Application Guidelines

Copeland™ CO_2 Scroll Refrigeration Units

OME-16T
OMTE-37T to OMTE-64T

COPELAND

About these guidelines

The purpose of these application guidelines is to provide guidance in the application of Copeland™ CO_2 scroll refrigeration units for use with natural refrigerant CO_2 (R744). They are intended to answer the questions raised while designing, assembling and operating a system with these products.

Besides the support they provide, the instructions listed herein are also critical for the proper and safe functioning of the refrigeration unit. The performance and reliability of the product may be impacted if it is not used according to these guidelines or is misused.

These application guidelines cover stationary applications only.

1 Safety instructions

Copeland refrigeration units are manufactured according to the latest European safety standards. Particular emphasis has been placed on the user's safety.

The CO_2 scroll refrigeration units are intended for installation in machines and systems in accordance with the European Machinery Directive MD 2006/42/EC, Pressure Equipment Directive PED 2014/68/EU, Low Voltage Directive LVD 2014/35/EU and Electromagnetic Compatibility Directive EMC 2014/30/EU. They may be put to service only if they have been installed in these systems according to instructions and conform to the corresponding provisions of legislation. For relevant standards please refer to the Manufacturer's Declaration, available at www.copeland.com/en-gb.

These instructions should be retained throughout the lifetime of both the compressor and the refrigeration unit.

You are strongly advised to follow these safety instructions.

1.1 Icon explanation

	**WARNING** This icon indicates instructions to avoid personal injury and material damage.		**CAUTION** This icon indicates instructions to avoid property damage and possible personal injury.
	**High voltage** This icon indicates operations with a danger of electric shock.		**IMPORTANT** This icon indicates instructions to avoid malfunction of the compressor.
	**Danger of burning or frost burn** This icon indicates operations with a danger of burning or frost burn.	***NOTE***	This word indicates a recommendation for easier operation.
	**Explosion hazard** This icon indicates operations with a danger of explosion.		

1.2 Safety statements

- **Refrigerant compressors and refrigeration units must be employed only for their intended use. The system has to be labelled according to the applicable standards and legislation.**
- **Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission and maintain this equipment.**
- **Electrical connections must be made by qualified electrical personnel.**
- **All valid standards for connecting electrical and refrigeration equipment must be observed.**
- **The national legislation and regulations regarding personnel protection must be observed.**

Use personal safety equipment. Safety goggles, gloves, protective clothing, safety boots and hard hats should be worn where necessary.

1.3 General instructions

WARNING
Pressurized system! Serious personal injuries and/or system breakdown! Accidental system start before complete set-up must be avoided. Never leave the system unattended without locking it out electrically when it is on vacuum and has no refrigerant charge, when it has a holding charge, or when the compressor service valves are closed.
System breakdown! Personal injuries! Only CO_2 and approved refrigeration oils must be used.

WARNING
CO_2 refrigerant! Danger of suffocation! Never release significant volumes of CO_2 or the entire contents of the system into closed rooms. In case of closed room, if possible, keep the room well ventilated and/or install a CO_2 detection device. CO_2 is odourless and colourless, so it cannot be perceived directly in case of emission.

WARNING
Earth leakage current! Danger of electric shock! This product can cause both AC and DC earth leakage current. To protect against both kinds of leakage current it is recommended to use an AC/DC sensitive RCD **type B or B+** on the power supply side.

WARNING
High surface temperature! Burning! Do not touch the compressor or piping until they have cooled down. Ensure that other materials in the area of the compressor do not come into contact with it. Mark and secure accessible sections.

CAUTION
Overheating! Bearing damage! Do not operate compressors without refrigerant charge or without being connected to the system.

CAUTION
Contact with refrigerant oil! Material damage! PAG lubricant must be handled carefully and the proper protective equipment (gloves, eye protection, etc.) must be used at all times. PAG must not come into contact with any surface or material that it might damage, including without limitation, certain polymers, eg, PVC/CPVC and polycarbonate.

IMPORTANT
Transit damage! Compressor and/or unit malfunction! Use original packaging. Avoid collisions and tilting.

IMPORTANT
This appliance is not designed to be accessible to the general public according to IEC 60335-2-40.

The contractor is responsible for the installation of the unit and should check the following points:

- sufficient liquid sub-cooling in the line to the expansion valve(s) to avoid "flash-gas" in the liquid line;
- sufficient amount of oil in the compressor (in case of long piping additional oil must be charged);
- sufficient amount of oil in the oil separator (the oil level should never fall below the bottom sight glass of the oil separator).

2 Product description

2.1 General information about Copeland CO_2 scroll refrigeration units

Copeland has developed the Copeland CO_2 scroll refrigeration unit to meet primarily the demands of the food retail and food service sectors. It is an air-cooled refrigeration unit that uses the latest Copeland scroll transcritical compressors with inverter. All electronic protection and diagnostics features, as well as the controls for the refrigeration unit, are built in the chassis.

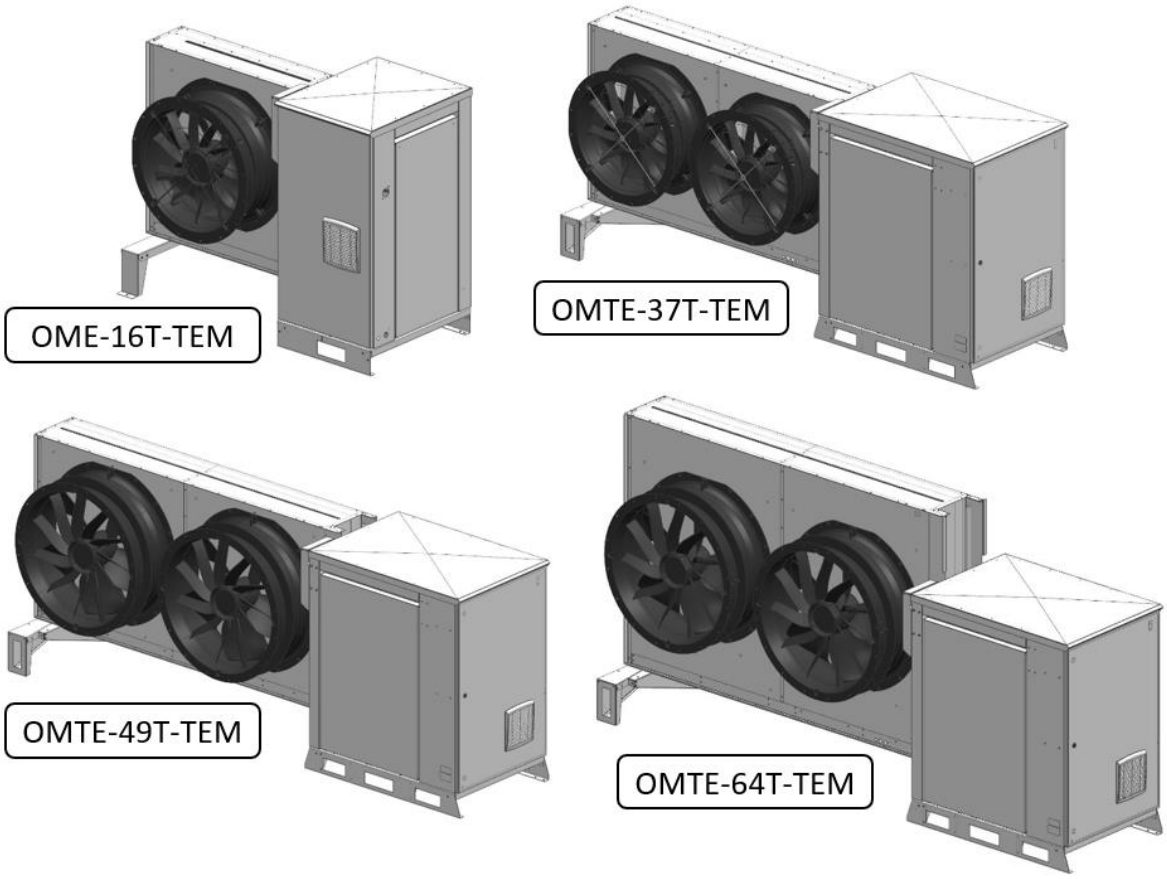

Figure 1: Copeland CO_2 scroll refrigeration units

2.2 EU Ecodesign Directive 2009/125/EC

The European Directive 2009/125/EC with regard to Ecodesign requirements for professional refrigerated storage cabinets, blast cabinets, condensing units and process chillers requires manufacturers to decrease the energy consumption of their products by establishing minimum energy efficiency standards. Copeland refrigeration units are prepared and optimized to meet the requirements of the Ecodesign Directive. The integrated variable speed fan and gas cooler reduce the noise level and energy consumption significantly. This, combined with Copeland CO_2 scroll compressor technology, allows for high-efficiency operation.

These guidelines meet the requirements of Regulation (EU) 2015/1095, Annex V, section 2(a), with regard to product information, namely:

- (v) ➔ See chapter 2.6 "Application range"
- (vi) ➔ See chapters 5.4 "Gas cooler fins" and 5.6 "Routine leak testing"
- (vii) ➔ See chapter 4.2 "Charging procedure"
- (viii) ➔ See chapter 7 "Dismantling & disposal"

The Ecodesign overview tables according to Annex V of Regulation 2015/1095 for all Copeland CO_2 scroll refrigeration units can be found in **Appendix 4.**

2.3 Main product features and dimensions

The refrigeration units covered in these guidelines are released for CO_2 (R744) refrigerant only. They are available in four different sizes and are equipped with one or two gas cooler fans.

The units are designed for medium temperature applications only. The inverter is calculated to drive the compressor in subcritical and transcritical applications.

Refrigeration unit	Refrigerant type	Cooling capacity* (kW)	Nominal power (kW)	Max. current (A)	PS high side (bar)	PS low side (bar)
OME-16T-TEM	R744	14.8	13.85	31	130	90
OMTE-37T-TEM		24.6	24.85	52		
OMTE-49T-TEM		33.5	36.7	73		
OMTE-64T-TEM		44.8	45.7	89.5		

** Cooling capacity declared at ambient temperature 32 °C, gas cooler outlet temperature 35 °C, evaporating temperature -10 °C, superheat 10 K and variable-speed compressor @ 5400 RPM*

Table 1: Copeland CO_2 scroll refrigeration unit technical data

Refrigeration unit	Outer dimensions length/width/height with closed e-box (mm)	Weight complete unit (kg)	Weight compressor compartment (kg)	Weight gas cooler including fans (kg)	Liquid receiver size (litres)
OME-16T-TEM	1851 / 827 / 1405	470	385	85	20
OMTE-37T-TEM	3130 / 827 / 1405	585	440	145	
OMTE-49T-TEM	3500 / 827 / 1410	700	500	200	2 x 20
OMTE-64T-TEM	3500 / 827 / 1770	750	515	235	

Table 2: Copeland CO_2 scroll refrigeration unit features

The figures hereafter show the overall physical dimensions of the Copeland CO_2 scroll refrigeration units in millimetres.

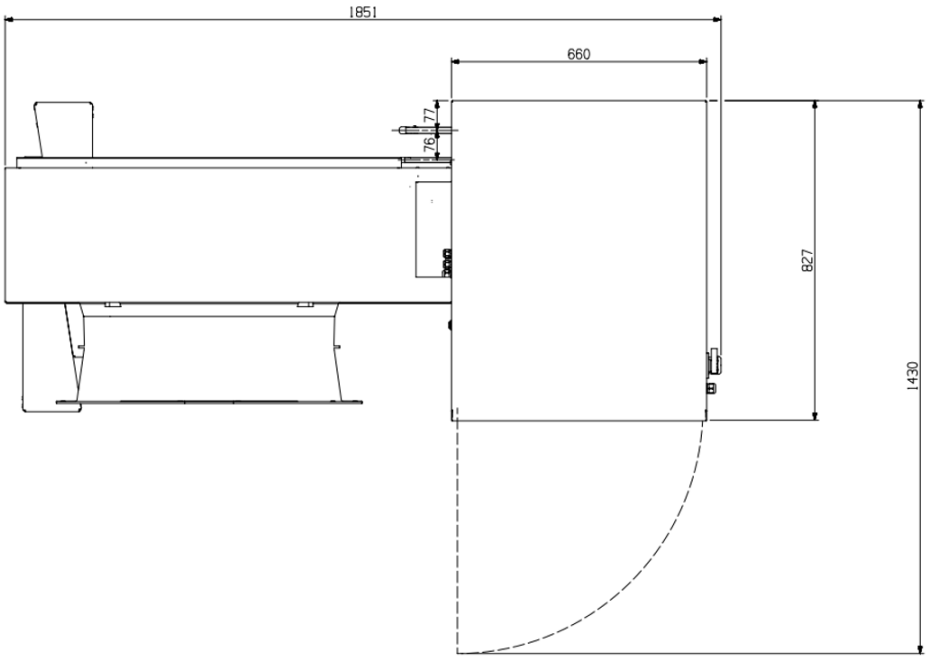

Figure 2: Dimensions of Copeland CO_2 scroll refrigeration unit (OME-16T) – Top view

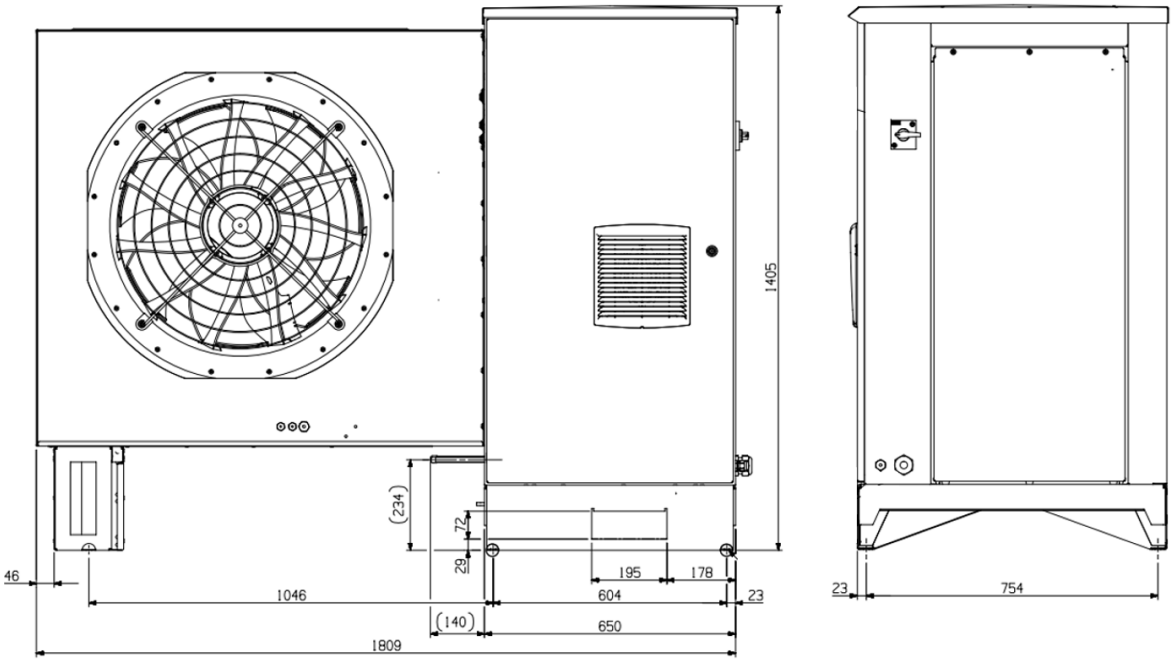

Figure 3: Dimensions of Copeland CO_2 scroll refrigeration unit (OME-16T) – Front view

2.4 Product nameplate

The refrigeration unit nameplate shows model designation and serial number, as well as rated current and safety pressures.

The compressor has its own nameplate with all electrical characteristics.

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MODEL	OME-16T-TEM
SERIAL NUMBER	23A304260 M
PRODUCTION DATE(YYYY-MM-DD)	2023-02-16
POWER SUPPLY	400/230V – 3 – 50 Hz
POWER SUPPLY CONTROLLER	
RATED UNIT CURRENT	31.0 A
REFRIGERANT	R744
REFRIGERANT CHARGE	
MAXIMUM PRESSURES	90.0 – 130.0 bar
IP RATED	IPX4
OIL	RFL 68 EP
HOLDING CHARGE (DRY AIR)	2 bar
WEIGHT	418 kg
WIRING DIAGRAM	052-3443-00
PRESSURE DIAGRAM (PID)	052-3549-00

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Figure 4: Nameplate of Copeland CO_2 scroll refrigeration units

2.5 Nomenclature

The model designation contains the following technical information about Copeland CO_2 scroll refrigeration units:

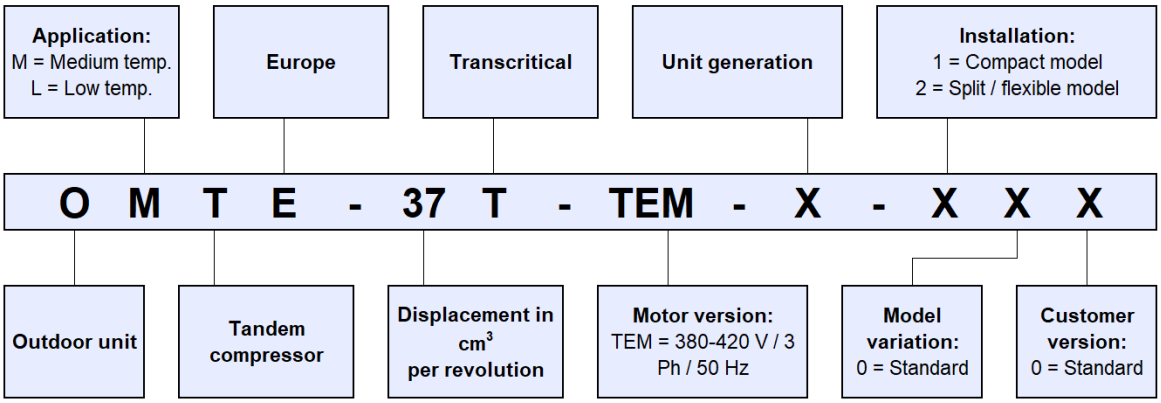


Figure 5: Nomenclature of Copeland CO2 scroll refrigeration units

2.6 Application range

2.6.1 Qualified refrigerant and oil

Qualified refrigerant	**R744 (CO_2)**			
Qualified servicing oil	PAG ZEROL RFL 68 EP			
Unit	**OME-16T-TEM**	**OMTE-37T-TEM**	**OMTE-49T-TEM**	**OMTE-64T-TEM**
Oil charge compressors (l)	1.2	2.4		
Pre-charge oil separator (l)	2.9		2.8	
Total oil charge (l)	4.1	5.3	5.2	

Table 3: Qualified refrigerant and oil

***NOTE:* Use only lubricants that are qualified for the product. The use of non-approved lubricants can damage the product and will result in loss of warranty!**

***NOTE:* The PAG oil is hygroscopic. Never keep the system open to the ambient. If for some reason there is no refrigerant in the system, it is recommended to charge the system with a protective gas, eg, inert gas N_2.**

***NOTE:* Copeland CO_2 scroll refrigeration units are equipped with an oil separator. This oil separator is pre-charged with 2.8 / 2.9 liters of oil.**

***NOTE:* Copeland CO_2 scroll refrigeration units are equipped with one high pressure limiter in the discharge line. According to EN 378-2, a refrigerant charge of 100 kg of R744 is permitted. If the system is charged with more than 100 kg, a high-pressure cut-out needs to be installed for each compressor.**

ZEROL RFL 68 EP is a “capped” PAG oil. Capped means that this oil has chemically inactive groups at both ends of the molecule. The advantages of a “capped” PAG oil are:

- Miscibility with CO_2 over a wide range of lubricant concentration and temperature.
- Reduced hygroscopicity compared with water absorbing tendancy of uncapped PAGs.
- High chemical, thermal and hydrolytic stability.
- Excellent lubricity.

The recommended quality for carbon dioxide purity class is 4.0 [(≥ 99.99 %) H_2O ≤ 10 ppm, O_2 ≤ 10 ppm, N_2 ≤ 50 ppm] or higher.

The characterization of R744 (CO_2) according to EN 378-1 is safety class A1, not flammable, ODP = 0 and GWP = 1. High concentrations of CO_2 are dangerous. This refrigerant is odourless and colourless. Therefore the use of CO_2 detectors is required.

CO_2 is heavier than air. As a result, local concentrations (especially at floor level or in deeper slots, ie, in CO_2 pockets) can be higher than average values in the machine room. The ventilation system must take this into account.

2.6.2 Application limits

WARNING
Oil dilution due to low superheat! Compressor breakdown! Low suction superheat leads to oil dilution. Always operate the system with adequate superheat to avoid oil viscosity decrease. Additional measures in system design might help to avoid unacceptable lubrication conditions.

For the application envelope, please refer to Select software at www.copeland.com/en-gb.

CO_2 scroll refrigeration units can be used with ambient temperatures from -7 to 44 °C. For lower ambient temperatures please contact your local Application Engineering representative.

2.6.3 Recommendations for minimum suction superheat – Lubrication conditions

The operation of CO_2 compressors / units at conditions where the viscosity of the oil is low might become very harmful with regard to compressor lifetime expectancy. Indicators like oil temperature and discharge temperature must be observed to judge about the lubrication conditions. In general, higher superheat on the suction inlet of a compressor provides higher safety, but the limits for the maximum allowable discharge temperature should be considered as well (superheat has a direct impact on discharge temperature). For medium temperature applications, an absolute minimum of 5 K is recommended.

Particular attention should be paid to the following points:

- Measuring the suction superheat becomes more critical with larger diameters on the suction tube. Ensure proper positioning of sensor. Sensor sleeves must be used with large diameters.
- The discharge temperature is observed by the unit controller. The temperature on the discharge line should never exceed 135 °C. The temperature of the discharge gas directly on the outlet is 10-15 K higher than the temperature on the discharge line.

2.6.4 Pressure levels of CO_2 vs. other refrigerants

Figure 6 below compares the evaporating pressures of R744 to those encountered with R410A and R404A. It can be observed that R744 systems will require to operate at much higher pressures than conventional systems.

