the annex.

5.3. Tools and materials needed

- A set of pressure hoses adapted to the pressures that will be applied during the test (at least 110 bar).
- A set of refrigeration pressure gauges adapted to the pressures that will be applied during the test (at least 110 bar).
- Cylinders with dry nitrogen (4.0) in an amount that allows obtaining the test pressure in the entire system.
- Key for Rotalock valves.
- Pressure regulator that allows to obtain pressure of at least 110 bar.
- Plugs in place of the installation of safety valves (1/2” NPT).

Detailed list of service tools needed for commissioning is available in chapter 12.2. *Basic service tools recommended.*

5.4. Strength test

Before commencing, read the safety notices and the introductory information.
The strength test involves exceeding, in a controlled manner, the maximum allowable pressure (PS) by 10%, in order to ensure that the system will not leak/rupture up to the safety valves set point.

- When performing the strength test, unscrew the safety valves located on the receiver of the unit and the suction part of the system and install NPT plugs.
- The personnel involved in conducting the strength test should be kept to a minimum. At least two people are needed to perform the test: One person is performing the test, and the other one is supervising.
- No unauthorized persons are allowed near the system during the strength test. If parts of the system are ruptured, there is a risk of injury.
- During the strength test, it is forbidden to stay near the test part of the system. If parts of the system are ruptured, there is a risk of injury.
- After safety valve replacement, fresh thread adhesive should be applied.

If a leak is found, lower the pressure by 10 bar, wait to ensure that there is no system degradation, and then locate the leak.

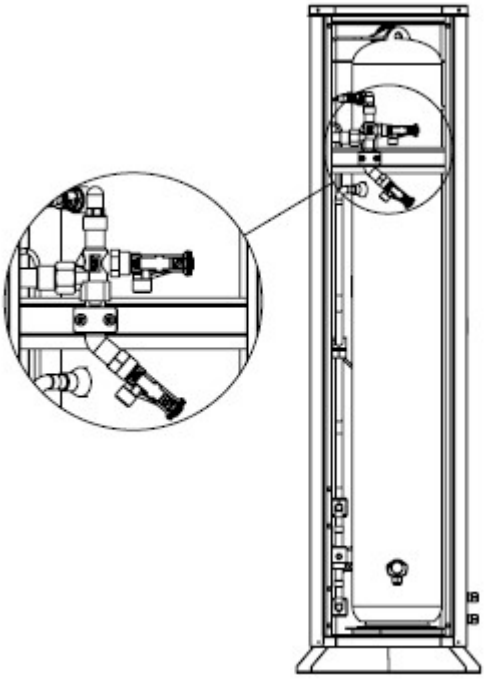


Figure 5.1 Location of safety valves

5.4.1 Achieving the strength test pressure

The final pressure of the strength test should be achieved gradually, with incrementation of the setting on the pressure reducer. Do not approach the unit without first reducing the pressure below the maximum allowable pressure (PS).
Before starting the test, check the following:

- Correct connection of test instruments.
- The nitrogen cylinder valve should be closed.
- The nitrogen reducer should be set to the minimum operating pressure.
- The valves of refrigeration gauges should be turned off.
- The active safety valve must be replaced with a cap (deactivated). The pressure over >PS would cause the valve to open. Please check 10.3 *Operating instruction for the three-way valve.*

Nitrogen should be released from the unit through the unconnected low pressure valve on the pressure gauges set.
In order to obtain the test pressure:

1. Check that inlet and outlet shut-off valves of the unit are closed.
2. Open the nitrogen cylinder valve.
3. Open the shut-off valve on the pressure reducer. The output pressure must not exceed 25 bar.

4. Open the high-pressure valve gradually on the set of refrigeration gauges. The system should start filling with nitrogen.
5. After equalizing the pressures, the unit can be filled to the maximum allowable pressure (PS) level. Do not exceed the maximum allowable pressure of the tested part of the system (PS). The recommended rate of pressure increase is approx. 5 bar/min.
6. It is recommended to stop filling the unit approximately every 20 bar, wait 2–3 minutes, and then inspect the unit for leaks and damage.
7. Check if there has been a pressure increase in the neighboring sections. If there is an increase in pressure, check the positions of the shut-off valves of the unit.
8. After reaching the maximum allowable pressure of a given section of the system (PS), it is possible to start filling the unit to the level of the strength test pressure (PT).
9. Open the high pressure valve minimally. The rate of pressure increase from the maximum allowable pressure (PS) to the test pressure (PT) should not exceed 1 bar/min.
10. After reaching the test pressure, close the valve on the reducer and the valve on the nitrogen cylinder. Leave the unit for 30 minutes.
11. After 30 minutes, gradually reduce the pressure in the unit to the maximum allowable pressure (PS).
12. Inspect all walls and connections.
13. The result of the test is considered positive if no cracks, permanent deformations, tears or leaks were found during the test.

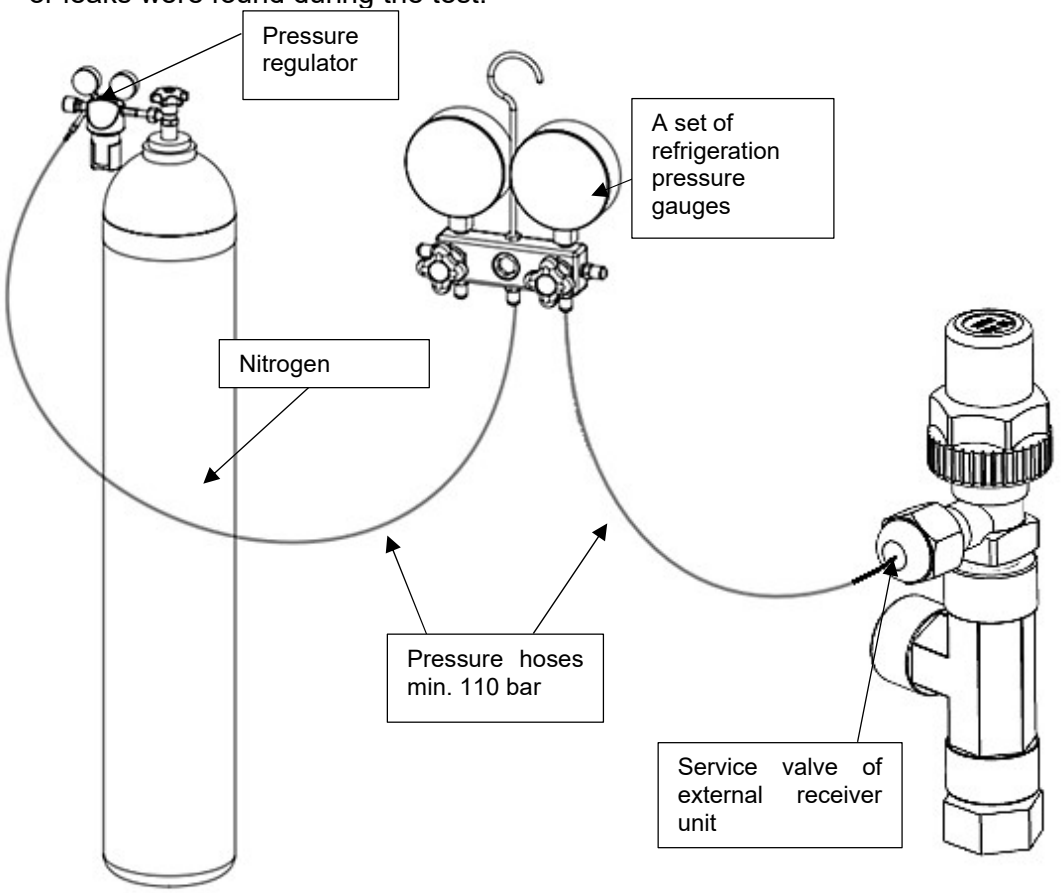


Figure 5.2 Connecting components for strength and leakage tests

5.5. Pressure drop caused by leaks or pressure equalization in the unit

During the strength and leakage tests, pressure drops can be observed, which may result from pressure equalization in the tested unit or leakage.
In the case of pressure equalization, the rate of pressure drop decreases over time until the pressure stabilizes. In the case of leaks, the rate of pressure drop remains at a similar level and the pressure does not stabilize.
Below is an example diagram showing the differences for both cases. The exact rate of change in pressure can vary depending on the size of the system, the size of the leak, the filling rate and other factors.

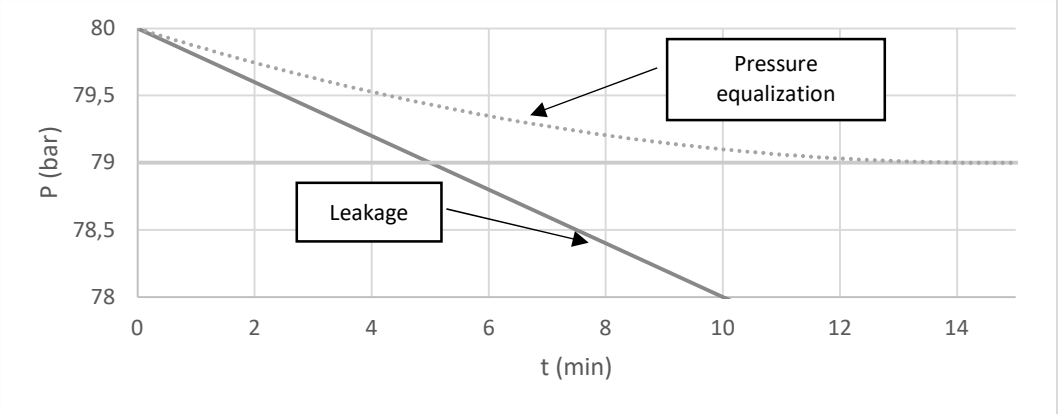


Diagram 1 – Example of pressure drop in case of leaks and pressure equalization (case of installation with PS=80bar for liquid line)

5.6. Leak-tightness test

The leak-tightness test should be conducted at the pressure inside the unit not greater than the maximum allowable system pressure (PS).
For refrigerants with GWP <150, leak-tightness means that there is no leakage detectable by a method that allows to obtain accuracy of 10^{-3} Pa m^3/s or better, e.g. applying water to the test surface with an admixture of a foaming agent or using a spray to detect leaks on the inspected surface.
Other methods of leak-tightness testing can be found in European standard EN 1779.
Lower pressures are allowed while maintaining the minimum required accuracy.
Each leak should be removed and the repaired section should be subjected to a new strength and leak-tightness test.