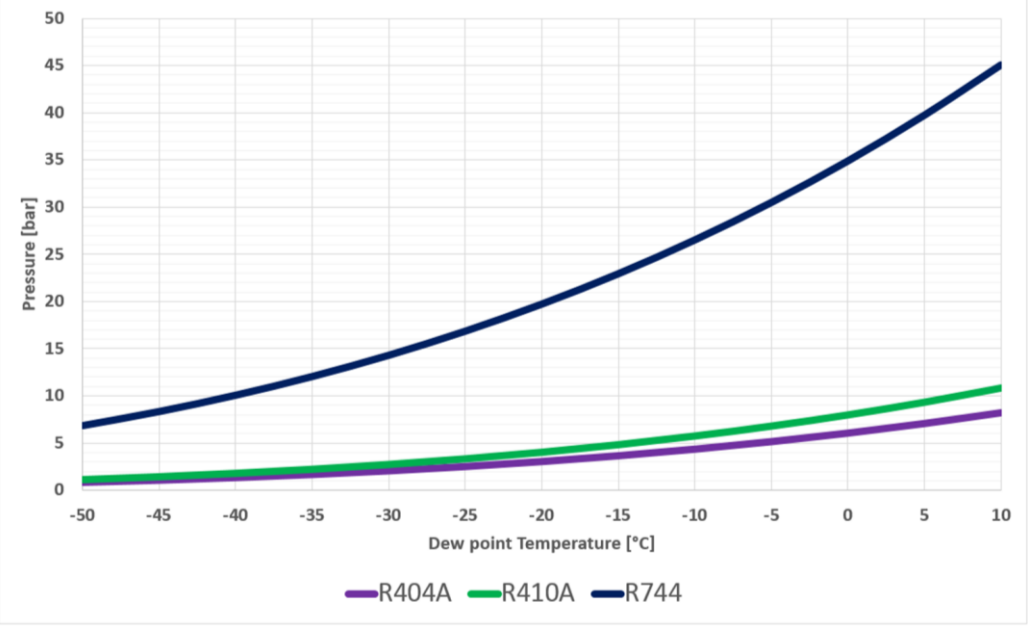


Figure 6: Pressure levels of CO_2

Note that below a pressure of 5.2 bar, solid and gaseous R744 phases may co-exist at low temperature. This behaviour is totally different from that observed with traditional refrigerants, and will have important consequences on the operation, servicing and maintenance of a system working with R744.

Gaseous R744 is 1.5 times heavier than air. Therefore, when released to the air it will concentrate at low elevations.

R744 will form "dry ice" at -56.6 °C. One kg of dry ice has the cooling capacity of 2 kg of ordinary ice. Gaseous or liquid R744 stored under pressure will form dry ice through an auto-refrigeration process if rapidly depressurized.

Figure 7 shows the thermodynamic properties (p-h-diagram) of R744. Compared to other fluids traditionally used as refrigerants, its critical point at 31 °C is very low and its critical pressure at about 73.6 bar is high.

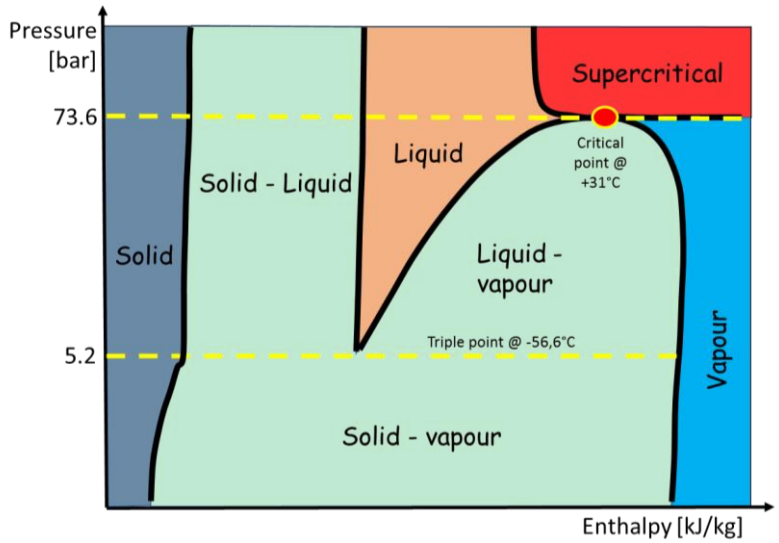


Figure 7: Pressure/enthalpy diagram CO_2

2.7 BOM variations

The BOM (bill of material) number at the end of the unit designation indicates the different unit layouts and details. The CO_2 scroll refrigeration units covered in these guidelines are available in the following BOM version:

BOM	Description
…TEM-*-1**	Compact model (gas cooler connected to compressor compartment)
…TEM-*-2**	Split / flexible model (gas cooler pipes disconnected from compressor compartment)

Table 4: BOM

Compact model

BOM number 1** indicates a CO2 scroll refrigeration unit with compact design.

This is the standard model.

The gas cooler is already connected to the compressor compartment (pipe connection + electrical connection).

Version 1** unit can't be used with remote gas cooler.

Flexible model (Split design or compact design)

Unit version 2** provides a fexible solution.

Unit version 2** can be installed either in split design (gas cooler disconnected from the compressor compartment) or in compact design (gas cooler connected to the compressor compartment).

The pipes of the gas cooler are not connected to the compressor compartment.

Unit version 2** requires a kit for installation.

There are two kits available, one for split design (3302998) and one for compact design.

The installation guide for each kit must be followed carefully. Please refer to the installation guide for more information.

2.8 P&I diagrams

2.8.1 *Single-compressor CO_2 scroll refrigeration units*

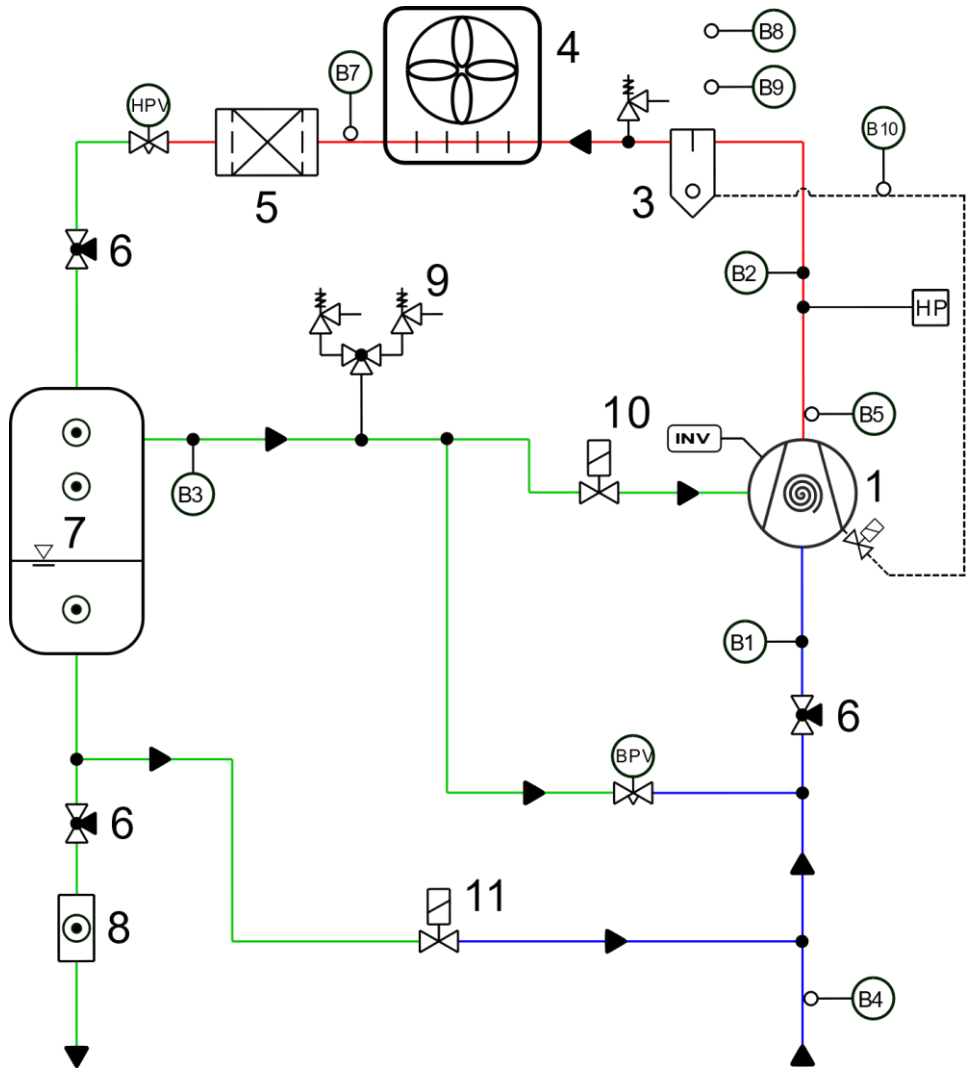


Figure 8: P&I diagram of CO_2 scroll refrigeration unit with single compressor

Position	Description	Position	Description
1	Copeland CO_2 scroll compressor (variable speed)	HP	High pressure limiter
3	Oil separator	INV	Compressor inverter
4	Gas cooler	B1	Suction pressure
5	Filter dryer	B2	Discharge pressure
6	Shut-off valve	B3	Liquid receiver pressure
7	Liquid receiver	B4	Suction temperature
8	Sight glass	B5	Discharge line temperature (variable-speed compressor)
9	Pressure relief valve (PRV)	B7	Gas cooler outlet temperature
10	Solenoid valve (DVI)	B8	Ambient temperature
11	Solenoid valve (liquid injection)	B9	E-box temperature
HPV	High pressure valve	B10	Oil temperature
BPV	Bypass valve		

Table 5: Legend of the P&I diagram of CO_2 scroll refrigeration units with single compressor

2.8.2 Tandem-compressor CO_2 scroll refrigeration units

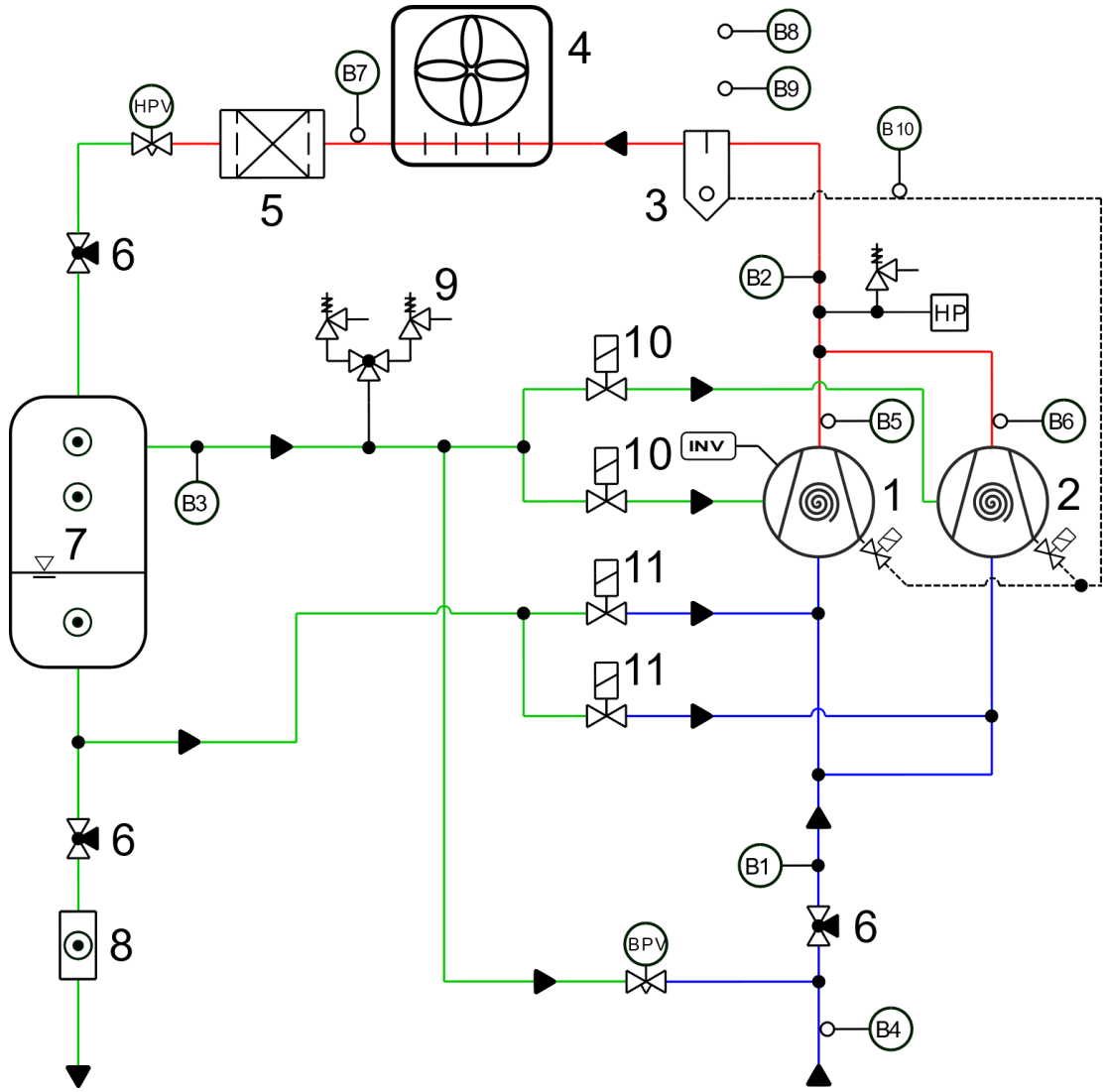


Figure 9: P&I diagram of CO_2 scroll refrigeration units with two compressors

Position	Description	Position	Description
1	Copeland CO_2 scroll compressor (variable speed)	HP	High pressure limiter
2	Copeland CO_2 scroll compressor (fixed speed)	INV	Compressor inverter
3	Oil separator	B1	Suction pressure
4	Gas cooler	B2	Discharge pressure
5	Filter dryer	B3	Liquid receiver pressure
6	Shut-off valve	B4	Suction temperature
7	Liquid receiver	B5	Discharge line temperature (variable-speed compressor)
8	Sight glass	B6	Discharge line temperature (fixed-speed compressor)
9	Pressure relief valve (PRV)	B7	Gas cooler outlet temperature
10	Solenoid valve (DVI)	B8	Ambient temperature
11	Solenoid valve (liquid injection)	B9	E-box temperature
HPV	High pressure valve	B10	Oil temperature
BPV	Bypass valve		

Table 6: Legend of the P&I diagram of CO_2 scroll refrigeration units with two compressors

2.9 Main components description

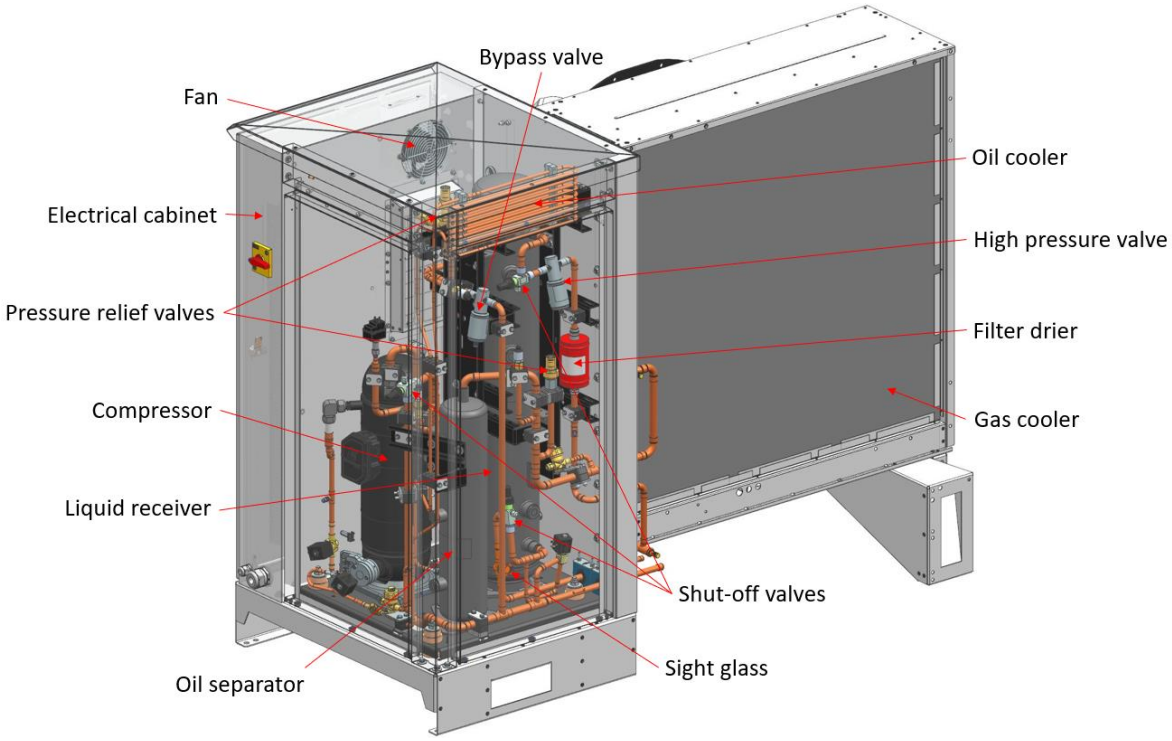


Figure 10: Main components of CO_2 scroll refrigeration unit (OME-16T)

2.9.1 Compressor

The smallest unit contains one variable-speed compressor. All other units have two compressors. The first compressor is variable speed and the second one is fixed speed. The compressors are installed in the compartment next to the electrical cabinet. The standard delivery is with shut-off valve on the suction side as well as with TraxOil™ oil management system connected to the sight glass connection.

All electrical wiring is pre-assembled in the factory. A pressure relief valve (130 bar) is installed in the discharge line of the compressors. A pressure limiter is installed on the discharge side of the compressors in compliance with EN 378 requirements.

The compressors used in each unit model are listed in **Table 7** below.

Unit model	Variable-speed compressor model	Fixed-speed compressor model
OME-16T-TEM	ZTW16AG	-
OMTE-37T-TEM	ZTW16AG	ZTI21AG
OMTE-49T-TEM	ZTW21AG	ZTI28AG
OMTE-64T-TEM	ZTW28AG	ZTI36AG

Table 7: Compressors used in Copeland CO2 scroll refrigeration units

2.9.2 Electrical cabinet

The electrical cabinet is located next to the the compressor compartment. All electrical components such as main unit controller, inverter, contactors, transformers, wiring terminals and fuses are installed in this area.

The electrical cabinet is closed by a door. A fan is activated to control the temperature inside the cabinet. This fan will also be activated if the oil temperature is high. The air flow passes through the compressor compartment as well and cools down the oil.

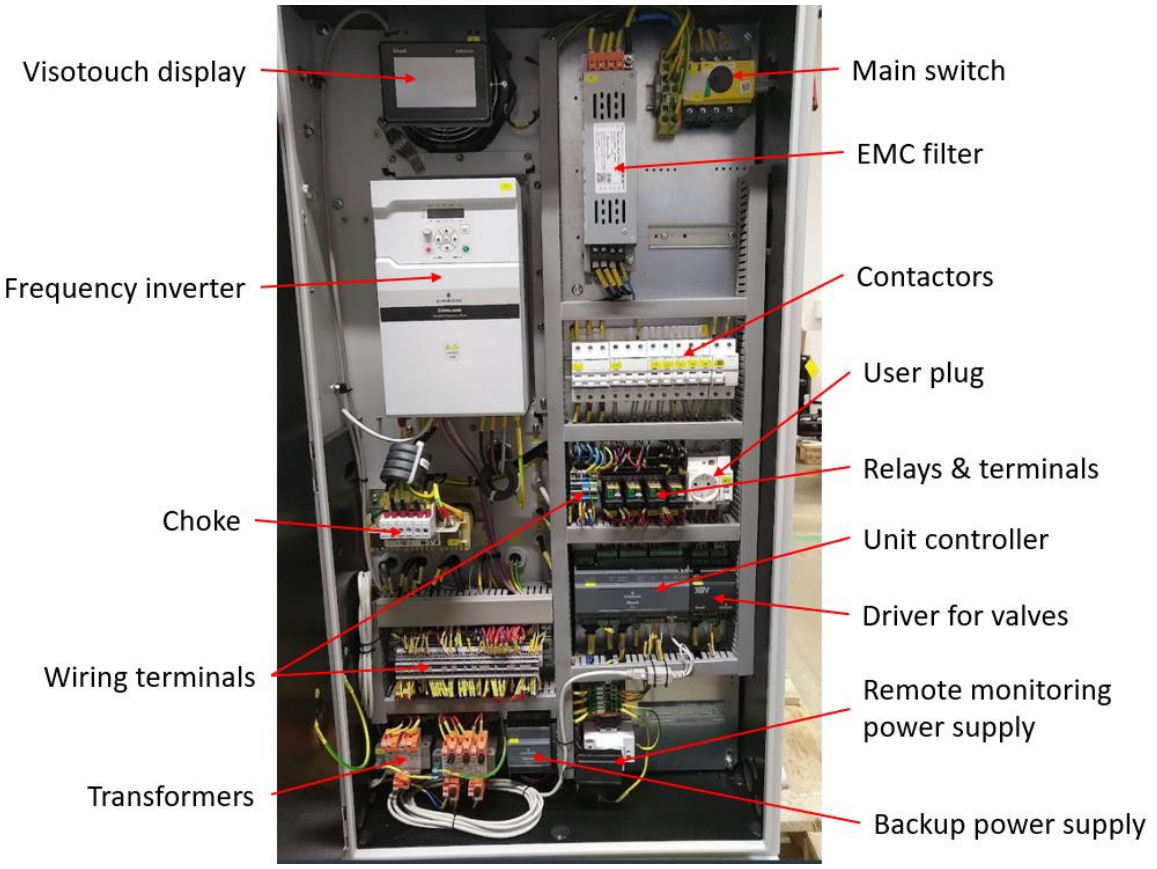


Figure 11: Electrical cabinet (OME-16T)

2.9.3 Liquid receiver

Units are equipped with 20 litres liquid receivers installed in the compressor compartment:

- 1 liquid receiver on OME-16T and OMTE-37T.
- 2 liquid receivers connected in parallel in OMTE-49T and OMTE-64T units.

The liquid receiver is equipped with a shut-off valve on the inlet and outlet and a safety group (2 pressure relief valves 90 bar, connected to a switch-over valve).

There are 3 sight glasses in the shell of the liquid receiver to check the refrigerant level. The liquid level must not be below the bottom sight glass and not above the top sight glass.

2.9.4 Fan

The gas cooler of the Copeland CO_2 scroll refrigeration unit is equipped with EC fans.

	Fan		Power input (W)	Maximum current (A)	Air flow (m^3/h)	Fan diameter (mm)
Unit	Number	Description				
OME-16T-TEM	1	ZN063-ZIL.DG.V7P2	405	4	8809	630
OMTE-37T-TEM	2		685		16000	630
OMTE-49T-TEM		ZN080-ZIL.GG.V7P3	850	3	21370	800
OMTE-64T-TEM			1330		28457	800

Table 8: Fan specifications

Technical data		
Supply frequency	Hz	50
Supply voltage	V	230 for OME-16T / OMTE-37T 400 for OMTE-49T / OMTE-64T
Min to max ambient temperature	°C	-25 to +55 for OME-16T / OMTE-37T -25 to +70 for OMTE-49T / OMTE-64T
ErP 2015	-	Yes
IP class	-	IP54
Fan motor type	-	EC
Fan blades	-	Plastic

Table 9: Fan technical data

Figure 12: Fan design

Maximum gas cooler fan pressure difference: CO_2 scroll refrigeration units can be installed indoors. To provide the gas cooler with appropriate air flow, the fan pressure drop must not exceed 65 Pa at 8809 m³/h (OME-16T). The gas cooler fan air flow for units OMTE-37 / 49 / 64T is given in **Table 8**. Additional components such as mufflers, flaps, protection grids, etc. must also be taken into account when designing the air ducts route as they will cause additional pressure drop.

The following table shows pressure drops at maximum gas cooler fan air flow for most commonly used ducting components:

Fan diameter	Spiral duct	Ventilation elbow 90°
630 mm	1 Pa/m	15 Pa
800 mm	0.5-1 Pa/m	10-15 Pa

Table 10: Pressure drop ducting components

Example (OME-16T): If 8 meters spiral duct and 3 bows 90° are required on the installation, then 1 Pa x 8 + 15 Pa x 3 = 8 Pa + 45 Pa = 53 Pa, so **53 Pa < 65 Pa**.

***NOTE:* The pressure drops of ducts and elbows given in this chapter are indicative values. The exact pressure drop shall be calculated individually for each project.**

2.9.5 High pressure valve (HPV)

The high pressure valve is installed between the gas cooler and the liquid receiver. It controls the high pressure for optimum COP in transcritical operation. In subcritical operation it will adjust the high pressure in order to maintain a certain subcooling.

The driver for the stepper motor valve is installed in the electrical cabinet.

The driver for the HPV is an XEV20D. It gets a signal from the unit controller – see **section 2.10 "CO2 scroll refrigeration unit control – General"**.

2.9.6 Bypass valve (BPV)

The bypass valve is installed between the liquid receiver and the suction line to the compressor. The bypass valve is aimed at keeping the liquid receiver pressure below the maximum allowed injection pressure of the compressor at all times.

2.9.7 Liquid injection valves

The liquid injection valves are installed between the liquid line and the suction line. The purpose of these valves is to inject liquid refrigerant to the suction line in order to keep the discharge temperature below 135 °C. There is one liquid injection valve for each compressor.

2.9.8 Design pressures

IMPORTANT
Piping design pressure! Risk of CO_2 blow-off! The CO_2 scroll refrigeration unit liquid and suction line piping is designed for a design pressure (PS) of 90 bar as pressures around 60 bar can occur in the liquid line and pressures around 40 bar in the suction line during normal operation. The installer must always consider the system liquid and suction lines in terms of maximum operating pressure. If the system piping design pressure (PS) is lower than 90 bar in the liquid line, additional safety devices are required. An additional safety device in the suction line is required in any case. The minimum required design pressure (PS) is 80 bar for the liquid line and 60 bar for the suction line. Longer standstill times of the unit can be achieved by a design pressure of more than 60 bar in the suction line.
The high pressure side of the unit is designed for a pressure of 130 bar as pressures around 112 bar can occur during normal operation. 130 bar is at the same time the minimum required design pressure (PS) for this section of the unit. A 130 bar pipe must be used for the connection between the gas cooler and the compressor compartment for units with the BOM number 2**.

The unit has 2 different pressure areas:

- The design on suction side is made for a maximum allowable absolute pressure of 90 bar at standstill. The section after the high pressure valve to the liquid line outlet of the unit is approved for an absolute pressure of 90 bar at standstill too.
- The area with discharge pipe, gas cooler and high-pressure valve is approved for a maximum allowable absolute pressure of 130 bar.

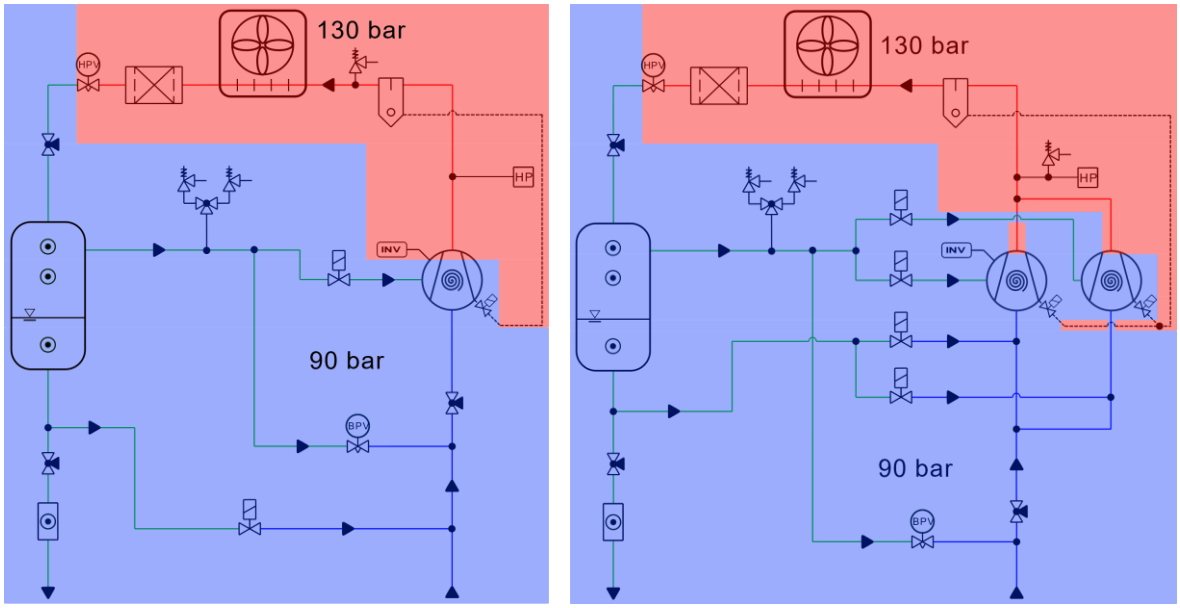


Figure 13: Design pressures of Copeland CO2 scroll refrigeration units

NOTE: **The design pressure PS is a safety-related value. The restrictions for reliable operation of the unit are defined by the application envelope which can be found in Select software at www.copeland.com/en-gb.**

2.9.9 Housing

Copeland CO_2 scroll refrigeration units have a new, unique design. They are equipped with an electrical cabinet located next to the compressor compartment. The electrical cabinet has a door for easy and service-friendly access. The compressor compartment and electrical cabinet are accessible independently. The fans have horizontal air flow and are protected by a safety grid. The gas cooler and connected parts are freely accessible by the service technician. The figure below shows the housing of unit model OMTE-37T. The housing design differs slightly in the other unit models.

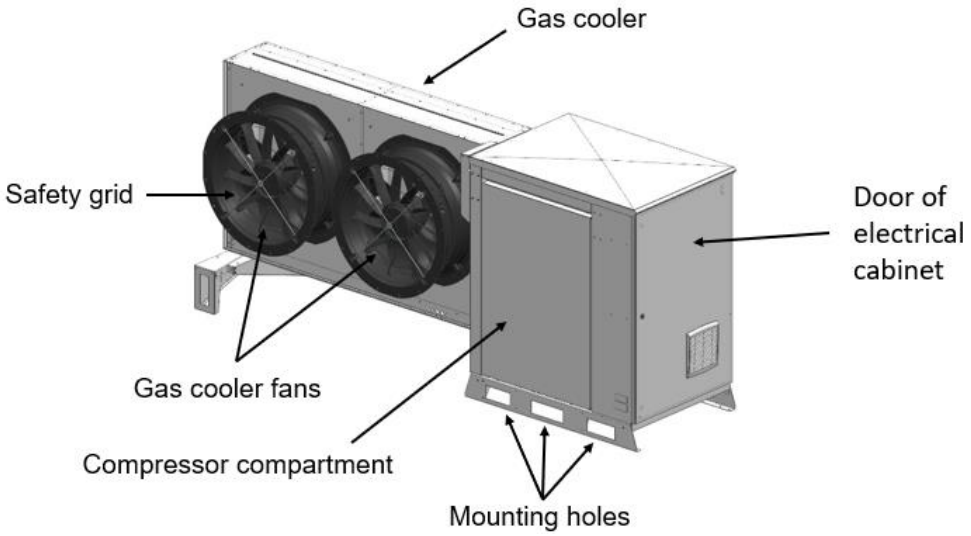


Figure 14: Overview of the unit housing

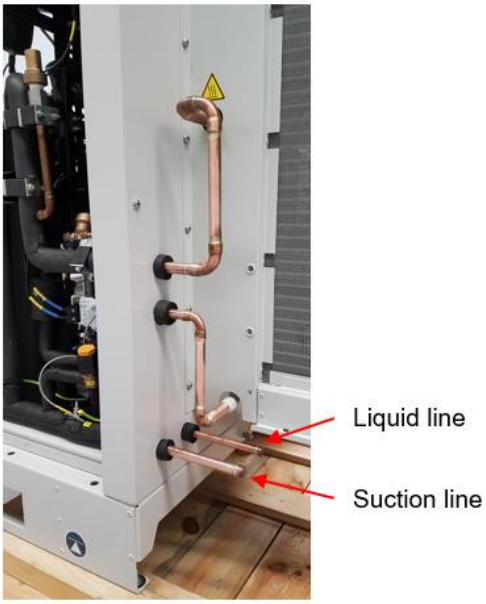


Figure 15: Liquid line and suction line

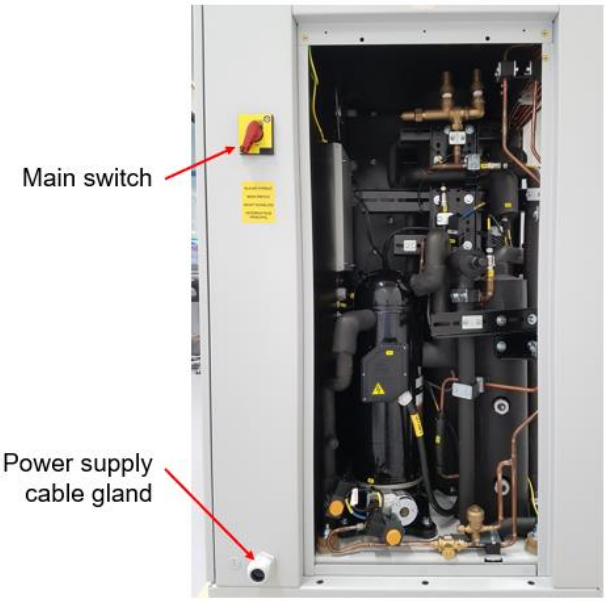


Figure 16: Main switch and power supply cable gland

2.10 CO_2 scroll refrigeration unit control – General

Copeland CO_2 scroll refrigeration units are equipped with an XC Pro controller IPG315D and a Visotouch display. The XC Pro controller manages the compressor variable frequency drive. It also handles the high pressure regulation which is done by a stepper motor valve, driven by a standard driver device, controlled by XC Pro through CanBus. The stepper motor valve driver can operate two valves simultaneously. The controller can handle gas cooler pressure and liquid receiver pressure in parallel. Additional features that are managed by the controller are injection of the flashgas into the compressors and liquid injection into the suction line in order to prevent the compressors from overheating.

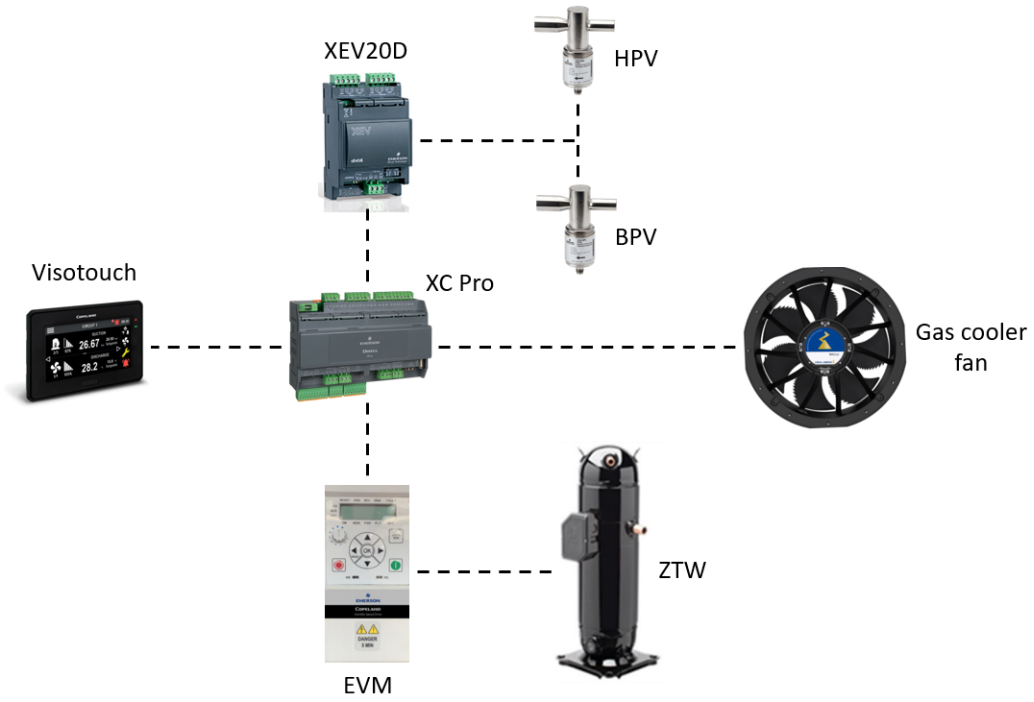


Figure 17: Copeland CO2 scroll refrigeration unit controller schematics

2.10.1 XC Pro controller description

The XC Pro controller is a standard IPG315D Dixell controller. The controller is factory-set for -10 °C evaporating temperature. To achieve the required temperatures, Copeland recommends to change only the evaporating temperature as the rest of the parameters are already pre-set.

2.10.2 Visotouch display description

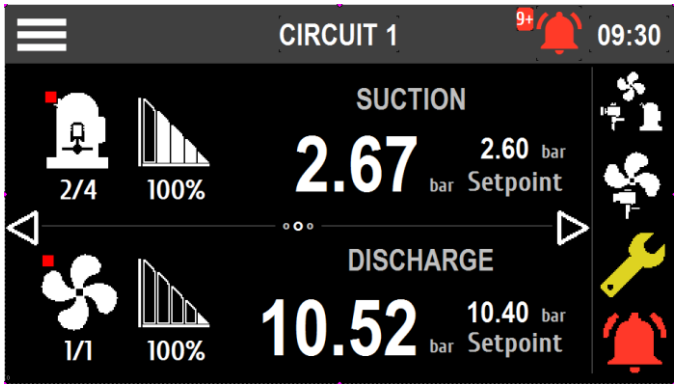
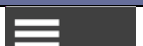
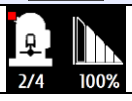


Figure 18: Visotouch display – Main page

Position	Description
	Go to **GENERAL MENU** page
	Go to **SCHEMATIC** page
	Go to **GAS COOLER** page
	Go to **SERVICE** page
	Go to **ALARM** page
	Go to **ALARM** page Number of active alarms
	Go to **COMPRESSORS** page Number of running/available compressors Speed of variable speed compressor in %

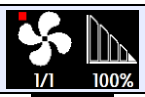
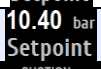
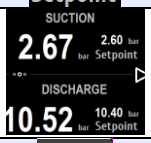
	Go to **GAS COOLER** page Number of running/available fans Fan speed in %
	Go to **SETPOINT** page
	Go to **SETPOINT** page
	Suction pressure and suction pressure setpoint at the top. Gas cooler pressure and gas cooler pressure setpoint at the bottom. Click on unit "bar" to switch from "bar" to "°C".
	Real time clock

Table 11: Display description – Main page

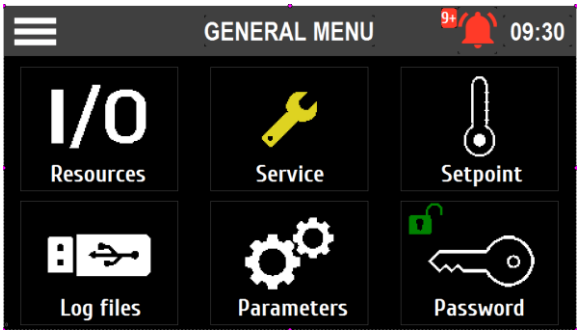


Figure 19: Visotouch display – General menu

Position	Description
	Go to **SERVICE** page
	Go to **PARAMETERS** page
	Go to **PASSWORD**  Password inserted  No password inserted
	Go to **LOG FILE**
	Go to **SETPOINT** page
	Go to **I/O** page

Table 12: Display description – General menu

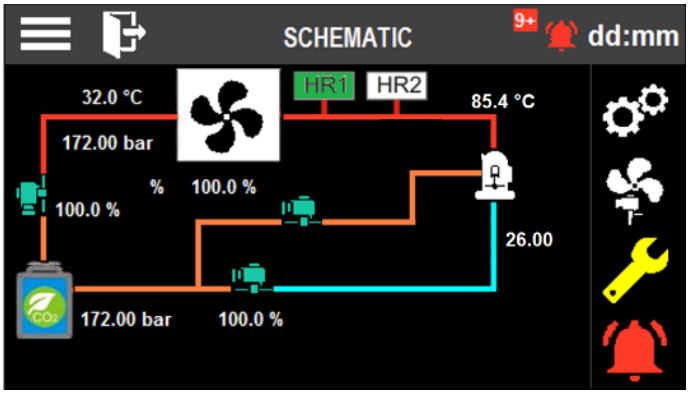


Figure 20: Visotouch display – Schematics

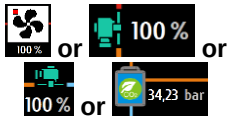
Position	Description
	Go to **MAIN PAGE**
	Go to **PARAMETERS** page
	Go to **GAS COOLER** page
	Go to **MEDIUM TEMPERATURE SUCTION LINE** page

Table 13: Display description – Schematics

2.11 How to use the XC Pro controller

2.11.1 How to change parameters

1) In the GENERAL MENU go to the PARAMETERS page.
2) The parameters are divided into level 1 and level 2. The parameters in level 2 are protected by a password. The default password is 12. Click for example on "Level 1".

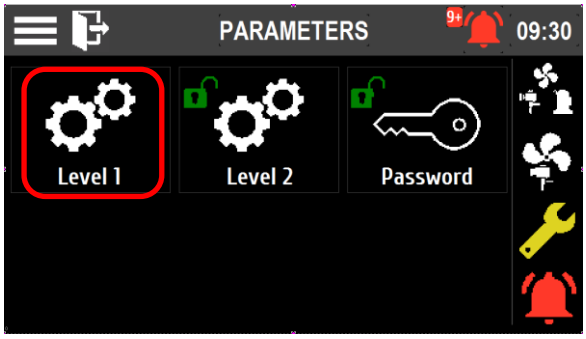


Figure 21: PARAMETERS page

3) Click on "SetPoint".

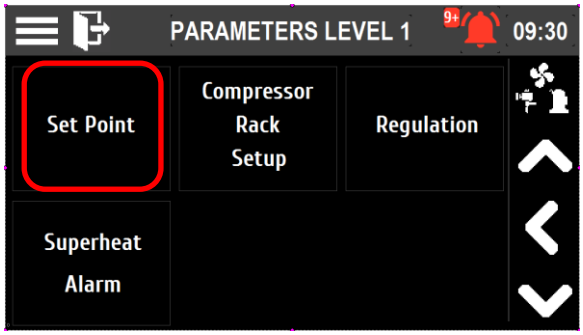


Figure 22: PARAMETERS LEVEL 1 page

4) Select the group of parameters that need to be changed. In this example "SetPoint".
5) Navigate to the correct parameter using the arrows on the right. "SETC1" is the setpoint of the evaporating temperature.

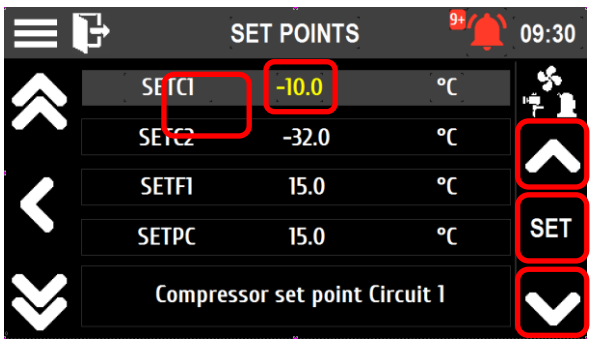


Figure 23: SETPOINTS page

6) Click on "SET": now the value can be changed using the arrow buttons.
7) Click on "SET" again to confirm the value.

The SETPOINTS page can also be reached directly from the GENERAL MENU or the main page by clicking on "SetPoint".

2.11.2 How to switch the XC Pro controller on/off

1) In the GENERAL MENU go to the SERVICE page.
2) Click on "ON - OFF".

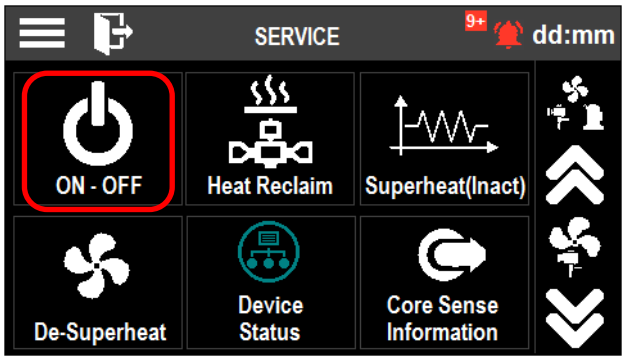


Figure 24: SERVICE page

3) Press the "Unit" button for 5 seconds to switch the controller off.