5.7. Completion of tests

After successful testing of strength and leak-tightness, the safety valves should be reinstalled on the system and a report on the performed tests should be prepared. After assembly of the safety valve, check the tightness of the connection, e.g. using water with a foaming agent or a special solution.
The system is ready for filling with the refrigerant.

6. Preparing for filling the external receiver

Before starting work, read the general safety notes.

In systems using carbon dioxide as a refrigerant, it is very important to remove any residual nitrogen, air and moisture form the system. In particular, it is important to thoroughly dry the system, because moisture in contact with carbon dioxide forms carbonic acid, which can lead to damage of the system.

6.1. Tools and materials needed

- Vacuum pump, allowing to obtain a vacuum of 0.02 mbar (~15 micron)
- Pressure hoses. In order to accelerate the preparation of the vacuum, it is recommended to use hoses with enlarged inside diameter (e.g. 3/8” SAE + Adapters 1/4” SAE > 3/8” SAE)
- Vacuum gauge with a sufficient degree of accuracy
- A set of refrigeration pressure gauges
- Key for Rotalock valves
- A set of flat keys
- A nitrogen cylinder with reducer
- Adapter for connecting pressure hoses to the nitrogen cylinder reducer
- Refrigerating scale with an accuracy of ± 0.01 kg

6.2. Recommended accuracy of the vacuum gauge

1. Analog vacuum gauge:

- Accuracy class: 1
- Minimum measuring range: 0–150 mbar
- Absolute error: 0.02 mbar

2. Digital vacuum gauge:

- Minimum measuring range is 0–50 mbar
- Accuracy ± 10 microns + 10% of the measured value in the range from 100 to 1000 microns
  (1 mbar ≈ 750 micron)

6.3. Connection of the set

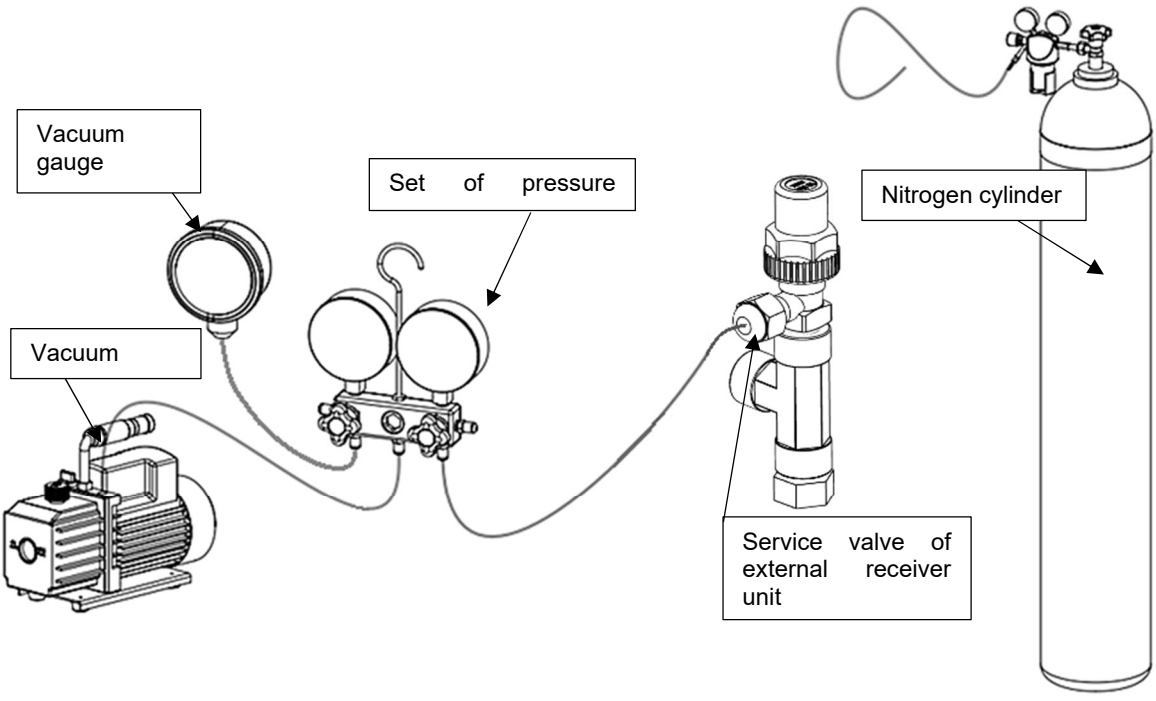


Figure 6.1 Connecting components for vacuum preparation

1. Close inlet and outlet shut-off valves of the unit.
2. Open the service valve in the unit to a small degree to ensure that there is no overpressure in the system (excessive opening may lead to oil loss). If necessary, keep the valves open until the system pressure equalizes to atmospheric pressure.
3. Close service valve on the unit.
4. Connect the vacuum pump to the middle connector of the pressure gauge set.
5. Using flexible hoses, connect the low pressure connector of the pressure gauge set with a vacuum gauge.
6. Using flexible hoses, connect the high pressure connector of the pressure gauge set with a service valve.
7. The set is ready to create a vacuum in the system.

6.4. Vacuum preparation

If there is a vacuum inside the system, do not perform any compressor motor insulation checks or start the compressor. It may cause damage.

The presence of moisture in the system may cause difficulties in obtaining the required vacuum level. In order to ensure thorough drying of the system, it is recommended to fill the system with dry nitrogen several times and drain the system. To do this, follow these instructions:

1. Open the service valve on the unit.
2. Open the valves of the pressure gauge set.
3. Start the vacuum pump. The system pressure should decrease.
4. When the pressure on the vacuum gauge reaches the desired value, close the service valve and high pressure connector of the pressure gauge set.
5. Disconnect the pressure gauge set from service valve.
6. Connect a hose from the nitrogen cylinder (from the reducer) to the now free service valve.
7. Open the valve on the nitrogen bottle and reducer.
8. Slightly loosen the nitrogen hose nut at the service valve in order to push the air remaining in the hose through the nitrogen.
9. Carefully tighten the nitrogen hose nut on the service valve.
10. Open the service valve. The system should start filling with nitrogen.
11. Fill the system to approx. 5 bar and then close the valve on the nitrogen bottle.
12. Close the service valve and disconnect the hose from the nitrogen bottle. Leave the unit for a few minutes.
13. Minimally open the service valve and empty the nitrogen from the unit.
14. When the system pressure is near atmospheric, close the service valve.
15. Reconnect the pressure gauge set and start the vacuum pump again.
16. Fully open the service valve.
17. Make sure that the external receiver pressure does not exceed the permissible overload pressure of the vacuum gauge and start draining the unit again.
18. Open high pressure connector of the pressure gauge set.
19. Repeat the procedure described in items 4–18 three times.
20. After three repetitions of steps 4–18, leave the vacuum pump turned on until a vacuum of **2 mbar (1500 micron)** is achieved.
21. After creating the vacuum, close all service valve, turn off the vacuum pump and leave the unit for about two hours.
22. Check that there is no moisture or leaks in the unit, as instructed in section 6.5. *Is there moisture in the unit?* .
23. If no moisture or leaks are found, the unit can be filled.

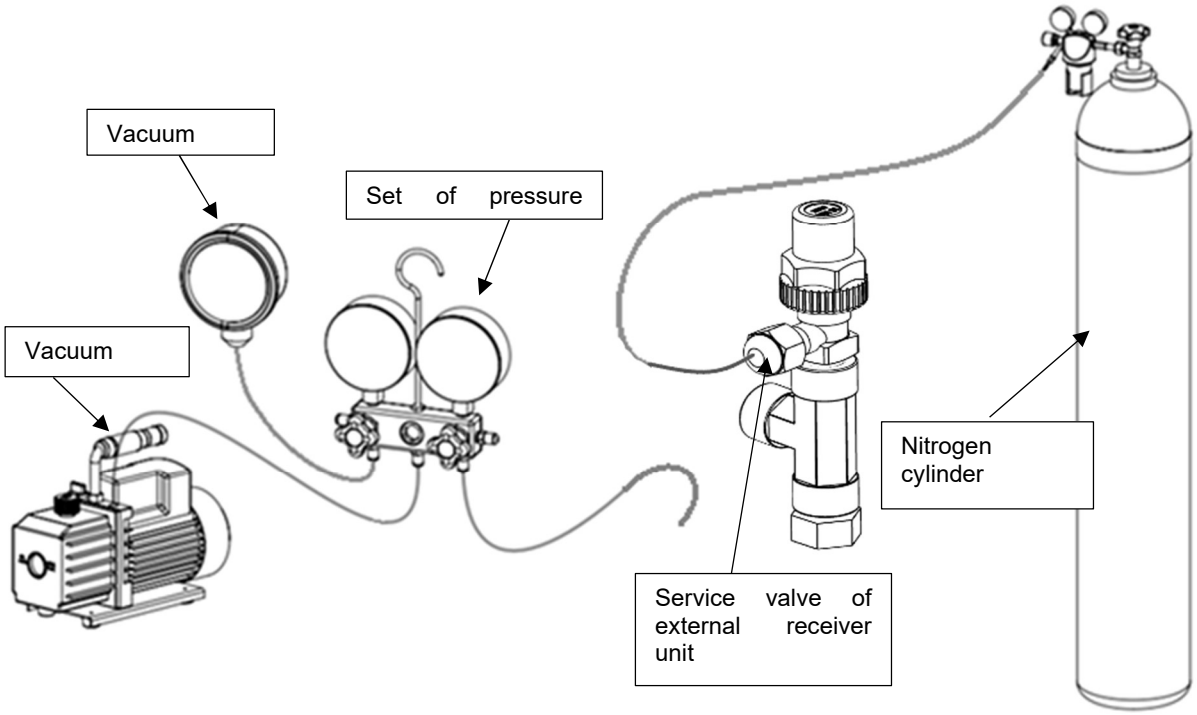


Figure 6.2 Connecting components for flushing system with dry nitrogen

6.5. Is there moisture in the unit?

Check the vacuum level about two or three hours after completing the system evacuation process. If there is an increase in pressure, it may indicate the presence of moisture or leakage in the system.

The presence of moisture in the unit can be determined by accurately measuring the vacuum pressure inside the unit. If there is moisture in the unit, after some time the pressure in the system will increase to the level of steam saturation pressure for a given ambient temperature, e.g.:

- If the ambient temperature of the system is 20 °C and there is moisture in the unit, the pressure in the unit will increase to about 23.4 mbar
- If the ambient temperature of the unit is 40 °C and there is moisture in the unit, the pressure in the unit will increase to about 73.8 mbar

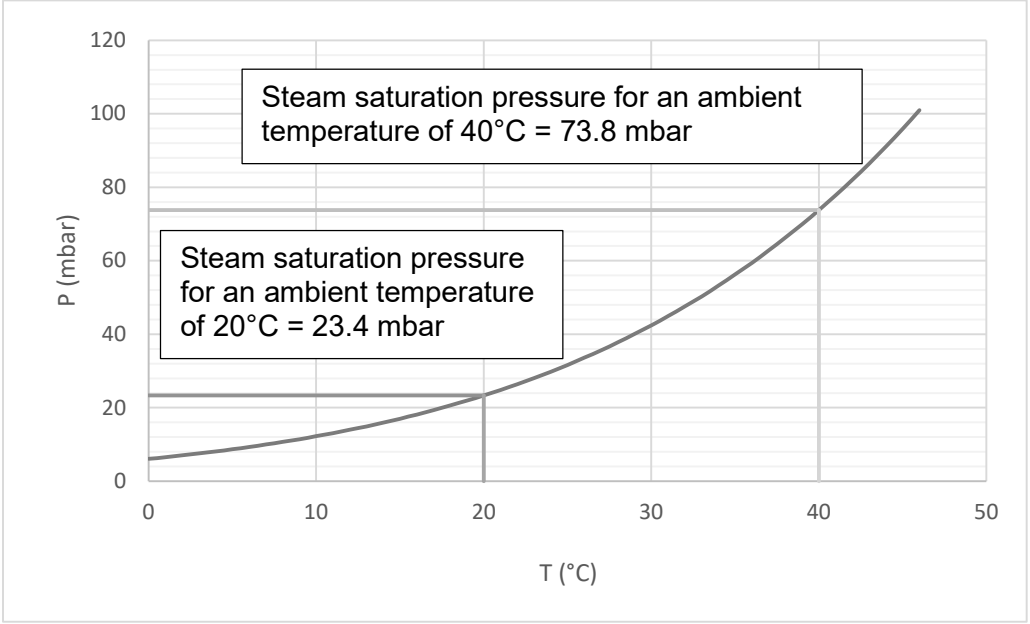


Diagram 2 – Steam vapor saturation pressure depending on temperature

If, however, there is a leak in the unit, the pressure inside the system will continue to increase until it equalizes with atmospheric pressure.
Example: steam saturation pressure at an ambient temperature of 20°C is 23.4 mbar. If at an ambient temperature of 20°C, after creating the vacuum and waiting for two or three hours, the unit pressure is:

- Greater than 23.4 mbar, then there is leak in the unit.
- Equal or lower than 23.4 mbar, the unit is hermetic, but there is moisture in it.
- Less or equal to 2 mbar, the unit is tight and free of moisture.

Below is an example of a pressure increase in time in the case of leakage and in the case of the presence of moisture in the unit (the times shown in the graph are approximate and largely depend on the size of the unit).

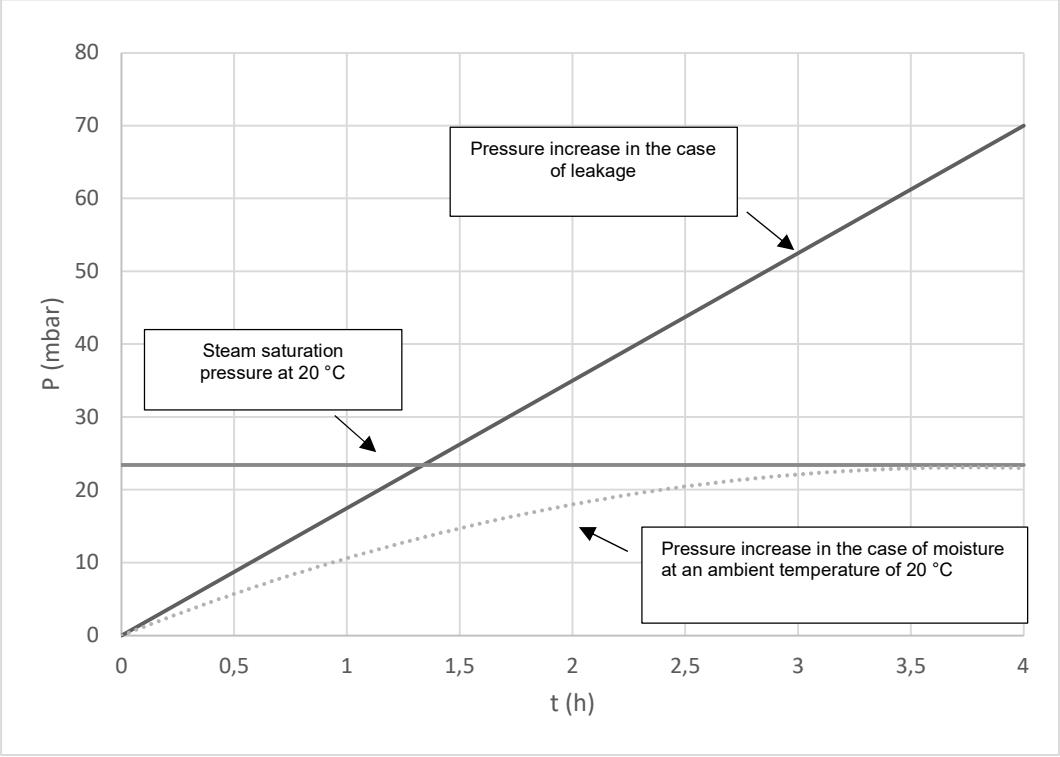


Diagram 3 – Example increase in vacuum pressure if there is moisture or leakage in the system at an ambient temperature of 20°C

7. Filling the external receiver

7.1. Safety notes

The personnel filling the unit must be equipped with personal protection equipment, such as protective gloves, safety glasses, helmet, appropriate clothing, etc.

The personnel filling of the unit should have appropriate qualifications for the operation of systems using supercritical carbon dioxide as a refrigerant.

Never use burners to heat the cylinder.



During filling operations cylinders should be secured against tipping and equipped with a collar.



Cylinders must not be placed near heat sources.

7.2. Required tools

- Cylinder containing carbon dioxide with a purity class of at least 4.5, with a valve in the gas section or a double valve for the gas and liquid section.
- Optionally, additional cylinder containing carbon dioxide with a purity class of at least 4.5, equipped with a valve in the liquid section.
- A set of refrigeration pressure gauges adapted to work with supercritical carbon dioxide (upper range of a high pressure gauge must be at least 160 bar).
- A set of flexible hoses for connecting refrigeration pressure gauges to the unit, suitable for operation with supercritical carbon dioxide (maximum allowable pressure at least 160 bar)
- Key for Rotalock valves
- Flexible hose for connecting refrigeration pressure gauges with a cylinder or cylinder adapter.
- Refrigerating scale with an accuracy of ± 0.01 kg.

7.3. Before filling

In the case of systems using carbon dioxide as a refrigerant it is very important to accurately determine the correct amount of refrigerant to be used for filling. It is not recommended to fill the system more than it is required. In order to determine the correct charge of the system please refer to the chapter 7.4 *Maximum amount of R744 charge*.
When filling the system, carefully control the amount of refrigerant fed to the system using scales. Do not allow the system to overflow.