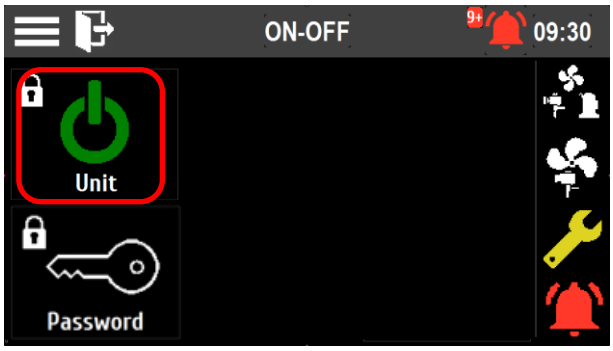


Figure 25: ON-OFF page

4) Press the "Unit" button again for 5 seconds to switch the controller on. The green colour of the icon indicates that the controller is switched on.

2.12 XC Pro controller – Functionality

The XC Pro controls the complete refrigeration unit. It provides a lot of customization features like alarms and special operating modes. Thanks to the high degree of flexibility, the user can either use the factory-set alarms or set up their own alarms according to the application requirements.

The following functionalities are pre-programmed:

- suction pressure control
- fan speed / gas cooler control
- alarms

The XC Pro has a built-in feature to keep the compressor inside its application envelope.

The refrigeration unit is able to operate in both subcritical and transcritical modes. The setpoint for switching from subcritical to transcritical operation is adjustable (**GC1**). The factory setting for this trigger point is 29 °C, measured over gas cooler outlet sensor B7 (**AIC10**). The (adjustable) hysteresis (**GC2**) for the (**GC1**) setpoint is 2 K. Although it is possible, it is not recommended to change these settings.

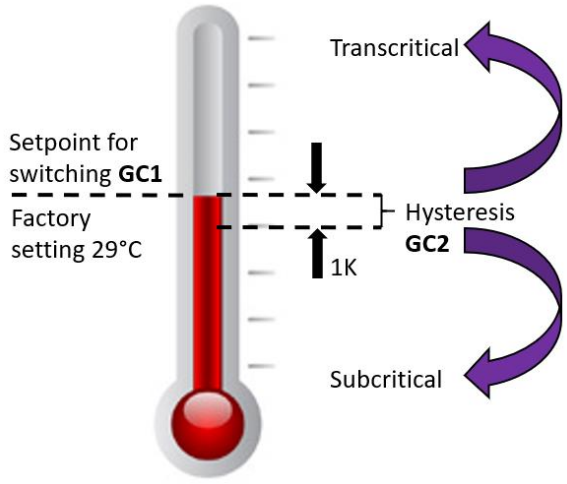


Figure 26: Switching between transcritical and subcritical mode

***NOTE:* A system control very close to the critical point may result in a loss of capacity and unstable system behaviour. This can be overcome by setting GC3 to a higher value (76-80 bar) or by dynamic offset using parameters GC16 and GC17.**

2.12.1 Suction pressure control

The setpoint for suction pressure control is parameter **SETC1**, the factory setting is -10 °C.

SETC1 **Compressor Circuit 1 setpoint**
Range: -15 to 0 °C
Unit: (°C)

Depending on the number of evaporators, ie, the suction side internal volume, a rapid decrease of the suction pressure during compressor start might occur. This can result in low-pressure cut-out before reaching stable regulation conditions. The acceleration of the compressor speed can be adjusted by decreasing the value of **SETC1**.

2.12.2 Pumpdown mode

The pumpdown function of the CO_2 scroll refrigeration unit does not work in the same way as in units using standard refrigerants. Based on the ambient temperature and the compressor setpoint, the controller calculates two different pumpdown setpoints:

- Setpoint based on ambient temperature = T_{Amb} – SPF5
- Setpoint based on compressor setpoint = SETC1 – SPF1

The lowest pumpdown setpoint will always be applied. The following diagram illustrates the controller logic:

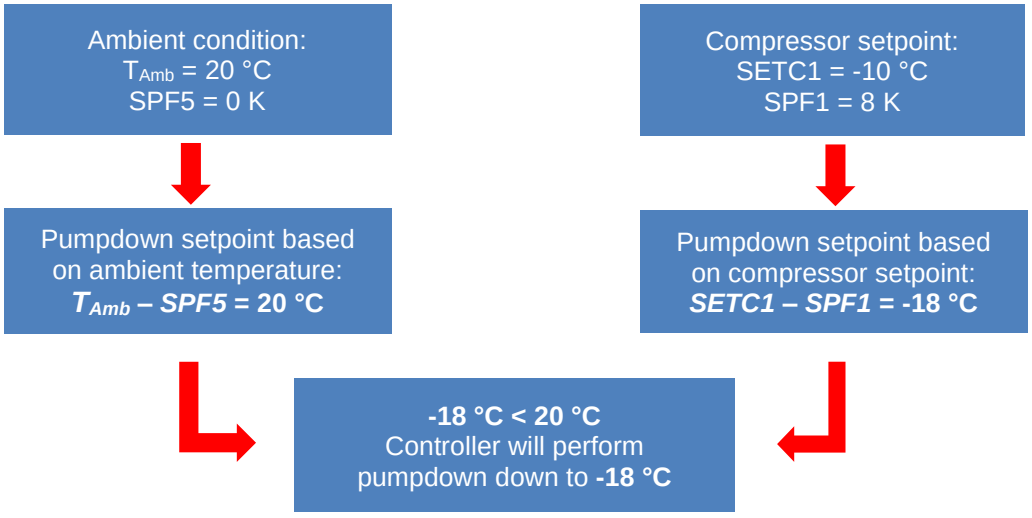


Figure 27: Controller logic for the pumpdown function with factory settings

***NOTE:* The pumpdown setpoint will never be lower than allowed by parameter RC2.**

***NOTE:* The parameter RC2 can be decreased to -20 °C to allow a lower pump down setpoint. The parameter SETC1 must never be selected lower than -15 °C.**

2.12.3 Fan speed / gas cooler control

2.12.3.1 Subcritical operation

Typically, with gas cooler outlet temperatures below 29 °C **(B7 = AIC10 < GC1 - GC2)**, the system operates in subcritical mode.

- The CO_2 refrigerant condenses inside the gas cooler (condenser).
- The gas cooler outlet temperature is read by the probe **AIC10** (= B7), which defines the fan speed.
- The high pressure valve HPV will keep a certain sub-cooling of the refrigerant (about 3-4 K) in order to create pressure differential between the gas cooler and the liquid receiver.
- The fan speed setpoint (related to the gas cooler outlet temperature) is +20 °C with a proportional band of 20 K (setpoint ± 10 K).

SETF1 **Gas cooler (condenser) Circuit 1 setpoint**
Range: +6 to +25 °C
Unit: (°C)

2.12.3.2 Transcritical operation

Typically, with gas cooler outlet temperatures above 29 °C **(B7 = AIC10 > GC1)**, the system operates in transcritical mode.

- According to the gas cooler outlet temperature detected by the **AIC10** (= **B7**) probe, the high pressure valve modulates to maintain a pressure that maximizes the COP (Coefficient of Performance).
- The fan speed setpoint is +20 °C with a proportional band of 20 K.

In transcritical operation mode in CO_2 systems, the liquid receiver becomes a flash tank, in which the liquid phase is separated from the gas phase. In high ambient conditions, the amount of gas will increase due to the thermodynamic properties of CO_2. Flashgas ratios of 50 % or more are not unusual. The flashgas is injected into the compressor. If required, the flashgas can also be directed to the suction side of the compressor to keep the pressures in the flash tank at acceptable levels.

Bypassing flashgas will reduce the mass flow coming from the cold rooms/cabinets. This necessary process will however reduce the overall system efficiency. The bypass valve limits the maximum pressure in the flash tank to 54 bar. When all compressors are off, this value is increased. This keeps the bypass valve closed and the compressors do not have to be started without a cooling demand.

2.12.4 Alarms

Click on the **ALARM** button  or  to enter the "Alarm" menu:

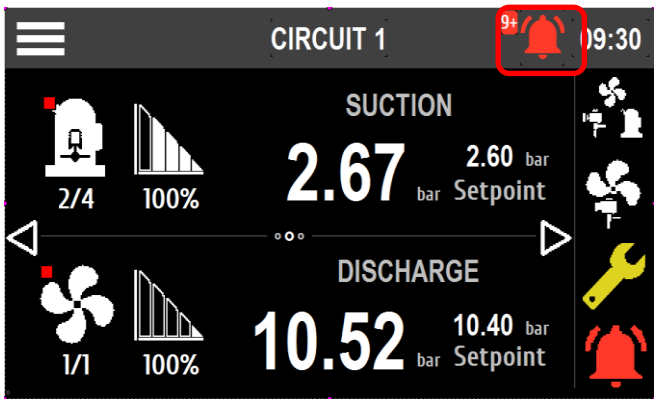


Figure 28: Alarm button

Different alarm groups are available. The group(s) with an active alarm will be flashing. The active alarms can be found by clicking on the corresponding alarm group button.

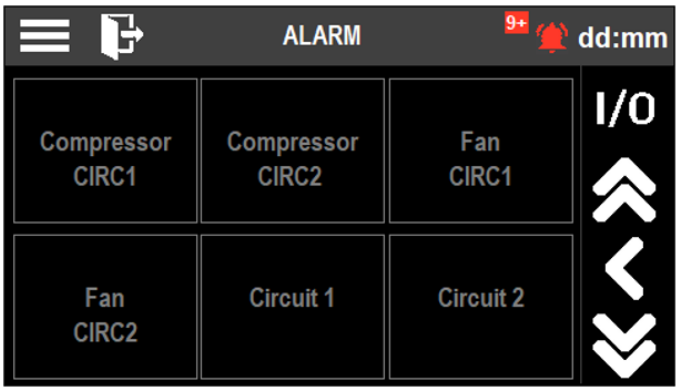


Figure 29: Alarm groups

The alarm menu will display the active alarm(s) in the following format:

- Column 1: Alarm code
- Column 2: Alarm description

2.13 XC Pro controller – Peripheral devices

The unit controller interacts with several devices inside the electrical cabinet. These guidelines only provide general information about and short descriptions of the peripheral devices. Dedicated technical documentation (manuals, operating instructions) for those devices is available at www.copeland.com/en-gb.

2.13.1 Variable frequency drive EVM/EVH

The Copeland variable frequency drive EVM/EVH has been designed for applications that require flexible integration with systems via industrial Ethernet protocols and fieldbuses, together with advanced RFC-A open-loop motor control. Connection to RS485 networks using Modbus RTU allows for communication with the unit controller.

The EVM/EVH frequency inverter uses the input signal of the controller to adjust the compressor speed to the requirements. For more details see the EVM/EVH Inverter handbook.

Unit model	Variable frequency drive
OME-16T-TEM	EVM-344038-E20EFN
OMTE-37T-TEM	EVM-344038-E20EFN
OMTE-49T-TEM	EVM-344046-E20EFN
OMTE-64T-TEM	EVH-344061-R21BEN

Table 14: Variable frequency drive models

NOTE: **The variable frequency drive should not be used to change the system settings. All required changes and adjustments can be made directly on the system controller via the Visotouch display. The display of the variable frequency drive is locked. The default password is 11.**

2.13.2 XEV20D Stepper valve actuator

The XEV20D stepper valve actuator communicates with the unit controller via CanBus. It is intended either for bipolar stepper valves or unipolar stepper valves. Both the high-pressure valve and the bypass valve are driven by the XEV20D. The address of the XEV20D has to be set to 3 (dip switches: ON, ON, OFF, OFF).

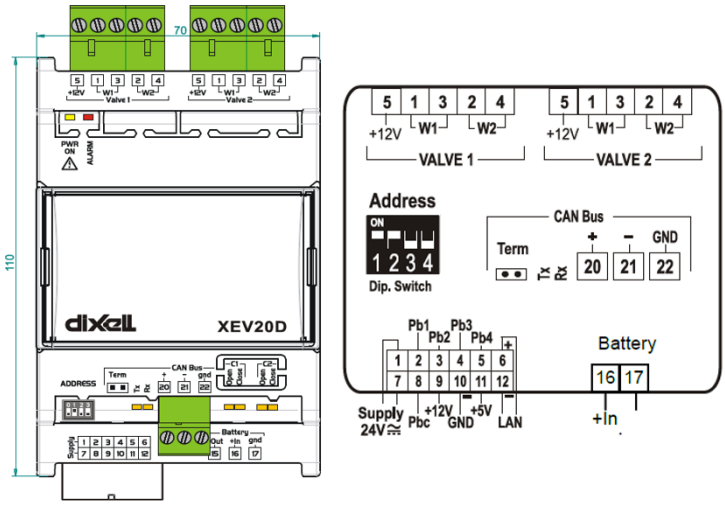


Figure 30: XEV20D stepper valve actuator

2.13.3 Circuit breakers

The components of the electrical main load circuit are located on the right-hand side of the electrical cabinet. Before commissioning some electrical components need power supply to enable heating up the compressor oil sump and to manually open the high pressure valve (HPV) and the bypass valve (BPV) on demand, eg, for tightness test.

***NOTE:* For safety reasons never switch the SB12 toggle switch (compressor) on without a minimum refrigerant charge inside the system.**

***NOTE:* The unit main switch must always be switched on to provide power to the control chain and dedicated electrical components.**

2.14 Compressor safety

2.14.1 Compressor motor protection

Copeland CO_2 scroll refrigeration units are equipped with scroll ZTW/ZTI compressors.

The Copeland EVM/EVH variable frequency drive covers all relevant electrical protection features for the ZTW compressor. For more details see the EVM/EVH Inverter handbook.

The ZTI compressor has an internal protection.

Both the ZTW and ZTI compressors are protected by an own circuit breaker.

The discharge line temperature is monitored and controlled by the controller.

The different areas of the system are limited by different design pressures (PS) – see **section 2.9.8 "Design pressures"** for details. There are different levels of protection and control to keep the pressures within the approved envelope at all times.

2.14.2 High-pressure safety (type-approved pressure limiter)

A type-approved pressure limiter (according to EN 12263) with automatic reset is installed on the compressor. It is a normally-closed CS3 switch from Alco Controls.

The pressure cut-out is set to 123 bar and the cut-in to 117 bar.

The tightening torque to the thread connection on the pipe is 15 Nm.

The CS3 pressure limiter can withstand 2 million cycles.

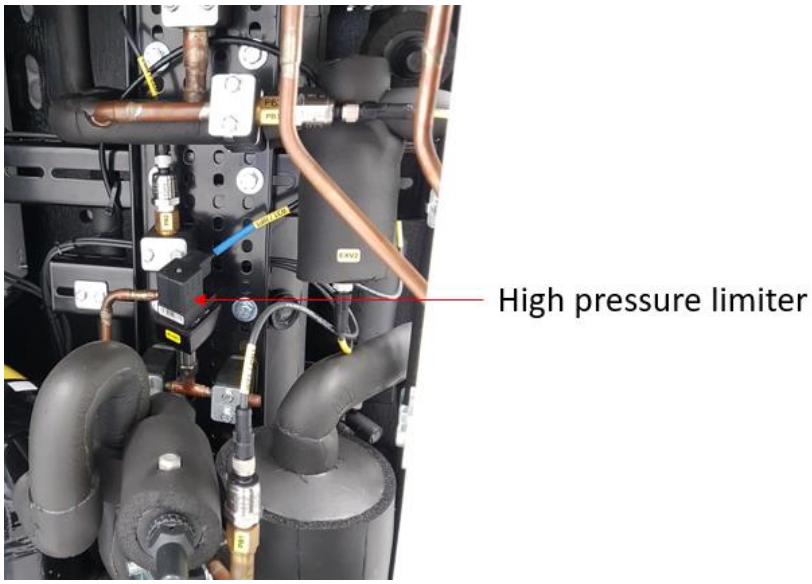


Figure 31: High-pressure limiter

2.14.3 High-pressure safety control

There are 3 pressure transmitters assembled in the unit. These transmitters are used for system control purposes as well as for safety. They are located on the suction side (B1 = **AIC1**), the discharge side (B2 = **AIC2**) and on the liquid receiver outlet (B3 = **AIC3**).

The setpoint of the discharge pressure is always below the cut-out value of the high-pressure limiter.

The transmitter on the liquid receiver is also used to limit the liquid receiver pressure by means of the flashgas-bypass.

2.14.4 Pressure relief valve (PRV) – High-pressure side

A pressure relief valve (130 bar) is installed on the high-pressure side. It is mounted on the discharge line. The valve protects the high-pressure side including the gas cooler. In case of blocked HPV the high-pressure limiter will switch the compressor off before the pressure relief valve opens.

The pressure relief valve will reach 100 % of blow-off capacity when the maximum allowable pressure PS of the section is exceeded by 10 % (opening at 1.0 x PS, max. capacity at 1.1 x PS).

Figure 32: Pressure relief valve on high pressure side

2.14.5 Pressure relief valve – Liquid receiver

There are two pressure relief valves (90 bar) on the liquid receiver, connected on a changeover valve. In case of refrigerant blow-off, this allows for easy replacement of the relief device without interruption of unit operation by using the second valve.

Typically, after a blow-off event, the relief devices are not 100 % tight anymore. Therefore, component replacement after activation is mandatory. Do not keep the pressure relief valve after a blow-off. When replacing the pressure relief valve follow the instructions in **section 5.8 "Pressure relief valves"**. The thread connections on the changeover valve and pressure relief valve are 1/2" NPT. Only original PRVs shall be used. The use of other than original PRVs could affect the system in terms of vibration.

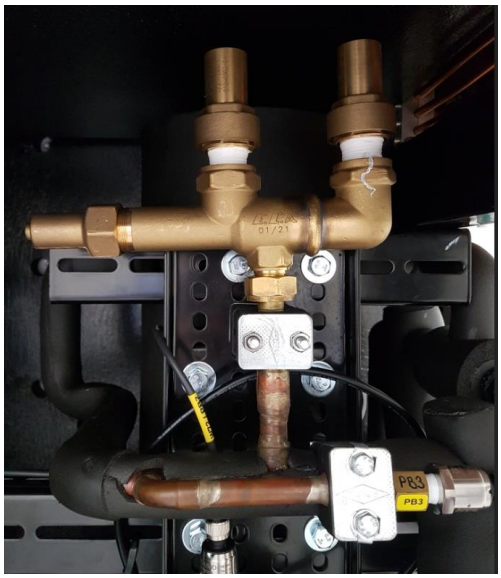


Figure 33: Pressure relief valves with changeover valve on liquid receiver

2.14.6 Low-pressure safety control

As on discharge and liquid sides, a suction pressure transmitter (B1 = **AIC1**) provides information about suction pressure to the system controller. This value is used to evaluate the load requirement and to protect the unit / system against low pressure on suction side.

Figure 34: Low side pressure transmitter

2.15 Oil management device – OM5 TraxOil™

The compressors in the Copeland CO_2 scroll refrigeration units are equipped with an Copeland OM5 TraxOil oil level management system. This device is intended to prevent the compressors from operating with insufficient oil by opening a valve which allows the oil to flow from the oil separator to the compressor. The OM5 uses a hall sensor to measure the oil level. Unaffected by foaming oil or light, a magnetic float changes its position according to the oil level. The hall sensor converts the magnetic field changes into an equivalent signal, which is used by the integrated electronic controller to monitor and display the actual oil level with LEDs.

In case of low oil level and after a delay time of 20 seconds the OM5 will generate an alarm which will make the unit controller stop the compressor immediately.

This alarm can be displayed on the Visotouch like any other alarm of the unit.

Figure 35 below depicts the sight glass level control zones. **Table 15** describes the LED code legend. **Figure 36** shows the OM5 TraxOil mounted on the compressor.

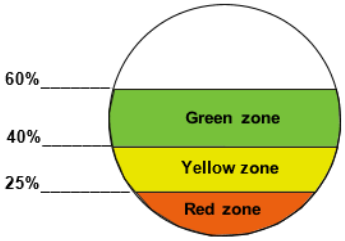


Figure 35: Sight glass level control zones

LEDs	Status	Function	Alarm
●	Oil level in green zone (60 - 40 %)	OK	
● ●	Oil level in green zone (60 - 40 %)	OK	
●	Oil level in yellow zone (40 - 25 %)	Warning	
●	Oil level in red zone (25 - 0 %)	Alarm	Yes, delay 20 sec

Table 15: LED code legend

Figure 36: OM5 TraxOil mounted on the compressor

3 Installation

WARNING
High pressure! Injury to skin and eyes possible! Be careful when opening connections on a pressurized item. Never install the unit at such a height that if the pressure relief valve opens, the gas flow can reach an individual's head.

IMPORTANT
Always install the unit in such a way that all installation, commissioning and servicing works can be carried out safely and easily.

IMPORTANT
Oil dilution! Bearing malfunction! Turn on the crankcase heater 12 hours before starting the unit.

Copeland CO_2 scroll refrigeration units are delivered with a holding charge of dry air.

The refrigeration unit should be located in such a place to prevent any dirt, dust, plastic bag, leaves or papers from covering the gas cooler and its fins.

A clogged gas cooler will increase the refrigeration temperature and/or the gas cooler outlet temperature which could lead to a high-pressure switch tripping. Clean the gas cooler fins on a regular basis.

The unit must be installed without restricting the airflow. Harmful environmental conditions like very low or high temperatures should also be avoided.

The place of installation has to be level and horizontal. The unit must be secured to the ground to avoid any movement of the base frame. The ground needs to be designed for the weight of the unit. It might be necessary to install additional vibration absorbers between the unit and the ground to avoid the transmission of vibration to the rest of the building.

The place of installation should be sufficiently lit and should allow easy access for service and maintenance work.

In case of installation in a machine room, standard EN 378-3 and all additional national regulations shall be observed.

A risk assessment of the place of installation has to be conducted before actual system installation. It should be documented for local authorities and should contain safety-related measures to avoid risks. The risk assessment of the unit itself has been performed by the manufacturer.

Copeland CO_2 scroll refrigeration units are delivered with a cardboard between the oil cooler and the housing. This cardboard must be removed during unit installation.

3.1 Refrigeration unit handling

3.1.1 Transport and storage

WARNING
Risk of collapse! Personal injuries! Move units only with appropriate handling equipment according to weight. Keep in the upright position. Respect stacking loads according to **Figure 37**. Do not stack anything on top of the unit packaging. Keep the packaging dry at all times.