7.4. Maximum amount of R744 charge

For precise value of maximum amount of charge of the installation please use “R744 PANASONIC system charge calculator”. For more demanding installations than permissible please contact the technical department of PANASONIC COLD CHAIN POLAND Sp. z o.o..



An overloaded or underloaded refrigerant circuit may malfunction and consequently damage the unit. Do not exceed the value given by the calculator. Always use the latest version of the calculator provided by the manufacturer

7.5. Preparation of the system filling set

When connecting the service valve, ensure they remain closed at all times. It is very important to remove residual atmospheric air from all hoses and pressure gauge sets before filling the system. As carbon dioxide hoses usually do not have shut-off valves, the following steps are recommended.

7.5.1 Pre-filling

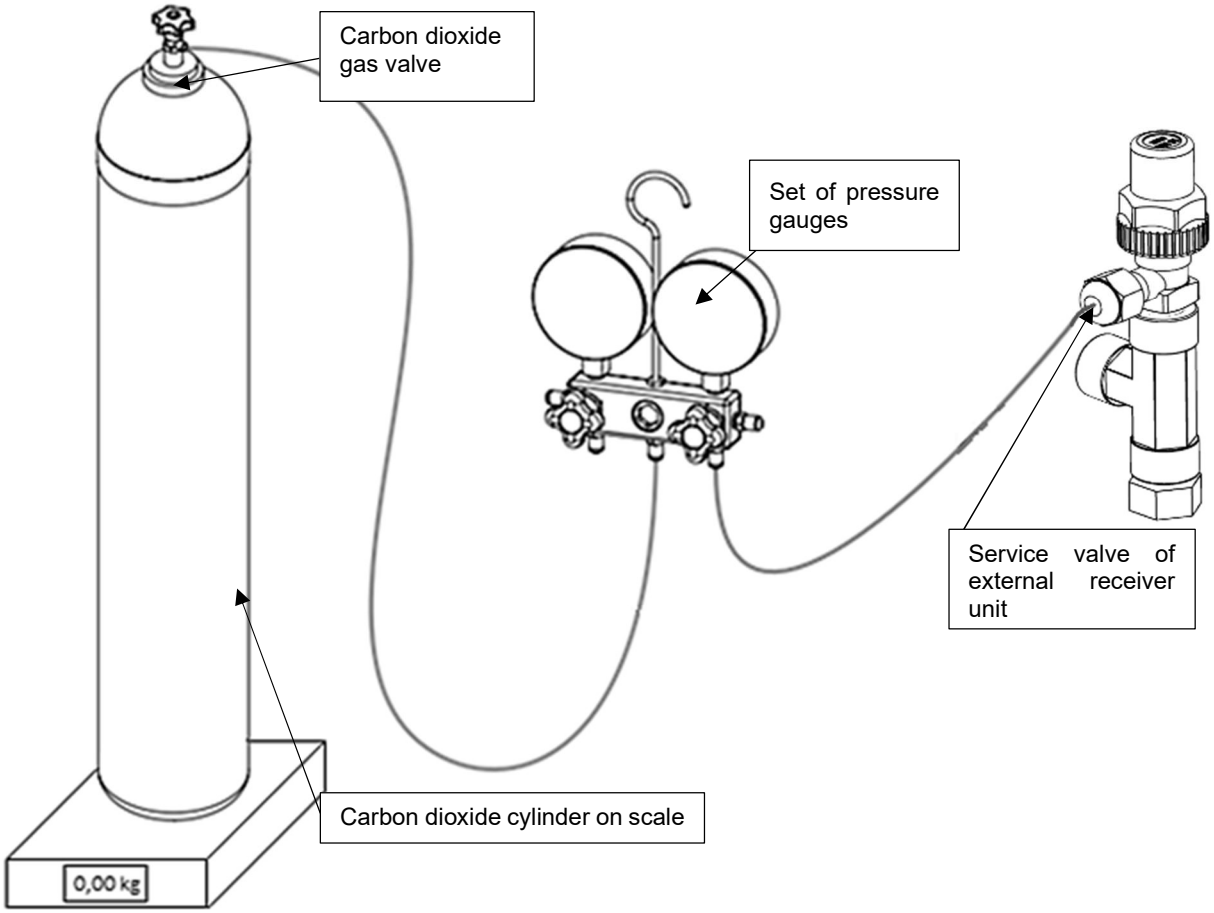


Figure 7.1 Connecting components for gas filling

1. The cylinder should be connected to the middle connector of the pressure gauge set, with a hose of adequate strength (e.g. 200 bar).
2. Using flexible hoses, connect the high pressure connector of the pressure gauge set with a service valve. Tighten the hose nut at the service valve by hand, leaving a small leakage.
3. Ensure that the valves on the low pressure side and the high pressure side of the pressure gauge set are closed.
4. Minimally open the gas valve on the carbon dioxide cylinder.
5. Open the valve of the high pressure section of the pressure gauge set. Gas should start to escape at the service valve of the unit. Carbon dioxide from the pressurized cylinder pushes out the remaining air from the pressure hoses. If the flow is insufficient, the pressure hose nut can be further loosened to release the air out of the hoses more quickly.
6. After a few seconds of flushing, only carbon dioxide should remain in the hoses. Fully tighten the pressure hose nut on the service valve.
7. Close the valve on the high pressure section of the pressure gauge set.
8. The unit is ready for pre-filling.

7.5.2 Filling with liquid

Filling with liquid can only be done after pre-filling (with gas) to 10 bar.
In order to improve the liquid filling process, it is recommended not to connect a set of pressure gauges; instead connect the cylinder directly to the unit.

1. The cylinder should be connected with flexible hoses with a service valve in the unit. The flexible hose must be adapted to the pressure prevailing in the cylinder and the unit. Tighten the hose nut on the valve on the cylinder by hand, leaving a small leakage. Fully tighten the nut at the service valve.

2. Open the service valve on the unit. Gas should start to escape from the valve on the cylinder. Carbon dioxide from the unit under pressure pushes residual air from pressure hoses. If the flow is insufficient, the pressure hose nut can be further loosened to release the air out of the hoses more quickly.
3. After a few seconds of flushing, only carbon dioxide should remain in the hoses. Fully tighten the pressure hose nut on the cylinder.
4. Close the service valve.
5. The unit is ready for filling with liquid.

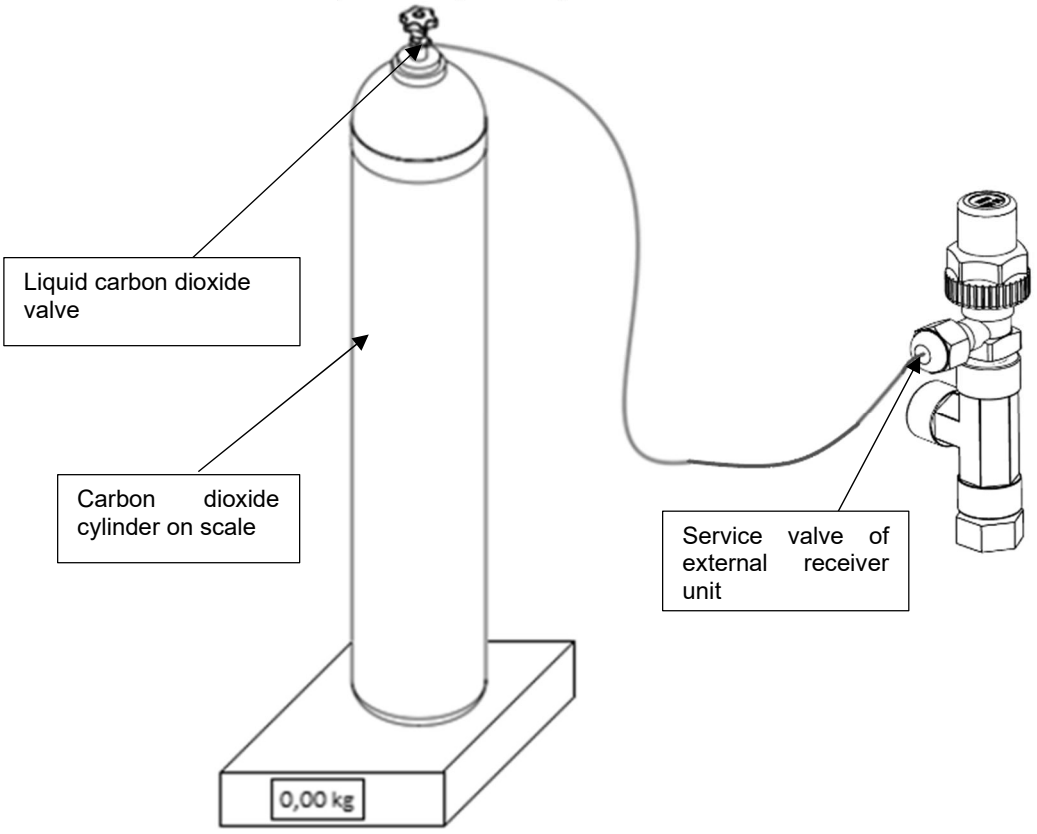


Figure 7.2 Connecting components for filling with liquid

7.6. Filling

Every time before servicing, make sure that the service hoses do not contain any residual air. For this purpose, refer to procedures Pre-filling or Filling with liquid (depending on the filling stage).

If there is a vacuum in the system, pre-filling must be done first.

When filling the system, monitor the amount of refrigerant fed to the system. Do not allow the system to overload – it may cause the compressor loud operation, problems with pump-down, incorrect suction superheat and in consequence leaks or compressor damage.

7.6.1 Pre-filling

If all steps from chapter *5. The test of strength and leak-tightness*, *6. Preparing for filling* the external receiver and 7.5.1 *Pre-filling* have been completed, proceed to pre-fill the system.

Since in the pre-filling phase the pressure in the system is lower than the pressure of the triple carbon dioxide point, there is a risk of dry ice creation, which can lead to clogging of the flexible hoses or parts of the system. To avoid this, the system should be filled with carbon dioxide gas to a pressure of at least 10 bar.

1. Open the service valve. The gas in the hose between the service valve and the set of refrigeration pressure gauges will flow into the system.
2. Slowly open valve of the high pressure section of the pressure gauge set. The gas from the cylinder will flow into the system.
3. Continue filling until 10 bar overpressure is achieved in both pressure gauges.

4. Close the valve of the high pressure section of the pressure gauge set.
5. Go to section *7.6.2 Filling with liquid*.

7.6.2 Filling with liquid



Take special care when filling the system with liquid carbon dioxide. Liquid must not be cut off in the filling hose. It may lead to excessive pressure increase and rupture of the cut-off section.



Special care should be taken when handling liquid refrigerant. Contact with a liquid refrigerant may cause frostbite.



It is forbidden to fill the suction part of the system with liquid.

Filling with the liquid fraction can only be done when the carbon dioxide in the system is at an overpressure of at least 10 bar.
Liquid filling may only be started after “flushing” the pressure hoses in accordance with procedure 7.5.2.
When filling with liquid, do not use pressure regulators.
During filling, the pressure in the receiver should be monitored and it should never exceed the permissible values.

1. Open the service valve on the unit.
2. Open the liquid fraction valve on the cylinder.
3. Liquid carbon dioxide should begin to flow into the receiver of the unit.
4. If the filling process has stopped (the cylinder's weight is not decreasing), it may mean that the pressure in the cylinder and in the unit is equal and that it will no longer be possible to fill the unit with liquid. In such case:
    a. Replace the cylinder with a new one. Remember to remove any residual air from the pressure hoses before resuming the filling.
    b. Heat the cylinder using the band heater installation, increasing the pressure in the cylinder.
5. Close the shut-off valve on the cylinder with the refrigerant, when it reaches the desired filling level.
6. Close the service valve on the unit and immediately loose the hose nut at the service valve to unseal and release the contained liquid carbon dioxide. Exercise caution when in contact with liquid carbon dioxide. It may cause frostbite.

8. Operation

8.1. Normal operation

During normal operation of the external receiver unit the inlet and outlet cut-off valves are open and the by-pass cut off valve has to be closed.

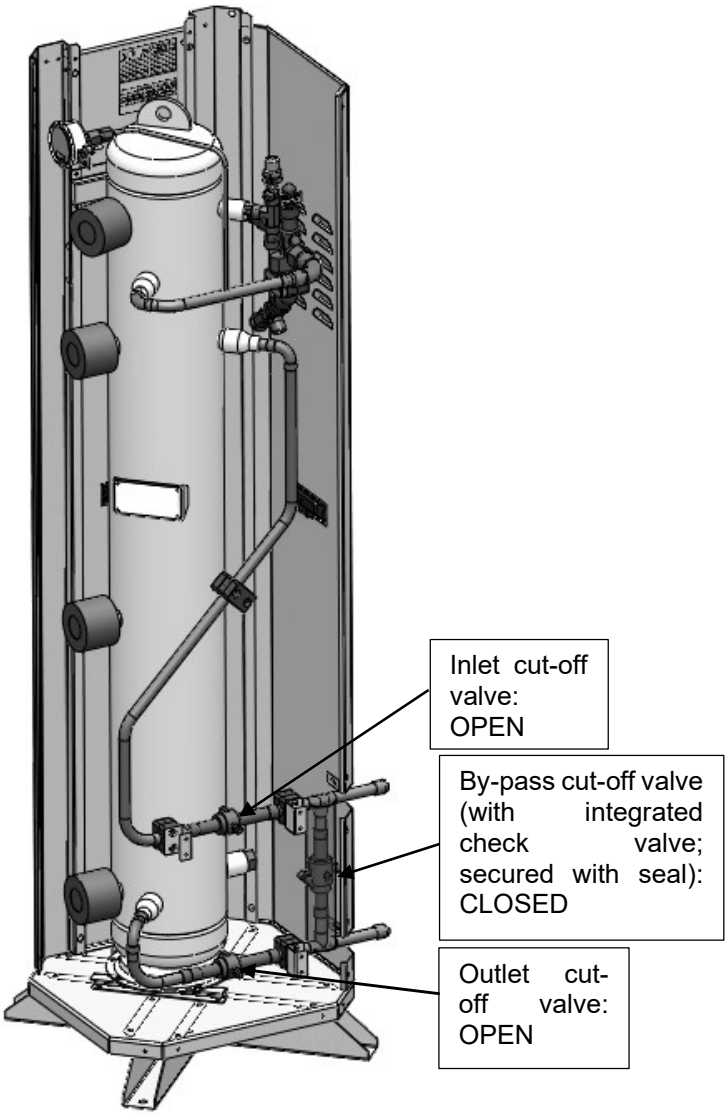


Figure 8.1 Shut-off valves opening status during normal operation

8.2. Emergency short-term operation

Due emergency situation when the external receiver unit has to be closed for maintenance but rest of the cooling installation and condensing unit still need to work, it is possible (for relatively short time) to work with the inlet and outlet cut-off valves closed (the by-pass cut off valve has to be open).

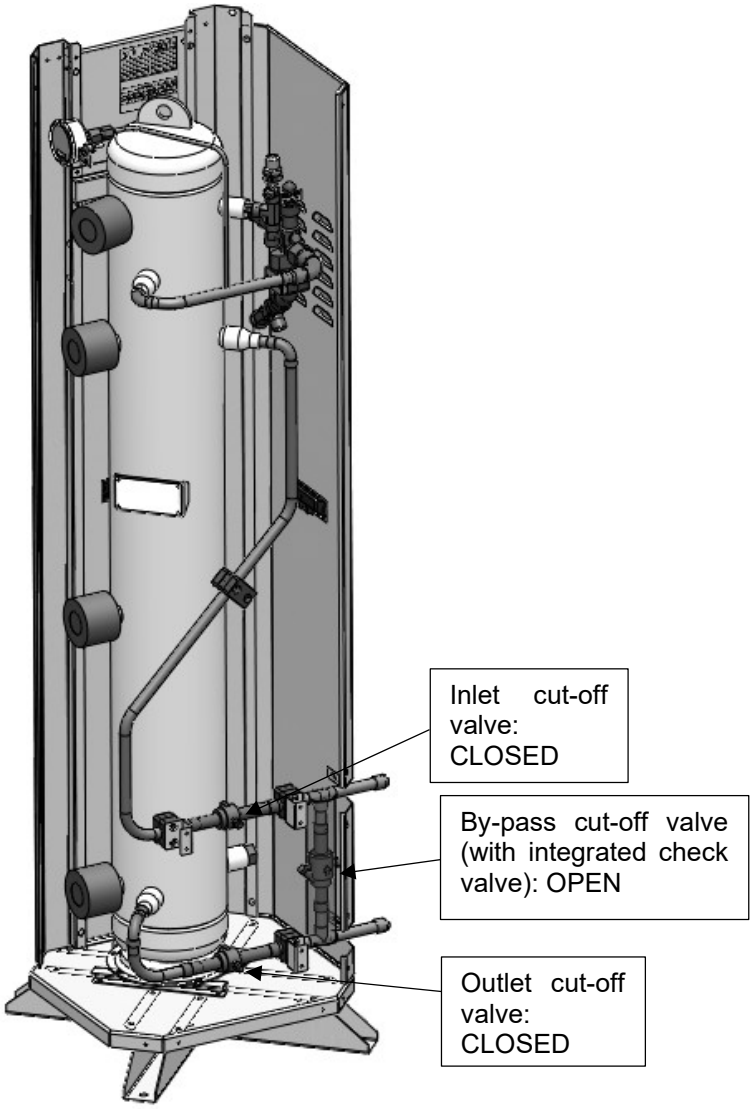


Figure 8.2 Shut-off valves opening status during emergency operation

In such a case, the amount of refrigerant in the installation may be too high, which may lead to low superheating, problems with pump down of compressor and flooding the compressor. Due to the cut off flow, pressure may increase in the module until the valve opens.

9. Service works

9.1. Planned shutdown of the refrigeration unit

In the case of a planned shutdown of the refrigeration unit, it is permissible to leave it idle under specific environmental conditions. Due to the risk of excessive pressure increase in the system, which may cause the safety valves to activate, the unit may be taken out of operation only if the ambient temperature does not exceed the limit value of 25°C. The device must be located in a properly ventilated area to ensure that, in the event of safety valve activation, the permissible concentration of carbon dioxide in the air is not exceeded.

For temporary shutdowns of up to 3 months, the following guidelines must be observed:

- Safety valves must be installed and operational.
- All ball valves must remain in the open position to allow pressure equalization within the system.
- The unit should be monitored for ambient temperature increases.
- If the permissible ambient temperature is exceeded, the unit must be started or measures must be taken to reduce the pressure.

If the planned shutdown period exceeds 3 months:

- The refrigerant must be drained according to the procedure described in Section 9.2.

9.2. Emptying the unit



Carbon dioxide is an asphyxiant gas. Gas may not be emptied in closed rooms. It may lead to suffocation.