Respect the maximum number of identical packages which may be stacked on one another, where "n" is the limiting number:

- **Transport: n = 0**
- **Storage: n = 0**

Figure 37: Maximum stacking loads for transport and storage

3.1.2 Weights

Unit	Weight complete unit (kg)	Weight compressor compartment (kg)	Weight gas cooler including fans (kg)
OME-16T-TEM	470	385	85
OMTE-37T-TEM	585	440	145
OMTE-49T-TEM	700	500	200
OMTE-64T-TEM	750	515	235

Table 16: Weights

3.1.3 Lifting

The unit can be lifted as described in **Figure 38** below.

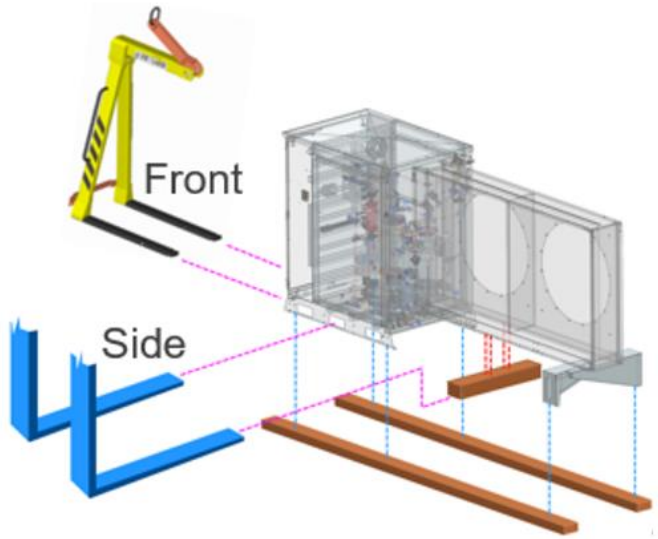


Figure 38: Lifting points for CO_2 scroll refrigeration units

3.2 Refrigeration piping connections

3.2.1 Refrigeration piping installation and connections

WARNING
High pressure! Risk of personal injury! The units are pressurized with dry air. Be careful when opening connections on a pressurized item.

IMPORTANT
Tubing quality! Installation contamination! All interconnecting piping should be of refrigeration grade, clean, dehydrated and must remain capped at both ends until installation. Even during installation, if the system is left for any reasonable period of time, eg, 2 hours, pipes should be re-capped to prevent moisture and contaminant from entering the system.
Connection sizes! Unsuitable refrigerant flow rate! Do not assume that the service connection sizes on the unit are in fact the correct size to run the interconnecting refrigeration pipes. All interconnecting piping should be sized to satisfy the duty required.

IMPORTANT
Piping design pressure! Risk of CO_2 blow-off! The CO_2 scroll refrigeration unit liquid and suction line piping is designed for a design pressure (PS) of 90 bar. The installer must always consider the system liquid and suction lines in terms of PS values. If the system piping design pressure is lower than 90 bar, additional safety devices are required.

The pipes should be sized to ensure optimum performance and good oil return. The sizing must also take into account the full capacity range through which a particular unit will need to operate.

The maximum horizontal distance tested between the refrigeration unit and evaporators is 30 meters. A vertical distance between refrigeration unit and evaporators has not been tested. For any distance beyond these limits, follow the state-of-the-art procedures and recommendations.

The piping on the unit is made of a high-pressure copper tube designed for high operating pressures. This kind of tube is more rigid than a standard copper tube; this must be considered for the design and fixation of the piping system.

Unit	Suction line	Liquid line
OME-16T-TEM	5/8" (15.875 mm)	1/2" (12.07 mm)
OMTE-37T-TEM	3/4" (19.05 mm)	5/8" (15.875 mm)
OMTE-49T-TEM	7/8" (22.225 mm)	3/4" (19.05 mm)
OMTE-64T-TEM	7/8" (22.225 mm)	3/4" (19.05 mm)

Table 17: Piping connections sizes

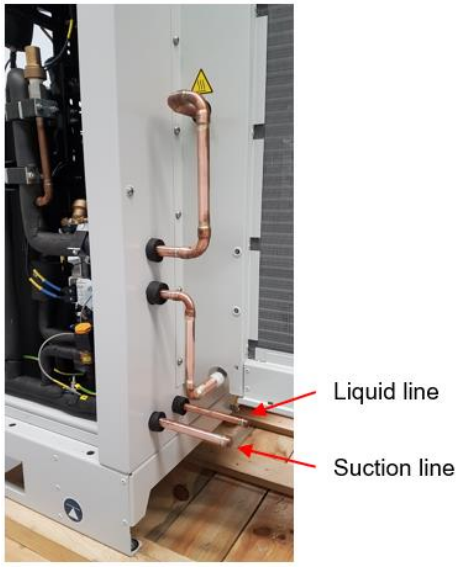


Figure 39: Piping connections

3.2.2 Service ports

There are 5 ports on single-compressor units and 6 ports on tandem-compressor units. Ports directly on the tube (marked in red in figures below) must not be opened once the unit is under pressure. There is no Schraeder valve inserted. These ports are covered with insulation and marked with a safety label: "Never open the port. Under pressure. Risk of serious injury".

Figure 40: Warning on ports

Ports on shut-off valves (marked in yellow in figures below) can be used to access the refrigerant circuit. The ports can be opened and closed using the shut-off valve rod:

- Fully opened shut-off valve rod ➔ Valve open, port closed;
- 3 turns of the rod in "close" direction ➔ Valve open, port open;
- Fully closed shut-off valve rod ➔ Valve closed, port open.

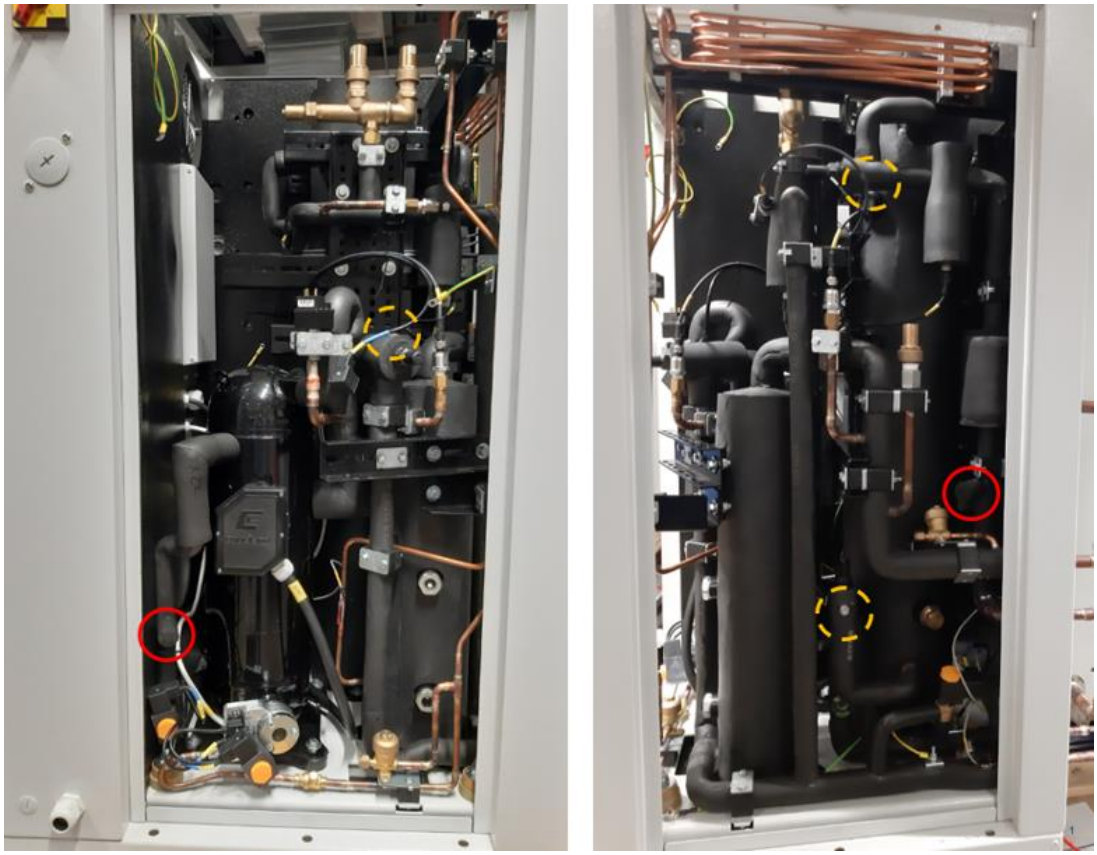


Figure 41: Service ports

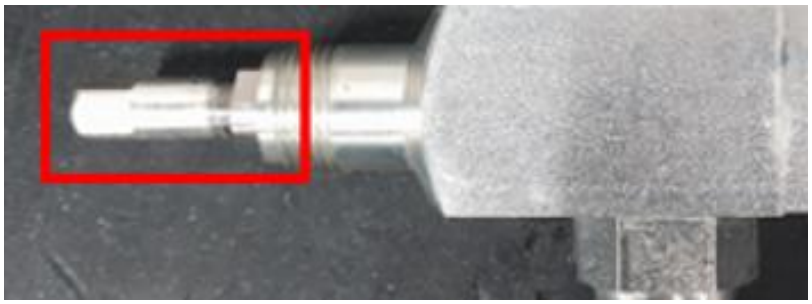


Figure 42: Fully opened shut-off valve rod

Figure 43: Fully closed shut-off valve rod

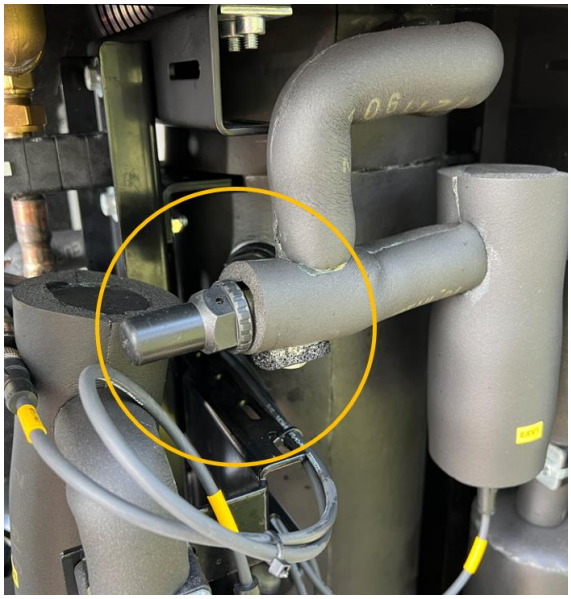


Figure 44: Close up of shut-off valve before liquid receiver

Figure 45: Close up of shut-off valve after liquid receiver

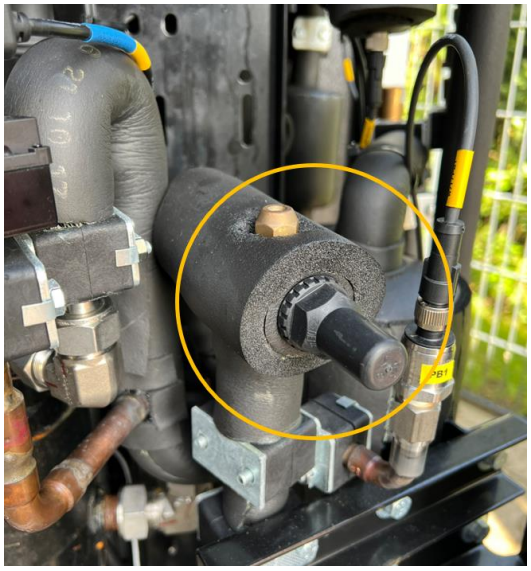


Figure 46: Close up of shut-off valve on suction line

3.2.3 Brazing recommendations

IMPORTANT

Blockage! Compressor breakdown! Maintain a flow of oxygen-free nitrogen through the system at very low pressure during brazing. Nitrogen displaces the air and prevents the formation of copper oxides in the system. If allowed to form, the copper oxide material can later be swept through the system and block screens such as those protecting capillary tubes and thermal expansion valves.

Contamination or moisture! Bearing failure! Do not remove the plugs until the compressor is set into the unit. This minimises any entry of contaminants and moisture.

1) Remove the liquid connection cap.
2) Remove the suction connection cap.
3) Open the liquid line valve midway. Care should be taken to avoid the holding charge releasing too quickly.
4) Be sure tube fitting inner surface and tube outer surface are clean prior to assembly.
5) Both tubes are extended from the refrigeration unit housing, therefore Copeland recommends isolating the housing by using a wet cloth on the copper tubing.
6) Use a double-tipped torch.

Recommended brazing materials are listed in **Table 18** below.

Brazing alloy	DIN EN ISO 17672	DVGW* number	Working temperature (°C)	Composition (% by weight)				
				Ag	Cu	Zn	Sn	P
BrazeTec 4576	Ag145	DV-0150CM0043	670	45	27	25.5	2.5	-
BrazeTec 3476	Ag134	DV-0150CM0045	710	34	36	27.5	2.5	-
BrazeTec 4404	Ag244	DV-0150CM0044	730	44	30	26	-	-
BrazeTec S 15	CuP284	-	700	15	80	-	-	5
BrazeTec S 5	CuP281	-	710	5	89	-	-	6
BrazeTec S 2	CuP279	DV-0105CL0475	740	2	91.7	-	-	6.3
Flux	**DIN EN 1045**	**DVGW* number**	**Active temperature (°C)**	**Comments**				
BrazeTec h	FH10	DV-0101AU2227	550-970	Flux residues are corrosive and must be removed				

** DVGW = German Technical and Scientific Association for Gas and Water*

Table 18: Extract of the recommendations for acceptable brazing alloys and flux

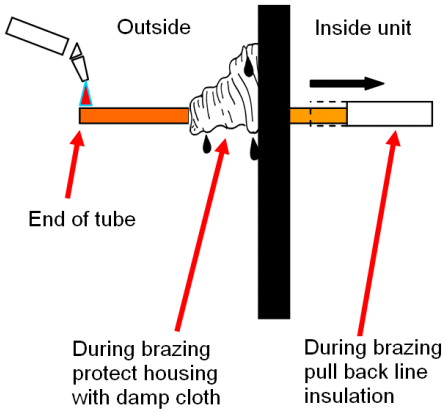


Figure 47: Brazing – Sectional view

3.2.4 Pressure testing at suction side

A pressure test on the suction side must be conducted with 1.1 x PS. The minimum required PS on the suction side is 60 bar. The PRVs on the liquid receiver must be considered accordingly if the liquid line PS is identical to the suction line PS. The tightness of the valves between suction line and liquid receiver cannot be ensured. Therefore, one PRV on the liquid receiver must be closed by the changeover valve. The second PRV must be removed during the pressure test and the connection closed with a plug. After the pressure test, the PRV must be reassembled.

3.3 Electrical connection

WARNING
Earth leakage current! Electrical shock hazard! This product includes a three-phase frequency drive. Additional protection devices could be necessary. This must be decided by the electricity network supplier or by the electrician company which provides the electrical connection.

Copeland CO_2 scroll refrigeration units can cause earth leakage currents, both AC and DC, due to the presence of an inverter and an EMC filter in the system. An AC/DC-sensitive Residual Current Device (RCD) should be used on the power supply side. The RCD can be **type B** or **B+**.

A delay of at least 50 ms should be incorporated to prevent spurious trips. The leakage current is likely to exceed the trip level if not all the phases are energized simultaneously.

The unit complies with IEC 61000-3-12 in case that the short-circuit power Ssc is greater than or equal to 5.37 MW at the interface between the user´s power supply and the public network. The installer or the user of the equipment is responsible for ensuring this and for consulting with the electricity supplier as necessary.

3.3.1 Power supply connections

WARNING
Electrical cabinet door open! Danger of electric shock! Always make sure the electrical cabinet door is properly closed before starting the unit.

The electrical connection of the refrigeration unit to the power supply must be made by qualified technicians in compliance with the valid electrical standards, eg, DIN EN 60204-1.

Additionally, the voltage drop and line temperatures must be considered for cable selection. The nominal power and maximum current are shown in **Table 19** hereunder:

Unit	Nominal power (kW)	Maximum current (A)	Power supply
OME-16T-TEM	13.85	31	3 / N / PE 50 Hz 400 V TN-S
OMTE-37T-TEM	24.85	52	
OMTE-49T-TEM	36.7	73	
OMTE-64T-TEM	45.7	89.5	

Table 19: CO_2 scroll refrigeration unit nominal power and maximum current

Copeland CO_2 scroll refrigeration units are designed to be connected to one of the following power supplies:

- TN-S system with 380-420 V / 3 Ph / 50 Hz + N + PE **or**
- TN-C system with 380-420 V / 3 Ph / 50 Hz + PEN

A voltage tolerance of ± 10 % is acceptable.

The main switch on the backside of the unit must be switched off before opening the electrical cabinet door and connecting the power supply cable.

The power supply cable should enter the electrical box through a rubber grommet.

***NOTE:* When a TN-C system is applied a jumper (part of the delivery) must be added between N & PE (X5.N & X5.PE) as per Figure 48.**

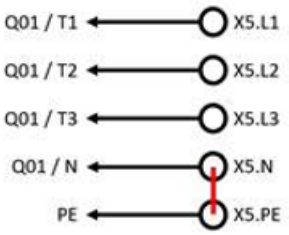


Figure 48: Power supply terminals with jumper

3.3.2 Electrical wiring

Ensure that the neutral wire "N" and the ground protection wire "PE" are connected to the main switch before commissioning.

3.3.3 Electrical protection standard (protection class)

- Units: IP class IPX4.
- ZTW/ZTI scroll compressor terminal box: IP54 according to IEC 34.
- Fan: IP54 according to IEC 34 (blades are IP24).

3.4 Location & fixings

IMPORTANT
Dust and dirt contamination! Unit life reduction! The unit should always be installed in a location where clean airflow is ensured. External fouling of the gas cooler fins leads to high condensing temperatures or pressures and will reduce the lifetime of the unit.

It is mandatory to keep a clearance space around the unit as shown in **Figure 49** – see dimensions in red colour. Both service access and airflow have been considered in making these recommendations. Sufficient space must be provided between the units to protect them from recirculation of hot air from a neighbouring gas cooler.

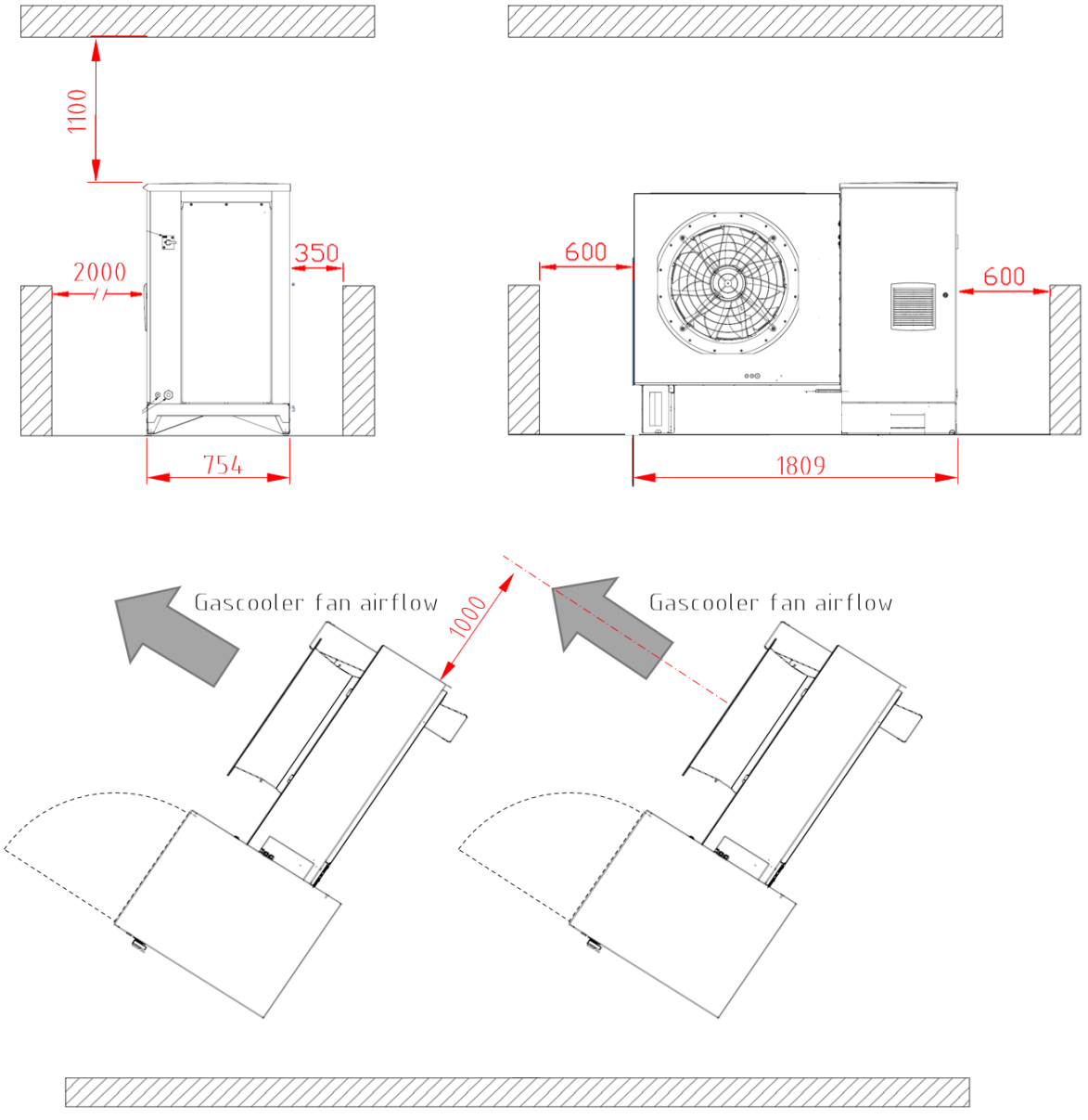


Figure 49: Distances required for unit installation (in mm)

Where multiple units are to be installed in the same location, the contractor needs to consider each individual case carefully. There can be many variations in terms of number of units and available space and it is not in the scope of these guidelines to cover each individual case. However, in general terms, air bypass around each gas cooler and between the units should always be avoided.

Ideally, the unit should be mounted level on a solid concrete slab with anti-vibration pads between unit feet and concrete as shown in **Figure 50**.

Figure 50: Unit mounted on concrete slab with anti-vibration pads

Select an installation location that meets the following conditions:

1) The location needs to be selected in such a way that nobody is disturbed by the airflow and the sound of the unit.
2) The ground needs to be prepared for the weight of the unit. Also, the floor must be flat to avoid vibration and sound generation.
3) Select the location in such a way that the suction vent and the outlet vent of the unit are not exposed to the wind. If the wind blows directly into the suction or outlet vent, the operation of the unit will be affected. A barrier to block the wind can be installed.
4) There must be sufficient space around the unit for servicing and for both the air inlet and the air outlet.

Other factors to consider in finding a proper installation site are the direction of the prevailing wind and the exposure to sunlight:

- If the air leaving the gas cooler faces the prevailing wind, the airflow through the gas cooler can be impeded, causing high refrigeration temperatures and ultimately resulting in reducing the lifetime of the unit. A baffle is a remedy for this situation.
- Direct sun exposure should be reduced as much as possible. Shade should be provided over the unit if South-facing.

NOTE: **It is recommended to install a CO2 gas sensor if the unit or parts of the unit are installed indoors.**

3.5 Air duct connection

WARNING
Uncovered rotating parts! Removable safety grids on the gas cooler fans! Personal injuries! Never start the condensing unit or run the fans with no air ducts connected or without protective end-grids on the air outlets.

The connection of the air ducts to the unit has to be made based on standard rules for air distribution ducts. Duct connection dimensions are designed based on standard EN 1506-2007, which has to be taken into consideration for all air ducts dimensioning.

The units covered in these guidelines are prepared for connection to air ducts with a diameter of 630 mm for units OME-16T / OMTE-37T and 800 mm for units OMTE-49 / 64T.

Before commissioning and starting the unit, check the ducts for air leaks. Look for sections that should be joined but might be separated and for possible holes in the air channels. Two values must be taken into consideration when designing a proper air duct route and selecting component parts, ie, the total pressure drop and the airflow. The length of the air duct has little impact on the total pressure drop and the air-flow (pressure drop approx. 1 Pa/m).

Elbows and other components such as diameter reductions on the air duct route have a much bigger influence on total pressure drop and air flow – see table below for OME-16T. This table must not be used for units OMTE-37 / 49 / 64T.

Air duct diameter Ø 630 mm															
		Total straight length (m)													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of elbows	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	4	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
	5	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
	6	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗

Table 20: Maximum acceptable air duct length depending on diameter and number of elbows for OME-16T

When taking into account all the fittings, the total linear length and additional components, the total pressure drop should be limited to 65 Pa at 8809 m³/h (OME-16T). Please also refer to Chapter 2.9.4 "Fan".

NOTE: **The pressure drops of ducts and elbows given in this chapter are indicative values. The exact pressure drop shall be calculated individually for each project.**

3.6 Transport bracket

The components in the compressor compartment are fixed to the unit housing with an orange bracket. This fixation prevents damage to the components during the transport of the unit. This orange bracket must be removed before the first start of the unit. The bracket is located in the upper right corner of the compressor compartment. The bolts marked by a yellow and a red circle in the figure below must be removed to disconnect the bracket. The bolt marked by the red circle must be reconnected after the bracket has been removed.

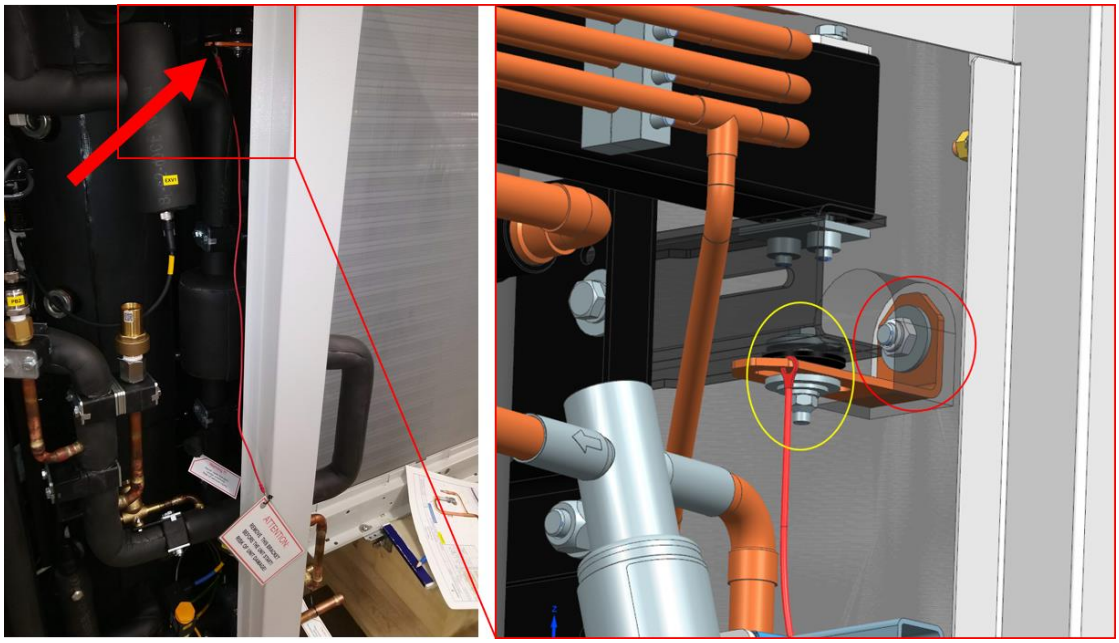


Figure 51: Transport braket

Figure 52: Label attached to transport bracket

NOTE: **The unit could be damaged during operation with the orange bracket on. Please remove the orange bracket before the first start up of the unit.**

4 Start-up & operation

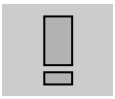
WARNING
High pressure! Risk of personal injury! Always keep sufficient distance from the pressure relief valve to avoid serious injury in the event of a sudden pressure release.

WARNING
Hot surfaces! Burning! Do not touch the top of the compressor or discharge line as their surfaces can reach high temperatures both during operation and at standstill.

WARNING
High noise level! Risk of hearing damage! In case of pressure release of the pressure relief valve, a sudden, intense sound is produced which can damage the inner ear and cause hearing loss. Wear earplugs or other protective devices when involved in any work on or near the unit.

Before commissioning, ensure that all valves on the refrigeration unit are fully opened. Only qualified personal and certified companies are allowed to perform installation, commissioning, service and maintenance work.

4.1 Checks before starting & during operation



IMPORTANT
Liquid valves not fully opened! Liquid trap! Both valves on the liquid line should be fully opened in order to prevent liquid trapping.

Before a system runs for the first time:

- Check that the valves on the liquid line are fully open except for HPV and BPV valves.
- Set the essential parameters of the electronic controller in the programming level 1 (evaporating temperature setpoint, condensing fan setpoint….) according to the required application.
- Carry out visual inspection.
- Perform control tests to ensure all controls operate correctly, including any manual backup system.
- Check also the following:
  - ✓ Documentation for the system and its marking, especially pressure equipment
  - ✓ Installation of safety devices
  - ✓ Set pressure of all safety devices and other pressure cut-outs
  - ✓ Compressor and oil reservoir oil levels
  - ✓ Pressure test records
  - ✓ All valves open/closed as required for operation

After start-up and when operation conditions have stabilised:

- It is recommended to check the oil level in the oil separator and to add oil if necessary to ensure a sufficient oil level (halfway up the upper sight glass).
- The following should also be checked:
  - ✓ Refrigerant level
  - ✓ Expansion valve superheat
  - ✓ Regulating valves in both subcritical and transcritical modes
  - ✓ Operating pressure in the receiver

4.2 Evacuation

IMPORTANT
The evacuation procedure is based upon achieving an actual system vacuum standard and is NOT TIME DEPENDENT! The installation has to be evacuated with a vacuum pump before commissioning. Proper evacuation reduces residual moisture to 50 ppm. The installation of adequately sized access valves at the furthest point from the compressor in the suction and liquid lines is advisable. The system must be evacuated down to less than 3 mbar. If required break the vacuum with dry nitrogen. Pressure must be measured using a vacuum pressure gauge on the access valves and not on the vacuum pump. This serves to avoid incorrect measurements resulting from the pressure gradient along the connecting lines to the pump.

IMPORTANT
Care must be taken that all components (solenoids, expansion devices, regulators, shut-off valves, etc…) in the refrigeration cycle, which separate a part of the installation when de-energized, are manually opened to guarantee successful evacuation in the whole piping system.

***NOTE:* The controller must be turned on before starting the evacuation.**

***NOTE:* For proper evacuation, both the HPV and BPV valves must be opened using the evacuation mode in the unit controller.**

To activate the evacuation mode:

1) In the GENERAL MENU select "SERVICE".

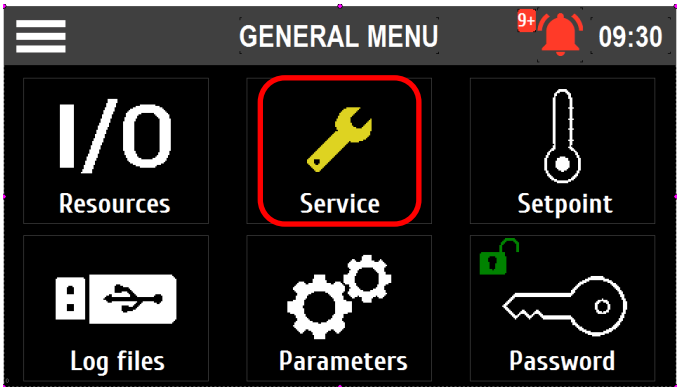


Figure 53: General Menu

2) Use the UP and DOWN buttons to go to the "Evacuation" sub-menu.
3) Click on the "Evacuation" button.
4) Click on "ENABLE".
5) The flashing "EVACUATION" on the main page indicates that the evacuation mode is active.

Starting the evacuation function:

The evacuation mode will start when clicking on "ENABLE" only if the suction, discharge and liquid receiver pressures are below 10 bar. If the evacuation mode is enabled but the pressures are above 10 bar, the following message will be displayed:

- "Enabling condition for Evacuation Mode not met, waiting for it"

Subsequently:

1) The HPV and BPV valves open directly at 100 % (the evacuation mode has priority over the valves override function).
2) The compressor is switched off (safety timers are ignored).
3) The fan is switched off, while auxiliary outputs are not influenced (safety timers are ignored).
4) The alarms are disabled except for the communication alarms.

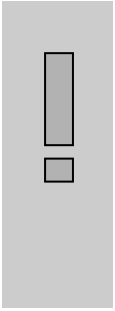
Stopping the evacuation function:

The evacuation mode will be deactivated when the pressures exceed 10 bar or by clicking on the "STOP" button.

When the evacuation function is stopped, the controller returns to its previous status, ie, Off or regulation.

4.3 Charging procedure

4.3.1 Refrigerant charging procedure



IMPORTANT
CO_2 refrigerant! Risk of dry ice! It is important to charge gaseous CO_2 to a pressure level well above the triple point of the refrigerant, ie, 5.185 bar(a) to avoid dry ice. A gaseous pre-charge of 10 bar in the whole system is common practice.
Inadequate charge! Overheating! The compressor design requires system charging as quickly as possible with liquid refrigerant into the liquid line. This will avoid running the compressor under conditions whereby insufficient suction gas is available not only to cool the motor but also to limit the discharge line.

Pre-charging must be done with gaseous refrigerant both on suction and discharge/liquid sides, through the shut-off valve on the liquid receiver and the suction shut-off valve. It is important to charge gaseous CO_2 to an absolute pressure level above the triple point of the refrigerant, ie, 5.185 bar to avoid dry ice formation. A gaseous pre-charge of 10 bar in the whole system is common practice.

After pre-charging gaseous CO_2, the main quantity of refrigerant can be charged liquid to the shut-off valve on the liquid receiver. Further charging can be carried out by carefully filling refrigerant through the suction line while simultaneously checking the sight glasses (on liquid receiver and in liquid line) when the system is in operation.

The refrigerant charge might vary depending on system size. The proper amount of refrigerant shall be charged by a qualified technician during unit commissioning based on actual application needs. The system is sufficiently charged when the liquid level in the receiver is between the lower and the middle sight glass. In order to prevent system overcharge for high ambient temperatures Copeland recommends charging the liquid receiver only up to 60 % considering a typical piping length of 30 meters. Charging must be done with compressors switched on.

***NOTE:* Never charge the system to a liquid level higher than the upper sight glass of the liquid receiver.**

***NOTE:* In order to meet the requirements of the Ecodesign Directive 2009/125/EC with regard to efficient system operation, ensure the refrigerant charge is sufficient.**

4.3.2 Oil charging procedure

Copeland CO_2 scroll refrigeration units are supplied with a compressor oil charge. After commissioning, the oil level should be checked and topped up if necessary.

As mentioned in **section 2.6.1 "Qualified refrigerant and oil"**, Copeland recommends charging with PAG ZEROL RFL 68 EP.

Additional oil charging is done through the Schraeder valve located on the compressor lower cover or through the service valve on the oil return line.

The compressors are equipped with an OM5 TraxOil to prevent them from running with an insufficient oil level – see **section 2.15 "**

Oil management device – OM5 TraxOil™**"**. In case of low oil level, the controller will immediately shut the compressor down. The compressor will automatically start again when an appropriate amount of oil is applied.

4.3.3 Oil separator

Copeland CO_2 scroll refrigeration units are equipped with an oil separator. The separator is pre-charged with 2.9 / 2.8 litres of oil.

Figure 54: Oil separator

***NOTE:* The oil level should be approximately halfway up the upper sight glass.**

4.4 Rotation direction of scroll compressors

Scroll compressors, like several other types of compressors, will only compress in one rotational direction. Copeland CO_2 scroll compressors have three phases. Swapping phases can result in reverse rotation direction.

Observing that suction pressure drops and discharge pressure rises when the compressor is energized allows verification of proper rotation direction. There is no negative impact on durability caused by operating three-phase Copeland CO_2 scroll compressors in the reversed direction for a short period of time (under one hour) but oil may be lost. After several minutes of operation in reverse, the compressor protection system will trip due to high motor temperature. The operator will notice a lack of cooling. However, if allowed to repeatedly restart and run in reverse without correcting the situation, the compressor will be permanently damaged.

All three-phase scroll compressors are identically wired internally. Therefore, once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the identified compressor terminals will ensure proper rotation direction.

However, a phase sequence check relay is installed in Copeland CO_2 scroll refrigeration units. This device ensures that the fixed-speed compressor does not start with incorrect phase sequence. The rotation direction of the variable-speed compressor is controlled by the inverter.

4.5 Maximum compressor cycle

The factory settings of the system controller take into account the maximum number of permitted starts and stops of the compressor, as well as the running time and minimal downtime. Copeland recommends to change these settings only in exceptional cases, eg, when the liquid line pressure cannot be kept by the factory settings.

5 Maintenance & repair

5.1 General considerations

It is recommended to perform a basic maintenance programme every six months (cleaning the gas cooler, checking the refrigerant level, tightening the screws in the electrical cabinet, etc…).

Always check the latest requirements in the latest version of these application guidelines available on www.copeland.com/en-gb. The minimum requirements for maintainance given by EN 378 need to be considered as well.

As part of standard servicing and maintenance it may be necessary to open the unit housing and covers.

5.2 Opening the unit housing

WARNING
Isolating switch "On"! Electrical shock hazard! Turn off the main power supply to de-energise the unit before undertaking any task on electrical equipment.
High voltage! Electrical shock hazard! There is a risk of electric shock if mains-supplied equipment is disconnected and the wire ends are open. The open ends may carry a potentially lethal voltage until the internal capacitors have discharged. This can take up to 10 minutes.
Electrical covers open! Electrical shock hazard! Always make sure that the compressor e-box cover and the electrical cabinet door are properly closed before restarting the unit. In all cases, if metal covers with grounding connections have been removed, eg, for maintenance, all grounding connections have to be reconnected before unit operation when the covers are put back in place.

WARNING
Hot surfaces! Burning! Do not touch the compressor heads or discharge line as their surfaces can reach high temperatures both during operation and at standstill.

CAUTION
Unauthorized parts! Unit damage! Only parts authorized by Copeland can be used for maintenance and replacement.

5.2.1 To open the electrical cabinet

WARNING
High voltage! Electrical shock hazard! Turn off the main power supply to de-energise the unit before opening the cabinet or undertaking any task on the electrical equipment. Never open the electrical cabinet in rainy weather if the isolating switch is on.

- Release the lock located on the right side of the electrical cabinet and open the door.

Figure 55: Position of the lock (OME-16T)

5.2.2 To open the compressor chamber

- Unscrew the three screws located on the top of the compressor chamber cover and the green/yellow grounding cable, then lift the cover. The compressor chamber can be opened on two sides.

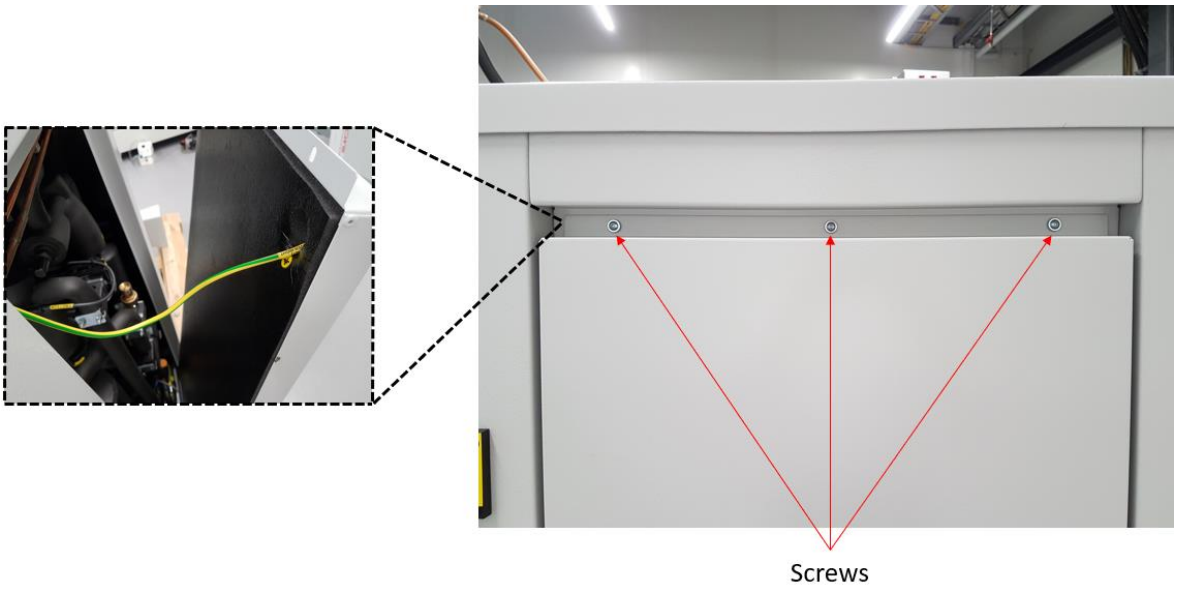


Figure 56: Opening the compressor chamber

5.2.3 To remove the fan safety grid

WARNING
Uncovered rotating parts! Personal injuries! Always de-energize the unit before removing the gas cooler fan grid. Never start the unit or run the fan with no safety grid on the fan.

- The grid can be removed only when the unit is turned off.
- To remove the grid, unscrew the four screws securing the grid and lift it off.

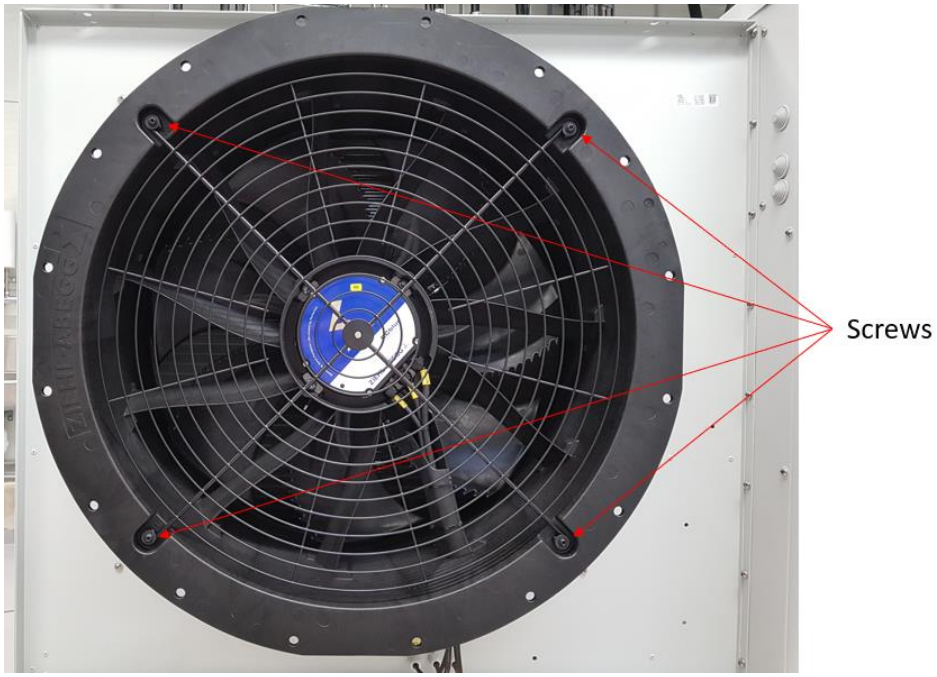


Figure 57: Opening the fan safety grid

5.3 Replacing a compressor

WARNING
Isolating switch "On"! Electrical shock hazard! Turn off the main power supply to de-energise the unit before undertaking any task on electrical equipment.
High voltage! Electrical shock hazard! There is a risk of electric shock if mains-supplied equipment is disconnected and the wire ends are open. In this case the open ends may carry a potentially lethal voltage until the internal capacitors have discharged. This can take up to 10 minutes.
Compressor e-box cover open! Electrical shock hazard! Always make sure that the compressor e-box cover is properly closed before restarting the unit.

WARNING
Toxic fumes! Danger of suffocation! In case of fire toxic fumes can be released by burning non-metallic parts. Avoid inhaling the fumes.

In case of motor burnout, most of the contaminated oil will be removed with the compressor. The rest of the oil is cleaned by means of a filter-dryer. A 100 % activated alumina suction line filter-dryer is recommended but must be removed after 72 hours. When a compressor is exchanged in the field, it is possible that a major portion of the oil may still be in the system. While this may not affect the reliability of the replacement compressor, the extra oil will add to rotor drag and increase power usage.

- Before any intervention, de-energize the refrigeration unit and allow for the capacitors in the drive to discharge; this can take up to 10 minutes.
- Close valves to isolate the unit from the system.
- Recover the refrigerant from the unit and make sure that the compressor is not under pressure.
- Release the compressor mounting parts then lift it to replace with a new compressor.