Because carbon dioxide is a gas with little potential to create the greenhouse effect (compared to other refrigerants), it may be released into the atmosphere.
As a rule, no recovery of carbon dioxide from the system is required.
The system should be emptied through a service valve connected to the section in which gas carbon dioxide is present, which will prevent oil loss and blockage of the outlet with dry ice.
Start from discharging the refrigerant from the high and low pressure section to the level of the lowest maximum allowable pressure in the system. Slowly release the refrigerant through the DISCHARGE service valve. Do not allow excessive gas outflow due to the possibility of oil entrainment.
Then open all shut-off, control and expansion valves to ensure that the system is completely empty:

- Gas cooler pressure control valve (HPV)
- Receiver pressure control valve (RPV)
- ECO valve
- Expansion valves on evaporators
- Shut-off valves on evaporators (if exists)

When the system pressure drops to approx. 5 bar, dry ice will form from the liquid residue inside the system. Its residues can still evaporate for a relatively long time. In order to speed up this process, it is recommended to stop the emptying and fill the system to about 7–10 bar with dry nitrogen; this will cause the dry ice to slowly change back into liquid and accelerate its evaporation. After about fifteen minutes, the system can be fully emptied.
After emptying, close all open service valves. The system should not be left in a depressurized state. This may cause moisture to enter the system.

9.3. Disposal of refrigeration equipment and systems

Electrical and electronic devices, including refrigeration systems, must be disposed of in accordance with Directive 2012/19/EU (WEEE) and national environmental protection regulations.
The device and its packaging must not be discarded with household waste. Packaging should be sorted for recycling, and the device should be delivered to an authorized e-waste collection point or returned to the retailer when purchasing a new device.



The crossed-out wheeled bin symbol indicates that the product is subject to selective waste collection. Proper disposal supports resource recovery and protects human health and the environment.



The device contains refrigerant under high pressure.



Do not dispose of the device with the refrigerant and oil inside**, as this may pose a risk of fire or explosion.

Incorrect disposal may result in legal penalties in accordance with applicable legislation.

9.4. Replacing the safety valve on the liquid receiver

Replacing the safety valve on the receiver does not require releasing the refrigerant from the system due to the use of a three-way changeover valve. The three-way valve operating instructions are provided in the annex: 10.3 *Operating instruction for the three-way valve*.
The safety valve on the receiver can only be replaced with a different valve with the same setting.

9.5. Pressure transducer replacement

The unit can optionally be equipped with a pressure transducer. The transducer operate within a range of 0–160 bar (Ratiometric) and feature a 7/16-20 UNF-2B connection. If a pressure transducer needs to be replaced, the system overpressure must first be released.



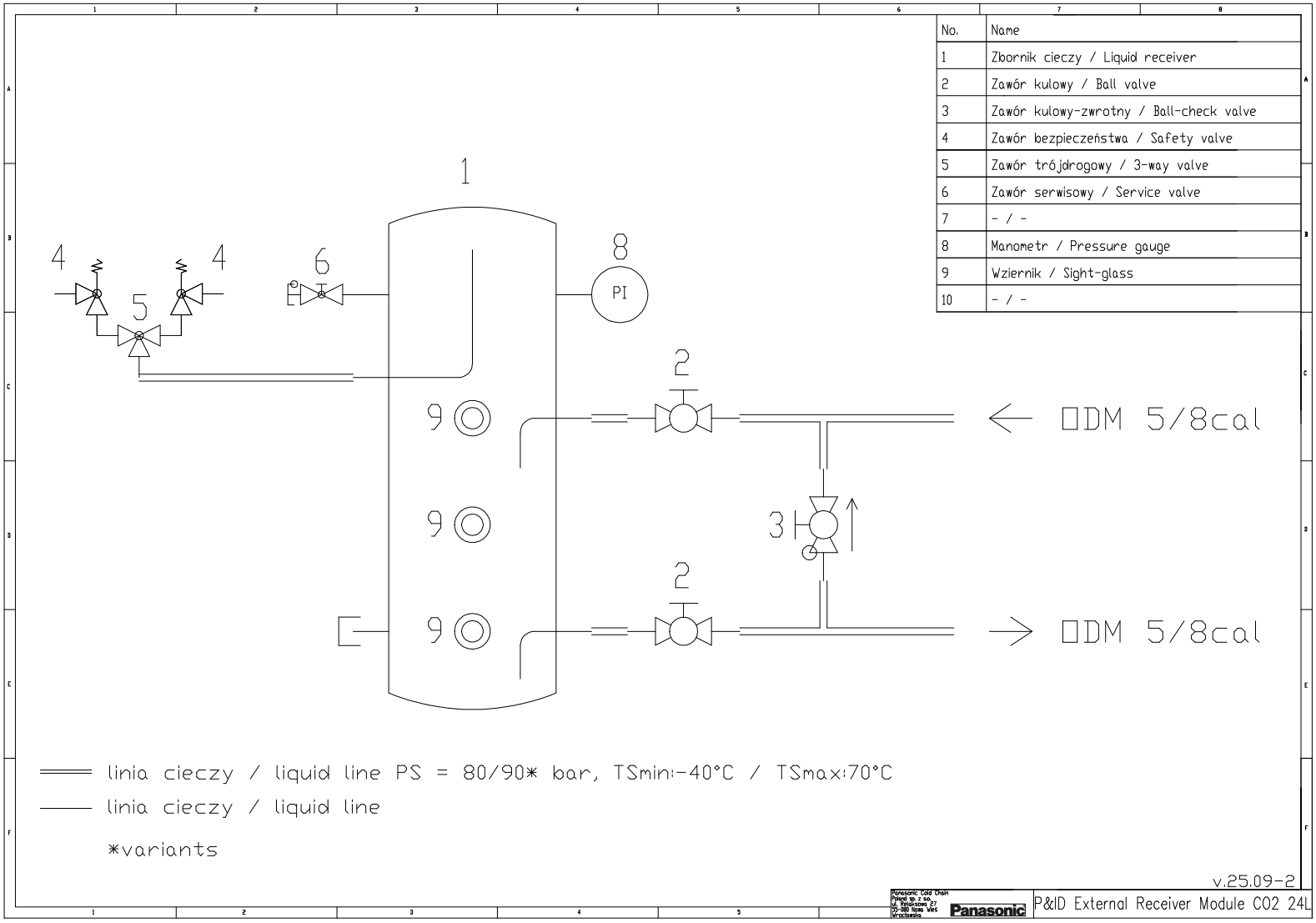
The pressure transducers are equipped with push pins. The transducer mounted on the liquid receiver does not use a Schrader valve due to the design of the intermediate adapter. It is strictly forbidden to remove the transducer mounted on the receiver while the system is under overpressure.

9.6. Warranty

Details of the warranty provided for the purchased refrigerating units are described in the warranty terms on the warranty card and in the general terms of sale.