NOTE: **For more detailed instructions, please refer to the compressor application guidelines.**

5.4 Gas cooler fins

CAUTION
Sharp gas cooler fins! Personal injuries! Be careful when cleaning the gas cooler fins. Always use protective gloves and an appropriate brush.

CAUTION
Acid cleaning! Corrosion of gas cooler fins! Do not use acidic solutions to clean the coil. After cleaning, the fins should be brushed lightly with a proper fin comb.

Gas cooler fins become dirty over time as ambient air is induced to the gas cooler. Dirty coil surfaces result in high condensing temperatures and poor unit performance. Regular cleaning is recommended, the frequency of doing so being dependent on the installation and the surrounding environment. As a general guide, it is advisable to do this at least once every two months.

As a general rule and for a clean environment Copeland recommends that the fins be cleaned with liquid detergent diluted with clean water. The refrigeration unit has a well-designed chassis and any cleaning solution should be able to drain away. A light brush downward (in the direction of the fins) should be done before washing to remove heavy deposits.

NOTE: **In order to meet the requirements of the Ecodesign Directive 2009/125/EC with regard to efficient system operation, ensure the heat exchangers remain clean at all times.**

5.5 Electrical installation

WARNING
Isolating switch "On"! Electrical shock hazard! Turn off the main power supply to de-energise the unit before undertaking any task on electrical equipment.

All refrigeration units will generate some degree of vibration. Copeland CO_2 scroll refrigeration units are no exception. Over time, due to these slight vibrations and to temperature fluctuations within the unit housing, electrical terminations might become loose. The components most likely to be affected are the main terminal strip and the compressor contactor. It is recommended to check the main electrical terminations for tightness and to carry out a visual inspection of the low voltage crimped terminals at least once every 6 months.

5.6 Routine leak testing

All joints inside the system should be leak-tested as part of a regular maintenance schedule.

***NOTE:* In order to meet the requirements of the Ecodesign Directive 2009/125/EC with regard to efficient system operation, ensure the refrigerant and oil charges are sufficient.**

5.7 Gas cooler fan & motor

A yearly inspection of these items is recommended. Fastenings can become loose, bearings may wear out and fans may require cleaning of solid deposits that can cause rotational imbalance.

Motors come with lifelong lubrication bearings that do not require lubricating on a routine basis, but just need to be checked for wear.

5.8 Pressure relief valves

The changeover valve must be in fully open position (spindle completely out) during unit operation as shown in **Figure 58**.

5.8.1 PRV blow-off

After a blow-off, a pressure relief valve (PRV) is not 100 % tight anymore. Therefore it must always be replaced. Do not keep it on the unit anymore. Only original PRVs shall be used. The use of other than original PRVs could affect the system in terms of vibration.

The unit shall be cleaned from oil that may be discharged during a blow-off.

5.8.2 Regular maintenance and check

Once per year:

- Visual check according to EN 378.
- Leakage test, internal and external. Please follow the instructions:
  - Remove brass cap (deflector) from pressure relief valves (PRV).
  - Use a bubble test and check if there is any leak between the connection of the changeover valve and the PRV or if there is any internal leak from the PRV.
  - If no leak is observed, the connection is fine. No further action is required.
  - If a leak is observed, the PRV must be replaced.
  - The old PRV must not be re-tightened.

Once every 5 years:

The pressure relief valves have to be replaced.

5.8.3 PRV replacement on liquid receiver

Follow the instructions below to replace the PRV on the liquid receiver:

- Make sure that the changeover valve on the leak side is closed. **Figure 58** shows the configuration with PRV 1 closed while **Figure 59** shows the configuration with PRV 2 closed.
- A new teflon tape must be used with the new PRV to ensure tightness.
- The recommended torque is 40 Nm. Apply the torque on the PRV body, not on the deflector. Make sure to hold the changeover valve body while the PRV is being released/fastened to avoid thread connection release between changeover valve and liquid receiver.

- Conduct a leak test to verify tight connection between PRV, changeover valve and liquid receiver.

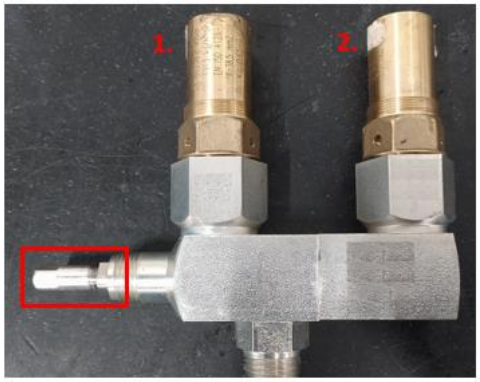


Figure 58: Changeover valve – Shaft in open position

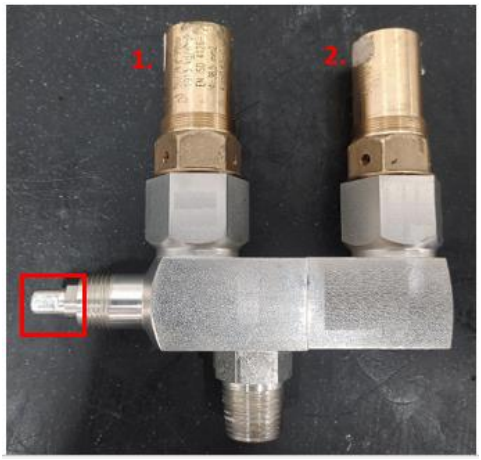


Figure 59: Changeover valve – Shaft in closed position

5.9 Pressure switch CS3

The CS3 pressure switch is TÜV EN 12263-approved and can withstand 2 million cycles. If the pressure switch is defective, it must be replaced. A new copper gasket must be used. The recommended torque is 15 Nm. Do not apply torsional force to housing assembly during mounting.

6 Certification & approval

- Copeland CO_2 scroll refrigeration units comply with the Low Voltage Directive LVD 2014/35/EU. The compliance is verified through harmonized standards:
  - EN 60335-1: Household and similar electrical appliances – Safety, General Requirements.
  - EN 60335-2-89: Household and similar electrical appliances – Safety, Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant condensing unit or compressor.
- The CO_2 scroll refrigeration units comply with the Electromagnetic Compatibility Directive EMC 2014/30/EU. The compliance is verified through harmonized standards:
  - EN 61800-3: Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods
  - EN 61000-2-12: Electromagnetic compatibility (EMC) Part 2-12: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public medium-voltage power supply systems.
  - EN 61000-3-3: Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current 16 A per phase and not subject to conditional connection
  - EN 61000-3-11: Electromagnetic compatibility (EMC) Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems. Equipment with rated current ≤ 75 A and subject to conditional connection.
- The CO_2 scroll refrigeration units and their piping comply with the Pressure Equipment Directive PED 2014/68/EU. Applied harmonized standards:
  - EN 378-2: Refrigerating systems and heat pumps – Safety and environmental requirements Part 2: Design, construction, testing, marking and documentation.
- The CO_2 scroll refrigeration units and their associated spare parts and accessories comply with the Directive RoHS 2011/65/EU, (EU) 2015/863 on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (recast).
- Conformity Declarations for components are available as far as required.
- The Manufacturer's Declaration of Incorporation has to be respected when incorporating these products into a machine.

7 Dismantling & disposal

Removing oil and refrigerant:

- **Do not disperse in the environment.**
- **Use the correct equipment and method of removal.**
- **Dispose of oil and refrigerant in compliance with national legislation and regulations.**

Dispose of compressor and/or unit in compliance with national legislation and regulations.

Appendix 1: XC Pro controller alarm menu

Medium temp Alarms, Circuit 1				
Code	**Description**	**Cause**	**Action**	**Reset**
LP1	Medium Temp (Circ. 1) - Low pressure-switch alarm	MT low pressure switch alarm (the Input is configured as DICxx=101 Low pressure Medium Temp (Circ. 1))	All compressors of Medium Temp (Circ. 1) are turned off. Fans unchanged.	**Automatically** if the number of activation are less than AL12 in the AL13 time when the Input is disable. - The compressors restart working according to the working algorithm. **Manually** (if AL12 activation happened in the AL13 time) When the Input is disable: - Reset the alarm manually from the Visograph or turn off and on the instrument/or - The compressors restart working according to the working algorithm.
HP1	Medium Temp (Circ. 1) - High pressure switch for alarm	MT high pressure switch (the Input is configured as DICxx=99 High pressure Medium Temp (Circ. 1))	• All compressors of Medium Temp (Circ. 1) and Low Temp are turned off. • All fans of Medium Temp (Circ. 1) are turned on.	**Automatically** if the number of activation are less than AL29 in AL30 time when the Input is disable. - Compressors and fans restart working according to the working algorithm. **Manually** if AL29 activation happened in the AL30 time When the Input is disable: - Reset the alarm manually from the Visograph or turn off and on the instrument. - Compressors and fans restart working according to the working algorithm.
LAC1	Medium Temp (Circ. 1) - low suction pressure	If AC1 = REL: Suction pressure or temperature ≤ SETC1-AL3 If AC1 = ABS: Suction pressure or temperature ≤ AL3	Only signalling	**Automatically:** as soon as the pressure or temperature reaches: - If AC1 =REL: SETC1 - AL3 + differential value. (differential = 0.3bar or 1°C) - If AC1 =ABS: AL3 + differential value. (differential = 0.3bar or 1°C)

Medium temp Alarms, Circuit 1				
Code	**Description**	**Cause**	**Action**	**Reset**
LAF1	Low Condenser pressure (temperature) Circ. 1.	If AC2 = REL: Condenser pressure or temperature ≤SETF1 - AL24 for timer AL26 If AC2 = ABS: Condenser pressure or temperature ≤ AL24 for timer AL26	Only signalling	**Automatically:** as soon as the pressure or temperature reaches: - IfAC2 =REL: SETF1 - AL24 + differential value. (differential = 0.3bar or 1°C) - IfAC2 =ABS: AL24 + differential value. (differential = 0.3bar or 1°C)
HAC1	Medium Temp (Circ. 1) - high suction pressure (temperature)	If AC1 = REL: MT Suction pressure or temperature ≥SETC1 + AL4 If AC1 = ABS: MT Suction pressure or temperature ≥ AL4	BPV is closed if MT compressors are prevented from running	**Automatically:** the MT suction pressure or temperature ≤ - If AC1 = REL: SETC1 + AL4 - differential value. (differential = 0.3bar or 1°C) - If AC1 =ABS: AL4 - differential value. (differential = 0.3bar or 1°C)
HAF1	High condenser pressure alarm (Circ. 1)	If AC2 = REL: Condenser pressure or temperature ≥SETF1 + AL25 for AL26 delay If AC2 = ABS: Condenser pressure or temperature ≥ AL25 for AL26 delay	If AL27 = yes The compressors Medium Temp (Circ. 1) are switched off every AL28 time	**Automatically:** the pressure or temperature ≤ - If AC2 =REL: SETF1 + AL25 - differential value. (differential = 0.3bar or 1°C) - If AC2 =ABS: AL25 - differential value. (differential = 0.3bar or 1°C)
LL1	Medium Temp (Circ. 1) - Low liquid level alarm for	Low liquid level in the flash tank: The Input configured as DICxx=109 Low Liquid level Medium Temp (Circ. 1) is active and the CDI1 delay is over	Only signalling	**Automatically** as soon as the Input is disabled
PrSH1	Medium Temp (Circ. 1) - Low superheat pre-alarm	MT superheat is ≤ ASH1 + ASH2 **and** ≥ ASH2	Only signalling	**Automatic:** when superheat exceeds ASH1 + ASH2 + differentiaal

Medium temp Alarms, Circuit 1				
Code	**Description**	**Cause**	**Action**	**Reset**
ALSH1	Medium Temp (Circ. 1) Low superheat alarm	Superheat 1 is ≤ ASH2	Depends on ASH4	**Automatic:** when superheat exceeds ASH5 + ASH2
LPC1	Medium Temp (Circ. 1) - Electronic low pressure switch	MT Pressure/temperature < AL21	Disable the compressors	**Automatic:** when the pressure/temperature exceeds AL21 + differential
PR1	Medium Temp (Circ. 1) - Suction probe failure	MT Suction Probe failure or out of range (e.g. the probe is configured as AICxx=1 NTC probe regulation suction Medium Temp (Circ. 1))	The compressors are activated according to the AL14/AL15 parameters.	**Automatically** as soon as the probe restarts working.
PR3	Medium Temp (Circ. 1) - Condensing probe failure	Condensing Probe failure or out of range (e.g. the probe is configured as AICxx = 3 NTC probe regulation condensing Medium Temp (Circ. 1))	The fans are activated according to the AL31 parameters".	**Automatically** as soon as the probe restarts working.
Flood back 1	Medium Temp (Circ. 1) - Flood back alarm	MT superheat < ASH2 for 90 minutes	Only a warning: buzzer ON and alarm relay (91-Alarm) ON	Clear automatically superheat > ASH2
Booster alarm	Booster configuration alarm	No compressor of MT Circ. 1 available	Signalling only	**Automatically** as soon as a compressor of Medium Temp (Circ. 1) is available
MT Comp. not available Circ. 1 alarm	Medium Temp comp. not available Circ. 1 alarm	No available compressors MT circuit	Relay set as 115 is activated	**Automatically** as soon as as the a MT compressor becomes available

Medium temp Alarms, Circuit 1				
Code	**Description**	**Cause**	**Action**	**Reset**
LOIL1	Medium Temp (Circ. 1) - Low oil level in oil separator	For solution 1~3, if DIC(i) = 161-Low oil level in MT oil separator is activate and the OIL12 delay is over; For solution 4~5, if DIC(i) = 186-Low oil level in MT oil receiver is activate and the OIL12 delay is over	During OIL12 time, according to OIL14 value => inverter runs at max speed (if present). Once alarm active, If OIL16=1, all the compressors including parallel compressors in Medium Temp (Circ. 1) are switched off.	**Automatically**: as soon as the Input is disabled. All the compressors restart working according to regulation.
HOIL1	Medium Temp (Circ. 1) - High oil level in oil separator	DIC(i) = 162-High oil level in MT oil separator is active and OIL24 time is over. If OIL24 = 0 we don't manage any warning.	signalling only	**Manually**: When the Input is disabled: - Reset the alarm manually from the Visograph or turn off and on the instrument.

Low temp Alarms, Circuit 2				
Code	**Description**	**Cause**	**Action**	**Reset**
LP2	Low Temp (Circ. 2) - Low pressure-switch alarm	LT Low pressure switch Input (the Input is configured as DICxx = 102 Low pressure Low Temp (Circ. 2))	All compressors of Low Temp (Circ. 2) are turned off. Fans unchanged.	**Automatically** if the number of activations is less than AL16 in the AL17 time when the Input is disable. - The compressors restart working according to the working algorithm. **Manually** (if AL16 activations happened in the AL17 time) When the Input is disabled: - Reset the alarm manually from the Visograph or turn off and on the instrument. - The compressors restart working according to the working algorithm.

Low temp Alarms, Circuit 2				
Code	**Description**	**Cause**	**Action**	**Reset**
HP2	Low Temp (Circ. 2) - High pressure switch alarm	LT High pressure switch Input activation (the Input is configured as DICxx=100)	All compressors of Low Temp (Circ. 2) are turned off.	**Automatically** if the number of activations is less than AL37 in AL38 time when the Input is disable. - Compressors and fans restart working according to the working algorithm. **Manually** if AL37 activation happened in the AL38 time When the Input is disable: - Reset the alarm manually from the Visograph or turn off and on the instrument. - Compressors and fans restart working according to the working algorithm.
LAC2	Low Temp (Circ. 2) - Low suction pressure (temperature) alarm	If AC1 = REL: Suction pressure or temperature ≤ SETC2 - AL6 If AC1 = ABS: Suction pressure or temperature ≤ AL6	Only signalling	**Automatically**: as soon as the LT pressure or temperature reaches: - If AC1 = REL: SETC2 - AL6 + differential value. (differential = 0.3bar or 1°C) - If AC1 =ABS: AL6 + differential value. (differential = 0.3bar or 1°C)
HAC2	Low Temp (Circ. 2) – High suction pressure (temperature) alarm	If AC1 = REL: Suction pressure or temperature ≥ SETC2 + AL7 If AC1 = ABS: Suction pressure or temperature ≥ AL7	Only signalling	**Automatically**: the pressure or temperature ≤ - If AC1 =REL: SETC2 + AL7 - differential value. (differential = 0.3bar or 1°C) - If AC1 =ABS: AL7 - differential value. (differential = 0.3bar or 1°C)
PrSH2	Low Temp (Circ. 2) – Low superheat Pre-alarm	LT Superheat is ≤ ASH1 + ASH9 and ≥ ASH9	Only signalling	**Automatic**: when superheat exceeds ASH1 + ASH9 + hysteresis
ALSH2	Low Temp (Circ. 2) – Low superheat alarm	Superheat is ≤ ASH9	Depends on ASH11	**Automatic**: when superheat exceeds ASH12 + ASH9
LPC2	Low Temp (Circ. 2) - Electronic low pressure switch	Pressure/temperature < AL23	disables the compressors	**Automatic**: when the pressure/temperature exceeds AL23 + differential

Low temp Alarms, Circuit 2				
Code	**Description**	**Cause**	**Action**	**Reset**
PR2	Low Temp (Circ. 2) - Suction probe failure	LT Suction Probe failure or out of range (e.g. the probe is configured as AICxx = 2 NTC probe regulation suction Low Temp (Circ. 2))	The compressors are activated according to the AL18 parameters.	**Automatically** as soon as the probe restarts working.
PR4	Low Temp (Circ. 2) - Condensing probe failure	LT Condensing Probe failure or out of range (e.g. the probe is configured as AICxx = 4 NTC probe regulation condensing Low Temp (Circ. 2))	The fans are activated according to the AL39 parameters.	**Automatically** as soon as the probe restarts working.
Floodback 2	Floodback Low Temp (Circ. 2) - Floodback alarm	LT superheat < ASH9 for 90 minutes	Only a warning: buzzer ON and alarm relay (91-Alarm) ON	Clear automatically superheat > ASH9
LT comp not available - Circ. 2 alarm	Low Temp comp. not available - Circ. 2 alarm	Low Temp comp. not available - Circ. 2 alarm	Relay set as 116 is activated	**Automatically** as soon as the serious alarm condition is no longer present

Compressor Alarms				
Code	**Description**	**Cause**	**Action**	**Reset**
EAO1… EAO24 (for each compressor)	MT Safety Oil Switch	MT Oil switch Input activation. (the Input is configured as DICxx = 1 Compressor oil pressure switch compressor 1 Medium Temp (Circ. 1)) NOTE: with step compressors 1 input for each compressor has to be used.	The corresponding compressor is turned off (with step compressors all relays referred to the Input are disabled).	**Automatically** as soon as the Input is disabled.

Compressor Alarms				
Code	**Description**	**Cause**	**Action**	**Reset**
ETO1… ETO24 (for each compressor)	MT safety Thermal switch	MT Thermal switch Input activation. (the Input is configured as DICxx = 3 Thermal Safety Compressor Medium Temp (Circ. 1)) NOTE: with step compressors 1 input for each compressor has to be used.	The corresponding compressor is turned off (with step compressors all relays referred to the Input are disabled).	**Automatically** as soon as the Input is disabled.
EPO1… EPO24 (for each compressor)	MT safety Pressure switch	MT Pressure switch load Input activation. (the Input is configured as DICxx = 2 Compressor safety pressostate Medium Temp (Circ. 1)) NOTE: with step compressors 1 input for each compressor has to be used.	The corresponding compressor is turned off (with step compressors all relays referred to the Input are disabled).	**Automatically** as soon as the Input is disabled.
MANT	Compressors maintenance alarm	A compressor has worked for the time set in the AL10 parameter	Only signalling	**Manually:** reset the running hour of the compressor
OIL DIFF L/O	High Oil Level in the Oil Separator	Contact closure from hi oil separator lockout input	Lockout all compressors when DI true > 5 min	**Automatically** when DI true < 5 min As soon as the Input is disabled the alarm is reset. The compressors restart working according to the working algorithm. **Manually** when DI true ≥ 5 min When the Input is disable, it also need turn off and on the instrument /or rest the alarm manually from the Visograph or remote. The compressors restart working according to the working algorithm.

GENERIC ALARMS				
Code	**Description**	**Cause**	**Action**	**Reset**
P1	Probe 1 failure alarm	Probe 1 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P2	Probe 2 failure alarm	Probe 2 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P3	Probe 3 failure alarm	Probe 3 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P4	Probe 4 failure alarm	Probe 4 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P5	Probe 5 failure alarm	Probe 5 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P6	Probe 6 failure alarm	Probe 6 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P7	Probe 7 failure alarm	Probe 7 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P8	Probe 8 failure alarm	Probe 8 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P9	Probe 9 failure alarm	Probe 9 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P10	Probe 10 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P11	Probe 11 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P12	Probe 12 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P13	Probe 13 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P14	Probe 14 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P15	Probe 15 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P16	Probe 16 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P17	Probe 17 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P18	Probe 18 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P19	Probe 19 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.