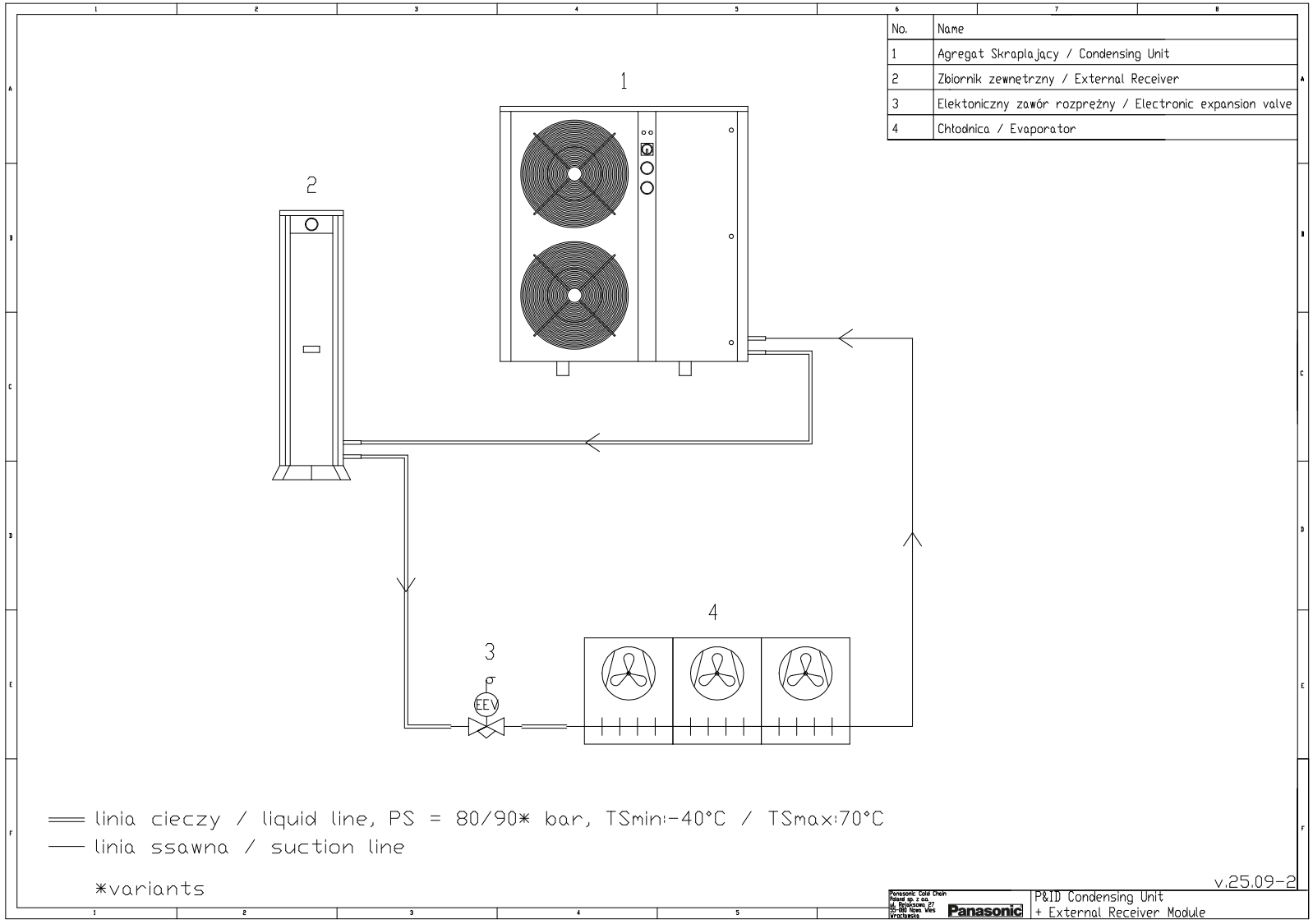
10. Annexes

10.1. Cooling diagram of 24L external receiver unit



No.	Name
1	Zbornik cieczy / Liquid receiver
2	Zawór kulowy / Ball valve
3	Zawór kulowy-zwrotny / Ball-check valve
4	Zawór bezpieczeństwa / Safety valve
5	Zawór trójdrogowy / 3-way valve
6	Zawór serwisowy / Service valve
7	- / -
8	Manometr / Pressure gauge
9	Wziernik / Sight-glass
10	- / -

10.2. Basic cooling diagram of OCU CO2 cooling system with external receiver unit



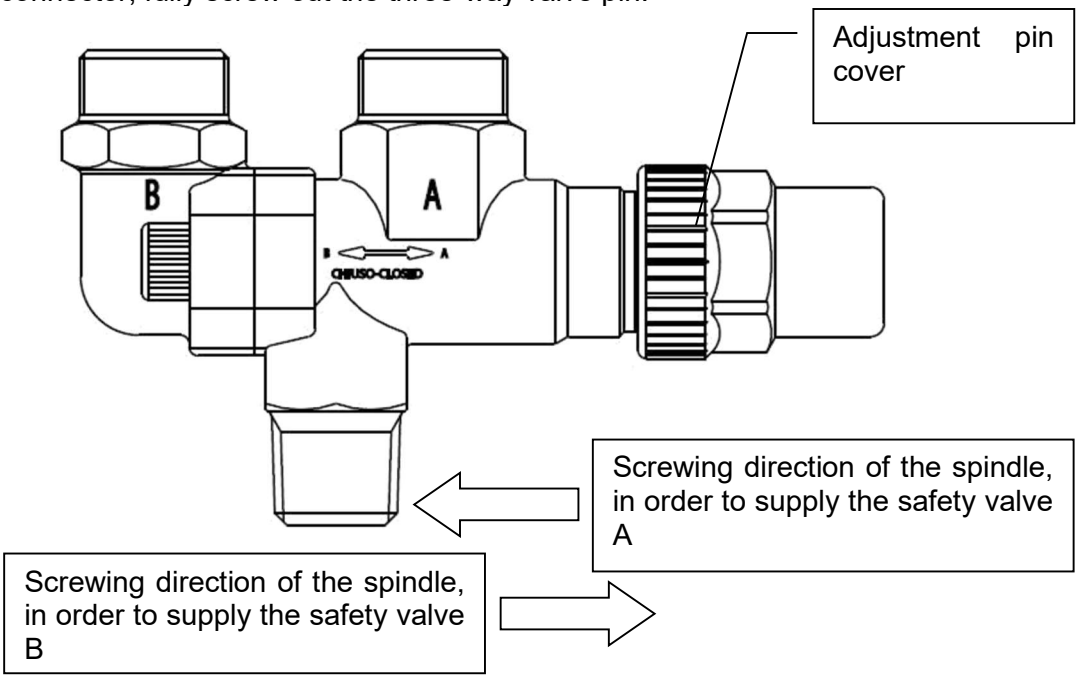
10.3. Operating instruction for the three-way valve

The three-way valve allows the replacement of the safety valve without emptying the pressure receiver.

Before proceeding with the valve power switching procedure, the protective cover of the adjustment pin must be removed.

In order to set the opening of the three-way valve in the direction of the safety valve screwed into the A connector, fully screw in the three-way valve pin.

In order to set the opening of the three-way valve in the direction of the safety valve screwed into the B connector, fully screw out the three-way valve pin.



11. Unit sensors

11.1. Pressure transducer (option)

It is recommend to connect the pressure transducer of the external receiver unit to the main electronic controller (Reftronix) of the condensing unit. It is possible via signal wire (standard attached to unit) to normally not used analog 5 V DC input J4. This feature allows to monitor the pressure in the external receiver thanks to standard software.

More specific information about Reftronix controller is available in dedicated manual of OCU condensing unit in chapter 11. *Reftronix controller operation.*

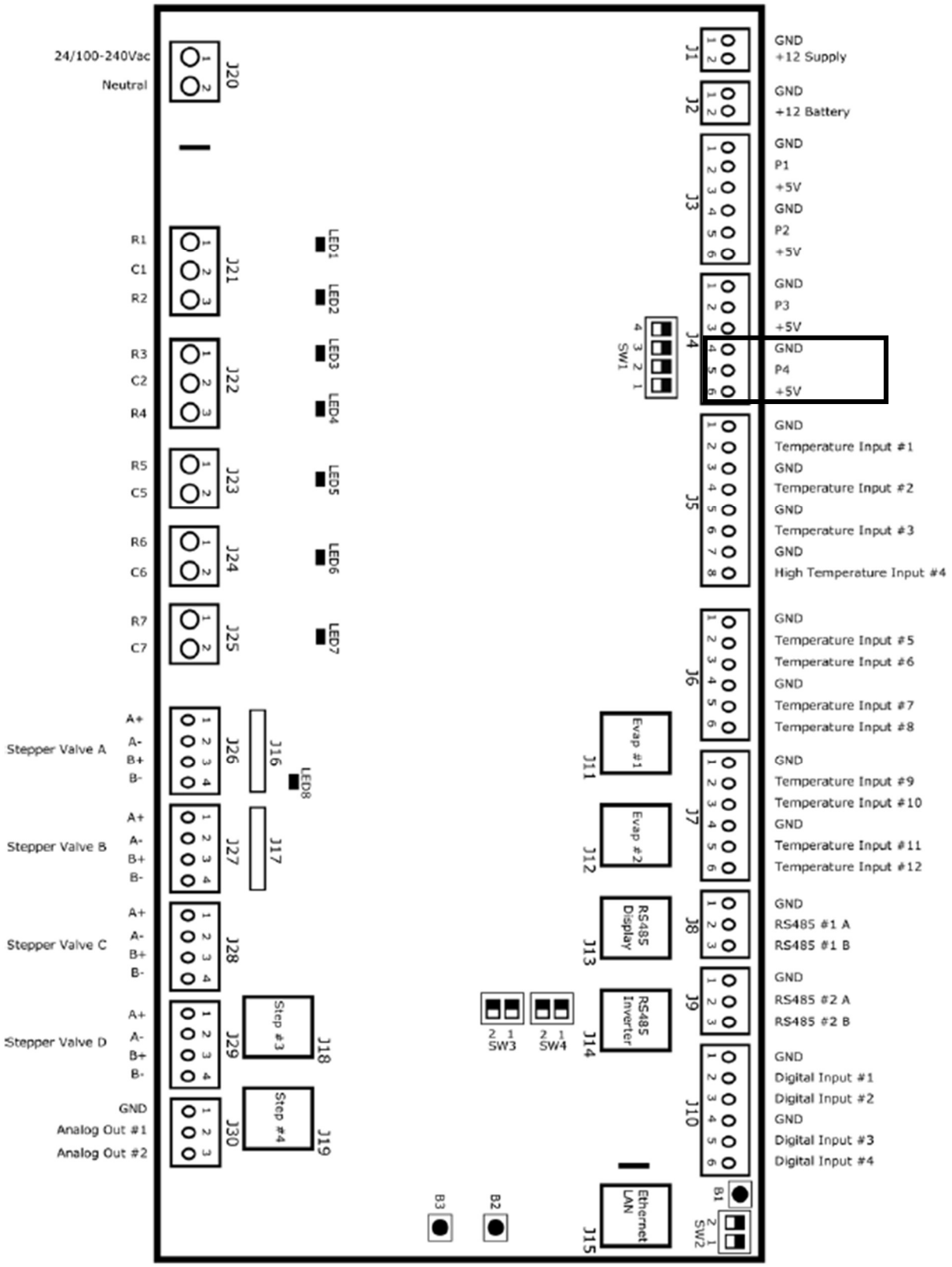


Figure 11.1 Diagram of the Reftronix controller connections

11.2. Liquid level sensor (option)

It is not possible to connect the external receiver liquid level sensor to existing electrical mainframe of the standard condensing unit. For remote monitoring of the liquid level in external receiver unit it is necessary for the client to create additional control board (enable to work with 230 V AC 50/60 Hz signal) that consists of at least electric components showed on the diagram.