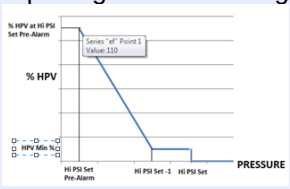
GENERIC ALARMS				
Code	**Description**	**Cause**	**Action**	**Reset**
P20	Probe 20 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P21	Probe 21 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P22	Probe 22 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P23	Probe 23 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P24	Probe 24 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P25	Probe 25 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P26	Probe 26 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P27	Probe 27 failure alarm	Probe 10 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P28	Probe 28 failure alarm	Probe 28 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P29	Probe 29 failure alarm	Probe 29 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P30	Probe 30 failure alarm	Probe 30 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P31	Probe 31 failure alarm	Probe 31 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P32	Probe 32 failure alarm	Probe 32 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P33	Probe 33 failure alarm	Probe 33 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P34	Probe 34 failure alarm	Probe 34 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
P35	Probe 35 failure alarm	Probe 35 failure	Depending on the probe setting	**Automatically** as soon as the probe restarts working.
BURST	Burst disc alarm	DIC(i) = 150 activation	Only a warning: buzzer ON and alarm relay (91-Alarm) ON	DIC(i) = 150 deactivation
PHASE	Rotating field/ Phase Alarm	DIC(i) = 151 activation	Only a warning: buzzer ON and alarm relay (91-Alarm) ON	DIC(i) = 151 deactivation

GENERIC ALARMS				
Code	**Description**	**Cause**	**Action**	**Reset**
EXT[i]	External alarm [i]	DIC(i) = 152 (or 153 - 154 - 155) activation	Only a warning: buzzer ON and alarm relay (91-Alarm) ON	DIC(i) = 152 (or 153 – 154 - 155) deactivation
GLeak1 [2-3-4]-PreAlr	Gas Leak pre-alarm 1 [2-3-4]	If value of Gas leak detector 1 [2-3-4] probe > GLD1 [GLD6 - GLD11 - GLD16] and Gas leak detector 1 [2-3-4] probe < GLD2 [GLD7 - GLD12 - GLD17].	Relay set in GLD4 [GLD9 - GLD14 - GLD19] on	When value of Gas leak detector 1 [2-3-4] probe ≤ GLD1- GLD3 [GLD6 - GLD8; GLD11 - GLD13; GLD16 - GLD18]
GLeak1 [2-3-4]-Alarm	Gas Leak alarm 1 [2-3-4]	If value of Gas leak detector 1 [2-3-4] probe > GLD2 [GLD7 - GLD12 - GLD17]	Relay set in GLD5 [GLD10 - GLD15 - GLD20] on	When value of Gas leak detector 1 [2-3-4] probe ≤ GLD2 - GLD21 [GLD7 - GLD22; GLD12 - GLD23; GLD17 - GLD24]
EMOA-106D	Expansion module offline alarm-IPX206D	The expansion module IPX106D is used and loses communication by can bus.	Only signalling	The communication is recovered automatically.
EMOA-215D	Expansion module offline alarm-IPX215D	The expansion module IPX215D is used and loses communication by can bus.	Only signalling	The communication is recovered automatically.

Fan Alarm				
Code	**Description**	**Cause**	**Action**	**Reset**
AL_AO (for each fan)	Fan safeties alarm	Safety switch load Input activation. (the Input is configured as DICxx = 73 Fan 1 safety Medium Temp (Circ. 1))	The corresponding fan is turned off.	**Automatically** as soon as the Input is disabled.

Compressor with Inverter Alarms				
Code	**Description**	**Cause**	**Action**	**Reset**
INVO (for Suction inverter)	MT Inverter Oil Safety Switch	MT inverter Oil switch Input activation. (the Input is configured as DICxx = 115 Compressor oil Inverter suction Medium Temp (Circ. 1))	The corresponding inverter is turned off.	**Automatically** as soon as the Input is disabled.
INVT (for Suction inverter)	MT Inverter Thermal Safety Switch	MT inverter thermal switch load activation. (the Input is configured as DICxx = 117 Thermal Safety Inverter suction Medium Temp (Circ. 1))	The corresponding inverter is turned off.	**Automatically** as soon as the Input is disabled.
INVP (for suction inverter)	MT Inverter Safety Pressure Switch	MT inverter pressure switch Input activation. (the Input is configured as DICxx = 116 Safety Inverter Suction Medium Temp (Circ. 1))	The corresponding inverter is turned off.	**Automatically** as soon as the Input is disabled.
MANTINV1 (for suction inverter)	MT Inverter maintenance alarm	The inverter 1 has worked for the time set in the AL10 parameter	Only signalling	**Manually:** reset the running hour of the inverter 1

Warnings				
Code	**Description**	**Cause**	**Action**	**Reset**
OIL DIFF HI	Oil Separator Element Clogged	contact to signal oil separator clogged active for more than 1 minute	Only a warning: buzzer ON and alarm relè ON	Clear automatically when DI is false

Gas cooler				
Code	**Description**	**Cause**	**Action**	**Reset**
PreHP Rec	Flash tank high pressure pre-alarm	GC28 > AI152 (AI153) > GC29	The % of the valve is updating every second in order to reach the correct percentage. If the flash tank pressure value is between the values GC29 and GC28 – 1 (bar), the % of valve opening is the following one: 	**Automatically** as soon as the HP REC is active or as soon as AI152 (AI153) < GC29 – GC30
HP REC	Flash tank high pressure alarm	AI152 (AI153) > GC28	The HPV will close (0%). The BY-PASS will open to a user definable % set by the BY-PASS % Open parameter GC37. The BY-PASS valve is opened at GC26.	**Automatically** as soon as AI152 (AI153) < GC28 – GC30
LP REC	Flash tank low pressure alarm	AI152 (AI153) < GC31	The HPV will have a minimum opening of the HPV valve to a user definable % set by GC36. If the PID % is greater than GC36, then the PID % will be the valve % output. The BY-PASS will close.	**Automatically** as soon as AI152 (AI153) > GC31 + GC32
OA-XEV20D_1	XEV20D Valve Driver Communication lost	The XEV20D_1 is used and it's no longer communicating.	Only signalling	The communication is recovered automatically.

Gas cooler				
Code	**Description**	**Cause**	**Action**	**Reset**
OA-XEV20D_2	XEV20D_2 Valve Driver Communication lost	The XEV20D_2 is used and it's no longer communicating..	Only signalling	The communication is recovered automatically.
HDi-T-1	Medium Temp (Circ. 1) - High discharge temperature	One of the probes set as AIxx = 156, 158, 69, 70, …, 80 > DSC4 & DSC5 timer exhausted	With DSC6 running: only warning With DSC6 exhausted: 1 compressors off every DSC7 sec	Automatically as soon as ALL the probes set as AIxx = 156, 158, 69, 70, …, 80 Aixx < DSC4 - DSC3
HDi-T-2	Low Temp (Circ. 2) - High discharge temperature	One of the probes set as AIxx = 157, 159, 81, 82, …, 92 > DSC11 & DSC12 timer exhausted	With DSC13 running: only warning With DSC13 exhausted: 1 compressors off every DSC14 sec	Automatically as soon as AIxx = 157, 159, 81, 82, …, 92 < DSC11 - DSC10
Inv1_Trip	Medium Temp (Circ. 1) - Inverter Trip alarm	Medium Temp (Circ. 1) - Inverter trip - Inverter digital input active (the Input is configured as DICxx=140)	Inverter compressor of Medium Temp (Circ. 1) is turned off. With T-Scroll the EVI valve is off.	**Automatically** if the number of activation are less than AL41 in the AL42 time, after DOCxx = 118 activation. - The compressors restart working according to the working algorithm. **Manually** (if AL41 activation happened in the AL42 time) When the Input is disable: - Reset the alarm manually from the Visotouch or turn off and on the instrument - The compressors restart working according to the working algorithm.
Inv2_Trip	Low Temp (Circ. 2) - Inverter Trip alarm	Low Temp (Circ. 2) - Inverter trip - Inverter digital input active (the Input is configured as DICxx=141)	Inverter compressor of Low Temp (Circ. 2) is turned off. With T-Scroll the EVI valve is off.	**Automatically** if the number of activation are less than AL44 in the AL45 time, after DOCxx = 119 activation. - The compressors restart working according to the working algorithm. **Manually** (if AL44 activation happened in the AL45 time) When the Input is disable: - Reset the alarm manually from the Visotouch or turn off and on the instrument - The compressors restart working according to the working algorithm.

Table 21: Controller alarm menu

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Appendix 2: Temperature / resistance curve for NTC

Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)
-50	329500	-20	67770	10	17960	40	5827	70	2228	100	973.1
-49.5	320200	-19.5	66170	10.5	17600	40.5	5728	70.5	2195.5	100.5	960.75
-49	310900	-19	64570	11	17240	41	5629	71	2163	101	948.4
-48.5	302200	-18.5	63055	11.5	16900	41.5	5533.5	71.5	2131.5	101.5	936.5
-48	293500	-18	61540	12	16560	42	5438	72	2100	102	924.6
-47.5	285350	-17.5	60110	12.5	16230	42.5	5346.5	72.5	2069.5	102.5	913
-47	277200	-17	58680	13	15900	43	5255	73	2039	103	901.4
-46.5	269600	-16.5	57325	13.5	15590	43.5	5167.5	73.5	2009.5	103.5	890.15
-46	262000	-16	55970	14	15280	44	5080	74	1980	104	878.9
-45.5	254850	-15.5	54690	14.5	14985	44.5	4995.5	74.5	1952	104.5	868.05
-45	247700	-15	53410	15	14690	45	4911	75	1924	105	857.2
-44.5	241000	-14.5	52195	15.5	14405	45.5	4830	75.5	1896.5	105.5	846.6
-44	234300	-14	50980	16	14120	46	4749	76	1869	106	836
-43.5	228000	-13.5	49830	16.5	13850	46.5	4671	76.5	1842.5	106.5	825.75
-43	221700	-13	48680	17	13580	47	4593	77	1816	107	815.5
-42.5	215800	-12.5	47590	17.5	13320	47.5	4518	77.5	1790.5	107.5	805.55
-42	209900	-12	46500	18	13060	48	4443	78	1765	108	795.6
-41.5	204400	-11.5	45465	18.5	12810	48.5	4371	78.5	1740.5	108.5	785.95
-41	198900	-11	44430	19	12560	49	4299	79	1716	109	776.3
-40.5	193700	-10.5	43450	19.5	12325	49.5	4229.5	79.5	1692	109.5	766.95
-40	188500	-10	42470	20	12090	50	4160	80	1668	110	757.6
-39.5	183500	-9.5	41520	20.5	11860	50.5	4093	80.5	1644.5		
-39	178500	-9	40570	21	11630	51	4026	81	1621		
-38.5	173750	-8.5	39670	21.5	11415	51.5	3961	81.5	1599		
-38	169000	-8	38770	22	11200	52	3896	82	1577		
-37.5	164600	-7.5	37915	22.5	10990	52.5	3833.5	82.5	1555		
-37	160200	-7	37060	23	10780	53	3771	83	1533		
-36.5	156050	-6.5	36250	23.5	10580	53.5	3711	83.5	1512		
-36	151900	-6	35440	24	10380	54	3651	84	1491		
-35.5	148000	-5.5	34670	24.5	10190	54.5	3593.5	84.5	1471		
-35	144100	-5	33900	25	10000	55	3536	85	1451		
-34.5	140400	-4.5	33170	25.5	9816	55.5	3480.5	85.5	1431		
-34	136700	-4	32440	26	9632	56	3425	86	1411		
-33.5	133250	-3.5	31745	26.5	9456.5	56.5	3371.5	86.5	1392		
-33	129800	-3	31050	27	9281	57	3318	87	1373		

Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)
-32.5	126550	-2.5	30390	27.5	9112.5	57.5	3266.5	87.5	1354.5		
-32	123300	-2	29730	28	8944	58	3215	88	1336		
-31.5	120200	-1.5	29105	28.5	8783	58.5	3165.5	88.5	1318		
-31	117100	-1	28480	29	8622	59	3116	89	1300		
-30.5	114200	-0.5	27880	29.5	8467.5	59.5	3068	89.5	1283		
-30	111300	0	27280	30	8313	60	3020	90	1266		
-29.5	108500	0.5	26705	30.5	8163.5	60.5	2973.5	90.5	1249		
-29	105700	1	26130	31	8014	61	2927	91	1232		
-28.5	103100	1.5	25580	31.5	7871	61.5	2882.5	91.5	1216		
-28	100500	2	25030	32	7728	62	2838	92	1200		
-27.5	98010	2.5	24510	32.5	7591	62.5	2794.5	92.5	1184		
-27	95520	3	23990	33	7454	63	2751	93	1168		
-26.5	93180	3.5	23495	33.5	7323	63.5	2709.5	93.5	1152.5		
-26	90840	4	23000	34	7192	64	2668	94	1137		
-25.5	88635	4.5	22525	34.5	7066	64.5	2628	94.5	1122.5		
-25	86430	5	22050	35	6940	65	2588	95	1108		
-24.5	84345	5.5	21600	35.5	6819.5	65.5	2549.5	95.5	1093.5		
-24	82260	6	21150	36	6699	66	2511	96	1079		
-23.5	80295	6.5	20725	36.5	6583	66.5	2473.5	96.5	1065		
-23	78330	7	20300	37	6467	67	2436	97	1051		
-22.5	76470	7.5	19890	37.5	6356	67.5	2400	97.5	1037.5		
-22	74610	8	19480	38	6245	68	2364	98	1024		
-21.5	72855	8.5	19090	38.5	6138.5	68.5	2329.5	98.5	1011.2		
-21	71100	9	18700	39	6032	69	2295	99	998.4		
-20.5	69435	9.5	18330	39.5	5929.5	69.5	2261.5	99.5	985.75		

Table 22: Temperature / resistance curve for NTC

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Appendix 3: Temperature / resistance curve for PTC

Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)
-65	420.6	-35	589	-5	772.8	25	990	55	1240.5	85	1524.5	115	1841
-64.5	423.57	-34.5	591.8	-4.5	776.15	25.5	993.9	55.5	1244.95	85.5	1529.5	115.5	1846.5
-64	426.54	-34	594.6	-4	779.5	26	997.8	56	1249.4	86	1534.5	116	1852
-63.5	429.51	-33.5	597.4	-3.5	782.85	26.5	1001.7	56.5	1253.9	86.5	1539.55	116.5	1857.5
-63	432.48	-33	600.2	-3	786.2	27	1005.6	57	1258.4	87	1544.6	117	1863
-62.5	435.45	-32.5	603.05	-2.5	789.6	27.5	1009.55	57.5	1262.9	87.5	1549.65	117.5	1868.5
-62	438.42	-32	605.9	-2	793	28	1013.5	58	1267.4	88	1554.7	118	1874
-61.5	441.39	-31.5	608.75	-1.5	796.4	28.5	1017.45	58.5	1271.9	88.5	1559.75	118.5	1879.5
-61	444.36	-31	611.6	-1	799.8	29	1021.4	59	1276.4	89	1564.8	119	1885
-60.5	447.33	-30.5	614.45	-0.5	803.25	29.5	1025.4	59.5	1280.95	89.5	1569.9	119.5	1890.5
-60	450.3	-30	617.3	0	806.7	30	1029.4	60	1285.5	90	1575	120	1896
-59.5	453.27	-29.5	620.2	0.5	810.15	30.5	1033.4	60.5	1290.05	90.5	1580.15	120.5	1901.4
-59	456.24	-29	623.1	1	813.6	31	1037.4	61	1294.6	91	1585.3	121	1906.8
-58.5	459.21	-28.5	626	1.5	817.05	31.5	1041.4	61.5	1299.2	91.5	1590.4	121.5	1912.2
-58	462.18	-28	628.9	2	820.5	32	1045.4	62	1303.8	92	1595.5	122	1917.6
-57.5	465.15	-27.5	631.85	2.5	823.95	32.5	1049.45	62.5	1308.4	92.5	1600.65	122.5	1923
-57	468.12	-27	634.8	3	827.4	33	1053.5	63	1313	93	1605.8	123	1928.4
-56.5	471.09	-26.5	637.7	3.5	830.9	33.5	1057.55	63.5	1317.6	93.5	1611	123.5	1933.8
-56	474.06	-26	640.6	4	834.4	34	1061.6	64	1322.2	94	1616.2	124	1939.2
-55.5	477.03	-25.5	643.6	4.5	837.95	34.5	1065.7	64.5	1326.8	94.5	1621.35	124.5	1944.6
-55	480	-25	646.6	5	841.5	35	1069.8	65	1331.4	95	1626.5	125	1950
-54.5	482.97	-24.5	649.55	5.5	845	35.5	1073.85	65.5	1336.05	95.5	1631.7	125.5	1955.3
-54	485.94	-24	652.5	6	848.5	36	1077.9	66	1340.7	96	1636.9	126	1960.6
-53.5	488.91	-23.5	655.5	6.5	852.05	36.5	1082.05	66.5	1345.4	96.5	1642.15	126.5	1965.9
-53	491.88	-23	658.5	7	855.6	37	1086.2	67	1350.1	97	1647.4	127	1971.2
-52.5	494.85	-22.5	661.55	7.5	859.2	37.5	1090.3	67.5	1354.75	97.5	1652.65	127.5	1976.5
-52	497.82	-22	664.6	8	862.8	38	1094.4	68	1359.4	98	1657.9	128	1981.8
-51.5	500.79	-21.5	667.6	8.5	866.4	38.5	1098.55	68.5	1364.15	98.5	1663.15	128.5	1987.1
-51	503.76	-21	670.6	9	870	39	1102.7	69	1368.9	99	1668.4	129	1992.4
-50.5	506.73	-20.5	673.65	9.5	873.6	39.5	1106.9	69.5	1373.6	99.5	1673.7	129.5	1997.7
-50	509.7	-20	676.7	10	877.2	40	1111.1	70	1378.3	100	1679	130	2003
-49.5	512.2	-19.5	679.8	10.5	880.85	40.5	1115.25	70.5	1383.05	100.5	1684.35	130.5	2008
-49	514.7	-19	682.9	11	884.5	41	1119.4	71	1387.8	101	1689.7	131	2013
-48.5	517.25	-18.5	686	11.5	888.1	41.5	1123.6	71.5	1392.55	101.5	1695.05	131.5	2018
-48	519.8	-18	689.1	12	891.7	42	1127.8	72	1397.3	102	1700.4	132	2023

Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)	Temp (°C)	Resistance (Ω)
-47.5	522.35	-17.5	692.2	12.5	895.4	42.5	1132.05	72.5	1402.1	102.5	1705.75	132.5	2028
-47	524.9	-17	695.3	13	899.1	43	1136.3	73	1406.9	103	1711.1	133	2033
-46.5	527.45	-16.5	698.4	13.5	902.75	43.5	1140.55	73.5	1411.7	103.5	1716.45	133.5	2038
-46	530	-16	701.5	14	906.4	44	1144.8	74	1416.5	104	1721.8	134	2043
-45.5	532.6	-15.5	704.65	14.5	910.15	44.5	1149.05	74.5	1421.3	104.5	1727.15	134.5	2048
-45	535.2	-15	707.8	15	913.9	45	1153.3	75	1426.1	105	1732.5	135	2053
-44.5	537.8	-14.5	711	15.5	917.6	45.5	1157.55	75.5	1430.95	105.5	1737.85	135.5	2058
-44	540.4	-14	714.2	16	921.3	46	1161.8	76	1435.8	106	1743.2	136	2063
-43.5	543.05	-13.5	717.35	16.5	925.05	46.5	1166.05	76.5	1440.65	106.5	1748.55	136.5	2068
-43	545.7	-13	720.5	17	928.8	47	1170.3	77	1445.5	107	1753.9	137	2073
-42.5	548.35	-12.5	723.7	17.5	932.55	47.5	1174.7	77.5	1450.35	107.5	1759.25	137.5	2078
-42	551	-12	726.9	18	936.3	48	1179.1	78	1455.2	108	1764.6	138	2083
-41.5	553.65	-11.5	730.15	18.5	940.05	48.5	1183.4	78.5	1460.1	108.5	1769.95	138.5	2088
-41	556.3	-11	733.4	19	943.8	49	1187.7	79	1465	109	1775.3	139	2093
-40.5	558.95	-10.5	736.6	19.5	947.6	49.5	1192.05	79.5	1469.9	109.5	1780.65	139.5	2098
-40	561.6	-10	739.8	20	951.4	50	1196.4	80	1474.8	110	1786	140	2103
-39.5	564.3	-9.5	743.1	20.5	955.25	50.5	1200.8	80.5	1479.75	110.5	1791.5	140.5	2107
-39	567	-9	746.4	21	959.1	51	1205.2	81	1484.7	111	1797	141	2111.6
-38.5	569.75	-8.5	749.65	21.5	962.9	51.5	1209.55	81.5	1489.65	111.5	1802.5	141.5	2116
-38	572.5	-8	752.9	22	966.7	52	1213.9	82	1494.6	112	1808	142	2120.2
-37.5	575.25	-7.5	756.2	22.5	970.55	52.5	1218.35	82.5	1499.55	112.5	1813.5	142.5	2124.5
-37	578	-7	759.5	23	974.4	53	1222.8	83	1504.5	113	1819	143	2128.8
-36.5	580.75	-6.5	762.8	23.5	978.3	53.5	1227.2	83.5	1509.5	113.5	1824.5	143.5	2134.1
-36	583.5	-6	766.1	24	982.2	54	1231.6	84	1514.5	114	1830	144	2137.4
-35.5	586.25	-5.5	769.45	24.5	986.1	54.5	1236.05	84.5	1519.5	114.5	1835.5	144.5	2141.7

Table 23: Temperature / resistance curve for PTC

Appendix 4: Ecodesign tables according to Regulation 2015/1095/EU

The SEPR-report of the OME-16T is shown hereunder. Reports can be extracted from Copeland Select software at www.copeland.com/en-gb.

Select Desktop, Software Version: 8.21.3.4419
Data Version 9.60 / 45195 [INTERNAL]
Thermodynamic properties (library / fluid rev.):
ASEREP Version]: 5.2.3.0 / 2021-09-15

2023-09-28

SEPR-Report EN 13215:2016 E

Model: OME-16T-TEM [TEST] Refrigerant: R744 Dew Point S.I.

Item	Symbol	Value (MT)	Unit
Evaporating Temperature	t	-10	°C
Annual Electricity Consumption	E	30525	kWh/a
Seasonal Energy Performance Ratio	SEPR	2.96	
Parameters at full load and ambient temperature 32 °C, Subcooling -4.4 K, Drive Frequency 90 Hz			
Rated Cooling Capacity	Q_A	14.70	kW
Rated Power Input	P_A	10.35	kW
Rated COP	COP_A	1.42	
Parameters at part load and ambient temperature 25 °C, Subcooling 3.0 K, Drive Frequency 33 Hz			
Declared Cooling Capacity	Q_B	5.79	kW
Declared Power Input	P_B	2.91	kW
Declared COP	COP_B	1.99	
Parameters at part load and ambient temperature 15 °C, Subcooling 3.0 K, Drive Frequency 57 Hz			
Declared Cooling Capacity	Q_C	11.15	kW
Declared Power Input	P_C	4.05	kW
Declared COP	COP_C	2.76	
Parameters at part load and ambient temperature 5 °C, Subcooling 3.0 K, Drive Frequency 42 Hz			
Declared Cooling Capacity	Q_D	8.85	kW
Declared Power Input	P_D	2.18	kW
Declared COP	COP_D	4.06	
Other Items			
Capacity Control		Stepless	
Degredation Coefficient	Cds	0.00	
Unit suction line temperature	t11	0.00	°C
Pressure at Condensing Unit outlet	pLR	36.00	bar
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Preliminary data, product not officially released

Appendix 5: List of tables and figures

Tables

Figures

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