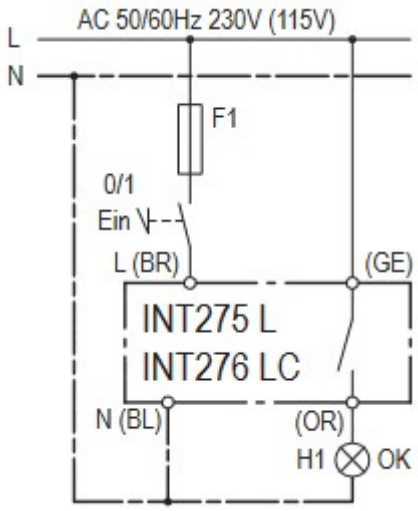


Diagram 11.1 Electrical diagram of liquid level sensor

12. Maintenance activities

To ensure efficient and reliable operation of the condensing unit during its lifetime and to avoid hazardous working conditions, please read carefully the hints contained in this chapter. Periodic maintenance, cleaning, and correct use are essential factors to guarantee the full efficiency and safety of the condensing unit. The maintenance interventions and the prescribed operations help prevent problems due to deterioration of the safety measures or resulting from unit downtime.

Periodic inspection of the cooling device and installation:

Maintenance activities description	
EVERY 6 MONTHS (must be performed by qualified technical personnel)	
REFRIGERANT SIDE	**ELECTRICAL SIDE**
Check the general external condition of the unit Make sure that the unit stands firmly and is properly supported. If the unit is crooked for any reason, turn it off, find and try to eliminate the cause, and then level the unit. **Visually assess the unit's surroundings** Check that there is nothing near the unit that could adversely affect its operation (unstable objects or equipment in the vicinity that could fall on the unit. If such items are present, secure or remove them.	**Check electrical cables status** Check the condition of the cables inside and outside of the unit (abrasion, burns, deterioration, etc.). Any damaged wire requires immediate replacement by the same type. Check the tightness of the cable glands. **Verification of pressure transducer** Check the correct readings of all pressure probe with the external manometers connected (probe readings can be checked in controller interface or through monitoring system – take care that readings in controller

Check tightness of soldered and screwed connections Using a foaming agent, thoroughly test all soldered and screwed connections for leaks. **Check the condition of piping insulation** Check the quality of foam insulation on cold sections. If any section of the insulation is damaged or has lost its insulating properties, it should be replaced. **Check the condition of the safety valves** Make sure that the safety valves still have their plastic caps. If they are not there, it means the pressure limit has been exceeded for some reason. Therefore, the oil and refrigerant charge level must be checked.	are bar absolute). If readings are incorrect – perform calibration or replace faulty transducer.

12.1. Commissioning check list on site.

Commissioning External Receiver Module unit on site

Date	

Serial number	Unit type	Reference
Name & surname of commissioning person		

A. Preliminary verification of unit and installation		
1. Unpacking the unit and visual inspection, verifying any damage during transport	OK	NG
2. Pressure reading on manometers (**approximately 10 bar** - the unit was filled with dry nitrogen)	OK	NG
3. Unit placement in accordance with the information provided in the manual	OK	NG
4. Connect the suction and liquid pipelines with the installation, open suction & liquid ball valves	OK	NG
5. Connect the power supply and Ethernet cable (if monitoring will be used)	OK	NG
6. Connect **permission to open evaporator expansion valves**	OK	NG
7. Put NPT plugs to active safety valves connectors (receiver, suction line)	OK	NG
8. Strength test (30 min.) of the suction line installation **PT = 1.1 · PS** (leave with **PS** for leak test)	OK	NG
9. Close the expansion valves on the evaporators and the shut-off valves on the suction line	OK	NG
10. Strength test (30 min.) of the liquid line **PT = 1.1 · PS** (leave with **PS** for leak test)	OK	NG
11. Liquid and suction side leak test - recommended **12 hours without leakage**	OK	NG
B. Preparing the vacuum and filling with R744 refrigerant		
1. Release of nitrogen through the **DISCHARGE** valve (note: do not allow oil to be dragged)	OK	NG
2. Open all expansion valves and the suction line shut-off valve (point A.9.)	OK	NG
3. Remove the NPT plugs and install the safety valves on the receiver and suction line	OK	NG
4. Create a vacuum, add additional calculated portion of oil (if required) and flush the system with dry nitrogen **(at least once, approx. 2 bar)**	OK	NG
5. Create a vacuum **≤ 2.0 mbar**, verification of moisture content and leaks **(30 min)**	OK	NG
6. Preliminary charge with **gaseous R744** through the **RECEIVER** valve to **~10 bar** (use a scale)	OK	NG
7. Connect the plugs of the electronic expansion valves to the controller, **power on the unit or press RESET button (B2) on the controller(if it was already powered on),** set the **auto** mode	OK	NG
8. Final filling with liquid refrigerant through the **RECEIVER** service valve (may be skipped)	OK	NG
9. Set the **S1** switch to the **ON** position to start the unit	OK	NG
10. Final filling with **gaseous R744** (if point B.8. was skipped) through the **SUCTION** (use a scale)	OK	NG
C. Unit operation		
1. Configuration of final controller settings (T0 setpoint, pump down, defrost - if applicable)	OK	NG
2. Check that the **oil level** and flow through the oil line are correct	OK	NG
3. Verification of the expansion valve opening degree and superheat at the T0 setpoint **(8-12 K)**	OK	NG
4. Verification of **permission to open the expansion valves**	OK	NG
5. Check if **monitoring and its functions** (e.g. alarms, notifications) work properly	OK	NG

Comments

PS - pressure strength, bar **PT** - test pressure, bar **EEV** - electronic expansion valve	Signature

12.2. Basic service tools recommended

Service tools for External Receiver Module CO2

Refrigerant tools

Magnetic coil set for manual driving of EEV [EEVMAG0000]	OK	N
Solenoid value operating magnet Refco e.g. Refco SVOM-18	OK	N
Ratcheting Service Wrench	OK	N
Digital vacuum gauge e.g. Testo 552 with refrigerant hose 1/4' SAE (with ball valve)	OK	N
2-way aluminum manifold with gauges for CO2 with refrigerant hoses	OK	N
Plugs 1/2 NPT for pressure strength test + dedicated sealing	OK	N
Refrigeration scale	OK	N
Adapters between cylinders and refrigerant hoses	OK	N
Vacuum pump, allowing to obtain a vacuum of 0.02 mbar	OK	N

Fluids and standard tools

Additional required portion of oil PZ68s	OK	N
Digital multimeter	OK	N
Adjustable wrench 2pcs. or set of flat wrenches	OK	N
Set of screwdrivers	OK	N
Cylinder of R744 with class min. 4.5	OK	N
Cylinder of nitrogen 4.0 with reducer (min. 90bar)	OK	N
Service lamp	OK	N
Individual protection (gloves, goggles, earmuffs, helmet)	OK	N

Accessiories

Computer + long internet cable (RJ-45)	OK	N
Commissioning report [EN20.01]	OK	N
Commissioning check-list [ACS.CCL.20.01]	OK	N
Manual of unit	OK	N

Comments

12.3. Strength tests report

	……..	……	……	……/……/……r.
Stamp	Name	Surname	Signature	Date of tests report

CO2 INSTALLATION CONNECTED WITH EXTERNAL RECIVER MODULE AND OCU MAIN STRENGHT PRESSURE TEST REPORT

- Installation location:

  Address:

  ……..

- Investor:

  Address:

  ……..

- Unit and installation data

  Unit code: ……..

  Serial number: ……..

  Diameter of main liquid line: …… mm

  Diameter of main suction line: …… mm

  PS of liquid line section: …… bar

  PS of suction line section: …… bar

No.	Time	Ambient temperature, °C	P_{SUC}, bar	P_{LIQ}, bar	Comments
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					

12.4. Leak-tightness tests

	……..	……	……	……/……/……r.
Stamp	Name	Surname	Signature	Date of tests report

MAIN LEAK AND MOISTURE VERIFICATION BY VACUUM EXTERNAL RECIVER MODULE REPORT

- Installation location:

  Address:

  …….

- Investor:

  Address:

  …….

- Unit and installation data

  Unit code: ……..

  Serial number: ……..

  Diameter of main liquid line: …… mm

  Diameter of main suction line: …… mm

  PS of liquid line section: …… bar

  PS of suction line section: …… bar

No.	Time	Ambient temperature, °C	P_{SUC}, bar	P_{LIQ}, bar	Comments
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					

12.5. Inspections report

ORDERING PARTY: **CONTRACTOR:**

…..... ….....

…..... ….....

…..... ….....

…..... ….....

CO2 PLANT INSPECTION REPORT

NUMBER ….....

INSPECTION DATE		
UNIT DATA	**LOCATION**	
	UNIT TYPE	
	SERIAL NUMBER	
	TYPE OF REFRIGERANT	CO2
	AMOUNT OF REFRIGERANT	

PERFORMED OPERATIONS:

NO.	**DESCRIPTION OF OPERATION**	**PERFORMED**	
		YES	**NO**
1.	Checking the correct operation of the refrigeration system and measurement of operation parameters		
2.	System tightness test and filling		
3.	Operation check and testing of control and measurement automation systems and possible repairs		
4.	Checking the correctness of safety measures operation		
5.	Cleaning the unit		

USED MATERIALS:

…..

COMMENTS:

…..

TECHNICAL CONDITION EVALUATION:

UNIT WORKS / DOES NOT WORK* CORRECTLY

* delete as appropriate

ORDERING PARTY: **CONTRACTOR:**

…..... ….....

Adress

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55 – 080 Nowa Wieś Wrocławska

Poland

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